FEASIBILITY STUDY FOR THE REMOVAL OF POMPTON DAM AND PEQUANNOCK DAM

Ramapo State Forest
Wayne, Pompton Lakes and Pequannock Townships
Passaic and Morris Counties, NJ

PROJECT NO. P1079-00

STATE OF NEW JERSEY

Honorable Chris Christie, Governor
Honorable Kim Guadagno, Lt. Governor

DEPARTMENT OF THE TREASURY
Andrew P. Sidamon-Eristoff, Treasurer

DIVISION OF PROPERTY MANAGEMENT AND CONSTRUCTION
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JUNE 2012

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1.1 CONTRACT

This report has been prepared by Civil Dynamics, Inc. under contract with the State of New Jersey Division of Property Management and Construction (DPMC). The report summarizes the investigation of the feasibility of removing the Pompton Dam and the Pequannock Dam, which are located in Wayne and Pequannock Townships in Passaic and Morris Counties.

The scope of this feasibility study is defined in the DPMC Scope of Work No. P1079-00 dated June 8, 2011 and Civil Dynamics' technical proposal and cost proposal dated September 7, 2011. Civil Dynamics received a Notice to Proceed on September 26, 2011.

1.2 PURPOSE OF STUDY

The objective of this project is to evaluate the feasibility of permanently removing the Pompton Dam and Pequannock Dam, which are known locally as the "feeder dams."

The driving force behind this Feasibility Study is the need to identify short-term and long-term options to mitigate the frequent flooding that has occurred within the Passaic River Basin. This includes the area upstream of the feeder dams.

Governor Christie created the Passaic River Basin Flood Advisory Commission by Executive Order 23 on April 23, 2010 following the severe Nor'easter of March 12-15, 2010 and its flooding of the Central Passaic River Basin. The Advisory Commission published its report in February 2011. The report provided 15 recommendations "that will help to minimize the impact of flooding in the Passaic River Basin." Recommendation Nos. 4, 5 and 6 relate to the feeder dams and the area upstream of the feeder dams.

4. Improved Operation of the Pompton Lake Dam Floodgates
5. Desnagging and Shoal Dredging
6. Feeder Dam Removal

This Feasibility Study is in response to Recommendation No. 6 and evaluates the permanent removal of the Pompton Dam and Pequannock Dam. The study examines the hydraulic impacts as well as other issues that may arise as a result of the removal of one or both of the feeder dams.

1.3 REPORT ORGANIZATION

This report has been divided into eleven sections:

Section 2.0 presents project background information.
Section 3.0 discusses data collected in the development of this project, including field surveying and base mapping. This section summarizes information obtained from collecting and reviewing property deeds. The various plans and maps developed for this study are also introduced in this section of the report.
Section 4.0 presents an assessment of historic and cultural resources in and around the feeder dams.
Section 5.0 presents the sampling and analysis of sediment upstream of the dams.
Section 6.0 discusses other potential issues of importance associated with dam removal.
Section 7.0 presents four dam removal alternatives.
Section 8.0 presents the hydrologic and hydraulic analyses conducted to evaluate the dam removal alternatives. Results of the analyses are included in this section.
Section 9.0 presents an evaluation of the sediment transport potential and the overall stability of the rivers.
Section 10.0 discusses the results of the analysis and evaluates the alternatives.
Section 11.0 summarizes the conclusions reached during the feasibility study.

2.1 GENERAL DESCRIPTION

The Pompton Dam and Pequannock Dam are located across the Ramapo River and the Pequannock River, respectively near their confluence within Wayne Township, Passaic County and Pequannock Township, Morris County. See the satellite image on the following page.

The Pompton Dam and Pequannock Dam are concrete overflow weirs (spillways) with concrete training walls at the earth abutments. Together, the dams raise the water level of the upstream rivers about 6 feet, relative to downstream water levels.

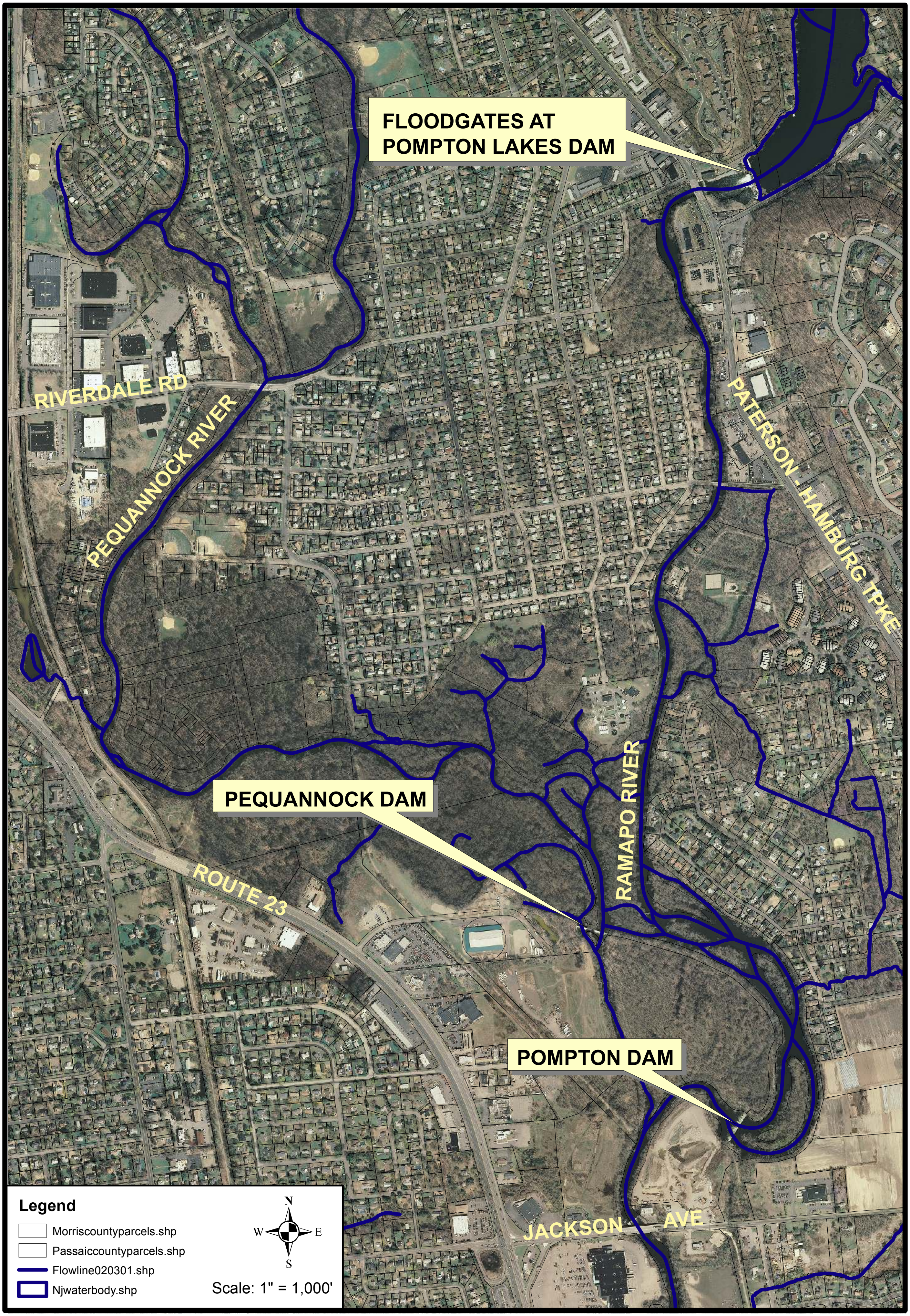
The Pompton Dam and Pequannock Dam are classified by the NJDEP Bureau of Dam Safety and Flood Control as Class III – Low Hazard structures.

2.1.1 Pompton Dam

The spillway crest at Pompton Dam is at Elevation 174.6 feet and is 270 feet long. *All elevation data is referenced to 1988 North American Vertical Datum (NAVD) unless otherwise noted.* The spillway crest is about 6 feet above the normal downstream tailwater and about 13 feet above the bottom of the downstream stream channel. There is no known concrete apron on the downstream side of the dam.

The top of the training walls are at Elevation 183.1 feet. There is an earth embankment at the left abutment of the dam that is about 170 feet long.

Neither the Pompton Dam nor the Pequannock Dam have any gates or low level outlets.



FLOODGATES AT
POMPTON LAKES DAM
RIVERDALE RD
PEQUANNOCK RIVER
PATERSON - HAMBURG TPKE
PEQUANNOCK DAM
RAMAPO RIVER
ROUTE 23
POMPTON DAM
JACKSON AVE
Legend
Morriscountyparcels.shp
Passaiccountyparcels.shp
Flowline020301.shp
Njwaterbody.shp
N
W
E
S
Scale: 1" = 1,000'

Neither the Pompton Dam nor the Pequannock Dam are located on lots identified on Tax Maps. The State of New Jersey has assumed responsibility for the dams.

2.1.2 Guard Dike

The right side of the dam consists of an earth embankment running along the right side of the Ramapo River that connects with the left side of the Pequannock Dam. The dike is about 2,400 feet long. The dike is severely eroded in many areas and the top of the dike varies from Elevation 180.9 feet to Elevation 183.2 feet.

The Guard Dike is located on Block 902, Lot 10 in Pequannock Township. Morris County lists the ownership as unknown.

2.1.3 Pequannock Dam

The spillway crest at Pequannock Dam is at Elevation 175.3 feet and is also 270 feet long. There is a 6-foot long notch at Elevation 174.3 on the right side of the spillway. Given the fact that the spillway crest is about 10 inches higher than the Pompton Dam crest, water flows through the notch only during normal flow conditions in the rivers and there is limited shallow flow in the downstream stream channel. There is also a concrete apron along the downstream toe of the spillway that is at Elevation 168.2 feet. Therefore, the spillway crest is 7.1 feet high.

The top of the training walls are at Elevation 183.9 feet. There is an earth embankment at the right abutment of the dam that is about 400 feet long. Tax maps show this earth embankment to be located on Block 902, Lot 3 in Pequannock Township which is privately held and the location of the North Jersey Equestrian Center LLC.

2.2 AREA HISTORY

The existing concrete Pompton Dam and Pequannock Dam are replacements to original timber crib dams built for the Pompton Feeder which was a component of the Morris Canal.

When completed in 1831, the Morris Canal was New Jersey's first viable inland transportation route, opening the state to tremendous development opportunities. The Canal originally connected Phillipsburg in the west to Newark in the east, a distance of 90 miles. In 1836, an 11.75 mile extension to Jersey City was added. (Rutsch and Sandy, 1995:III-1)

The Morris Canal, a world famous engineering marvel of its time, was known as the "mountain climbing canal." It crossed the New Jersey Highlands, overcoming more elevation change than any other canal built in the world. A system of 23 lift locks and 23 inclined planes enabled the canal to traverse an elevation change of 1,674 feet. The canal's famous inclined planes were water powered marine railways on which cradle cars carried canal boats up and down hillsides. The lock operated similar to water elevators, allowing canal boats to traverse smaller changes in elevation. Mules towed the canal boats across the state in the five-day journey from Jersey City to Phillipsburg. (Passaic County Planning Department, June 2008)

Operation of the canal required significant water to replenish water lost to seepage out of the canal prism and the operation of the locks and planes. Lake Hopatcong was expanded by a new dam and was a major source of water for the canal. However, it became apparent that Lake Hopatcong would not supply sufficient water for the canal (Vermeule, 1929).

The Ryerson Forge property at Long Pond was acquired and the Greenwood Lake reservoir built to supply more water. The Pompton Feeder was constructed to carry the water from the Wanaque River to the main canal at what is the Mountain View area of Wayne. The feeder canal also benefited local businesses as it provided a connection to the industries and raw materials of northern New Jersey.

The Pompton Feeder was built in 1836 to 1837. The Feeder Canal consisted of a six-mile long canal from Mountain View to the confluence of the Pequannock and Ramapo Rivers, just north of Pompton Plains Crossroads in Wayne. At this location, the two feeder dams and guard dike were constructed to raise the water level and push water into the Feeder Canal.

> At the head of the Feeder Canal, where the artificial channel met the impounded river at the dam, a guard lock was installed to allow boats to enter and leave the river on their way to and from the Pompton ironworks. The guard lock also helped to regulate the amount of water let into the Feeder Canal. (George Keppler quoted in Kalata 1983, (Rutsch and Sandy, 1995:III-9)).

Above the dams, the Ramapo River was deepened and rechanneled to allow for navigation up to the site of the old Pompton Steel Works where the Hamburg Turnpike crosses the Ramapo River below the Power Dam (Vermeule, 1929). This section of the river was referred to as the "Slackwater Canal."

From 1844 until the end of the Civil War, the Morris Canal's business steadily increased, but after 1866 it rapidly declined, largely due to competition from railroads. In 1871, the Lehigh Valley Railroad leased the canal, largely to acquire its riverfront properties in Jersey City and Phillipsburg. By 1902, the canal's business life was virtually over. (Rutsch and Sandy, 1995:III-9)

Pressure for abandonment of the canal began in the 1880's, and it increased over the years. In some cities, it became an open sewer and, on occasion, local children drowned in it. But it was not until 1922 that its abandonment began, and it was not health or safety issues that caused its demise, but rather the question of water supply. The State of New Jersey stepped in, and a short time later the Lehigh Valley Railroad turned the canal over to the State. In 1923, the canal was drained and between 1923 and 1929 was prepared for final abandonment. (Rutsch and Sandy, 1995:III-10)

The *Final Report of Consulting and Directing Engineer* dated June 29, 1929 by Cornelius C. Vermeule, Jr. provided many details on the abandonment work of the canal, including the rebuilding of the two feeder dams.

> In April 1923, the Governor appointed a committee of citizens to recommend what disposition should be made of the property of the Morris Canal and Banking Company. The recommendations of the Governor's Committee were, in general, embodied in a series of laws passed in 1924 and known as the "Morris Canal Abandonment Acts." These acts provided for the sale of canal property, except that necessary to maintain the lakes and also permitted municipalities and the counties through which the waterway passed, to acquire property. (Vermeule, 1929)

> After a wait of funds, the Pompton Dam and Pequannock Spillway was put under contract in August 1928, being the last of the dismantling work, and one of the most difficult from a construction point of view on account of possible floods in the rivers. (Vermeule, 1929)

As a note, in most historic documents, the two dams are typically referred to as the "Pompton Dam" and the "Pequannock Spillway." Also, Cornelius Vermeule referred to the section of the river above the Pompton Dam as the Pompton River, which may be why the dam is named the "Pompton Dam" and not the "Ramapo Dam." This section of river is currently designated as the Ramapo River.

In summary, the existing concrete dams are replacements to the original timber crib dams. The current dams were completed in 1929. The dams were somewhat altered in 1940 when the gaging station was installed at the right side of the Pequannock Dam.

2.3 1981 PHASE I INSPECTION

A Phase I Inspection Report for the Pompton Dam was conducted by the Department of Army, U.S. Army Corps of Engineers in 1981 as part of the National Dam Safety Program. The Pequannock Dam was not included in the report.

The report concluded that the dam was in "good overall condition." However, the report judged the spillway to be "inadequate" due to the fact that the dam would overtop during the design storm event.

2.4 1982 PHASE II INVESTIGATION

A Phase II Investigation for the Pompton Dam was conducted in 1982. This report concluded that the Pompton Dam should be classified as a Class II, Significant Hazard structure with a spillway design storm equal to the 100-year storm event. The report generally reviewed alternatives for the "future disposition of the Pompton Dam."

There was no subsequent design or construction work.

2.5 2001 DESIGN OF REPAIRS

In 2001, Civil Dynamics initiated a study for the State of New Jersey to evaluate the hydrology and hydraulics and design repairs to the Pompton Dam and Pequannock Dam. The hydrologic and hydraulic analysis of the dams recommended that the dams be classified as Class III – Low Hazard structures since failure of the dams is not expected to cause downstream property damage or loss of life.

The Scope of Work included development of plans and specifications for minor repairs to the concrete surfaces and some limited excavation work to remove sediment immediately upstream of the crest of both weirs.

The State of New Jersey later decided to not complete the repair work and the project was closed.

2.6 2010 REGULAR DAM INSPECTION

The dams were last visually inspected in 2010. With the exception of general weathering and erosion along with some localized spalling of the concrete surfaces, the dams and training walls were judged to be in fair condition. However, the earth guard dike was severely eroded in several areas. As a result, the dams were rated as being in "poor" condition.

2.7 REFERENCES AND OTHER RELEVANT STUDIES

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3.1 DAM STRUCTURES TOPOGRAPHIC SURVEY

Data from several surveys was compiled to develop topographic information on the two dams and the guard dike.

Civil Dynamics conducted surveying of the Pequannock Dam and Guard Dike and AECOM conducted a survey of the Pompton Dam as part of their work for the Pompton Lake Dam Floodgates Facility Analysis. Additionally, we utilized available LiDAR (Light Detection and Ranging) topographic data to fill in the topography for the surrounding areas.

3.2 RIVER AND IMPOUNDMENT SURVEY

Civil Dynamics conducted surveying of numerous cross sections of the Pequannock River from Riverdale Road to the Pequannock Dam. AECOM conducted surveying of numerous cross sections of the Ramapo River from the Hamburg Turnpike to the Pompton Dam. This data was used to develop the hydraulic model discussed in later sections of this report.

This data was supplemented with additional soundings of the river bottom conducted by Civil Dynamics to develop a bathymetric plan of the impoundment areas upstream of the two dams.

3.3 DEED AND TITLE SEARCH

3.3.1 Deed Search

In accordance with the Scope of Work, Civil Dynamics obtained copies of available deeds for the dam sites and impoundment-abutting properties. The limits of the deed search along the Ramapo River were from the Paterson-Hamburg Turnpike to the Pompton Dam. The limits of the deed search along the Pequannock River were from Riverdale Road to the Pequannock Dam.

Based upon the New Jersey Municipal Tax Board listings, we searched for current property owners, and then we searched for current deeds. We identified 182 lots based on the limits of our study section and the results of our deed search are summarized in the following table:

Table 3-1
Summary of Deeds

Borough/Township	Lots Abutting Rivers	Deeds Found	Deeds Missing
Pequannock	21	6	15
Riverdale	6	6	0
Pompton Lakes	70	50	20
Wayne	85	80	5
Total	**182**	**142**	**40**

Of the 40 deeds that were not found:

> 23 are owned by the borough/townships,
> 9 are owned by Passaic County Park Commission,
> 1 is owned by NJDEP,
> 1 is a railway, and
> 6 had no owner listed.

Block and Lot number information is detailed on the attached Parcel Map, which also includes a list of property owners. Copies of the available deeds are maintained in our files and have not been included in this report. Please note that most of the deeds were obtained between November 2011 and January 2012, so some changes in ownership may have occurred subsequent to our search.

3.3.2 Ownership of the Dams Based on 1930 Deed

A deed dated January 3, 1930 from the Morris Canal and Banking Company to the Passaic County Park Commission was obtained and reviewed. This deed describes several tracts that were transferred to Passaic County at the time of the abandonment of the canal. At that time, the Morris Canal and Banking Company was a corporation of the State of New Jersey.

Based on our review of this deed, the two "new" concrete dams and spillways (and portions of the Guard Dike adjacent to the dam abutments) were specifically retained by the State of New Jersey and not transferred to Passaic County. A detailed title search would have to be conducted to determine if there were any subsequent transfers of these properties.

The remainder (and larger portion) of the Guard Dike was transferred to Passaic County. The State maintained an easement through adjacent properties and across the Guard Dike for access and maintenance of the dams.

The 1930 deed also transfers other tracts, some of which were likely inundated by the construction of the dams, to Passaic County.

3.3.3 Results of Deed Search

Based on our review of the deeds that were obtained, we did not find any specific easements or "rights" to the waters of the Ramapo River or Pequannock River.

3.3.4 Title Search

The Scope of Work includes an allowance for conducting title searches of tracts that may have easements and/or rights relating to the dam and/or impoundment based on the review of the deeds.

At this point in time, we have not conducted a detailed title search on any of the 182 properties.

3.4 EXISTING CONDITIONS PLANS

Using the data collected, the following plans were developed. These large-size plans are attached to this report and are referenced in other sections of this report.

Plan of Study Area (Plate 1): This plan presents the general limits of the study area which are the Pequannock River at Riverdale Road in Pompton Lakes, the Ramapo River at the Hamburg Turnpike in Wayne and the Pompton River at Pompton Plains Crossroads in Wayne. This plan includes the following planimetric information:

- county and municipal boundaries
- river channels
- dam structures
- roads
- alignment of the Wanaque Aqueduct
- parcel layout based on tax maps
- 100-year and 500-year floodplain lines
- wetland limits from NJDEP
- locations of historic features (discussed in Section 4.0)

Enlarged Plan of Dam Structures with Bathymetric Contours (Plate 2): This plan presents an enlarged topographic plan of the dams with bathymetric contours of the impoundment areas upstream of the two dams.

Parcel Map (Plate 3): This plan presents the parcel layout within the study area. The plan also includes the block and lot numbers of the parcels near the rivers and dam structures. The plan includes a list of current property owners.

Hydraulic Model Sections and Sediment Sampling Locations (Plate 4): This plan presents the location of some of the numerous sections used in the hydraulic model of the rivers. The plan also shows the locations of the various sediment samples obtained for both physical and analytical (chemical) testing.

4.1 BACKGROUND

Prior to award of this project in August 2011, Civil Dynamics communicated with the NJDEP Historic Preservation Office (HPO) to clarify the scope of work for Task 3: Historic Resource Assessment. Mr. Vincent Maresca, a Senior Historic Preservation Specialist at HPO stated that since the scope of this project is only a "Feasibility Study" to evaluate removing the dams, it is not necessary or appropriate to conduct field test pits. Therefore, he agreed with only conducting Phase IA studies (and not full Phase I) for each dam area.

Through Civil Dynamic's initial data collection tasks, we determined that a Cultural Resources Investigation was conducted in the early 1990's by the Corps of Engineers for the Passaic River Flood Protection Project.

Civil Dynamics confirmed with Vincent Maresca of HPO that the Cultural Resources Investigation Report would satisfy the HPO's request for a Phase IA report.

Civil Dynamics spent time in the HPO library reviewing the report and obtained copies of relevant sections of the report.

This section summarizes the results of the previous Cultural Resources Investigation and presents an assessment of historic and cultural resources in and around the feeder dams.

4.2 CULTURAL RESOURCES INVESTIGATION SUMMARY

The December 1995, four volume, Cultural Resources Investigation Report for the Passaic River Flood Protection Project studied a large area which completely envelopes the scope of work for this feasibility study. See the attached Figure III-1 which shows the limits of the 1995 study area.

The Cultural Resources Investigation was performed for the Passaic River Flood Protection Project which was designed to control flooding in the 935-square mile area of the Passaic River Basin. The proposed project included construction of a 20-mile long diversion tunnel plus several smaller activities.

The cultural resource surveys were conducted by Rutgers University Center for Public Archaeology of New Brunswick, New Jersey and Historic Conservation and Interpretation, Inc. of Newton, New Jersey under the coordination and direction of Boston Affiliates, Inc. of Boston, Massachusetts which is a subcontractor to WCH Industries, Inc. of Fort Washington, Maryland (the prime contractor for the study).

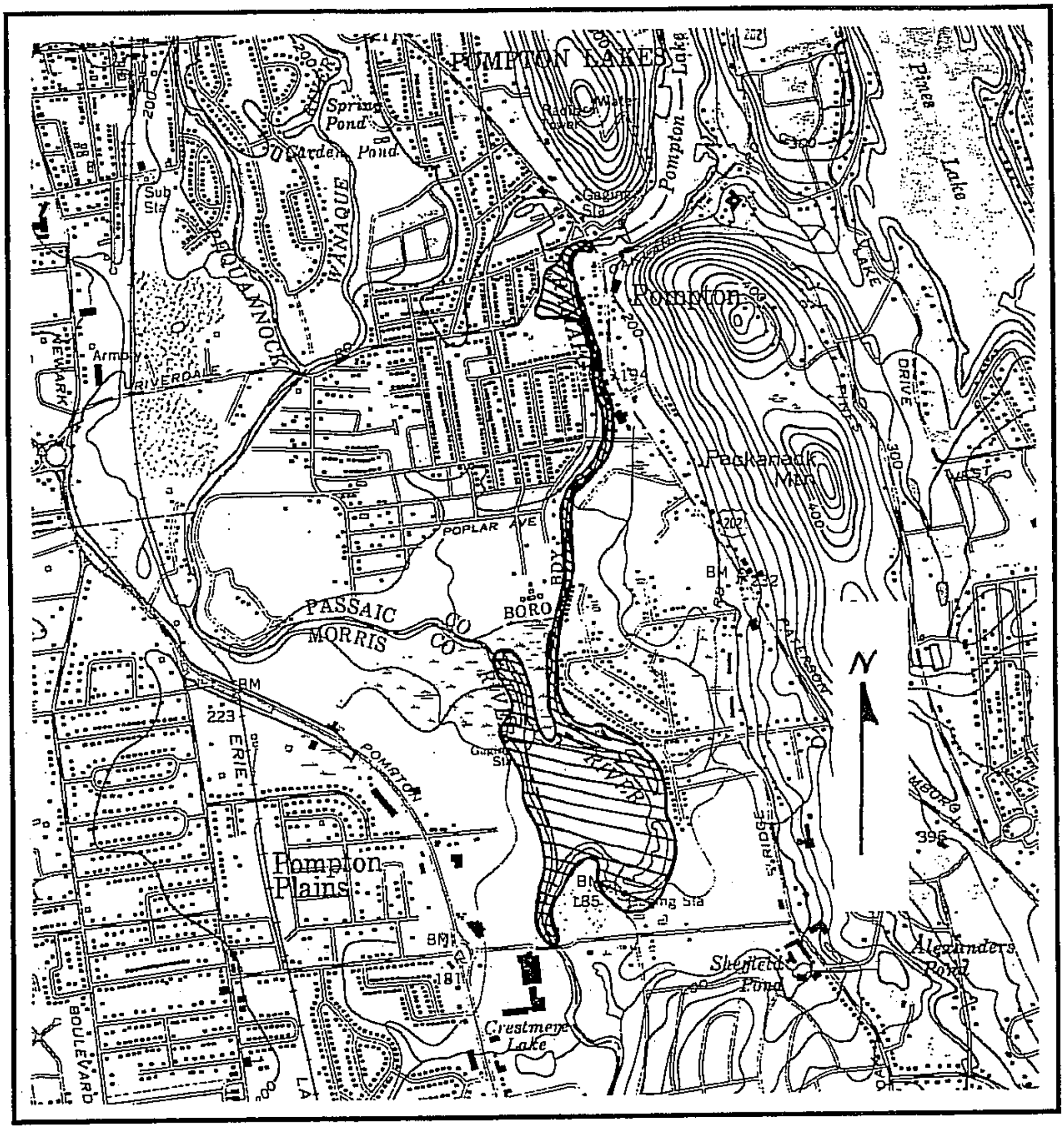

Figure III-1 A portion of the USGS Pompton Plains Quadrangle on which the location of the study area is indicated (USGS Pompton Plains Quadrangle, 7.5-minute series, 1955, photo-revised 1981, scale: 1:24 000).

A survey of recorded and potential prehistoric sites was carried out comprising background research, a reconstruction of the paleoenvironment, and site inspections limited to surface reconnaissance and selective augering of landforms.

A survey of the Pompton Feeder was conducted including archaeological testing of the Head of Feeder Lock and Locktender's house site. The survey showed that many features of the Pompton Feeder were present in the study area, including the Lock, in-ground remains of the Locktender's House, the Guard Bank, Pequannock Dam and Pompton Dam, retaining walls, the Ramapo River Slackwater Canal and towpaths, causeways and other related features.

4.3 CULTURAL RESOURCES INVESTIGATION FINDINGS

The Cultural Resources Investigation identified both dam locations as moderate to high sensitivity for both Native American and historic period archaeological sites.

The Morris Canal was placed on the National Register of Historic Places as a linear historic district in 1974.

The following sites related to the Morris Canal's Pompton Feeder were investigated and are briefly discussed below:

<u>Head of Feeder Lock</u>
The lock was discovered to be intact, except for coping stones that had been removed before it was filled. The lock is considered to be a contributing element of the Morris Canal Historic District.

<u>Locktender's House Site</u>
Elements of building debris, a well or cistern, and domestic artifacts were found at the site, indicating that an in-ground record of its presence and culture exists. The site is considered to be a contributing element of the Morris Canal Historic District.

<u>Guard Banks, Ramapo River Slackwater Canal, Towpath, Wall Remnants and Related Structures</u>
The guard banks, Ramapo River Slackwater Canal, towpath, wall remnants and related structures were located by archeologists. Canal-related structures on Finch Island including the substantial guard bank and the Pequannock Spillway were also documented and found to be present and largely intact. Stone retaining walls leading between the lock site, the river and the nearby dam were uncovered and found to be largely intact. The fieldwork on the Ramapo River Slackwater Canal section of the Feeder Canal revealed that the river still flows in the channel prepared for it and that sections of exposed towpath, causeways across former bends in the river, and retaining walls were still observable, although obscured by time. These elements are considered to be a contributing element of the Morris Canal Historic District.

The results of this research and subsequent fieldwork indicate that all of these components of the Pompton Feeder are significant elements of the Historic Morris Canal National Register site.

The Cultural Resources Investigation Report also identified six sites within this feasibility study's scope of work that justified investigation of their eligibility for listing on the National Register of Historic Places. A description of each site's determination of eligibility for Historic Preservation Status is included below:

> Schuyler-Colfax House, Wayne Township, Passaic County
> The Cultural Resources Investigation recommended that the National Register nomination for this property be expanded to include associated archaeological resources and the Colfax Cemetery located some 100 feet to the north, stating that additional historical research is needed to confirm the association of the cemetery with the dwelling. Additionally, it is important to determine the date and function of the riverbank structures. Testing will be necessary in the rear yard and riverbank portions of the property to determine the nature and extent of archaeological resources.
>
> George Washington Colfax House, Wayne Township, Passaic County
> The George Washington Colfax House is ineligible for the National Register of Historic Places due to a relocation of the building from its original site, changes to the "historic fabric" of the building over time, and the fact that the site on which it currently stands does not contain potentially eligible archaeological resources.
>
> Finch Island House site, Pequannock Township, Morris County
> Research indicates that an early twentieth-century house which was probably associated with the Morris Canal stood at this site. The site appears to have been sufficiently disturbed as to render it ineligible for the National Register of Historic Places. No foundation remains are extant above ground.
>
> Dawes Avenue Concrete Bridge, Wayne Township, Passaic County
> The Dawes Avenue Concrete Bridge has been determined eligible for inclusion on the National Register of Historic Places based on its association with the Morris Canal abandonment.
>
> Van Ness House, Pompton Lakes, Passaic County
> The Van Ness House and its associated archaeological resources are potentially eligible for inclusion on the National Register of Historic Places. Additional research to determine the exact date and history of the structure and to define the extent of modern disturbance is recommended for this site.
>
> Schuyler/Graham house Site, Wayne Township, Passaic County
> The Schuyler/Graham house site has been sufficiently disturbed so as to render it ineligible for inclusion on the National Register of Historic Places.

The Ludlum Steel Company Dumpsite has been evaluated as a potentially significant historic district that meets Criterion D of the National Register of Historic Places. The Ludlum Steel Company Dumpsites 1 and 2 are considered contributing elements to such a district.

4.4 ASSESSMENT OF HISTORIC AND CULTURAL RESOURCES

From the previous archaeological research performed, there are significant cultural resources that have the potential to be affected by changes to the feeder dams and guard dike.

No additional cultural resource survey work is recommended at this time until specific changes are proposed.

5.1 BACKGROUND

The objectives of the sediment sampling and testing for this Feasibility Study focus on assessing the characteristics of the sediment upstream of the two dams. Specifically, there are two objectives for sediment sampling and testing:

Physical Testing: Determine the physical characteristics of the materials in the river channels for use in evaluating the long-term stability of the stream bed if the dams are removed. Results of this effort will also determine areas to be sampled for analytical testing.

Analytical Testing: Determine if there are any potential pollutants in the sediment that may be present upstream of the two feeder dams. Such data will be used to evaluate sediment management options if sediment is to be removed with the dam removal.

The sediment sampling was conducted in two phases. The sampling for physical testing was conducted in November 2011 and then the sampling for analytical testing was conducted in April 2012.

5.2 PHYSICAL TESTING

5.2.1 Sampling

Civil Dynamics collected samples from the bottom of the Ramapo River and Pequannock River on November 2, 2011 and November 9, 2011, respectively. These samples were collected for physical testing only.

For both rivers, we probed the consistency and depth of the river bottom at regular intervals with a long pole and then collected representative grab samples using a Petite Ponar clamshell-style dredge. Five samples were obtained in the Ramapo River, six samples were obtained in the Pequannock River and another sample was obtained in a cross channel at the lower end of the Pequannock River.

The sampled locations are shown on Plate 4.

5.2.2 Physical Test Results

All 12 samples were tested for particle size analysis. The results showed that five of the samples were well-graded or poorly-graded gravel with some sand. The other seven samples were poorly-graded sand. All of the samples had less than 5 percent fines except one sample that had 9 percent fines.

The data sheets from the geotechnical laboratory are included in Appendix A.

The visual observations in the river along with the particle size data indicate that the sediment in the river is generally sand and gravels (bed load material) with little to no fine-grained material. This is not a surprise given the frequency of flood flows that would wash any fine-grained sediment downstream.

5.3 ANALYTICAL TESTING

5.3.1 Sampling and Analysis Plan

Using the data collected from the physical sediment sampling and testing, a Sampling and Analysis Plan was developed by Civil Dynamics for the proposed analytical testing of sediment.

The Plan was submitted to the NJDEP Office of Dredging and Sediment Technologies (ODST) for their review and approval in March 2012. The ODST approved the Plan in mid-April and provided their recommendations for the analytical testing parameters.

The recommended suite of bulk sediment chemistry analysis consisted of the target analytes found in Appendix B of the Dredging Manual, excluding volatiles, Dioxins/Furans and PCB's.

It is important to note that this suite of analytes includes mercury and lead which are the primary contaminants of concern associated with the proposed sediment removal from the Acid Brook Delta in the Ramapo River upstream of the Pompton Lake Dam.

5.3.2 Analytical Test Results

2004 Sampling
In 2004, Civil Dynamics collected two sediment samples for analytical analysis. The work was associated with a potential project to conduct repairs at the two dams. The project was not conducted (See Section 2.5).

The sampling and analysis was conducted to determine the feasibility of excavating the sediment immediately upstream of the two spillways and spreading it on-site. Specifically, surface samples of sediment were obtained at two locations. The first sample was taken adjacent to the right wingwall at the Pompton Dam and the second sample was taken upstream of the spillway at the Pequannock Dam. The locations are shown on Plate 4.

A copy of the results of the 2004 analytical analysis are included in Appendix A.

2012 Sampling
The initial physical testing of the upstream sediment indicated that the sediment is generally sand and gravel. Therefore, the sampling for analytical testing focused on locations closer to the two dams, where there is more likely to be finer-grained sediment. Samples were collected using a Wildco hand corer with a 2-inch diameter stainless steel sampling barrel.

The sampling was conducted by Civil Dynamics on April 19, 2012.

Six samples from the Ramapo River (labeled R-1 through R-6) were obtained upstream of the Pompton Dam and four samples from the Pequannock River (labeled P-1 through P-4) were obtained upstream of the Pequannock Dam. The sampled locations are shown on the Plate 4.

The 10 samples were delivered to TestAmerica for analytical testing. Duplicate samples were also tested for grain size.

A copy of the physical and analytical test results are included in Appendix A.

Summary of Results
In general, various metals and some semi-volatile compounds were detected in the sediment during both sampling events. With a few exceptions, all analytes tested were below the New Jersey Residential Soil Cleanup Criteria. The exceptions are both surface samples from 2004 and two samples from 2012 near the Pequannock Dam which had concentrations of benzo(a)pyrene above New Jersey Residential Soil Cleanup Criteria. The same two samples from 2012 near the Pequannock Dam had concentrations of lead above New Jersey Residential Soil Cleanup Criteria.

Relative to the key pollutants found at the Acid Brook Delta, lead and mercury were detected in all 12 of the samples analyzed. However, the concentrations detected in these samples were significantly below the levels found at depth in the Acid Brook Delta.

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This section identifies and reviews other issues that may be affected by the removal of the Feeder Dams.

6.1 FISH PASSAGE

In the river system's current state, the movement of fish between areas upstream and downstream of the dams is likely limited to periods of high flow when the surface water overtops the dams. In contrast, the transport of young or eggs may occur in a net downstream fashion during typical flow conditions by being carried downstream through the notch at the Pequannock Dam and over the top of the Pompton Dam. The removal of the Pompton and Pequannock Dams would inevitably allow fish to move freely throughout the river system between areas that would have normally been impeded or made difficult by the presence of the dams.

The dams currently function to isolate segments of the river into distinct reaches where fish communities do not interact with one another for periods of time, until a significant flow event allows for movement of these fish. Hence, inter-specific competition and predator/prey interactions are subsequently affected which may in turn affect community assemblages and species diversity.

With regards to fish species that inhabit this river system, the NJDEP Division of Fish and Wildlife (DFW) reports the following species in their Fish Index of Biotic Integrity (FIBI) studies for the Pequannock and Ramapo Rivers at the nearest monitoring stations to the dams:

Pequannock River – FIBI077
(Sampling date of 07/10/2008)

Ranked in decreasing order of abundance:
Blacknose dace (*Rhinichthys atratulus*)
Common shiner (*Luxilus cornutus*)
Tessellated darter (*Etheostoma olmstedi*)
Cutlips minnow (*Exoglossum maxillingua*)
Creek chub (*Semotilus atromaculatus*)
White sucker (*Catostomus commersoni*)
Brown trout (*Salmo trutta*)
Smallmouth bass (*Micropterus dolomieu*)
Fallfish (*Semotilus corporalis*)
Brook trout (*Salvelinus fontinalis*)
Bluegill (*Lepomis macrochirus*)
Rainbow trout – stocked (*Oncorhynchus mykiss*)
Green sunfish (*Lepomis cyanellus*)

Ramapo River – FIBI006
(Sampling date of 08/15/2005)

Ranked in decreasing order of abundance:
Tessellated darter (*Etheostoma olmstedi*)
Green sunfish (*Lepomis cyanellus*)
Largemouth bass (*Micropterus salmoides*)
Redbreast sunfish (*Lepomis auritus*)
White sucker (*Catostomus commersoni*)
Creek chub (*Semotilus atromaculatus*)
Cutlips minnow (*Exoglossum maxillingua*)
Rock bass (*Ambloplites rupestris*)
Yellow bullhead (*Ameiurus natalis*)
Smallmouth bass (*Micropterus dolomieu*)
Yellow perch (*Perca flavescens*)
Bluegill (*Lepomis macrochirus*)
White perch (*Morone americana*)

Recent input from the NJDEP DFW confirmed that these species assemblages (dated 2005 and 2008) are accurate and that all species with the exception of the largemouth bass would experience an increase in habitat availability from the removal of the dams. The dam removals may have a minimally adverse effect on largemouth bass in that there would be less of the impounded water that they prefer. However, the removal of the dams will not eliminate this species since it will continue to occupy the relatively slower moving portions of the rivers.

Absent from the species assemblages listed above is American eel (*Anguilla rostrata*), a catadromous fish that moves between marine waters and fresh waters to complete its life cycle. The NJDEP DFW reports that this species in the Passaic River drainage can only make it to the base of the Dundee Dam in Garfield, New Jersey.

The removal of the dams may also affect fish movements with regards to their responses to changes in surface water temperatures. Surface water temperatures are anticipated to decrease following dam removal because the waters will no longer rise in temperature within the impounded segments of the rivers. This drop in water temperature may result in an associated increase in the ability of the water to maintain a higher level of dissolved oxygen. This higher level of dissolved oxygen may have a direct effect upon an individual's behavior to inhabit previously unoccupied areas.

6.2 STRUCTURAL IMPACTS

The following structural features are located in the study area and the potential impact to the structures due to dam removal alternatives needs to be considered:

Dawes Highway Bridge on Ramapo River: The bridge is the original "Colfax Bridge" built in 1929 during the abandonment of the Morris Canal. Significant changes in flow rate or shear in the river due to the removal of the feeder dams could impact the bridge abutments.

Railroad Embankment along the right bank of the Pequannock River: Significant changes in flow rate or shear in the river could potentially impact the embankment.

Wanaque Aqueduct: There are two river crossings in study area, one across the Pequannock River well upstream of the Pequannock Dam and the other across the Pompton River below the Pompton Dam. In both cases, the aqueduct is deep and encased in concrete. As a result, any changes to the river flow or shear conditions are unlikely to impact the aqueduct.

Pompton Lakes MUA Sewage Treatment Plant Outfall: The outfall is in about 4 feet of water depth at the right bank of Ramapo River in Pompton Lakes. Changes in the normal water surface of the Ramapo River due to the removal of the feeder dams could expose this outfall.

USGS Gaging Station: The weir is just upstream of Pompton Plains Crossroads. Significant changes in flow rate or shear in the river due to the removal of the feeder dams could impact the stability of the weir.

Pompton Plains Crossroads Bridge: Again, significant changes in flow rate or shear in the river due to the removal of the feeder dams could impact the bridge abutments.

6.3 WATER SUPPLY

Downstream of the Pompton Dam and just upstream of Pompton Plains Crossroads/Jackson Avenue Bridge, is a water supply intake that is owned and operated by the Passaic Valley Water Commission. This intake pumps water into Point View Reservoir in Wayne when there is need to replenish water in the reservoir.

There is the potential concern that sediment could become mobilized during dam removal and dredging which could impact the quality of the pumped water. Additionally, it is possible that sediment could cause damage to the pumps and mechanical equipment.

However, based on telephone communication with the Passaic Valley Water Commission, Civil Dynamics learned that that this pump station is used rarely and has not been operated in two years. Therefore, since the pumping is infrequent, this concern does not appear critical and can be mitigated by managing the pumping schedule.

6.4 SPECIES OF CONCERN

The results of a NJDEP Natural Heritage Program and Landscape Project review indicated the following rare species or their respective habitats to be present on the project area:

Freshwater Mussels
Creeper (*Strophitus undulatus*) – not listed
Eastern lampmussel (*Lampsilis radiata*) – threatened
Triangle floater (*Alasmidonta undulata*) – threatened

Bird
Red-shouldered hawk (*Buteo lineatus*) – endangered (breeding) / threatened (non-breeding)

The review also indicated the following species or its habitat to be present within 1/4 mile of the project area:

Amphibian
Fowler's toad (*Bufo woodhousii fowleri*) – special concern

Lastly, the review also indicated that the project area is situated within the "Pompton River Gravel Bar" Natural Heritage Priority Site that spans both Morris and Passaic Counties. This Priority Site consists of a series of small gravel bars and gravelly shoreline along the Pompton and Ramapo Rivers. The critical areas for this Priority Site are the rivershores, upstream wetlands, and adjacent undeveloped lands. This Priority Site also contains the following state critically imperiled plant species:

Plant
Small-flower halfchaff sedge (*Hemicarpha micrantha*)

6.4.1 Freshwater Mussels

Freshwater mussels prefer well-oxygenated water flowing over stable substrates, usually sand and gravel with some silt. When a body of water is dammed, the stream or river channel is transformed from a free-flowing, well-oxygenated environment to one that is more stagnant and prone to heavy silt deposition. This is an intolerable condition for many freshwater mussel species adapted to riverine conditions. Another effect of dams is related to the unique relationship between mussels and fish, a relationship which determines the reproductive success and subsequently, the dispersal of mussels. Due to their sedentary lifestyle, freshwater mussels rely on a unique reproductive strategy that is dependent upon host fish species to colonize new areas. Freshwater mussels have three basic life stages: larval (or parasitic), juvenile, and adult. When environmental variables reach ideal reproductive conditions, male mussels release sperm into the water column. The female mussels draw in the sperm as they filter water. After fertilization within the female, the females brood the young from the egg to the larval stage in their gills. The larvae, called glochidia, are then released by the female. The glochidia must attach to the gills or fins of an appropriate host fish in order to complete their metamorphosis to the juvenile stage.

Glochidia may remain attached to host fish from 2 weeks to several months, depending on the species of the mussel. Following metamorphosis, the juveniles drop from the host fish and take up life as sedentary filter feeders (NRCS & WHC, 2007). Thus, this relationship allows glochidia to be transported to the reaches of streams and rivers. A structural impediment to fish movement, such as a dam, may result in hosts becoming inaccessible to their glochidial parasites. Under certain conditions, this could result in mussel populations that continue to grow old and die without natural recruitment (Watters, 2000). Thus fish passage barriers are thought to represent the single greatest threat to freshwater mussels by impeding their ability to reproduce. Because bivalves depend on flowing water and unimpeded movements of host fish, dam removal allows for the reconnection of fragmented bivalve populations (Gregory et al. 2002).

A variety of fish hosts have been identified for the creeper, including largemouth bass, green sunfish, yellow perch, golden shiner, longnose dace, Atlantic sturgeon, and others (Beans and Niles, 2003). The eastern lampmussel is thought to use fish hosts such as rock bass, pumpkinseed, bluegill, smallmouth bass, longear sunfish, largemouth bass, white perch, sand shiner, yellow perch, bluntnose minnow, and black crappie (Cordeiro, n.d.; Nedeau, 2000). The triangle floater seems to be affected less by habitat degradation than some other mussel species, and is thought to use a greater diversity of fish hosts than most other mussels found in similar ecosystems (Connecticut DEP, 2003; Nedeau, 2000). Some of the host fish reported for the triangle floater in New Jersey include common shiner, blacknose dace, longnose dace, pumpkinseed, white sucker, slimy sculpin, largemouth bass, and fallfish (Beans and Niles, 2003).

The presumed beneficial effects to bivalves from dam removal may not be seen immediately following removal. Removing a dam can release large amounts of sediment to downstream reaches over short periods of time, which can result in adverse biological consequences (Gregory et al. 2002). However, effects to individual mussels are only an immediate consequence, whereas the longer-term role of the freshwater mussel in the ecosystem may be restored. That is, to transfer nutrients to other parts of the ecosystem (Anderson, 2005) through the transformation of materials received from upstream sources into living tissue that will eventually be transported back upstream or to outside of the aquatic environment via predation.

6.4.2 Red-Shouldered Hawk

In New Jersey, the breeding habitat for the red-shouldered hawk includes mature wet woods such as hardwood swamps and riparian forests. Nesting territories, which can be deciduous, coniferous, or mixed woodlands, are typically located within remote and extensive old-growth forests containing standing water. Within the Pequannock watershed, red-shouldered hawks are found in stream bottomlands and coniferous or mixed forests containing eastern hemlock or white pine. Nests are predominantly located in wilderness areas where there are abundant wetlands, small forest openings, and limited areas of open water such as lakes. In the Pequannock watershed, they avoid areas of human habitation, steep uplands, dry slopes, open water, areas with limited conifers, and areas with too many or too few forest openings (Beans and Niles, 2003).

The above habitat description, specific to New Jersey and the Pequannock watershed, suggests that the river system in its current state may contain too much open water for this species. The removal of these dams may allow for greater floodplain forest development over time, which is a habitat type that is more suitable for the red-shouldered hawk. In Michigan, the loss of wet hardwood forests has been identified as one of two major factors that have led to the decline of this species (USFWS, 2012). It can be safely assumed that wet hardwood forests have been lost as a result of the Pequannock and Pompton Dams; however, their potential for return exists upon dam removal.

6.4.3 Fowler's Toad

The Fowler's toad inhabits loose, well-drained sandy or gravelly soils throughout New Jersey, breeding in vernal pools, ditches, and the shallow edges of streams, lakes, and ponds (Schwartz and Golden, 2002). In New England, where the species co-occurs with the American toad (*Bufo americanus*), as is often the case in New Jersey, the Fowler's toad is often found in dryer areas than the American (Klemens, 1993). Similar to the changes described above for the red-shouldered hawk, the removal of the dams may provide more usable floodplain habitat for this species.

6.4.4 Small-Flower Halfchaff Sedge

Hemicarpha micrantha (also known as *Lipocarpha micrantha* by some taxonomists) inhabits open and wet sandy environments, usually in areas of very sparse vegetation, and does not tolerate competition or organic sediment (COSEWIC, 2002). This species germinates in the late summer, when dropping water levels expose the open sandy habitat it requires. High water levels may prevent germination from occurring, with the population remaining dormant until appropriate conditions occur (Smith et al. 2004). It may remain dormant and undetected for years, even decades, if water levels are unfavorably high (COSEWIC, 2002). It is usually found in areas of very sparse vegetation, and apparently is intolerant of competition from other plant species. These habitat conditions are maintained by fluctuating water levels (Smith et al. 2004). While this species requires low seasonal water levels to germinate and flower, periodic high water is also required to prevent more vigorous species from dominating its habitat (Smith et al. 2004).

The above habitat description suggests that the Pompton River Gravel Bar Priority Site currently provides the necessary conditions for this species to persist. However, bar formation in rivers and streams is a highly dynamic process, and the mechanisms by which they form, shift, or diminish is expected to continue to exist regardless of whether the dams are present or not. The Michigan Natural Features Inventory (MNFI) reports that management of this species requires conservation of habitat and protection of the hydrology, including maintenance of cyclical drawdown regime and water table. Dam removal will restore the hydrology of these rivers; however, what is unknown is whether or not the current hydrologic and hydraulic condition of the rivers provides the degree of fluctuating water levels necessary for germination, or the periodicity of high water necessary for minimizing inter-specific competition.

6.5 RECREATIONAL USAGE

Several parks are located adjacent to the waters of the Pompton, Pequannock, and Ramapo Rivers. These parks provide for potential recreational boating, fishing, and hiking opportunities. Attempts were made to acquire usage statistics on the various parks in the area; however, detailed information was unobtainable and may not be documented. This being said, the Riverdale Natural Resources Inventory notes that these areas have extraordinary recreational potential that is largely underutilized.

While there are organizations that plan activities and events on these properties, the scope and frequency of usage is limited. For example, the Pequannock River Coalition plans clean ups, hikes, and kayak/canoe tours of the Three Rivers Trail, a recreational boating route along sections of the Pequannock River, Ramapo River, and Pompton River; however, these events are limited and only two kayak/canoe trips are planned for this summer.

Fishing is a popular pastime throughout the Pequannock River. The NJDEP Division of Fish and Wildlife stocks approximately 6,000 brook and rainbow trout in the northern reaches of the Pequannock River from West Milford to Riverdale. Additionally, the Division notes that the Pequannock is particularly rich in wild brown trout. The lower Pequannock River also has great potential for angling, particularly for warm water species such as bass, panfish, and pickerel.

As the recreational usage of the Pompton, Pequannock, and Ramapo Rivers is limited, the potential impacts due to dam removal should be minimal.

6.6 OTHER SOCIO-ECONOMIC AND POLITICAL ISSUES

The townships and communities downstream of the Pompton Dam and Pequannock Dam are likely to have concerns that should these dams be removed, the river would experience changes which may impact their residents. Specifically, concerns have already been raised that removal of the dams may increase flows and flooding during storm events or cause additional sediment movement and increased turbidity of the water downstream. Alternatives to remove the feeder dams need to address these concerns.

6.7 INVASIVE SPECIES

Dam removal activities have the potential to result in producing environmental conditions favorable for invasive plant species.

These conditions may arise by two different means. First, by its very nature, a dam removal project is not unlike other construction projects which result in earth disturbance, intentional and inadvertent vegetation removal, exposure of the ground surface to sunlight and higher ambient temperatures, and the transport of seeds and plant fragments from one area to another.

In their Natural Resource Inventory (NRI) for the Borough of Riverdale (PRC, 2007), the Pequannock River Coalition (PRC) identify Japanese knotweed (*Polygonum cuspidatum*) and purple loosestrife (*Lythrum salicarium*) as two particularly notable non-native and invasive species in the watershed. Observations of the site area in April 2012 indeed revealed many portions of the shorelines for both rivers to be vegetated with stands of Japanese knotweed. Although purple loosestrife was not observed, the month of April at the elevations of these watersheds is considered too early in the growing season for this species to emerge. The potential for these species to proliferate in the watershed following dam removal is high. Japanese knotweed is capable of establishing new populations simply through the propagation of any fragment of itself. Thus, any disturbance of Japanese knotweed that results in allowing plant fragments to float downstream can contribute to its dispersal. Purple loosestrife disperses readily through seed and likewise, any disturbance to plants during the flowering period that results in the release of seeds will contribute to its dispersal.

