Delaware River Basin Comprehensive Flood Risk Management Interim Feasibility Study and Integrated Environmental Assessment for New Jersey



Flooding in the Study Area, April 2005

### June 2015 APPENDIX A: Draft Engineering Technical Appendix



U.S. ARMY CORPS OF ENGINEERS PHILADELPHIA DISTRICT



New Jersey Department of Environmental Protection

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Delaware River Basin Comprehensive Flood Risk Management Interim Feasibility Study and Integrated EA for New Jersey

### 1 General

The Tentatively Selected Plan consists of two project sites. One site is in Lambertville, New Jersey and one in Gibbstown, New Jersey. This Engineering Technical Appendix details proposed construction of these sites.

### 2 Hydrology and Hydraulics

See separate Hydraulics and Hydrology Appendix.

### **3** Surveying and Mapping Requirements

The surveying and mapping data for the project were developed using LiDAR (Light Detection and Ranging data, aerial photography, and computer modeling to combine and manipulate public domain geospatial data to engineering elevation models of the study areas. The following provides an in depth description of the LiDAR information and how it was processed to develop the elevation models.

LiDAR data is remotely sensed high-resolution elevation data collected by an airborne collection platform. LiDAR data from 2010 (for Lambertville) and 2007 (for Gibbstown) was imported into ArcMap 10.1. Digital Elevation Models were created in ArcMap and exported into a TIFF file format readable in AutoCAD. This information combined with aerial photography was utilized in AutoCAD to layout, analyze, and compute quantities for the levee and floodwall structures.

The dataset used for Lambertville, New Jersey was produced by the PAMAP Program in 2010 and consists of a raster digital elevation model with a horizontal ground resolution of 3.2 feet. The model was constructed from PAMAP LiDAR elevation points. PAMAP data are organized into blocks, which do not have gaps or overlaps, which represent 10,000 feet by 10,000 feet on the ground. The coordinate system for blocks in the northern half of the state is Pennsylvania State Plane North; blocks in the southern half of the state are in Pennsylvania State Plane South. Both coordinate block systems utilize the same datum reference (datum: NAD83, units: feet). A block name is formed by concatenating the first four digits of the State Plane northing and easting defining the block's northwest corner, the State identifier "PA", and the State Plane zone designator "N" or "S" (e.g. 45001210PAS).

The data set for Gibbstown, New Jersey was a raster file of elevation extracted from a larger classified data set and only includes points classified as Ground, Model Key-point (mass point), Bathymetric LiDAR Points, and Acoustic Bathymetry (bare earth) within the delineated geographic bounds. By positioning laser range finding with the use of 1 second GPS with 100 Hz inertial measurement unit corrections, Terrapoint's LIDAR instruments are able to make highly detailed geospatial elevation products of the ground, man-made structures and vegetation. These data were collected from March 29 through April 6, 2007 for Gloucester County, New Jersey. The project area covers 353 square miles. The LiDAR flight lines for this project were planned for a 50 percent acquisition overlap. The nominal resolution of this project without overlap is 1.25 meters. Four returns were recorded for each

pulse in addition to an intensity value. GPS Week Time, Intensity, flight line and number attributes were provided for each LiDAR data point. Data is provided as random points, in LAS v1.1 format.

More recent and comprehensive topographic survey will be required in order to develop plans and specifications. Due to the abundance of residential properties affected, it is recommended that an American Land Title Association (ALTA) Land Survey be performed in PED. This survey will provide existing physical features including topographic features, property boundary lines, easements, right-of-ways, structures, utilities, streets and railways, etc.

### 4 Geotechnical Investigation

### 4.1 General

This section presents general criteria based on limited subsurface investigations, analysis methods and assumptions for the geotechnical design of project features. Geotechnical design considerations for permanent structures are provided herein. The considerations consist of design of the structural foundations, earthen levees, and backfill.

### 4.2 Design Criteria

The following Engineer Manuals will be used in the geotechnical design of the projects.

EM 1110-1-1905, "Bearing Capacity of Soils" 10/30/1992 EM 1110-2-1906, "Laboratory Soils Testing" 10/31/1997 EM 1110-2-1913, "Design and Construction of Levees" 4/30/2000 EM 1110-2-2502, "Retaining and Flood Walls" 9/29/1989

### 4.3 Regional Geology

### **GIBBSTOWN**

The proposed site location in Gibbstown consists of four geological units; the Quaternary Alluvium, The Unit 2 of the Quaternary Cape May Formation, the Cretaceous Magothy Formation, the Cretaceous Potomac Formation. A brief discussion of the formations is discussed herein:

1. Quaternary Alluvium. Beneath the modern salt marsh and estuarine environments of Salem and Gloucester Counties, geologic mapping data available from the New Jersey Geological Survey (NJGS) indicates that stream alluvium deposits may be present. Mapping data describes this alluvium as predominantly quartz sand and silt, with common intercalated deposits and lenses of gravel, peat, and less commonly silt/clay.

2. Quaternary Cape May Formation, Unit 2. According to NJGS Geologic Map GMS 06-2, Unit 2 of the Quaternary Cape May Formation should be present in the project area in a pattern that fringes the present day creeks and tidal guts feeding into the Delaware estuary. In general, published maps place this unit below a maximum elevation of approximately 35 feet, where it forms a terrace and is generally found to pinch out up against older Coastal Plain deposits (Stanford, 2006). Published descriptions of the Cape May Formation describe it as a yellow to pale brown fine to medium sand with occasional beds of gravel, mud, and peat. Primarily quartz sand, accessory minerals such feldspar, mica, and the marine clay glauconite can occur in lesser amounts.

3. Cretaceous Magothy Formation. According to NJGS Geologic Map GMS 06-1, two Cretaceous-age geologic formations occur in the project area. These are the Magothy and Potomac (described below) Formations, and are found primarily in the subsurface, beneath the much younger, fluvial and marine deposits described above. The mapped patterns of these formations indicate that they subcrop more recent deposits along a northeast strike and are present in bands a few miles wide, where they dip to the east/southeast and become covered by progressively younger and younger geologic units. In general, the Magothy Formation is described as a gray (white to yellow where weathered) fine to very coarse quartz sand with comparatively thin beds of clay and silt are common.

4. Cretaceous Potomac Formation. In general, the Potomac Formation is the oldest of the Coastal Plain geologic formations in the region and overlies saprolite and/or weathered bedrock of the Piedmont Province to the north and west. NJGS Geologic Map GMS 06-1 describes the Potomac Formation as a white fine to very coarse quartz sand with gravel and varicolored, but commonly red, clay and silt beds that are more extensive than the sand beds. Both the muddy and sandy portions of the formation can contain lignite, and the unit is as much as 350 feet thick.

#### LAMBERTVILLE

The proposed site is located in the Passaic Formation. The preliminary borings for this site encountered silts, clays, and sands of varying composition, which are variable shades of brown and gray in color. Amounts of gravel and rock fragments were encountered within the soil layers. An alluvium strata consisting of sand and gravel was encountered in the borings next to the canal. The overburden soils are underlain by bedrock strata. The bedrock present at the site consists of weathered siltstone. The weathered siltstones are hard, light and medium shades of reddish gray and brown in color and contain occasional thin sandstone seams and iron-stained joints. The overburden soils generally classify as clay (CL), silt (ML), silty sand (SM), and silty gravel (GM) according to the Unified Soil Classification System. The liquid limits of these soils vary between NP and 33, and the plastic limits vary between NP and 10. The passing -200 sieve of these materials was ranging between 12% and 86%.

### 4.4 Seismological Evaluation

#### **GIBBSTOWN**

No seismic analysis has been performed on the site.

### LAMBERTVILLE

A preliminary analysis performed during the Lambertville Subsurface Exploration by the subcontractor, Tetra Tech, yielded the following information:

Based on the results of the field and laboratory tests conducted for this investigation, review of the available geologic mapping, and site class definitions shown in Table 1613.5.2 from International Building Code (IBC 2006), it is our opinion that the subject site can be classified as Site Class C in the Very Dense Soil and Soft Rock category. This category is characterized by the following average soil/rock properties within the top 100 feet of the surface: Shear wave velocity between 1,200 to 2,500 feet per second, standard penetration resistance (N) > 50, and soil undrained shear strength > 2,000 pounds per square foot (psf).

### 4.5 Subsurface Investigations and In Situ Testing

### **GIBBSTOWN**

Four exploratory borings were performed in 2013 along the planned alignment. These borings were completed using Standard Penetrating Test Methods to collect disturbed and undisturbed samples. Laboratory testing on selected samples included the performance of index testing, hydraulic conductivity testing, and triaxial compression strength testing. The number and types of tests are listed in Table 1: Gibbstown Soil Tests. Further information can be found in Attachments 1 and 2, Figures A1and A2.

Minimum #	Minimum #					
of	of					
Undisturbed	Undisturbed			Field		
Samples	Samples	Sieve	Atterberg	Moisture	UU Triaxial	
Collected	Lab Tested	Analysis	Limits	Content	Compression	Permeability
5	5	13	3	13	2	5

#### Table 1 : Gibbstown Soil Tests

Subsurface conditions encountered at the boring locations are shown in the boring logs. The subsurface conditions observed across the site were generally consistent in stratigraphy, but highly variable in thickness and textural consistency. Beneath surficial fill deposits (where present), Duffield Associates' field program, geologic map review, review of topographic data, and experience from past studies in the area supports that shallow subsurface deposits beneath the area being considered for flood control improvements can be characterized by the following stratigraphic framework, in order of increasing age and depth below ground surface:

- The Quaternary Alluvium
- The Unit 2 of the Quaternary Cape May Formation

- The Cretaceous Magothy Formation
- The Cretaceous Potomac Formation

The Quaternary Alluvium stratum soils generally consisted of a loose to medium dense sand soils with an interlayered layer of fibrous organic soils. The underlying geologic formations were observed to consist primarily of coarse-grained loose to dense sands with several interlayered fine-grained medium to very stiff silty clays. Bedrock was not encountered in any of the borings and the maximum depth was 60 feet below ground surface.

### LAMBERTVILLE

Four exploratory borings were performed in 2014 along the planned alignment. These borings were completed using Standard Penetrating Test Methods to collect disturbed and undisturbed samples. Laboratory testing on selected samples included the performance of index testing, hydraulic conductivity testing, and triaxial compression strength testing. The number and types of tests are listed in Table 2: Lambertville Soil Tests. Further information can be found in Attachments 3 and 4, Figures A3 and A4

Minimum # of Undisturbed Samples Collected	Minimum # of Undisturbed Samples Lab Tested	Sieve Analysis	Atterberg Limits	Field Moisture Content	UU Triaxial Compression	Permeability	Unconfined Compression	Specific Gravity
5	5	13	8	8	4	5	5	5

Table 2	2:	Lambertville	Soil	Test
Table 2	2:	Lambertville	Soil	Tes

Subsurface conditions encountered at the boring locations are shown in the boring logs. Generally, in the borings drilled for this study, the site soils encountered consist of silts, clays, and sands of varying composition, which are variable shades of brown and gray in color. Amounts of gravel and rock fragments were encountered within the soil layers. An alluvium strata consisting of sand and gravel was encountered in the borings next to the canal. The overburden soils are underlain by bedrock strata. The bedrock present at the site consists of weathered siltstone. The weathered siltstones are hard, light and medium shades of reddish gray and brown in color and contain occasional thin sandstone seams and ironstained joints. Observations made in the field of the soil materials retrieved from the borings, with the exception of the top few inches, the soils encountered in the borings drilled on the towpath, within the road, and open field appear to be of natural origin and no evidence of man-placed fill was noted. It should be appreciated that fill materials may not always be distinguishable from native soils, and may also be present within the site at locations other than the boring locations. The overburden soils generally classify as clay (CL), silt (ML), silty sand (SM), and silty gravel (GM) according to the Unified Soil Classification System. Depths from ground surface to bedrock ranged from 14 feet to 22 feet.

### 4.6 Design

### GIBBSTOWN

A preliminary design of the levee and floodwall was completed by URS Corporation. The designs of the levees and floodwalls reflect the results of a limited geotechnical study. In the Gibbstown area the borings indicate a layer of compressible soils near elevation 0 NAVD. Any levees exceeding 8 feet high in this area will likely require ground stabilization before and during construction. These treatments include surcharging the levee load and installing wick drains to accelerate soil compression, excavating unsuitable material and installing geogrids under the levees. With the exception of the relatively low walls at the northern project tieoff and the industrial ring structures, the floodwalls at Gibbstown are T-wall structures with a wide base to provide stability. These structures would be supported by 50 foot long steel piles with spacing of approximately 10 feet.

### LAMBERTVILLE

A preliminary design of the levee and floodwall was completed by URS Corporation. In Lambertville the levee segments will utilize a design section with a 10 foot top width, a 10 foot wide impervious core extending to 6 feet below the levee and a 2.5 horizontal to 1 vertical side slope. The floodwalls are generally about 5 feet high with a maximum height of about 7 feet. Given the relatively low heights and the limited area for construction a cantilevered I-wall type structure was chosen. This structure consists of a sheetpile wall driven to bedrock at a depth of approximately 13 feet. The wall will included a concrete cap to ensure an impervious structure.

### 4.7 Potential Disposal Sites

No disposal sites for either project have been identified at this time.

### 5 Project Design

### 5.1 Description of the Selected Plan

### LAMBERTVILLE

The proposed flood mitigation structure consists of a levee along Alexauken Creek and a floodwall adjacent to the D&R Canal. The levee is generally 10 to 12 feet high. The maximum height is 15 feet and the length is 516 feet. A 10 foot wide crest with 2.5H: 1V side slopes is proposed for the typical levee section. The top of the levee and floodwall is proposed at elevation +76.0 NAVD, pending optimization. The floodwall is 1,409 linear feet with a maximum height of 7 feet. The floodwall alignment is proposed to be approximately 15 feet from the waterline of the Canal in order to protect the Canal and provide sufficient space for temporary construction. This plan will require one property buy-out and demolition, and the construction of a 54 inch diameter gravity outlet in the area of Ely Creek. A preliminary alignment is shown below in Figure 5.1.1.



#### Figure 5.1.1: Lambertville

#### **GIBBSTOWN**

The proposed preliminary line of protection runs parallel to the Delaware River for approximately 4 miles, in the vicinity of Route 44 between Repaupo Station Road and Billingsport Road, in Gibbstown (Greenwich Township), Gloucester County, New Jersey. Refer to Figure 5.1.2 for the site location map and the preliminary alignment of the line of protection.