The other means by which dam removal may produce favorable conditions for these species is by exposing previously submerged lands. These newly exposed land areas will provide invasive species, native and non-native, the opportunity to colonize and form near monotypic stands. The control of these invasive species has been well-studied and there are several methods available for use, many of which employ a combination of chemical, mechanical, and biological control. Many different variations of methodologies are reported in the literature; however, control methods that are effective in one geographical area may not be as effective in another. Much of the variability seen in method success relates to the genetic variability of the plants across geographic regions, thus it is important to select control methods that have exhibited success within the same region.

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Four alternatives for the removal of the Pompton and Pequannock Feeder Dams were evaluated under this study. The alternatives evaluated are as follows:

Alternative 1

This alternative consists of lowering the entire 270-foot length of the crest of the Pompton Dam (located on the Ramapo River) to Elevation 165 feet. This proposed elevation is about 3.5 feet below the downstream tailwater, which is typically in the range of Elevation 168.5 feet and is controlled by downstream structures.

The existing crest is at Elevation 174.6 feet, so the spillway crest will be lowered about 10 feet for this alternative. The total height of the spillway is reported to be about 22 feet, but given the downstream tailwater, there would be no benefit to remove more of the structure.

This alternative also includes major excavation upstream of the dam to enlarge the river and improve flow to the dam. Specifically, this alternative includes dredging of the Ramapo River channel for a distance of about 3,200 feet upstream of the dam. The proposed dredging will yield a uniform channel bottom width of 200 feet and a uniform channel slope from Elevation 165.0 at the dam to Elevation 168.4 at the upstream limit of excavation. We have estimated about 140,000 cubic yards of excavation. Based on the analytical testing (see Section 5.3.2), we have assumed that this material will meet “clean” fill standards and will not require special disposal. The dredging will remove the original timber crib dam that is reported to be upstream of the current dam, accumulated sediment, and portions of the islands in the river.

Figure 7-1 illustrates Alternative 1.

Alternative 2

This alternative includes all of the modifications associated with Alternative 1 plus the lowering of the earth Guard Dike (the dike located between the Feeder Dams along the right side of the Ramapo River) to Elevation 178 feet.

As noted in Section 2.0, this dike is about 2,400 feet long and the top of the dike varies from Elevation 180.9 feet to Elevation 183.2 feet. Therefore, the proposed lowering will reduce the height about 3 to 5 feet.

As a note, the top of the dike cannot be lowered any further, because the downstream ground surface is at Elevation 178 feet.

Figure 7-2 illustrates Alternative 2.

Alternative 3

This alternative includes all of the modifications associated with Alternatives 1 and 2, as well as the lowering of the Pequannock Dam to Elevation 168.3 feet for a 150-foot length on the left side.

The elevation was selected since the downstream concrete apron is at an average elevation of about 168.3 feet. Also, the proposed lowering was limited to 150-feet since the width of the downstream channel is significantly less than the existing 270-foot length of the spillway crest.

Similar to Alternative 1, this alternative also includes major excavation in the Pequannock River upstream of the dam for a distance of about 1,600 feet. We estimated an additional 27,000 cubic yards of excavation in addition to the 140,000 cubic yards for Alternative 1.

We have conservatively assumed that the 27,000 cys from the Pequannock River will not meet “clean” fill requirements due to the concentration of lead and benzo[a]pyrene (see Section 5.3.2).

Figure 7-3 illustrates Alternative 3.

Alternative 4

As discussed above, Alternatives 1, 2 and 3 include major excavation in the rivers. Given that such excavation work will be difficult to permit, and difficult and costly to implement, we also evaluated an alternative that focused on removal of the concrete feeder dams and limited the upstream excavation work in the rivers.

Alternative 4 consists of lowering the entire 270-foot length of the crest of the Pompton Dam to Elevation 167 feet. The existing crest is at Elevation 174.6 feet, so the spillway crest will be lowered about 8 feet. This proposed elevation of the crest is about 1.5 feet below the downstream tailwater.

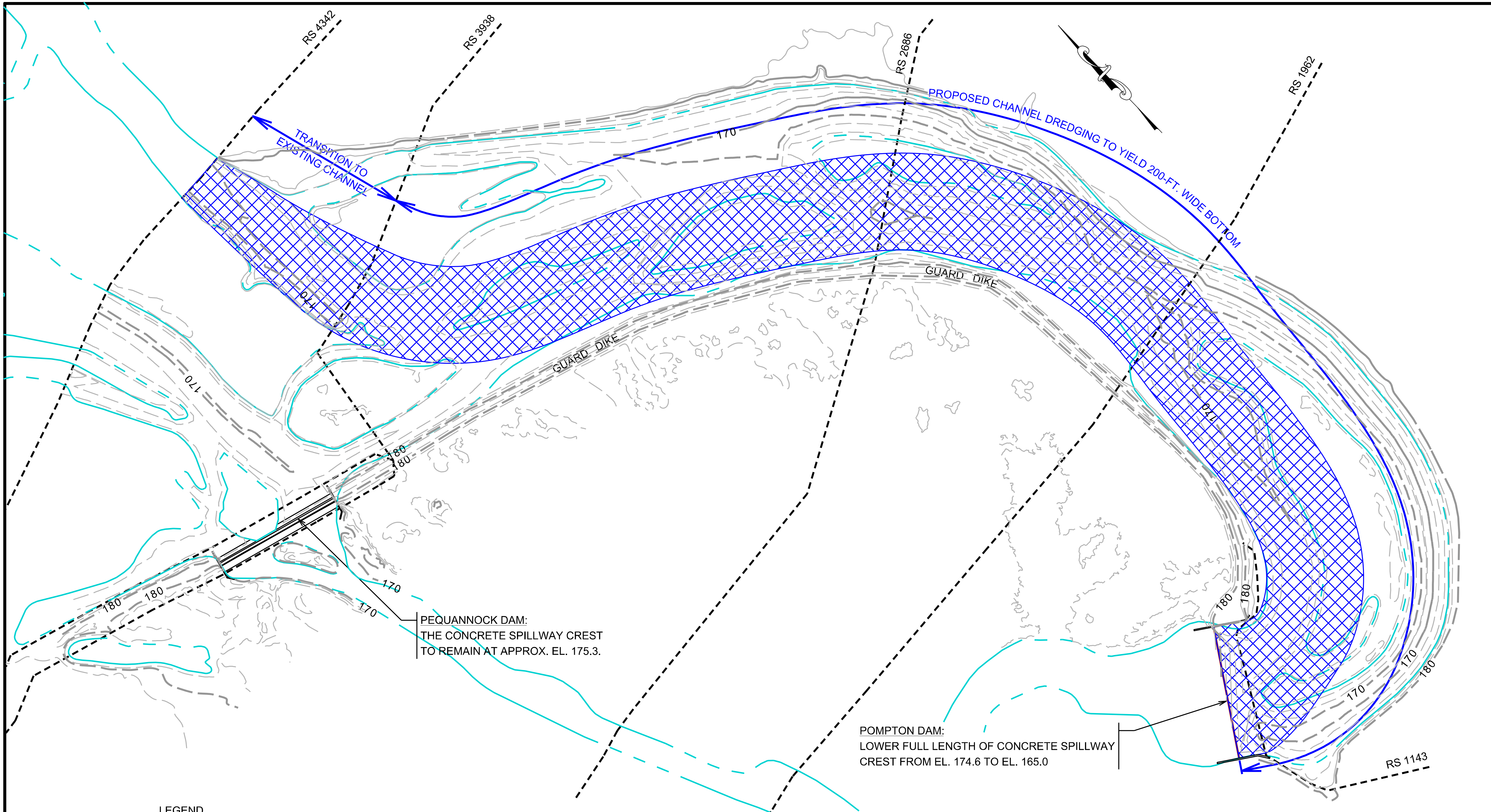
To provide an appropriate approach to the lowered dam, this alternative includes excavation of the Ramapo River channel for a distance of about 900 feet. The proposed dredging will provide a 200-foot wide channel at the dam at Elevation 167.0 that narrows to a 100-foot wide channel at the upstream limit of dredging at Elevation 167.4.

This alternative also includes the lowering of the Pequannock Dam to Elevation 170.0 feet for a 100-foot length with very limited dredging upstream of the dam for a distance of about 100 feet.

The total proposed excavation in the rivers is about 22,000 cubic yards for this alternative.

Figure 7-4 illustrates Alternative 4.

In addition to the four alternatives presented above, a fifth alternative was discussed that would "straighten" the alignment of the Ramapo River and bypass the meander in the area between the two feeder dams. However, based on the results of the hydraulic analyses of the four alternatives presented above, it was judged that such an alternative would yield similar results to Alternative 1. Additionally, such an alternative has the potential for more environmental issues since there historically has not been a straight channel through this area. The straightened channel would also pass through private property. Due to these considerations, this alternative was not evaluated further.



LEGEND

RS 6343	RIVER STATION
180	EXISTING CONTOUR
	EDGE OF WATER

PLAN

SCALE: 1" = 200'

0 100 200 400 600

GRAPHIC SCALE

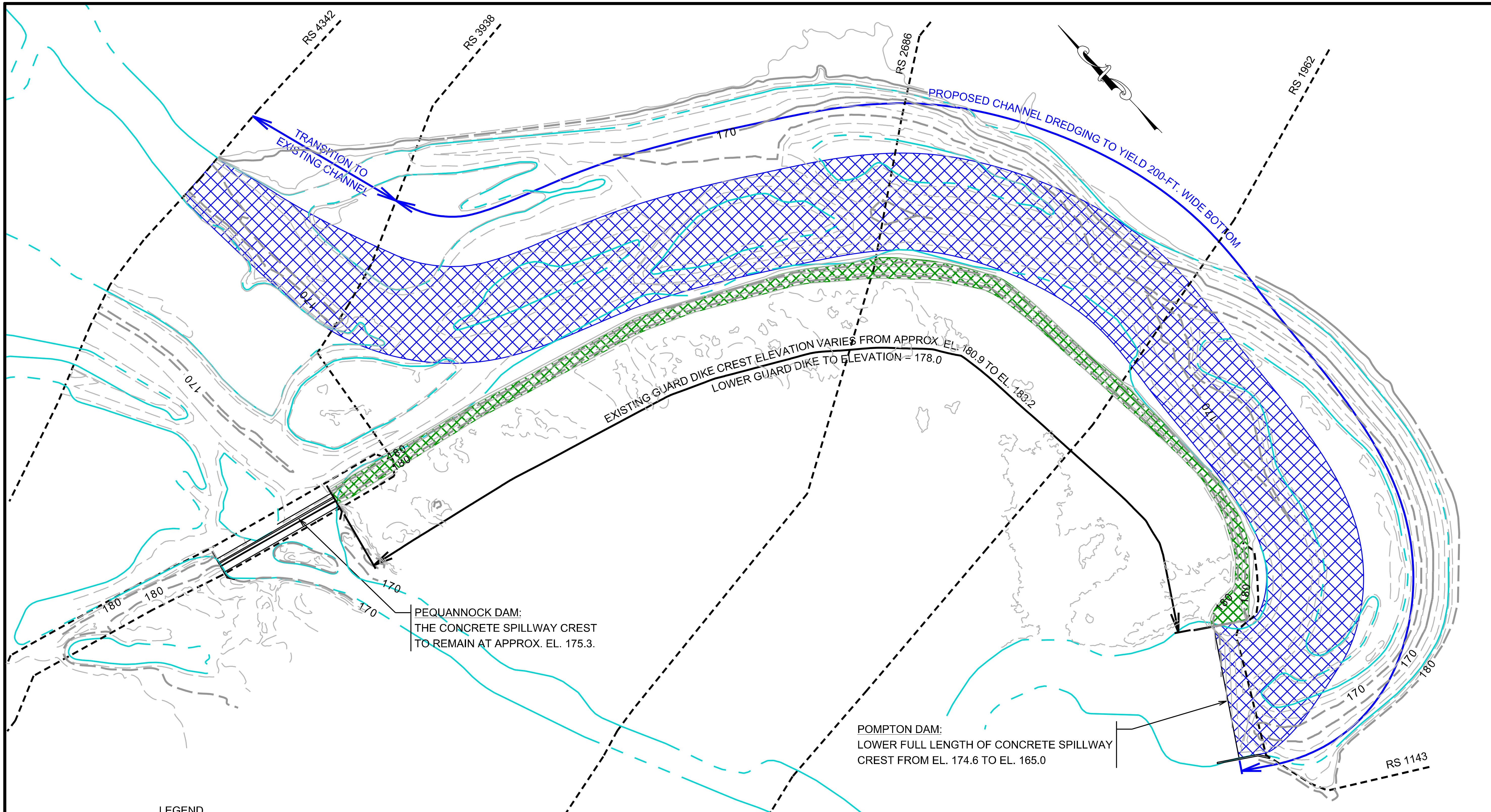
1. EXISTING TOPO AND FEATURES ARE BASED ON A SURVEY BY AECOM IN FEBRUARY 2012 AND CIVIL DYNAMICS, INC. IN DECEMBER 2011 AND FEBRUARY 2012. DEPTH OF WATER MEASUREMENTS CONDUCTED BY CIVIL DYNAMICS, INC. IN NOVEMBER 2011. LiDAR AND AERIAL PHOTOS WERE USED TO SUPPLEMENT THE SURVEYED FIELD DATA IN THE DEVELOPMENT OF THE EXISTING TOPOGRAPHY.

2. VERTICAL DATUM IS NAVD 88.

ALTERNATIVE No. 1
FEASIBILITY STUDY
for the
REMOVAL of POMPTOM DAM and PEQUANNOCK DAM

CIVIL DYNAMICS, inc.

Scale: 1" = 200'	Date: 4/17/12	Figure 7-1



LEGEND

RS 6343	RIVER STATION
180	EXISTING CONTOUR
	EDGE OF WATER

PLAN

SCALE: 1" = 200'

0 100 200 400 600

GRAPHIC SCALE

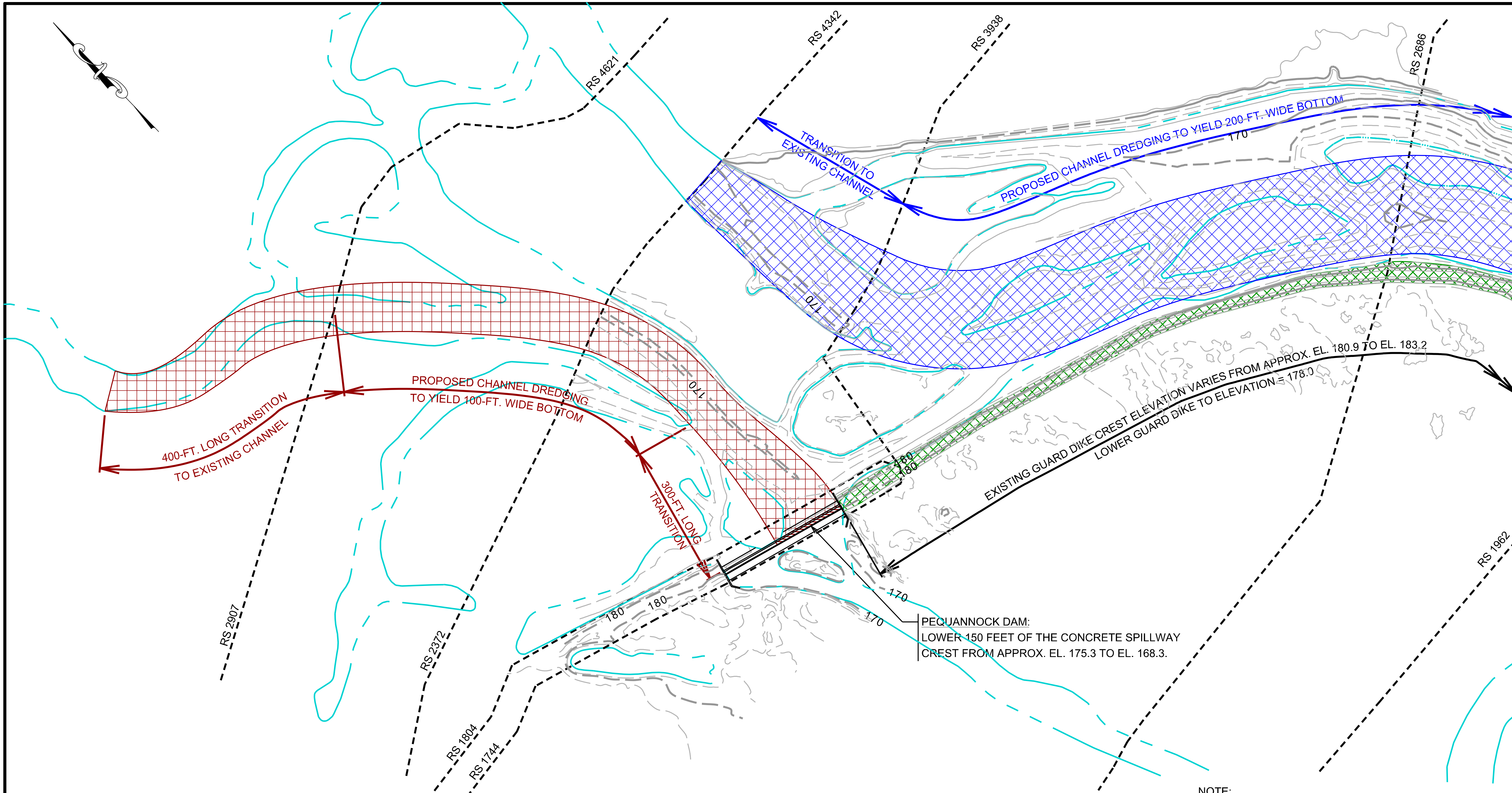
1. EXISTING TOPO AND FEATURES ARE BASED ON A SURVEY BY AECOM IN FEBRUARY 2012 AND CIVIL DYNAMICS, INC. IN DECEMBER 2011 AND FEBRUARY 2012. DEPTH OF WATER MEASUREMENTS CONDUCTED BY CIVIL DYNAMICS, INC. IN NOVEMBER 2011. LiDAR AND AERIAL PHOTOS WERE USED TO SUPPLEMENT THE SURVEYED FIELD DATA IN THE DEVELOPMENT OF THE EXISTING TOPOGRAPHY.

2. VERTICAL DATUM IS NAVD 88.

ALTERNATIVE No. 2
FEASIBILITY STUDY
for the
REMOVAL of POMPTOM DAM and PEQUANNOCK DAM

CIVIL DYNAMICS, inc.

Scale: 1" = 200'	Date: 4/17/12	Figure 7-2



NOTE:
ALTERNATIVE 3 INCLUDES ALL THE WORK FOR ALTERNATIVE 1 AND ALTERNATIVE 2.

LEGEND

RS 6343	RIVER STATION
180	EXISTING CONTOUR
	EDGE OF WATER

PLAN

SCALE: 1" = 200'

0 100 200 400 600

GRAPHIC SCALE

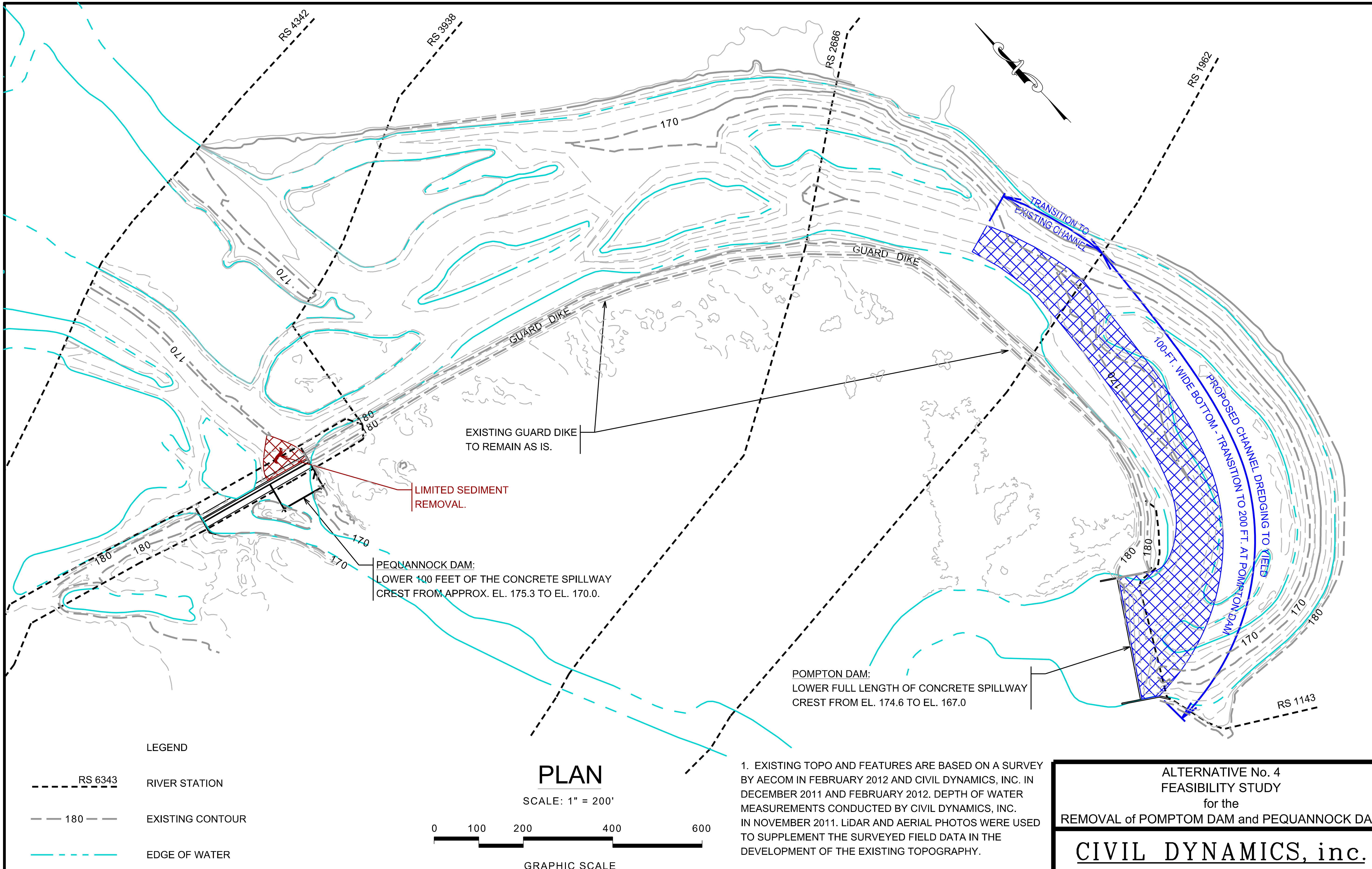
1. EXISTING TOPO AND FEATURES ARE BASED ON A SURVEY BY AECOM IN FEBRUARY 2012 AND CIVIL DYNAMICS, INC. IN DECEMBER 2011 AND FEBRUARY 2012. DEPTH OF WATER MEASUREMENTS CONDUCTED BY CIVIL DYNAMICS, INC. IN NOVEMBER 2011. LiDAR AND AERIAL PHOTOS WERE USED TO SUPPLEMENT THE SURVEYED FIELD DATA IN THE DEVELOPMENT OF THE EXISTING TOPOGRAPHY.

2. VERTICAL DATUM IS NAVD 88.

ALTERNATIVE No. 3
FEASIBILITY STUDY
for the
REMOVAL of POMPTOM DAM and PEQUANNOCK DAM

CIVIL DYNAMICS, inc.

Scale: 1" = 200'	Date: 4/17/12	Figure 7-3



PLAN

SCALE: 1" = 200'

1. EXISTING TOPO AND FEATURES ARE BASED ON A SURVEY BY AECOM IN FEBRUARY 2012 AND CIVIL DYNAMICS, INC. IN DECEMBER 2011 AND FEBRUARY 2012. DEPTH OF WATER MEASUREMENTS CONDUCTED BY CIVIL DYNAMICS, INC. IN NOVEMBER 2011. LiDAR AND AERIAL PHOTOS WERE USED TO SUPPLEMENT THE SURVEYED FIELD DATA IN THE DEVELOPMENT OF THE EXISTING TOPOGRAPHY.

2. VERTICAL DATUM IS NAVD 88.

ALTERNATIVE No. 4 FEASIBILITY STUDY for the REMOVAL of POMPTOM DAM and PEQUANNOCK DAM		
CIVIL DYNAMICS, inc.		
Scale: 1" = 200'	Date: 6/20/12	Figure 7-4

8.1 INTRODUCTION

The purpose of this hydrologic and hydraulic analysis was to evaluate a number of alternatives for the removal of the Pompton and Pequannock Feeder Dams, using a hydraulic computer model. The study reaches includes approximately 5.50 miles of the Ramapo River (which includes Pompton Lake) and 0.17 miles of the Pompton River.

The study limits are from the Pompton Plains Crossroads/Jackson Avenue Bridge (Pompton River crossing), which is approximately 11,500 feet below the Pompton Lake Dam, to the downstream face of the Route 287 Bridge (Ramapo River crossing). Tributary flows from the Wanaque, Pequannock, Haycock, and Pompton Rivers were also incorporated into the hydrologic and hydraulic models.

8.1.1 Analysis Overview

The US Army Corps of Engineers (USACE) HEC-RAS Unsteady Flow model was used to determine downstream water surface elevations during various flood events for the various Feeder Dam removal alternatives. The HEC-RAS model was originally developed by AECOM to simulate the downstream effects resulting from the operation of the Floodgate Facility at the Pompton Lake Dam (AECOM, 2012); therefore, the model takes into account the existing rules for controlling the Pompton Lake Dam floodgate openings and operation.

An existing HEC-HMS (ArcHydro/HEC-GeoHMS) hydrologic model, again originally developed by AECOM for the Pompton Lake Dam Floodgate Facility Analysis (AECOM, 2012) was used to establish the inflow hydrographs for input into the unsteady flow HEC-RAS model.

As part of the previous analysis of the Pompton Lake Dam Floodgate Study, the HEC-HMS and HEC-RAS models were calibrated to four flood events: the March 12-14, 2010, March 6-9, 2011, March 9-13, 2011, and Hurricane Irene (August 2011). Data from the USGS Pompton Lake stream gage, USGS Dawes Highway stream gage, SCADA data from the floodgate facility, as well as other available/collected data (i.e. high water marks) were used to calibrate the models and overall analysis.

8.1.2 Flood Events Investigated

Six simulated events representing a range in flows were modeled and analyzed. These six events include the 2-year, 5-year, 10-year, 25-year, 50-year, and 100-year. For each flood event, the peak water surface elevation, channel velocity, total flow, and channel shear stress in each river reach was evaluated under the four alternatives.

8.1.3 Evaluation of Alternatives for Removal of the Feeder Dams

Four alternatives for the removal of the Feeder Dams were evaluated under this study. The alternatives are discussed in detail in Section 7.0 and presented below.

> **Alternative 1:** Lowering the entire 270-foot length of the crest of the Pompton Dam to Elevation 165 feet and dredging of the Ramapo River channel for a distance of about 3,200 feet. See Figure 7-1.
>
> **Alternative 2:** Alternative 1 plus the lowering the top of the earth Guard Dike to Elevation 178 feet. See Figure 7-2.
>
> **Alternative 3:** Alternatives 1 and 2, plus lowering 150 feet of the Pequannock Dam to Elevation 168.3 feet and dredging upstream of the dam for a distance of about 1,600 feet. See Figure 7-3.
>
> **Alternative 4:** Lowering the entire 270-foot length of the crest of the Pompton Dam to Elevation 167 feet and dredging of the Ramapo River channel for a distance of about 900 feet. Lowering a 100-foot length of the Pequannock Dam to Elevation 170.0 and limited upstream dredging. See Figure 7-4.

For the each alternative, the peak water surface elevation, channel velocity, total flow, and channel shear stress for a number of stations (cross sections) along the Ramapo, Pequannock, and Pompton Rivers was compared and evaluated under the flood events discussed above.

8.2 ANALYSIS

8.2.1 Hydrologic and Hydraulic Modeling

This study focuses on the Feeder Dams located on the Pequannock and Ramapo Rivers, which are part of the Pompton River Basin, located in the larger Passaic River Watershed, which includes areas of northeastern New Jersey and southeastern New York.

The downstream reach of the Pompton River Basin receives 354 square miles of runoff from numerous tributaries and storage reservoirs. The basin includes three major rivers that flow into the Pompton River near the downstream boundary, the Pequannock, Wanaque, and Ramapo Rivers. The Pompton River Basin is characterized by a varying density of residential areas upstream in the watershed, and increasingly higher density residential and urban land uses downstream in the watershed. The Pompton River Basin has been sub-divided into 64 sub-basins representing a varying degree of land cover, river confluences, impervious coverage, and storage areas within the watershed. The sub-basins were delineated based on a USGS 10-meter elevation topographic grid data and the New Jersey Department of Environmental Protection (NJDEP) Hydrologic Unit Code 14 (HUC14) Delineations.

Figure 8-1 shows the drainage watersheds for the major rivers that drain into the Pompton River.

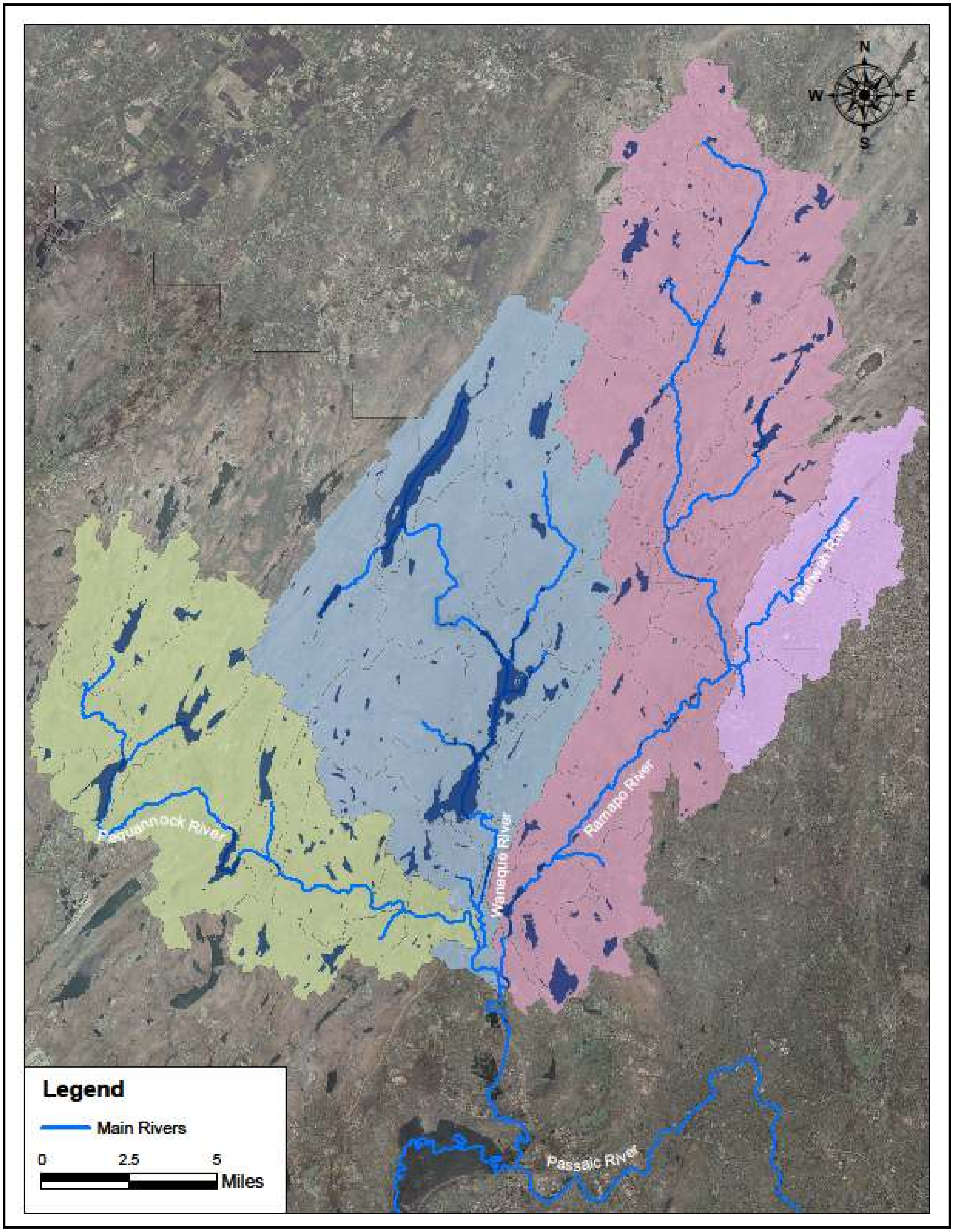


Figure 8-1
Study Area Watershed

The HEC-HMS hydrologic model used in this study was originally developed by AECOM for the Pompton Lake Dam Floodgate Facility Analysis (AECOM, 2012). This model of the Pompton River Basin was calibrated to four recent flood events. These four recent calibration events included the March 12-14, 2010, March 6-9, 2011, March 9-13, 2011, and Hurricane Irene (August 27-29, 2011) events. The model was validated to be within one standard error for the 2-, 10-, 25-, 40-, 50- and 100-year frequency rainfall events (AECOM, 2012).

8.2.2 Hydraulics

8.2.2.1 HEC-RAS – Unsteady Flow Model

The USACE Hydrologic Engineering Centers River Analysis System computer model (HEC-RAS) was used to solve for the flow profiles both up and downstream of the Feeder Dams. The unsteady option within HEC-RAS was chosen for its ability to solve the full dynamic, Saint-Venant equations using the implicit finite difference method. Under unsteady flow, a discharge hydrograph is applied at the upstream boundary, and a discharge-stage rating (rating curve) at the downstream boundary. The unsteady methodology allows the program to calculate both stages and discharges throughout the studied reach. Due to the operation of the Pompton Lake Dam floodgates and presence and removal of the Feeder Dams in the various scenarios, the water surface elevation and flow both upstream and downstream of the dams have the potential to change. Therefore, the use of the dynamic wave (discharge and stage vary over time) approach will allow for the attenuation of the water as it moves downstream of the dams. The HEC-RAS model used in this study was originally developed by AECOM to study the effects of the Pompton Lake Dam Floodgate Facility on the upstream and downstream floodplains (AECOM, 2012). Thus, the alternatives evaluated in this study take into account the rule curve and floodgate operation on the Pompton Lake Dam.

Processing
The processing methodology incorporates WISE (Watershed Concepts, 2004) as a preprocessor to HEC-RAS. WISE utilizes the georeferenced data from the terrain model and miscellaneous shapefiles (including streams, cross sections, etc.) and with user input creates the input data files for HEC-RAS. HEC-RAS Version 4.1.0 (USACE, 2010) is then executed to determine the flood elevation at each cross section of the modeled stream. The resulting elevations are then imported back to WISE for creation of the flood boundaries. The techniques and tools utilized to perform the analyses meet FEMA's adopted standards. No individual community criteria were incorporated within this study.

Model cross sections are placed along the study streams using the available contour data. Where roads or other structures are encountered, supplemental cross sections are placed along the top of the structure and at the upstream and downstream faces of the structure to meet HEC-RAS data input needs. Survey data is collected for each detail study structure. All data points collected for each structure are precisely captured and recorded. In addition to structures, natural channel cross sections are also surveyed, and cross sections are placed in these locations using the WISE tools. The channel shapes of the surveyed locations are then used to create a channel shape for the non-surveyed cross sections located near the survey locations. The HEC-RAS preprocessor within WISE blends the survey data with the topographic data to create a seamless transition between the datasets and generates a HEC-RAS model.

Surveyed Data

Cross-sectional data for 45 channel cross-sections were surveyed and combined with the LiDAR data and used for the cross section information for HEC-RAS for the entire modeled reach. Detailed descriptions of the surveyed cross-sections can be found in the Survey Data section of Appendix D in the AECOM Pompton Lake Dam Floodgate Facility Analysis Final Report (AECOM, 2012). In addition to the surveyed cross-sections, data for nine bridges, six dams, and one culvert were collected and combined with the LiDAR data for use in HEC-RAS. Detailed descriptions of the surveyed structures can be found in the Survey Data section of Appendices E, F, and G in the AECOM Pompton Lake Dam Floodgate Facility Analysis Final Report (AECOM, 2012).

Parameter Estimation

To estimate the Manning's roughness coefficients, engineering judgment was used based on available survey pictures, aerial photography and land use data. Polygons were created to identify areas of different Manning's n-values. The original Manning's n-values represented by the polygons were adjusted where necessary in the hydraulic modeling phase on a cross section by cross section basis. The drag coefficients for the bridge piers were selected based on the pier shape according to Table 5.3 of the HEC-RAS Hydraulic Reference Manual.

Table 8-1 below represents a summary of Manning's n-values used with the unsteady model.

Table 8-1
Summary of Roughness Coefficients

Flooding Source	Channel	Overbanks
Pequannock River	0.035	0.024-0.150
Pompton River	0.035	0.024-0.150
Ramapo River	0.024-0.035	0.024-0.150
Ramapo River Lt. Diversion Channel	0.035	0.030-0.15
Ramapo River Rt. Diversion Channel	0.035	0.024-0.140

Inflow Hydrographs

The unsteady HEC-RAS model was developed for the study limits presented in Table 8-2.

Table 8-2
Flooding Sources Studied by Unsteady HEC-RAS

Flooding Source	Reach Length (miles)	Study Limits
Pequannock River	2.0	From approximately 88 ft downstream of Riverdale Road to the confluence of the Ramapo and Pequannock Rivers
Pompton River	0.2	From the confluence of the Pequannock and Ramapo Rivers to approximately 148 feet downstream of Pompton Plains Crossroads/Jackson Avenue
Ramapo River	5.3	From approximately 260 ft downstream of Interstate 287 to the confluence with the Pequannock River
Ramapo River Lt. Diversion Channel	0.3	From approximately 100 ft upstream of the Potash Lake weir to 867 ft upstream of Doty Road
Ramapo River Rt. Diversion Channel	0.6	From approximately 100 ft upstream of the Potash Lake weir to 867 ft upstream of Doty Road

Within the unsteady HEC-RAS model inflow hydrographs were used as inputs into the model. The source for the data comes from the calibrated HEC-HMS model described above. The locations of the boundary conditions are listed in Table 8-3.

Table 8-3
Unsteady HEC-RAS Inflow Boundary Conditions

River	Reach	RS	Boundary Condition
Pequannock River	Reach-1	10642	Flow Hydrograph
Pequannock River	Reach-1	407	Lateral Inflow Hydrograph
Ramapo River	Reach-1	28220	Flow Hydrograph
Ramapo River	Reach-3	10512	Uniform Lateral Inflow
Ramapo River	Reach-3	955	Lateral Inflow Hydrograph

Rating Curve
For all model runs, a downstream boundary condition of a rating curve was chosen to be the most appropriate approach. A rating curve was constructed for USGS Gage No. 01388500 near Pompton Plains Crossroads/Jackson Avenue from the USGS Water Watch website Custom Rating Curve Builder toolkit (U.S. Department of the Interior). All stage versus discharge data was converted from NGVD 29 to NAVD88 and then the stage value was converted to water surface elevation using the gages localized datum.

Calibration of the Unsteady HEC-RAS Analysis
Since a great deal of effort was spent in calibrating the existing HEC-HMS model (AECOM, 2012), the goal of the hydraulic calibration in the Pompton Lake Dam Floodgate Facility Analysis was to maintain as close as possible duplication of the routed inflow hydrograph data to that of observed hydrograph at the following USGS gages: No. 1388500 upstream of Pompton Plains Crossroads/Jackson Avenue, and No. 1388000 just upstream of Pompton Lake Dam and the stages at No. 0138810 Dawes Highway Bridge. Minor modifications were made to two of the inflow hydrographs by the use of a multiplier. Various multipliers were tested for the Hurricane Irene plan since numerous high waters were available for this event. A multiplier of 0.9 was applied to the inflow hydrograph for the Ramapo River and 0.4 for the Pequannock River. These values yielded the best comparison between the routed hydrology and observed hydrographs as well as the observed high water marks (AECOM, 2012).

8.2.2.2 Steady State Modeling of Baseflow

The "normal" conditions in the study area were analyzed by modeling the baseflow through the three reaches under the existing conditions and the proposed alternatives. The baseflow was developed using USGS mean annual flow data for the stream gages within the study area and the corresponding baseflow value index multiplier published for the particular stream gage.

The baseflow through the reaches was simulated using the HEC-RAS model under steady-state conditions, since flows of this low magnitude could not be analyzed using the unsteady computations. Using the steady-state model to perform the simulations was the most appropriate method to analyze the baseflow conditions since there is no flow diversion over the Guard Dike between the Pompton and Pequannock Dams during the baseflow conditions.

8.3 STUDY RESULTS

8.3.1 Base Flow Conditions

The results of the steady state analysis of the base flow conditions for the four dam removal alternatives are summarized in Tables 8-4 through 8-6. These tables present the Peak Water Surface Elevation, Total Flow, Velocity and Peak Shear Stress at various representative river cross sections.

Relative to the base flow water surface elevation, Alternative 1 lowers the Ramapo River about 0.6 feet downstream of the Hamburg Turnpike, about 2.6 feet in the area of Dawes Highway and 4.7 feet upstream of the Pompton Dam. Alternative 1 does not impact the water surface in the Pequannock River.

Alternative 2 (lowering of the Guard Dike) does not impact the base flow water surface in either river.

Alternative 3 does not lower the Pequannock River level at the upper portions of the Study Area (below Riverdale Road). Alternative 3 does lower the Pequannock River level 1 to 2 feet in the downstream portion of the river. The maximum decrease in the base flow water surface is 5 feet upstream of the dam. Alternative 3 does not result in any changes to the Ramapo River, beyond those changes resulting from Alternative 1.

Alternative 4 lowers the Ramapo River about 0.6 feet downstream of the Hamburg Turnpike, about 1.8 feet in the area of Dawes Highway and 4.7 feet upstream of the Pompton Dam. Similar to Alternative 3, Alternative 4 lowers the Pequannock River 1 to 2 feet in the downstream portion of the river and a maximum of 4.9 feet just upstream of the dam.

8.3.2 Storm Events

The results of the unsteady analysis of the storm flow conditions for the four dam removal alternatives are summarized in Tables 8-7 through 8-24. These tables present the Peak Water Surface Elevation, Total Flow, Velocity and Peak Shear Stress at various representative river cross sections for each of the storm events (2, 5, 10, 25, 50 and 100-year events).

Hydraulic profiles of the three river reaches (Ramapo, Pequannock and Pompton Rivers) generated by HEC-RAS are included in Appendix C. The profiles graphically present the peak water surface elevation at each river station for the existing condition plus the four alternatives. The profiles also show the lowest elevation of the channel bottom and the elevation of the left and right channel banks. We have included the following profiles as examples of the results:

Ramapo River:	2-year event
	5-year event
	10-year event
	100-year event
Pequannock River:	5-year event
	10-year event
Pompton River:	5-year event
	10-year event

8.4 REFERENCES

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U.S. Department of the Interior. (2012). *Map of real-time streamflow compared to historical streamflow.* U.S. Geological Survey. Retrieved from website: http://waterwatch.usgs.gov

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TABLE 8-4
SUMMARY OF PEAK WATER SURFACE ELEVATIONS
BASEFLOW CONDITIONS

BASEFLOW											
River	Description	Station	Peak Water Surface Elevation (ft)								
			Existing	Proposed							
			-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)
RAMAPO	Ramapo River 16.0	9450	175.2	174.6	-0.6	174.6	-0.6	174.6	-0.6	174.6	-0.6
	Ramapo River 11.0 (Above Dawes Hwy.)	7818	175.2	172.6	-2.6	172.6	-2.6	172.6	-2.6	173.4	-1.8
	Ramapo River 9.0 (Below Dawes Hwy.)	6343	175.2	172.4	-2.8	172.4	-2.8	172.4	-2.8	173.3	-1.9
	Ramapo River 8.0	5327	175.2	171.2	-4.0	171.2	-4.0	171.2	-4.0	173.2	-2.0
	Ramapo River 6.0	4342	175.1	170.5	-4.6	170.5	-4.6	170.5	-4.6	173.1	-2.0
	Ramapo River 3.0	1962	175.1	170.4	-4.7	170.4	-4.7	170.4	-4.7	170.4	-4.7
	Pompton Dam Directly US	1143	175.1	170.4	-4.7	170.4	-4.7	170.4	-4.7	170.4	-4.7
	Pompton Dam Directly DS	1026	170.4	170.4	0.0	170.4	0.0	170.4	0.0	170.4	0.0
PEQUANNOCK	Pequannock River 16.0	10642	176.7	176.7	0.0	176.7	0.0	176.7	0.0	176.7	0.0
	Pequannock River 9.0	5539	175.6	175.6	0.0	175.6	0.0	174.0	-1.6	174.0	-1.6
	Pequannock River 8.25	3812	175.5	175.5	0.0	175.5	0.0	173.6	-1.9	173.6	-1.9
	Pequannock River 6.0	2372	175.5	175.5	0.0	175.5	0.0	170.5	-5.0	170.7	-4.8
	Pequannock Dam Directly US	1804	175.5	175.5	0.0	175.5	0.0	170.5	-5.0	170.6	-4.9
	Pequannock Dam Directly DS	1744	170.5	170.5	0.0	170.5	0.0	170.5	0.0	170.5	0.0
POMPTON	Pompton River 2.0 Below Confluence (Pompton & Ramapo)	35534	170.3	170.3	0.0	170.3	0.0	170.3	0.0	170.3	0.0
	Weir #1 Directly US	34820	170.3	170.3	0.0	170.3	0.0	170.3	0.0	170.3	0.0
	Weir #1 Directly DS	34810	169.0	169.0	0.0	169.0	0.0	169.0	0.0	169.0	0.0
	Pompton Plains XR Directly US	34765	169.0	169.0	0.0	169.0	0.0	169.0	0.0	169.0	0.0

TABLE 8-5
SUMMARY OF TOTAL FLOWS
BASEFLOW CONDITIONS

BASEFLOW												
River	Description	Station	Total Flow (cfs)									
			Existing	Proposed								
			-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)
RAMAPO	Ramapo River 16.0	9450	233	233	0	233	0	233	0	233	0
	Ramapo River 11.0 (Above Dawes Hwy.)	7818	233	233	0	233	0	233	0	233	0
	Ramapo River 9.0 (Below Dawes Hwy.)	6343	233	233	0	233	0	233	0	233	0
	Ramapo River 8.0	5327	233	233	0	233	0	233	0	233	0
	Ramapo River 6.0	4342	233	233	0	233	0	233	0	233	0
	Ramapo River 3.0	1962	233	233	0	233	0	233	0	233	0
	Pompton Dam Directly US	1143	233	233	0	233	0	233	0	233	0
	Pompton Dam Directly DS	1026	233	233	0	233	0	233	0	233	0
PEQUANNOCK	Pequannock River 16.0	10642	77	77	0	77	0	77	0	77	0
	Pequannock River 9.0	5539	77	77	0	77	0	77	0	77	0
	Pequannock River 8.25	3812	77	77	0	77	0	77	0	77	0
	Pequannock River 6.0	2372	77	77	0	77	0	77	0	77	0
	Pequannock Dam Directly US	1804	77	77	0	77	0	77	0	77	0
	Pequannock Dam Directly DS	1744	77	77	0	77	0	77	0	77	0
POMPTON	Pompton River 2.0 Below Confluence (Pompton & Ramapo)	35534	370	370	0	370	0	370	0	370	0
	Weir #1 Directly US	34820	370	370	0	370	0	370	0	370	0
	Weir #1 Directly DS	34810	370	370	0	370	0	370	0	370	0
	Pompton Plains XR Directly US	34765	370	370	0	370	0	370	0	370	0

TABLE 8-6
SUMMARY OF CHANNEL VELOCITY AND SHEAR VALUES
BASEFLOW CONDITIONS

BASEFLOW																				
River	Description	Station	Channel Velocity (ft/s)									Channel Shear (lb/sq ft)								
			Existing	Proposed								Existing	Proposed							
			-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)	-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)
RAMAPO	Ramapo River 16.0	9450	2.0	5.0	3.0	5.0	3.0	5.0	3.0	5.0	3.0	0.16	0.94	0.78	0.94	0.78	0.94	0.78	0.94	0.78
	Ramapo River 11.0 (Above Dawes Hwy.)	7818	0.4	0.8	0.4	0.8	0.4	0.8	0.4	0.7	0.3	0.00	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01
	Ramapo River 9.0 (Below Dawes Hwy.)	6343	0.6	2.1	1.5	2.1	1.5	2.1	1.5	1.2	0.6	0.01	0.14	0.13	0.14	0.13	0.14	0.13	0.04	0.03
	Ramapo River 8.0	5327	0.4	1.1	0.7	1.1	0.7	1.1	0.7	0.6	0.2	0.00	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01
	Ramapo River 6.0	4342	0.4	2.3	1.9	2.3	1.9	2.3	1.9	0.7	0.3	0.00	0.16	0.16	0.16	0.16	0.16	0.16	0.01	0.01
	Ramapo River 3.0	1962	0.2	0.2	0.0	0.2	0.0	0.2	0.0	0.6	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
	Pompton Dam Directly US	1143	0.3	0.2	-0.1	0.2	-0.1	0.2	-0.1	0.3	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Pompton Dam Directly DS	1026	0.1	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PEQUANNOCK	Pequannock River 16.0	10642	1.0	1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0	0.03	0.03	0.00	0.03	0.00	0.03	0.00	0.03	0.00
	Pequannock River 9.0	5539	0.3	0.3	0.0	0.3	0.0	0.7	0.4	0.7	0.4	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
	Pequannock River 8.25	3812	0.5	0.5	0.0	0.5	0.0	1.4	0.9	1.4	0.9	0.01	0.01	0.00	0.01	0.00	0.06	0.05	0.06	0.05
	Pequannock River 6.0	2372	0.1	0.1	0.0	0.1	0.0	0.5	0.4	4.2	4.1	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.74	0.74
	Pequannock Dam Directly US	1804	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Pequannock Dam Directly DS	1744	0.2	0.2	0.0	0.2	0.0	0.2	0.0	0.2	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
POMPTON	Pompton River 2.0 Below Confluence (Pompton & Ramapo)	35534	0.5	0.5	0.0	0.5	0.0	0.5	0.0	0.5	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Weir #1 Directly US	34820	0.6	0.6	0.0	0.6	0.0	0.6	0.0	0.6	0.0	0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00
	Weir #1 Directly DS	34810	0.8	0.8	0.0	0.8	0.0	0.8	0.0	0.8	0.0	0.02	0.02	0.00	0.02	0.00	0.02	0.00	0.02	0.00
	Pompton Plains XR Directly US	34765	0.4	0.4	0.0	0.4	0.0	0.4	0.0	0.4	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 8-7
SUMMARY OF PEAK WATER SURFACE ELEVATIONS
2-YEAR EVENT