Figure 5.1.2: Tentatively Selected Plan (Alternative 1)

The tentatively selected plan is Alternative 1. This plan consists of a combination of levee and floodwall structures, flood gates, and ringwalls; the plan includes 13,788 feet of floodwall and 7,386 feet of levee, including 165 feet of closure gates. At the southernmost point, the line of protection begins with a levee segment along the south side of the railroad tracks adjacent to Route 44 (W. Broad St.). The typical height of the southwest levee segment varies from 1 to 12 feet. The levee transitions into a floodwall that circles the town in a clockwise manner. A floodwall was chosen for the center portion to lessen the footprint and avoid the need for more structure buyouts. The typical height of the floodwall varies from 10 to 14 feet. This portion of the floodwall includes one 115-foot railroad crossing gate and one 50-foot road crossing gate. The central floodwall ties into high ground near the center of town where North School Road meets Railroad Avenue. East of North School Road the ground elevation is above the project's design elevation. The line of protection continues as a levee on the north side of Railroad Street along the Northern face of the railroad tracks. The typical height of the levee in this section varies from 1 to 14 feet. The levee transitions back to a floodwall that continues in the northeast direction. The typical height of the floodwall in this section is from 14 feet down to 1 foot high. The design height of the levee/floodwall line of protection is proposed at elevation +12.0 feet NAVD88,

pending optimization. This alignment will require one property buyout along the alignment (building footprint shown in Figure 5.1.2) and 17 property buyouts in satellite locations depicted in Figure 5.1.3.





In addition to the levee system within Alternative 1, the alternative includes ringwall structures that encompass three separate areas.

The first area is located at 77 Asbury Road and is shown in Figure 5.1.4. This area includes a levee portion (represented as cyan), floodwall portion (represented as green), and one 42-foot gate and one 67-foot gate (both represented as red). The ringwall height would vary from approximately 7 to 10 feet.



Figure 5.1.4: 77 Asbury Road

The second area is located at 43 Asbury Station Road and is shown in Figure 5.1.5. This area includes a levee portion (represented as cyan), floodwall portion (represented as green), and one 48 foot gate (represented as red). The ringwall height would vary from approximately 6 to 9 feet.





The third area is located at A line Road and is shown in Figure 5.1.6. This area also includes levee portion (represented as cyan), a floodwall portion (represented as green), and one 67-foot gate (represented as red). The ringwall height would vary from approximately 7 to 10 feet.





### 5.2 **Project Alternatives GIBBSTOWN**

Figure 5.2.1 shows Alternative 2, which follows the same alignment as Alternative 1, but replaces levee sections with floodwalls to avoid impacts to wetlands areas.



### Figure 5.2.1: Gibbstown Alternative 2

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Figure 5.2.2 shows Alternative 3, which also follows the same alignment as Alternative 1 and Alternative 2, but replaces fewer levee sections with floodwalls compared to Alternative 2 and was considered a balance between Alternative 1 and Alternative 2.



### Figure 5.2.2: Gibbstown Alternative 3

### **5.3 Quantity Computations**

### LAMBERTVILLE

The levee is generally 10 to 12 feet high. The maximum height is 15 feet and the length is 516 feet. The levee typical section has a 10 foot top width and 2.5H: 1V side slopes. The key depth is 6 feet with a 1:1 trench side slope and 10 foot bottom width on the trench. The levee zonation calls for impervious fill for the 10 foot width of the key trench for the full height of the levee. The remainder of the material is common fill. Stripping depth was assumed to be 1 foot. A volume of 3,180 Cubic Yards of impervious fill and 8,862 Cubic Yards of common fill is used in the cost estimate for the levee.

The floodwall alignment is 1,409 feet long. The floodwall is generally five feet high with a maximum height of approximately seven feet. Given the relatively low heights and the limited area for construction, a steel sheet pile cantilevered concrete I-wall type structure

was chosen. This structure consists of a sheetpile wall driven to bedrock at an elevation of +53.0 feet NAVD. The quantity of sheet pile used in the cost estimate is 31,602 SF.

### **GIBBSTOWN**

The proposed preliminary line of protection runs parallel to the Delaware River for approximately 4.0 miles. Alternative 1 consists of a total of 13,788 feet of floodwall and approximately 7,386 feet of levee including gates. The maximum levee height is 12 feet, pending optimization. A volume of 48,761 Cubic Yards of impervious fill and 140,239 Cubic Yards of common fill is used in the cost estimate for the levee.

The railroad crossing gate is proposed as 115 feet long, and the floodwall road crossing gate is proposed as 50 feet long. The total length of levee for the three proposed ringwalls is approximately 2,795 feet. The total length of floodwall for the three proposed ringwalls is approximately 2,620 feet. There are also two 67 feet gates, one 48 feet gate and one 42 feet gate included in the ringwall designs.

Alternative 2 consists of a total of 21,339 linear feet of floodwall, including gates. Alternative 3 consists of a total of 16,765 linear feet of floodwall and 4,409 linear feet of levee, not including gates. The ringwalls and gates are the same for all alternatives.

It is expected that the proposed full height floodwall is likely to be an inverted T (known as T-wall) concrete wall. The top elevation of the proposed T-wall is +12 feet NAVD, pending optimization, which is identical to the levee top elevation. The height of the wall from the top to the base slab is 14 feet, pending optimization. A 12 feet wide and 3 feet thick base slab is proposed. In addition, the width of the wall stem is considered to be 2 feet. Considering the existence of soft compressible organic soils, it is recommended that the proposed T-wall be supported on deep foundations such as driven piles.

### 5.4 Assumptions for Gibbstown and Lambertville Designs

### LAMBERTVILLE

Bedrock was assumed to be at elevation +53.0 NAVD. The height of the main line of protection is estimated to be +76.0 feet NAVD. The unit costs of the items used in the cost estimates have been sourced from RS Means 2010. Typical sections of levee and floodwall are given in Figure 5.4.1 and Figure 5.4.3.

Closure gates/outlet structures are necessary to drain the interior runoff and are therefore included in the cost estimates. It is assumed five 24" Diameter flap and five 24" Diameter sluice gates are needed along with two 60" flap gates and two 60" sluice gates. The cost estimate also includes jacking a 54" pipe 225 linear feet under the D&R Canal to a proposed outlet structure. Associated costs are broken down in the cost estimate.

### GIBBSTOWN

Structure costs have been calculated for heights above grade ranging from zero feet at the tieins up to a maximum of 12 feet above grade. The unit costs of the items used in these estimates have been sourced from RS Means 2010. The height of the main line of protection levee is estimated to be +12.0 feet NAVD. Three feet of freeboard is included here as a placeholder until optimization is conducted and structure height is established. After optimization, inclusion of freeboard can be requested by the non-Federal sponsor. FEMA recommends 3' of free board in levee height in order to get the levee certified, but the addition will be considered the Locally Preferred Plan and funding apportioned accordingly. A typical section of Levee is as follows:





All design shall be compliant with EM 1110-2-1913, Design and Construction of Levees.

Inverted T-wall design is assumed for areas needing ring wall protection. A typical section of Inverted T-wall is as follows:



Figure 5.4.2: Inverted T-wall Section (Gibbstown)

All design shall be compliant with EM 1110-2-2502, Retaining and Floodwalls.



All design shall be compliant with EM 1110-2-2502, Retaining and Floodwalls.

An Inverted T-wall section similar to the one shown in Figure 5.4.3 containing 50' closed end steel piles, with a diameter of 14 inches, at spacing of 10 feet is assumed for the design in areas where the soil is marshy and provides a poor foundation.





### 5.4.1 Closure Gates

Closure gates/outlet structures are necessary to drain the interior runoff and are therefore included in the cost estimates. It is assumed fifty-four 24" Diameter flap and fifty-four 24" Diameter sluice gates are needed along the floodwall. Associated costs are broken down in the cost estimate.

### 5.4.2 Road/Rail Gates

Each ringwall would require at least one movable gate to allow traffic access. The railroad gate is also required to be movable for train access. As the floodwall also crosses Dry Ice Corp/A Line Road, another gate is needed in this location. The quantity used for the cost estimate was assumed to be 1,947 square feet of swing gates. The gate design is not optimized at this stage of design.

### 5.5 Relocations

Utilities located in the vicinity of the project were identified by using GIS files. For the selected plan sanitary sewer, potable water, gas, electric and telephone lines will have to be identified on the plans. There are no relocations identified at this time, however a lump sum value of approximately \$4 Million is included in the cost estimate for Utility Relocations.

### 5.6 Risk for Cost Overruns in Civil Design

### 5.6.1 Utilities

Utilities are always a challenge when constructing a project of this type. It is difficult to determine where underground utilities are located. Record files will be utilized in the design of this project, but it is quite common for utility lines to be present when not indicated on the drawings. This is especially true regarding abandoned utility lines. The depth of the utilities is also hard to predict, hence knowing whether or not a utility crossing the floodwall needs to be relocated is challenging. It is reasonable to believe that there are more utilities in the ground than what we will have record of.

#### 5.6.2 Unknown Site Conditions

Unknown site conditions are always a potential risk on a project. The Gibbstown project area contains many locations where HTRW is being cleaned up. There is a possibility that more HTRW could be discovered during construction. Any differing site conditions could affect cost and schedule. Other possible unknown site conditions include utilities, rock formations, and artificial subsurface obstructions.

### 5.6.3 Design Criteria and Standards

The following documents and standards, as a minimum, will be incorporated in the design of this flood risk management project.

- US Army Corps of Engineers, EM\_1110-2-1913, "Design and Construction of Levees", 2000.
- US Army Corps of Engineers, EM\_1110-2-2502, "Retaining and Flood Walls", 1989.
- "Roadside Design Guide" 4<sup>th</sup> Edition, 2011. American Association of State and Highway (AASHTO)
- "Manual on Uniform Traffic Control Devices (MUTCD)", Federal Highway Administration
- International Building Code ®
- ASTM International Standards
- SpecsIntact will be utilized to develop the project specifications

### 5.6.4 Railroad Crossing

Coordination with the railroad has some inherit unknowns based on who owns the line, who operates on the line, and the individual entities that are involved with the design approval and coordination. The proposed railroad crossing gate spans 115 feet. If space permits, two smaller mechanical gates may be utilized instead of one large gate. The gate design shall be optimized through design and coordination with the Railroad Company in later stages.

### 5.6.5 Road Gates

There are several proposed road crossing gates of varying lengths from 42 feet to 67 feet. Each ringwall would require at least one movable gate to allow traffic access (and railroad access in the case of Dry Ice Corp/A Line Road). These have not been included in the ring levee cost estimates, but preliminary investigations suggest a cost of around \$1 million to \$1.3 million, depending on the width of the opening.

### 6 Construction Procedure and Water Control Plan

TBD

### 7 Initial Reservoir Filling and Surveillance Plan

N/A

### 8 Storm Emergency Plan

TBD

### 9 Construction Materials

TBD

### **10 Reservoir Clearing**

N/A

### **11 Operations and Maintenance**

Permanent easements are needed for the structure footprints, and temporary easements are needed for construction. Operation, Maintenance, Repair, Rehabilitation and Relocation (OMRR&R) costs include annual inspections and maintenance of the line of protection including gates and gate chambers, access ramps, and levee cover. The O&M costs also include annual inspections and maintenance of the interior drainage features and include the annualized cost of replacement of interior drainage appurtenant structures (e.g., gates, backflow valves, sluice gates, etc.) at the end of their useful project life of approximately 25 years. Annual OMRR&R costs are approximately \$198,000 for Gibbstown and \$30,000 and Lambertville.

### **12 Access Roads**

The projects are located within the cities of Lambertville, NJ and Gibbstown, NJ and in most cases it will be feasible to use the existing public city streets for transportation of miscellaneous construction equipment and hauling of excavated material, debris and construction materials. Access roads and permanent easements are needed for levee inspection and maintenance. A maintenance path will need to be established, but no such area is defined at this time. The project site will have construction easements along the alignment of the floodwalls and levees. The easements will provide sufficient right of way for the sponsor to go back in the future and perform maintenance as required.

### **13** Corrosion Mitigation

Coatings and/or cathodic protection will be included in the design as required for materials which are installed in the soil.