2-YEAR EVENT											
River	Description	Station	Peak Water Surface Elevation (ft)								
			Existing	Proposed							
			-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)
RAMAPO	Ramapo River 16.0	9450	183.0	183.0	0.0	183.0	0.0	183.0	0.0	183.0	0.0
	Ramapo River 11.0 (Above Dawes Hwy.)	7818	182.0	181.9	-0.1	181.9	-0.1	181.9	-0.1	181.9	-0.1
	Ramapo River 9.0 (Below Dawes Hwy.)	6343	180.5	180.3	-0.2	180.3	-0.2	180.2	-0.3	180.4	-0.1
	Ramapo River 8.0	5327	179.6	179.1	-0.5	179.1	-0.5	179.0	-0.6	179.4	-0.2
	Ramapo River 6.0	4342	179.3	178.5	-0.8	178.5	-0.8	178.4	-0.9	178.9	-0.4
	Ramapo River 3.0	1962	179.0	178.2	-0.8	178.2	-0.8	178.2	-0.8	178.3	-0.7
	Pompton Dam Directly US	1143	178.3	178.2	-0.1	178.1	-0.2	178.1	-0.2	178.1	-0.2
	Pompton Dam Directly DS	1026	177.9	177.9	0.0	177.9	0.0	177.9	0.0	177.8	-0.1
PEQUANNOCK	Pequannock River 16.0	10642	181.4	181.4	0.0	181.4	0.0	181.4	0.0	181.4	0.0
	Pequannock River 9.0	5539	179.6	179.0	-0.6	179.0	-0.6	179.0	-0.6	179.3	-0.3
	Pequannock River 8.25	3812	179.6	178.9	-0.7	178.9	-0.7	178.7	-0.9	179.2	-0.4
	Pequannock River 6.0	2372	179.3	178.5	-0.8	178.5	-0.8	178.4	-0.9	178.9	-0.4
	Pequannock Dam Directly US	1804	179.2	178.4	-0.8	178.4	-0.8	178.4	-0.8	178.8	-0.4
	Pequannock Dam Directly DS	1744	178.7	178.1	-0.6	178.2	-0.5	178.2	-0.5	178.5	-0.2
POMPTON	Pompton River 2.0 Below Confluence (Pompton & Ramapo)	35534	177.7	177.7	0.0	177.7	0.0	177.7	0.0	177.7	0.0
	Weir #1 Directly US	34820	177.4	177.4	0.0	177.4	0.0	177.4	0.0	177.4	0.0
	Weir #1 Directly DS	34810	177.1	177.0	-0.1	177.0	-0.1	177.0	-0.1	177.0	-0.1
	Pompton Plains XR Directly US	34765	177.1	177.1	0.0	177.1	0.0	177.1	0.0	177.1	0.0

TABLE 8-8
SUMMARY OF PEAK WATER SURFACE ELEVATIONS
5-YEAR EVENT

5-YEAR EVENT											
River	Description	Station	Peak Water Surface Elevation (ft)								
			Existing	Proposed							
			-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)
RAMAPO	Ramapo River 16.0	9450	185.4	185.3	-0.1	185.3	-0.1	185.3	-0.1	185.3	-0.1
	Ramapo River 11.0 (Above Dawes Hwy.)	7818	184.2	184.1	-0.1	184.1	-0.1	184.0	-0.2	184.1	-0.1
	Ramapo River 9.0 (Below Dawes Hwy.)	6343	182.5	182.3	-0.2	182.2	-0.3	182.2	-0.3	182.4	-0.1
	Ramapo River 8.0	5327	182.0	181.7	-0.3	181.6	-0.4	181.5	-0.5	181.8	-0.2
	Ramapo River 6.0	4342	181.7	181.4	-0.3	181.2	-0.5	181.2	-0.5	181.6	-0.1
	Ramapo River 3.0	1962	181.5	181.3	-0.2	181.0	-0.5	181.0	-0.5	181.3	-0.2
	Pompton Dam Directly US	1143	181.2	181.2	0.0	181.0	-0.2	181.0	-0.2	181.2	0.0
	Pompton Dam Directly DS	1026	180.9	180.9	0.0	180.8	-0.1	180.8	-0.1	180.9	0.0
PEQUANNOCK	Pequannock River 16.0	10642	182.7	182.7	0.0	182.7	0.0	182.7	0.0	182.7	0.0
	Pequannock River 9.0	5539	182.0	181.7	-0.3	181.6	-0.4	181.5	-0.5	181.9	-0.1
	Pequannock River 8.25	3812	181.9	181.7	-0.2	181.5	-0.4	181.5	-0.4	181.8	-0.1
	Pequannock River 6.0	2372	181.7	181.4	-0.3	181.3	-0.4	181.2	-0.5	181.6	-0.1
	Pequannock Dam Directly US	1804	181.7	181.4	-0.3	181.3	-0.4	181.2	-0.5	181.5	-0.2
	Pequannock Dam Directly DS	1744	181.2	181.0	-0.2	181.0	-0.2	181.0	-0.2	181.1	-0.1
POMPTON	Pompton River 2.0 Below Confluence (Pompton & Ramapo)	35534	180.7	180.7	0.0	180.7	0.0	180.7	0.0	180.7	0.0
	Weir #1 Directly US	34820	180.4	180.4	0.0	180.4	0.0	180.4	0.0	180.4	0.0
	Weir #1 Directly DS	34810	179.9	179.9	0.0	180.0	0.1	179.9	0.0	179.9	0.0
	Pompton Plains XR Directly US	34765	180.0	180.0	0.0	180.1	0.1	180.0	0.0	180.0	0.0

TABLE 8-9
SUMMARY OF PEAK WATER SURFACE ELEVATIONS
10-YEAR EVENT

10-YEAR EVENT											
River	Description	Station	Peak Water Surface Elevation (ft)								
			Existing	Proposed							
			-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)
RAMAPO	Ramapo River 16.0	9450	186.3	186.2	-0.1	186.2	-0.1	186.2	-0.1	186.2	-0.1
	Ramapo River 11.0 (Above Dawes Hwy.)	7818	185.1	185.0	-0.1	185.0	-0.1	185.0	-0.1	185.1	0.0
	Ramapo River 9.0 (Below Dawes Hwy.)	6343	183.4	183.2	-0.2	183.1	-0.3	183.1	-0.3	183.3	-0.1
	Ramapo River 8.0	5327	182.9	182.7	-0.2	182.6	-0.3	182.5	-0.4	182.8	-0.1
	Ramapo River 6.0	4342	182.7	182.5	-0.2	182.2	-0.5	182.2	-0.5	182.6	-0.1
	Ramapo River 3.0	1962	182.5	182.3	-0.2	182.0	-0.5	182.0	-0.5	182.3	-0.2
	Pompton Dam Directly US	1143	182.3	182.3	0.0	182.1	-0.2	182.1	-0.2	182.2	-0.1
	Pompton Dam Directly DS	1026	182.0	182.0	0.0	181.9	-0.1	181.9	-0.1	182.0	0.0
PEQUANNOCK	Pequannock River 16.0	10642	183.1	183.1	0.0	183.1	0.0	183.1	0.0	183.1	0.0
	Pequannock River 9.0	5539	182.9	182.7	-0.2	182.6	-0.3	182.5	-0.4	182.8	-0.1
	Pequannock River 8.25	3812	182.8	182.6	-0.2	182.5	-0.3	182.5	-0.3	182.7	-0.1
	Pequannock River 6.0	2372	182.6	182.4	-0.2	182.3	-0.3	182.3	-0.3	182.5	-0.1
	Pequannock Dam Directly US	1804	182.6	182.4	-0.2	182.3	-0.3	182.3	-0.3	182.5	-0.1
	Pequannock Dam Directly DS	1744	182.2	182.1	-0.1	182.1	-0.1	182.1	-0.1	182.2	0.0
POMPTON	Pompton River 2.0 Below Confluence (Pompton & Ramapo)	35534	181.8	181.8	0.0	181.8	0.0	181.8	0.0	181.8	0.0
	Weir #1 Directly US	34820	181.5	181.4	-0.1	181.4	-0.1	181.4	-0.1	181.4	-0.1
	Weir #1 Directly DS	34810	181.0	181.0	0.0	181.0	0.0	181.0	0.0	181.0	0.0
	Pompton Plains XR Directly US	34765	181.1	181.1	0.0	181.1	0.0	181.1	0.0	181.1	0.0

TABLE 8-10
SUMMARY OF PEAK WATER SURFACE ELEVATIONS
25-YEAR EVENT

25-YEAR EVENT											
River	Description	Station	Peak Water Surface Elevation (ft)								
			Existing	Proposed							
			-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)
RAMAPO	Ramapo River 16.0	9450	188.6	188.6	0.0	188.6	0.0	188.6	0.0	188.6	0.0
	Ramapo River 11.0 (Above Dawes Hwy.)	7818	187.7	187.7	0.0	187.7	0.0	187.7	0.0	187.7	0.0
	Ramapo River 9.0 (Below Dawes Hwy.)	6343	185.3	185.2	-0.1	185.2	-0.1	185.1	-0.2	185.3	0.0
	Ramapo River 8.0	5327	184.9	184.8	-0.1	184.8	-0.1	184.8	-0.1	184.9	0.0
	Ramapo River 6.0	4342	184.7	184.6	-0.1	184.5	-0.2	184.5	-0.2	184.7	0.0
	Ramapo River 3.0	1962	184.4	184.4	0.0	184.4	0.0	184.3	-0.1	184.4	0.0
	Pompton Dam Directly US	1143	184.4	184.5	0.1	184.4	0.0	184.4	0.0	184.4	0.0
	Pompton Dam Directly DS	1026	184.3	184.3	0.0	184.2	-0.1	184.2	-0.1	184.2	-0.1
PEQUANNOCK	Pequannock River 16.0	10642	185.0	184.9	-0.1	184.8	-0.2	184.8	-0.2	185.0	0.0
	Pequannock River 9.0	5539	184.9	184.8	-0.1	184.8	-0.1	184.7	-0.2	184.9	0.0
	Pequannock River 8.25	3812	184.8	184.7	-0.1	184.7	-0.1	184.7	-0.1	184.8	0.0
	Pequannock River 6.0	2372	184.7	184.6	-0.1	184.5	-0.2	184.5	-0.2	184.7	0.0
	Pequannock Dam Directly US	1804	184.7	184.6	-0.1	184.5	-0.2	184.5	-0.2	184.7	0.0
	Pequannock Dam Directly DS	1744	184.5	184.4	-0.1	184.4	-0.1	184.4	-0.1	184.5	0.0
POMPTON	Pompton River 2.0 Below Confluence (Pompton & Ramapo)	35534	184.2	184.1	-0.1	184.1	-0.1	184.1	-0.1	184.1	-0.1
	Weir #1 Directly US	34820	183.8	183.7	-0.1	183.7	-0.1	183.7	-0.1	183.7	-0.1
	Weir #1 Directly DS	34810	183.2	183.2	0.0	183.2	0.0	183.2	0.0	183.2	0.0
	Pompton Plains XR Directly US	34765	183.3	183.3	0.0	183.3	0.0	183.3	0.0	183.3	0.0

TABLE 8-11
SUMMARY OF PEAK WATER SURFACE ELEVATIONS
50-YEAR EVENT

50-YEAR EVENT											
River	Description	Station	Peak Water Surface Elevation (ft)								
			Existing	Proposed							
			-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)
RAMAPO	Ramapo River 16.0	9450	189.4	189.4	0.0	189.4	0.0	189.5	0.1	189.4	0.0
	Ramapo River 11.0 (Above Dawes Hwy.)	7818	188.5	188.5	0.0	188.5	0.0	188.5	0.0	188.5	0.0
	Ramapo River 9.0 (Below Dawes Hwy.)	6343	186.7	186.6	-0.1	186.6	-0.1	186.6	-0.1	186.7	0.0
	Ramapo River 8.0	5327	186.5	186.4	-0.1	186.4	-0.1	186.4	-0.1	186.5	0.0
	Ramapo River 6.0	4342	186.2	186.1	-0.1	186.1	-0.1	186.1	-0.1	186.2	0.0
	Ramapo River 3.0	1962	186.0	186.0	0.0	185.9	-0.1	185.9	-0.1	186.0	0.0
	Pompton Dam Directly US	1143	186.0	186.0	0.0	186.0	0.0	186.0	0.0	186.0	0.0
	Pompton Dam Directly DS	1026	185.8	185.8	0.0	185.8	0.0	185.8	0.0	185.8	0.0
PEQUANNOCK	Pequannock River 16.0	10642	186.5	186.4	-0.1	186.4	-0.1	186.4	-0.1	186.5	0.0
	Pequannock River 9.0	5539	186.4	186.4	0.0	186.3	-0.1	186.3	-0.1	186.4	0.0
	Pequannock River 8.25	3812	186.4	186.3	-0.1	186.3	-0.1	186.2	-0.2	186.3	-0.1
	Pequannock River 6.0	2372	186.2	186.1	-0.1	186.1	-0.1	186.1	-0.1	186.2	0.0
	Pequannock Dam Directly US	1804	186.2	186.1	-0.1	186.1	-0.1	186.1	-0.1	186.2	0.0
	Pequannock Dam Directly DS	1744	186.0	186.0	0.0	185.9	-0.1	185.9	-0.1	186.0	0.0
POMPTON	Pompton River 2.0 Below Confluence (Pompton & Ramapo)	35534	185.7	185.7	0.0	185.7	0.0	185.7	0.0	185.7	0.0
	Weir #1 Directly US	34820	185.2	185.2	0.0	185.2	0.0	185.2	0.0	185.2	0.0
	Weir #1 Directly DS	34810	184.6	184.6	0.0	184.6	0.0	184.6	0.0	184.6	0.0
	Pompton Plains XR Directly US	34765	184.7	184.7	0.0	184.7	0.0	184.7	0.0	184.7	0.0

TABLE 8-12
SUMMARY OF PEAK WATER SURFACE ELEVATIONS
100-YEAR EVENT

100-YEAR EVENT											
River	Description	Station	Peak Water Surface Elevation (ft)								
			Existing	Proposed							
			-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)
RAMAPO	Ramapo River 16.0	9450	190.3	190.3	0.0	190.3	0.0	190.3	0.0	190.3	0.0
	Ramapo River 11.0 (Above Dawes Hwy.)	7818	189.3	189.3	0.0	189.3	0.0	189.3	0.0	189.3	0.0
	Ramapo River 9.0 (Below Dawes Hwy.)	6343	187.9	187.9	0.0	187.9	0.0	187.9	0.0	187.9	0.0
	Ramapo River 8.0	5327	187.7	187.7	0.0	187.7	0.0	187.6	-0.1	187.7	0.0
	Ramapo River 6.0	4342	187.4	187.4	0.0	187.3	-0.1	187.3	-0.1	187.4	0.0
	Ramapo River 3.0	1962	187.2	187.2	0.0	187.2	0.0	187.2	0.0	187.2	0.0
	Pompton Dam Directly US	1143	187.2	187.2	0.0	187.2	0.0	187.2	0.0	187.2	0.0
	Pompton Dam Directly DS	1026	187.0	187.0	0.0	187.0	0.0	187.0	0.0	187.0	0.0
PEQUANNOCK	Pequannock River 16.0	10642	187.7	187.6	-0.1	187.6	-0.1	187.6	-0.1	187.7	0.0
	Pequannock River 9.0	5539	187.6	187.6	0.0	187.6	0.0	187.6	0.0	187.6	0.0
	Pequannock River 8.25	3812	187.6	187.5	-0.1	187.5	-0.1	187.5	-0.1	187.6	0.0
	Pequannock River 6.0	2372	187.4	187.4	0.0	187.4	0.0	187.3	-0.1	187.4	0.0
	Pequannock Dam Directly US	1804	187.4	187.4	0.0	187.4	0.0	187.4	0.0	187.4	0.0
	Pequannock Dam Directly DS	1744	187.2	187.2	0.0	187.2	0.0	187.2	0.0	187.2	0.0
POMPTON	Pompton River 2.0 Below Confluence (Pompton & Ramapo)	35534	186.9	186.9	0.0	186.9	0.0	186.9	0.0	186.9	0.0
	Weir #1 Directly US	34820	186.3	186.3	0.0	186.3	0.0	186.3	0.0	186.3	0.0
	Weir #1 Directly DS	34810	185.6	185.6	0.0	185.6	0.0	185.6	0.0	185.6	0.0
	Pompton Plains XR Directly US	34765	185.7	185.7	0.0	185.7	0.0	185.7	0.0	185.7	0.0

TABLE 8-13
SUMMARY OF TOTAL FLOWS
2-YEAR EVENT

2-YEAR EVENT												
River	**Description**	**Station**	**Total Flow (cfs)**									
			Existing	**Proposed**								
			-	**ALT-1**	**Δ (prop-exist)**	**ALT-2**	**Δ (prop-exist)**	**ALT-3**	**Δ (prop-exist)**	**ALT-4**	**Δ (prop-exist)**	
RAMAPO	Ramapo River 16.0	9450	5335	5342	7	5340	5	5351	16	5339	4	
	Ramapo River 11.0 (Above Dawes Hwy.)	7818	6319	6324	5	6325	6	6326	7	6317	-2	
	Ramapo River 9.0 (Below Dawes Hwy.)	6343	6885	6898	13	6904	19	6911	26	6861	-24	
	Ramapo River 8.0	5327	7338	7294	-44	7305	-33	7306	-32	7273	-65	
	Ramapo River 6.0	4342	4270	4662	392	4685	415	4368	98	4370	100	
	Ramapo River 3.0	1962	3917	5880	1963	5642	1725	5403	1486	4366	449	
	Pompton Dam Directly US	1143	4469	6430	1961	6098	1629	5877	1408	4915	446	
	Pompton Dam Directly DS	1026	4462	6429	1967	6096	1634	5876	1414	4914	452	
PEQUANNOCK	Pequannock River 16.0	10642	1602	1602	0	1602	0	1602	0	1602	0	
	Pequannock River 9.0	5539	1418	1405	-13	1405	-13	1397	-21	1409	-9	
	Pequannock River 8.25	3812	1275	1358	83	1602	327	1374	99	1346	71	
	Pequannock River 6.0	2372	3977	3503	-474	3493	-484	3798	-179	3801	-176	
	Pequannock Dam Directly US	1804	5436	3370	-2066	3132	-2304	3465	-1971	4895	-541	
	Pequannock Dam Directly DS	1744	5436	3370	-2066	3132	-2304	3465	-1971	4895	-541	
POMPTON	Pompton River 2.0 Below Confluence (Pompton & Ramapo)	35534	9999	9916	-83	9930	-69	9918	-81	9921	-78	
	Weir #1 Directly US	34820	9999	9915	-84	9930	-69	9918	-81	9921	-78	
	Weir #1 Directly DS	34810	9999	9915	-84	9930	-69	9918	-81	9921	-78	
	Pompton Plains XR Directly US	34765	9999	9915	-84	9930	-69	9918	-81	9921	-78	

TABLE 8-14
SUMMARY OF TOTAL FLOWS
5-YEAR EVENT

5-YEAR EVENT											
River	Description	Station	Total Flow (cfs)								
			Existing	Proposed							
			-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)
RAMAPO	Ramapo River 16.0	9450	8185	8190	5	8197	12	8199	14	8187	2
	Ramapo River 11.0 (Above Dawes Hwy.)	7818	9787	9800	13	9815	28	9821	34	9796	9
	Ramapo River 9.0 (Below Dawes Hwy.)	6343	10569	10556	-13	10603	34	10598	29	10564	-5
	Ramapo River 8.0	5327	11299	11268	-31	11305	6	11298	-1	11278	-21
	Ramapo River 6.0	4342	5896	6086	190	6321	425	6066	170	5938	42
	Ramapo River 3.0	1962	5949	7616	1667	6392	443	6296	347	6329	380
	Pompton Dam Directly US	1143	6813	8483	1670	4024	-2789	3972	-2841	7200	387
	Pompton Dam Directly DS	1026	6811	8481	1670	4024	-2787	3972	-2839	7198	387
PEQUANNOCK	Pequannock River 16.0	10642	2455	2443	-12	2455	0	2455	0	2455	0
	Pequannock River 9.0	5539	2036	2106	70	2106	70	2087	51	2099	63
	Pequannock River 8.25	3812	2878	2792	-86	2455	-423	2704	-174	2834	-44
	Pequannock River 6.0	2372	6969	6746	-223	6549	-420	6796	-173	6905	-64
	Pequannock Dam Directly US	1804	8654	6940	-1714	4024	-4630	4396	-4258	8246	-408
	Pequannock Dam Directly DS	1744	8654	6940	-1714	4024	-4630	4396	-4258	8246	-408
POMPTON	Pompton River 2.0 Below Confluence (Pompton & Ramapo)	35534	15651	15608	-43	15662	11	15651	0	15625	-26
	Weir #1 Directly US	34820	15650	15607	-43	15661	11	15650	0	15624	-26
	Weir #1 Directly DS	34810	15650	15607	-43	15661	11	15650	0	15624	-26
	Pompton Plains XR Directly US	34765	15651	15607	-44	15661	10	15650	-1	15624	-27

TABLE 8-15
SUMMARY OF TOTAL FLOWS
10-YEAR EVENT

10-YEAR EVENT											
River	Description	Station	Total Flow (cfs)								
			Existing	Proposed							
			-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)
RAMAPO	Ramapo River 16.0	9450	9543	9547	4	9563	20	9561	18	9544	1
	Ramapo River 11.0 (Above Dawes Hwy.)	7818	11390	11398	8	11425	35	11425	35	11393	3
	Ramapo River 9.0 (Below Dawes Hwy.)	6343	12202	12173	-29	12209	7	12203	1	12175	-27
	Ramapo River 8.0	5327	13050	12995	-55	13031	-19	13017	-33	13010	-40
	Ramapo River 6.0	4342	6633	6837	204	7189	556	6983	350	6672	39
	Ramapo River 3.0	1962	6600	8230	1630	7065	465	6978	378	7058	458
	Pompton Dam Directly US	1143	7215	8908	1693	4266	-2949	4225	-2990	7771	556
	Pompton Dam Directly DS	1026	7213	8907	1694	4266	-2947	4224	-2989	7767	554
PEQUANNOCK	Pequannock River 16.0	10642	2840	2840	0	2840	0	2840	0	2840	0
	Pequannock River 9.0	5539	2274	2390	116	2390	116	2394	120	2372	98
	Pequannock River 8.25	3812	3563	3514	-49	2840	-723	3452	-111	3541	-22
	Pequannock River 6.0	2372	8259	8008	-251	7686	-573	7880	-379	8187	-72
	Pequannock Dam Directly US	1804	10011	8447	-1564	5006	-5005	5306	-4705	9630	-381
	Pequannock Dam Directly DS	1744	10011	8447	-1564	5006	-5005	5306	-4705	9630	-381
POMPTON	Pompton River 2.0 Below Confluence (Pompton & Ramapo)	35534	18094	18031	-63	18077	-17	18060	-34	18050	-44
	Weir #1 Directly US	34820	18093	18030	-63	18076	-17	18060	-33	18050	-43
	Weir #1 Directly DS	34810	18093	18030	-63	18075	-18	18060	-33	18049	-44
	Pompton Plains XR Directly US	34765	18093	18030	-63	18075	-18	18060	-33	18049	-44

TABLE 8-16
SUMMARY OF TOTAL FLOWS
25-YEAR EVENT

25-YEAR EVENT											
River	Description	Station	Total Flow (cfs)								
			Existing	Proposed							
			-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)
RAMAPO	Ramapo River 16.0	9450	13198	13187	-11	13176	-22	13173	-25	13192	-6
	Ramapo River 11.0 (Above Dawes Hwy.)	7818	15927	15912	-15	15897	-30	15892	-35	15920	-7
	Ramapo River 9.0 (Below Dawes Hwy.)	6343	16704	16671	-33	16622	-82	16611	-93	16670	-34
	Ramapo River 8.0	5327	17903	17849	-54	17795	-108	17778	-125	17858	-45
	Ramapo River 6.0	4342	9788	9973	185	10063	275	9934	146	9758	-30
	Ramapo River 3.0	1962	6980	8220	1240	8616	1636	8571	1591	7151	171
	Pompton Dam Directly US	1143	5321	6260	939	5263	-58	5241	-80	5529	208
	Pompton Dam Directly DS	1026	5320	6259	939	5263	-57	5241	-79	5528	208
PEQUANNOCK	Pequannock River 16.0	10642	3713	3713	0	3713	0	3713	0	3713	0
	Pequannock River 9.0	5539	3391	3386	-5	3370	-21	3370	-21	3391	0
	Pequannock River 8.25	3812	5353	5322	-31	3713	-1640	5297	-56	5342	-11
	Pequannock River 6.0	2372	10727	10526	-201	10347	-380	10462	-265	10716	-11
	Pequannock Dam Directly US	1804	10690	9291	-1399	8300	-2390	8420	-2270	10411	-279
	Pequannock Dam Directly DS	1744	10690	9291	-1399	8300	-2390	8420	-2270	10411	-279
POMPTON	Pompton River 2.0 Below Confluence (Pompton & Ramapo)	35534	24885	24825	-60	24748	-137	24730	-155	24832	-53
	Weir #1 Directly US	34820	24886	24824	-62	24747	-139	24729	-157	24831	-55
	Weir #1 Directly DS	34810	24886	24823	-63	24747	-139	24729	-157	24831	-55
	Pompton Plains XR Directly US	34765	24886	24823	-63	24747	-139	24729	-157	24831	-55

TABLE 8-17
SUMMARY OF TOTAL FLOWS
50-YEAR EVENT

50-YEAR EVENT											
River	Description	Station	Total Flow (cfs)								
			Existing	Proposed							
			-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)
RAMAPO	Ramapo River 16.0	9450	15776	15786	10	15793	17	15796	20	15779	3
	Ramapo River 11.0 (Above Dawes Hwy.)	7818	18442	18488	46	18516	74	18524	82	18458	16
	Ramapo River 9.0 (Below Dawes Hwy.)	6343	20851	20831	-20	20802	-49	20791	-60	20834	-17
	Ramapo River 8.0	5327	22432	22418	-14	22376	-56	22368	-64	22428	-4
	Ramapo River 6.0	4342	12765	13010	245	13100	335	13005	240	12749	-16
	Ramapo River 3.0	1962	8486	9895	1409	10264	1778	10223	1737	8683	197
	Pompton Dam Directly US	1143	5976	6893	917	6259	283	6239	263	6208	232
	Pompton Dam Directly DS	1026	5975	6893	918	6259	284	6238	263	6208	233
PEQUANNOCK	Pequannock River 16.0	10642	4474	4474	0	4474	0	4474	0	4474	0
	Pequannock River 9.0	5539	4525	4526	1	4546	21	4548	23	4533	8
	Pequannock River 8.25	3812	7197	7184	-13	4474	-2723	7173	-24	7193	-4
	Pequannock River 6.0	2372	12951	12684	-267	12565	-386	12650	-301	12951	0
	Pequannock Dam Directly US	1804	12362	11129	-1233	10620	-1742	10737	-1625	12369	7
	Pequannock Dam Directly DS	1744	12362	11129	-1233	10620	-1742	10737	-1625	12369	7
POMPTON	Pompton River 2.0 Below Confluence (Pompton & Ramapo)	35534	31231	31200	-31	31157	-74	31144	-87	31210	-21
	Weir #1 Directly US	34820	31231	31198	-33	31157	-74	31143	-88	31207	-24
	Weir #1 Directly DS	34810	31231	31198	-33	31157	-74	31142	-89	31207	-24
	Pompton Plains XR Directly US	34765	31231	31198	-33	31157	-74	31143	-88	31207	-24

TABLE 8-18
SUMMARY OF TOTAL FLOWS
100-YEAR EVENT

100-YEAR EVENT											
River	Description	Station	Total Flow (cfs)								
			Existing	Proposed							
			-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)
RAMAPO	Ramapo River 16.0	9450	19208	19208	0	19208	0	19208	0	19208	0
	Ramapo River 11.0 (Above Dawes Hwy.)	7818	23221	23217	-4	23218	-3	23217	-4	23220	-1
	Ramapo River 9.0 (Below Dawes Hwy.)	6343	25106	25097	-9	25086	-20	25086	-20	25100	-6
	Ramapo River 8.0	5327	27115	27100	-15	27100	-15	27093	-22	27116	1
	Ramapo River 6.0	4342	16117	16379	262	16479	362	16411	294	16108	-9
	Ramapo River 3.0	1962	10302	11847	1545	12239	1937	12201	1899	10511	209
	Pompton Dam Directly US	1143	7068	8015	947	7433	365	7415	347	7304	236
	Pompton Dam Directly DS	1026	7067	8015	948	7433	366	7414	347	7303	236
PEQUANNOCK	Pequannock River 16.0	10642	5529	5529	0	5529	0	5529	0	5529	0
	Pequannock River 9.0	5539	5931	5936	5	5942	11	5943	12	5931	0
	Pequannock River 8.25	3812	9490	9488	-2	5529	-3961	9489	-1	9490	0
	Pequannock River 6.0	2372	15607	15340	-267	15233	-374	15295	-312	15613	6
	Pequannock Dam Directly US	1804	15052	13822	-1230	13345	-1707	13462	-1590	15066	14
	Pequannock Dam Directly DS	1744	15052	13822	-1230	13345	-1707	13462	-1590	15066	14
POMPTON	Pompton River 2.0 Below Confluence (Pompton & Ramapo)	35534	38638	38632	-6	38620	-18	38614	-24	38634	-4
	Weir #1 Directly US	34820	38637	38629	-8	38619	-18	38612	-25	38632	-5
	Weir #1 Directly DS	34810	38637	38629	-8	38618	-19	38612	-25	38632	-5
	Pompton Plains XR Directly US	34765	38637	38629	-8	38619	-18	38612	-25	38632	-5

TABLE 8-19
SUMMARY OF CHANNEL VELOCITY AND SHEAR VALUES
2-YEAR EVENT

2-YEAR EVENT																				
River	Description	Station	Channel Velocity (ft/s)									Channel Shear (lb/sq ft)								
			Existing	Proposed								Existing	Proposed							
			-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)	-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)
RAMAPO	Ramapo River 16.0	9450	2.8	2.8	0.0	2.8	0.0	2.8	0.0	2.8	0.0	0.13	0.14	0.01	0.14	0.01	0.14	0.01	0.14	0.01
	Ramapo River 11.0 (Above Dawes Hwy.)	7818	4.7	4.7	0.0	4.7	0.0	4.7	0.0	4.7	0.0	0.34	0.35	0.01	0.35	0.01	0.36	0.02	0.35	0.01
	Ramapo River 9.0 (Below Dawes Hwy.)	6343	6.0	6.3	0.3	6.3	0.3	6.3	0.3	6.1	0.1	0.62	0.69	0.07	0.69	0.07	0.70	0.08	0.66	0.04
	Ramapo River 8.0	5327	5.3	5.9	0.6	5.9	0.6	6.1	0.8	5.6	0.3	0.47	0.59	0.12	0.59	0.12	0.63	0.16	0.53	0.06
	Ramapo River 6.0	4342	4.0	4.9	0.9	5.0	1.0	4.7	0.7	4.4	0.4	0.27	0.43	0.16	0.43	0.16	0.38	0.11	0.33	0.06
	Ramapo River 3.0	1962	1.8	1.9	0.1	1.9	0.1	1.8	0.0	1.9	0.1	0.05	0.06	0.01	0.05	0.00	0.05	0.00	0.06	0.01
	Pompton Dam Directly US	1143	2.8	2.1	-0.7	2.0	-0.8	1.9	-0.9	1.9	-0.9	0.15	0.06	-0.09	0.06	-0.09	0.05	-0.10	0.06	-0.09
	Pompton Dam Directly DS	1026	1.2	1.7	0.5	1.6	0.4	1.5	0.3	1.3	0.1	0.02	0.04	0.02	0.04	0.02	0.03	0.01	0.02	0.00
PEQUANNOCK	Pequannock River 16.0	10642	2.6	2.6	0.0	2.6	0.0	2.7	0.1	2.6	0.0	0.14	0.14	0.00	0.14	0.00	0.14	0.00	0.14	0.00
	Pequannock River 9.0	5539	0.6	0.7	0.1	2.6	2.0	2.6	2.0	0.6	0.0	0.01	0.01	0.00	0.13	0.12	0.13	0.12	0.01	0.00
	Pequannock River 8.25	3812	1.2	1.0	-0.2	1.0	-0.2	0.9	-0.3	1.1	-0.1	0.03	0.02	-0.01	0.02	-0.01	0.13	0.10	0.03	0.00
	Pequannock River 6.0	2372	2.2	2.4	0.2	2.4	0.2	2.1	-0.1	2.3	0.1	0.09	0.11	0.02	0.11	0.02	0.08	-0.01	0.11	0.02
	Pequannock Dam Directly US	1804	1.0	0.7	-0.3	0.6	-0.4	0.7	-0.3	0.9	-0.1	0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00
	Pequannock Dam Directly DS	1744	1.9	1.3	-0.6	1.1	-0.8	1.3	-0.6	1.7	-0.2	0.06	0.03	-0.03	0.02	-0.04	0.03	-0.03	0.05	-0.01
POMPTON	Pompton River 2.0 Below Confluence (Pompton & Ramapo)	35534	4.5	4.5	0.0	4.5	0.0	4.5	0.0	4.5	0.0	0.33	0.33	0.00	0.33	0.00	0.33	0.00	0.33	0.00
	Weir #1 Directly US	34820	4.1	4.1	0.0	4.1	0.0	4.1	0.0	4.1	0.0	0.28	0.28	0.00	0.28	0.00	0.28	0.00	0.28	0.00
	Weir #1 Directly DS	34810	4.0	4.0	0.0	4.0	0.0	4.0	0.0	4.0	0.0	0.27	0.27	0.00	0.27	0.00	0.27	0.00	0.27	0.00
	Pompton Plains XR Directly US	34765	3.1	3.1	0.0	3.1	0.0	3.1	0.0	3.1	0.0	0.15	0.15	0.00	0.15	0.00	0.15	0.00	0.15	0.00

TABLE 8-20
SUMMARY OF CHANNEL VELOCITY AND SHEAR VALUES
5-YEAR EVENT

5-YEAR EVENT																				
River	Description	Station	Channel Velocity (ft/s)									Channel Shear (lb/sq ft)								
			Existing	Proposed								Existing	Proposed							
			-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)	-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)
RAMAPO	Ramapo River 16.0	9450	3.0	3.1	0.1	3.1	0.1	3.1	0.1	3.1	0.1	0.15	0.15	0.00	0.15	0.00	0.15	0.00	0.15	0.00
	Ramapo River 11.0 (Above Dawes Hwy.)	7818	5.5	5.5	0.0	5.5	0.0	5.6	0.1	5.5	0.0	0.44	0.45	0.01	0.46	0.02	0.46	0.02	0.45	0.01
	Ramapo River 9.0 (Below Dawes Hwy.)	6343	5.9	6.1	0.2	6.3	0.4	6.3	0.4	6.0	0.1	0.56	0.60	0.04	0.64	0.08	0.65	0.09	0.58	0.02
	Ramapo River 8.0	5327	5.0	5.2	0.2	5.4	0.4	5.5	0.5	5.1	0.1	0.39	0.43	0.04	0.46	0.07	0.47	0.08	0.41	0.02
	Ramapo River 6.0	4342	4.0	4.3	0.3	4.6	0.6	4.4	0.4	4.1	0.1	0.26	0.30	0.04	0.34	0.08	0.31	0.05	0.27	0.01
	Ramapo River 3.0	1962	2.0	2.0	0.0	1.7	-0.3	1.7	-0.3	2.0	0.0	0.06	0.05	-0.01	0.04	-0.02	0.04	-0.02	0.06	0.00
	Pompton Dam Directly US	1143	2.9	2.2	-0.7	1.0	-1.9	1.0	-1.9	2.1	-0.8	0.14	0.07	-0.07	0.02	-0.12	0.01	-0.13	0.06	-0.08
	Pompton Dam Directly DS	1026	1.4	1.8	0.4	0.8	-0.6	0.8	-0.6	1.5	0.1	0.03	0.04	0.01	0.01	-0.02	0.01	-0.02	0.03	0.00
PEQUANNOCK	Pequannock River 16.0	10642	3.2	3.2	0.0	3.2	0.0	3.2	0.0	3.2	0.0	0.20	0.20	0.00	0.20	0.00	0.20	0.00	0.20	0.00
	Pequannock River 9.0	5539	0.6	0.6	0.0	0.6	0.0	0.6	0.0	0.6	0.0	0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00
	Pequannock River 8.25	3812	1.3	1.4	0.1	1.4	0.1	1.4	0.1	1.3	0.0	0.03	0.03	0.00	0.04	0.01	0.04	0.01	0.03	0.00
	Pequannock River 6.0	2372	2.3	2.3	0.0	2.3	0.0	2.3	0.0	2.3	0.0	0.09	0.09	0.00	0.10	0.01	0.09	0.00	0.09	0.00
	Pequannock Dam Directly US	1804	1.2	1.0	-0.2	0.6	-0.6	0.6	-0.6	1.2	0.0	0.02	0.01	-0.01	0.00	-0.02	0.01	-0.01	0.02	0.00
	Pequannock Dam Directly DS	1744	2.0	1.7	-0.3	1.0	-1.0	1.1	-0.9	1.9	-0.1	0.06	0.04	-0.02	0.01	-0.05	0.02	-0.04	0.06	0.00
POMPTON	Pompton River 2.0 Below Confluence (Pompton & Ramapo)	35534	4.5	4.5	0.0	4.5	0.0	4.5	0.0	4.5	0.0	0.31	0.31	0.00	0.31	0.00	0.31	0.00	0.31	0.00
	Weir #1 Directly US	34820	4.5	4.5	0.0	4.5	0.0	4.5	0.0	4.5	0.0	0.32	0.32	0.00	0.32	0.00	0.32	0.00	0.32	0.00
	Weir #1 Directly DS	34810	4.6	4.6	0.0	4.6	0.0	4.6	0.0	4.6	0.0	0.33	0.33	0.00	0.33	0.00	0.33	0.00	0.33	0.00
	Pompton Plains XR Directly US	34765	3.8	3.8	0.0	3.8	0.0	3.8	0.0	3.8	0.0	0.20	0.20	0.00	0.20	0.00	0.20	0.00	0.20	0.00

TABLE 8-21
SUMMARY OF CHANNEL VELOCITY AND SHEAR VALUES
10-YEAR EVENT

10-YEAR EVENT																				
River	Description	Station	Channel Velocity (ft/s)									Channel Shear (lb/sq ft)								
			Existing	Proposed								Existing	Proposed							
			-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)	-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)
RAMAPO	Ramapo River 16.0	9450	3.2	3.2	0.0	3.2	0.0	3.2	0.0	3.2	0.0	0.16	0.16	0.00	0.16	0.00	0.16	0.00	0.16	0.00
	Ramapo River 11.0 (Above Dawes Hwy.)	7818	5.6	5.7	0.1	5.7	0.1	5.7	0.1	5.7	0.1	0.46	0.47	0.01	0.48	0.02	0.48	0.02	0.47	0.01
	Ramapo River 9.0 (Below Dawes Hwy.)	6343	5.7	5.9	0.2	6.0	0.3	6.1	0.4	5.8	0.1	0.52	0.54	0.02	0.58	0.06	0.58	0.06	0.53	0.01
	Ramapo River 8.0	5327	4.9	5.0	0.1	5.2	0.3	5.2	0.3	5.0	0.1	0.37	0.39	0.02	0.42	0.05	0.42	0.05	0.38	0.01
	Ramapo River 6.0	4342	4.0	4.3	0.3	4.6	0.6	4.5	0.5	4.1	0.1	0.25	0.28	0.03	0.33	0.08	0.31	0.06	0.26	0.01
	Ramapo River 3.0	1962	2.0	2.0	0.0	1.7	-0.3	1.7	-0.3	2.1	0.1	0.06	0.05	-0.01	0.04	-0.02	0.04	-0.02	0.06	0.00
	Pompton Dam Directly US	1143	2.7	2.1	-0.6	1.0	-1.7	1.0	-1.7	2.1	-0.6	0.12	0.06	-0.06	0.01	-0.11	0.01	-0.11	0.06	-0.06
	Pompton Dam Directly DS	1026	1.4	1.7	0.3	0.8	-0.6	0.8	-0.6	1.5	0.1	0.03	0.04	0.01	0.01	-0.02	0.01	-0.02	0.03	0.00
PEQUANNOCK	Pequannock River 16.0	10642	3.5	3.5	0.0	3.5	0.0	3.5	0.0	3.5	0.0	0.22	0.22	0.00	0.22	0.00	0.22	0.00	0.22	0.00
	Pequannock River 9.0	5539	0.5	0.6	0.1	0.6	0.1	0.6	0.1	0.5	0.0	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Pequannock River 8.25	3812	1.3	1.4	0.1	1.4	0.1	1.4	0.1	1.3	0.0	0.03	0.03	0.00	0.03	0.00	0.04	0.01	0.03	0.00
	Pequannock River 6.0	2372	2.3	2.3	0.0	2.3	0.0	2.3	0.0	2.3	0.0	0.09	0.09	0.00	0.09	0.00	0.09	0.00	0.09	0.00
	Pequannock Dam Directly US	1804	1.3	1.1	-0.2	0.7	-0.6	0.7	-0.6	1.2	-0.1	0.02	0.02	0.00	0.01	-0.01	0.01	-0.01	0.02	0.00
	Pequannock Dam Directly DS	1744	2.0	1.8	-0.2	1.0	-1.0	1.1	-0.9	2.0	0.0	0.06	0.05	-0.01	0.02	-0.04	0.02	-0.04	0.06	0.00
POMPTON	Pompton River 2.0 Below Confluence (Pompton & Ramapo)	35534	4.6	4.6	0.0	4.6	0.0	4.6	0.0	4.6	0.0	0.31	0.31	0.00	0.31	0.00	0.31	0.00	0.31	0.00
	Weir #1 Directly US	34820	4.7	4.7	0.0	4.7	0.0	4.7	0.0	4.7	0.0	0.33	0.33	0.00	0.33	0.00	0.33	0.00	0.33	0.00
	Weir #1 Directly DS	34810	4.8	4.8	0.0	4.8	0.0	4.8	0.0	4.8	0.0	0.35	0.35	0.00	0.35	0.00	0.35	0.00	0.35	0.00
	Pompton Plains XR Directly US	34765	4.0	4.0	0.0	4.0	0.0	4.0	0.0	4.0	0.0	0.23	0.23	0.00	0.23	0.00	0.23	0.00	0.23	0.00

TABLE 8-22
SUMMARY OF CHANNEL VELOCITY AND SHEAR VALUES
25-YEAR EVENT

25-YEAR EVENT																				
River	Description	Station	Channel Velocity (ft/s)									Channel Shear (lb/sq ft)								
			Existing	Proposed								Existing	Proposed							
			-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)	-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)
RAMAPO	Ramapo River 16.0	9450	3.4	3.4	0.0	3.4	0.0	3.4	0.0	3.4	0.0	0.17	0.17	0.00	0.17	0.00	0.17	0.00	0.17	0.00
	Ramapo River 11.0 (Above Dawes Hwy.)	7818	5.0	5.0	0.0	5.0	0.0	5.0	0.0	5.0	0.0	0.34	0.34	0.00	0.34	0.00	0.34	0.00	0.34	0.00
	Ramapo River 9.0 (Below Dawes Hwy.)	6343	5.6	5.7	0.1	5.7	0.1	5.7	0.1	5.6	0.0	0.47	0.49	0.02	0.49	0.02	0.49	0.02	0.48	0.01
	Ramapo River 8.0	5327	4.8	4.9	0.1	4.9	0.1	4.9	0.1	4.8	0.0	0.34	0.35	0.01	0.36	0.02	0.36	0.02	0.34	0.00
	Ramapo River 6.0	4342	4.3	4.5	0.2	4.5	0.2	4.5	0.2	4.3	0.0	0.26	0.29	0.03	0.30	0.04	0.29	0.03	0.27	0.01
	Ramapo River 3.0	1962	1.8	1.7	-0.1	1.8	0.0	1.8	0.0	1.8	0.0	0.05	0.04	-0.01	0.04	-0.01	0.04	-0.01	0.05	0.00
	Pompton Dam Directly US	1143	1.6	1.3	-0.3	1.1	-0.5	1.1	-0.5	1.3	-0.3	0.04	0.02	-0.02	0.02	-0.02	0.02	-0.02	0.02	-0.02
	Pompton Dam Directly DS	1026	0.9	1.0	0.1	0.9	0.0	0.9	0.0	0.9	0.0	0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00
PEQUANNOCK	Pequannock River 16.0	10642	1.2	1.3	0.1	1.3	0.1	1.3	0.1	1.3	0.1	0.03	0.03	0.00	0.03	0.00	0.03	0.00	0.03	0.00
	Pequannock River 9.0	5539	0.5	0.5	0.0	0.5	0.0	0.5	0.0	0.5	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Pequannock River 8.25	3812	1.5	1.5	0.0	1.5	0.0	1.5	0.0	1.5	0.0	0.03	0.04	0.01	0.04	0.01	0.04	0.01	0.03	0.00
	Pequannock River 6.0	2372	2.2	2.2	0.0	2.2	0.0	2.4	0.2	2.2	0.0	0.08	0.08	0.00	0.08	0.00	0.08	0.00	0.08	0.00
	Pequannock Dam Directly US	1804	1.1	1.0	-0.1	0.9	-0.2	0.9	-0.2	1.1	0.0	0.02	0.01	-0.01	0.01	-0.01	0.01	-0.01	0.02	0.00
	Pequannock Dam Directly DS	1744	1.6	1.4	-0.2	1.3	-0.3	1.3	-0.3	1.6	0.0	0.04	0.03	-0.01	0.03	-0.01	0.03	-0.01	0.04	0.00
POMPTON	Pompton River 2.0 Below Confluence (Pompton & Ramapo)	35534	4.7	4.7	0.0	4.7	0.0	4.7	0.0	4.7	0.0	0.31	0.31	0.00	0.31	0.00	0.31	0.00	0.31	0.00
	Weir #1 Directly US	34820	5.2	5.2	0.0	5.2	0.0	5.2	0.0	5.2	0.0	0.39	0.39	0.00	0.39	0.00	0.39	0.00	0.39	0.00
	Weir #1 Directly DS	34810	5.5	5.4	-0.1	5.4	-0.1	5.4	-0.1	5.4	-0.1	0.42	0.42	0.00	0.42	0.00	0.42	0.00	0.42	0.00
	Pompton Plains XR Directly US	34765	4.8	4.8	0.0	4.8	0.0	4.8	0.0	4.8	0.0	0.30	0.30	0.00	0.30	0.00	0.30	0.00	0.30	0.00

TABLE 8-23
SUMMARY OF CHANNEL VELOCITY AND SHEAR VALUES
50-YEAR EVENT

50-YEAR EVENT																				
River	Description	Station	Channel Velocity (ft/s)									Channel Shear (lb/sq ft)								
			Existing	Proposed								Existing	Proposed							
			-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)	-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)
RAMAPO	Ramapo River 16.0	9450	3.7	3.7	0.0	3.7	0.0	3.7	0.0	3.7	0.0	0.20	0.20	0.00	0.20	0.00	0.20	0.00	0.20	0.00
	Ramapo River 11.0 (Above Dawes Hwy.)	7818	4.9	4.9	0.0	4.9	0.0	4.9	0.0	4.9	0.0	0.33	0.33	0.00	0.33	0.00	0.33	0.00	0.33	0.00
	Ramapo River 9.0 (Below Dawes Hwy.)	6343	4.5	4.5	0.0	4.5	0.0	4.5	0.0	4.5	0.0	0.29	0.29	0.00	0.29	0.00	0.29	0.00	0.29	0.00
	Ramapo River 8.0	5327	4.0	4.0	0.0	4.0	0.0	4.1	0.1	4.0	0.0	0.23	0.23	0.00	0.23	0.00	0.23	0.00	0.23	0.00
	Ramapo River 6.0	4342	4.2	4.3	0.1	4.4	0.2	4.4	0.2	4.2	0.0	0.24	0.26	0.02	0.27	0.03	0.27	0.03	0.24	0.00
	Ramapo River 3.0	1962	1.9	1.8	-0.1	1.9	0.0	1.9	0.0	1.9	0.0	0.05	0.04	-0.01	0.05	0.00	0.05	0.00	0.05	0.00
	Pompton Dam Directly US	1143	1.6	1.3	-0.3	1.2	-0.4	1.2	-0.4	1.3	-0.3	0.04	0.02	-0.02	0.02	-0.02	0.02	-0.02	0.02	-0.02
	Pompton Dam Directly DS	1026	0.9	1.0	0.1	0.9	0.0	0.9	0.0	0.9	0.0	0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00
PEQUANNOCK	Pequannock River 16.0	10642	1.3	1.3	0.0	1.3	0.0	1.3	0.0	1.3	0.0	0.03	0.03	0.00	0.03	0.00	0.03	0.00	0.03	0.00
	Pequannock River 9.0	5539	0.5	0.5	0.0	0.5	0.0	0.5	0.0	0.5	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Pequannock River 8.25	3812	1.6	1.7	0.1	1.7	0.1	1.7	0.1	1.6	0.0	0.04	0.04	0.00	0.04	0.00	0.04	0.00	0.04	0.00
	Pequannock River 6.0	2372	2.3	2.2	-0.1	2.2	-0.1	2.5	0.2	2.3	0.0	0.08	0.07	-0.01	0.07	-0.01	0.09	0.01	0.08	0.00
	Pequannock Dam Directly US	1804	1.2	1.1	-0.1	1.1	-0.1	1.1	-0.1	1.2	0.0	0.02	0.02	0.00	0.02	0.00	0.02	0.00	0.02	0.00
	Pequannock Dam Directly DS	1744	1.7	1.5	-0.2	1.5	-0.2	1.5	-0.2	1.7	0.0	0.04	0.03	-0.01	0.03	-0.01	0.03	-0.01	0.04	0.00
POMPTON	Pompton River 2.0 Below Confluence (Pompton & Ramapo)	35534	5.0	5.0	0.0	5.0	0.0	5.0	0.0	5.0	0.0	0.34	0.34	0.00	0.34	0.00	0.34	0.00	0.34	0.00
	Weir #1 Directly US	34820	5.8	5.8	0.0	5.8	0.0	5.8	0.0	5.8	0.0	0.47	0.47	0.00	0.46	-0.01	0.46	-0.01	0.47	0.00
	Weir #1 Directly DS	34810	6.1	6.1	0.0	6.1	0.0	6.1	0.0	6.1	0.0	0.51	0.51	0.00	0.51	0.00	0.51	0.00	0.51	0.00
	Pompton Plains XR Directly US	34765	5.5	5.5	0.0	5.5	0.0	5.5	0.0	5.5	0.0	0.39	0.39	0.00	0.39	0.00	0.39	0.00	0.39	0.00

TABLE 8-24
SUMMARY OF CHANNEL VELOCITY AND SHEAR VALUES
100-YEAR EVENT

100-YEAR EVENT																				
River	Description	Station	Channel Velocity (ft/s)									Channel Shear (lb/sq ft)								
			Existing	Proposed								Existing	Proposed							
			-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)	-	ALT-1	Δ (prop-exist)	ALT-2	Δ (prop-exist)	ALT-3	Δ (prop-exist)	ALT-4	Δ (prop-exist)
RAMAPO	Ramapo River 16.0	9450	4.1	4.1	0.0	4.1	0.0	4.1	0.0	4.1	0.0	0.23	0.23	0.00	0.23	0.00	0.23	0.00	0.23	0.00
	Ramapo River 11.0 (Above Dawes Hwy.)	7818	5.3	5.3	0.0	5.3	0.0	5.3	0.0	5.3	0.0	0.37	0.37	0.00	0.37	0.00	0.37	0.00	0.37	0.00
	Ramapo River 9.0 (Below Dawes Hwy.)	6343	4.4	4.4	0.0	4.4	0.0	4.4	0.0	4.4	0.0	0.27	0.27	0.00	0.27	0.00	0.27	0.00	0.27	0.00
	Ramapo River 8.0	5327	4.1	4.1	0.0	4.1	0.0	4.1	0.0	4.1	0.0	0.23	0.23	0.00	0.23	0.00	0.23	0.00	0.23	0.00
	Ramapo River 6.0	4342	4.3	4.4	0.1	4.4	0.1	4.4	0.1	4.3	0.0	0.25	0.26	0.01	0.27	0.02	0.27	0.02	0.25	0.00
	Ramapo River 3.0	1962	2.0	1.9	-0.1	2.0	0.0	2.0	0.0	1.9	-0.1	0.05	0.05	0.00	0.05	0.00	0.05	0.00	0.05	0.00
	Pompton Dam Directly US	1143	1.7	1.4	-0.3	1.3	-0.4	1.3	-0.4	1.4	-0.3	0.04	0.03	-0.01	0.02	-0.02	0.02	-0.02	0.03	-0.01
	Pompton Dam Directly DS	1026	1.0	1.1	0.1	1.0	0.0	1.0	0.0	1.0	0.0	0.01	0.02	0.01	0.01	0.00	0.01	0.00	0.01	0.00
PEQUANNOCK	Pequannock River 16.0	10642	1.7	1.7	0.0	1.7	0.0	1.7	0.0	1.7	0.0	0.04	0.05	0.01	0.05	0.01	0.05	0.01	0.04	0.00
	Pequannock River 9.0	5539	0.6	0.7	0.1	0.7	0.1	0.7	0.1	0.6	0.0	0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00
	Pequannock River 8.25	3812	1.9	1.9	0.0	1.9	0.0	1.9	0.0	1.9	0.0	0.05	0.05	0.00	0.05	0.00	0.05	0.00	0.05	0.00
	Pequannock River 6.0	2372	2.4	2.4	0.0	2.4	0.0	2.7	0.3	2.4	0.0	0.08	0.08	0.00	0.08	0.00	0.10	0.02	0.08	0.00
	Pequannock Dam Directly US	1804	1.4	1.3	-0.1	1.2	-0.2	1.2	-0.2	1.4	0.0	0.03	0.02	-0.01	0.02	-0.01	0.02	-0.01	0.03	0.00
	Pequannock Dam Directly DS	1744	1.8	1.7	-0.1	1.6	-0.2	1.6	-0.2	1.8	0.0	0.04	0.04	0.00	0.04	0.00	0.04	0.00	0.04	0.00
POMPTON	Pompton River 2.0 Below Confluence (Pompton & Ramapo)	35534	5.4	5.4	0.0	5.4	0.0	5.4	0.0	5.4	0.0	0.39	0.39	0.00	0.39	0.00	0.39	0.00	0.39	0.00
	Weir #1 Directly US	34820	6.7	6.7	0.0	6.7	0.0	6.7	0.0	6.7	0.0	0.60	0.60	0.00	0.60	0.00	0.60	0.00	0.60	0.00
	Weir #1 Directly DS	34810	7.0	7.0	0.0	7.0	0.0	7.0	0.0	7.0	0.0	0.66	0.66	0.00	0.66	0.00	0.66	0.00	0.66	0.00
	Pompton Plains XR Directly US	34765	6.4	6.4	0.0	6.4	0.0	6.4	0.0	6.4	0.0	0.52	0.52	0.00	0.52	0.00	0.52	0.00	0.52	0.00

Changes in sediment transport conditions due to the alternative conditions were analyzed based on the results of the unsteady HEC-RAS simulations.

Three additional investigations were initiated to support the results of the hydrologic and hydraulic simulations. This allowed for an additional understanding of the current sediment conditions in the study area reaches and the prediction of potential sediment transport as a result of the alternatives.

The additional investigations included a HEC-6 analysis of the potential sediment transport rates occurring in the study reaches, a HEC-18 analysis of the potential contraction and local pier scour at the Dawes Highway and Pompton Plains Crossroads/Jackson Avenue Bridge, and a long term streambed stability analysis using USGS rating curve data for each reach in the study area.

9.1. UNSTEADY HEC-RAS SIMULATION RESULTS

9.1.1 Channel Shear Stress

Under existing conditions, the river reaches experience minimal shear stresses during all storm events. Specifically, channel shear stresses during the 2-year event on the Ramapo River ranged from 0.15 lb/sq ft just upstream of the Pompton Dam to 0.62 lb/sq ft just below the Dawes Highway Bridge. Shear stresses during a 100-year event ranged from 0.04 lb/sq ft to 0.27 lb/sq ft at the same locations.

Channel shear stresses during a 2-year event under existing conditions on the Pequannock River ranged from 0.01 lb/sq ft just upstream of the Pequannock Dam to 0.14 lb/sqft approximately 8,850 feet upstream of the dam. During the 100-year event, shear stresses on the Pequannock River ranged from 0.03 lb/sq ft to 0.04 lb/sq ft at the same locations.

Alternative 3 showed the greatest impact on channel shear on the Ramapo River during the 2-year event, with a minor increase of 0.16 lb/sq ft approximately 4,200 feet upstream of the Pompton Dam. During the 100-year event, this section experiences no change.

There were similar minimal changes in shear stresses on the Pequannock River, with a maximum increase of 0.12 lb/sq ft in Alternative 2 and 3 approximately 3,750 feet upstream of the Pequannock Dam during the 2-year event. There was no change in channel shear stress during the 100-year event at this location for all alternatives. During all storm events, there were generally slight decreases in channel shear stress downstream of the Pequannock Dam.

There was no change in shear stress on the Pompton River in any of the alternative conditions.

Based on the modeling results, there was minimal change in channel shear stresses in the alternative conditions during all storm events, indicating that the alternative conditions will not have any detrimental impacts on the current sediment transport and mobility in the system.

9.1.2 Channel Velocity

During a 2-year event, existing channel velocities in the Ramapo River range from 2.8 ft/sec directly upstream of the Pompton Dam to 6.0 ft/sec just below the Dawes Highway Bridge. During a 100-year event, existing channel velocities range from 1.7ft/sec to 4.4 ft/sec at the same locations.

The results of the unsteady HEC-RAS simulations of the alternatives showed greater increases in the channel velocity during lower flow events. Specifically, during the 2-year event, channel velocity increased 1.0 ft/sec in Alternative 2 approximately 3,000 feet upstream of the Pompton Dam, which is near the upstream limit of proposed excavation. There was a maximum increase of 0.3 ft/sec just below the Dawes Highway Bridge in Alternative 1, 2 and 3. During the 5-year event, channel velocity increased 0.6 ft/sec in Alternative 2. There was a maximum increase of 0.4 ft/sec in Alternative 2 and 3 just below the Dawes Highway Bridge. Alternative 4 showed less increase at the same locations.

The results show minimal increases (0.2 ft/sec or less) in channel velocity during higher flow events (25-year and above) for all of the modeled alternatives in the Ramapo River upstream of the Pompton Dam.

Directly upstream of the Pompton Dam, decreases in velocity were experienced during all storm events. The greatest reduction in channel velocity was 1.9 ft/sec which occurred during the 5-year event in Alternatives 2 and 3. During the 100-year event, channel velocity directly upstream of the Pompton Dam was reduced by a maximum of 0.4 ft/sec in Alternative 2 and 3.

On the Pequannock River, existing channel velocities range from 1.0 ft/sec directly upstream of the Pequannock Dam to 2.2 ft/sec approximately 550 feet upstream of the feeder dam during a 2-year event. During a 100-year event, existing channel velocities range from 1.4 ft/sec to 2.4 ft/sec at the same locations.

In the modeled alternatives, there was minimal change in channel velocity just upstream of the Pequannock Dam. Channel velocity just upstream of the Pequannock Dam did not change or decreased. At this location, the maximum decreases in velocity occurred during the 5-year event for Alternative 2 and Alternative 3, with a decrease of 0.6 ft/sec. There was no change in velocity for Alternative 4. During a 100-year event, the maximum decrease in velocity was 0.2 ft/sec for Alternative 2 and Alternative 3. There was no change in velocity in Alternative 4 during the 100-year event.

There was no change in channel velocity on the Pompton River in any of the alternative conditions.

The minimal increases in channel velocity and channel shear stresses show that the alternative conditions will have no significant impact on the existing sediment transport dynamics in the system.

In order to confirm the unsteady HEC-RAS model results, additional sediment transport and stability studies were initiated using the methods developed by the Hydrologic Engineering Center (HEC).

9.2 HEC-6 SEDIMENT TRANSPORT

Sediment transport was modeled using the existing HEC-RAS model developed for the Pompton Lake Dam Floodgate Study.

Sediment data used for the analysis was collected by Civil Dynamics on November 2, 2011 and November 9, 2011. Twelve samples were retrieved to analyze the particle size distribution throughout the Ramapo and Pequannock Rivers within the study area limits. Five samples were obtained in the Ramapo River, six samples were obtained in the Pequannock River and another sample was obtained in a cross channel at the lower end of the Pequannock River.

The particle size distributions and classifications for the collected samples were incorporated into the HEC-6 Quasi-Unsteady Sediment Transport module within HEC-RAS. Given the sediment yield from upstream sources, HEC-6 performs a continuous simulation of the sediment transport capability of a stream profile for both bed and suspended load. Long-term simulations of scour and deposition can be performed in order to analyze the effects of proposed hydraulic conditions on the existing stream bed. The appropriate sediment transport equations were applied to estimate the scour and deposition on the streambed due to the proposed alternatives.

Based on the initial results of the HEC-6 analysis, the streambed profile will remain stable, and no long-term detrimental effects due to scour or deposition would be caused through the implementation of any of the alternative conditions. Since the initial results from the HEC-6 analysis align with the conclusions based on the unsteady HEC-RAS results, a detailed investigation using the HEC-6 sediment transport calculations was not pursued.

9.3 HEC-18 CONTRACTION AND LOCAL PIER SCOUR

Contraction scour and local pier scour was evaluated at the Dawes Highway Bridge and the Pompton Plains Crossroads/Jackson Avenue Bridge using the HEC-18 scour computations. Contraction scour upstream of the structures due to increases in flow and velocity in the channel was not significant for either the 100-yr or 500-yr event during any of the proposed alternatives. This is the case for both sediment transport due to clear-water or live-bed scour in the channel.

Local pier scour due to the proposed alternatives was evaluated at the Pompton Plains Crossroads/Jackson Avenue Bridge to determine the effects of flow acceleration on the sediment material removal around the base of the bridge piers. No significant effects are expected from the proposed dam removals outlined in all of the alternative conditions. The Dawes Highway Bridge has no in-stream pier structures, therefore only the Pompton Plains Crossroads/Jackson Avenue Bridge was evaluated for local pier scour.

Based on the initial results of the HEC-18 analysis, there will be no detrimental scour effects due to contraction or local pier scour at the structures evaluated for all alternatives. These results support the results of the unsteady HEC-RAS simulations for the existing and alternative conditions; therefore, further development of the HEC-18 analysis was not continued.

9.4 LONG-TERM STREAMBED STABILITY

Stage-discharge rating curves for the Pequannock, Ramapo, and Pompton Rivers were evaluated in order to understand the long term stability of the reaches in the study area. It is important to evaluate sedimentation in the channels, since excessive sedimentation may lead to increased flood heights and potential for downstream flooding.

A change in the stage-discharge relationship for a channel is a good indication of a response to a disturbance, such as an increase or decrease in sediment. For instance, if the stage elevation in a channel for a particular discharge has a downward trend, it is possible that the channel-bed elevation may be declining with time because of sediment erosion. Similarly, the stage elevation in a channel for a particular discharge may rise due to sediment deposition. If there are no observable trends in the rating curves, it is likely that the sediment load in the channel is stable.

9.4.1 Data Sources

Stage-discharge data was obtained from the USGS at three locations in the study area, including one gage on the Pequannock, Pompton, and Ramapo Rivers for varying lengths of time. The following table presents the locations and analysis period of the data obtained for the three rivers:

Table 9-1
USGS Stage-Discharge Rating Curve Data - Periods of Record

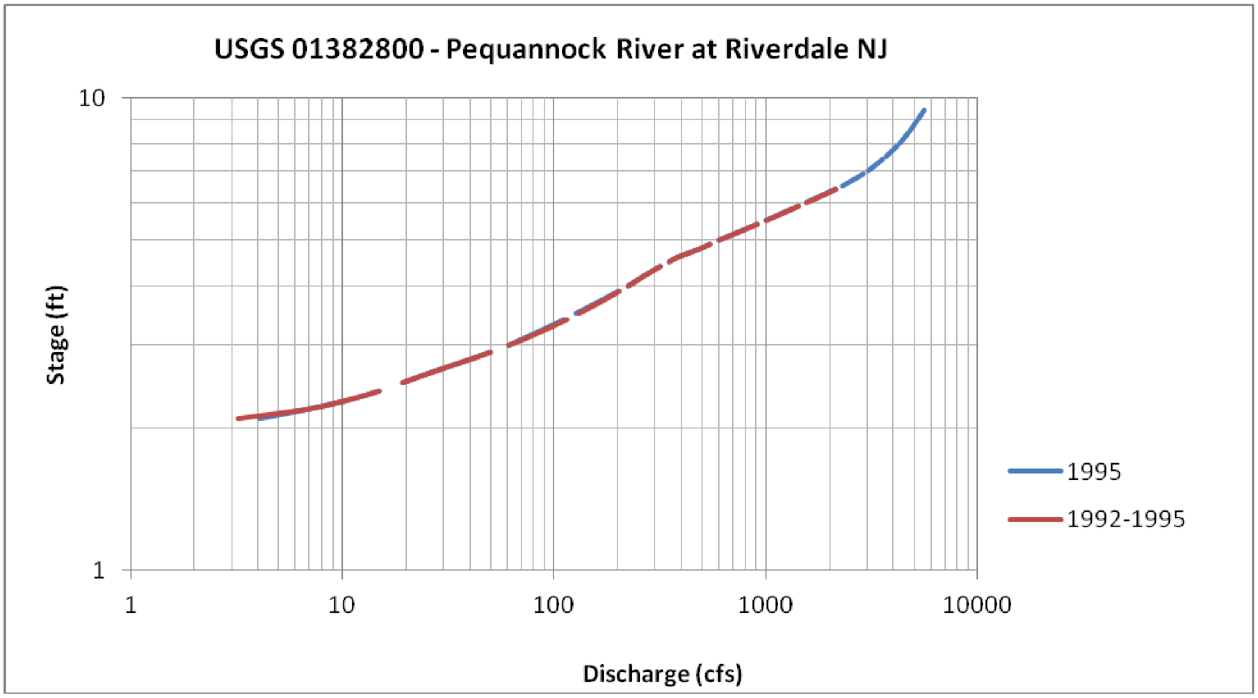
River	Station Location	Time Period Analyzed
Pequannock	Riverdale	1992-1995 1995
Ramapo	Pompton Lakes	1979-1980 1980-1981 1981-2001 2001-2004 2004-2006 2007-2008 2008-2009 2009-2011 2011
Pompton	Pompton Plains Crossroads/ Jackson Ave. Bridge	1967-1972 1972-1982 1982-1983 1983-1986 1986-1994 1994-1996 1996-1998 1998-2002 2002-2004 2004-2009 2009-2011 2011

The rating curve data from the available electronic records was plotted for each gage for the time period of analysis. Shifts in rating curves throughout the historical records were analyzed to determine the sediment aggregation or degradation occurring in the system.

9.4.2 Pequannock River

The following figure presents the stage-discharge rating curve in the Pequannock River from 1992 to 1995.

Figure 9-1
Stage-Discharge Rating Curves - USGS 01382800

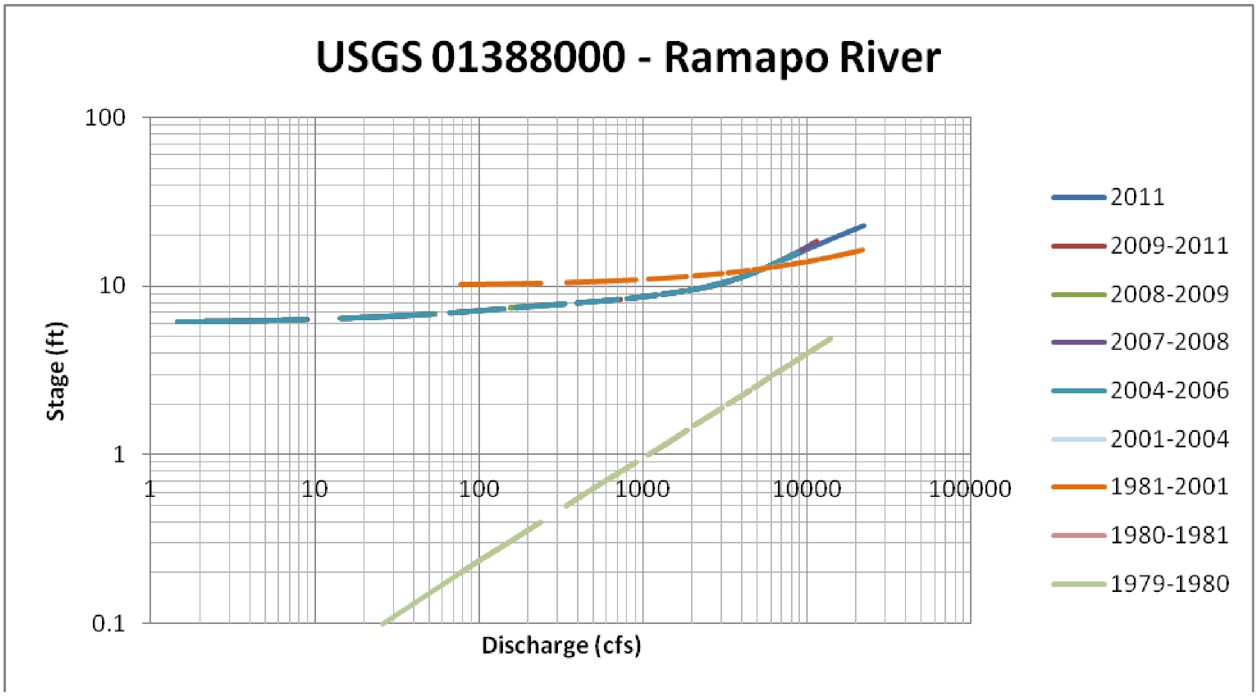


As shown on this figure, the rating curves for the two records are uniform for the varying flows. This equivalence in rating curves shows that the channel has been historically stable and there is no net flux in sediment transport occurring in the river.

9.4.3 Ramapo River

The following rating curves show the changes in the stage-discharge relationship in the Ramapo River from 1979 to 2011.

Figure 9-2
Stage-Discharge Rating Curves - USGS 01388000



According to the USGS, the location of this gage was approximately 19.61 feet higher than its current elevation before 2004 and at a different location; additionally, this gage was approximately 29.61 feet higher prior to 1981. Due to this significant shift in location, the data shown on the above figure prior to 2004 was not considered in this evaluation.

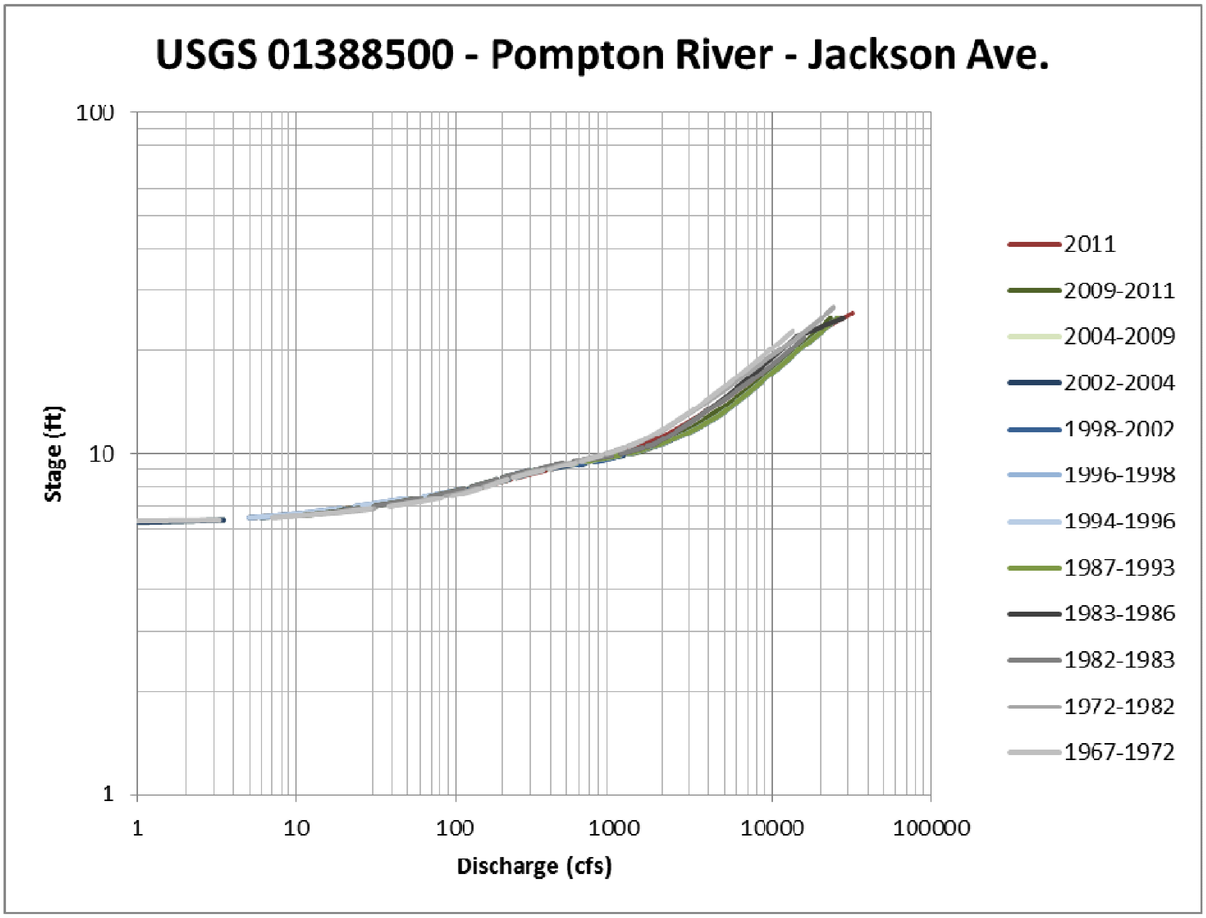
The analysis of rating curve data from 2004-2011 shows that the Ramapo River has been continually stable throughout the stream section location at the USGS 0138800 gage below the Pompton River Dam.

However, the most recent rating curve (2011) shows a possible upward trend in the stage-discharge relationship. Additional data is necessary to evaluate the sediment dynamics occurring at high flow events.

9.4.4 Pompton River

The following rating curve shows the fluctuation in the stage-discharge relationship in the stream section just upstream of the Pompton Plains Crossroads/Jackson Avenue Bridge from 1967 to 2011.

Figure 9-3
Stage-Discharge Rating Curves - USGS 01388500



In general, there is no-net sediment aggregation or degradation occurring in the Pompton River to shift the long-term stability of the stream channel.

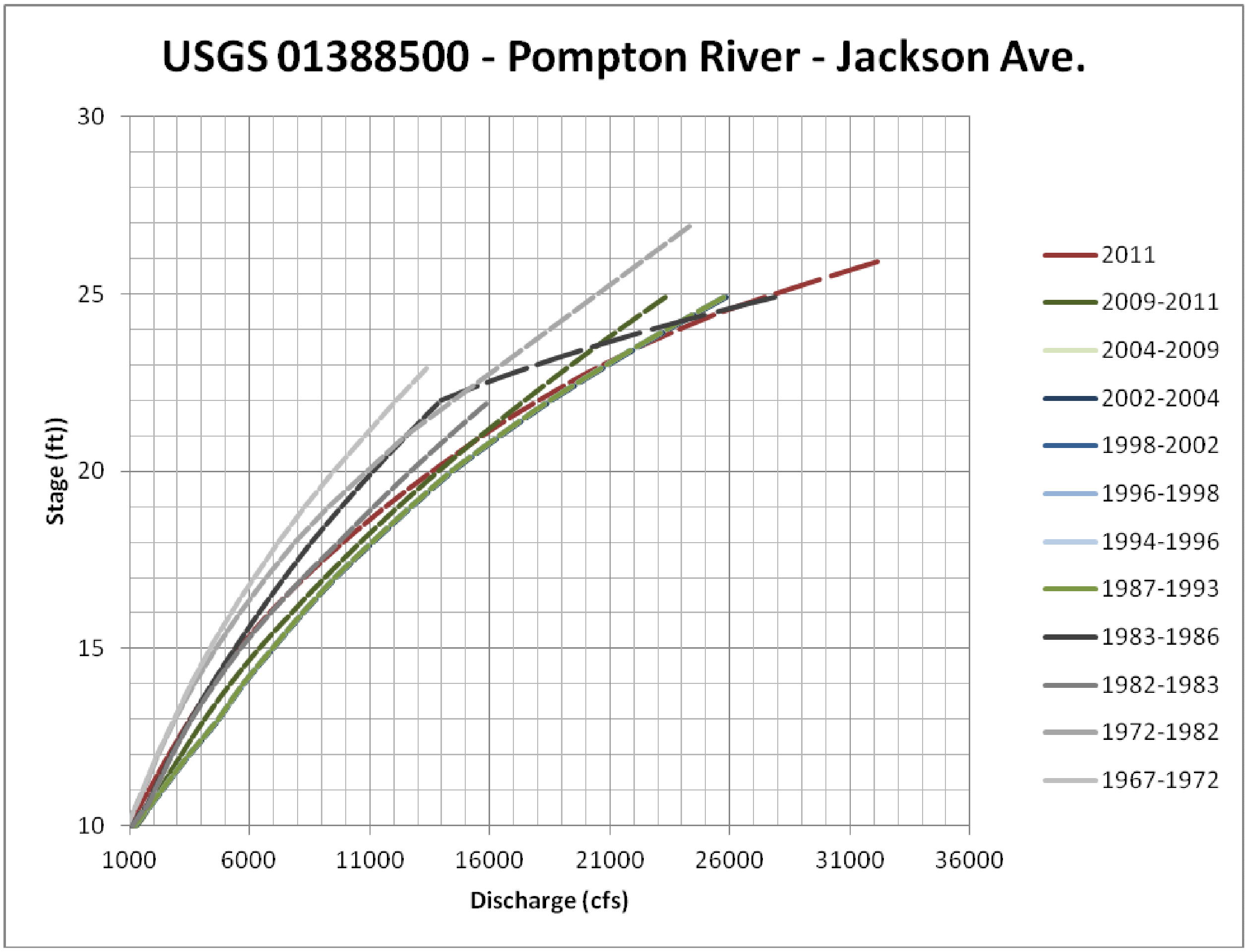
The following table discusses the stage elevation changes throughout the past 33 years of record provided by USGS upstream of the Pompton Plains Crossroads/Jackson Avenue Bridge.

Table 9-2
Relationship between Stage-Discharge Rating Curves - USGS 01388500

Time Interval	General Trend
1972-1982	decrease
1982-1983	decrease
1983-1996	increase
1996-1998	decrease
1998-2002	same
2002-2004	same
2004-2009	same
2009-2011	increase
2011-Present	decrease

In general, it appears that sediment deposition and aggregation has been occurring interchangeably throughout the reach. Exchanges in scour and deposition in the stream bed have been occurring in a 1 to 2-foot range throughout the past three decades, and within 1 foot during the recent years of record. With these minimal fluctuations in long-term sediment transport in the reach, the long-term stability of the streambed in this reach has remained constant.

Figure 9-4
Stage-Discharge Rating Curves - USGS 01388500



9.4.5 Summary

Based on the available data, it appears that the Pequannock River, Ramapo River and Pompton River gaging stations have been relatively stable throughout the data collection periods analyzed in this report. There appears to be no appreciable sediment erosion or sediment deposition in the stream channel that would cause any detrimental effects within the rivers.

9.5 CONCLUSIONS

Based on the sediment transport evaluations and the long-term bed stability analysis, we believe that the proposed alternatives for the feeder dam removals will have minimal effects on the existing stream bed stability and sediment transport characteristics in the Pequannock River, Ramapo River and Pompton River. Specifically, there is minimal change in channel velocities in the study reaches during all storm events under all alternative conditions, and almost no change in channel shear stress observed for all conditions.

The lack of changes in velocity and shear stress within the river sections also means that various structures discussed in Section 6.2 will not be subject to scouring or structural problems with implementation of any of the alternatives.

The evaluation of the alternatives presented in this section focuses on the Peak Water Surface Elevations during various storm events since this parameter determines flooding impacts and potential benefits.

This evaluation of the alternatives also presents the corresponding construction cost estimates. Construction cost estimates are based on estimated quantities of work and estimated unit rates based on the nature and difficulty of the work. The cost estimates include a 30-percent contingency. A copy of each construction cost estimate is included in Appendix D.

10.1 ALTERNATIVE 1

10.1.1 Summary of Flood Reduction

As shown in the tables in Section 8.0, Alternative 1 provides some reduction in peak water surface elevation in the Ramapo River upstream of the Pompton Dam. The largest reduction is about 0.8 feet at a distance of 3,000 feet upstream of the Pompton Dam during the 2-year storm event. This area is the upstream limit of the proposed channel dredging associated with Alternative 1. While there is a reduction in the peak water surface elevation, this reduction does not provide a benefit in reducing flood impacts since homes are not affected in this area during the 2-year event.

As expected, there is less reduction in the peak water surface elevation with increasing storm events. Specifically, the maximum reduction is 0.3 and 0.2 feet during the 5 and 10-year events. There is an insignificant reduction of 0.1 feet or less at the 25-year and larger events.

In the southern end of Pompton Lakes downstream of Dawes Highway (an area that is frequently flooded), the maximum reduction in the peak water surface in the Ramapo River is 0.2 feet during the 2, 5, and 10-year events. Such a decrease is not significant and is not likely to provide any significant reduction in flooding impacts to the area. As an example, the ground surface elevations in this area of Pompton Lakes are as low as Elevation 180 feet and will be flooded by 2 feet or more of water during the 5-year storm event so a reduction of 0.2 feet is not a significant benefit to the area.

Relative to other parameters there is a decrease in velocity and an increase in flow in the Ramapo River near the Pompton Dam during all storm events for Alternative 1. The increase is a result of more water from the Pequannock River flowing into the dredged channel in the Ramapo River. At the same time, there is a comparable decrease in flow in the Pequannock River. Alternative 1 does not cause any significant change in channel shear stress on the Ramapo River reach.

Alternative 1 results in a 0.8-foot decrease in the peak water surface in the Pequannock River upstream of the dam during the 2-year event but there are no structures in this area. There is a 0.6-foot decrease near Riverdale Boulevard, but there is no flooding of homes in this area during the 2-year event. For the 5-year event, the decrease in this area reduces to 0.3 feet, but again there is limited to no flooding of homes.

On the Pompton River, Alternative 1 did not result in any water surface elevation, velocity, or channel shear changes. There was a general decrease in total flow, in the order of 40 to 70 cfs during the 5-year and 10-year events experienced along the Pompton River reach as a result of Alternative 1. This decrease is likely a result of the increased storage volume by the dam removal and dredging.

10.1.2 Construction Cost Estimate

The construction cost for Alternative 1 was estimated at $18,000,000.

The costs associated with excavation/dredging and disposal of 140,000 cys of excavated material comprise 96 percent of the cost. The cost of the excavation is high because the work will be very difficult given the need to work in the water, the lack of access roads, the lack of staging areas and the need to dispose of the excavated sediment offsite. The cost estimate assumes that the excavated material meets New Jersey Residential Standards and there will not be an additional cost to dispose of the materials.

10.2 ALTERNATIVE 2

10.2.1 Summary of Flood Reduction

Alternative 2 yielded a similar reduction (as compared to Alternative 1) of 0.2 feet in the peak water surface elevation in the Ramapo River in the southern Pompton Lakes area for the 2-year event. Reductions were slightly larger for the 5 and 10-year events. Specifically, the reduction is 0.3 feet for these two events. There is an insignificant reduction of 0.1 feet during the 25-year and larger events.

In the Pequannock River, there are similar reductions during the 2-year event as compared to Alternative 1. For the 5-year event, the reduction at the Riverdale Boulevard area is 0.4 feet, which is a 0.1-foot increase over Alternative 1. However, there is little to no flooding of homes during this event, so the reduction provides little to no benefit.

The results for the 10-year event in the Pequannock River are similar to the 5-year event. Specifically, there is a 0.2-foot decrease, but there is little to no flooding of homes expected during the 10-year event.

There are no changes in the Pompton River.

10.2.2 Construction Cost Estimate

The construction cost estimate for Alternative 2 was estimated at $18,300,000. Similar to Alternative 1, the costs associated with excavation/dredging and disposal of 140,000 cys of excavated material comprise 95 percent of the cost of Alternative 2.

10.3 ALTERNATIVE 3

10.3.1 Summary of Flood Reduction

Alternative 3 provides a 0.9-foot reduction in peak water surface elevation in the lower portion of the Ramapo River upstream of the Pompton Dam during the 2-year event. But, as with the other alternatives, this reduction provides no benefit as there is no flooding in this area during the 2-year event.

Upstream in the southern end of Pompton Lakes, the maximum reduction in the peak water surface in the Ramapo River is 0.3 feet during the 2, 5, and 10-year events. The reduction is 0.2 feet and less during the 25-year and larger events.

Similar to Alternatives 1 and 2, there is a 0.6-foot reduction in the peak water surface in the Pequannock River in the Riverdale Boulevard area during the 2-year event, but again, there is no flooding of homes during this event. For the 5-year and 10-year events, the reduction in this area decreases to 0.4 feet, which is slightly larger than the reduction for Alternatives 1 and 2.

Figure 10-1 presents a floodmap of the 10-year event to illustrate the potential benefits from Alternative 3 in reducing the peak water surface elevation. The map shows the limits of flooding during the 10-year event with the existing conditions and highlights in “red” the areas where the floodplain is reduced by reduction in the peak water surface elevation.

From a review of Figure 10-1, one can see that the reduction in floodplain is small and does not appear to provide any benefit by reducing the number of homes impacted.

There are no changes in the Pompton River.

10.3.2 Construction Cost Estimate

The construction cost estimate for Alternative 3 was estimated at $24,800,000. Similar to Alternative 1, the costs associated with excavation/dredging and disposal of 167,000 cys of excavated material comprise 95 percent of the cost of Alternative 3.

The cost estimate uses a higher disposal cost for the 27,000 cys from the Pequannock River since the concentrations of lead and benzo(a)pyrene exceed the New Jersey Residential Soil Cleanup Criteria (see Section 5.3.2).

10.4 ALTERNATIVE 4

10.4.1 Summary of Flood Reduction

As discussed in Section 7.0, Alternative 4 focuses on removal of the feeder dams and limiting the excavation in the rivers.

Alternative 4 provides a 0.7-foot reduction in peak water surface elevation in the lower portion of the Ramapo River upstream of the Pompton Dam during the 2-year event. But, as with the other alternatives, this reduction provides no benefit as there is no flooding in this area during the 2-year event.

Upstream in the southern end of Pompton Lakes, the maximum reduction in the peak water surface in the Ramapo River is 0.1 feet during the 2, 5, and 10-year events. There is no reduction during the 25-year and larger events.

There is a 0.3-foot reduction in the peak water surface in the Pequannock River in the Riverdale Boulevard area during the 2-year event, but again, there is no flooding of homes during this event. For the 5-year and 10-year events, the reduction in this area decreases to 0.1 feet, which is less than the reduction for Alternatives 1, 2 and 3. But as discussed several times, there is limited flooding of homes in this area of the Pequannock River.

Figures 10-2 and 10-3 present floodmaps of the 2-year and 10-year events to illustrate the potential benefits from Alternative 4 in reducing the peak water surface elevation. The maps show the limits of flooding during the 2-year and 10-year event with the existing conditions and highlight in "red" the areas where the floodplain is reduced by the reduction in the peak water surface elevation.

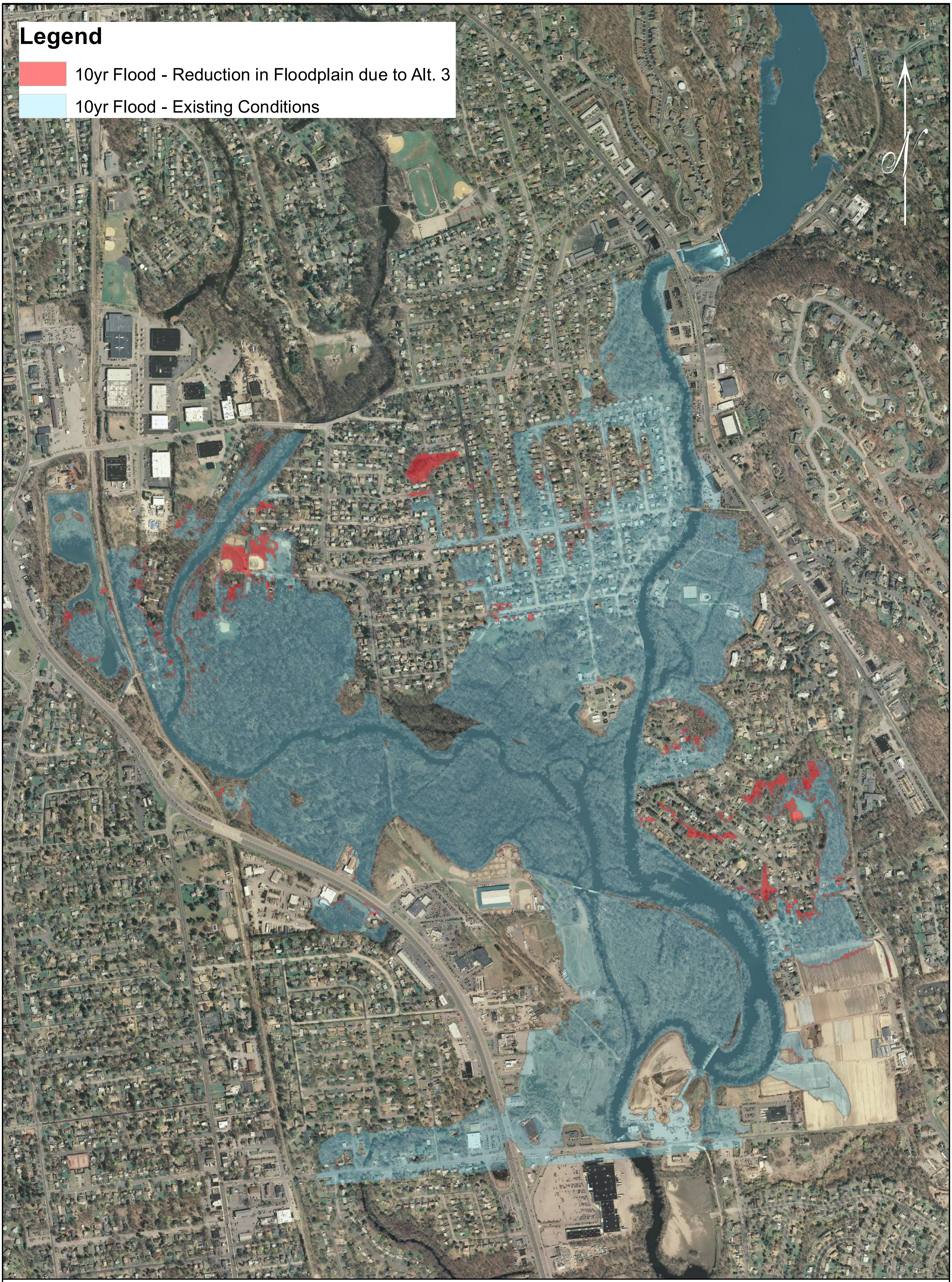
From a review of these maps, it is apparent that the reduction in the floodplain is not significant and there does not appear to be any benefit in reducing the number of homes impacted.

There are no changes on the Pompton River for this alternative.

10.4.2 Construction Cost Estimate

The construction cost estimate for Alternative 4 was estimated at $3,500,000. The costs associated with excavation/dredging and disposal of about 22,000 cys of excavated material comprise 80 percent of the cost of Alternative 4.

While not a large volume, the cost estimate uses a higher disposal cost for the 760 cys from the Pequannock River since the concentrations of lead and benzo(a)pyrene exceed New Jersey Residential Soil Cleanup Criteria (see Section 5.3.2).



10-Year Floodmap - Reduction in Floodplain due to Alternative 3

Feasibility Study for the Removal of Pompton Dam and Pequannock Dam
Project No. P1079-00
Ramapo State Forest
Wayne, Pompton Lakes and Pequannock Townships
Passaic and Morris Counties, NJ

0 500 1,000 2,000 Feet

Figure 10-1

2-Year Floodmap - Reduction in Floodplain due to Alternative 4

Feasibility Study for the Removal of Pompton Dam and Pequannock Dam
Project No. P1079-00
Ramapo State Forest
Wayne, Pompton Lakes and Pequannock Townships
Passaic and Morris Counties, NJ

0 500 1,000 2,000 Feet

Figure 10-2

10-Year Floodmap - Reduction in Floodplain due to Alternative 4

Feasibility Study for the Removal of Pompton Dam and Pequannock Dam
Project No. P1079-00
Ramapo State Forest
Wayne, Pompton Lakes and Pequannock Townships
Passaic and Morris Counties, NJ

0 500 1,000 2,000 Feet

Figure 10-3

11.0 CONCLUSIONS

Detailed hydrologic and hydraulic analyses were conducted of the Ramapo, Pequannock and Pompton Rivers to evaluate the potential benefit of removing the two feeder dams on the Ramapo River and the Pequannock River. The analyses utilized the best available topographic information coupled with detailed field surveying of the river cross sections.

Four alternatives to remove the two feeder dams and the adjacent earthen Guard Dike were modeled and the results of the analyses were evaluated. Alternatives included major excavation/dredging of both the Ramapo and Pequannock Rivers. The cost to implement the four alternatives ranged from $3.5 to $24.8 million.

However, potential benefits to the populated areas upstream of the two dams were determined to be minimal. Specifically, the largest reduction in the peak water surface elevation in the most vulnerable section of Pompton Lakes was determined to only be 0.3 feet during the 2, 5 and 10-year storm events. This minimal reduction results from Alternative 3 which includes major excavation work at the highest cost of $24.8 million. Figure 10-1 shows that the reduction in the floodplain limit during the 10-year event is not significant and there does not appear to be any benefit in reducing the number of homes impacted.

The fact that the results do not show any significant reduction in the peak water surface during storm event is not unexpected. The reason is because the flow and water surface in the rivers are controlled by downstream river conditions and not the feeder dams. One immediate example of a downstream control is the Pompton Plains Crossroads/Jackson Avenue Bridge which restricts flow and causes the water to slow down and increase in elevation. In fact, previous hydraulic studies of the Ramapo and Pompton Rivers show that the water surface downstream of the Pompton Dam is similar to the upstream elevation (and the dam is submerged) for events as small as the 2-year event.

These conditions are the reason that removing or lowering the dams 6 feet does not yield a 6-foot reduction in the water surface during a storm event.

Therefore, given the potential high cost and minimal benefit, we cannot recommend implementation of any alternative to remove the Feeder Dams.

Physical Testing

2011 Grain Size Data

2012 Grain Size Data

Analytical Testing

2004 Analytical Test Results

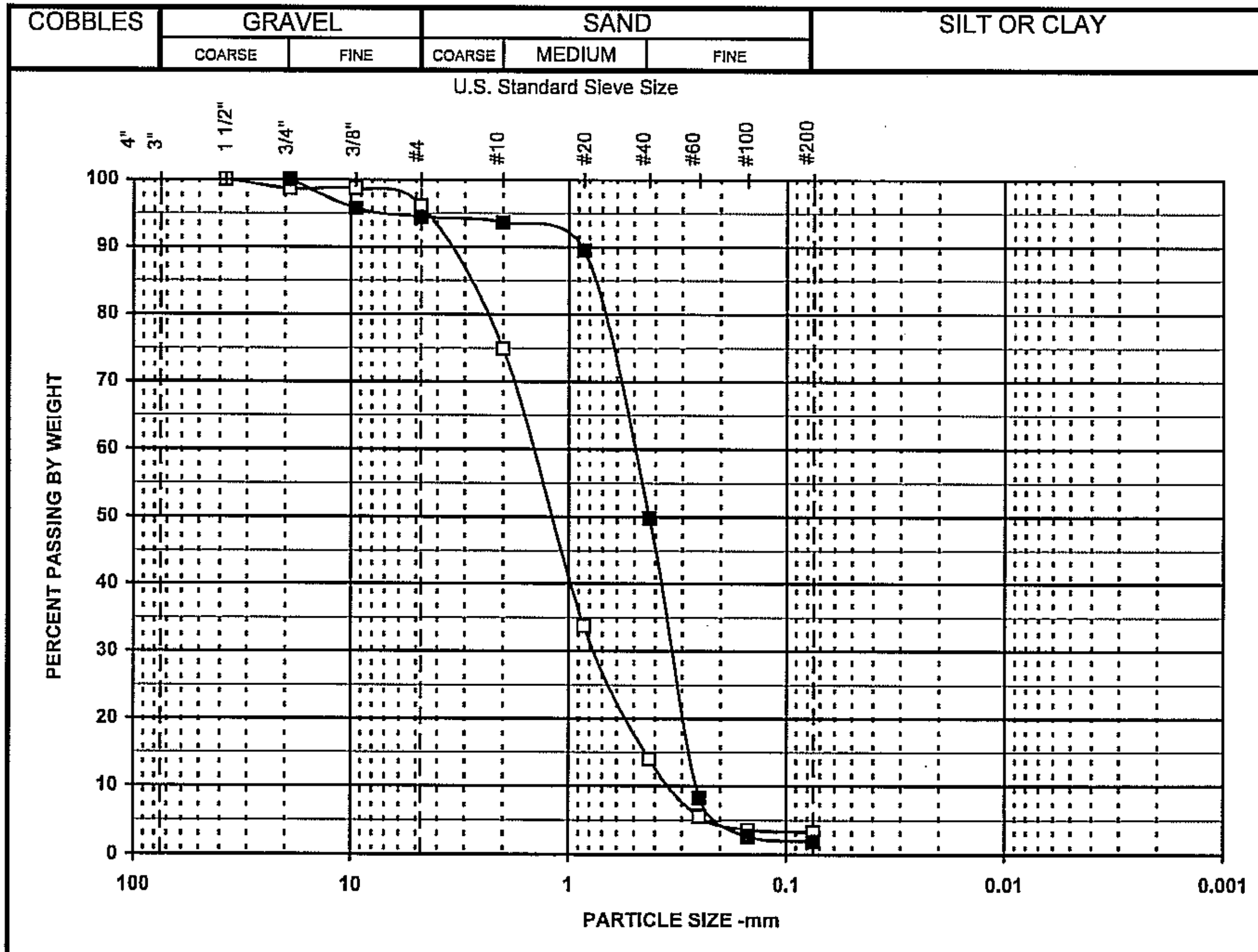
2012 Analytical Test Results

Ramapo River

Civil Dynamics ##258
Pompton-Pequannock Dams
LABORATORY TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS WATER CONTENT (%)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	REMARKS
Section 2	Left		24.4	SP	3.2	
Section 6	Left		23.7	SP	1.9	
Section 8.5	Left		5.1	GW	0.2	
Section 10	Right		33.5	SP	4.5	

Note: (1) USCS symbol based on visual observation and Sieve results reported.



Symbol	□	■	O
Boring	Section 2	Section 6	
Sample	Left	Left	
Depth			
% +3"	0.0	0.0	
% Gravel	3.8	5.6	
% SAND	93.0	92.5	
%C SAND	21.3	0.8	
%M SAND	60.8	43.8	
%F SAND	10.7	47.9	
% FINES	3.2	1.9	
% -2μ			
D_{100} (mm)	37.50	19.00	
D_{60} (mm)	1.59	0.53	
D_{30} (mm)	0.77	0.34	
D_{10} (mm)	0.34	0.26	
Cc	1.1	0.8	
Cu	4.6	2.1	

Particle Size (Sieve #)	PERCENT FINER □	■	O
4"			
3"			
1 1/2"	100.0		
3/4"	98.7	100.0	
3/8"	98.7	95.7	
4	96.2	94.4	
10	74.8	93.6	
20	33.7	89.5	
40	14.0	49.8	
60	5.6	8.2	
100	3.6	2.6	
200	3.2	1.9	

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	24.4				SP	Brown, Poorly graded sand	11/7/2011
■	23.7				SP	Brown, Poorly graded sand	11/7/2011
O							

TerraSense, LLC 7889-11004

Civil Dynamics #258

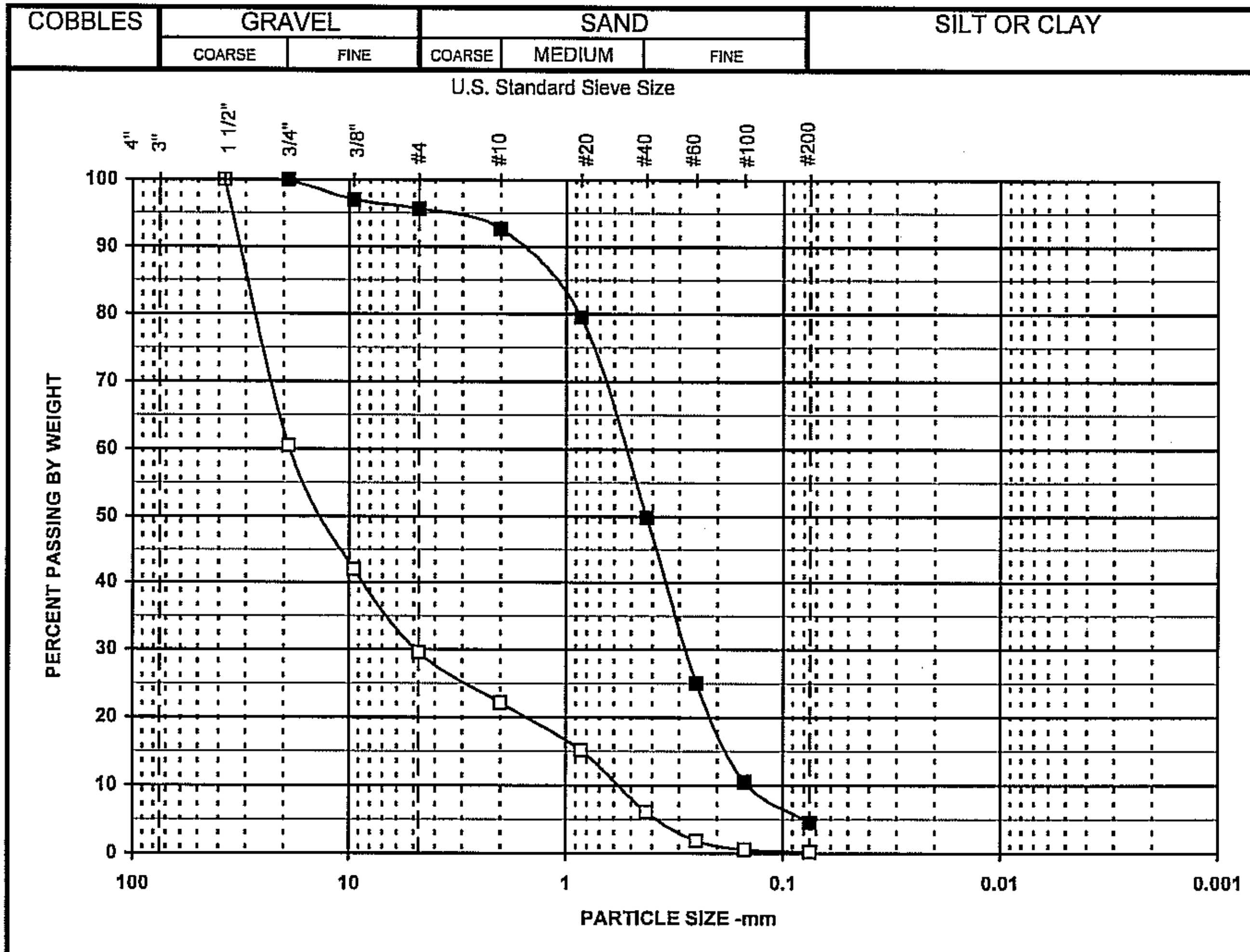
PARTICLE SIZE DISTRIBUTION
Pompton-Pequannock Dams

Analysis File: 3SV-MasterRev3

siev4A.xls 11/10/2011

PARTICLE SIZE DISTRIBUTION

Pompton-Pequannock Dams



Symbol	□	■	○
Boring	Section 8.5	Section 10	
Sample	Left	Right	
Depth			
% +3"	0.0	0.0	
% Gravel	70.4	4.4	
% SAND	29.4	91.1	
%C SAND	7.5	3.0	
%M SAND	16.0	42.8	
%F SAND	5.9	45.4	
% FINES	0.2	4.5	
% -2μ			
D_{100} (mm)	37.50	19.00	
D_{60} (mm)	18.75	0.57	
D_{30} (mm)	4.91	0.28	
D_{10} (mm)	0.61	0.14	
Cc	2.1	1.0	
Cu	30.8	4.0	

Particle Size (Sieve #)	PERCENT FINER □	■	○
4"			
3"			
1 1/2"	100.0		
3/4"	60.5	100.0	
3/8"	42.0	97.0	
4	29.6	95.6	
10	22.1	92.6	
20	15.1	79.5	
40	6.1	49.9	
60	1.9	25.0	
100	0.6	10.5	
200	0.2	4.5	

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	5.1				GW	Brown, Well-graded gravel with sand	11/7/2011
■	33.5				SP	Dark brown, Poorly graded sand organics and roots present	11/7/2011
○							

TerraSense, LLC	Civil Dynamics
7889-11004	#258

Analysis File: 3SV-MasterRev3

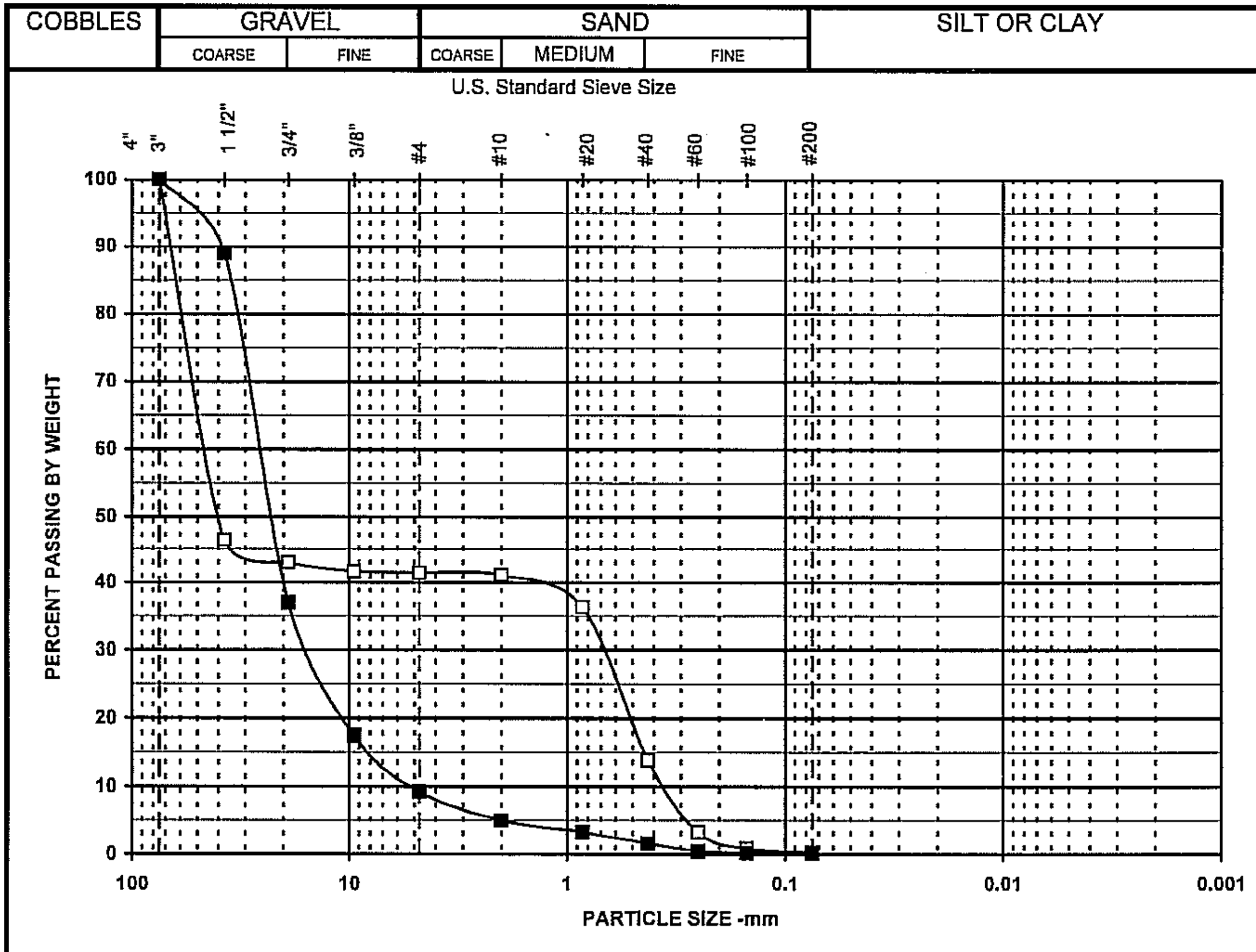
siev4B.xls 11/10/2011

Pequannock River

Civil Dynamics ##258
Pompton-Pequannock Dams
LABORATORY TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS				REMARKS
			WATER CONTENT (%)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	ORGANIC CONTENT (burnoff) (%)	
Section 4	Right			GP	0.2		
Section 6	Left			GW	0.1		
Section 7.2	Right			SP	2.2		
Section 7.5	Center			GW	0.0		
Section 7.7	Left Side			GP	0.2		
Section 8	Center			SP	0.3		
Section 9	Right Center			SP	2.4	6.7	
Section 9.2	Center			SP-SM	8.9	2.9	

Note: (1) USCS symbol based on visual observation and Sieve results results reported.