### **14 Project Security**

TBD

### **15 Cost Engineering Technical Support Document**

#### SECTION 15 - COST ESTIMATE

<u>Paragraph</u>	Description
(	CONCEPT-LEVEL ALTERNATIVES INITIAL PROJECT CHARGES
1	General
2	Basis of Cost
INCRI	EMENTAL ALTERNATIVE PLAN DEVELOPMENT AND ASSESSMENT
15	Alternatives Considered
16	Lambertville Alternative Plans
17	Gibbstown Alternative Plans
18	Basis of Cost for Gibbstown Alternative Plans
	TENTATIVELY SELECTED PLANS
20	TSP Alternatives Considered
21	Lambertville TSP
22	Basis of Cost for Lambertville TSP
28	Annual Charges for Lambertville TSP
31	Gibbstown TSP
32	Basis of Cost for Gibbstown TSP
38	Annual Charges for Gibbstown TSP
0	PTIMIZATION OF SITE 5: LAMBERTVILLE, HUNTERDON CO., NJ
41	General
	OPTIMIZATION OF SITE 8: GIBBSTOWN (GREENWICH AND LOGAN TOWNSHIPS), GLOUCESTER CO, NJ
42	General

### LIST OF TABLES

<u>No.</u>	Description
1	Tentatively Selected Plan Costs - Site 5: Levee/Floodwall, Lambertville, NJ
2	Tentatively Selected Plan Costs - Site 8: Levee/Floodwall, Gibbstown, NJ
Site 1 thru Site 8	Concept-Level Costs for Site 1 thru Site 8
Alt 1 thru Alt 3	Incremental Alternative Plan Costs for Site 8: Levee/Floodwall Analysis, Gibbstown (Greenwich and Logan Townships), NJ

### SECTION 15 - COST ENGINEERING TECHNICAL SUPPORT DOCUMENT

#### CONCEPT-LEVEL ALTERNATIVES INITIAL PROJECT CHARGES

1. <u>General</u>: This section presents screening of parametric type cost estimates for conceptlevel initial construction resulting in total and annualized project costs for alternative flood risk management reduction plans for eleven sites. The eleven alternative sites include:

#### Site

#### **Description**

- 1 Knowlton Township, Warren Co., NJ 4,000 LF floodwall along Delaware River
- 2a Phillipsburg, Warren Co., NJ 700 LF floodwall along Lopatcong Creek
- 2b Phillipsburg, Warren Co., NJ 1,725 LF floodwall/ringwall at waste water treatment plant
- 3 Frenchtown, Hunterdon Co., NJ 7,000 LF floodwall along bicycle path
- 4 Stockton, Hunterdon Co., NJ Reinforce 5,400 LF of existing Delaware and Raritan Canal embankment
- 5 Lambertville, Hunterdon Co., NJ 590 LF earthen levee at Alexauken Creek and 810 LF floodwall along D&R Canal embankment
- 6 Ewing Township, Mercer Co., NJ 7,700 LF floodwall along Delaware River-side of Route 29
- Trenton, Mercer Co., NJ (Delaware River Site The Island and Glen Afton) 7,280
   LF floodwall along Delaware River
- Trenton, Mercer Co., NJ (Delaware River Site The Island and Glen Afton) 7,280
   LF floodwall with removable sections along Delaware River
- 7b.1 Trenton, Mercer Co., NJ (Downtown) Portable floodwalls for deployment in downtown area, with permanently installed foundation
- 8 Gibbstown (Greenwich and Logan Townships), Gloucester Co., NJ 25,000 LF levee/floodwall between Delaware River and developed areas

Typical levee features included a 2.5:1 side slope, an impervious core, 10-foot top width, and provide three feet of freeboard above the effective Base Flood Elevation (BFE) (100-yr event or 1% annual chance of exceedance) for the specific location. The freeboard allowance is a placeholder; a detailed study would be required to address design uncertainties and to ensure reliable performance of the risk management feature. Typical floodwall types were established based on height above grade. Floodwall types included concrete inverted cantilever T-walls w/ key, T-walls with pile supports, I-walls, and I-walls with sheeting. Although interior drainage features are required for any structural flood risk management component, no interior drainage analysis was conducted at this level of analysis. Therefore, a typical requirement of one 24-inch outlet per 400 feet of levee/floodwall was used for cost estimating purposes. Each 24-inch outlet included a manhole, flap gate, sluice gate, trash rack, excavation and backfill, and slope protection. The plan layouts of the concept-level plans are shown in the section of the Feasibility Study, Main Report describing the concept-level alternative sites.

2. <u>Basis of Cost</u>: Cost estimates presented herein for the concept-level analysis are based on December 2010 price levels. The costs in the summary tables are rounded to the nearest \$1,000. The Concept-Level costs were developed in accordance with the construction procedures outlined herein. All initial construction costs presented in this paragraph are concept-level costs. The major assumptions include:

a. Readily available, land-based construction equipment will do the work.

b. There will be no severe weather events during construction.

c. The project acquisition plan will be open bid (unrestricted) due to the size and cost of the nature of the work.

d. Equipment standby costs are not included since work will take place 5 days per week, 8 hours per day.

e. Construction work will be performed by an excavation/heavy construction contractor and the work for surveys and environmental restoration performed by a subcontractor.

f. Mobilization and demobilization costs assume construction equipment located within 500 miles from the project site will perform the work.

3. A brief description of each alternative site follows:

- a. Site 1 Knowlton Township, Warren Co., NJ: 4,000 LF floodwall along Delaware River: 4,000 LF floodwall, 9 feet above ground with tie-off levees perpendicular to the river and 9 interior drainage outlets. The wall would run along the rear part of residential properties located immediately on the Delaware River bank. Surrounding area is largely agricultural or wooded.
- b. Site 2a Phillipsburg, Warren Co., NJ 700 LF floodwall along Lopatcong Creek: 700 LF floodwall (concrete T-wall with pile support) with a top height approximately 15 feet above grade along Lopatcong Creek. The wall would extend along the right bank of Lopatcong Creek, in front of a mix of commercial, single-family residential, and apartment building properties.
- c. Site 2b Phillipsburg, Warren Co., NJ 1,725 LF floodwall/ringwall at waste water treatment plant 1,725 LF floodwall/ringwall (concrete T-wall with pile support) with a top height approximately 10 feet above grade surrounding the municipal wastewater treatment plant (WWTP). The ringwall would protect the WWTP facility, tying into high ground on the downstream side. Depending on site topography, the wall may fit entirely on the WWTP facility lot, or it may need to encroach for at least a portion of its length on the adjacent undeveloped wooded area/hillside.
- d. Site 3 Frenchtown, Hunterdon Co., NJ 7,000 LF floodwall along bicycle path:
   7,000 LF floodwall (concrete inverted cantilever T-wall w/ key with sheetpile cutoff) with a top height 6 feet above grade along the existing bike path. The floodwall

would extend along an existing municipally-owned bike path alignment although additional land along sides of the municipal ROW may be needed for inverted cantilever T-wall w/ key footings and construction access.

- e. Site 4 Stockton, Hunterdon Co., NJ Reinforce 5,400 LF of existing Delaware and Raritan Canal embankment: Reinforce 5,400 LF of the existing canal embankment which has an existing top height 9 feet above existing canal embankment. The canal bank requires reinforcement at various locations through this section. The embankment is owned by the public NJ Municipal Water Supply Authority. Reinforcement work is not likely to require easements on private property. Due to the embankment being part of the Delaware & Raritan Canal, additional mitigation may be needed to address the historic significance of the canal. Therefore, construction cost includes an estimated 25% increase over the base construction cost to address the mitigation (the required cost for this mitigation has not been established). The quantity of new material required has been reduced by 50% to account for the existing canal embankment material, which if suitable, would serve as part of the future line of protection (LOP).
- f. Site 5 Lambertville, Hunterdon Co., NJ 590 LF earthen levee at Alexauken Creek and 810 LF floodwall along D&R Canal embankment: 590 LF earthen levee at Alexauken Creek (top height 12 feet above grade) and 810 LF floodwall along Delaware and Raritan Canal (top height 5 feet above grade). Levee would extend through the municipal park (baseball field) for much of its length, tying into the railroad embankment. Due to the levee location in the park and potential environmental or Green Acres impacts, mitigation is estimated as 10% of the project cost. The floodwall would run along eastern bank of Delaware and Raritan Canal. This site is recommended for further evaluation.
- g. Site 6 Ewing Township, Mercer Co., NJ 7,700 LF floodwall along Delaware River-side of Route 29: 7,700 LF floodwall (concrete T-wall) with a top height 9 feet above grade constructed along Delaware River-side of Route 29 including levee tieoff to higher ground. There is no development on the river side of Route 29 in this area. A levee tie-off section, approximately 1,200 feet in length, would extend through a predominantly residential area and would likely avoid direct impacts to buildings.
- h. Site 7a.1 Trenton, Mercer Co., NJ (Delaware River Site The Island and Glen Afton) 7,280 LF floodwall along Delaware River: 7,280 LF floodwall (concrete T-wall with piles) with a top height 13 feet above grade. The foundation and floodwall would be constructed along the river side of Riverside Drive. This land is riverbank and likely to be publicly-owned. Two short tie-off sections of approximately 600' (northern tie-off) and 300' (southern tie-off) are required. The northern tie-off would be located on public ROW of existing roadway. The southern tie-off would go through public parkland (Stacy Park).
- i. Site 7a.2 Trenton, Mercer Co., NJ (Delaware River Site The Island and Glen Afton) 7,280 LF floodwall with removable sections along Delaware River: 7,280 LF

floodwall (concrete T-wall, with removable sections) with a top height 13 feet above grade. The foundation and floodwall would be constructed along the river side of Riverside Drive. This land is riverbank and likely to be publicly-owned. Two short tie-off sections of approximately 600' (northern tie-off) and 300' (southern tie-off) are required. The northern tie-off would be located on public ROW of existing roadway. The southern tie-off would go through public parkland (Stacy Park). Approximately 40% of the structure will consist of removable panels that are inserted (when needed) into permanent foundations prior to flood events.

- j. Site 7b.1 Trenton, Mercer Co., NJ (Downtown) Portable floodwalls for deployment in downtown area, with permanently installed foundation: Floodwalls panels to be installed as needed. Top height is 6 feet above grade. A 150' section along US Route 1 and a second section 375' along NJ Route 29 and State-owned property. This cost estimate is based on a fixed, structural measure with an adjustment factor and is based on a permanently installed deployable flood barrier provided by *FloodBreak Inc*.
- k. Site 8 Gibbstown (Greenwich and Logan Townships), Gloucester Co., NJ 21,400 LF levee/floodwall between Delaware River and developed areas: 21,400 LF levee/floodwall; 65% (14,000 LF) of the structure would be floodwall (primarily concrete T-wall) and remainder of structure is levee (approximately 7,400 LF). Top height is 12 feet above grade and includes nonstructural protection for 20 buildings outside alignment, including a ringwall for several manufacturing facilities, at a cost of approximately \$13 million. The line of protection would extend through mixed wetland/upland areas and along the edge (but not through) primarily residential areas. Mitigation is estimated to be 15% of the project cost. The site is recommended for further evaluation.

4. Unit costs are based on MCACES estimates, actual costs and production rates from projects and construction of a similar nature, and cost estimating judgment based on engineering experience. The majority of unit costs were taken from recent projects estimated in MCACES (which include overhead and profit), or from *RS Means Building Construction Cost Data 2010 Edition*, and include contractor overhead, profit and bond of at least 30%.

5. Lump sum cost items were assigned a lump sum cost or were based on a project percentage to be used as a place holder until additional design information is obtained. As an example, the cost item "Maintenance of Traffic, Survey, and Access" was included at 2% of the basic construction cost to cover maintenance and protection of traffic and assorted items that may be required such as site preparation, site access, or contractor staging areas. Mobilization and demobilization costs of \$125,000 were included and are based on construction for similar projects.

6 Lands and damages costs have been included since the sponsor will be required to provide lands, easements and rights-of-way. The extent of the lands required for project implementation was estimated from typical project layouts (e.g., levee footprint plus required toe easements, typical construction easements, etc.). Most of the lands involved are either residential or park, open space, public, conservation, or wetlands.

7. For screening purposes, park, open space, public, conservation, and wetlands, the underlying fee value was estimated at \$3,800 per acre. The perpetual easement for levee/floodwall and canal improvement does not add significantly to restrictions already imposed on these lands by environmental and zoning regulations, and by their topography. Thus, a 20% impact to the underlying fee value was selected, or \$670 per acre (\$3,800 x 20% = \$670).

8. The fee simple value of residential lands was estimated at \$7.15 per square foot or \$311,454 per acre. It was assumed that residential improvements on lands affected by the concept-level alignments would not be affected as the alignments are located at the rear of the properties. Thus, a similar 20% impact was applied to the underlying fee value, resulting in an easement cost of \$62,290 per acre ( $$311,454 \times 20\% = $62,290$ ) for residential properties.

9. For both categories of land, real estate appraisal/survey costs were estimated at 9% of the real estate cost. The real estate cost estimates have an effective date of December, 2010.

10. Contingency allowances of 35% were assigned to the various cost items, real estate, engineering and design, and construction management and are based on construction for similar projects.

11. Mitigation costs were included based on the proximity of the concept-level alignments to rivers and wetland. Since no detailed environmental mitigation requirement was available, mitigation costs allowances of 5% of the levee and floodwall construction cost plus lands and damages, including contingency. For concept-level sites located near wetlands, parks, or potential Green Acres properties, the mitigation cost percentage of 15% was used.

12. Engineering and design costs of 12% of construction costs were used for screening purposes and includes the preparation of plans and specifications, as well as pre-construction monitoring and engineering support through project construction.

13. Construction management (S&A) costs to cover activities from pre-award requirements through final contract closeout effort were included as 10% of construction costs.

14. The costs for the eleven alternative sites as described in paragraph 1 for this concept-level screening phase of site selection are shown in Table Site 1 thru Table Site 8.

#### INCREMENTAL ALTERNATIVE PLAN DEVELOPMENT AND ASSESSMENT

15. <u>Alternatives Considered</u>: Since plans for Gibbstown and the Alexauken Creek area of Lambertville remained feasible, more detailed alternative plans for design were considered as a third phase of the plan selection process.

16. <u>Lambertville Alternative Plans</u>: There are no alternative locations for the Lambertville floodwall due to physical constraints associated with developed property on one side and the

historic Delaware and Raritan Canal on the other side. These impediments also leave no room for a levee. There are also not viable alternatives to the levee segment. Moving it closer to Alexauken Creek would cause hydraulic and environmental impacts. Replacing it with a floodwall would eliminate public access to the adjacent ball field. As a result, no alternative plans were created for the Lambertville site.

17. <u>Gibbstown Alternative Plans</u>: Based on items identified in the project Risk Register, interior drainage and mitigation requirements and more detailed topographic mapping and current aerial photography, the plan layout for Gibbstown was significantly revised. Three Alternative Plans were created: Alternative 1-Floodwall and Levee System (emphasis on levee); Alternative 2-Complete Floodwall System (emphasis on floodwall); and Alternative 3- Floodwall and Levee System (mix of levee and floodwall).

18. <u>Basis of Cost for Gibbstown Alternative Plans</u>: Cost estimate presented herein for the Gibbstown Alternative Plans analysis are based on May 2014 price levels. The Alternative Plans costs generally follow the assumptions and construction procedures outlined in the concept-level analysis.

19. The costs for the Gibbstown Alternative Plans as described in paragraph "Gibbstown Alternative Plans" for this third phase of site selection are shown in Tables Alt 1 thru Alt 3: Concept-Level Costs for Site 8: Levee/Floodwall Analysis, Gibbstown (Greenwich and Logan Townships), NJ.

### TENTATIVELY SELECTED PLANS (TSP)

20. <u>TSP Alternatives Considered</u>: Alternative plans were developed in three phases for the plan selection process. In the first phase the concept-level alternative site plans were compared during the Phase 1 - Screening of Measures. During the Phase 2-First Added Assessment of Alternatives and Phase 3-Incremental Alternative Plan Development and Assessment, additional refinement of the two viable alternative sites took place. For more information on these plans, refer to the section of the Feasibility Study, Main Report describing the Tentatively Selected Plans (TSP). Based on an analysis of these annual costs with their associated benefits, Site 5: Lambertville, Hunterdon Co., NJ - 516 LF earthen levee at Alexauken Creek and 1,409 LF floodwall along D&R Canal embankment and Site 8: Gibbstown (Greenwich and Logan Townships), Gloucester Co., NJ – 13,788 LF floodwall and 7,386 LF earthen levee between Delaware River and developed areas were selected for the TSP phase optimization and selection.