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□					GP	Brown, Poorly graded gravel with sand	11/10/2011
■					GW	Brown, Well-graded gravel	11/10/2011
○							

Symbol	□	■	○
Boring	Section 4	Section 6	
Sample	Right	Left	
Depth			
% +3"	0.0	0.0	
% Gravel	58.6	90.8	
% SAND	41.2	9.1	
%C SAND	0.3	4.2	
%M SAND	27.2	3.5	
%F SAND	13.6	1.5	
% FINES	0.2	0.1	
% -2μ			
D_{100} (mm)	75.00	75.00	
D_{60} (mm)	46.99	27.18	
D_{30} (mm)	0.73	15.60	
D_{10} (mm)	0.36	5.21	
Cc	0.0	1.7	
Cu	130.0	5.2	

Particle Size (Sieve #)	PERCENT FINER □	■	○
4"			
3"	100.0	100.0	
1 1/2"	46.5	89.0	
3/4"	43.0	37.0	
3/8"	41.6	17.4	
4	41.4	9.2	
10	41.0	5.0	
20	36.3	3.3	
40	13.9	1.6	
60	3.2	0.4	
100	0.8	0.1	
200	0.2	0.1	

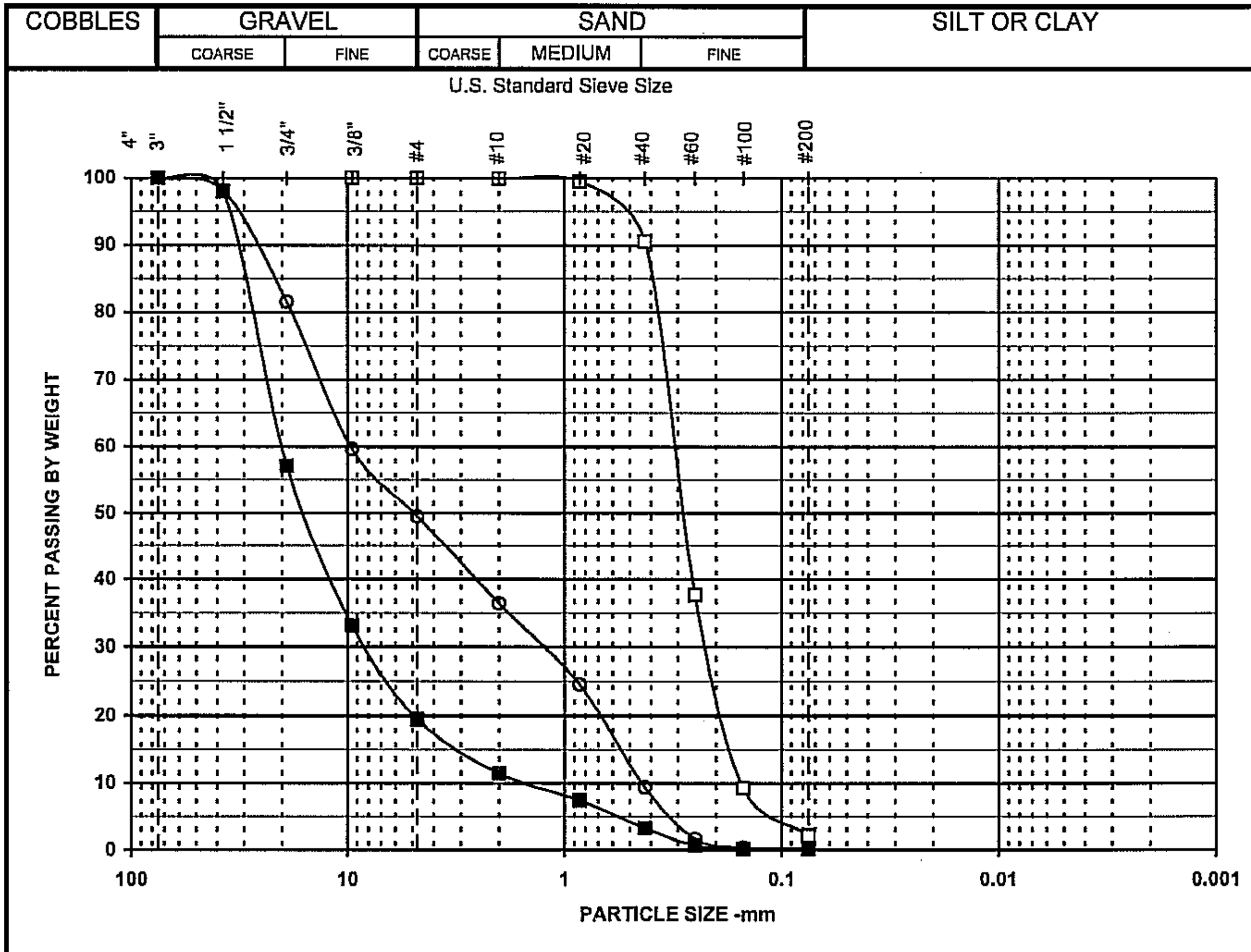
TerraSense, LLC	**Civil Dynamics**
7889-11004	#258

PARTICLE SIZE DISTRIBUTION

Pompton-Pequannock Dams

Analysis File: 3SV-MasterRev3

siev4A-2.xls 11/18/2011



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□					SP	Brown, Poorly graded sand	11/10/2011
■					GW	Brown, Well-graded gravel with sand	11/10/2011
O					GP	Brown, Poorly graded gravel with sand	11/10/2011

Symbol	□	■	O
Boring	Section 7.2	Section 7.5	Section 7.7
Sample	Right	Center	Left Side
Depth			
% +3"	0.0	0.0	0.0
% Gravel	0.0	80.6	50.5
% SAND	97.8	19.4	49.3
%C SAND	0.1	8.0	13.0
%M SAND	9.4	8.2	27.1
%F SAND	88.4	3.2	9.2
% FINES	2.2	0.0	0.2
% -2μ			
D_{100} (mm)	9.50	75.00	75.00
D_{60} (mm)	0.32	20.35	9.71
D_{30} (mm)	0.22	8.41	1.38
D_{10} (mm)	0.15	1.59	0.44
Cc	1.0	2.2	0.4
Cu	2.1	12.8	21.9

Particle Size (Sieve #)	PERCENT FINER □	■	O
4"			
3"		100.0	100.0
1 1/2"		98.0	98.1
3/4"		57.0	81.5
3/8"	100.0	33.1	59.5
4	100.0	19.4	49.5
10	99.9	11.4	36.4
20	99.5	7.4	24.5
40	90.5	3.3	9.3
60	37.7	0.7	1.7
100	9.3	0.1	0.3
200	2.2	0.0	0.2

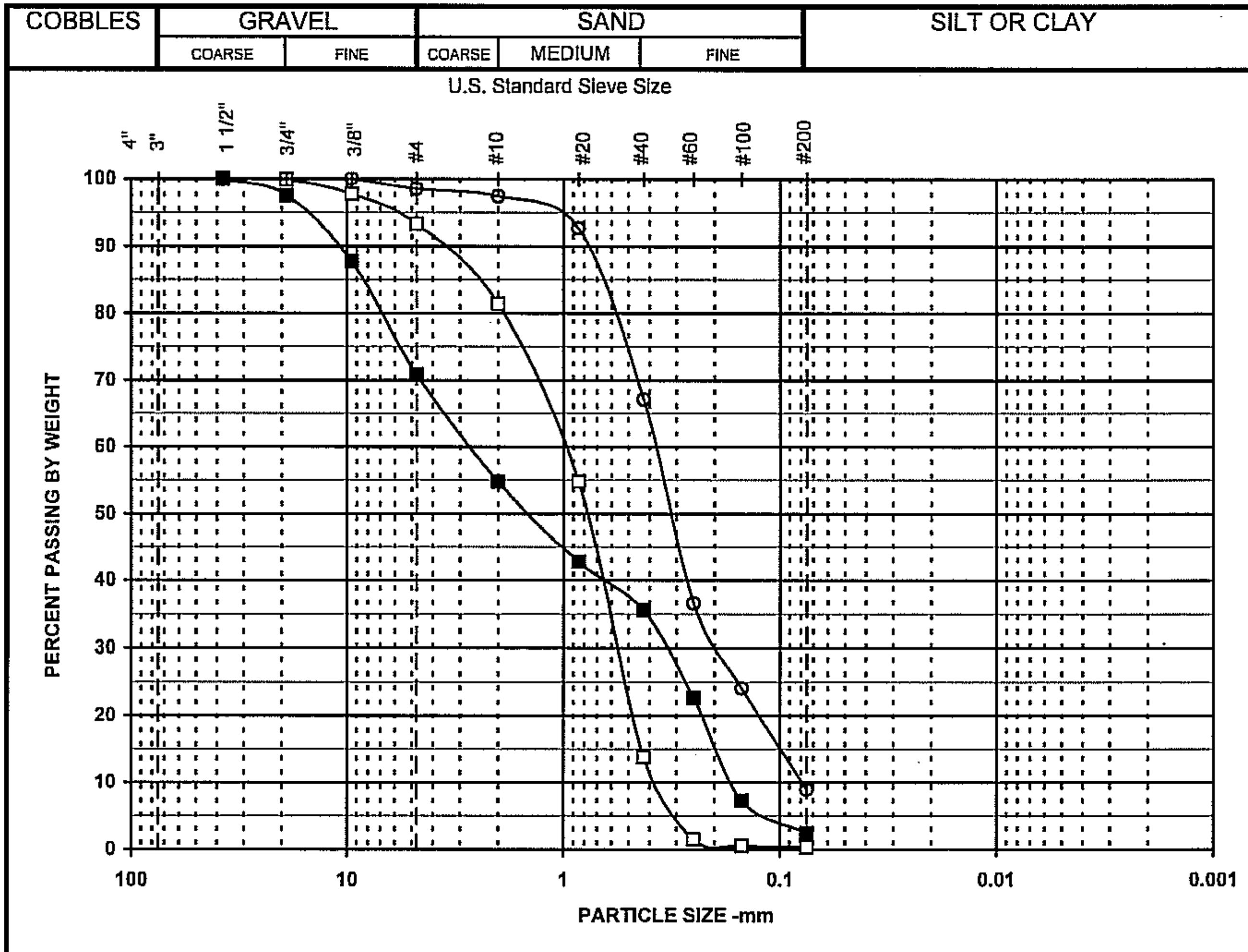
TerraSense, LLC 7889-11004

Civil Dynamics #258

PARTICLE SIZE DISTRIBUTION
Pompton-Pequannock Dams

Analysis File: 3SV-MasterRev3

siev4B-2.xls 11/18/2011



Symbol	□	■	O
Boring	Section 8	Section 9	Section 9.2
Sample	Center	Right Center	Center
Depth			
% +3"	0.0	0.0	0.0
% Gravel	6.6	29.1	1.5
% SAND	93.1	68.5	89.6
%C SAND	11.9	16.1	1.1
%M SAND	67.7	19.2	30.3
%F SAND	13.4	33.1	58.2
% FINES	0.3	2.4	8.9
% -2μ			
D_{100} (mm)	37.50	37.50	9.50
D_{60} (mm)	1.08	2.90	0.38
D_{30} (mm)	0.59	0.35	0.20
D_{10} (mm)	0.37	0.17	0.08
Cc	0.9	0.3	1.3
Cu	2.9	17.3	4.8

Particle Size (Sieve #)	PERCENT FINER □	■	O
4"			
3"			
1 1/2"	100.0	100.0	
3/4"	99.9	97.6	
3/8"	97.8	87.7	100.0
4	93.4	70.9	98.5
10	81.4	54.7	97.5
20	54.8	42.8	92.7
40	13.8	35.5	67.1
60	1.5	22.6	36.6
100	0.5	7.3	24.0
200	0.3	2.4	8.9

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□					SP	Brown, Poorly graded sand	11/10/2011
■					SP	Black, Poorly graded sand with gravel	11/10/2011
O					SP-SM	Black, Poorly-graded sand with silt	11/10/2011

TerraSense, LLC — 7889-11004

Civil Dynamics — #258

PARTICLE SIZE DISTRIBUTION

Pompton-Pequannock Dams

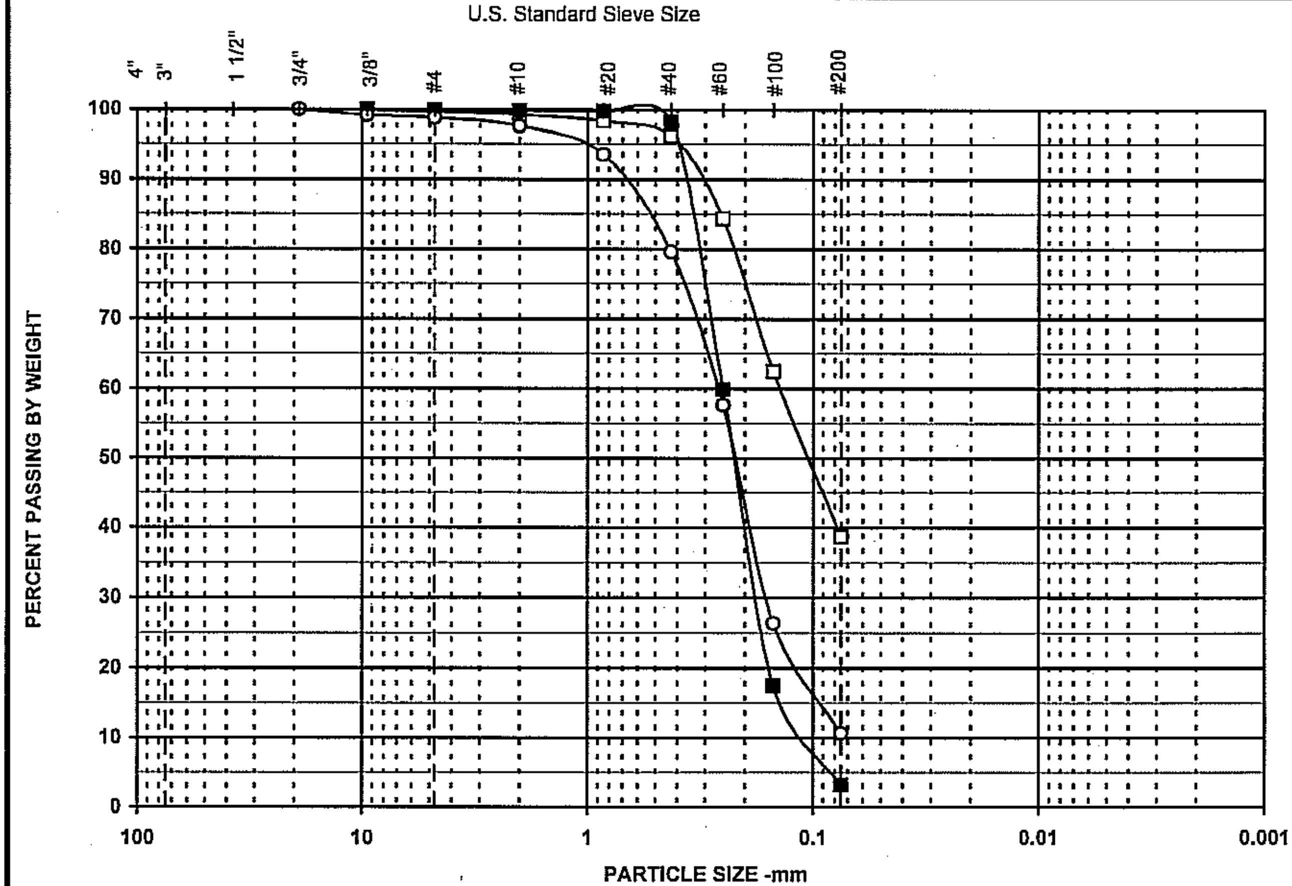
Analysis File: 3SV-MasterRev3

siev4C-2.xls 11/18/2011

Civil Dynamics #258
Pomptom-Pequannock Dams
LABORATORY TESTING DATA SUMMARY

ID	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS WATER CONTENT (%)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	REMARKS
Ramapo River Samples						
	R-1			SM	38.7	
	R-2			SP	3.2	
	R-3			SP-SM	10.7	
	R-4			SP	3.4	
	R-5			SP	3.1	
	R-6			SP-SM	7.1	
Pequannock River Samples						
	P-1			SM	13.8	
	P-2			SP-SM	8.7	
	P-3			SP	2.9	
	P-4			SP-SM	6.7	

Note: (1) USCS symbol based on visual observation and Sieve results reported.



Symbol	□	■	O
Boring			
Sample	R-1	R-2	R-3
Depth			
% +3"	0.0	0.0	0.0
% Gravel	0.3	0.1	1.2
% SAND	61.0	96.7	88.1
%C SAND	0.4	0.0	1.2
%M SAND	3.1	1.7	18.0
%F SAND	57.4	94.9	68.9
% FINES	38.7	3.2	10.7
% -2μ			
D_{100} (mm)	9.50	9.50	19.00
D_{60} (mm)	0.14	0.25	0.27
D_{30} (mm)		0.18	0.16
D_{10} (mm)		0.11	0.07
Cc		1.2	1.3
Cu		2.3	3.7

Particle Size (Sieve #)	PERCENT FINER □	■	O
4"			
3"			
1 1/2"			
3/4"			100.0
3/8"	100.0	100.0	99.2
4	99.7	99.9	98.8
10	99.3	99.8	97.6
20	98.3	99.7	93.5
40	96.1	98.1	79.6
60	84.4	59.9	57.6
100	62.4	17.4	26.4
200	38.7	3.2	10.7

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□					SM	Gray, Silty sand	4/20/2012
■					SP	Gray, Poorly graded sand	4/20/2012
O					SP-SM	Brown, Poorly-graded sand with silt organic mat'l noted	4/20/2012

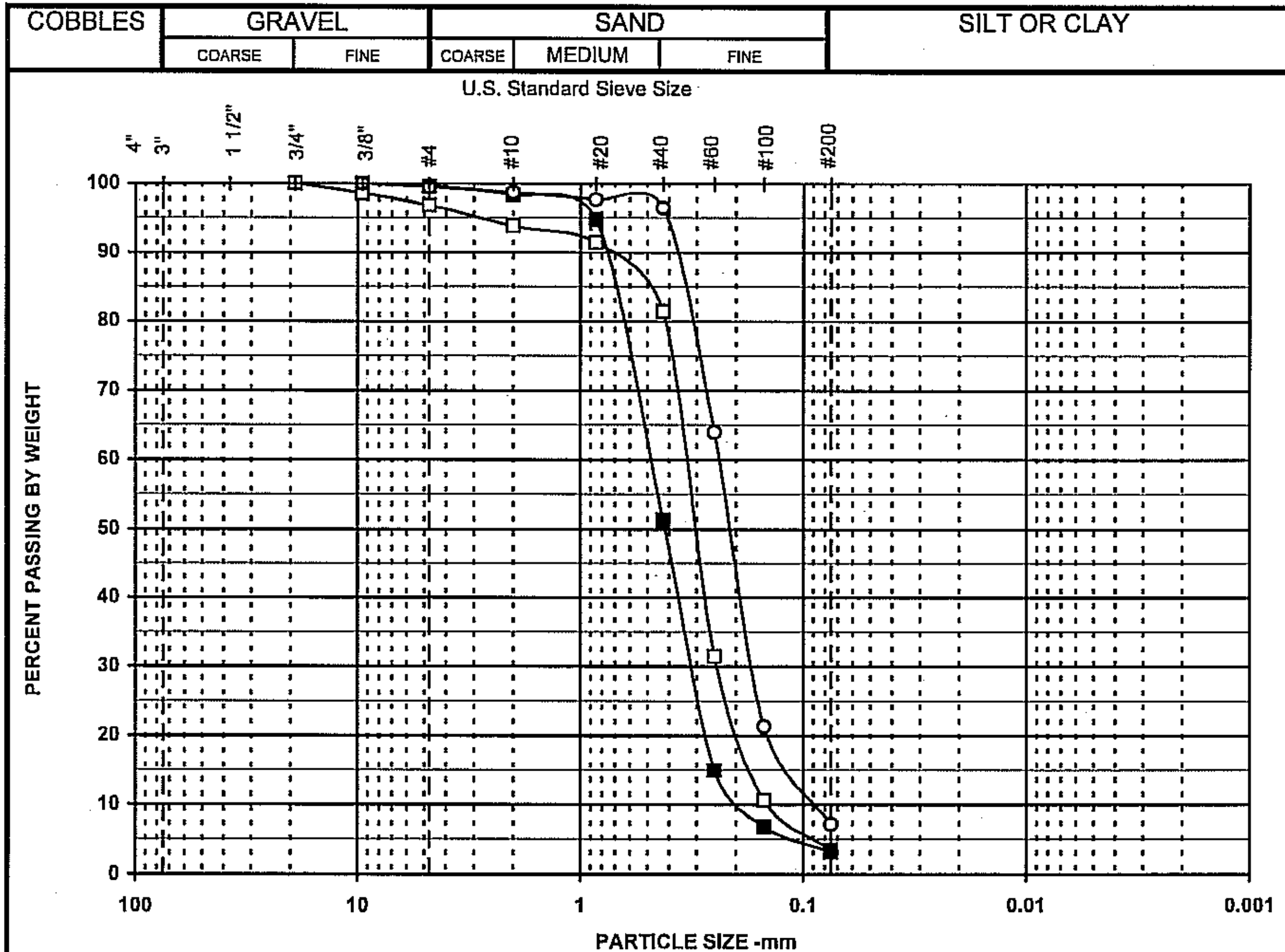
TerraSense, LLC	Civil Dynamics
7889-11004	#258

PARTICLE SIZE DISTRIBUTION

Pomptom-Pequannock Dams - Ramapo River

Analysis File: 3SV-MasterRev3

siev3a.xls 4/25/2012



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□					SP	Gray, Poorly graded sand organic mat'l noted	4/20/2012
■					SP	Brown, Poorly graded sand organic mat'l noted	4/20/2012
○					SP-SM	Gray, Poorly-graded sand with silt organic mat'l noted	4/20/2012

Symbol	□	■	○
Boring			
Sample	R-4	R-5	R-6
Depth			
% +3"	0.0	0.0	0.0
% Gravel	3.2	0.5	0.5
% SAND	93.4	96.4	92.4
%C SAND	3.0	1.2	0.8
%M SAND	12.4	47.1	2.2
%F SAND	78.0	48.2	89.4
% FINES	3.4	3.1	7.1
% -2μ			
D_{100} (mm)	19.00	9.50	9.50
D_{60} (mm)	0.35	0.51	0.24
D_{30} (mm)	0.24	0.32	0.17
D_{10} (mm)	0.14	0.19	0.09
Cc	1.2	1.1	1.3
Cu	2.4	2.7	2.7

Particle Size (Sieve #)	PERCENT FINER □	■	○
4"			
3"			
1 1/2"			
3/4"	100.0		
3/8"	98.6	100.0	100.0
4	96.8	99.5	99.5
10	93.8	98.4	98.7
20	91.4	94.8	97.7
40	81.4	51.3	96.5
60	31.4	14.9	63.9
100	10.6	6.7	21.3
200	3.4	3.1	7.1

TerraSense, LLC — 7889-11004

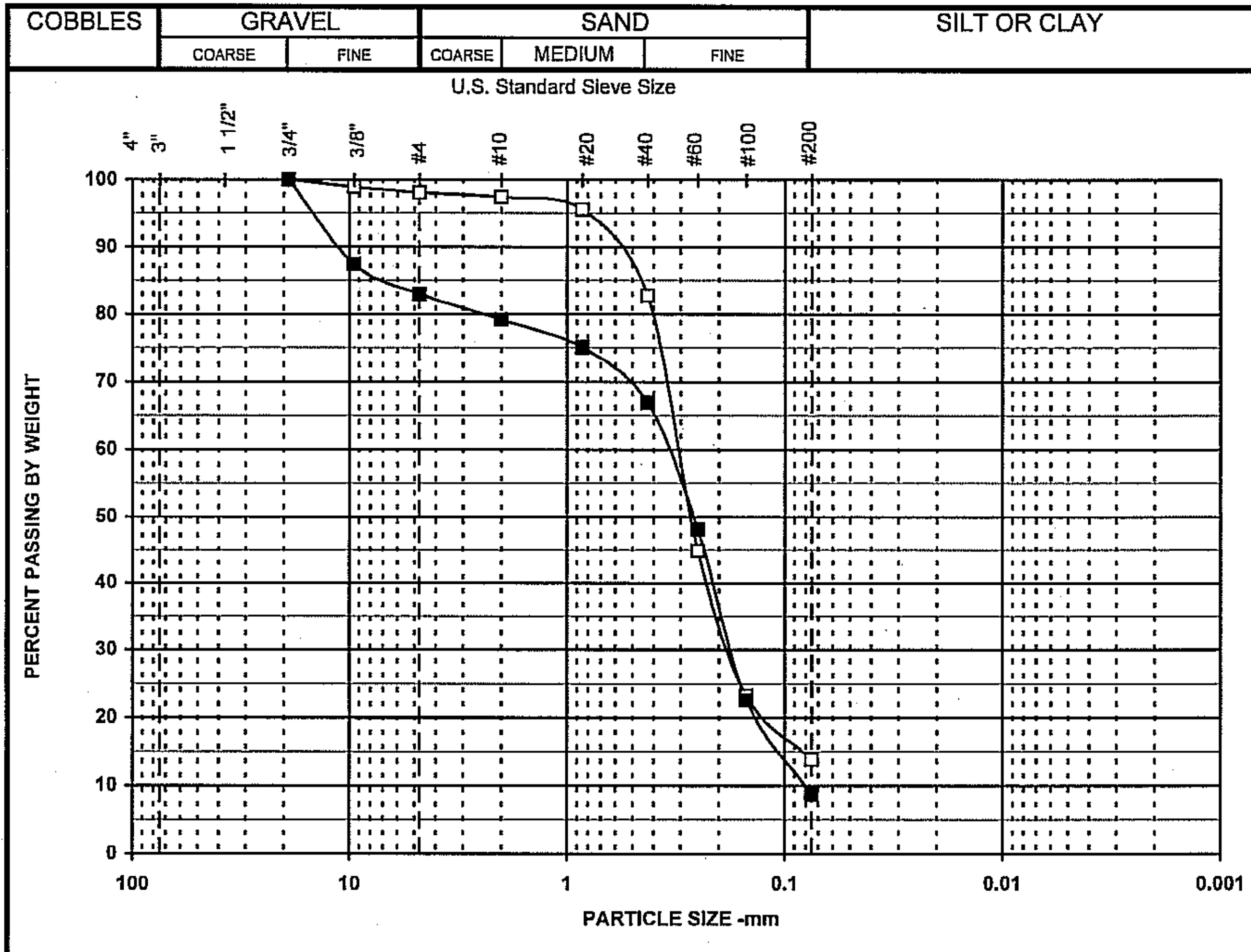
Civil Dynamics — #258

PARTICLE SIZE DISTRIBUTION

Pomptom-Pequannock Dams - Ramapo River

Analysis File: 3SV-MasterRev3

siev3b.xls 4/25/2012



Symbol	□	■	○
Boring			
Sample	P-1	P-2	
Depth			
% +3"	0.0	0.0	
% Gravel	1.9	17.0	
% SAND	84.3	74.3	
%C SAND	0.6	3.8	
%M SAND	14.6	12.3	
%F SAND	69.0	58.1	
% FINES	13.8	8.7	
% -2μ			
D_{100} (mm)	19.00	19.00	
D_{60} (mm)	0.32	0.36	
D_{30} (mm)	0.18	0.18	
D_{10} (mm)		0.08	
Cc		1.1	
Cu		4.4	

Particle Size (Sieve #)	PERCENT FINER □	PERCENT FINER ■	PERCENT FINER ○
4"			
3"			
1 1/2"			
3/4"	100.0	100.0	
3/8"	98.9	87.4	
4	98.1	83.0	
10	97.4	79.2	
20	95.6	75.1	
40	82.8	66.9	
60	44.9	48.1	
100	23.2	22.6	
200	13.8	8.7	

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□					SM	Brown, Silty sand	4/20/2012
■					SP-SM	Brown, Poorly-graded sand with silt and gravel organic mat'l noted	4/20/2012
○							

TerraSense, LLC	Civil Dynamics
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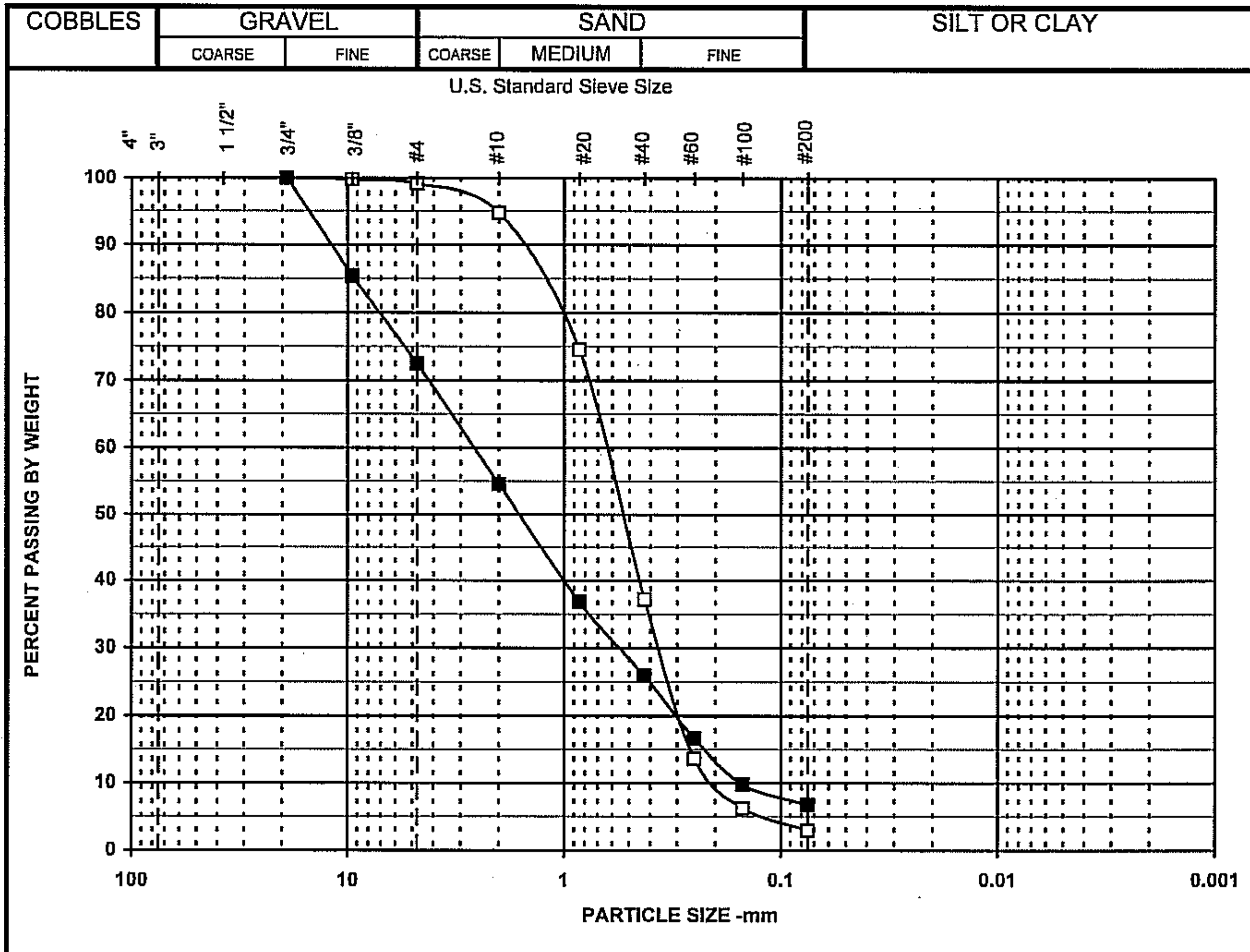
PARTICLE SIZE DISTRIBUTION

Pomptom-Pequannock Dams - Pequannock River

Analysis File: 3SV-MasterRev3

siev3c.xls 4/25/2012



Symbol	□	■	○
Boring			
Sample	P-3	P-4	
Depth			
% +3"	0.0	0.0	
% Gravel	0.9	27.6	
% SAND	96.2	65.7	
%C SAND	4.3	17.9	
%M SAND	57.6	28.6	
%F SAND	34.2	19.2	
% FINES	2.9	6.7	
% -2μ			
D_{100} (mm)	19.00	19.00	
D_{60} (mm)	0.68	2.84	
D_{30} (mm)	0.37	0.58	
D_{10} (mm)	0.20	0.15	
Cc	1.0	0.8	
Cu	3.4	18.5	

Particle Size (Sieve #)	PERCENT FINER □	■	○
4"			
3"			
1 1/2"			
3/4"	100.0	100.0	
3/8"	99.8	85.5	
4	99.1	72.4	
10	94.8	54.6	
20	74.5	36.8	
40	37.2	25.9	
60	13.6	16.6	
100	6.2	9.8	
200	2.9	6.7	

SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□					SP	Brown, Poorly graded sand organic mat'l noted	4/20/2012
■					SP-SM	Brown, Poorly-graded sand with silt and gravel	4/20/2012
○							

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7889-11004 | #258

PARTICLE SIZE DISTRIBUTION

Pomptom-Pequannock Dams - Pequannock River

Analysis File: 3SV-MasterRev3

siev3d.xls 4/25/2012

SEVERN TRENT STL

SUMMARY OF ANALYTICAL RESULTS: N177

The Action Levels listed reflect current STL Edison knowledge of the standards and are intended as general guidance for the user. Please consult appropriate regulations and cleanup standards for your specific application.

Sample ID	New Jersey Residential	New Jersey Non-Residential	New Jersey Impact to	POMPTON-DAM		PEQUANNOCK-DAM	
Lab Sample No.	Direct Contact	Direct Contact	Ground Water	576258		576259	
Sampling Date	Soil Cleanup	Soil Cleanup	Soil Cleanup	10/18/2004 0:00		10/18/2004 0:00	
Matrix	Criteria	Criteria	Criteria	SOLID		SOLID	
Dilution Factor				1		1	
Units	mg/kg	mg/kg	mg/kg	mg/kg		mg/kg	
PESTICIDES/PCBs							
Aldrin	0.04	0.17	50	0.016	U	0.012	U
alpha-BHC	NA	NA	NA	0.016	U	0.012	U
beta-BHC	NA	NA	NA	0.016	U	0.012	U
delta-BHC	NA	NA	NA	0.016	U	0.012	U
gamma-BHC (Lindane)	0.52	2.2	50	0.016	U	0.012	U
Chlordane	NA	NA	NA	0.16	U	0.12	U
4,4'-DDD	3	12	50	0.016	U	0.012	U
4,4'-DDE	2	9	50	0.016	U	0.012	U
4,4'-DDT	2	9	500	0.016	U	0.013	
Dieldrin	0.042	0.18	50	0.016	U	0.012	U
Endosulfan I	340	6200	50	0.016	U	0.012	U
Endosulfan II	NA	NA	NA	0.016	U	0.012	U
Endosulfan sulfate	NA	NA	NA	0.016	U	0.012	U
Endrin	17	310	50	0.016	U	0.012	U
Endrin aldehyde	NA	NA	NA	0.016	U	0.012	U
Heptachlor	0.15	0.65	50	0.016	U	0.012	U
Heptachlor epoxide	NA	NA	NA	0.016	U	0.012	U
Toxaphene	0.1	0.2	50	0.16	U	0.12	U

NR - Not analyzed.

U - The compound was not detected at the indicated concentration.

J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than zero. The concentration given is an approximate value.

B - The analyte was found in the laboratory blank as well as the sample. This indicates possible laboratory contamination of the sample.

P - For dual column analysis, the percent difference between the quantitated concentrations on the two columns is greater than 40%

* - For dual column analysis, the lowest quantitated concentration is being reported due to coeluting interference.

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SEVERN TRENT STL

SUMMARY OF ANALYTICAL RESULTS: N177

The Action Levels listed reflect current STL Edison knowledge of the standards and are intended as general guidance for the user. Please consult appropriate regulations and cleanup standards for your specific application.

Sample ID	New Jersey Residential	New Jersey Non-Residential	New Jersey Impact to	POMPTON-DAM		PEQUANNOCK-DAM	
Lab Sample No.	Direct Contact	Direct Contact	Ground Water	576258		576259	
Sampling Date	Soil Cleanup	Soil Cleanup	Soil Cleanup	10/18/2004 0:00		10/18/2004 0:00	
Matrix	Criteria	Criteria	Criteria	SOLID		SOLID	
Dilution Factor				1		1	
Units	mg/kg	mg/kg	mg/kg	mg/kg		mg/kg	
PESTICIDES/PCBs							
Aroclor-1016	0.49	2	50	0.16	U	0.12	U
Aroclor-1221	0.49	2	50	0.16	U	0.12	U
Aroclor-1232	0.49	2	50	0.16	U	0.12	U
Aroclor-1242	0.49	2	50	0.16	U	0.12	U
Aroclor-1248	0.49	2	50	0.16	U	0.12	U
Aroclor-1254	0.49	2	50	0.16	U	0.12	U
Aroclor-1260	0.49	2	50	0.16	U	0.12	U
Aroclor-1262	NA	NA	NA	0.16	U	0.12	U
Aroclor-1268	NA	NA	NA	0.16	U	0.12	U

NR - Not analyzed.

U - The compound was not detected at the indicated concentration.

J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than zero. The concentration given is an approximate value.

B - The analyte was found in the laboratory blank as well as the sample. This indicates possible laboratory contamination of the sample.

P - For dual column analysis, the percent difference between the quantitated concentrations on the two columns is greater than 40%

* - For dual column analysis, the lowest quantitated concentration is being reported due to coeluting interference.

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SEVERN TRENT STL

SUMMARY OF ANALYTICAL RESULTS: N177

The Action Levels listed reflect current STL Edison knowledge of the standards and are intended as general guidance for the user. Please consult appropriate regulations and cleanup standards for your specific application.

Sample ID	New Jersey Residential	New Jersey Non-Residential	New Jersey Impact to	POMPTON-DAM		PEQUANNOCK-DAM	
Lab Sample No.	Direct Contact	Direct Contact	Ground Water	576258		576259	
Sampling Date	Soil Cleanup	Soil Cleanup	Soil Cleanup	10/18/2004 0:00		10/18/2004 0:00	
Matrix	Criteria	Criteria	Criteria	SOLID		SOLID	
Dilution Factor							
Units	mg/kg	mg/kg	mg/kg	mg/kg		mg/kg	
METALS							
Antimony	14	340	NA	1.9	U	1.3	U
Arsenic	20	20	NA	5.2		3.8	
Beryllium	2	2	NA	0.71	B	0.53	B
Cadmium	39	100	NA	0.36	B	0.14	U
Chromium	NA	NA	NA	22.8		17.8	
Copper	600	600	NA	54.9		41.9	
Lead	400	600	NA	166		123	
Mercury	14	270	NA	2.4		1.5	
Nickel	250	2400	NA	17.3	B	14.5	
Selenium	63	3100	NA	2.2	U	1.6	U
Silver	110	4100	NA	0.38	U	0.28	U
Thallium	2	2	NA	1	U	1.5	U
Zinc	1500	1500	NA	323		224	

NR - Not analyzed.

U - The compound was not detected at the indicated concentration.

B - Reported value is less than the Reporting Limit but greater than the Instrument Detection Limit.

N - The spiked sample recovery is not within control limits.

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SEVERN TRENT STL

SUMMARY OF ANALYTICAL RESULTS: N177

The Action Levels listed reflect current STL Edison knowledge of the standards and are intended as general guidance for the user. Please consult appropriate regulations and cleanup standards for your specific application.

Sample ID	New Jersey Residential	New Jersey Non-Residential	New Jersey Impact to	POMPTON-DAM		PEQUANNOCK-DAM	
Lab Sample No.	Direct Contact	Direct Contact	Ground Water	576258		576259	
Sampling Date	Soil Cleanup	Soil Cleanup	Soil Cleanup	10/18/2004 0:00		10/18/2004 0:00	
Matrix	Criteria	Criteria	Criteria	SOLID		SOLID	
Dilution Factor							
Units							
WET CHEMISTRY							
Total Cyanide (mg/kg)	1100	21000	NA	0.5	U	0.5	U
Total Phenols (mg/kg)	NA	NA	NA	8.6		5	U

NR - Not analyzed.
U - The compound was not detected at the indicated concentration.

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SEVERN TRENT STL

SUMMARY OF ANALYTICAL RESULTS: M973

The Action Levels listed reflect current STL Edison knowledge of the standards and are intended as general guidance for the user. Please consult appropriate regulations and cleanup standards for your specific application.

Sample ID	New Jersey Residential	New Jersey Non-Residential	New Jersey Impact to	Pompton-Dam		Pequannock-Dam		TB	
Lab Sample No.	Direct Contact	Direct Contact	Ground Water	574796		574797		574798	
Sampling Date	Soil Cleanup	Soil Cleanup	Soil Cleanup	10/18/2004 0:00		10/18/2004 0:00		10/18/2004 0:00	
Matrix	Criteria	Criteria	Criteria	SOLID		SOLID		SOLID	
Dilution Factor				50		50		50	
Units	mg/kg	mg/kg	mg/kg	mg/kg		mg/kg		mg/kg	
VOLATILE COMPOUNDS (GC/MS)									
Chloromethane	520	1000	10	1.3	U	1	U	0.62	U
Bromomethane	79	1000	1	1.3	U	1	U	0.62	U
Vinyl Chloride	2	7	10	1.3	U	1	U	0.62	U
Chloroethane	NA	NA	NA	1.3	U	1	U	0.62	U
Methylene Chloride	49	210	1	0.79	U	0.63	U	0.38	U
Trichlorofluoromethane	NA	NA	NA	1.3	U	1	U	0.62	U
1,1-Dichloroethene	8	150	10	0.52	U	0.42	U	0.25	U
1,1-Dichloroethane	570	1000	10	1.3	U	1	U	0.62	U
trans-1,2-Dichloroethene	1000	1000	50	1.3	U	1	U	0.62	U
cis-1,2-Dichloroethene	79	1000	1	1.3	U	1	U	0.62	U
Chloroform	19	28	1	1.3	U	1	U	0.62	U
1,2-Dichloroethane	6	24	1	0.52	U	0.42	U	0.25	U
1,1,1-Trichloroethane	210	1000	50	1.3	U	1	U	0.62	U
Carbon Tetrachloride	2	4	1	0.52	U	0.42	U	0.25	U
Bromodichloromethane	11	46	1	0.26	U	0.21	U	0.12	U
1,2-Dichloropropane	10	43	NA	0.26	U	0.21	U	0.12	U
cis-1,3-Dichloropropene	4	5	1	1.3	U	1	U	0.62	U
Trichloroethene	23	54	1	0.26	U	0.21	U	0.12	U
Dibromochloromethane	110	1000	1	1.3	U	1	U	0.62	U
1,1,2-Trichloroethane	22	420	1	0.79	U	0.63	U	0.38	U
Benzene	3	13	1	0.26	U	0.21	U	0.12	U
trans-1,3-Dichloropropene	4	5	1	1.3	U	1	U	0.62	U
2-Chloroethyl Vinyl Ether	NA	NA	NA	1.3	U	1	U	0.62	U
Bromoform	86	370	1	1	U	0.84	U	0.5	U
Tetrachloroethene	4	6	1	0.26	U	0.21	U	0.12	U
1,1,2,2-Tetrachloroethane	34	70	1	0.26	U	0.21	U	0.12	U
Toluene	1000	1000	500	1.3	U	1	U	0.62	U
Chlorobenzene	37	680	1	1.3	U	1	U	0.62	U
Ethylbenzene	1000	1000	100	1	U	0.84	U	0.5	U
Xylene (Total)	410	1000	67	1.3	U	1	U	0.62	U
Total Confident Conc.				0		0		0	
Total Estimated Conc. (TICs)				0		0		0	

NR - Not analyzed.

SEVERN TRENT STL

SUMMARY OF ANALYTICAL RESULTS: M973

The Action Levels listed reflect current STL Edison knowledge of the standards and are intended as general guidance for the user. Please consult appropriate regulations and cleanup standards for your specific application.

Sample ID	New Jersey Residential	New Jersey Non-Residential	New Jersey Impact to	Pompton-Dam	Pequannock-Dam	TB
Lab Sample No.	Direct Contact	Direct Contact	Ground Water	574796	574797	574798
Sampling Date	Soil Cleanup	Soil Cleanup	Soil Cleanup	10/18/2004 0:00	10/18/2004 0:00	10/18/2004 0:00
Matrix	Criteria	Criteria	Criteria	SOLID	SOLID	SOLID
Dilution Factor				50	50	50
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
VOLATILE COMPOUNDS (GC/MS)						

U - The compound was not detected at the indicated concentration.

J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than zero. The concentration given is an approximate value.

B - The analyte was found in the laboratory blank as well as the sample. This indicates possible laboratory contamination of the sample.

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SEVERN TRENT STL

SUMMARY OF ANALYTICAL RESULTS: N177

The Action Levels listed reflect current STL Edison knowledge of the standards and are intended as general guidance for the user. Please consult appropriate regulations and cleanup standards for your specific application.

Sample ID	New Jersey Residential	New Jersey Non-Residential	New Jersey Impact to	POMPTON-DAM		PEQUANNOCK-DAM	
Lab Sample No.	Direct Contact	Direct Contact	Ground Water	576258		576259	
Sampling Date	Soil Cleanup	Soil Cleanup	Soil Cleanup	10/18/2004 0:00		10/18/2004 0:00	
Matrix	Criteria	Criteria	Criteria	SOLID		SOLID	
Dilution Factor				1		1	
Units	mg/kg	mg/kg	mg/kg	mg/kg		mg/kg	
SEMIVOLATILE COMPOUNDS (GC/MS)							
Phenol	10000	10000	50	0.79	U	0.57	U
2-Chlorophenol	280	5200	10	0.79	U	0.57	U
2-Nitrophenol	NA	NA	NA	0.79	U	0.57	U
2,4-Dimethylphenol	1100	10000	10	0.79	U	0.57	U
2,4-Dichlorophenol	170	3100	10	0.79	U	0.57	U
4-Chloro-3-methylphenol	10000	10000	100	0.79	U	0.57	U
2,4,6-Trichlorophenol	62	270	10	0.79	U	0.57	U
2,4-Dinitrophenol	110	2100	10	3.2	U	2.3	U
4-Nitrophenol	NA	NA	NA	3.2	U	2.3	U
4,6-Dinitro-2-methylphenol	NA	NA	NA	3.2	U	2.3	U
Pentachlorophenol	6	24	100	3.2	U	2.3	U
N-Nitrosodimethylamine	NA	NA	NA	0.79	U	0.57	U
bis(2-Chloroethyl)ether	0.66	3	10	0.079	U	0.057	U
1,3-Dichlorobenzene	5100	10000	100	0.79	U	0.57	U
1,4-Dichlorobenzene	570	10000	100	0.79	U	0.57	U
1,2-Dichlorobenzene	5100	10000	50	0.79	U	0.57	U
bis(2-chloroisopropyl)ether	2300	10000	10	0.79	U	0.57	U
N-Nitroso-di-n-propylamine	0.66	0.66	10	0.079	U	0.057	U
Hexachloroethane	6	100	100	0.079	U	0.057	U
Nitrobenzene	28	520	10	0.079	U	0.057	U
Isophorone	1100	10000	50	0.79	U	0.57	U
bis(2-Chloroethoxy)methane	NA	NA	NA	0.79	U	0.57	U
1,2,4-Trichlorobenzene	68	1200	100	0.079	U	0.057	U

SEVERN TRENT STL

SUMMARY OF ANALYTICAL RESULTS: N177

The Action Levels listed reflect current STL Edison knowledge of the standards and are intended as general guidance for the user. Please consult appropriate regulations and cleanup standards for your specific application.