21. <u>Lambertville TSP</u>: The TSP in the north end of the City of Lambertville includes approximately 516 LF of levee at Alexauken Creek and approximately 1,409 LF of I-wall type floodwall along the D&R Canal. Alexauken Creek lies upstream towards the city's northern border and has a 15 square-mile drainage area. Nearing the confluence with the Delaware River, Alexauken Creek goes under a railroad bridge and is then carried under the D&R Canal aqueduct, approximately 300 feet before it meets the Delaware River.

22. <u>Basis of Cost for Lambertville TSP</u>: Cost estimate presented herein for the Lambertville TSP analysis are based on May 2014 price levels. The TSP costs generally follow the construction procedures outlined in the concept-level analysis and include new or updated costs based on the following additional information.

23. Lump sum cost items were added based on updated site information as follows: "Levee/Floodwall Mitigation" in the amount of \$482,000 was added to cover mitigation requirements. "Maintenance of Traffic" in the amount of \$75,000 was added to cover costs for a traffic plan and a flag-person for maintenance and protection of traffic.

24. Lands and damages costs have been broken out in more detail based on information provided by NAB-RE.

25. Mitigation costs were updated as shown in item "06 Fish and Wildlife Facilities" and are based on refinement of TSP alignment. For more information on the mitigation costs used for the mitigation optimization, refer to the Section of the Feasibility Study, Main Report describing Line of Protection.

26. Interior drainage costs of \$902,000 were added as shown in item "15 Floodway Control-Diversion Structure" and are based on maximizing NED benefits. For more information on the interior drainage optimization, refer to the Section of the Feasibility Study, Main Report describing Interior Drainage.

27. The costs for the Lambertville TSP as described in paragraph 16 for this first phase of site selection are shown in Table 1.

28. <u>Annual Charges for Lambertville TSP</u>: The estimate of annual charges for the tentatively selected plan is based on an economic project life of 50 years and an interest rate of 3.5%. The annual charges include annualized first cost and interest during construction, post construction monitoring costs, and OMRR&R costs. It is noted that interest during construction was developed for the first cost of the project constructed over a 30-month period. For the Lambertville TSP, the total annualized cost is \$432,000.

29. OMRR&R costs for the TSP were estimated to be \$36,000 annually and covers inspections and maintenance of the gates, gate chambers, access ramps, levees, and interior drainage appurtenant structures.

30. Post construction monitoring costs include environmental monitoring over the 50-year project life. Total annualized monitoring costs are \$20,000 per year for the first 5 years after construction.

31. <u>Gibbstown TSP</u>: The TSP in Gibbstown consists of approximately 7,386 linear feet of levee and approximately 13,788 LF of floodwall forming the line of protection which generally follows the railway alignment along the north edge of town. The TSP also included

acquisition of 16 residential properties and one currently vacant commercial property and three ringwalls around commercial facilities.

32. <u>Basis of Cost for Gibbstown TSP</u>: Cost estimate presented herein for the Gibbstown TSP analysis are based on May 2014 price levels. The TSP costs generally follow the construction procedures outlined in the concept-level analysis and include new or updated costs based on the following additional information.

33. Lump sum cost items were added based on updated site information as follows: "Utility relocation" in the amount of \$3,000,000 was included as a place holder to account for pipe crossings, buried communication lines and overhead wires. "Levee/Floodwall Mitigation" in the amount of \$3,521,000 (excluding contingencies) was added to cover mitigation requirements. "Maintenance of Traffic" in the amount of \$1,000,000 was added to cover costs for a traffic plan and a flag-person for maintenance and protection of traffic.

34. Lands and damages costs have been broken out in more detail based on information provided by NAB-RE.

35. Mitigation costs were updated as shown in item "06 Fish and Wildlife Facilities" and are based on three alternative alignments that were considered for the Gibbstown line of protection. For more information on the mitigation costs used for the mitigation optimization, refer to the Section of the Feasibility Study, Main Report describing Line of Protection.

36. Interior drainage costs of \$12,572,000 were added as shown in item "15 Floodway Control-Diversion Structure" and are based on maximizing NED benefits. For more information on the interior drainage optimization, refer to the Section of the Feasibility Study, Main Report describing Interior Drainage.

37. The costs for the Gibbstown TSP as described in paragraph 26 for this first phase of site selection are shown in Table 2.

38 <u>Annual Charges for Gibbstown TSP</u>: The estimate of annual charges for the tentatively selected plan is based on an economic project life of 50 years and an interest rate of 3.5%. The annual charges include annualized first cost and interest during construction, post construction monitoring costs, and OMRR&R costs. It is noted that interest during construction was developed for the first cost of the project constructed over a 30-month period. For the Gibbstown TSP, the total annualized cost is \$8,286,000.

39. OMRR&R costs for the TSP were estimated to be \$198,000 annually and covers inspections and maintenance of the gates, gate chambers, access ramps, levees, and interior drainage appurtenant structures.

40. Post construction monitoring costs include environmental monitoring over the 50-year project life. Total annualized monitoring costs are \$20,000 per year for the first 5 years after construction.

### OPTIMIZATION OF SITE 5: LAMBERTVILLE, HUNTERDON CO., NJ

41. <u>General</u>: [to be provided by NAP]

# OPTIMIZATION OF SITE 8: GIBBSTOWN (GREENWICH AND LOGAN TOWNSHIPS), GLOUCESTER CO., NJ

42. <u>General</u>: [to be provided by NAP]

#### Table 1: Tentatively Selected Plan Costs - Site 5: Levee/Floodwall, Lambertville, NJ

Price Level:

May-14

 

 Location:
 Along Alexauken Creek (levee) and Delaware & Raritan Canal embankment (floodwall).

 Measure:
 516 LF of earthen levee at Alexauken Creek (top height 14 feet above grade) and 1409 LF of floodwall 118

 Account NUMBER
 DESCRIPTION OF ITEM
 QUAN-TITY
 UOM
 UNIT PRICE
 ESTIMATED AMOUNT
 CONTINGENCY
 TOTAL COST

 01
 Lands and Damages
 200
 \$288,052
 \$101,000
 \$389,0

						the second	
01	Lands and Damages				\$288.052	\$101.000	\$380 000
~1	Permanent Fasement	21	Acres	\$62 200 00	\$102 560	\$67,000	\$350 560
-	Tamporary Essement	0.0	Acres	\$6,2290.00	\$5,405	\$2,000	\$7.405
	I and acces with 54" nine install	0.9	Acres	\$6,229.00	\$2,405	\$2,000	\$7,40.
-	Survey and Americal	1	LS	302,290.00	\$02,000	\$22,000	\$84,000
	Survey and Appraisa	1	12	8%	\$28,078	\$10,000	\$58,078
06	Fish and Wildlife Facilities		1				
	Levee/Floodwall Mitigation	1	LS	\$482,000.00	\$482,000	\$169,000	\$651,000
11	7 171 1 0					A1 745 000	
11	Levees and Floodwalls		7.0	676 000 00	\$3,216,000	\$1,127,000	\$4,343,000
_	Mobilization & Demobilization	1	LS	\$75,000.00	\$75,000	\$26,000	\$101,000
	Access Road Preparatory Work	1925	LF	\$80.00	\$154,000	\$54,000	\$208,000
	Contractor Staging Areas	1	EA	\$25,000.00	\$25,000	\$9,000	\$34,000
_	Maintenance of Traffic	1	Job	\$75,000.00	\$75,000	\$26,000	\$101,000
	Floodwalls		1				
	Concrete	572	CY	\$838.50	\$480,000	\$168,000	\$648,000
	Clearing & Grubbing	2.25	Acres	\$21,242.00	\$48,000	\$17,000	\$65,000
	Excavation	1.979	CY	\$12.18	\$24,000	\$8,000	\$32.000
-	Common Fill	2.007	CY	\$30.19	\$61,000	\$21,000	\$82,000
	Care of Water	9	Davs	\$1,185,08	\$11,000	\$4 000	\$15.000
	Stripping	573	CY	\$10.06	\$6 000	\$2,000	\$8 000
-	Sheet Piling	31,602	SF	\$50.31	\$1,590,000	\$557,000	\$2,147,000
	6" Tonsoil & Seeding	3 107	SY	\$5.03	\$16 000	\$6.000	\$22.000
		-,					
	Levee				in the second	0000	
	Clearing & Grubbing	1.71	Acres	\$21,242.00	\$36,000	\$13,000	\$49,000
	Excavation	1,817	CY	\$12.30	\$22,000	\$8,000	\$30,000
	Purchase Impervious Fill	3,180	CY	\$30.19	\$96,000	\$34,000	\$130,000
	Common Fill	8,862	CY	\$30.19	\$267,000	\$93,000	\$360,000
	Haul Fill - 5 miles	12,641	CY	\$12.69	\$160,000	\$56,000	\$216,000
	Backfill of material	11,442	CY	\$3.35	\$38,000	\$13,000	\$51,000
-	Care of Water/dewatering	4	Days	\$1,185.08	\$5,000	\$2,000	\$7,000
_	Stripping	1,424	CY	\$10.06	\$14,000	\$5,000	\$19,000
-	6" Topsoil & Seeding	2,551	SY	\$5.03	\$13,000	\$5,000	\$18,000
15	Floodway Control-Diversion				\$902,000	\$316,000	\$1,218,000
	Execution for nine	325	CV	\$12.30	\$1.000	\$1.400	\$5.400
	Backfill of material for nine	557	CV	\$3.35	\$1,000	\$700	\$2.600
-	Sheetpiling	2 600	CE	\$50.31	\$131,000	\$16,000	\$177.000
	Markels Transa & Carrier	2,000	TACT	\$067.07	\$151,000	\$2,000	\$111,000
_	Manhole Frame & Cover	1265	EACH	\$907.07	\$7,000	\$2,000	\$9,000
_	Concrete for injet/outlet/MH	130.3	TT	3403.97	\$03,000	\$22,000	\$85,000
	24 RCP	1/3	LF	304.84	\$11,000	\$4,000	\$15,000
	24 Dia. Flap Gate	2	EACH	\$4.052.75	\$20,000	\$7,000	\$27,000
	24 Sluice Gate	2	EACH	\$18,558.80	\$93,000	\$55,000	\$126,000
	24 x 24 Trash Rack	2	EACH	\$5/1.30	\$5,000	\$1,100	\$4,100
	60" x 60" Shuce Gate	- 2	EACH	\$50,310.00	\$101,000	\$35,400	\$136,400
	60" dia Flap gate	2	EACH	\$19,006.00	\$38,000	\$13,300	\$51,300
	Concrete for Chamber	69	CY	\$838.50	\$58,000	\$20,300	\$78,300
	Excavation for chamber	11/	CY	\$12.30	\$1,000	\$400	\$1,400
	Jacking/Bore 54" pipe	200	LF	\$1.246.00	\$318,000	\$111,300	\$429,300
	54" Inlet Structure	1	EACH	\$23.003.00	\$23,000	\$8,100	\$31,100
	54" Outlet fructure	1	EACH	\$23.003.00	\$23,000	\$8,100	\$31,100
-	60" x 60" Trash rack	2	EACH	\$3,194.00	\$6,000	\$2,100	\$8,100
19	Buildings and Grounds		1	- II	\$437,100	\$153,000	\$590.000
	One buyout	1.0	LS	\$437,100.00	\$437,100	\$153,000	\$590,100
-							
30	Planning, Engineering, and Design		Job	12%	\$816,000	\$122,000	\$938,000
31	Construction Management		Job	10%	\$680.000	\$102.000	\$782.000
		1	1			Total First Cost	\$8 911 000

Delaware River Basin Comprehensive Flood Risk Management Interim Feasibility Study and Integrated EA for New Jersey