Sample ID	New Jersey Residential	New Jersey Non-Residential	New Jersey Impact to	POMPTON-DAM		PEQUANNOCK-DAM	
Lab Sample No.	Direct Contact	Direct Contact	Ground Water	576258		576259	
Sampling Date	Soil Cleanup	Soil Cleanup	Soil Cleanup	10/18/2004 0:00		10/18/2004 0:00	
Matrix	Criteria	Criteria	Criteria	SOLID		SOLID	
Dilution Factor				1		1	
Units	mg/kg	mg/kg	mg/kg	mg/kg		mg/kg	
SEMIVOLATILE COMPOUNDS (GC/MS)							
Naphthalene	230	4200	100	0.79	U	0.57	U
Hexachlorobutadiene	1	21	100	0.16	U	0.11	U
Hexachlorocyclopentadiene	400	7300	100	0.79	U	0.57	U
2-Chloronaphthalene	NA	NA	NA	0.79	U	0.57	U
Dimethylphthalate	10000	10000	50	0.79	U	0.57	U
Acenaphthylene	NA	NA	NA	0.024	J	0.043	J
2,6-Dinitrotoluene	1	4	10	0.16	U	0.11	U
Acenaphthene	3400	10000	100	0.79	U	0.016	J
2,4-Dinitrotoluene	1	4	10	0.16	U	0.11	U
Diethylphthalate	10000	10000	50	0.79	U	0.57	U
4-Chlorophenyl-phenylether	NA	NA	NA	0.79	U	0.57	U
Fluorene	2300	10000	100	0.79	U	0.027	J
N-Nitrosodiphenylamine	140	600	100	0.79	U	0.57	U
4-Bromophenyl-phenylether	NA	NA	NA	0.79	U	0.57	U
Hexachlorobenzene	0.66	2	100	0.079	U	0.057	U
Phenanthrene	NA	NA	NA	0.19	J	0.32	J
Anthracene	10000	10000	100	0.044	J	0.069	J
Di-n-butylphthalate	5700	10000	100	0.79	U	0.57	U
Fluoranthene	2300	10000	100	0.35	J	0.61	
Pyrene	1700	10000	100	0.35	J	0.65	
Benzidine	NA	NA	NA	3.2	U	2.3	U

SEVERN TRENT STL

SUMMARY OF ANALYTICAL RESULTS: N177

The Action Levels listed reflect current STL Edison knowledge of the standards and are intended as general guidance for the user. Please consult appropriate regulations and cleanup standards for your specific application.

Sample ID	New Jersey Residential	New Jersey Non-Residential	New Jersey Impact to	POMPTON-DAM		PEQUANNOCK-DAM	
Lab Sample No.	Direct Contact	Direct Contact	Ground Water	576258		576259	
Sampling Date	Soil Cleanup	Soil Cleanup	Soil Cleanup	10/18/2004 0:00		10/18/2004 0:00	
Matrix	Criteria	Criteria	Criteria	SOLID		SOLID	
Dilution Factor				1		1	
Units	mg/kg	mg/kg	mg/kg	mg/kg		mg/kg	
SEMIVOLATILE COMPOUNDS (GC/MS)							
Butylbenzylphthalate	1100	10000	100	0.79	U	0.57	U
3,3'-Dichlorobenzidine	2	6	100	1.6	U	1.1	U
Benzo(a)anthracene	0.9	4	500	0.14		0.28	
Chrysene	9	40	500	0.24	J	0.37	J
bis(2-Ethylhexyl)phthalate	49	210	100	0.79	U	0.13	J
Di-n-octylphthalate	1100	10000	100	0.79	U	0.57	U
Benzo(b)fluoranthene	0.9	4	50	0.17		0.22	
Benzo(k)fluoranthene	0.9	4	500	0.22		0.31	
Benzo(a)pyrene	0.66	0.66	100	0.19		0.27	
Indeno(1,2,3-cd)pyrene	0.9	4	500	0.12		0.14	
Dibenz(a,h)anthracene	0.66	0.66	100	0.049	J	0.057	J
Benzo(g,h,i)perylene	NA	NA	NA	0.16	J	0.17	J
Total Confident Conc.				0.84		2.48	
Total Estimated Conc. (TICs)				15.63		2.17	

NR - Not analyzed.

U - The compound was not detected at the indicated concentration.

J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than zero. The concentration given is an approximate value.

B - The analyte was found in the laboratory blank as well as the sample. This indicates possible laboratory contamination of the sample.

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ADER IN ENVIRONMENTAL TESTING

SUMMARY OF ANALYTICAL RESULTS: 460-39374-1

Client ID	NJ Residential	NJ Non Res.	NJ Impact to			R-1			R-2			R-3			R-4			R-5
Lab Sample ID	SRS	SRS	GW Soil			460-39374-1			460-39374-2			460-39374-3			460-39374-4			460-39374-5
Sampling Date	Soil Cleanup	Soil Cleanup	Screening			04/19/2012 14:20:00			04/19/2012 12:20:00			04/19/2012 12:40:00			04/19/2012 13:00:00			04/19/2012 13:20:00
Matrix	Criteria	Criteria	Level			Soil			Soil			Soil			Soil			Soil
Dilution Factor				1			1			1			1			1		
Unit	mg/kg	mg/kg	mg/kg	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
SVOA-8270C-SOIL				Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 8270C																		
1,2,4-Trichlorobenzene	73	620	0.4	0.0059	U	0.0059	0.0053	U	0.0053	0.0061	U	0.0061	0.0065	U	0.0065	0.0063	U	0.0063
1,2-Dichlorobenzene	5300	59000	11	0.060	U	0.060	0.055	U	0.055	0.062	U	0.062	0.067	U	0.067	0.065	U	0.065
1,3-Dichlorobenzene	5300	59000	12	0.047	U	0.047	0.043	U	0.043	0.048	U	0.048	0.052	U	0.052	0.050	U	0.050
1,4-Dichlorobenzene	5	13	1	0.058	U	0.058	0.053	U	0.053	0.060	U	0.060	0.065	U	0.065	0.063	U	0.063
2,2'-oxybis[1-chloropropane]	NA	NA	NA	0.057	U	0.057	0.052	U	0.052	0.059	U	0.059	0.063	U	0.063	0.062	U	0.062
2,4,5-Trichlorophenol	6100	68000	44	0.067	U	0.067	0.061	U	0.061	0.069	U	0.069	0.074	U	0.074	0.072	U	0.072
2,4,6-Trichlorophenol	19	74	0.2	0.061	U	0.061	0.055	U	0.055	0.063	U	0.063	0.067	U	0.067	0.065	U	0.065
2,4-Dichlorophenol	180	2100	0.2	0.076	U	0.076	0.069	U	0.069	0.078	U	0.078	0.084	U	0.084	0.081	U	0.081
2,4-Dimethylphenol	1200	14000	0.7	0.13	U	0.13	0.12	U	0.12	0.13	U	0.13	0.14	U	0.14	0.14	U	0.14
2,4-Dinitrophenol	120	1400	0.3	0.29	U	0.29	0.27	U	0.27	0.30	U	0.30	0.33	U	0.33	0.32	U	0.32
2,4-Dinitrotoluene	0.7	3	NA	0.017	U	0.017	0.015	U	0.015	0.018	U	0.018	0.019	U	0.019	0.018	U	0.018
2,6-Dinitrotoluene	0.7	3	NA	0.016	U	0.016	0.014	U	0.014	0.016	U	0.016	0.017	U	0.017	0.017	U	0.017
2-Chloronaphthalene	NA	NA	NA	0.058	U	0.058	0.052	U	0.052	0.060	U	0.060	0.064	U	0.064	0.062	U	0.062
2-Chlorophenol	310	2200	0.5	0.068	U	0.068	0.062	U	0.062	0.070	U	0.070	0.075	U	0.075	0.073	U	0.073
2-Methylnaphthalene	230	2400	5	0.067	U	0.067	0.060	U	0.060	0.069	U	0.069	0.074	U	0.074	0.071	U	0.071
2-Methylphenol	310	3400	NA	0.088	U	0.088	0.080	U	0.080	0.091	U	0.091	0.098	U	0.098	0.095	U	0.095
2-Nitroaniline	39	23000	NA	0.22	U	0.22	0.20	U	0.20	0.22	U	0.22	0.24	U	0.24	0.23	U	0.23
2-Nitrophenol	NA	NA	NA	0.058	U	0.058	0.052	U	0.052	0.060	U	0.060	0.064	U	0.064	0.062	U	0.062
3,3'-Dichlorobenzidine	1	4	0.2	0.18	U	0.18	0.16	U	0.16	0.19	U	0.19	0.20	U	0.20	0.20	U	0.20
3-Nitroaniline	NA	NA	NA	0.18	U	0.18	0.17	U	0.17	0.19	U	0.19	0.20	U	0.20	0.20	U	0.20
4,6-Dinitro-2-methylphenol	6	68	0.3	0.14	U	0.14	0.13	U	0.13	0.15	U	0.15	0.16	U	0.16	0.15	U	0.15
4-Bromophenyl phenyl ether	NA	NA	NA	0.051	U	0.051	0.047	U	0.047	0.053	U	0.053	0.057	U	0.057	0.055	U	0.055
4-Chloro-3-methylphenol	NA	NA	NA	0.078	U	0.078	0.071	U	0.071	0.081	U	0.081	0.086	U	0.086	0.084	U	0.084
4-Chloroaniline	NA	NA	NA	0.14	U	0.14	0.12	U	0.12	0.14	U	0.14	0.15	U	0.15	0.15	U	0.15
4-Chlorophenyl phenyl ether	NA	NA	NA	0.061	U	0.061	0.055	U	0.055	0.063	U	0.063	0.067	U	0.067	0.065	U	0.065
4-Methylphenol	31	340	NA	0.10	U	0.10	0.093	U	0.093	0.11	U	0.11	0.11	U	0.11	0.11	U	0.11
4-Nitroaniline	NA	NA	NA	0.16	U	0.16	0.15	U	0.15	0.17	U	0.17	0.18	U	0.18	0.17	U	0.17
4-Nitrophenol	NA	NA	NA	0.33	U	0.33	0.30	U	0.30	0.34	U	0.34	0.37	U	0.37	0.36	U	0.36
Acenaphthene	3400	37000	74	0.075	U	0.075	0.069	U	0.069	0.078	U	0.078	0.084	U	0.084	0.081	U	0.081
Acenaphthylene	NA	300000	NA	0.061	U	0.061	0.056	U	0.056	0.063	U	0.063	0.068	U	0.068	0.066	U	0.066
Anthracene	17000	30000	1500	0.063	U	0.063	0.057	U	0.057	0.065	U	0.065	0.070	U	0.070	0.068	U	0.068
Benzo[a]anthracene	0.6	2	0.5	0.037	J	0.0036	0.042	J	0.0033	0.059		0.0037	0.055	J	0.004	0.082		0.0039
Benzo[a]pyrene	0.2	0.2	0.2	0.035	J	0.0037	0.030	J	0.0033	0.053		0.0038	0.058		0.0041	0.11		0.0039
Benzo[b]fluoranthene	0.6	2	2	0.049	J	0.0033	0.047		0.003	0.074		0.0034	0.072		0.0036	0.13		0.0035
Benzo[g,h,i]perylene	380000	30000	NA	0.039	J	0.038	0.035	U	0.035	0.052	J	0.040	0.050	J	0.042	0.096	J	0.041
Benzo[k]fluoranthene	6	23	16	0.023	J	0.0039	0.024	J	0.0038	0.031	J	0.0041	0.039	J	0.0043	0.051	J	0.0042
Bis(2-chloroethoxy)methane	NA	NA	NA	0.067	U	0.067	0.061	U	0.061	0.069	U	0.069	0.074	U	0.074	0.072	U	0.072
Bis(2-chloroethyl)ether	0.4	2	0.2	0.0071	U	0.0071	0.0064	U	0.0064	0.0073	U	0.0073	0.0078	U	0.0078	0.0076	U	0.0076
Bis(2-ethylhexyl) phthalate	35	140	790	0.17	U	0.17	0.16	U	0.16	0.18	U	0.18	0.19	U	0.19	0.19	U	0.19
Butyl benzyl phthalate	1200	14000	150	0.047	U	0.047	0.043	U	0.043	0.049	U	0.049	0.052	U	0.052	0.051	U	0.051
Carbazole	24	96	NA	0.061	U	0.061	0.056	U	0.056	0.063	U	0.063	0.068	U	0.068	0.066	U	0.066
Chrysene	62	230	52	0.060	U	0.060	0.055	U	0.055	0.062	U	0.062	0.072	J	0.067	0.11	J	0.065
Dibenz(a,h)anthracene	0.2	0.2	0.5	0.0065	U	0.0065	0.0059	U	0.0059	0.0067	U	0.0067	0.0072	U	0.0072	0.016	J	0.007
Dibenzofuran	NA	NA	NA	0.061	U	0.061	0.055	U	0.055	0.063	U	0.063	0.067	U	0.067	0.065	U	0.065
Diethyl phthalate	49000	550000	57	0.062	U	0.062	0.056	U	0.056	0.064	U	0.064	0.068	U	0.068	0.066	U	0.066
Dimethyl phthalate	NA	NA	NA	0.061	U	0.061	0.056	U	0.056	0.063	U	0.063	0.068	U	0.068	0.066	U	0.066
Di-n-butyl phthalate	6100	68000	620	0.064	U	0.064	0.058	U	0.058	0.066	U	0.066	0.071	U	0.071	0.069	U	0.069
Di-n-octyl phthalate	2400	27000	3300	0.033	U	0.033	0.030	U	0.030	0.034	U	0.034	0.037	U	0.037	0.035	U	0.035
Fluoranthene	2300	24000	840	0.069	U	0.069	0.077	J	0.063	0.092	J	0.071	0.099	J	0.076	0.18	J	0.074
Fluorene	2300	24000	110	0.066	U	0.066	0.060	U	0.060	0.068	U	0.068	0.073	U	0.073	0.071	U	0.071
Hexachlorobenzene	0.3	1	0.2	0.0071	U	0.0071	0.0064	U	0.0064	0.0073	U	0.0073	0.0078	U	0.0078	0.0076	U	0.0076
Hexachlorobutadiene	6	25	0.6	0.013	U	0.013	0.011	U	0.011	0.013	U	0.013	0.014	U	0.014	0.014	U	0.014
Hexachlorocyclopentadiene	45	110	210	0.061	U	0.061	0.055	U	0.055	0.063	U	0.063	0.067	U	0.067	0.065	U	0.065
Hexachloroethane	35	140	0.2	0.0058	U	0.0058	0.0052	U	0.0052	0.0059	U	0.0059	0.0064	U	0.0064	0.0062	U	0.0062
Indeno[1,2,3-cd]pyrene	0.6	2	5	0.041	J	0.0086	0.028	J	0.0087	0.048	J	0.0099	0.039	J	0.011	0.098		0.010
Isophorone	510	2000	0.2	0.063	U	0.063	0.057	U	0.057	0.065	U	0.065	0.069	U	0.069	0.067	U	0.067
Naphthalene	6	17	16	0.060	U	0.060	0.054	U	0.054	0.062	U	0.062	0.066	U	0.066	0.064	U	0.064
Nitrobenzene	31	340	0.2	0.0074	U	0.0074	0.0067	U	0.0067	0.0076	U	0.0076	0.0081	U	0.0081	0.0079	U	0.0079
N-Nitrosodi-n-propylamine	0.2	0.3	0.2	0.0086	U	0.0086	0.0078	U	0.0078	0.0089	U	0.0089	0.0096	U	0.0096	0.0093	U	0.0093
N-Nitrosodiphenylamine	99	390	0.2	0.051	U	0.051	0.046	U	0.046	0.053	U	0.053	0.056	U	0.056	0.055	U	0.055
Pentachlorophenol	3	10	0.3	0.15	U	0.15	0.14	U	0.14	0.16	U	0.16	0.17	U	0.17	0.17	U	0.17
Phenanthrene	NA	300000	NA	0.066	U	0.066	0.060	U	0.060	0.068	U	0.068	0.073	U	0.073	0.073	J	0.071
Phenol	18000	210000	5	0.070	U	0.070	0.063	U	0.063	0.072	U	0.072	0.077	U	0.077	0.075	U	0.075
Pyrene	1700	18000	550	0.069	J	0.043	0.076	J	0.039	0.10	J	0.045	0.10	J	0.048	0.17	J	0.047
Total Conc	NA	NA	NA	0.293			0.324			0.509			0.564			1.116		
Total Estimated Conc. (TICs)	NA	NA	NA	0*T			0*T			0*T			0*T			0*T		

*T There are no TICs reported for the sample

J : Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

U : Indicates the analyte was analyzed for but not detected.

TestAmerica

ADER IN ENVIRONMENTAL TESTING

SUMMARY OF ANALYTICAL RESULTS: 460-39374-1

Client ID	NJ Residential	NJ Non Res.	NJ Impact to	R-6			P-1			P-2			P-3			P-4		
Lab Sample ID	SRS	SRS	GW Soil	460-39374-6			460-39374-7			460-39374-8			460-39374-9			460-39374-10		
Sampling Date	Soil Cleanup	Soil Cleanup	Screening	04/19/2012 13:40:00			04/19/2012 14:50:00			04/19/2012 15:05:00			04/19/2012 15:35:00			04/19/2012 15:50:00		
Matrix	Criteria	Criteria	Level	Soil			Soil			Soil			Soil			Soil		
Dilution Factor				1			1			1			1			1		
Unit	mg/kg	mg/kg	mg/kg	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
SVOA-8270C-SOIL				Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 8270C																		
1,2,4-Trichlorobenzene	73	820	0.4	0.0051	U	0.0051	0.014	J	0.0075	0.0059	U	0.0059	0.0058	U	0.0058	0.0083	U	0.0083
1,2-Dichlorobenzene	5300	59000	11	0.052	U	0.052	0.077	U	0.077	0.060	U	0.060	0.059	U	0.059	0.085	U	0.085
1,3-Dichlorobenzene	5300	59000	12	0.041	U	0.041	0.060	U	0.060	0.047	U	0.047	0.046	U	0.046	0.066	U	0.066
1,4-Dichlorobenzene	5	13	1	0.051	U	0.051	0.074	U	0.074	0.058	U	0.058	0.056	U	0.056	0.083	U	0.083
2,2'-oxybis[1-chloropropane]	NA	NA	NA	0.050	U	0.050	0.073	U	0.073	0.057	U	0.057	0.057	U	0.057	0.081	U	0.081
2,4,5-Trichlorophenol	6100	68000	44	0.058	U	0.058	0.085	U	0.085	0.067	U	0.067	0.066	U	0.066	0.094	U	0.094
2,4,6-Trichlorophenol	19	74	0.2	0.053	U	0.053	0.077	U	0.077	0.061	U	0.061	0.060	U	0.060	0.086	U	0.086
2,4-Dichlorophenol	180	2100	0.2	0.066	U	0.066	0.097	U	0.097	0.076	U	0.076	0.075	U	0.075	0.11	U	0.11
2,4-Dimethylphenol	1200	14000	0.7	0.11	U	0.11	0.16	U	0.16	0.13	U	0.13	0.13	U	0.13	0.18	U	0.18
2,4-Dinitrophenol	120	1400	0.3	0.26	U	0.26	0.38	U	0.38	0.29	U	0.29	0.29	U	0.29	0.42	U	0.42
2,4-Dinitrotoluene	0.7	3	NA	0.015	U	0.015	0.022	U	0.022	0.017	U	0.017	0.017	U	0.017	0.024	U	0.024
2,6-Dinitrotoluene	0.7	3	NA	0.014	U	0.014	0.020	U	0.020	0.016	U	0.016	0.015	U	0.015	0.022	U	0.022
2-Chloronaphthalene	NA	NA	NA	0.050	U	0.050	0.074	U	0.074	0.058	U	0.058	0.057	U	0.057	0.082	U	0.082
2-Chlorophenol	310	2200	0.5	0.059	U	0.059	0.087	U	0.087	0.068	U	0.068	0.067	U	0.067	0.096	U	0.096
2-Methylnaphthalene	230	2400	5	0.058	U	0.058	0.085	U	0.085	0.066	U	0.066	0.066	U	0.066	0.094	U	0.094
2-Methylphenol	310	3400	NA	0.077	U	0.077	0.11	U	0.11	0.088	U	0.088	0.087	U	0.087	0.12	U	0.12
2-Nitroaniline	39	23000	NA	0.19	U	0.19	0.28	U	0.28	0.22	U	0.22	0.21	U	0.21	0.31	U	0.31
2-Nitrophenol	NA	NA	NA	0.050	U	0.050	0.074	U	0.074	0.058	U	0.058	0.057	U	0.057	0.082	U	0.082
3,3'-Dichlorobenzidine	1	4	0.2	0.16	U	0.16	0.23	U	0.23	0.18	U	0.18	0.18	U	0.18	0.26	U	0.26
3-Nitroaniline	NA	NA	NA	0.16	U	0.16	0.23	U	0.23	0.18	U	0.18	0.18	U	0.18	0.26	U	0.26
4,6-Dinitro-2-methylphenol	6	66	0.3	0.12	U	0.12	0.18	U	0.18	0.14	U	0.14	0.14	U	0.14	0.20	U	0.20
4-Bromophenyl phenyl ether	NA	NA	NA	0.045	U	0.045	0.065	U	0.065	0.051	U	0.051	0.051	U	0.051	0.073	U	0.073
4-Chloro-3-methylphenol	NA	NA	NA	0.068	U	0.066	0.10	U	0.10	0.078	U	0.078	0.077	U	0.077	0.11	U	0.11
4-Chloroaniline	NA	NA	NA	0.12	U	0.12	0.17	U	0.17	0.14	U	0.14	0.14	U	0.14	0.19	U	0.19
4-Chlorophenyl phenyl ether	NA	NA	NA	0.053	U	0.053	0.077	U	0.077	0.061	U	0.061	0.060	U	0.060	0.086	U	0.086
4-Methylphenol	31	340	NA	0.089	U	0.089	0.13	U	0.13	0.10	U	0.10	0.10	U	0.10	0.14	U	0.14
4-Nitroaniline	NA	NA	NA	0.14	U	0.14	0.21	U	0.21	0.16	U	0.16	0.16	U	0.16	0.23	U	0.23
4-Nitrophenol	NA	NA	NA	0.29	U	0.29	0.43	U	0.43	0.33	U	0.33	0.33	U	0.33	0.47	U	0.47
Acenaphthene	3400	37000	74	0.066	U	0.066	0.096	U	0.096	0.075	U	0.075	0.075	U	0.075	0.11	U	0.11
Acenaphthylene	NA	300000	NA	0.053	U	0.053	0.078	U	0.078	0.061	U	0.061	0.060	U	0.060	0.086	U	0.086
Anthracene	17000	30000	1500	0.055	U	0.055	0.089	J	0.080	0.063	U	0.063	0.062	U	0.062	0.089	U	0.089
Benzo[a]anthracene	0.6	2	0.5	0.047		0.0032	0.35		0.0046	0.15		0.0036	0.11		0.0036	0.30		0.0051
Benzo[a]pyrene	0.2	0.2	0.2	0.048		0.0032	0.32		0.0047	0.15		0.0037	0.10		0.0036	0.28		0.0052
Benzo[b]fluoranthene	0.6	2	2	0.064		0.0029	0.36		0.0042	0.18		0.0033	0.12		0.0032	0.33		0.0046
Benzo[g,h,i]perylene	380000	30000	NA	0.045	J	0.033	0.30	J	0.049	0.13	J	0.038	0.089	J	0.038	0.31	J	0.054
Benzo[k]fluoranthene	6	23	16	0.033	J	0.0034	0.13		0.005	0.092		0.0039	0.063		0.0039	0.12		0.0056
Bis(2-chloroethoxy)methane	NA	NA	NA	0.058	U	0.058	0.085	U	0.085	0.067	U	0.067	0.066	U	0.066	0.094	U	0.094
Bis(2-chloroethyl)ether	0.4	2	0.2	0.0062	U	0.0062	0.009	U	0.009	0.0071	U	0.0071	0.007	U	0.007	0.010	U	0.010
Bis(2-ethylhexyl) phthalate	35	140	790	0.15	U	0.15	0.22	U	0.22	0.17	U	0.17	0.17	U	0.17	0.24	U	0.24
Butyl benzyl phthalate	1200	14000	150	0.041	U	0.041	0.060	U	0.060	0.047	U	0.047	0.047	U	0.047	0.067	U	0.067
Carbazole	24	96	NA	0.053	U	0.053	0.078	U	0.078	0.061	U	0.061	0.060	U	0.060	0.086	U	0.086
Chrysene	62	230	52	0.061	J	0.053	0.49	J	0.077	0.19	J	0.060	0.14	J	0.060	0.40	J	0.085
Dibenz(a,h)anthracene	0.2	0.2	0.5	0.0094	J	0.0057	0.049	J	0.0083	0.020	J	0.0065	0.024	J	0.0064	0.051	J	0.0092
Dibenzofuran	NA	NA	NA	0.053	U	0.053	0.077	U	0.077	0.061	U	0.061	0.060	U	0.060	0.086	U	0.086
Diethyl phthalate	49000	550000	57	0.054	U	0.054	0.079	U	0.079	0.062	U	0.062	0.061	U	0.061	0.087	U	0.087
Dimethyl phthalate	NA	NA	NA	0.054	U	0.054	0.078	U	0.078	0.061	U	0.061	0.061	U	0.061	0.087	U	0.087
Di-n-butyl phthalate	6100	68000	620	0.056	U	0.056	0.14	J	0.081	0.064	U	0.064	0.063	U	0.063	0.090	U	0.090
Di-n-octyl phthalate	2400	27000	3300	0.029	U	0.029	0.042	U	0.042	0.033	U	0.033	0.033	U	0.033	0.047	U	0.047
Fluoranthene	2300	24000	840	0.096	J	0.060	0.60	J	0.088	0.33	J	0.069	0.22	J	0.068	0.48	J	0.098
Fluorene	2300	24000	110	0.058	U	0.058	0.087	J	0.084	0.066	U	0.066	0.065	U	0.065	0.094	U	0.094
Hexachlorobenzene	0.3	1	0.2	0.0062	U	0.0062	0.009	U	0.009	0.0071	U	0.0071	0.007	U	0.007	0.010	U	0.010
Hexachlorobutadiene	6	25	0.6	0.011	U	0.011	0.016	U	0.016	0.013	U	0.013	0.012	U	0.012	0.018	U	0.018
Hexachlorocyclopentadiene	45	110	210	0.053	U	0.053	0.078	U	0.078	0.061	U	0.061	0.060	U	0.060	0.086	U	0.086
Hexachloroethane	35	140	0.2	0.005	U	0.005	0.0073	U	0.0073	0.0058	U	0.0058	0.0057	U	0.0057	0.0081	U	0.0081
Indeno[1,2,3-cd]pyrene	0.6	2	5	0.039	J	0.0084	0.23		0.012	0.13		0.0096	0.099		0.0095	0.25		0.014
Isophorone	510	2000	0.2	0.055	U	0.055	0.080	U	0.080	0.063	U	0.063	0.062	U	0.062	0.089	U	0.089
Naphthalene	6	17	16	0.052	U	0.052	0.076	U	0.076	0.060	U	0.060	0.059	U	0.059	0.085	U	0.085
Nitrobenzene	31	340	0.2	0.0064	U	0.0064	0.0094	U	0.0094	0.0074	U	0.0074	0.0073	U	0.0073	0.010	U	0.010
N-Nitrosodi-n-propylamine	0.2	0.3	0.2	0.0075	U	0.0075	0.011	U	0.011	0.0086	U	0.0086	0.0085	U	0.0085	0.012	U	0.012
N-Nitrosodiphenylamine	99	390	0.2	0.045	U	0.045	0.22	J	0.065	0.051	U	0.051	0.050	U	0.050	0.072	U	0.072
Pentachlorophenol	3	10	0.3	0.13	U	0.13	0.20	U	0.20	0.15	U	0.15	0.15	U	0.15	0.22	U	0.22
Phenanthrene	NA	300000	NA	0.058	U	0.058	0.61	J	0.084	0.20	J	0.066	0.081	J	0.065	0.43	J	0.093
Phenol	18000	210000	5	0.061	U	0.061	0.089	U	0.089	0.069	U	0.069	0.069	U	0.069	0.098	U	0.098
Pyrene	1700	18000	550	0.099	J	0.038	0.81		0.055	0.31	J	0.043	0.19	J	0.043	0.70	J	0.061
Total Conc	NA	NA	NA	0.5414			4.799			1.882			1.236			3.651		
Total Estimated Conc. (TICs)	NA	NA	NA	0*T			0*T			0*T			0*T			0*T		

*T There are no TICs reported for the sample

J : Result is less than the RL but greater than or equal to the MDL an

U : Indicates the analyte was analyzed for but not detected.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

SUMMARY OF ANALYTICAL RESULTS: 460-39374-1

Client ID	NJ Residential	NJ Non Res.	NJ Impact to			R-1			R-2			R-3			R-4
Lab Sample ID	SRS	SRS	GW Soil			460-39374-1			460-39374-2			460-39374-3			460-39374-4
Sampling Date	Soil Cleanup	Soil Cleanup	Screening			04/19/2012 14:20:00			04/19/2012 12:20:00			04/19/2012 12:40:00			04/19/2012 13:00:00
Matrix	Criteria	Criteria	Level			Soil			Soil			Soil			Soil
Dilution Factor						1			1			1			1
Unit	mg/kg	mg/kg	mg/kg	mg/kg			mg/kg			mg/kg			mg/kg		
GCSVOA-8081A-SOIL				Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 8081A															
4,4'-DDD	3	13	3	0.0013	U	0.0013	0.0011	U	0.0011	0.0013	U	0.0013	0.0014	U	0.0014
4,4'-DDE	2	9	12	0.002	U	0.002	0.0018	U	0.0018	0.0021	U	0.0021	0.0023	U	0.0023
4,4'-DDT	2	8	7	0.0013	U	0.0013	0.0012	U	0.0012	0.0014	U	0.0014	0.0015	U	0.0015
Aldrin	0.04	0.2	0.1	0.0023	U	0.0023	0.0021	U	0.0021	0.0024	U	0.0024	0.0026	U	0.0026
alpha-BHC	0.1	0.5	0.002	0.0019	U	0.0019	0.0018	U	0.0018	0.002	U	0.002	0.0022	U	0.0022
alpha-Chlordane	NA	NA	NA	0.0022	U	0.0022	0.002	U	0.002	0.0023	U	0.0023	0.0024	U	0.0024
beta-BHC	0.4	2	0.002	0.0014	U	0.0014	0.0013	U	0.0013	0.0015	U	0.0015	0.0016	U	0.0016
delta-BHC	NA	NA	NA	0.0016	U	0.0016	0.0014	U	0.0014	0.0017	U	0.0017	0.0018	U	0.0018
Dieldrin	0.04	0.2	0.003	0.002	U	0.002	0.0018	U	0.0018	0.0021	U	0.0021	0.0022	U	0.0022
Endosulfan I	NA	NA	NA	0.0022	U	0.0022	0.002	U	0.002	0.0023	U	0.0023	0.0024	U	0.0024
Endosulfan II	NA	NA	NA	0.0016	U	0.0016	0.0014	U	0.0014	0.0016	U	0.0016	0.0018	U	0.0018
Endosulfan sulfate	470	6800	1	0.0013	U	0.0013	0.0012	U	0.0012	0.0014	U	0.0014	0.0015	U	0.0015
Endrin	23	340	0.6	0.0015	U	0.0015	0.0013	U	0.0013	0.0015	U	0.0015	0.0016	U	0.0016
Endrin aldehyde	NA	NA	NA	0.0026	U	0.0026	0.0024	U	0.0024	0.0027	U	0.0027	0.0029	U	0.0029
Endrin ketone	NA	NA	NA	0.0015	U	0.0015	0.0014	U	0.0014	0.0016	U	0.0016	0.0017	U	0.0017
gamma-BHC (Lindane)	0.4	2	0.002	0.0012	U	0.0012	0.0011	U	0.0011	0.0013	U	0.0013	0.0014	U	0.0014
gamma-Chlordane	NA	NA	NA	0.0021	U	0.0021	0.0019	U	0.0019	0.0022	U	0.0022	0.0024	U	0.0024
Heptachlor	0.1	0.7	0.3	0.0015	U	0.0015	0.0014	U	0.0014	0.0016	U	0.0016	0.0017	U	0.0017
Heptachlor epoxide	0.07	0.3	0.009	0.0021	U	0.0021	0.0019	U	0.0019	0.0022	U	0.0022	0.0023	U	0.0023
Methoxychlor	390	5700	100	0.0012	U	0.0012	0.0011	U	0.0011	0.0012	U	0.0012	0.0013	U	0.0013
Toxaphene	0.6	3	0.2	0.022	U	0.022	0.020	U	0.020	0.023	U	0.023	0.024	U	0.024

U : Indicates the analyte was analyzed for but not detected.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

SUMMARY OF ANALYTICAL RESULTS: 460-39374-1

Client ID	NJ Residential	NJ Non Res.	NJ Impact to	R-5			R-6		
Lab Sample ID	SRS	SRS	GW Soil	460-39374-5			460-39374-6		
Sampling Date	Soil Cleanup	Soil Cleanup	Screening	04/19/2012 13:20:00			04/19/2012 13:40:00		
Matrix	Criteria	Criteria	Level	Soil			Soil		
Dilution Factor				1			1		
Unit	mg/kg	mg/kg	mg/kg	mg/kg			mg/kg		
GCSVOA-8081A-SOIL				Result	Q	MDL	Result	Q	MDL
SOIL BY 8081A									
4,4'-DDD	3	13	3	0.0013	U	0.0013	0.0011	U	0.0011
4,4'-DDE	2	9	12	0.0022	U	0.0022	0.0018	U	0.0018
4,4'-DDT	2	8	7	0.0014	U	0.0014	0.0011	U	0.0011
Aldrin	0.04	0.2	0.1	0.0025	U	0.0025	0.002	U	0.002
alpha-BHC	0.1	0.5	0.002	0.0021	U	0.0021	0.0017	U	0.0017
alpha-Chlordane	NA	NA	NA	0.0024	U	0.0024	0.0019	U	0.0019
beta-BHC	0.4	2	0.002	0.0015	U	0.0015	0.0012	U	0.0012
delta-BHC	NA	NA	NA	0.0017	U	0.0017	0.0014	U	0.0014
Dieldrin	0.04	0.2	0.003	0.0022	U	0.0022	0.0018	U	0.0018
Endosulfan I	NA	NA	NA	0.0024	U	0.0024	0.0019	U	0.0019
Endosulfan II	NA	NA	NA	0.0017	U	0.0017	0.0014	U	0.0014
Endosulfan sulfate	470	6800	1	0.0014	U	0.0014	0.0012	U	0.0012
Endrin	23	340	0.6	0.0016	U	0.0016	0.0013	U	0.0013
Endrin aldehyde	NA	NA	NA	0.0028	U	0.0028	0.0023	U	0.0023
Endrin ketone	NA	NA	NA	0.0017	U	0.0017	0.0014	U	0.0014
gamma-BHC (Lindane)	0.4	2	0.002	0.0013	U	0.0013	0.0011	U	0.0011
gamma-Chlordane	NA	NA	NA	0.0023	U	0.0023	0.0019	U	0.0019
Heptachlor	0.1	0.7	0.3	0.0016	U	0.0016	0.0013	U	0.0013
Heptachlor epoxide	0.07	0.3	0.009	0.0023	U	0.0023	0.0018	U	0.0018
Methoxychlor	390	5700	100	0.0013	U	0.0013	0.001	U	0.001
Toxaphene	0.6	3	0.2	0.023	U	0.023	0.019	U	0.019

U : Indicates the analyte was analyzed for but not detected.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

SUMMARY OF ANALYTICAL RESULTS: 460-39374-1

Client ID	NJ Residential	NJ Non Res.	NJ Impact to			P-1			P-2			P-3			P-4
Lab Sample ID	SRS	SRS	GW Soil			460-39374-7			460-39374-8			460-39374-9			460-39374-10
Sampling Date	Soil Cleanup	Soil Cleanup	Screening			04/19/2012 14:50:00			04/19/2012 15:05:00			04/19/2012 15:35:00			04/19/2012 15:50:00
Matrix	Criteria	Criteria	Level			Soil			Soil			Soil			Soil
Dilution Factor						1			1			1			1
Unit	mg/kg	mg/kg	mg/kg	mg/kg			mg/kg			mg/kg			mg/kg		
GCSVOA-8081A-SOIL				Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 8081A															
4,4'-DDD	3	13	3	0.0016	U	0.0016	0.0013	U	0.0013	0.0012	U	0.0012	0.0018	U	0.0018
4,4'-DDE	2	9	12	0.0026	U	0.0026	0.002	U	0.002	0.002	U	0.002	0.0029	U	0.0029
4,4'-DDT	2	8	7	0.0017	U	0.0017	0.0013	U	0.0013	0.0013	U	0.0013	0.0019	U	0.0019
Aldrin	0.04	0.2	0.1	0.0029	U	0.0029	0.0023	U	0.0023	0.0023	U	0.0023	0.0033	U	0.0033
alpha-BHC	0.1	0.5	0.002	0.0025	U	0.0025	0.0019	U	0.0019	0.0019	U	0.0019	0.0027	U	0.0027
alpha-Chlordane	NA	NA	NA	0.0028	U	0.0028	0.0022	U	0.0022	0.0022	U	0.0022	0.0031	U	0.0031
beta-BHC	0.4	2	0.002	0.0018	U	0.0018	0.0014	U	0.0014	0.0014	U	0.0014	0.002	U	0.002
delta-BHC	NA	NA	NA	0.002	U	0.002	0.0016	U	0.0016	0.0016	U	0.0016	0.0023	U	0.0023
Dieldrin	0.04	0.2	0.003	0.0026	U	0.0026	0.002	U	0.002	0.002	U	0.002	0.0029	U	0.0029
Endosulfan I	NA	NA	NA	0.0028	U	0.0028	0.0022	U	0.0022	0.0022	U	0.0022	0.0031	U	0.0031
Endosulfan II	NA	NA	NA	0.002	U	0.002	0.0016	U	0.0016	0.0016	U	0.0016	0.0022	U	0.0022
Endosulfan sulfate	470	6800	1	0.0017	U	0.0017	0.0013	U	0.0013	0.0013	U	0.0013	0.0019	U	0.0019
Endrin	23	340	0.6	0.0019	U	0.0019	0.0015	U	0.0015	0.0015	U	0.0015	0.0021	U	0.0021
Endrin aldehyde	NA	NA	NA	0.0033	U	0.0033	0.0026	U	0.0026	0.0026	U	0.0026	0.0037	U	0.0037
Endrin ketone	NA	NA	NA	0.002	U	0.002	0.0016	U	0.0016	0.0015	U	0.0015	0.0022	U	0.0022
gamma-BHC (Lindane)	0.4	2	0.002	0.0016	U	0.0016	0.0012	U	0.0012	0.0012	U	0.0012	0.0017	U	0.0017
gamma-Chlordane	NA	NA	NA	0.0027	U	0.0027	0.0022	U	0.0022	0.0021	U	0.0021	0.003	U	0.003
Heptachlor	0.1	0.7	0.3	0.0019	U	0.0019	0.0015	U	0.0015	0.0015	U	0.0015	0.0021	U	0.0021
Heptachlor epoxide	0.07	0.3	0.009	0.0027	U	0.0027	0.0021	U	0.0021	0.0021	U	0.0021	0.003	U	0.003
Methoxychlor	390	5700	100	0.0015	U	0.0015	0.0012	U	0.0012	0.0012	U	0.0012	0.0017	U	0.0017
Toxaphene	0.6	3	0.2	0.028	U	0.028	0.022	U	0.022	0.022	U	0.022	0.031	U	0.031

U : Indicates the analyte was analyzed for but not detected.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

SUMMARY OF ANALYTICAL RESULTS: 460-39374-1

Client ID	NJ Residential	NJ Non Residential	NJ Impact to			R-1			R-2			R-3			R-4
Lab Sample ID	SRS	SRS	GW Soil			460-39374-1			460-39374-2			460-39374-3			460-39374-4
Sampling Date	Soil Cleanup	Soil Cleanup	Screening			04/19/2012 14:20:00			04/19/2012 12:20:00			04/19/2012 12:40:00			04/19/2012 13:00:00
Matrix	Criteria	Criteria	Level			Soil			Soil			Soil			Soil
Unit	mg/kg	mg/kg	mg/kg	mg/kg			mg/kg			mg/kg			mg/kg		
METALS-SOIL				Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 6010B															
Aluminum	78,000	NA	3900	4990		26.9	4080		24.6	4430		26.8	4380		29.8
Antimony	31	450	6	1.8	U	1.8	1.7	U	1.7	1.8	U	1.8	2.0	U	2.0
Arsenic	19	19	19	1.9		1.4	1.5		1.3	1.6		1.4	1.9		1.5
Barium	16,000	59,000	1300	34.6	J	1.7	25.4	J	1.5	30.5	J	1.7	31.1	J	1.9
Beryllium	16	140	0.5	0.25	J	0.21	0.19	U	0.19	0.28	J	0.21	0.24	U	0.24
Cadmium	78	78	1	0.23	J	0.22	0.20	U	0.20	0.43	J	0.22	0.26	J	0.24
Calcium	NA	NA	NA	1440	J	105	1010	J	95.8	1550		104	1740		116
Chromium	NA	NA	NA	12.1		1.3	9.3		1.2	14.4		1.3	11.1		1.4
Cobalt	1,600	590	59	5.6	J	1.3	4.0	J	1.2	5.2	J	1.3	4.9	J	1.4
Copper	3,100	45,000	7300	14.4		2.9	7.0		2.6	19.7		2.9	13.0		3.2
Iron	NA	NA	NA	11900		17.9	10100		16.4	9880		17.8	11100		19.8
Lead	400	800	59	27.7		1.3	24.4		1.2	129		1.3	27.6		1.4
Magnesium	NA	NA	NA	1940		106	1540		97.5	1710		106	1760		118
Manganese	11,000	5,900	42	181		1.3	158		1.2	167		1.3	249		1.4
Nickel	1,600	23,000	31	8.8	J	1.3	6.8	J	1.2	8.9	J	1.3	8.3	J	1.4
Potassium	NA	NA	NA	305	J	158	236	J	145	289	J	157	314	J	175
Selenium	390	5,700	7	2.0	U	2.0	1.8	U	1.8	1.9	U	1.9	2.2	U	2.2
Silver	390	5,700	1	0.30	U	0.30	0.27	U	0.27	0.29	U	0.29	0.33	U	0.33
Sodium	NA	NA	NA	233	U	233	214	U	214	232	U	232	259	U	259
Thallium	5	79	3	1.7	U	1.7	1.5	U	1.5	1.7	U	1.7	1.9	U	1.9
Vanadium	78	1,100	NA	16.6		1.1	14.5		1.0	15.8		1.1	15.6	J	1.3
Zinc	23,000	110,000	600	69.9		1.6	66.6		1.5	164		1.6	99.9		1.8
SOIL BY 7471A															
Mercury	23	65	0.1	0.25		0.033	0.15		0.029	0.34		0.035	0.22		0.036

J : Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

U : Indicates the analyte was analyzed for but not detected.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

SUMMARY OF ANALYTICAL RESULTS: 460-39374-1

Client ID	NJ Residential	NJ Non Residential	NJ Impact to	R-5			R-6		
Lab Sample ID	SRS	SRS	GW Soil	460-39374-5			460-39374-6		
Sampling Date	Soil Cleanup	Soil Cleanup	Screening	04/19/2012 13:20:00			04/19/2012 13:40:00		
Matrix	Criteria	Criteria	Level	Soil			Soil		
Unit	mg/kg	mg/kg	mg/kg	mg/kg			mg/kg		
METALS-SOIL				Result	Q	MDL	Result	Q	MDL
SOIL BY 6010B									
Aluminum	78,000	NA	3900	4250		29.4	4170		22.2
Antimony	31	450	6	2.0	U	2.0	1.5	U	1.5
Arsenic	19	19	19	2.6		1.5	1.4		1.1
Barium	16,000	59,000	1300	35.7	J	1.8	24.1	J	1.4
Beryllium	16	140	0.5	0.23	J	0.23	0.23	J	0.18
Cadmium	78	78	1	0.48	J	0.24	0.23	J	0.18
Calcium	NA	NA	NA	7550		115	1040	J	86.4
Chromium	NA	NA	NA	11.9		1.4	10.2		1.0
Cobalt	1,600	590	59	5.1	J	1.4	4.5	J	1.0
Copper	3,100	45,000	7300	11.7		3.1	10.5		2.4
Iron	NA	NA	NA	11300		19.6	10500		14.8
Lead	400	800	59	60.4		1.4	25.1		1.0
Magnesium	NA	NA	NA	1770		116	1620		87.9
Manganese	11,000	5,900	42	185		1.4	119		1.1
Nickel	1,600	23,000	31	8.9	J	1.4	8.1	J	1.1
Potassium	NA	NA	NA	320	J	173	260	J	131
Selenium	390	5,700	7	2.1	U	2.1	1.6	U	1.6
Silver	390	5,700	1	0.32	U	0.32	0.24	U	0.24
Sodium	NA	NA	NA	256	U	256	193	U	193
Thallium	5	79	3	1.8	U	1.8	1.4	U	1.4
Vanadium	78	1,100	NA	13.2	J	1.2	15.2		0.94
Zinc	23,000	110,000	600	91.9		1.7	84.7		1.3

SOIL BY 7471A									
Mercury	23	65	0.1	0.20		0.037	0.11		0.027

J : Result is less than the RL but greater than or equal to the MDL and the concent
U : Indicates the analyte was analyzed for but not detected.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

SUMMARY OF ANALYTICAL RESULTS: 460-39374-1

Client ID	NJ Residential	NJ Non Residential	NJ Impact to			P-1			P-2			P-3			P-4
Lab Sample ID	SRS	SRS	GW Soil			460-39374-7			460-39374-8			460-39374-9			460-39374-10
Sampling Date	Soil Cleanup	Soil Cleanup	Screening			04/19/2012 14:50:00			04/19/2012 15:05:00			04/19/2012 15:35:00			04/19/2012 15:50:00
Matrix	Criteria	Criteria	Level			Soil			Soil			Soil			Soil
Unit	mg/kg	mg/kg	mg/kg	mg/kg			mg/kg			mg/kg			mg/kg		
METALS-SOIL				Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 6010B															
Aluminum	78,000	NA	3900	8020		34.9	3990		26.7	4440		28.1	7030		37.3
Antimony	31	450	6	11.9		2.4	1.8	U	1.8	1.9	U	1.9	3.5	J	2.5
Arsenic	19	19	19	4.8		1.8	2.0		1.4	1.6		1.5	4.7		1.9
Barium	16,000	59,000	1300	82.1		2.2	24.0	J	1.7	29.7	J	1.8	58.1	J	2.3
Beryllium	16	140	0.5	0.40	J	0.28	0.21	U	0.21	0.22	U	0.22	0.30	U	0.30
Cadmium	78	78	1	2.2		0.28	0.24	J	0.22	0.23	U	0.23	1.0	J	0.30
Calcium	NA	NA	NA	1590	J	136	1110	J	104	1000	J	109	1840	J	145
Chromium	NA	NA	NA	22.1		1.7	11.1		1.3	106		1.3	17.0		1.8
Cobalt	1,600	590	59	5.8	J	1.6	4.8	J	1.2	4.3	J	1.3	5.5	J	1.7
Copper	3,100	45,000	7300	70.3		3.7	16.8		2.8	14.7		3.0	48.4		4.0
Iron	NA	NA	NA	14500		23.2	9660		17.8	11100		18.7	12600		24.8
Lead	400	800	59	412		1.7	64.1		1.3	524		1.3	386		1.8
Magnesium	NA	NA	NA	2540		138	1640		106	2000		111	2160		148
Manganese	11,000	5,900	42	129		1.7	115		1.3	149		1.4	186		1.8
Nickel	1,600	23,000	31	13.1	J	1.7	8.4	J	1.3	9.0	J	1.4	11.8	J	1.8
Potassium	NA	NA	NA	481	J	205	308	J	157	315	J	165	451	J	220
Selenium	390	5,700	7	2.5	U	2.5	1.9	U	1.9	2.0	U	2.0	2.7	U	2.7
Silver	390	5,700	1	0.38	U	0.38	0.29	U	0.29	0.31	U	0.31	0.41	U	0.41
Sodium	NA	NA	NA	303	U	303	232	U	232	244	U	244	324	U	324
Thallium	5	79	3	2.2	U	2.2	1.7	U	1.7	1.7	U	1.7	2.3	U	2.3
Vanadium	78	1,100	NA	23.4		1.5	15.0		1.1	11.7	J	1.2	21.8		1.6
Zinc	23,000	110,000	600	2570		5.2	121		1.6	94.2		1.7	655		2.2

SOIL BY 7471A															
Mercury	23	65	0.1	0.53		0.044	0.36		0.033	0.13		0.033	0.32		0.046

J : Result is less than the RL but greater than or equal to the MDL and the concent
U : Indicates the analyte was analyzed for but not detected.

TestAmerica
LEADER IN ENVIRONMENTAL TESTING

SUMMARY OF ANALYTICAL RESULTS: 460-39374-1

Client ID	NJ Residential	NJ Non Residential	NJ Impact to	R-1			R-2			R-3		
Lab Sample ID	SRS	SRS	GW Soil	460-39374-1			460-39374-2			460-39374-3		
Sampling Date	Soil Cleanup	Soil Cleanup	Screening	04/19/2012 14:20:00			04/19/2012 12:20:00			04/19/2012 12:40:00		
Matrix	Criteria	Criteria	Level	Soil			Soil			Soil		
WETCHEM-SOIL				Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 9012A												
Cyanide, Total (mg/kg)	1,600	23,000	13	0.085	U	0.085	0.077	U	0.077	0.087	U	0.087

Client ID	NJ Residential	NJ Non Residential	NJ Impact to	R-4			R-5			R-6		
Lab Sample ID	SRS	SRS	GW Soil	460-39374-4			460-39374-5			460-39374-6		
Sampling Date	Soil Cleanup	Soil Cleanup	Screening	04/19/2012 13:00:00			04/19/2012 13:20:00			04/19/2012 13:40:00		
Matrix	Criteria	Criteria	Level	Soil			Soil			Soil		
WETCHEM-SOIL				Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 9012A												
Cyanide, Total (mg/kg)	1,600	23,000	13	0.094	U	0.094	0.091	U	0.091	0.074	U	0.074

Client ID	NJ Residential	NJ Non Residential	NJ Impact to	P-1			P-2			P-3		
Lab Sample ID	SRS	SRS	GW Soil	460-39374-7			460-39374-8			460-39374-9		
Sampling Date	Soil Cleanup	Soil Cleanup	Screening	04/19/2012 14:50:00			04/19/2012 15:05:00			04/19/2012 15:35:00		
Matrix	Criteria	Criteria	Level	Soil			Soil			Soil		
WETCHEM-SOIL				Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 9012A												
Cyanide, Total (mg/kg)	1,600	23,000	13	0.11	U	0.11	0.085	U	0.085	0.083	U	0.083

Client ID	NJ Residential	NJ Non Residential	NJ Impact to	P-4		
Lab Sample ID	SRS	SRS	GW Soil	460-39374-10		
Sampling Date	Soil Cleanup	Soil Cleanup	Screening	04/19/2012 15:50:00		
Matrix	Criteria	Criteria	Level	Soil		
WETCHEM-SOIL				Result	Q	MDL
SOIL BY 9012A						
Cyanide, Total (mg/kg)	1,600	23,000	13	0.12	U	0.12

U : Indicates the analyte was analyzed for but not detected.

APPENDIX B
ENVIRONMENTAL AND RECREATIONAL IMPACTS

Department of Environmental Protection: Natural Heritage Database

Threatened/Endangered Species Information Letter

Plan of Pompton River Gravel Bar Site

Natural Heritage Priority Sites FAQ

Three Rivers Trail Map and Guide

State of New Jersey

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Division of Parks and Forestry
Mail Code 501-04
ONLM -Natural Heritage Program
P.O. Box 420
Trenton, NJ 08625-0420
Tel. #609-984-1339
Fax. #609-984-1427

BOB MARTIN
Commissioner

November 22, 2011

Jessica Bergmann, P.E.
Civil Dynamics, Inc.
109A County Rte. 515
P.O. Box 760
Stockholm, NJ 07460-0760

Re: Feasibility Study for Removal of Pompton and Pequannock Dams

Dear Ms. Bergmann:

Thank you for your data request regarding rare species information for the above referenced project site in Pompton Lakes Borough, Pequannock Township, Riverdale Borough and Wayne Township, Passaic and Morris County.