Table 2: Tentatively Selected Plan Costs for Site 8: Levee/Floodwall, Gibbstown, NJ											
	(Greenwich and Logan Toy	vnships, N.	<b>I</b> )								
	(0100101010101010200gun 10)	·	- )				-				
Location	Patruage Delaware Biver and develop	ad areas		Drice Level M	Low 2014						
Location: Mossure	21330 I E lavae and floodwall excludin	et areas.	ac ring u	rice Level. M	rances: 64.6% (	13788) of the strue	etura	would be			
wie as ure.	floodwall (concrete T well and L S we	ig the fing level	es, mg v	E of lavaa Dima	Tances, 04.0% (	13,700) Of the struct	in thi	would be			
	Top beight is 12 feet NAVD88	n with piles) at	iu 7,380 i	LF of levee. King	wans and levee	s are not included i	n une	siengui			
	Top height is 12 feet NAV D88.	7 huildinga auto		and 2 manufact	wing fogiliting		-				
	includes nonstructural protection for 1	/ buildings outs	side LOP	and 5 manufactu	iring facilities		-				
ACCOUNT CODE	DESCRIPTION OF ITEM	QUANTITY	UOM	UNIT PRICE	ES TIMATED AMOUNT	CONTINGENCY		TOTAL			
							<u> </u>				
01	Lands and Damages				\$5,182,000	\$1,814,000		\$6,996,000			
	Permanent Easement	62.5	Acres	\$62,500.00	\$3,905,000	\$ 1,367,000		\$5,272,000			
	Temporary Easement	12.3	Acres	\$62,500.00	\$772,000	\$ 270,000	<u> </u>	\$1,042,000			
	Survey and Appraisal		LS	8%	\$505,000	\$ 177,000		\$682,000			
	¥7,494, 1 /4			** ~~~ ~~~ ~~	<b>**</b> • • • • • • •	<b>* *</b> • • • • • • • • • • • • • • • • • • •		<b>* * • • •</b> • • • • •			
02	Utility relocation	1	LS	\$3,000,000.00	\$3,000,000	\$ 1,050,000		\$4,050,000			
						<b>* 1 * * * *</b>					
06	Fish and Wildlife Facilities		~ ~		\$ 3,521,000	\$ 1,232,000	\$	4,753,000			
	Levee/Floodwall Mitigation	1	LS	\$3,521,000.00	\$ 3,521,000	\$ 1,232,000	\$	4,753,000			
11	Lesses and Flag density				\$94.9 <b>7</b> 5.000	\$20 <b>5</b> 00 000	đ	114 502 000			
11	Levees and Floodwalls				\$84,875,000	\$29,708,000	\$	114,583,000			
		1	τc	¢75.000.00	¢75.000	¢ 26.000	-	¢101.000			
	Mob & Demob	10,100	LS	\$/5,000.00	\$75,000	\$ 26,000		\$101,000			
	Temporary Access Road	19,100		\$80.00	\$1,528,000	\$ 535,000		\$2,063,000			
	Contractor Staging Areas	3	EA	\$25,000.00	\$/5,000	\$ 26,000	¢	\$101,000			
	Maintenance of Traffic	1	LS	\$1,000,000.00	\$ 1,000,000	\$ 350,000	\$	1,350,000			
	Ping Lavaa				\$5 740 000	\$2,000,000	-	\$7.740.000			
	Clearing & Cruthing	10.2	A	\$21,242,00	\$3,740,000	\$2,009,000	¢	\$7,749,000			
	Excavation	16.269	CV	\$21,242.00	\$220,000	\$ 70,000	ې ۲	297,000			
	Durahasa Imparujana Fill	20.044	CV	\$12.30	\$200,000	\$ 70,000	ф Ф	270,000			
	Purchase Common Fill	20,944 66.026	CV	\$30.19	\$1,993,000	\$ 698,000	ф Ф	2 691 000			
	Haul Fill - 5 miles (impervious &	00,020	CI	\$12.69	\$1,995,000	\$ 098,000	φ	2,091,000			
	purchased common fill)	85 3/3	CV	\$12.07	\$1.083.000	\$ 379,000	\$	1 462 000			
	Haul and Disposal	14 642	CY	\$12.69	\$1,085,000	\$ 65,000	\$	251,000			
	Dump Charges (25% of material)	5 683	Tons	\$81.87	\$465,000	\$ 163,000	\$	628,000			
	Dump Charges (75% of material)	17 049	Tons	\$24.58	\$419,000	\$ 147,000	\$	566,000			
	Backfill of material	88 597	CV	\$3.35	\$297,000	\$ 104,000	\$	401,000			
	Dewatering	39	Davs	\$1 185 08	\$46,000	\$ 16,000	\$	62,000			
	Stripping of Topsoil	9437	CY CY	\$10.06	\$95,000	\$ 33,000	\$	128,000			
	6" Topsoil & Seeding	20.741	SY	\$5.03	\$104,000	\$ 36,000	\$	140,000			
		20,7 11		40.00	\$10 H,000	\$ 20,000	÷	110,000			
	Ring Walls (Non Structural)				\$2,429,000	\$852.000		\$3.281.000			
	Concrete in place	2.063	CY	\$838.50	\$1.730.000	\$ 606.000	\$	2.336.000			
	Clearing & Grubbing	4.3	Acres	\$21,242.00	\$92.000	\$ 32.000	\$	124.000			
	Excavation	4,840	CY	\$12.30	\$60,000	\$ 21,000	\$	81,000			
	Purchase Common Fill	3,389	CY	\$30.19	\$102,000	\$ 36,000	\$	138,000			
	Haul Fill - 5 miles (impervious &	2 200	CV	¢10.00	¢ 42 000	¢ 15.000	¢	50 000			
	purchased common fill)	3,389	CΪ	\$12.09	\$45,000	φ 15,000	ð	38,000			
	Haul and Disposal	4,356	CY	\$12.69	\$55,000	\$ 19,000	\$	74,000			
	Dewatering	25	Days	\$1,185.08	\$30,000	\$ 11,000	\$	41,000			
	Dump Charges (25% of material)	1,691	TON	\$81.87	\$138,000	\$ 48,000	\$	186,000			
	Dump Charges (75% of material)	5,072	TON	\$24.58	\$125,000	\$ 44,000	\$	169,000			
	Backfill of material	3,873	CY	\$3.35	\$13,000	\$ 5,000	\$	18,000			
	Stripping of Topsoil	1,023	CY	\$10.06	\$10,000	\$ 4,000	\$	14,000			
	6" Topsoil & Seeding	6,138	SY	\$5.03	\$31,000	\$ 11,000	\$	42,000			

Table 2: Tentatively Selected Plan Costs for Site 8: Levee/Floodwall, Gibbstown, NJ											
	(Greenwich and Logan Toy	vnships. N.	<b>J</b> )								
ACCOUNT CODE	DESCRIPTION OF ITEM	QUANTITY	UOM	UNIT PRICE	ES /	STIMATED AMOUNT	С	ONTINGENCY		TOTAL	
	Levees				\$2	0,000,000	\$	7,001,000	\$	27,001,000	
	Clearing & Grubbing	35.8	Acres	\$21,242.00	\$	760,000	\$	266,000	\$	1,026,000	
	Excavation	60,985	CY	\$12.30	\$	750,000	\$	263,000	\$	1,013,000	
	Purchase Impervious Fill	48,761	CY	\$30.19	\$	1,472,000	\$	515,000	\$	1,987,000	
	Purchase Common Fill	140,239	СҮ	\$30.19	\$	4,233,000	\$	1,482,000	\$	5,715,000	
	Haul Fill - 5 miles (impervious &										
	purchased common fill)	189,000	CY	\$12.69	\$	2,398,000	\$	839,000	\$	3,237,000	
	Backfill of material	195,098	CY	\$3.35	\$	654,000	\$	229,000	\$	883,000	
	Care of water/dewatering	21.961	Days	\$1,185.08	\$	220,000	\$ \$	37,000	\$ \$	207,000	
	6" Topsoil & Seeding	/18 030	SV SV	\$10.06	s s	220,000	\$ \$	86,000	ф Ф	297,000	
	Geotextile	173.079	SY	\$3.03	\$	240,000	\$	271,000	\$	1 045 000	
	Vertical (wick) Drains	2.880.057	LF	\$1.50	\$	4.315.000	\$	1.510.000	\$	5.825.000	
	Haul and Dispose	54,887	CY	\$12.69	\$	696,000	\$	244,000	\$	940,000	
	Dump Charges (25% of material)	21,303	TONS	\$81.87	\$	1,744,000	\$	610,000	\$	2,354,000	
	Dump Charges (75% of material)	63,908	TONS	\$24.58	\$	1,571,000	\$	550,000	\$	2,121,000	
	Levee Surcharge Fill Volume	5,022	CY	\$12.30	\$	62,000	\$	22,000	\$	84,000	
										+=== == = = = =	
	Floodwalls				\$:	54,028,000		\$18,909,000		\$72,937,000	
	Concrete in place	32,045	CY	\$838.50		\$26,870,000	\$	9,405,000	\$	36,275,000	
	Clearing & Grubbing	34.7	Acres	\$21,242.00		\$738,000	\$	258,000	\$	996,000	
	Excavation	96,548	CY	\$12.30		\$1,187,000	\$	415,000	\$	1,602,000	
	Purchase Common Fill	60,798	CY	\$33.54		\$2,039,000	\$	714,000	\$	2,753,000	
	Dewatering	345	Days	\$1,185.08		\$409,000	\$	143,000	\$	552,000	
	runchased common fill	51,143	CY	\$12.69		\$649,000	\$	227,000	\$	876,000	
	Haul and Disposal	86 893	CY	\$12.69		\$1,103,000	\$	386,000	\$	1 489 000	
	Stripping of Topsoil	19,864	CY	\$10.06		\$200,000	\$	70,000	\$	270,000	
	Piles	164,729	LF	\$83.85		\$13,812,000	\$	4,834,000	\$	18,646,000	
	Sheet Piling	14,100	SF	\$60.60		\$854,000	\$	299,000	\$	1,153,000	
	Toe Drain Filter	979	CY	\$32.48		\$32,000	\$	11,000	\$	43,000	
	Dump Charges (25% of material)	33,725	TONS	\$81.87		\$2,761,000	\$	966,000	\$	3,727,000	
	Dump Charges (75% of material)	101,176	TONS	\$24.58		\$2,486,000	\$	870,000	\$	3,356,000	
	Backfill of material	70,453	CY	\$3.35		\$236,000	\$	83,000	\$	319,000	
	Toe Drain 6" Perf. Pipe	13,168	LF	\$3.91		\$52,000	\$	18,000	\$	70,000	
	6" Topsoil & Seeding	119,184	SY	\$5.03		\$600,000	\$	210,000	\$	810,000	
15	Floodway Control-Diversion Structure				\$	9,312,000	\$	3,260,000	\$	12,572,000	
	Exacavation	5,578	CY	\$12.30	\$	69,000	\$	24,000	\$	93,000	
	Backfull of material for pipe	3,953	CY	\$3.35	\$	13,000	\$	5,000	\$	18,000	
	Concrete for Shring Cotter	1 714	EACH	\$967.07	\$ ¢	57,000	\$ ¢	502,000	¢	1 040 000	
	Concrete for inlet/outlet/MH	1,/14		\$463.97	و ک	534,000	ф S	187,000	ې ک	721,000	
	24" RCP	2.065	LF	\$64.84	\$	134,000	\$	47.000	\$	181,000	
	24" Dia. Flap Gate	59	EACH	\$4.052.75	\$	239.000	\$	84.000	\$	323.000	
<u> </u>	24" Sluice Gate	59	EACH	\$18,558.80	\$	1,095,000	\$	383,000	\$	1,478,000	
	24" x 24" Trash Rack	59	EACH	\$571.30	\$	34,000	\$	12,000	\$	46,000	
	10' x 6' Sluice Gate	12	EACH	\$111,800.00	\$	1,342,000	\$	470,000	\$	1,812,000	
	10'x6' Flap Gate	12	EACH	\$39,130.00	\$	470,000	\$	165,000	\$	635,000	
	Piles	9,750	LF	\$83.85	\$	818,000	\$	286,000	\$	1,104,000	
	Dewatering	360	DAYS	\$1,677.00	\$	604,000	\$	211,000	\$	815,000	
	Haul and Disposal	1,625	CY	\$12.69	\$	21,000	\$	7,000	\$	28,000	
	Allowance for electrical	3	EACH	\$300,000.00	\$	900,000	\$	315,000	\$	1,215,000	
	Swing Gates	1,947	51	\$/93.78	\$	1,545,000	\$	541,000	Э	2,086,000	
Data			1						A (	No. No.	

Delaware River Basin Comprehensive Flood Risk Management Interim Feasibility Study and Integrated EA for New Jersey

Table 2:	Tentatively Selected Plan Co	osts for Site	e 8: Le	vee/Floodwa	ll, Gibbstow	vn, NJ				
	(Greenwich and Logan To	wnships, N.	J)							
ACCOUNT CODE	DESCRIPTION OF ITEM	QUANTITY	UOM	UNIT PRICE	ESTIMATED AMOUNT	CONTINGENCY		TOTAL		
_										
19	Buildings & Grounds				\$ 3,308,560	\$ 1,159,000	\$	4,467,560		
	Voluntary Acquisition (approx. 17)	1	LS	\$2,485,000.00	\$ 2,485,000	\$ 870,000	\$	3,355,000		
	Abatement	1	LS	\$170,000.00	\$ 170,000	\$ 60,000	\$	230,000		
	Demolition	1	LS	\$331,000.00	\$ 331,000	\$ 116,000	\$	447,000		
	Survey and Appraisal		LS	8%	\$322,560	\$ 113,000		\$435,560		
	Planning, Engineering, and									
30	Design	1	Job	12%	\$16,365,000	\$ 2,455,000	\$	18,820,000		
31	Construction Management	1	Iob	10%	\$13.638.000	\$ 2.046.000	\$	15.684.000		
	and the second sec		300	10/0	+ 10,000,000	÷ 2,010,000	Ψ	10,00 1,000		
Total First Cost \$										

Table Site 1 Concept-Level Costs for Site 1: Floodwall, Knowlton, NJ (The Island/Glen Afton)

Location: Knowlton Township, NJ, running along the bank of the Delaware River.

Locucion	reconsidered to the second and the second are been the been the second s	
Measure:	4,000 LF floodwall, tie-off levees perpendicular to the river, 9 interior drainage outlets. Top height 9 feet above ground	Price Level:
		1

ACCOUNT ESTIMATED QUANTITY UOM DESCRIPTION OF ITEM UNIT PRICE CONTINGENCY TOTAL COST NUMBER AMOUNT 01 Lands and Damages LS 462,000 116,000 578,000 461,569 \$ S 1 \$ S Fish and Wildlife Facilities 06 \$506,000 \$ 177,000 S 683.000 Levee/Floodwall Mitigation LS 506,400 506,000 683.000 1 \$ \$ \$ 177.000 \$ 11 Levees and Floodwalls S 10,128,000 3,545,000 13,673,000 S S Floodwalls Mobilization & Demobilization 125,000 125,000 169,000 1 Job \$ \$ \$ 44,000 \$ Maint, of Traffic, Access Roads, and 2% \$ 203,000 \$ 71,000 \$ 274,000 Job 1 Survey 750.00 \$ 2,724,000 \$ 10,378 CY 7,783,000 10,507,000 Concrete \$ \$ 29,524 CY 16.52 488,000 171,000 659,000 Excavation \$ \$ \$ \$ 27.00 \$ 570,000 770,000 Common Fill 21,111 CY \$ \$ 200,000 \$ Care of Water 106 Days \$ 1,060.00 \$ 112,000 \$ 39,000 \$ 151,000 5,531 CY 9.00 \$ 50,000 \$ 18,000 \$ 68,000 Stripping \$ Toe Drain Filter CY 29.05 \$ 7,000 \$ 2,000 \$ 9,000 243 \$ 6" Perf. Pipe 3,200 FT \$ 3.50 \$ 11,000 \$ 4,000 \$ 15,000 Topsoil & Seeding 15,948 SY \$ 3.25 \$ 52,000 \$ 18,000 \$ 70,000 254,000 **Tieoff Levees** 1 LS \$ 726,855.67 \$ 726,856 \$ \$ 980,856 Floodway Control-Diversion \$373,000 \$ 131,000 S 504,000 15 Structure Excavation for pipe 603 CY \$10.89 \$7,000 2,000 9.000 \$ \$ Backfill of material for pipe 603 CY \$2.94 \$2,000 1,000 \$ 3,000 \$ Manhole Frame & Cover 9 EACH \$665.00 \$6,000 \$ 2,000 \$ 8,000 Concrete for inlet/outlet/MH 176 CY \$750.00 \$132,000 \$ 46,000 \$ 178,000 24" RCP \$16,000 \$ 315 LF \$49.50 6,000 \$ 22,000 24" DIA. Flap Gate 9 EACH \$100,000 \$ 35,000 \$ 135,000 \$11,100 24" Sluice Gate 9 EACH \$10,700 \$96,000 \$ 130,000 34,000 \$ 24" x 24" Trash Rack 9 EACH \$511 \$5,000 \$ 2,000 \$ 7,000 Riprap 2 CY \$90.00 \$0 \$ \$ Excavation for Channel 800 CY \$10.89 \$9,000 \$ 3,000 \$ 12,000 30 Job 12% \$1,783,000 267,000 2,050,000 Planning, Engineering, and Design 1 \$ \$ **Construction Management** 31 Job 10% \$1,486,000 223,000 1,709,000 \$ 1 S Total First Cost \$ 19,197,000

Dec-10

 Table Site 2a:
 Concept Level Costs for Site 2a: Floodwall, Phillipsburg, NJ

 Location:
 Along Lopatcong Creek

Measure:	700 LF floodwall (concrete T-wall). T	op height app	height approximately 15 feet above grade.				Price	e Level:	Dec-10		
ACCOUNT NUMBER	DESCRIPTION OF ITEM	QUANTITY	UOM	UN	UNIT PRICE		ESTIMATED AMOUNT		NTINGENCY	т	OTAL COST
01	Lands and Damages	1	LS	\$	52,323	s	52,000	\$	13,000	s	65,000
06	Fish and Wildlife Facilities					s	199,000	s	70,000	s	269,000
	Levee/Floodwall Mitigation	1	LS	\$	199,050	\$	199,000	\$	70,000	\$	269,000
11	Levees and Floodwalls			1		\$	3,981,000	\$	1,393,000	\$	5,374,000
	Floodwalls					5					
	Mobilization & Demobilization	1	Job	\$	125,000	\$	125,000	\$	44,000	\$	169,000
	Maint. Of Traffic, Access Roads, and Survey	1	Job		2%	\$	76,000	\$	27,000	\$	103,000
	Concrete	4,384	CY	\$	750.00	\$	3,288,000	\$	1,151,000	\$	4,439,000
	Excavation	11,670	CY	\$	16.52	\$	193,000	\$	68,000	\$	261,000
	Common Fill	8,104	CY	\$	27.00	\$	219,000	\$	77,000	\$	296,000
	Care of Water	41	Days	\$	1,060.00	\$	43,000	\$	15,000	\$	58,000
	Stripping	1,777	CY	\$	9.00	\$	16,000	\$	6,000	\$	22,000
	Toe Drain Filter	53	CY	\$	29.05	\$	2,000	\$	1,000	\$	3,000
	6" Perf. Pipe	700	FT	\$	3.50	\$	2,000	\$	1,000	\$	3,000
	Topsoil & Seeding	5,189	SY	\$	3.25	\$	17,000	\$	6,000	\$	23,000
15	Floodway Control-Diversion Structure					\$	35,000	\$	12,000	\$	47,000
	Excavation for pipe	67	CY	11	\$10.89	\$	1,000	\$	350	\$	1,000
	Backfill of material for pipe	67	CY	<u></u>	\$2.94	\$	200	\$	70	\$	300
	Manhole Frame & Cover	1	EACH	1	\$665	\$	1,000	\$	350	\$	1,000
	Concrete for inlet/outlet/MH	20	CY	10	\$400	\$	8,000	\$	2,800	\$	11,000
	24" RCP	35	LF	11	\$50	\$	2,000	\$	700	\$	3,000
	24" Dia. Flap Gate	1	EACH	10.000	\$11,100	\$	11,000	\$	3,850	\$	15,000
	24" Sluice Gate	1	EACH	1.	\$10,700	\$	11,000	\$	3,850	\$	15,000
	24" x 24" Trash Rack	1	EACH		\$511	\$	1,000	\$	350	\$	1,000
30	Planning, Engineering, and Design	1	Job		12%	s	683,000	\$	102,000	\$	785,000
31	Construction Management	1	Job		10%	s	569,000	\$	85,000	\$	654,000
								Т	otal First Cost	\$	7,194,000

#### Table Site 2b: Concept Level Costs for Site 2b: Floodwall, Phillipsburg, NJ

Location: Municipal Waste Water Treatment Plant (WWTP).

Measure: 1,725 LF floodwall/ringwall (concrete T-wall) surrounding municipal WWTP. Top height approximately 10 feet above grade.

ACCOUNT NUMBER	DESCRIPTION OF ITEM	QUANTITY	UOM	UNIT PRICE	E	ESTIMATED AMOUNT CONTINGENCY		NTINGENCY	TOTAL COS	
01	Lands and Damages	1	LS	\$1,615	\$	1,615	\$	400	s	2,000
06	Fish and Wildlife Facilities				\$	370,000	s	130,000	s	500,000
	Levee/Floodwall Mitigation	1	LS	\$ 369,650	\$	370,000	\$	130,000	\$	500,000
11	Levees and Floodwalls				\$	7,393,000	s	2,588,000	s	9,981,000
	Floodwalls	1.1			10.11				1.1	
	Mobilization & Demobilization	1	Job	\$ 125,000	\$	125,000	\$	44,000	\$	169,000
	Maint. of Traffic, Access Roads, and Survey	1	Job	2%	ó \$	145,000	\$	51,000	\$	196,000
	Concrete	8,211	CY	\$ 750.00	\$	6,158,000	\$	2,155,000	\$	8,313,000
()	Excavation	22,537	CY	\$ 16.52	\$	372,000	\$	130,000	\$	502,000
	Common Fill	15,865	CY	\$ 27.00	\$	428,000	\$	150,000	\$	578,000
	Care of Water	80	Days	\$ 1,060.00	\$	85,000	\$	30,000	\$	115,000
	Stripping	3,782	CY	\$ 9.00	\$	34,000	\$	12,000	\$	46,000
	Toe Drain	131	CY	\$ 29.05	\$	4,000	\$	1,000	\$	5,000
	6" Perf. Pipe	1,725	LF	\$ 3.50	\$	6,000	\$	2,000	\$	8,000
	Topsoil & Seeding	10,999	SY	\$ 3.25	\$	36,000	\$	13,000	\$	49,000
15	Floodway Control-Diversion Structure				\$	134,000	\$	46,000	s	180,000
	Excavation for pipe	268	CY	\$10.89	\$	3,000	\$	1,000	\$	4,000
	Backfill of material for pipe	268	CY	\$2.94	\$	1,000	\$	400	\$	1,400
	Manhole Frame & Cover	4	EACH	\$665	\$	3,000	\$	1,000	\$	4,000
	Concrete for inlet/outlet/MH	78	CY	\$400	\$	31,000	\$	11,000	\$	42,000
	24" RCP	140	LF	\$50	\$	7,000	\$	2,000	\$	9,000
	24" Dia. Flap Gate	4	EACH	\$11,100	\$	44,000	\$	15,000	\$	59,000
	24" Sluice Gate	4	EACH	\$10,700	\$	43,000	\$	15,000	\$	58,000
_	24" x 24" Trash Rack	4	EACH	\$511	\$	2,000	\$	1,000	\$	3,000
30	Planning, Engineering, and Design		Job	12%	\$	1,220,000	s	183,000	s	1,403,000
31	Construction Management		Job	10%	6 \$	1,016,000	\$	152,000	s	1,168,000
							Tota	l First Cost	s	13.234.000

#### Table Site 3: Concept Level Costs for Site 3: Floodwall, Frenchtown, NJ.

Location: Along existing bike path in Frenchtown.

Measure:	7,000 LF floodwall (concrete inverted	odwall (concrete inverted cantilever T-wall w/ key with sheetpile cutoff).					Price Level:	Dec-10			
ACCOUNT NUMBER	DESCRIPTION OF ITEM	QUANTITY	UOM	U	NIT PRICE	E	STIMATED AMOUNT	CO	NTINGENCY	т	OTAL COST
01	Lands and Damages	1	LS	\$	10,224	\$	10,000	\$	3,000	\$	13,000
06	Fish and Wildlife Facilities									1	
	Levee/Floodwall Mitigation	1	LS	\$	452,000	\$	452,000	\$	158,000	\$	610,000
11	Levees and Floodwalls		1	1		\$	9,048,000	\$	3,167,000	\$	12,215,000
	Floodwalls			1							
	Mobilization & Demobilization	1	Job	\$	125,000	\$	125,000	\$	44,000	\$	169,000
	Maint. of Traffic, Access Roads, and Survey	1	Job		2%	S	186,100	\$	65,000	\$	251,100
	Concrete	5,025	CY	\$	750.00	\$	3,769,000	\$	1,319,000	\$	5,088,000
	Excavation	14,583	CY	\$	16.52	\$	241,000	\$	84,000	\$	325,000
	Common Fill	14,705	CY	\$	27.00	\$	397,000	\$	139,000	\$	536,000
	Care of Water	73	Days	\$	1,060.00	S	77,000	\$	27,000	\$	104,000
	Stripping	2,917	CY	\$	9.00	\$	26,000	\$	9,000	\$	35,000
	Sheet Piling	92,750	SF	\$	45.00	\$	4,174,000	\$	1,461,000	\$	5,635,000
	Topsoil & Seeding	16,375	SY	\$	3.25	\$	53,000	\$	19,000	\$	72,000
15	Flood Control-Diversion Structure		1.7.1	1.		\$	568,000	\$	199,000	\$	767,000
· · · · · · · · · · · · · · · · · · ·	Excavation for pipe	1,139	CY	\$	10.89	S	12,000	\$	4,000	\$	16,000
	Backfill of material for pipe	1,139	CY	\$	2.94	S	3,000	\$	1,000	\$	4,000
	Manhole Frame & Cover	17	EACH	\$	665.00	\$	11,000	\$	4,000	\$	15,000
1.1	Concrete for inlet/outlet/MH	332	CY	\$	400.00	S	133,000	\$	47,000	\$	180,000
	24" RCP	595	LF	\$	49.50	S	29,000	\$	10,000	\$	39,000
	24" Dia. Flap Gate	17	EACH	\$	11,100.00	\$	189,000	\$	66,000	\$	255,000
	24" Sluice Gate	17	EACH	\$	10,700.00	\$	182,000	\$	64,000	\$	246,000
	24" x 24" Trash Rack	17	EACH	\$	511.00	\$	9,000	\$	3,000	\$	12,000
30	Planning, Engineering, and Design	1	Job		12%	\$	1,631,000	\$	245,000	\$	1,876,000
31	Construction Management	1	Job		10%	s	1,359,000	s	204,000	\$	1,563,000
				_		-		T	otal First Cost	\$	17,044,000

#### Table Site 4: Concept-Level Costs for Site 4: Levee Reinforcement, Stockton, NJ

Location: Along Delaware and Raritan Canal embankment.

Measure: Reinforce 5,400 LF of the exising D&R Canal embankment. Top height 9 feet above embankment.

ACCOUNT NUMBER	DESCRIPTION OF ITEM	QUAN- TITY	UOM	UNI	IT PRICE	E	STIMATED AMOUNT	co	NTINGENCY	T	DTAL COST
01	Lands and Damages	1	LS				\$12,000	\$	3,000		\$15,000
11	Levees and Floodwalls <sup>(1)</sup>					\$	3,680,000	\$	2,062,000	s	5,742,000
200 C 100	Levees					124					
	Mobilization & Demobilization	1	Job	\$	125,000	\$	125,000	\$	44,000	\$	169,000
	Maint. of Traffic, Access Roads, and Survey	1	Job		2%	\$	143,000	\$	50,000	\$	193,000
	Clearing & Grubbing	20	Acres		\$19,000	\$	389,000	\$	136,000	\$	525,000
	Excavation	6,400	CY		\$10.89	\$	70,000	\$	25,000	\$	95.000
	Purchase Impervious Fill	19,500	CY		\$27.00	\$	527,000	\$	184,000	\$	711,000
- 1	Purchase Common Fill (Assume 67% reuse of excavated material)	101,306	СҮ		\$27.00	\$	2,735,000	\$	957,000	\$	3,692,000
	Hau Fill - 5 lilles (impervious &	120.000	OV		011 35	•	1 271 000	•	480.000	¢	1.051.000
	Packfill of motorial	112,800	CV		\$2.04	0	1,371,000	Ф Ф	480,000	0	1,851,000
	Cara of Water/dewatering	115,200	Dave		\$2.94	0	333,000	Ф Ф	17,000	\$	450,000
	Stripping of Topsoil	43	Days		\$1,000.00	0	46,000	Ф Ф	20,000	¢	116,000
	Topsoil & Seed	9,500	CI		\$9.00	0	62,000	Ф Ф	30,000	9	110,000
	Mitigation-Historic Significance	19,040	LS	-	25%	\$	1,472,000	\$	-	\$	1,472,000
15	Floodway Control-Diversion Structure					\$	65,000	\$	22,000	s	87,000
	Excavation for pipe	134	CY	\$	10.89	\$	1,000	\$	400	\$	1,400
	Backfill of material for pipe	134	CY	\$	2.94	\$	400	\$	100	\$	500
	Manhole Frame & Cover	2	EACH	\$	665	\$	1,000	\$		\$	1,000
	Concrete for inlet/outlet/MH	39	CY	\$	400	\$	16,000	\$	6,000	\$	22,000
	24" RCP	70	LF	\$	49.50	\$	3,000	\$	1,000	\$	4,000
	24" DIA. Flap Gate	2	EACH	\$	11,100	\$	22,000	\$	8,000	\$	30,000
	24"Sluice Gate	2	EACH	\$	10,700	\$	21,000	\$	7,000	\$	28,000
_	24"X24" Trash Rack	2	EACH	\$	511.00	\$	1,000	\$		\$	1,000
30	Planning, Engineering, and Design		Job		12%	\$	699,000	s	105,000	s	804,000
31	Construction Management		Job		10%	\$	583,000	\$	87,000	S	670,000
1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-								Т	otal First Cost	1.	\$7,318,000

Price Level: Dec 10

#### Table Site 5: Concept-Level Costs for Site 5: Levee/Floodwall, Lambertville, NJ

Along Alexauken Creek (levee) and Delaware & Raritan Canal embankment (floodwall).