Searches of the Natural Heritage Database and the Landscape Project (Version 3 for the highlands region, Version 2.1 elsewhere) are based on a representation of the boundaries of your project site in our Geographic Information System (GIS). We make every effort to accurately transfer your project bounds from the topographic map(s) submitted with the Request for Data into our Geographic Information System. We do not typically verify that your project bounds are accurate, or check them against other sources.

We have checked the Natural Heritage Database and the Landscape Project habitat mapping for occurrences of any rare wildlife species or wildlife habitat on the referenced site. Please see Table 1 for species list and conservation status.

Table 1 (on referenced site).

Common Name	Scientific Name	Federal Status	State Status	Grank	Srank
creeper	*Strophitus undulatus*			G5	S3
eastern lampmussel	*Lampsilis radiata*		T	G5	S2
potential vernal habitat area					
red-shouldered hawk	*Buteo lineatus*		E/T	G5	S1B,S2N
triangle floater	*Alasmidonta undulata*		T	G4	S2

We have also checked the Natural Heritage Database and the Landscape Project habitat mapping for occurrences of any rare wildlife species or wildlife habitat within 1/4 mile of the referenced site. Please see Table 2 for species list and conservation status. This table excludes any species listed in Table 1.

Table 2 (additional species within 1/4 mile of referenced site).

Common Name	Scientific Name	Federal Status	State Status	Grank	Srank
Fowler's toad	*Bufo woodhousii fowleri*		SC	G5	S3

We have also checked the Natural Heritage Database for occurrences of rare plant species or ecological communities. The Natural Heritage Database has records for three occurrences of *Hemicarpha micrantha* that may be in the immediate vicinity of the site. The attached list provides more information about these occurrences. **Because some species are sensitive to disturbance or sought by collectors, this information is provided to you on the condition that no specific locational data are released to the general public. This is not intended to preclude your submission of this information to regulatory agencies from which you are seeking permits.**

A list of rare plant species and ecological communities that have been documented from Passaic and Morris County can be downloaded from http://www.state.nj.us/dep/parksandforests/natural/heritage/countylist.html. If suitable habitat is present at the project site, the species in that list have potential to be present.

Status and rank codes used in the tables and lists are defined in EXPLANATION OF CODES USED IN NATURAL HERITAGE REPORTS, which can be downloaded from http://www.state.nj.us/dep/parksandforests/natural/heritage/nhpcodes_2008.pdf.

The Natural Heritage Program reviews its data periodically to identify priority sites for natural diversity in the State. Included as priority sites are some of the State's best habitats for rare and endangered species and ecological communities. One of these sites is located within or near the areas you have outlined. Please refer to the enclosed Natural Heritage Priority Site Map for the location and boundary of this site. On the back of each Priority Site Map is a report describing the significance of the site.

If you have questions concerning the wildlife records or wildlife species mentioned in this response, we recommend that you visit the interactive I-Map-NJ website at the following URL, http://www.state.nj.us/dep/gis/depsplash.htm or contact the Division of Fish and Wildlife, Endangered and Nongame Species Program at (609) 292 9400.

PLEASE SEE 'CAUTIONS AND RESTRICTIONS ON NHP DATA', which can be downloaded from http://www.state.nj.us/dep/parksandforests/natural/heritage/newcaution2008.pdf.

Thank you for consulting the Natural Heritage Program. The attached invoice details the payment due for processing this data request. Feel free to contact us again regarding any future data requests.

Sincerely,

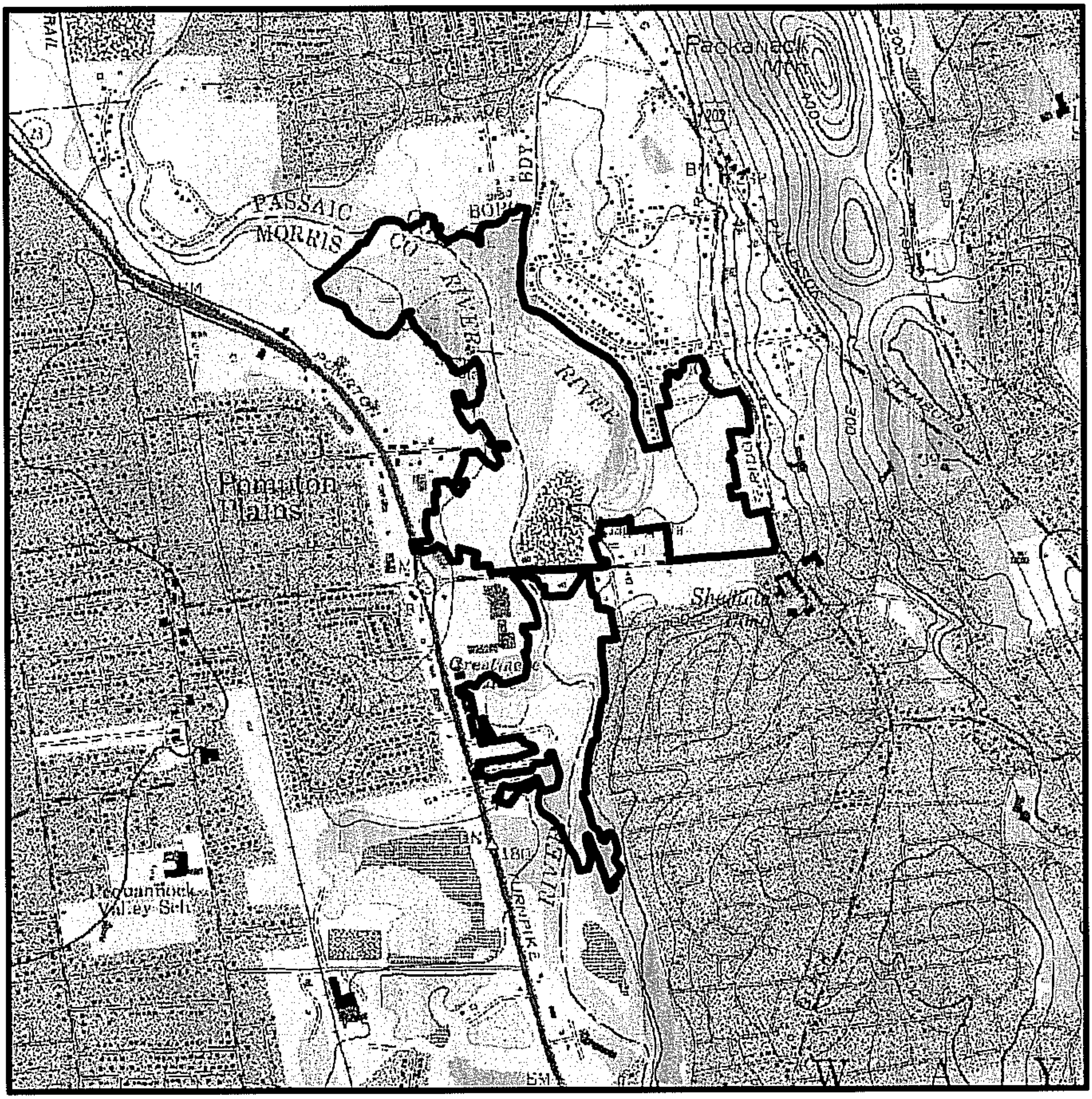
Robert J. Cartica
Administrator

c: NHP File No. 11-4007483-0322

Immediate Vicinity of Project Site
Based on Search of Natural Heritage Database
Rare Plant Species and Ecological Communities Currently Recorded in the New Jersey Natural Heritage Database

Scientific Name	Common Name	Federal Status	State Status	Regional Status	G Rank	S Rank	Last Obs	Ident	Location
Vascular Plant									
Hemicarpha micrantha	Small-flower Halfchaff Sedge		E	LP, HL	G5	S1	1990-??-??	Y	SOUTH SIDE OF RAMAPO RIVER, WEST OF THE DAM CA. 1.3 MI. SOUTH OF POMPTON.
Hemicarpha micrantha	Small-flower Halfchaff Sedge		E	LP, HL	G5	S1	1961-09-15	Y	WEST SIDE OF POMPTON RIVER BELOW A WESTWARD BEND, POMPTON PLAINS.
Hemicarpha micrantha	Small-flower Halfchaff Sedge		E	LP, HL	G5	S1	1939-09-23	Y	POMPTON RIVER, EAST OF POMPTON PLAINS.

3 Records Selected



Natural Heritage Priority Site

Pompton River Gravel Bar Site

Morris and Passaic Counties

NJ Department of Environmental Protection
Division of Parks and Forestry
Natural Lands Management

Miles
0.4 0.2 0 0.4

Priority Sites
Public Land

4

Natural Heritage Priority Site

Pompton River Gravel Bar Site

Locational Information

Quad Name: Pompton Plains
County: Passaic ; Morris
Municipality: Pequannock Twp ; Wayne Twp ; Pompton Lakes Boro

Description of Site

A series of small gravel bars and gravelly shoreline along the Pompton and Ramapo Rivers.

Boundary Justification

Critical area is the rivershore but buffer includes upstream wetlands and adjacent undeveloped lands.

Biodiversity Rank *B5V2*

Contains a state critically imperiled plant species.

Frequently Asked Questions
About Natural Heritage Priority Sites

What are Natural Heritage Priority Sites?
Through its Natural Heritage Database, the Office of Natural Lands Management (ONLM) identifies critically important areas to conserve New Jersey's biological diversity. The database provides detailed information on rare species and ecological communities to planners, developers, and conservation agencies for use in resource management, environmental impact assessment, and both public and private land protection efforts.

Using the database, ONLM has identified 414 Natural Heritage Priority Sites, representing some of the best remaining habitat for rare species and exemplary ecological communities in the state. The DEP Endangered and Nongame Species Program provided key information and assisted with the delineation of a number of the sites. These areas should be considered to be top priorities for the preservation of biological diversity in New Jersey. If these sites become degraded or destroyed, we may lose some of the unique components of our natural heritage.

How are Natural Heritage Priority Site maps used in conservation of biological diversity?
Natural Heritage Priority Site maps are used by individuals and agencies concerned with the protection and management of land. The maps have been used by municipalities preparing natural resource inventories; public and private conservation organizations preparing open space acquisition goals; land developers and consultants identifying environmentally sensitive lands; and public and private landowners developing land management plans.

Natural Heritage Priority Sites contain some of the best and most viable occurrences of endangered and threatened species and ecological communities, but they do not cover all known habitat for endangered and threatened species in New Jersey. If information is needed on whether or not endangered or threatened species have been documented from a particular piece of land, a Natural Heritage Database search can be requested by contacting the Office of Natural Lands Management at the address below.

What do the boundaries of the sites contain?
The boundaries of each Natural Heritage Priority Site are drawn to encompass critical habitat for rare species or ecological communities. Often the boundaries extend to include additional buffer lands that should be managed to protect the habitat. A justification for the boundary is provided for each site. The term "primary bounds" is sometimes used to refer to boundaries enclosing critical habitat. The term "secondary bounds" is sometimes used to refer to boundaries enclosing additional buffer. In maps where both primary and secondary boundaries are described, only the outermost boundary is provided in the mapping.

What is the background map that the sites are drawn upon?
The sites are portrayed on background maps produced from a digital copy of the U.S. Geological Survey 7.5 minute topographic maps. The background maps contain topographic lines as well as streams, lakes, roads, towns and place names. These background maps do not always reflect recent changes in land development. Some may be more than 20 years old. Some sites appear to be shifted in position against this topo map. This shift is due to the fact that most sites have been digitized using rectified aerial photography, and some of the digitized USGS topo maps do not align with this photography.

What do "public lands" depict on the maps?
The "public lands" shaded on these maps are state-owned open space lands that have been digitized as a GIS coverage by the state Green Acres Program. This information is provided to show patterns of State land ownership in the vicinity of the Priority Site. The public lands are areas such as State Parks and Forests, Wildlife Management Areas, and Natural Lands Trust preserves. They do not currently include lands owned by other state agencies, federal, county or municipal governments or nonprofit conservation organizations. This GIS coverage is constantly being updated, and therefore future editions of the maps will likely contain additional public lands that are not currently mapped as such.

What is the biodiversity significance rank and how is it used?
Each site is ranked according to its significance for biological diversity using a scale developed by The Nature Conservancy, the network of Natural Heritage Programs, and the New Jersey Natural Heritage Program. The ranks can be used to distinguish between sites that are of global significance for conservation of biological diversity vs. those that are of state significance. The global biodiversity significance ranks range from B1 to B5. In some cases the global biodiversity significance rank is then combined with a state biodiversity significance rank which provides information about the significance of the site on a state level. The state biodiversity significance rank ranges from V1 to V5. The specific definitions for each rank are as follows:

B1 - Outstanding significance on a global level, generally the "last of the least" in the world, such as the only known occurrence of any element (species or ecological community), the best or an excellent occurrence of an element ranked critically imperiled globally, or a concentration (4+) of good or excellent occurrences of elements that are imperiled or critically imperiled globally. The site should be viable and defensible for the elements or ecological processes contained.

B2 - Very high significance on a global level, such as the most outstanding occurrence of any ecological community. Also includes areas containing other occurrences of elements that are critically imperiled globally, a good or excellent occurrence of an element that is imperiled globally, an excellent occurrence of an element that is rare globally, or a concentration (4+) of good occurrences of globally rare elements or viable occurrences of globally imperiled elements.

B3 - High significance on a global level, such as any other viable occurrence of an element that is globally imperiled, a good occurrence of a globally rare element, an excellent occurrence of any ecological community, or a concentration (4+) of good or excellent occurrences of elements that are critically imperiled in the State.

B4 - Moderate significance on a global level, such as a viable occurrence of a globally rare element, a good occurrence of any ecological community, a good or excellent occurrence or only viable state occurrence of an element that is critically imperiled in the State, an excellent occurrence of an element that is imperiled in the State, or a concentration (4+) of good occurrences of elements that are imperiled in the State or excellent occurrences of elements that are rare in the State.

B5 - Of general biodiversity interest on a global level.

V1 - Outstanding significance on a state level. Only known occurrence in the state for an element or Site with an excellent occurrence or the best occurrence in the state for an element ranked critically imperiled in the state or a concentration (4+) of good or excellent occurrences of elements that are imperiled or critically imperiled in the state.

V2 - Very high significance on a state level. Includes sites containing other occurrences of elements that are critically imperiled in the state or a concentration (4+) of other occurrences of state imperiled elements and/or good or excellent occurrences of state rare elements.

V3 - High significance on a state level. Includes sites containing the best occurrence in the state or an excellent occurrence of a state imperiled element or multiple (2+) other occurrences for state imperiled elements and/or excellent, good or moderate quality occurrences of state rare elements.

V4 - Moderate significance on a state level. Includes sites containing the best occurrence in the state or an excellent occurrence of a state rare element or any site with other occurrences of a state imperiled element or multiple (2+) other occurrences of state rare elements.

V5 - Any site with any other occurrence of a state rare element.

Note: All sites have been assigned a global biodiversity significance rank (B rank), but not all sites have been assigned a state biodiversity rank (V rank).

How can I obtain Natural Heritage Priority Site maps for an area of interest to me?

Natural Heritage Priority Site hard copy maps can be obtained by submitting a written request accompanied by a check or money order made payable to the Office of Natural Lands Management at the following address:

Office of Natural Lands Management
P.O. Box 404
Trenton, NJ 08625-0404
Phone: 609-984-1339; Fax: 609-984-1427

Individual 8.5" X 11" maps are available at the following rate:

1 - 10 site maps & reports:	$1.50/site
11 - 20 site maps & reports:	$1.00/site
> 20 sites:	$0.50/site

How often are the maps updated?

The Natural Heritage Priority Site information is constantly being updated in the Natural Heritage Database. A new edition of the maps will be made available after significant revisions or additions to the Database.

April 5, 2006

NJ Department of Environmental Protection
Division of Parks and Forestry
Natural Lands Management

Three Rivers Trail - Map and Guide
A publication of the Pequannock River Coalition

General Info

The Three Rivers Trail is a recreational boating route along sections of the Pequannock River, Ramapo River, and Pompton River in western Morris County and eastern Passaic County. This area is surprisingly scenic, and rich in wildlife.

This guide provides information on access points, recommended routes and some hazards. Users should note that river conditions change, and they should always seek the most up-to-date information. Other sources of information are listed in this guide.

Rules of the River

- **Always wear a Coast Guard-approved personal flotation device (PFD).**
- **Don't paddle alone! Boating companions make your day on the water safer and more enjoyable.**
- **Be aware of river flow conditions. High flows can greatly alter river characteristics, increasing risks.**
- **Stay alert! Some hazards are indicated here, but rivers are constantly changing. Fallen trees, shifting channels and other alterations can occur suddenly.**
- **Let someone know where you will be floating and when you will return.**
- **Carry a spare paddle and a cellular phone in a waterproof covering. In cool weather, bring a change of dry clothes, just in case.**
- **Don't litter! Respect private property. Public sites are generally well-marked.**

Other Sources of Information

Borough of Riverdale (973) 835-4060

Borough of Pompton Lakes Environmental Officer
(973) 835-0143, Ext. 227

Pequannock Township Parks and Recreation
(973) 835-4225

Hazards

Boating on any river has risks. Flowing water is not a safe place to learn basic boating skills.

The greatest hazards are two concrete dams on the Pequannock/Pompton Rivers (see map). These dams are dangerous and can be difficult to see from upstream. Posted warning signs may help, but as a precaution keep to the left bank if you are near these dams.

Boaters must stay alert for things like fallen or submerged trees, stumps, and boulders. Negotiating the more narrow side channels on this route (see map) can call for quick turns and some skill in boat handling.

Always check river flow levels before embarking. We strongly recommend that you not float when any river level is over 70% of the "flood stage" gage height. Keep in mind that rain can increase flows quickly. Check the following sites for river flow info that will affect this route:

Pompton River
http://waterdata.usgs.gov/nj/nwis/uv?01388500
(70% of flood stage gage height is 11.2 feet)
Wanaque River
http://waterdata.usgs.gov/nj/nwis/uv/?01387000
(70% of flood stage gage height is 3.5 feet)
Pequannock River
http://waterdata.usgs.gov/nj/nwis/uv/?01382500
(70% of flood stage gage height is 3.85 feet)

Access Points: Signs posted at these sites will instruct you where to park and launch. Please obey all posted signs! Continued access on these public lands depends on your good behavior.

1) Freedom Park, Riverdale—From Newark Pompton Turnpike take Riverdale Road south. Turn left onto North Corporate Drive. At end of drive, park in culdesac. Follow signs to small footbridge and launch area.

2) Joe Grill Field, Pompton Lakes—from Newark Pompton Turnpike follow Riverdale Road east to Riverdale Boulevard. Make a right onto Riverdale Boulevard. Make a right onto Willow St. Look for launch and parking signs.

3) Stiles Park, Pompton Lakes– From Hamburg Turnpike turn onto Dawes Highway. Make first right onto River Edge Drive. Park is on right. Look for launch and parking signs.

Dams: Use caution! The route passes quite close to dam "B" (see map). The concrete dams (B and C) are high and cannot be passed safely by any boat at any river level.

A—Debris dam

B– Concrete Dam

C—Concrete Dam

Rest stops: These are good places to take a break on public land along the route. They are generally well-marked.

Routes and segments:

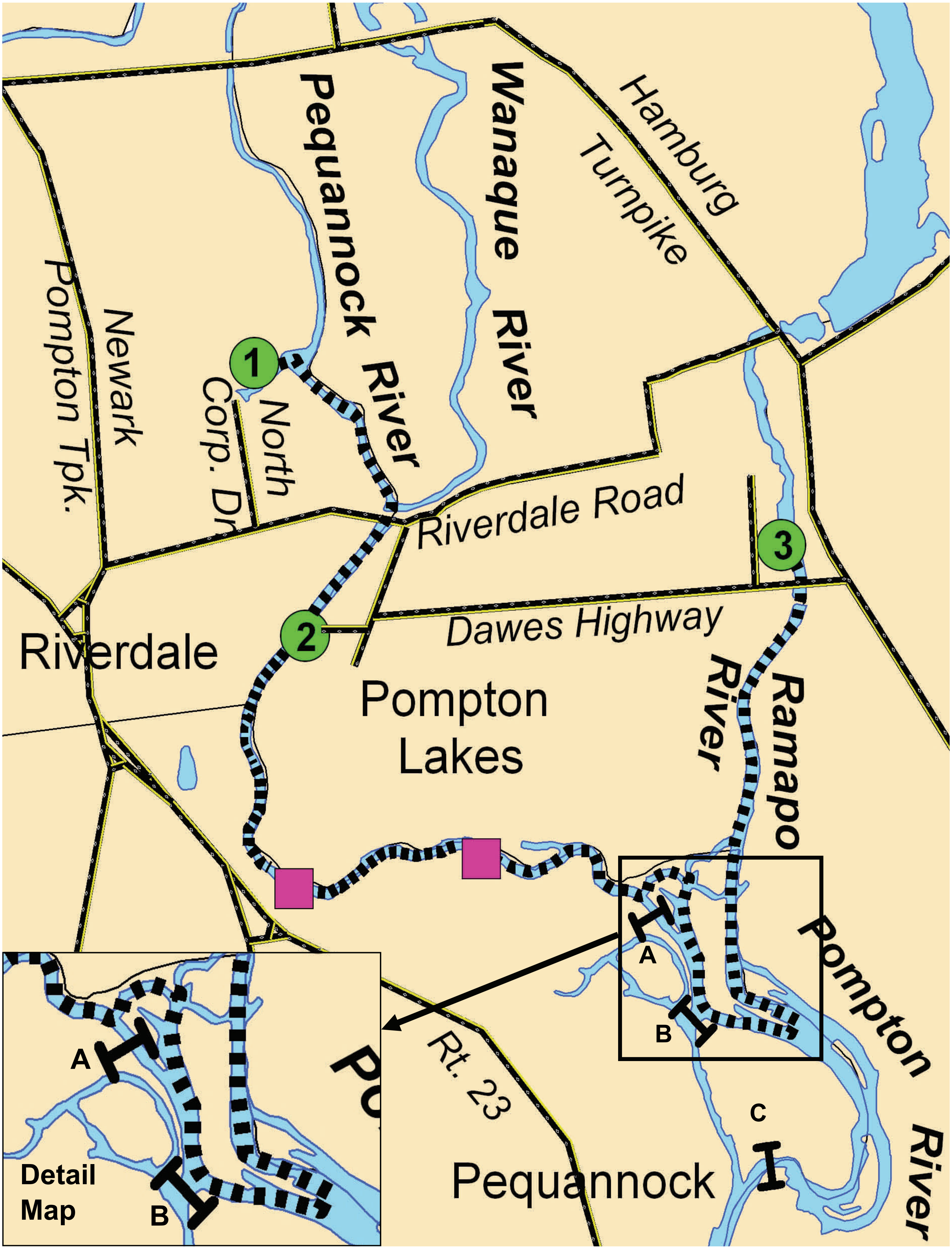
Having several rivers in this small area can be confusing! Simply put, the Wanaque River is a tributary of the Pequannock River, entering the Pequannock in Pompton Lakes. The Pequannock River and the Ramapo River then join to form the Pompton River.

The most popular routes are Freedom Park (1) to Stiles Park (3) and Joe Grill Field (2) to Stiles Park (3). Allow several hours for these trips. Launching at Freedom Park is best at higher river levels, when the flow on the Pequannock River is greater than 25 cubic feet per second.

Along these routes you will cross from the Pequannock to the Pompton/Ramapo using 2 side-channels. See the Detail Map and look for signs along the way

The segment from the junction of the Pequannock and Pompton Rivers to Stiles Park is about a mile of upstream paddling on the Ramapo River. The current is very slow, but some exertion is required.

In times of low water be prepared to walk your boat through occasional areas of shallow water. Remember that 2 vehicles are needed for these trips—one at the launch point and one at the take-out.



Pequannock River
Wanaque River
Hamburg Turnpike
Newark Pompton Tpk.
North Corp. Dr.
Riverdale Road
Dawes Highway
Riverdale
Pompton Lakes
Ramapo River
Pompton River
Rt. 23
Pequannock
1
2
3
A
B
C
Detail Map
A
B

Natural Highlights

Although this route is in a suburban setting, it offers surprising opportunities for scenic appreciation and wildlife viewing.

Majestic trees such as sycamore, yellow poplar (tulip), silver maple, pin oak and basswood line the river banks.

Look for aquatic mammals in and around the water including river otter, muskrat, and mink. Beavers occasionally visit this area but are not currently resident.

Deer abound, and coyotes are frequently sighted. A wide array of waterfowl can usually be seen, particularly in spring and fall. This is prime habitat for wood ducks who nest in hollow trees and nest boxes. Black–crowned and yellow-crowned night herons (both threatened species in NJ), great blue herons, and small green herons stalk the river shallows. Kingfishers are commonplace and even ospreys are sporadic visitors.

Common reptiles include painted turtles, snapping turtles and banded water snakes. A rarity is the wood turtle, another threatened species in New Jersey.

Even mollusks can surprise you. Did you know we have clams in our rivers? You will see thousands of the tiny shells from fingernail clams on sections of the river bottom. For anglers, fishing for bass, panfish and pickerel can be quite good.

We encourage you to make the most of this wonderful environment. Enjoy! And please report any threatened species you observe to the NJDEP. Call them at 609-292-9400.

River Conservation

The Pequannock River Coalition is working to keep our waterways clean and healthy. We conduct river clean-ups, water monitoring, and a broad range of other programs (such as producing this guide) to promote, restore and protect our waterways. New members and volunteers are always welcome. For more information visit our website at www.pequannockriver.org.

Want to help? Please join us!

Yes, I'd like to help! Here's my donation.

Name: ______________________________

Address: ______________________________

City: ____________________ **State:** _____

Zip: __________ **Email:** __________________

Membership Level: **Protector ($500)** _____

Sustaining ($100)_____ **Supporting ($50)**_____

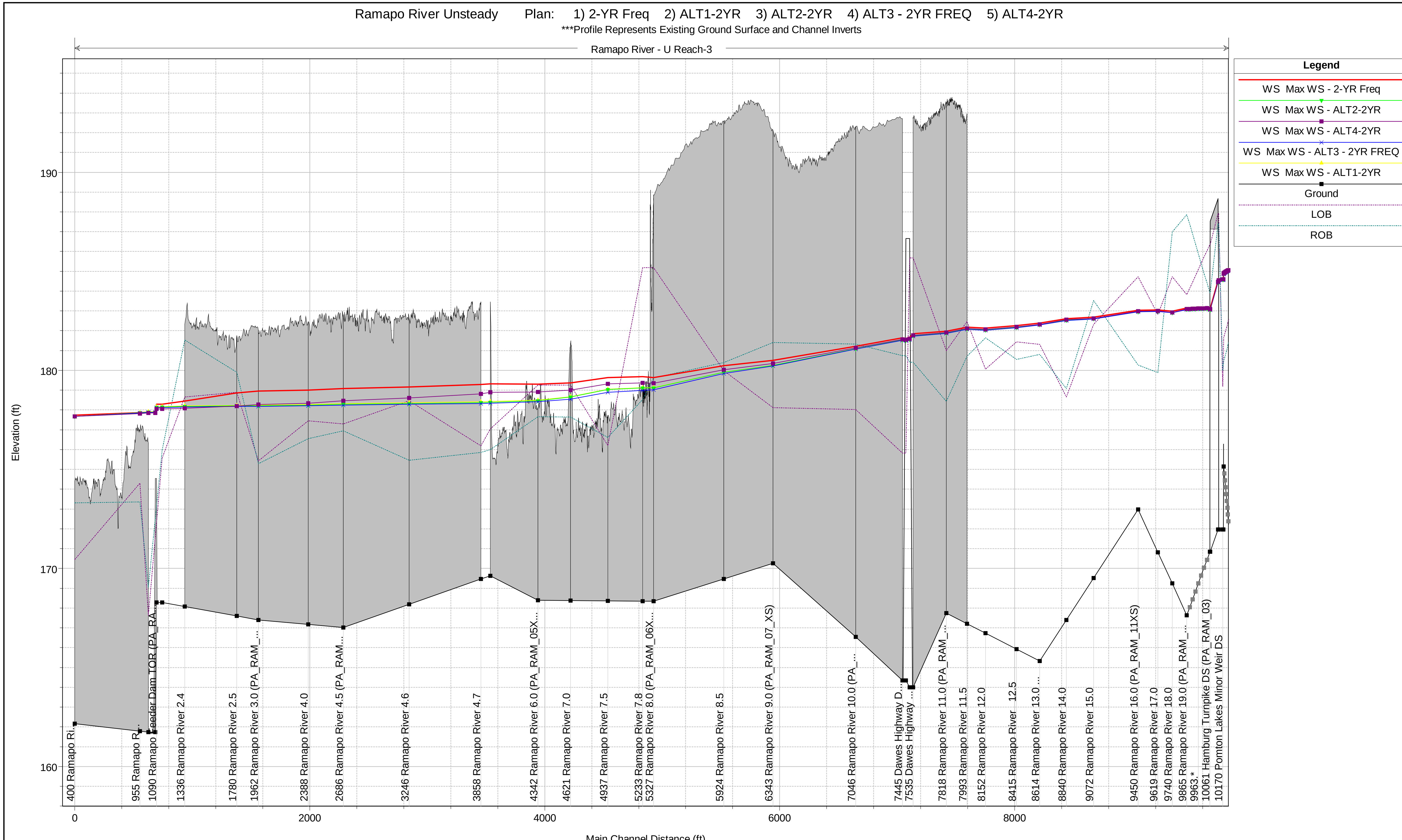
Guardian/Family($25)_____ **Regular ($15)**_____

Send to: Pequannock River Coalition

P.O. Box 392, Newfoundland, NJ 07435

Donations are tax deductible to the extent allowed by law.

Ramapo River:	2-year event
	5-year event
	10-year event
	100-year event
Pequannock River:	5-year event
	10-year event
Pompton River:	5-year event
	10-year event


Ramapo River Unsteady Plan: 1) 2-YR Freq 2) ALT1-2YR 3) ALT2-2YR 4) ALT3 - 2YR FREQ 5) ALT4-2YR
***Profile Represents Existing Ground Surface and Channel Inverts
Ramapo River - U Reach-3
Legend
WS Max WS - 2-YR Freq
WS Max WS - ALT2-2YR
WS Max WS - ALT4-2YR
WS Max WS - ALT3 - 2YR FREQ
WS Max WS - ALT1-2YR
Ground
LOB
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Elevation (ft)
Main Channel Distance (ft)
160
170
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190
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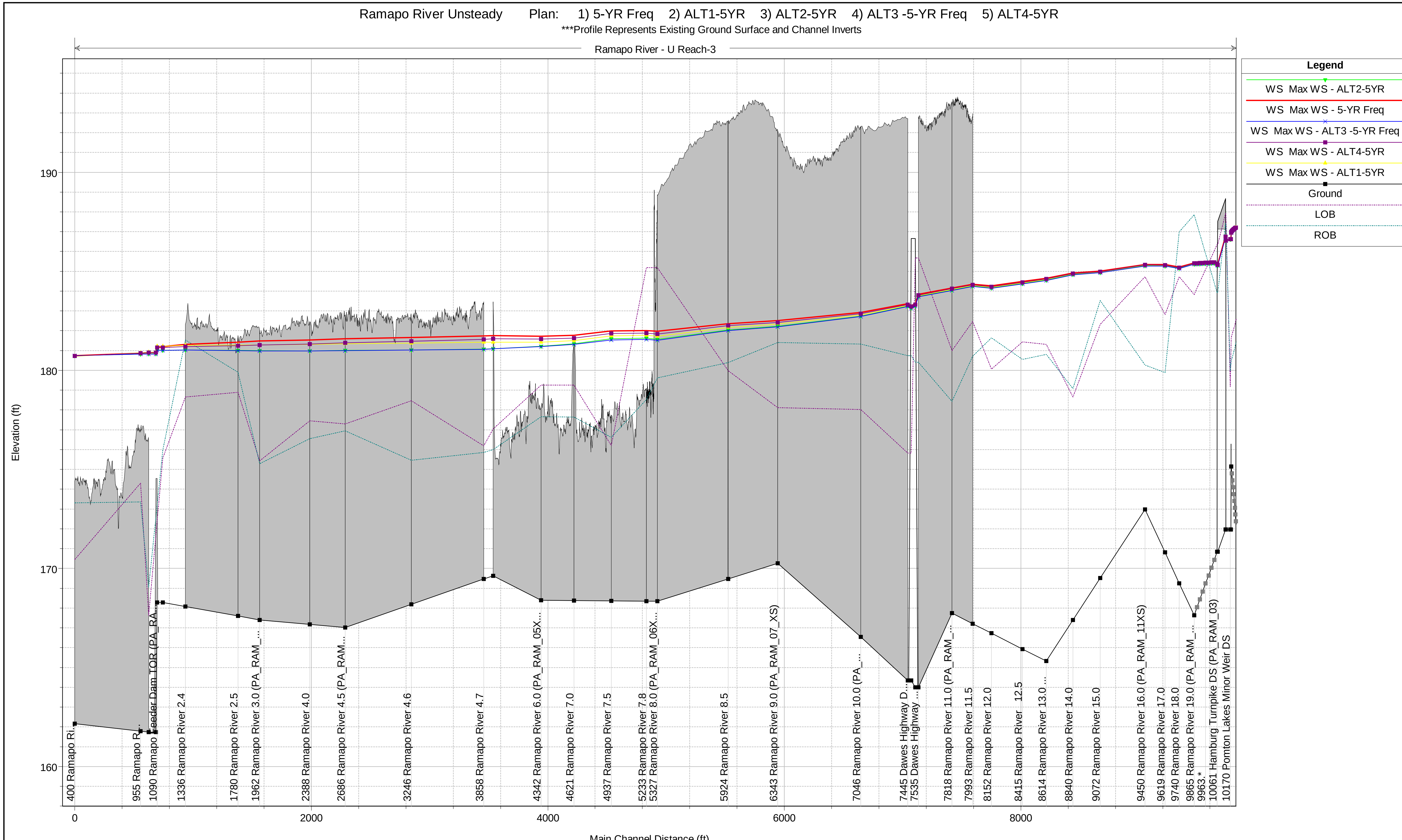
400 Ramapo Ri...
955 Ramapo R...
1090 Ramapo Feeder Dam TOR (PA_RA
1336 Ramapo River 2.4
1780 Ramapo River 2.5
1962 Ramapo River 3.0 (PA_RAM_...
2388 Ramapo River 4.0
2686 Ramapo River 4.5 (PA_RAM...
3246 Ramapo River 4.6
3858 Ramapo River 4.7
4342 Ramapo River 6.0 (PA_RAM_05X...
4621 Ramapo River 7.0
4937 Ramapo River 7.5
5233 Ramapo River 7.8
5327 Ramapo River 8.0 (PA_RAM_06X...
5924 Ramapo River 8.5
6343 Ramapo River 9.0 (PA_RAM_07_XS)
7046 Ramapo River 10.0 (PA_...
7445 Dawes Highway D...
7535 Dawes Highway ...
7818 Ramapo River 11.0 (PA_RAM_...
7993 Ramapo River 11.5
8152 Ramapo River 12.0
8415 Ramapo River 12.5
8614 Ramapo River 13.0 ...
8840 Ramapo River 14.0
9072 Ramapo River 15.0
9450 Ramapo River 16.0 (PA_RAM_11XS)
9619 Ramapo River 17.0
9740 Ramapo River 18.0
9865 Ramapo River 19.0 (PA_RAM_...
9963.*
10061 Hamburg Turnpike DS (PA_RAM_03)
10170 Pomton Lakes Minor Weir DS



Ramapo River Unsteady Plan: 1) 5-YR Freq 2) ALT1-5YR 3) ALT2-5YR 4) ALT3 -5-YR Freq 5) ALT4-5YR
***Profile Represents Existing Ground Surface and Channel Inverts
Ramapo River - U Reach-3
Legend
WS Max WS - ALT2-5YR
WS Max WS - 5-YR Freq
WS Max WS - ALT3 -5-YR Freq
WS Max WS - ALT4-5YR
WS Max WS - ALT1-5YR
Ground
LOB
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Elevation (ft)
Main Channel Distance (ft)
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1090 Ramapo Feeder Dam TOR (PA_RA...
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1780 Ramapo River 2.5
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3858 Ramapo River 4.7
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4621 Ramapo River 7.0
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6343 Ramapo River 9.0 (PA_RAM_07_XS)
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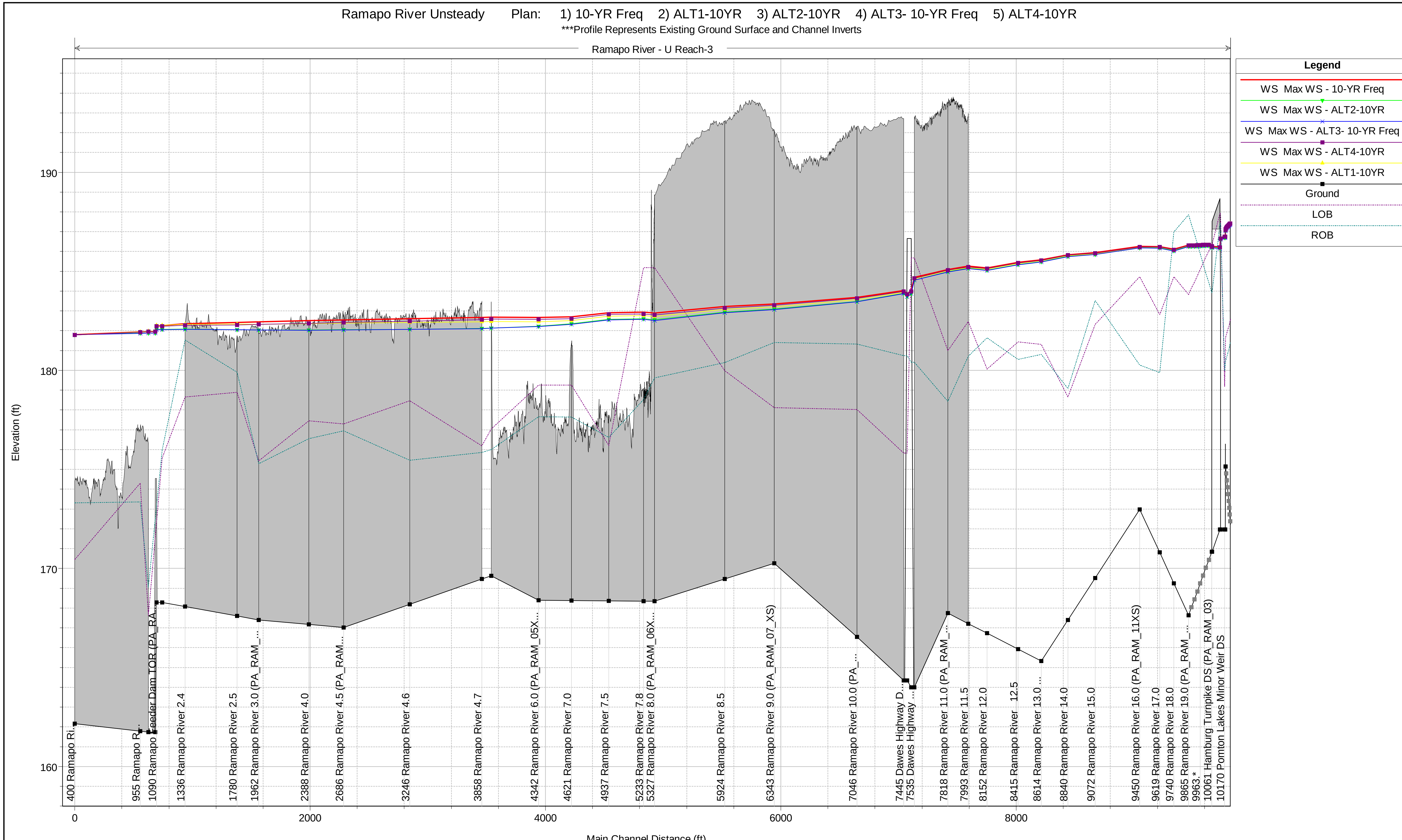
9963.*
10061 Hamburg Turnpike DS (PA_RAM_03)
10170 Pomton Lakes Minor Weir DS



Ramapo River Unsteady Plan: 1) 10-YR Freq 2) ALT1-10YR 3) ALT2-10YR 4) ALT3- 10-YR Freq 5) ALT4-10YR
***Profile Represents Existing Ground Surface and Channel Inverts
Ramapo River - U Reach-3
Legend
WS Max WS - 10-YR Freq
WS Max WS - ALT2-10YR
WS Max WS - ALT3- 10-YR Freq
WS Max WS - ALT4-10YR
WS Max WS - ALT1-10YR
Ground
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ROB
Elevation (ft)
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Main Channel Distance (ft)
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955 Ramapo R...
1090 Ramapo Feeder Dam TOR (PA_RA
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1780 Ramapo River 2.5
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3246 Ramapo River 4.6
3858 Ramapo River 4.7
4342 Ramapo River 6.0 (PA_RAM_05X...
4621 Ramapo River 7.0
4937 Ramapo River 7.5
5233 Ramapo River 7.8
5327 Ramapo River 8.0 (PA_RAM_06X...
5924 Ramapo River 8.5
6343 Ramapo River 9.0 (PA_RAM_07_XS)
7046 Ramapo River 10.0 (PA_...
7445 Dawes Highway D...
7535 Dawes Highway ...
7818 Ramapo River 11.0 (PA_RAM_...
7993 Ramapo River 11.5
8152 Ramapo River 12.0
8415 Ramapo River 12.5
8614 Ramapo River 13.0 ...
8840 Ramapo River 14.0
9072 Ramapo River 15.0
9450 Ramapo River 16.0 (PA_RAM_11XS)
9619 Ramapo River 17.0
9740 Ramapo River 18.0
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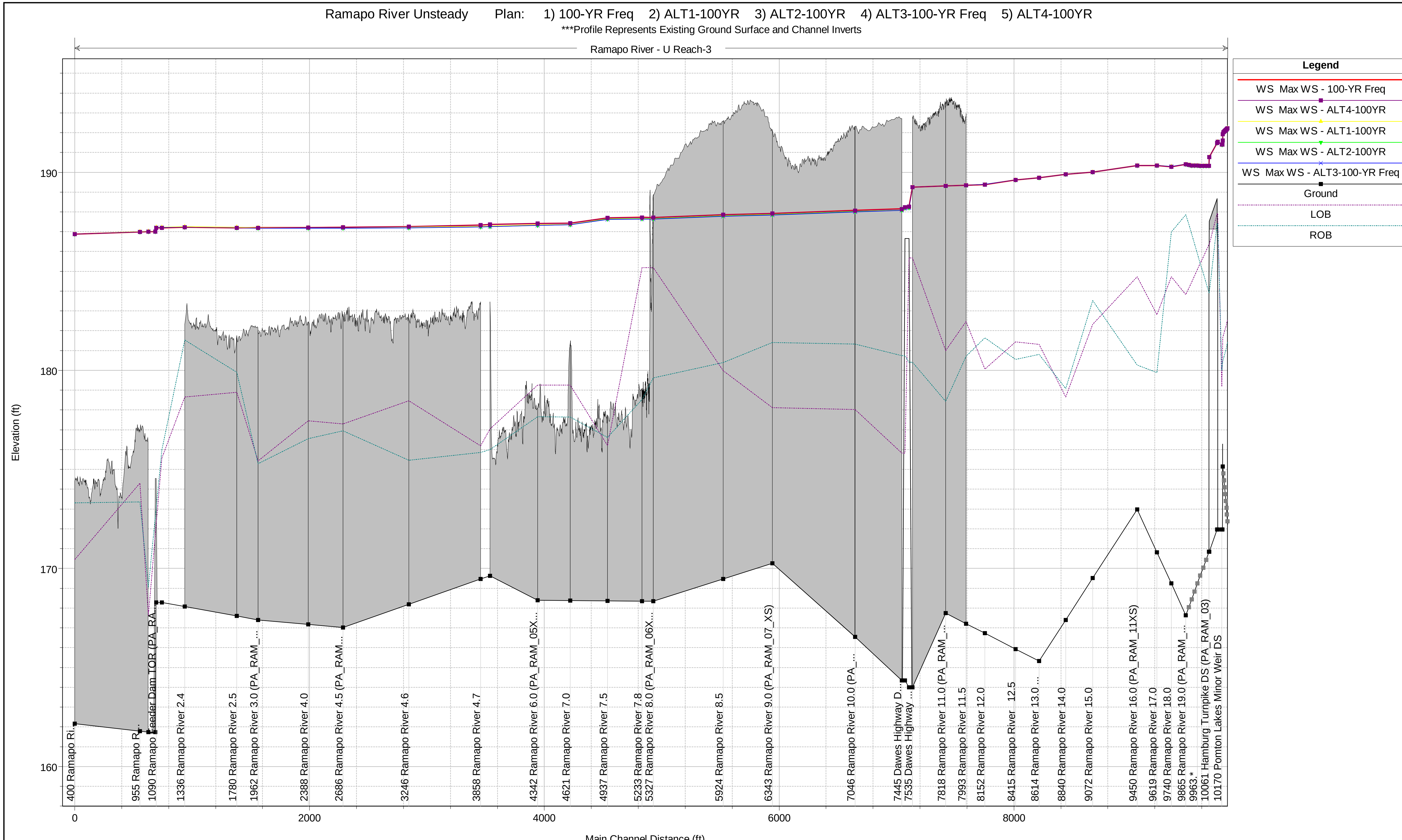
10061 Hamburg Turnpike DS (PA_RAM_03)
10170 Pompton Lakes Minor Weir DS


Ramapo River Unsteady Plan: 1) 100-YR Freq 2) ALT1-100YR 3) ALT2-100YR 4) ALT3-100-YR Freq 5) ALT4-100YR
***Profile Represents Existing Ground Surface and Channel Inverts
Ramapo River - U Reach-3
Legend
WS Max WS - 100-YR Freq
WS Max WS - ALT4-100YR
WS Max WS - ALT1-100YR
WS Max WS - ALT2-100YR
WS Max WS - ALT3-100-YR Freq
Ground
LOB
ROB
Elevation (ft)
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170
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Main Channel Distance (ft)
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400 Ramapo Ri...
955 Ramapo R...
1090 Ramapo Feeder Dam TOR (PA_RA
1336 Ramapo River 2.4
1780 Ramapo River 2.5
1962 Ramapo River 3.0 (PA_RAM_...
2388 Ramapo River 4.0
2686 Ramapo River 4.5 (PA_RAM...
3246 Ramapo River 4.6
3858 Ramapo River 4.7
4342 Ramapo River 6.0 (PA_RAM_05X...
4621 Ramapo River 7.0
4937 Ramapo River 7.5
5233 Ramapo River 7.8
5327 Ramapo River 8.0 (PA_RAM_06X...
5924 Ramapo River 8.5
6343 Ramapo River 9.0 (PA_RAM_07_XS)
7046 Ramapo River 10.0 (PA_...
7445 Dawes Highway D...
7535 Dawes Highway ...
7818 Ramapo River 11.0 (PA_RAM_...
7993 Ramapo River 11.5
8152 Ramapo River 12.0
8415 Ramapo River 12.5
8614 Ramapo River 13.0 ...
8840 Ramapo River 14.0
9072 Ramapo River 15.0
9450 Ramapo River 16.0 (PA_RAM_11XS)
9619 Ramapo River 17.0
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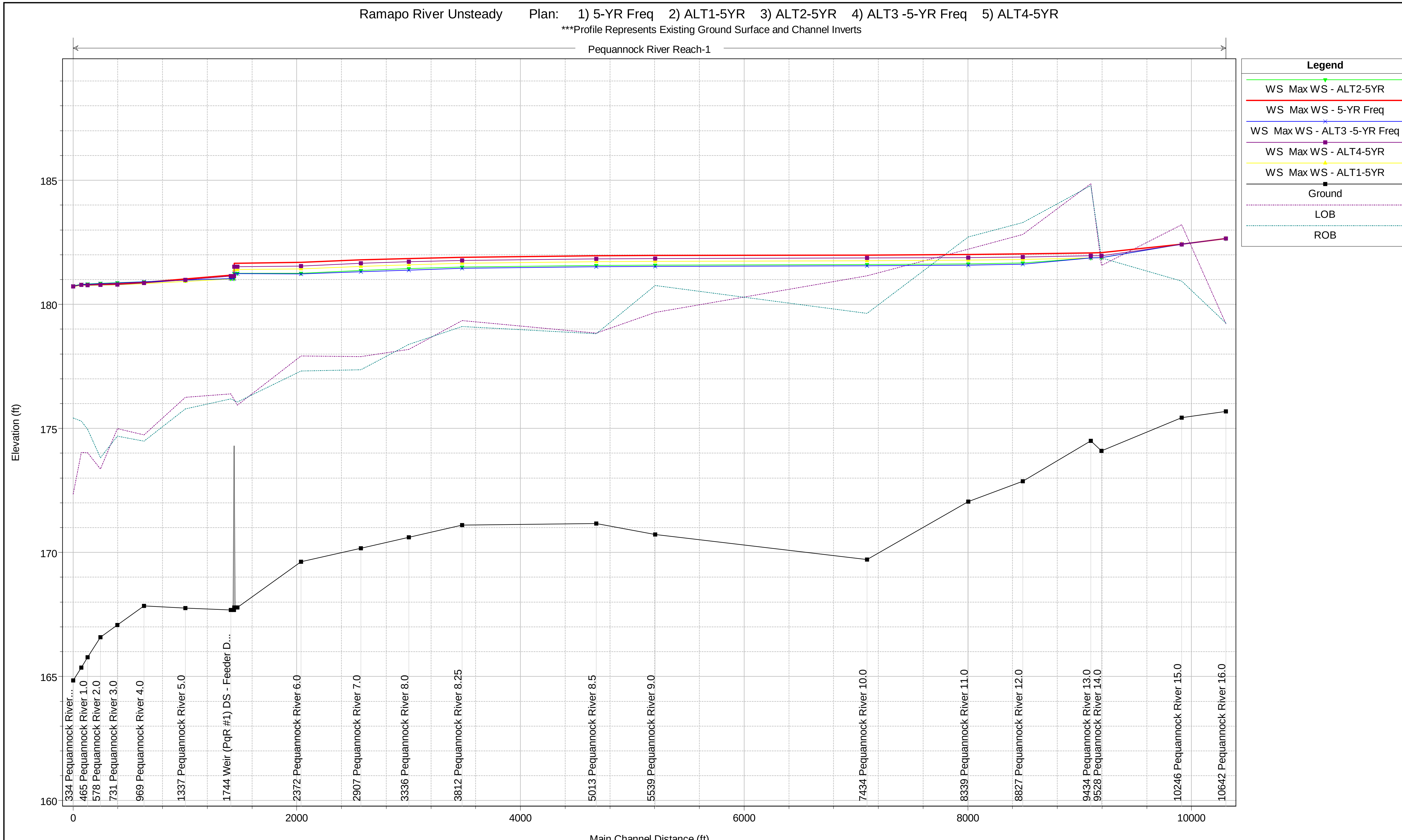
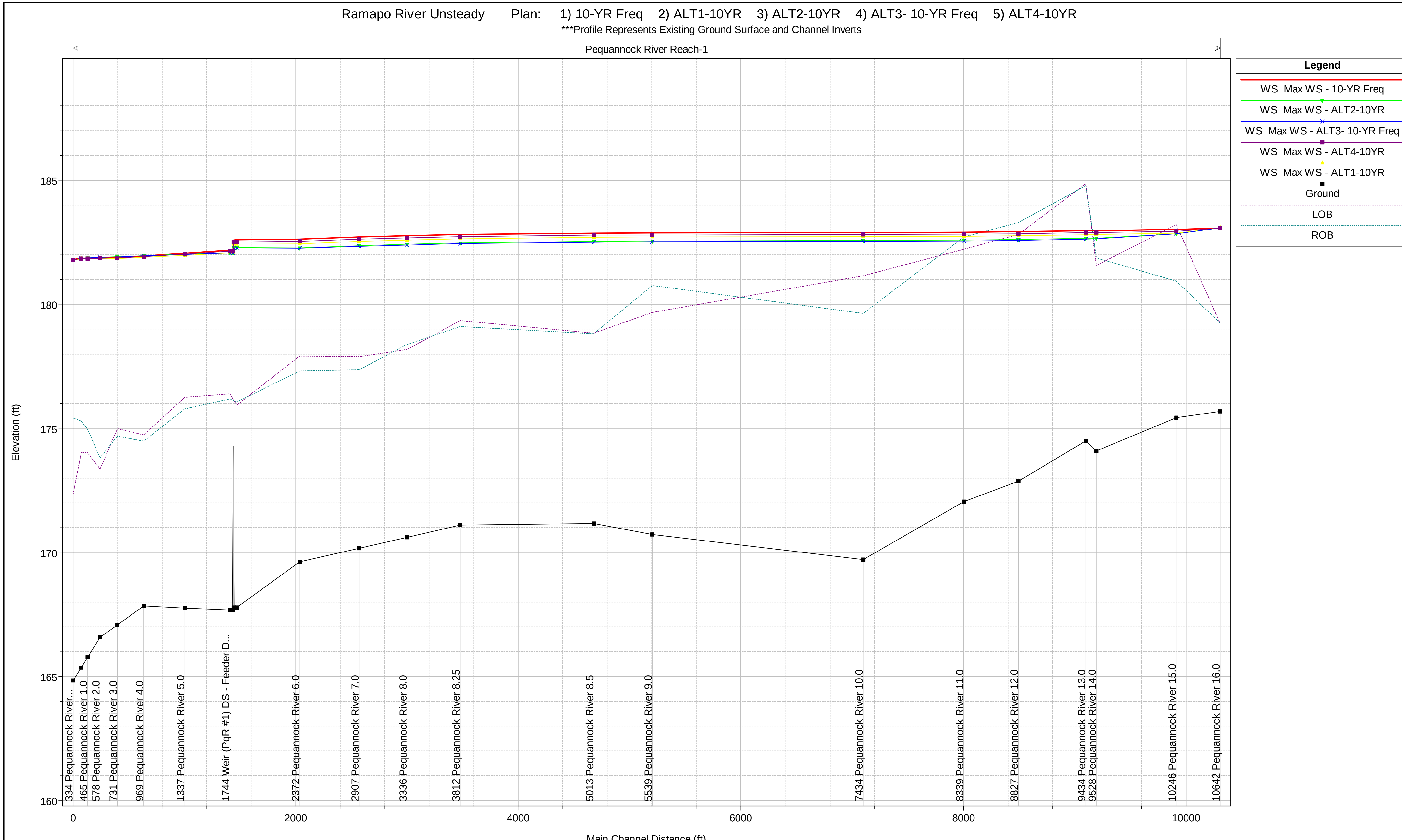
9865 Ramapo River 19.0 (PA_RAM_...
9963.*
10061 Hamburg Turnpike DS (PA_RAM_03)
10170 Pomton Lakes Minor Weir DS