Price Level:

Dec-10

Location: Measure: 590 LF of earthen levee at Alexauken Creek (top height 12 feet above grade) and 810 LF of floodwall along

ACCOUNT NUMBER	DESCRIPTION OF ITEM	QUANTITY	UOM	UN	NIT PRICE	E	STIMATED AMOUNT	CON	TINGENCY	T	DTAL COST
01	Lands and Damages	1	LS		\$167,000		\$167,000	\$	42,000	\$	209,000
06	Fish and Wildlife Facilities	-		-				-			
	Levee/Floodwall Mitigation	1	LS	\$	310,000	-	\$310,000	\$	47,000	\$	357,000
11	Levees and Floodwalls					\$	2,064,000	\$	723,000	\$	2,787,000
	Floodwalls							1 =			
	Mobilization & Demobilization	1	Job	\$	125,000	\$	125,000	\$	44,000	\$	169,000
	Concrete	1,530	CY	\$	750	\$	1,147,000	\$	401,000	\$	1.548,000
_	Excavation	4,877	CY	S	10.89	\$	53,000	\$	19,000	\$	72,000
	Common Fill	3,574	CY	S	27.00	\$	97,000	\$	34,000	\$	131,000
	Care of Water	18	Days	\$	1,060	\$	19,000	\$	7,000	\$	26,000
	Stripping	1,099	CY	S	9.00	\$	10,000	\$	4,000	\$	14,000
	Length of Piles	17,978	LF	S	10.00	\$	180,000	\$	63,000	\$	243,000
	Toe Drain Filter	62	CY	S	29.05	\$	2.000	\$	1,000	\$	3.000
	6" Perf. Pipe	809	LF	S	3.50	\$	3,000	\$	1,000	\$	4.000
	Topsoil & Seeding	3,133	SY	S	3.25	\$	10,000	\$	4,000	\$	14,000
	Levees			-				-			_
	Maint. of Traffic, Access Roads, and Survey	1	Job		2%	\$	41,000	\$	14,000	\$	55,000
	Clearing & Grubbing	1.70	Acres	\$	19,000	\$	32,000	\$	11,000	\$	43,000
	Excavation	1,375	CY	\$	10.89	\$	15,000	\$	5,000	\$	20,000
	Purchase Impervious Fill	2,578	CY	S	27.00	\$	70,000	\$	25,000	\$	95,000
	Common Fill	4,787	CY	S	27.00	S	129,000	\$	45,000	\$	174.000
	Haul Fill - 5 miles	7,365	CY	S	11.35	\$	84,000	\$	29,000	\$	113.000
	Backfill of material	8,286	CY	S	2.94	\$	24,000	\$	8,000	\$	32.00
	Care of Water/dewatering	3	Davs	S	1.060	\$	3 000	\$	1.000	\$	4 000
	Stripping	1 235	CY	S	9.00	\$	11 000	\$	4 000	S	15 000
	Topsoil & Seed	2,789	SY	S	3.25	\$	9,000	\$	3,000	\$	12,00
15	Floodway Control-Diversion Structure					\$	134,000	\$	46,000	\$	180,000
	Excavation for pipe	268	CY	S	10.89	\$	3,000	\$	1.000	\$	4.000
	Backfill of material for pipe	268	CY	S	2.94	\$	1 000	\$	400	\$	1 400
	Manhole Frame & Cover	4	FACH	S	665	\$	3,000	\$	1 000	S	4 000
	Concrete for inlet/outlet/MH	78	CY	S	400	\$	31,000	\$	11 000	ŝ	42.000
	24" RCP	140	LF	S	50	\$	7 000	\$	2,000	S	9 000
	24" Dia Flan Gate	4	FACH	S	11 100	\$	44 000	\$	15,000	\$	59.000
	24" Shice Gate	4	FACH	S	10 700	\$	43,000	\$	15,000	ŝ	58.000
	24" x 24" Trash Rack	4	EACH	S	511	\$	2,000	\$	1,000	\$	3,000
30	Planning, Engineering, and Design		Job		12%	\$	424,000	\$	64,000	\$	488,000
31	Construction Management		Job		10%	\$	353,000	\$	53,000	\$	406,000
				-				To	tal First Cost	\$	4 427 000

#### Table Site 6 Concept-Level Costs for Site 6: Floodwall, Ewing Township, NJ

Location: Delaware River-side of Route 29.

Measure: 7,700 LF Floodwall (concrete T-wall). Top height 9 feet above grade.

ACCOUNT NUMBER	DESCRIPTION OF ITEM	QUAN- TITY	UOM	UNIT PRICE	E	STIMATED AMOUNT	со	NTINGENCY	T	OTAL COST
01	Lands and Damages	1	LS	\$ 136,000	s	136,000	\$	34,000	\$	170,000
06	Fish and Wildlife Facilities						_		1.1-4	
	Levee/Floodwall Mitigation	1	LS	\$ 823,550	S	823,550	\$	288,000	\$	1,112,000
11	Levees and Floodwalls		_		s	16,471,000	\$	5,766,000	\$	22,237,000
	Floodwalls								11.	1.301.1111
-	Mobilization & Demobilization	1	Job	\$ 125,000	\$	125,000	\$	44,000	\$	169,000
121	Maint. Of Traffic, Access Roads, and Survey	1	Job	2%	\$	333,000	\$	117,000	\$	450,000
	Concrete	17.437	CY	\$750.00	\$	13.078.000	\$	4,577,000	\$	17.655.000
	Excavation	51 048	CY	\$16.52	\$	843 000	\$	295 000	\$	1 138 000
	Common Fill	36 780	CY	\$27.00	\$	993 000	\$	348 000	\$	1.341.000
	Care of Water	184	Davs	\$1,060,00	\$	195,000	S	68,000	\$	263.000
	Stripping	10 111	CY	\$9.00	\$	91 000	\$	32,000	\$	123 000
	Toe Drain Filter	479	CY	\$29.05	\$	14 000	\$	5 000	\$	19 000
	6" Perf Pipe	6 300	FT	\$3.50	\$	22,000	\$	8 000	\$	30,000
	Topsoil & Seeding	29.065	SY	\$3.25	\$	94,000	S	33,000	\$	127,000
	Tieoff Levee	1	LS	\$683,000.00	\$	683,000	\$	239,000	\$	922,000
15	Floodway Control-Diversion Structure				s	645,000	\$	227,000	\$	872,300
	Excavation for pipe	1273	CY	\$10.89	\$	14,000	\$	5,000	\$	19,000
	Backfill of material for pipe	1273	CY	\$2.94	\$	4,000	\$	1.000	\$	5,000
	Manhole Frame & Cover	19	EACH	\$665	\$	13,000	\$	5,000	\$	18,000
	Concrete for inlet/outlet/MH	370.5	CY	\$400	\$	148,000	\$	52,000	\$	200,000
	24" RCP	665	LF	\$49.50	\$	33,000	\$	12,000	\$	45,000
	24" Dia, Flap Gate	19	EACH	\$11,100	\$	211,000	\$	74,000	\$	285,000
	24" Sluice Gate	19	EACH	\$10,700	\$	203,000	\$	71,000	\$	274,000
	24" x 24" Trash Rack	19	EACH	\$511	\$	10,000	\$	4,000	\$	14,000
	Riprap	2	CY	\$90	\$	200	\$	100	\$	300
	Excavation for Channel	800	CY	\$10.89	\$	9,000	\$	3,000	\$	12,000
30	Planning, Engineering, and Design	1	Job	12%	s	2,907,000	\$	436,000	\$	3,343,000
31	Construction Management	1	Job	10%	s	2,422,000	\$	363,000	\$	2,785,000
							Tota	l First Cost	\$	30,519,000

Price Level:

Dec-10

## Table Site 7a.1: Concept-Level Costs for Site 7a.1: Floodwall, Trenton, NJ (The Island/Glen Afton) Location: Glen Afton/The Island neighborhoods along bank of Delaware River.

ACCOUNT	7,280 LF Floodwall (concrete 1-wall)	with piles). To	p neight	13 Teet above gro	ind.	STIMATED	100	Price Level:	-	Dec-1
NUMBER	DESCRIPTION OF ITEM	QUANTITY	UOM	UNIT PRICE	-	AMOUNT	CO	ONTINGENCY	T	OTAL COST
01	Lands and Damages	1	LS	\$8,000	s	8,000	\$	2,000	\$	10,00
06	Fish and Wildlife Facilities	11			s	1,652,000	\$	578,000	\$	2,230,00
	Levee/Floodwall Mitigation	1	LS	\$ 1,651,750	\$	1,652,000	\$	578,000	\$	2,230,00
11	Levees and Floodwalls				S	33,035,000	\$	11,563,000	s	44,598,00
	Mobilization & Demobilization	1	Job	125,000	\$	125,000	\$	44,000	\$	169,00
	Maint. Of Traffic, Access Roads, and Survey	1	Job	2%	\$	653,000	\$	229,000	\$	882,00
	Concrete	27,249	CY	\$750	\$	20,437,000	\$	7,153,000	\$	27,590,00
	Excavation	75,766	CY	\$16.52	\$	1,252,000	\$	438,000	\$	1,690,00
	Common Fill	53,795	CY	\$27.00	\$	1,452,000	\$	508,000	\$	1,960,00
	Care of Water	269	Days	\$1,060	\$	285,000	\$	100,000	\$	385,00
	Stripping	13,481	CY	\$9.00	\$	121,000	\$	42,000	\$	163,00
(1)	Length of Piles	388,267	LF	\$22.00	\$	8,542,000	\$	2,990,000	\$	11,532,00
	Toe Drain Filter	554	CY	\$29.05	\$	16.000	\$	6.000	\$	22.00
	6" Perf. Pipe	7,280	FT	\$3.50	\$	25,000	\$	9,000	\$	34.00
	Topsoil & Seeding	38,978	SY	\$3.25	\$	127,000	\$	44,000	\$	171,00
15	Floodway Control-Diversion Structure				\$	368,000	\$	129,000	\$	509,00
	Excavation for pipe	737	CY	\$10.89	\$	8,000	\$	3,000	\$	11,00
	Backfill of material for pipe	737	CY	\$2.94	\$	2,000	\$	1,000	\$	3,00
1.1	Manhole Frame & Cover	11	EACH	\$665	\$	7,000	\$	2,000	\$	9,00
1	Concrete for inlet/outlet/MH	214.5	CY	\$400	\$	86,000	\$	30,000	\$	116,00
	24" RCP	385	LF	\$49.50	\$	19,000	\$	7,000	\$	26,00
	24" Dia. Flap Gate	11	EACH	\$11,100	\$	122,000	\$	43,000	\$	165,00
	24" Sluice Gate	11	EACH	\$10,700	\$	118,000	\$	41,000	\$	159,00
	24" x 24" Trash Rack	11	EACH	\$511	\$	6,000	\$	2,000	\$	8,00
	Riprap	2	CY	\$90.00	\$	200	\$	100	\$	30
	Excavation for Channel	800	CY	\$10.89	\$	9,000	\$	3,000	\$	12,00
30	Planning, Engineering, and Design	1	Job	12%	\$	5,680,000	\$	852,000	\$	6,532,00
31	Construction Management	1	Job	10%	s	4,734,000	\$	710,000	\$	5,444,00
					-		-			50 222 00

Table Site 7a.2 Concept-Level Costs for Site 7a.2: Floodwall, Trenton (Glen Afton/The Island), NJ

Glen Afton/The Island neighborhoods along bank of Delaware River. Location:

7,280 LF Floodwall (concrete T-wall with piles, with removable sections). Top height 13 feet above ground. Measure: Note: A 50% increase in the Code 11 Account sub-total has been added to reflect assumed higher cost of removable sections. Price Level:

CCOUNT	DESCRIPTION OF ITEM	OUANTITY	TOM	TU	NIT DRICE	E	STIMATED	co	NTINCENCY	т	OTAL COST
NUMBER	DESCRIPTION OF ITEM	QUANTITY	COM	0.	MI PRICE	-	AMOUNT	cu	MINGENCI	TOTAL COST	
01	Lands and Damages	1	LS	\$	8,000	S	8,000	\$	2,000	\$	10,0
06	Fish and Wildlife Facilities			1		s	2,478,000	\$	867,000	\$	3,345,0
-	Levee/Floodwall Mitigation	1	LS	\$	2,478,000	\$	2,478,000	\$	867,000	\$	3,345,0
11	Levees and Floodwalls	-				\$	49,554,000	\$	17,344,000	\$	66,898,0
1000	Floodwalls	1		1 =				1		1	
	Mobilization & Demobilization	1	Job	\$	125,000	\$	125,000	\$	44,000	\$	169,0
	Survey	1	Job	1 =	2%	\$	654,000	\$	229,000	\$	883,0
	Concrete	27,249	CY	\$	750	\$	20,437,000	\$	7,153,000	\$	27,590,0
	Excavation	75,766	CY	\$	17	\$	1,252,000	\$	438,000	\$	1,690,0
	Common Fill	53,795	CY	\$	27	\$	1,452,000	\$	508,000	\$	1,960,0
	Care of Water	269	Days	\$	1,060	\$	285,000	\$	100,000	\$	385,0
	Stripping	13,481	CY	\$	9	\$	121,000	\$	42,000	\$	163,0
(1	Length of Piles	388,267	LF	\$	22	\$	8,542,000	\$	2,990,000	\$	11,532,0
	Toe Drain Filter	554	CY	\$	29	\$	16,000	\$	6,000	\$	22,0
	6" Perf. Pipe	7,280	FT	\$	4	\$	25,000	\$	9,000	\$	34,0
	Topsoil & Seeding	38,978	SY	\$	3	\$	127,000	\$	44,000	\$	171,0
15	Structure	1				s	443,000	\$	155,000	s	610,0
1. de 1. a D	Excavation for pipe	737	CY	\$	10.89	\$	8,000	\$	3,000	\$	11,0
	Backfill of material for pipe	737	CY	\$	2.94	\$	2,000	\$	1,000	\$	3,0
	Manhole Frame & Cover	11	EACH	\$	665.00	\$	7,000	\$	2,000	\$	9,0
	Concrete for inlet/outlet/MH	214.5	CY	\$	750	\$	161,000	\$	56,000	\$	217,0
	24" RCP	385	LF	\$	49.50	\$	19,000	\$	7,000	\$	26,0
_	24" dia. Flap Gate	11	EACH	\$	11,100	\$	122,000	\$	43,000	\$	165,0
	24" Sluice Gate	11	EACH	\$	10,700	\$	118,000	\$	41,000	\$	159,0
	24" x 24" Trash Rack	11	EACH	\$	511.00	\$	6,000	\$	2,000	\$	8,0
	Riprap	2	CY	\$	90.00	\$		\$		\$	
	Excavation for Channel	800	CY	\$	10.89	\$	9,000	\$	3,000	\$	12,0
30	Planning, Engineering, and Design	1	Job		12%	s	8,502,000	\$	1,275,000	\$	9,777,
31	Construction Management	1	Job		10%	s	7,085,000	\$	1,063,000	\$	8,148,
				1				т	otal First Cost	\$	88 788

Assumption is made that there is a 33% chance piles will be needed. Pile quantity adjusted to 1/3 of original quantity

#### Table Site 7b.1Concept-Level Costs for Site 7b.1: Portable Floodwall, Trenton (Downtown), NJ

Location: Downtown Trenton (two sections). 150 LF section along Route 1 and 375 LF section along NJ Route 29.