Ramapo River Unsteady Plan: 1) 5-YR Freq 2) ALT1-5YR 3) ALT2-5YR 4) ALT3 -5-YR Freq 5) ALT4-5YR
***Profile Represents Existing Ground Surface and Channel Inverts
Pequannock River Reach-1
Legend
WS Max WS - ALT2-5YR
WS Max WS - 5-YR Freq
WS Max WS - ALT3 -5-YR Freq
WS Max WS - ALT4-5YR
WS Max WS - ALT1-5YR
Ground
LOB
ROB
Elevation (ft)
Main Channel Distance (ft)
334 Pequannock River...
465 Pequannock River 1.0
578 Pequannock River 2.0
731 Pequannock River 3.0
969 Pequannock River 4.0
1337 Pequannock River 5.0
1744 Weir (PqR #1) DS - Feeder D...
2372 Pequannock River 6.0
2907 Pequannock River 7.0
3336 Pequannock River 8.0
3812 Pequannock River 8.25
5013 Pequannock River 8.5
5539 Pequannock River 9.0
7434 Pequannock River 10.0
8339 Pequannock River 11.0
8827 Pequannock River 12.0
9434 Pequannock River 13.0
9528 Pequannock River 14.0
10246 Pequannock River 15.0
10642 Pequannock River 16.0


Ramapo River Unsteady Plan: 1) 10-YR Freq 2) ALT1-10YR 3) ALT2-10YR 4) ALT3- 10-YR Freq 5) ALT4-10YR
***Profile Represents Existing Ground Surface and Channel Inverts
Pequannock River Reach-1
Legend
WS Max WS - 10-YR Freq
WS Max WS - ALT2-10YR
WS Max WS - ALT3- 10-YR Freq
WS Max WS - ALT4-10YR
WS Max WS - ALT1-10YR
Ground
LOB
ROB
Elevation (ft)
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165
160
334 Pequannock River...
465 Pequannock River 1.0
578 Pequannock River 2.0
731 Pequannock River 3.0
969 Pequannock River 4.0
1337 Pequannock River 5.0
1744 Weir (PqR #1) DS - Feeder D...
2372 Pequannock River 6.0
2907 Pequannock River 7.0
3336 Pequannock River 8.0
3812 Pequannock River 8.25
5013 Pequannock River 8.5
5539 Pequannock River 9.0
7434 Pequannock River 10.0
8339 Pequannock River 11.0
8827 Pequannock River 12.0
9434 Pequannock River 13.0
9528 Pequannock River 14.0
10246 Pequannock River 15.0
10642 Pequannock River 16.0
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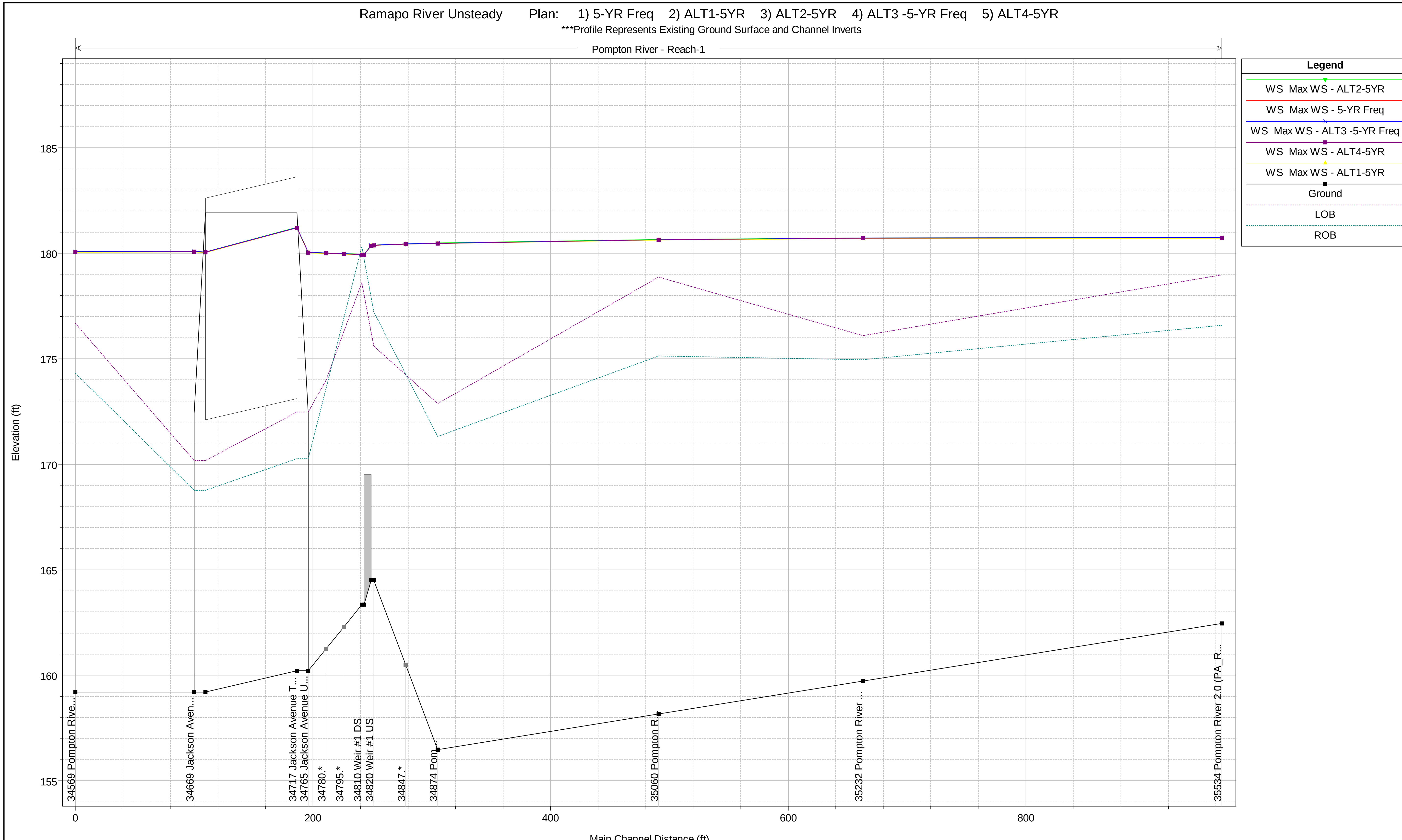

Ramapo River Unsteady Plan: 1) 5-YR Freq 2) ALT1-5YR 3) ALT2-5YR 4) ALT3 -5-YR Freq 5) ALT4-5YR
***Profile Represents Existing Ground Surface and Channel Inverts
Pompton River - Reach-1
Legend
WS Max WS - ALT2-5YR
WS Max WS - 5-YR Freq
WS Max WS - ALT3 -5-YR Freq
WS Max WS - ALT4-5YR
WS Max WS - ALT1-5YR
Ground
LOB
ROB
Elevation (ft)
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170
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160
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34569 Pompton Rive...
34669 Jackson Aven...
34717 Jackson Avenue T...
34765 Jackson Avenue U...
34780.*
34795.*
34810 Weir #1 DS
34820 Weir #1 US
34847.*
34874 Pom...
35060 Pompton R...
35232 Pompton River ...
35534 Pompton River 2.0 (PA_R...
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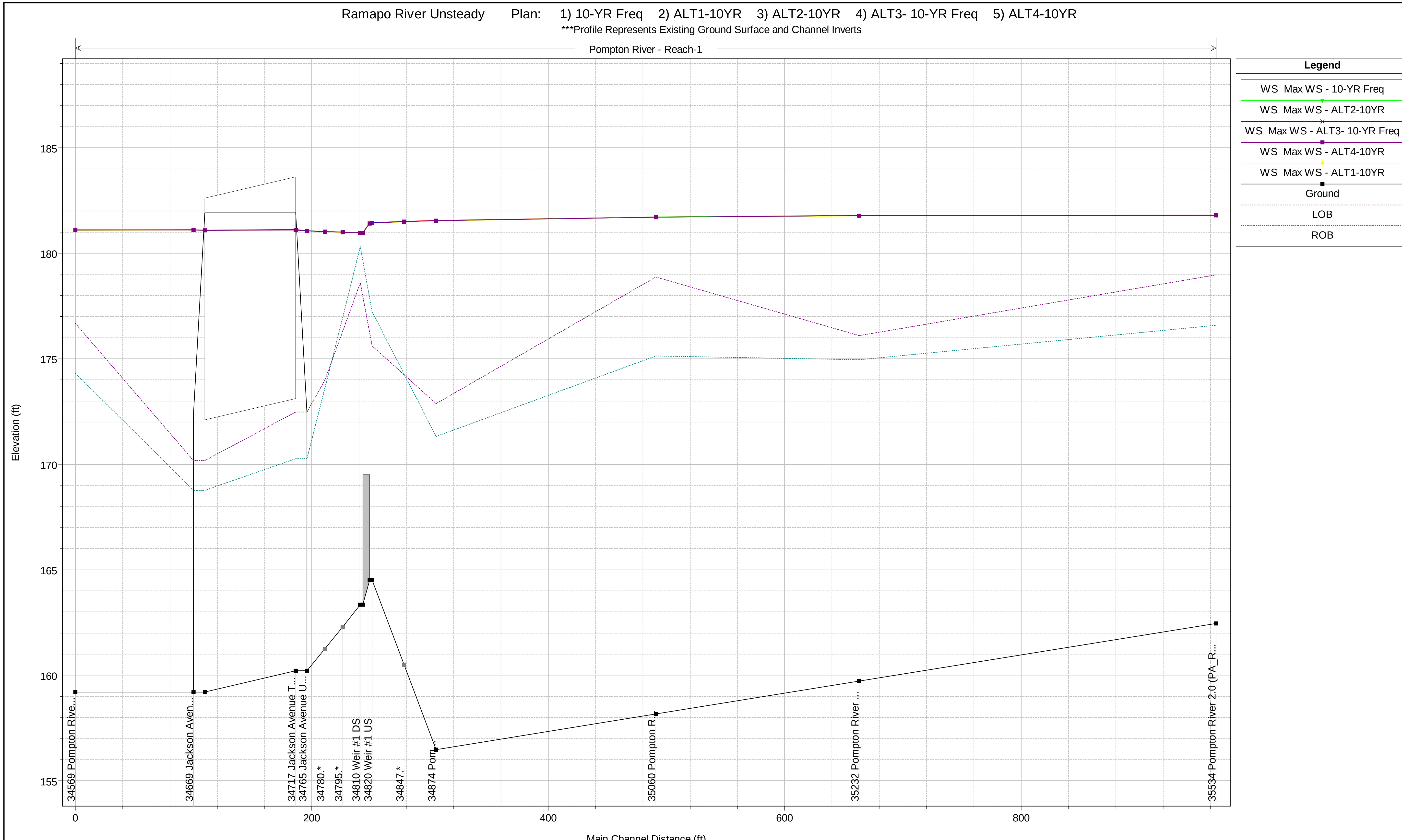
Main Channel Distance (ft)



Ramapo River Unsteady Plan: 1) 10-YR Freq 2) ALT1-10YR 3) ALT2-10YR 4) ALT3- 10-YR Freq 5) ALT4-10YR
***Profile Represents Existing Ground Surface and Channel Inverts
Pompton River - Reach-1
Legend
WS Max WS - 10-YR Freq
WS Max WS - ALT2-10YR
WS Max WS - ALT3- 10-YR Freq
WS Max WS - ALT4-10YR
WS Max WS - ALT1-10YR
Ground
LOB
ROB
Elevation (ft)
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160
155
34569 Pompton Rive...
34669 Jackson Aven...
34717 Jackson Avenue T...
34765 Jackson Avenue U...
34780.*
34795.*
34810 Weir #1 DS
34820 Weir #1 US
34847.*
34874 Pom...
35060 Pompton R...
35232 Pompton River ...
35534 Pompton River 2.0 (PA_R...
0
200
400
600
800
Main Channel Distance (ft)

APPENDIX D
COST ANALYSIS

Alternative 1 - Construction Cost Estimate

Alternative 2 - Construction Cost Estimate

Alternative 3 - Construction Cost Estimate

Alternative 4 - Construction Cost Estimate

ALTERNATIVE 1 - CONSTRUCTION COST ESTIMATE
Feasiblity Study for the Removal of the Pompton Dam and Pequannock Dam
June 2012

		Quantity	Unit	Unit Cost	Total
DIVISION 01 - GENERAL REQUIREMENTS					
01-55-13	Temporary Access Road	1	LS	$50,000	$50,000
01-57-13	Soil Erosion and Sediment Control	1	LS	$35,000	$35,000
01-57-19	Environmental Protection	1	LS	$25,000	$25,000
01-57-22	Temporary Stream Diversion	1	LS	$30,000	$30,000
01-71-13	Mobilization, Admin. and Demobilization	1	LS	$75,000	$75,000
01-71-23	Field Engineering	1	LS	$25,000	$25,000
DIVISION 02 - EXISTING CONDITIONS					
02-40-00	Demolition and Disposal of Concrete	1,150	Cu.Yd.	$125	$143,750
DIVISION 31 - EARTHWORK					
31-11-00	Clearing and Grubbing	1	LS	$80,000	$80,000
31-22-13	Rough Grading	1	LS	$30,000	$30,000
DIVISION 32 - EXTERIOR IMPROVEMENTS					
32-92-00	Topsoil and Seeding	1	LS	$50,000	$50,000
DIVISION 35 - WATERWAY AND MARINE CONSTRUCTIO					
35-20-23	Dredging of River Sediment	138,000	Cu.Yd.	$60	$8,280,000
	Dredging of Timber/Rockfill Remnants	2,000	Cu.Yd.	$75	$150,000
	Disposal of "Clean" River Sediment	140,000	Cu.Yd.	$35	$4,900,000
		30% Contingency			$4,162,125
				ESTIMATED TOTAL =	**$18,000,000**

ALTERNATIVE 2 - CONSTRUCTION COST ESTIMATE
Feasiblity Study for the Removal of the Pompton Dam and Pequannock Dam
June 2012

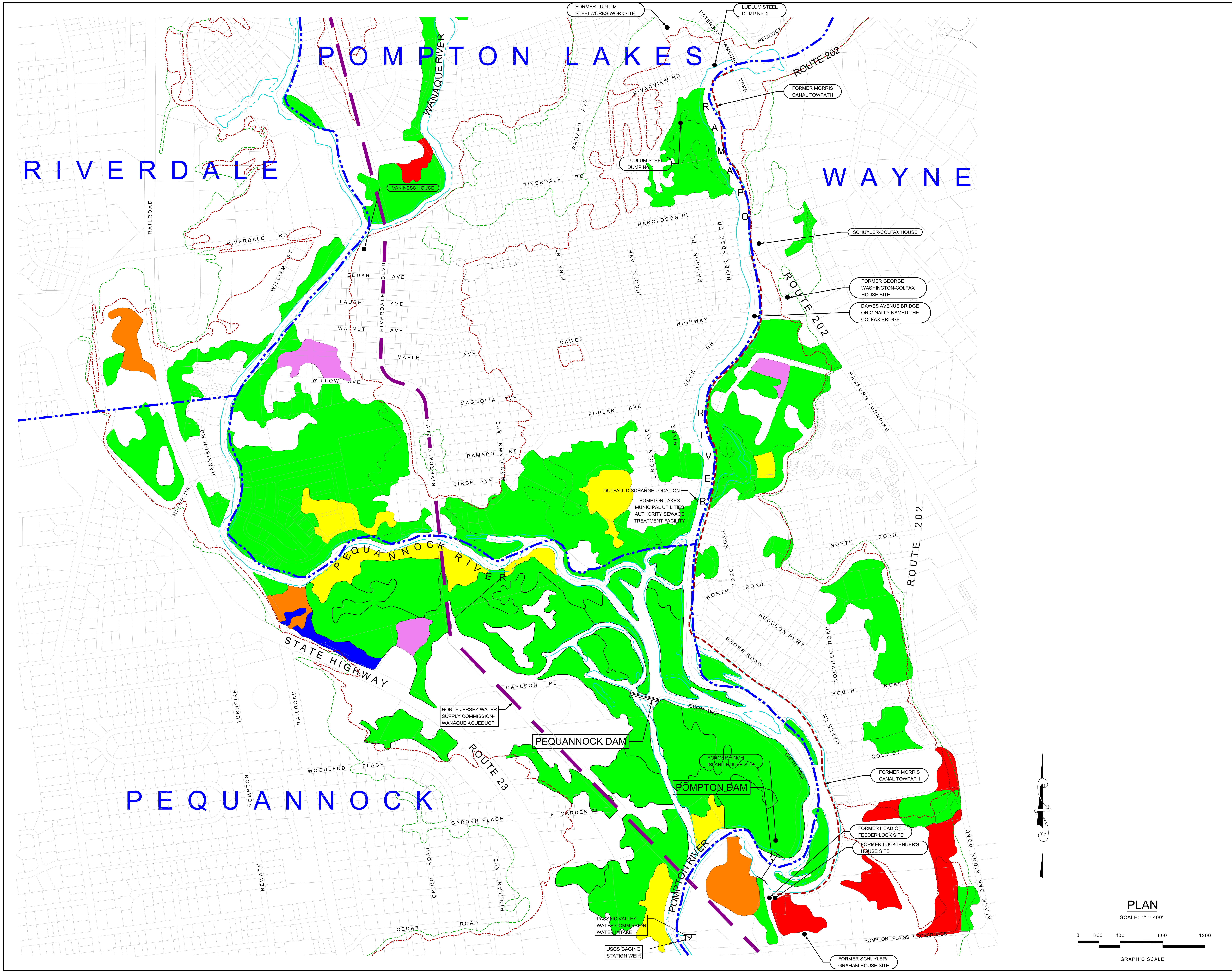
		Quantity	Unit	Unit Cost	Total
DIVISION 01 - GENERAL REQUIREMENTS					
01-55-13	Temporary Access Road	1	LS	$50,000	$50,000
01-57-13	Soil Erosion and Sediment Control	1	LS	$35,000	$35,000
01-57-19	Environmental Protection	1	LS	$25,000	$25,000
01-57-22	Temporary Stream Diversion	1	LS	$30,000	$30,000
01-71-13	Mobilization, Admin. and Demobilization	1	LS	$75,000	$75,000
01-71-23	Field Engineering	1	LS	$25,000	$25,000
DIVISION 02 - EXISTING CONDITIONS					
02-40-00	Demolition and Disposal of Concrete	1,150	Cu.Yd.	$125	$143,750
DIVISION 31 - EARTHWORK					
31-11-00	Clearing and Grubbing	1	LS	$80,000	$80,000
31-14-00	Stripping	2,500	Cu.Yd.	$15	$37,500
31-22-13	Rough Grading	1	LS	$8,000	$8,000
31-22-16	Fine Grading	1	LS	$25,000	$25,000
31-23-13	Excavation	3,500	Cu.Yd.	$50	$175,000
DIVISION 32 - EXTERIOR IMPROVEMENTS					
32-92-00	Topsoil and Seeding	1	LS	$50,000	$50,000
DIVISION 35 - WATERWAY AND MARINE CONSTRUCTIO					
35-20-23	Dredging of River Sediment	138,000	Cu.Yd.	$60	$8,280,000
	Dredging of Timber/Rockfill Remnants	2,000	Cu.Yd.	$75	$150,000
	Disposal of "Clean" River Sediment	140,000	Cu.Yd.	$35	$4,900,000
		30% Contingency			$4,226,775
				ESTIMATED TOTAL =	**$18,300,000**

ALTERNATIVE 3 - CONSTRUCTION COST ESTIMATE
Feasiblity Study for the Removal of the Pompton Dam and Pequannock Dam
June 2012

DIVISION 01 - GENERAL REQUIREMENTS		Quantity	Unit	Unit Cost	Total
01-55-13	Temporary Access Road	1	LS	$70,000	$70,000
01-57-13	Soil Erosion and Sediment Control	1	LS	$45,000	$45,000
01-57-19	Environmental Protection	1	LS	$35,000	$35,000
01-57-22	Temporary Stream Diversion	1	LS	$45,000	$45,000
01-71-13	Mobilization, Admin. and Demobilization	1	LS	$90,000	$90,000
01-71-23	Field Engineering	1	LS	$30,000	$30,000
DIVISION 02 - EXISTING CONDITIONS					
02-40-00	Demolition and Disposal of Concrete	1,450	Cu.Yd.	$125	$181,250
DIVISION 31 - EARTHWORK					
31-11-00	Clearing and Grubbing	1	LS	$80,000	$80,000
31-14-00	Stripping	2,500	Cu.Yd.	$15	$37,500
31-22-13	Rough Grading	1	LS	$8,000	$8,000
31-22-16	Fine Grading	1	LS	$25,000	$25,000
31-23-13	Excavation	3,500	Cu.Yd.	$50	$175,000
DIVISION 32 - EXTERIOR IMPROVEMENTS					
32-92-00	Topsoil and Seeding	1	LS	$60,000	$60,000
DIVISION 35 - WATERWAY AND MARINE CONSTRUCTIO					
35-20-23	Dredging of River Sediment	165,000	Cu.Yd.	$60	$9,900,000
	Dredging of Timber/Rockfill Remnants	2,000	Cu.Yd.	$75	$150,000
	Disposal of "Clean" River Sediment	140,000	Cu.Yd.	$35	$4,900,000
	Disposal of "Contaminated" River Sediment	27,000	Cu.Yd.	$120	$3,240,000
		30% Contingency			$5,721,525
				ESTIMATED TOTAL =	**$24,800,000**

ALTERNATIVE 4 - CONSTRUCTION COST ESTIMATE
Feasiblity Study for the Removal of the Pompton Dam and Pequannock Dam
June 2012

		Quantity	Unit	Unit Cost	Total
DIVISION 01 - GENERAL REQUIREMENTS					
01-55-13	Temporary Access Road	1	LS	$50,000	$50,000
01-57-13	Soil Erosion and Sediment Control	1	LS	$35,000	$35,000
01-57-19	Environmental Protection	1	LS	$25,000	$25,000
01-57-22	Temporary Stream Diversion	1	LS	$30,000	$30,000
01-71-13	Mobilization, Admin. and Demobilization	1	LS	$75,000	$75,000
01-71-23	Field Engineering	1	LS	$25,000	$25,000
DIVISION 02 - EXISTING CONDITIONS					
02-40-00	Demolition and Disposal of Concrete	1,050	Cu.Yd.	$125	$131,250
DIVISION 31 - EARTHWORK					
31-11-00	Clearing and Grubbing	1	LS	$80,000	$80,000
31-22-13	Rough Grading	1	LS	$30,000	$30,000
DIVISION 32 - EXTERIOR IMPROVEMENTS					
32-92-00	Topsoil and Seeding	1	LS	$50,000	$50,000
DIVISION 35 - WATERWAY AND MARINE CONSTRUCTIO					
35-20-23	Dredging of River Sediment	20,160	Cu.Yd.	$60	$1,209,600
	Dredging of Timber/Rockfill Remnants	1,600	Cu.Yd.	$75	$120,000
	Disposal of "Clean" River Sediment	21,000	Cu.Yd.	$35	$735,000
	Disposal of "Contaminated" River Sediment	760	Cu.Yd.	$120	$91,200
		30% Contingency			$806,115
				ESTIMATED TOTAL =	**$3,500,000**



1. PARCEL LAYOUT, COUNTY BOUNDARY LINES AND RIVER EDGES WERE OBTAINED FROM THE NEW JERSEY GEOGRAPHIC INFORMATION NETWORK.

2. 100-YR AND 500-YR FLOOD LINES FOR MORRIS COUNTY ARE APPROXIMATE AND HAVE BEEN DIGITIZED USING THE FEMA FLOOD INSURANCE RATE MAPS FOR RIVERDALE AND PEQUANNOCK.

3. 100-YR AND 500-YR FLOOD LINES FOR PASSAIC COUNTY ARE BASED ON A .SHP FILE OBTAINED FROM FEMA MAP SERVICE DIGITAL FLOOD INSURANCE RATE MAP.

4. WETLAND DELINEATION LINES WERE OBTAINED FROM THE NJDEP GIS WEBSITE.

WETLANDS LEGEND

- AGRICULTURAL
- DECIDUOUS SCRUB/SHRUB
- DECIDUOUS WOODED
- DISTURBED (MODIFIED)
- HERBACEOUS
- MANAGED (MODIFIED)

LEGEND

- EDGE OF WATER
- 100 YR FLOOD LINE
- 500 YR FLOOD LINE
- MUNICIPAL AND COUNTY BOUNDARY LINE
- HISTORIC FEATURE

PROJECT:

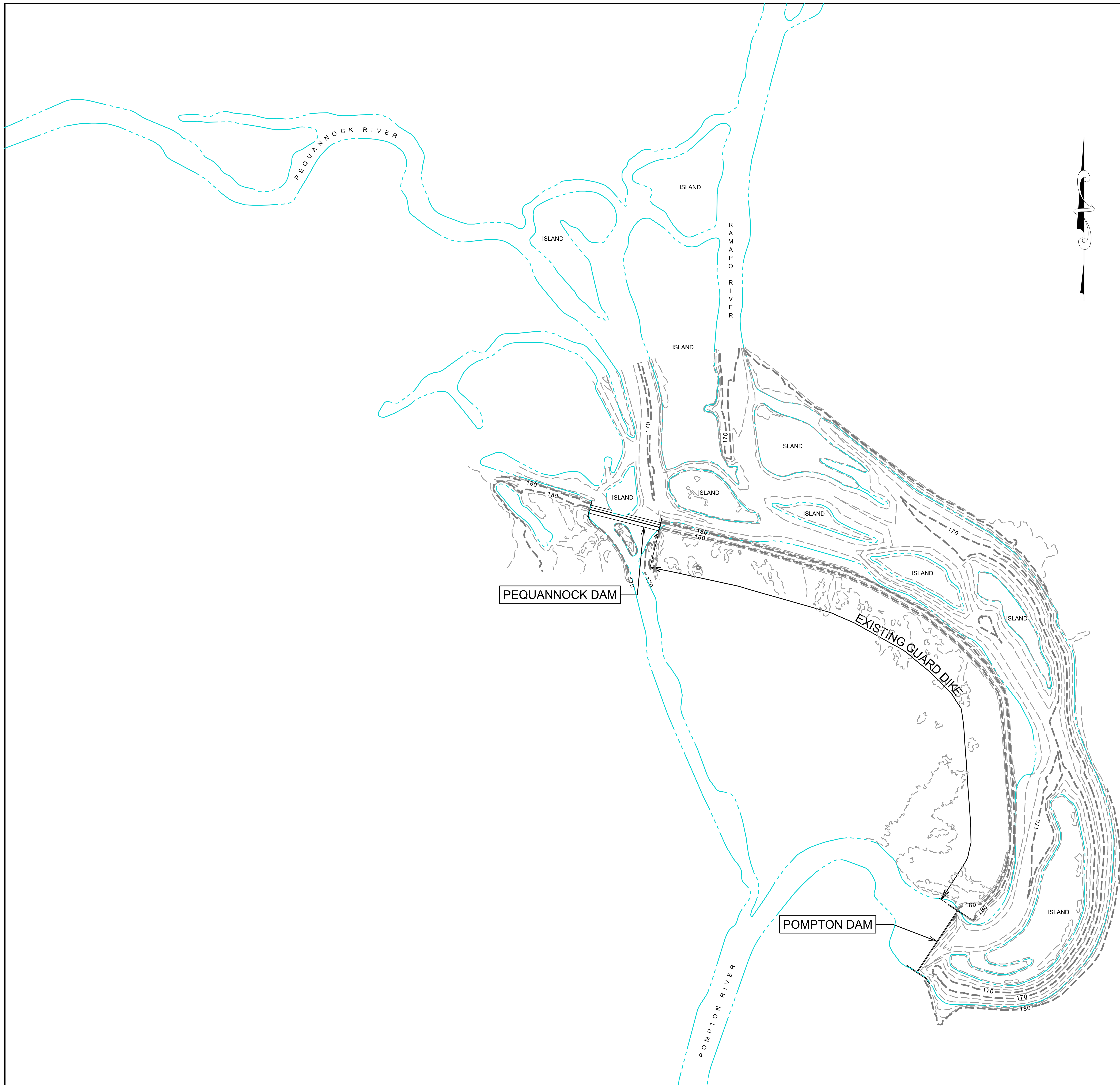
FEASIBILITY STUDY
for the
REMOVAL of POMPTOM DAM
and PEQUANNOCK DAM

Morris County and Passaic County, New Jersey

TITLE:

PLAN OF STUDY AREA
Plate 1

CIVIL DYNAMICS, inc.
CERTIFICATE of AUTHORIZATION No. 24GA27966500
109A County Rte. 515, P.O.Box 760, Stockholm, N.J. 07460-0760
Phone (973) 697-3496 Fax (973) 697-1678



PLAN

SCALE: 1" = 200'

0 100 200 400 600

GRAPHIC SCALE

1. EXISTING TOPO AND FEATURES ARE BASED ON A SURVEY BY AECOM IN FEBRUARY 2012 AND CIVIL DYNAMICS, INC. IN DECEMBER 2011 AND FEBRUARY 2012. DEPTH OF WATER MEASUREMENTS CONDUCTED BY CIVIL DYNAMICS, INC. IN NOVEMBER 2011. LiDAR AND AERIAL PHOTOS WERE USED TO SUPPLEMENT THE SURVEYED FIELD DATA IN THE DEVELOPMENT OF THE EXISTING TOPOGRAPHY.

2. VERTICAL DATUM IS NAVD 88.

LEGEND

EDGE OF WATER

170 EXISTING CONTOUR

PROJECT:

FEASIBILITY STUDY
for the
REMOVAL of POMPTOM DAM
and PEQUANNOCK DAM

Morris County and Passaic County, New Jersey

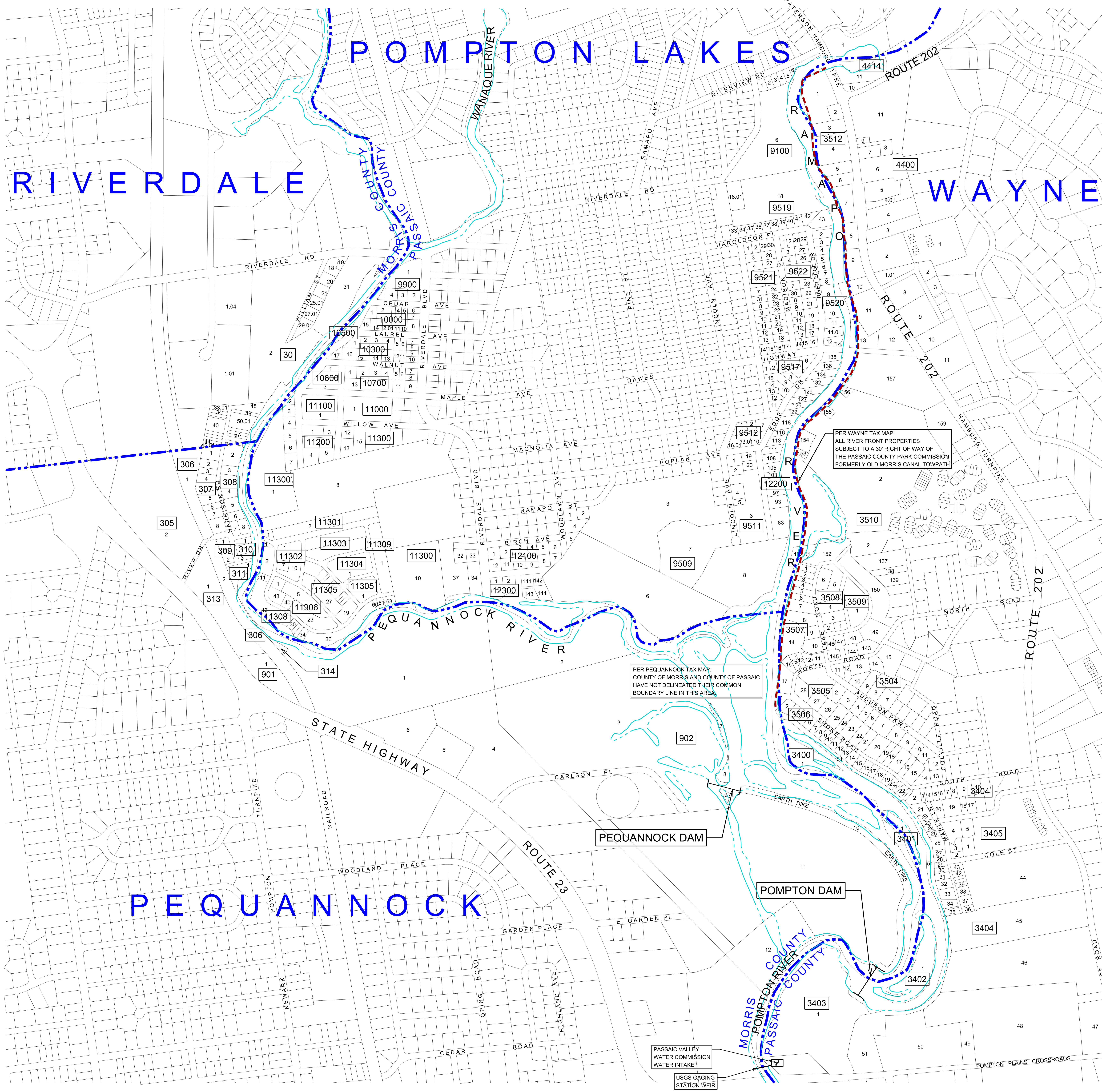
TITLE:

ENLARGED PLAN
OF
DAM STRUCTURES
WITH BATHYMETRIC CONTOURS
Plate 2

CIVIL DYNAMICS, inc.

CERTIFICATE of AUTHORIZATION No. 24GA27966500

109A County Rte. 515, P.O.Box 760, Stockholm, N.J. 07460-0760
Phone (973) 697-3496 Fax (973) 697-1678



WATERFRONT PROPERTY OWNERSHIP

Pompton Lakes

BLOCK	LOT	OWNER
9100	5	HEAD, WILLIAM & HELEN
9100	6	BOROUGH OF POMPTON LAKES
9509	6	PASSAIC COUNTY PARK COMM.
9509	8	MUNICIPAL UTILITIES AUTHORITY
9509	143	ZAKU, MINIR & NAZIBE & ZAKU, URIM
9509	144	BOROUGH OF POMPTON LAKES
9519	18	BOROUGH OF POMPTON LAKES
9519	43	STATE OF NJ - DEP
9520	2	ISDANAVICH THOMAS
9520	3	STATE OF NJ - DEP
9520	4	ZAKU KUJTIM & NEDZIBIJE
9520	5	STATE OF NJ - DEP
9520	6	STATE OF NJ - DEP
9520	7	STATE OF NJ - DEP
9520	8	BOROUGH OF POMPTON LAKES
9520	9	BOROUGH OF POMPTON LAKES
9520	10	STATE OF NJ - DEP
9520	11	BAS, TLYAZ & HANIFE
9520	11.01	YILDIRIM, UNAL & DILBER
9520	12	BOROUGH OF POMPTON LAKES
9520	14	BOROUGH OF POMPTON LAKES
9900	1	BULACAN ARTHUR & ZENAIDA H/W
10000	1	CASTRO WERNY & ENEIDA
10000	15	ZAKU SEVGIM & AF H/W
10300	1	STATE OF NJ - DEP
10300	17	COOPER, FRANK & VICTORIA
10500	1	BOROUGH OF POMPTON LAKES
10500	1.01	UNKNOWN
10500	1.02	UNKNOWN
10600	1	STATE OF NJ - DEP
10600	3	BOROUGH OF POMPTON LAKES
11300	1	BOROUGH OF POMPTON LAKES
11300	2	BOROUGH OF POMPTON LAKES
11300	3	BOROUGH OF POMPTON LAKES
11300	8	BOROUGH OF POMPTON LAKES
11300	10	STATE OF NJ - DEP
11300	34	BOROUGH OF POMPTON LAKES
11300	37	STATE OF NJ - DEP
11301	1	PASSAIC COUNTY PARK COMMISSION
11308	1	PASSAIC COUNTY PARK COMM
11308	2	STATE OF NJ - DEP
11308	11	PASSAIC COUNTY PARK COMM.
11308	13	STATE OF NJ - DEP
11308	30	BOROUGH OF POMPTON LAKES
11308	32	STATE OF NJ - DEP
11308	33	BOROUGH OF POMPTON LAKES
11308	34	BOROUGH OF POMPTON LAKES
11308	36	STATE OF NJ - DEP
11308	60	VALENTINI NICHOLAS & CATHERINE
11308	61	KRAFT, ROBERT
11308	63	STATE OF NJ - DEP
12200	83	BOROUGH OF POMPTON LAKES
12200	93	STATE OF NJ - DEP
12200	97	STATE OF NJ - DEP
12200	103	BOROUGH OF POMPTON LAKES
12200	105	FURTUN ZULFIYE
12200	108	NOVACK, FREDERICK & LILY
12200	111	MONDO, SALVATORE & SERAFINA
12200	113	STATE OF NJ - DEP
12200	116	STATE OF NJ - DEP
12200	118	STATE OF NJ - DEP
12200	122	STATE OF NJ - DEP
12200	126	EMC MORTGAGE CORP
12200	127	STATE OF NJ - DEP
12200	129	STATE OF NJ - DEP
12200	132	STATE OF NJ - DEP
12200	134	STATE OF NJ - DEP
12200	136	SAVONA, GIUSEPPE & CARMELA
12200	138	STATE OF NJ - DEP
12300	2	BOROUGH OF POMPTON LAKES

Pequannock

BLOCK	LOT	OWNER
306	2	NY SUSQUEHANNA & WESTERN RAILWAY
308	1	VANTYUL, STEVEN
308	2	PEQUANNOCK TOWNSHIP
308	3	STATE OF NJ - DEP
308	4	PEQUANNOCK TOWNSHIP
308	5	PEQUANNOCK TOWNSHIP
308	6	PEQUANNOCK TOWNSHIP
308	7	PEQUANNOCK TOWNSHIP
310	1	PEQUANNOCK TOWNSHIP
310	2	STATE OF NJ - DEP
310	3	PEQUANNOCK TOWNSHIP
311	1	PEQUANNOCK TOWNSHIP
314	1	PEQUANNOCK TOWNSHIP
902	1	PEQUANNOCK TOWNSHIP
902	2	PASSAIC CTY PK COMM
902	3	BAUER, KARL
902	7	UNKNOWN
902	8	UNKNOWN
902	9	UNKNOWN
902	10	UNKNOWN
902	11	CARLO & JOHN COVELLO

Wayne

BLOCK	LOT	OWNER
3400	1	PASSAIC COUNTY PARKS DEPARTMENT
3401	1	PASSAIC COUNTY PARKS DEPARTMENT
3402	1	PASSAIC COUNTY PARKS DEPARTMENT
3403	1	ROMBOUGH, ALLAN J SR
3404	1	RAISSIS, BEVERLY
3404	2	DE GROAT, JASON & MERCEDES
3404	21	JORDAN, THOMAS M & KAREN
3404	22	JORDAN, THOMAS M & KAREN
3404	23	CANCRO, LYNN
3404	24	GRESSIANU, FLORIANA
3404	25	LANG, BARBARA & LANG, MARK G
3404	26	LANG, MARK & DORIS
3404	27	BRENNAN, COLLEEN
3404	28	RUCKER, MARIA
3404	29	815 RINGWOOD AVE REALTY, LLC
3404	30	ALIAGA, JUAN
3404	31	KANG, MOON BACK & SEON HEE CHO
3404	32	JAMANDRE,EDEN
3404	33	HARTY, ROBIN L
3404	34	MUCKRIDGE, JANE COLE
3404	34.01	TOWNSHIP OF WAYNE
3404	35	BROWER, JOHN O & KATHLEEN
3404	45	KUEHM, GEORGE & IRENE
3404	46	KUEHM, GEORGE & IRENE
3404	48	PASSAIC COUNTY
3404	50	UNITED STATES POSTAL SERVICE
3404	51	PASSAIC COUNTY PARKS DEPARTMENT
3506	1	METER VALERIE
3506	2	MANCINO, JERRY E
3506	3	OSMANI, NERMINE
3506	4	OSMANI, PAJAZIT & NERMINE
3506	5	HOWAI, ALVIN & JENNIFER
3506	6	MALICI, MEDI & LATIFE
3506	7	BINDHAMMER, K & NIELSEN, C
3506	8	HANDL, GYORGY & ZSUZSANNA TURI
3506	9	ABATE, JEAN E
3506	10	DENIZ, GURAY & AYFER
3506	11	STENDER, GEORGE W II
3506	12	IRETON, DEBRA & MICHAEL
3506	13	GIORDANO, ROBERT V
3506	14	RUST, ANGELA
3506	15	BARTILOTTA, SALVATORE
3506	16	MACEMON, CHRISTINE
3506	17	PARNO-SAPANARO, CHERYLYNN
3506	18	MC EWAN, ROBERT D
3506	19	SADEK, KHALED
3506	20	WHALEN, DENNIS
3506	21	FROATZ, TYLER J & JEANNE M
3506	22	CAMPBELL, ALBERT & SHIRLEY
3507	1	HOFFMAN, NICHOLAS & MEGHAN
3507	2	ALBERT, PAUL E & RUTH
3507	3	TRACY, HAROLD
3507	4	MILLER, ERIC & PHYLLIS
3507	5	GILL, JOHN D
3507	6	OH, STEVE SI WHAN
3507	7	MARTELL, JOSE
3507	8	LACHOCKI, HELEN
3507	9	LACHOCKI, DEZYDERIUSZ& HELEN
3507	10	KEAY, DOUGLAS & KRISTEN
3507	11	CROWLEY, ROBERT & JOAN
3507	12	ARTEAGA, BEATRICE
3507	13	EBERLE,ERIC, MORELLI,A & ANTOINE,B
3507	14	PASSAIC CTY PARK COMMISSION
3507	15	TIERNEY, JAMES B & MILDRED
3507	16	MAJEK, WALDEMAR & MARTA
3507	17	GORDON, ROBERT D & MARTHA K TRUSTEE
3510	2	HERITAGE MANOR HOMEOWNERS ASSOC
3510	152	CONGLETON, KATHLEEN
3510	152.01	PASSAIC COUNTY PARKS DEPARTMENT
3510	153	AUSTIN, DAVID
3510	154	SANZARI, FLORY C/O CASALE, S
3510	155	GIBNEY, RAYMOND
3510	156	LIATTO, EST %MARGARET FLANAGAN
3510	157	MOUNTAINVIEW TERRACE ASSOCIATES,LLC
3512	1	MAROON, RAYMOND JR
3512	3	MAROON, RAYMOND JR
3512	4	2419 HAMBURG TPK REALTY LLC
3512	5	2411 REALTY LLC
3512	6	MAMAKOS, THOMAS
3512	7	DST REALTY CORP-NORTH END OFFICE
3512	8	COLFAX,JOYCE
3512	9	TOWNSHIP OF WAYNE
3512	10	2317 REALTY CO
3512	11	2317 REALTY CO
3512	13	2317 REALTY CO

Riverdale

BLOCK	LOT	OWNER
30	2	RIVERDALE ROAD DEVELOPMENT LLC
30	31	RIVERDALE ROAD DEVELOPMENT LLC
30	48	LAYER,WILLIAM & ALDONA
30	49	LAYER,WILLIAM & ALDONA
30	50.01	OLYNYK, MARK
30	57	ROSENBERG, WES

PLAN

SCALE: 1" = 400'

0 200 400 800 1200

GRAPHIC SCALE

1. PARCEL LAYOUT, BLOCK AND LOT NUMBERS, COUNTY BOUNDARY LINES AND RIVER EDGES WERE OBTAINED FROM THE NEW JERSEY GEOGRAPHIC INFORMATION NETWORK.

2. OWNER NAMES ARE BASED ON A RECORD SEARCH USING NEW JERSEY ASSOCIATION OF COUNTY TAX BOARDS DATABASE.

LEGEND

(cyan dashed line)	EDGE OF WATER
11000	BLOCK
(blue dash-dot line)	MUNICIPAL AND COUNTY BOUNDARY LINE

PROJECT:

FEASIBILITY STUDY
for the
REMOVAL of POMPTOM DAM
and PEQUANNOCK DAM

Morris County and Passaic County, New Jersey

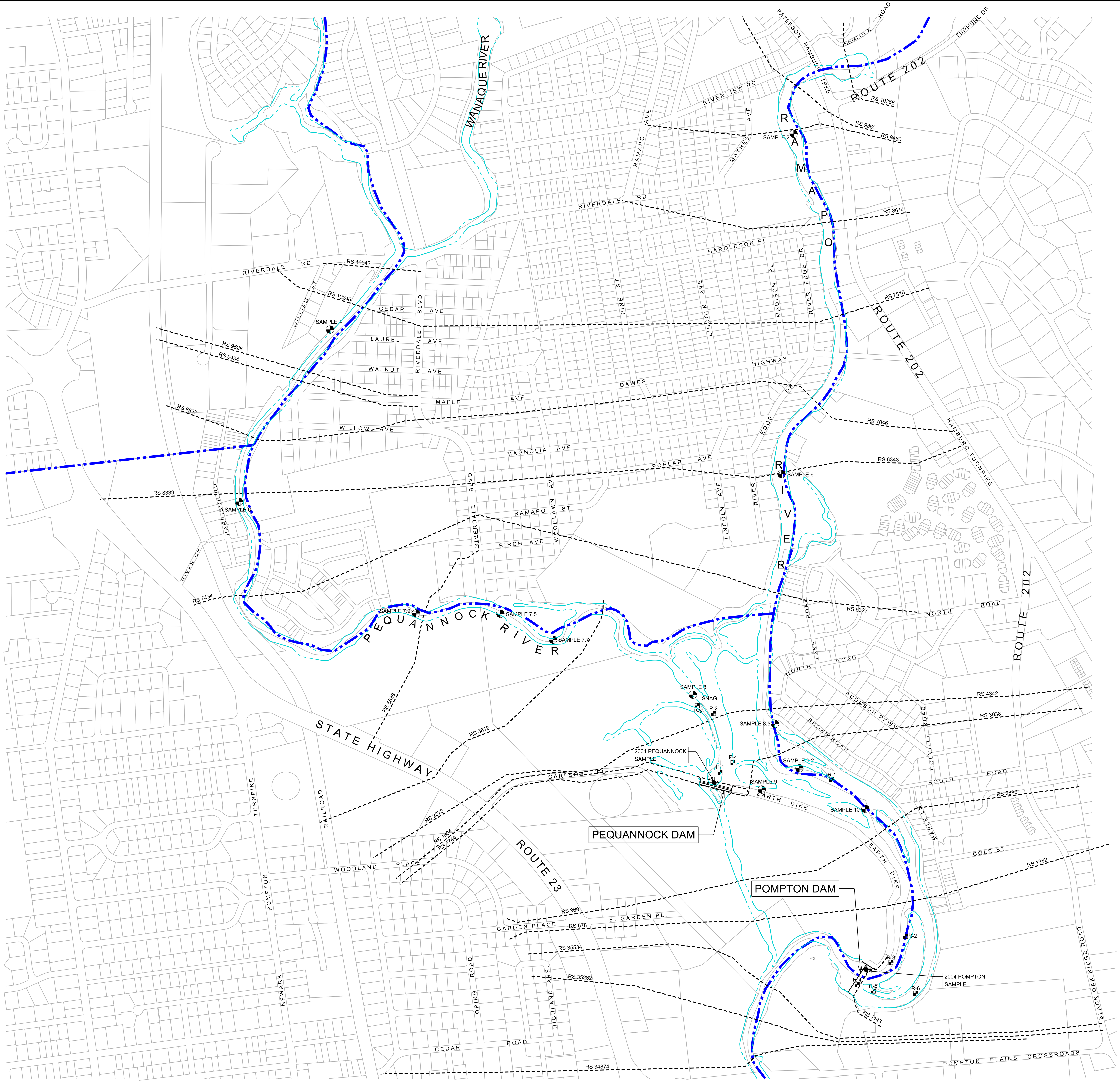
TITLE:

PARCEL MAP
Plate 3

CIVIL DYNAMICS, inc.
CERTIFICATE of AUTHORIZATION No. 24GA27966500
109A County Rte. 515, P.O.Box 760, Stockholm, N.J. 07460-0760
Phone (973) 697-3496 Fax (973) 697-1678

1. PARCEL LAYOUT, COUNTY BOUNDARY LINES AND RIVER EDGES WERE OBTAINED FROM THE NEW JERSEY GEOGRAPHIC INFORMATION NETWORK.

2. CROSS SECTION LOCATIONS SHOWN ARE ONLY A PORTION OF THOSE USED FOR MODELING.



PLAN

SCALE: 1" = 400'

0 200 400 800 1200

GRAPHIC SCALE

LEGEND

EDGE OF WATER	
RS 6343	CROSS SECTION LOCATION WITH RIVER STATION
	MUNICIPAL AND COUNTY BOUNDARY LINE
SAMPLE 6	SAMPLE OBTAINED FOR PHYSICAL TESTING
2004 PEQUANNOCK SAMPLE	SAMPLE ANALYTICALLY TESTED IN 2004
P-2	ANALYTICAL SAMPLE TAKEN 2012

PROJECT:

FEASIBILITY STUDY
for the
REMOVAL of POMPTOM DAM
and PEQUANNOCK DAM

Morris County and Passaic County, New Jersey

TITLE:

HYDRAULIC MODEL SECTIONS
AND
SEDIMENT SAMPLING LOCATIONS
Plate 4

CIVIL DYNAMICS, inc.

CERTIFICATE of AUTHORIZATION No. 24GA27966500

109A County Rte. 515, P.O.Box 760, Stockholm, N.J. 07460-0760
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