Measure:	525 LF removable floodwall.			_		E.	TRUTER		Price Level:	-	Dec-10
NUMBER	DESCRIPTION OF ITEM	QUANTITY	UOM	UN	TT PRICE	Es	AMOUNT	CO	NTINGENCY	T	DTAL COST
01	Lands and Damages	1	LS	\$	603	\$	600	\$	150	s	750
06	Fish and Wildlife Facilities		-			\$	67,000	s	23.000	s	90.000
	Levee/Floodwall Mitigation	1	LS	\$	66,825	\$	67,000	\$	23,000	\$	90,000
11	Levees and Floodwalls <sup>(1)</sup>					\$	1,336,500	\$	468,000	s	1,804,500
1.1.1	Floodwalls							ni n			
	Mobilization & Demobilization	1	Job	\$	125,000	\$	125,000	\$	44,000	\$	169,000
	Maint. Of Traffic, Access Roads, and Survey	1	Job		2%	\$	16,000	\$	6,000	\$	22,000
T	Concrete	430.73	CY	\$	750	\$	323,000	\$	113,000	\$	436,000
	Excavation	1250.00	CY	\$	16.52	\$	21,000	\$	7,000	\$	28,000
	Common Fill	1260.42	CY	\$	27.00	\$	34,000	\$	12,000	\$	46,000
	Care of Water	7.00	Days	\$	1,060	\$	7,000	\$	2,000	\$	9,000
	Stripping	250.00	CY	\$	9.00	\$	2,000	\$	1,000	\$	3,000
	Sheet Piling	7950.00	SF	\$	45.00	\$	358,000	\$	125,000	\$	483,000
	Topsoil & Seeding	1403.54	SY	\$	3.25	\$	5,000	\$	2,000	\$	7,000
15	Floodway Control-Diversion Structure					\$	44,400	s	16,400	s	60,800
÷	Excavation for pipe	67	CY	\$	10.89	\$	1,000	\$	400	\$	1,400
	Backfill of material for pipe	67	CY	\$	2.94	\$	200	\$	100	\$	300
	Manhole Frame & Cover	1	EACH	\$	665.00	\$	1,000	\$	400	\$	1,400
	Concrete for inlet/outlet/MH	19.5	CY	\$	400.00	\$	8,000	\$	3,000	\$	11,000
10000	24" RCP	35	LF	\$	49.50	\$	2,000	\$	1,000	\$	3,000
1	24" Dia. Flap Gate	1	EACH	\$	11,100	\$	11,000	\$	4,000	\$	15,000
	24" Sluice Gate	1	EACH	\$	10,700	\$	11,000	\$	4,000	\$	15,000
	24" x 24" Trash Rack	1	EACH	\$	511	\$	1,000	\$	400	\$	1,400
	Riprap	2	CY	\$	90.00	\$	200	\$	100	\$	300
	Excavation for Channel	800	CY	\$	10.89	\$	9,000	\$	3,000	\$	12,000
30	Planning, Engineering, and Design	1	Job		12%	\$	235,000	s	35,000	s	270,000
31	Construction Management	1	Job		10%	\$	196,000	\$	29,000	s	225,000
								Te	otal First Cost	s	2.451.000

Table Site 8: Concept-Level Costs for Site 8: Levee/Floodwall, Gibbstown (Greenwich and Logan Townships), NJ

Location: Between Delaware River and developed areas.

Measure: 25,000 LF levee/floodwall; 40% (9,900 LF) of the structure would be floodwall (concrete T-wall with piles).

Top height is 9 feet above grade. Includes nonstructural protection for 20 buildings outside LOP and

manufacturing facility (approximately \$5 million total). Price Level: Dec 10 ACCOUNT QUAN-ESTIMATED DESCRIPTION OF ITEM UOM UNIT PRICE CONTINGENCY TOTAL COST AMOUNT NUMBER TITY 01 Lands and Damages LS \$27,000 \$27,000 7.000 34,000 \$ s 06 **Fish and Wildlife Facilities** 5,493,000 1,923,000 7,416,000 Levee/Floodwall Mitigation LS 5.182.350 \$ 5,182,000 1.814.000 6.996.000 \$ S \$ Interior Drainage Mitigation LS \$ 311,000 \$ 311.000 s 109.000 \$ 420,000 47,394,000 11 Levees and Floodwalls 34,549,000 12,092,000 \$ \$ \$ Floodwalls Job 125,000 Mobilization & Demobilization S \$125,000 44 000 169,000 S \$ Maintenance of Traffic. Access Roads and Survey (floodwall) Job 29 \$527,000 S 184,000 \$ 711.000 \$750.00 \$20,563,000 \$ ,197,000 27,760,000 Concrete 27,417 CY \$ 80,267 \$1,326,000 \$ 464,000 1,790,000 Excavation CY 16.52 \$ CY 27.00 \$1,561,000 \$ 2.107,000 Common Fill 57.831 \$ 546.000 \$ \$1,060.00 \$307,000 \$ 107,000 414,000 289 Dewatering Davs \$ 15,899 Stripping CY 9.00 \$143,000 \$ 50,000 \$ 193,000 Piles 102.729 LF \$ 22.00 \$2,260,000 \$ 791,000 \$ 3.051.000 29.05 Toe Drain Filter 753 CY \$22,000 \$ 8,000 \$ 30,000 \$ Toe Drain 6" Perf. Pipe 9,906 3.50 \$35,000 \$ 12.000 \$ 47,000 LF \$ Topsoil & Seeding 45,701 SY 3.25 \$149,000 \$ 52,000 201.000 \$ \$ Levees Maintenance of Traffic, Access Roads and Survey (levee) 2% 52,000 200.000 Job 5 148,000 \$ \$ Clearing & Grubbing 40 Acres S 19,000 \$ 791,000 \$ 277,000 \$ 1.068,000 Excavation 35.835 CY \$ 10.89 \$ 390,000 \$ 137.000 \$ 527,000 1,587,000 \$ Purchase Impervious Fill 58,792 555,000 2.142.000 CY \$ 27.00 \$ \$ Purchase Common Fill (Assume 67% reuse of excavated material) 76,498 CY \$ 27.00 2.065.000 723.000 2,788,000 S 5 \$ Haul Fill - 5 miles (impervious & purchased common fill) 135,290 CY \$ 11.35 s 1,536,000 \$ 538,000 \$ 2,074,000 Backfill of material 159.299 CY \$ 2.94 \$ 468,000 \$ 164,000 \$ 632,000 Care of Water/dewatering 75 \$ 1.060 \$ 80.000 \$ 28,000 \$ 108.000 Davs Stripping of Topsoil 27 996 CY \$ 9.00 \$ 252,000 \$ \$8,000 \$ 340,000 Topsoil & Seed 65,903 SY 3.25 \$ 214,000 \$ 75,000 \$ 289,000 \$ 195,000 \$ Gate across Railroad \$1,771.00 \$ 558,000 \$ 753,000 315 SF Floodway Control-Diversion 15 2.072.000 724,000 2.796.000 Structure \$ \$ \$ 16,000 \$ Excavation for pipe 4.154 CY \$ 10.89 \$ 45,000 \$ 61,000 Backfill of material for pipe CY 12,000 \$ 4,000 \$ 4.154 \$ 2.94 \$ 16 000 Manhole Frame & Cover 62 EACH ¢ 665 \$ 41,000 \$ 14,000 \$ 55,000 Concrete for inlet/outlet/MH 653,000 1.209 CY 400 S 484,000 \$ 169,000 \$ \$ 24" RCP 2.170 LF \$ 49.50 \$ 107,000 \$ 37.000 144,000 \$ 62 EACH 241,000 24" Dia. Flap Gate ŝ 11.100 \$ 688.000 S \$ 929.000 24" Shuice Gate 62 EACH 10,700 \$ 663.000 S 232,000 \$ 895,000 \$ 24" x 24" Trash Rack EACH 11,000 43,000 62 \$ 511 \$ 32,000 \$ \$ 19 **Buildings & Grounds** \$ 3,675,000 \$ 1,287,000 \$ 4.962.000 Nonstructural Treatments (approx. 150,000 3,000,000 1.050.000 20) 20 Each s \$ s \$ 4.050.000 Ringwall at Manufacturing Facility Each 650,000 650,000 228,000 878,000 s \$ ŝ \$ Mobilization & Demobilization LS S 25,000 \$ 25,000 \$ 34,000 9.000 \$ 30 Job 12% 7,508,000 1,126,000 Planning, Engineering, and Design \$ \$ \$ 8,634,000 6.257,000 31 10% 939.000 7,196,000 **Construction Management** Job 1 - 5

#### Total First Cost \$ 78,432,000

(1) Assumption is made that piles will be required for 1/3 of floodwall section, due to possible presence of relict drainage channels. Sensitivity testing indicates that if piles are needed for all of floodwall section, overall construction cost of measure will increase approximately 15%.

Delaware River Basin Comprehensive Flood Risk Management Interim Feasibility Study and Integrated EA for New Jersey

Table Alt	#1: Incremental Alternative	<b>Plan Cost</b>	s for S	ite 8: Levee/	Floodwall, (	Gibbstown, N	J	
	(Greenwich and Logan Tow	vnships, N.	J)					
		± /						
Location:	Between Delaware River and develop	ed areas		Price Level: N	[av 2014			
Measure:	21339 I F levee and floodwall excludin	og the ring leve	es ring v	valls and their ent	rances: 64 6% (	13 788) of the stru	ture would be	e
incusure.	floodwall (concrete T-wall and I-S wa	ll with piles) at	13,1112	I E of levee Ring	walls and levee	s are not included	in this length	C
	Ton height is 12 feet NAVD88	n with pites) a	la 7,500 l		, wans and it vee			
	Includes nonstructural protection for 1	7 buildings out	side LOP	and 3 manufactu	uring facilities			
		, comongo out						
ACCOUNT CODE	DES CRIPTION OF ITEM	QUANTITY	UOM	UNIT PRICE	ES TIMATED AMOUNT	CONTINGENCY	TOTAL	ப
01	I ands and Damages				\$5 182 000	\$1 817 000	\$6.006	5 000
01	Darmanant Easamant	62 5	Aaras	\$62,500,00	\$3,162,000	\$1,014,000	\$0,990	2000
	Temporary Easement	12.3	Acres	\$62,500.00	\$3,903,000	\$ 1,307,000 \$ 270,000	\$1.04	2,000
	Survey and Appraisal	12.3	IS	\$02,500.00	\$505,000	\$ 270,000 \$ 177,000	\$68	2,000
	Survey and Appraisan		LS	070	\$505,000	\$ 177,000	φ00.	2,000
02	Utility relocation	1	LS	\$3,000,000.00	\$3,000,000	\$ 1,050,000	\$4,050	),000
06	Fish and Wildlife Facilities				\$ 3.521.000	\$ 1.232.000	\$ 4.753	3.000
00	Levee/Floodwall Mitigation	1	LS	\$3 521 000 00	\$ 3521,000	\$ 1,232,000	\$ 475	<u>3 000</u>
	De veel 1 loou van 1 langadon	-	2.5	\$0,021,000100	¢ 0,021,000	¢ 1,202,000	¢ i,re	2,000
11	Levees and Floodwalls				\$84,875,000	\$29,708,000	\$114,583	3,000
	Mob & Demob	1	LS	\$75,000.00	\$75,000	\$ 26,000	\$10	1,000
	Temporary Access Road	19,100	LF	\$80.00	\$1,528,000	\$ 535,000	\$2,06	3,000
	Contractor Staging Areas	3	EA	\$25,000.00	\$75,000	\$ 26,000	\$10	1,000
	Maintenance of Traffic	1	LS	\$1,000,000.00	\$ 1,000,000	\$ 350,000	\$ 1,35	0,000
	<u>Ring Levee</u>				\$5,740,000	\$2,009,000	\$7,749	),000
	Clearing & Grubbing	10.3	Acres	\$21,242.00	\$220,000	\$ 77,000	\$ 29	7,000
	Excavation	16,269	CY	\$12.30	\$200,000	\$ 70,000	\$ 27	0,000
	Purchase Impervious Fill	20,944	CY	\$30.19	\$632,000	\$ 221,000	\$ 85	3,000
	Purchase Common Fill	66,026	CY	\$30.19	\$1,993,000	\$ 698,000	\$ 2,69	1,000
	Haul Fill - 5 miles (impervious &	05.040	GU	\$12.69	¢1.00 <b>2</b> .000	<b>•</b> • • • • • • • • • • • • • • • • • •	<b>•</b> • • • •	•
	purchased common fill)	85,343	CY	¢12.c0	\$1,083,000	\$ 379,000	\$ 1,46	12,000
	Dump Charges (25% of material)	14,642	CY Tama	\$12.69	\$186,000	\$ 65,000	\$ 25	1,000
	Dump Charges (75% of material)	3,085	Tons	\$01.07 \$24.59	\$403,000	\$ 105,000	\$ 02 \$ 56	6,000
	Backfill of material	88 507	CV	\$24.36	\$297,000	\$ 104,000 \$ 104,000	\$ 30	1 000
	Dewatering	39	Dave	\$1.185.08	\$46,000	\$ 16,000 \$ 16,000	\$ 6	2 000
	Stripping of Topsoil	9437	CY	\$10.06	\$95,000	\$ 33,000	\$ 12	8,000
	6" Topsoil & Seeding	20.741	SY	\$5.03	\$104,000	\$ 36,000	\$ 14	0.000
		20,711	~ 1	\$5.05	÷101,000	- 20,000	* 17	-,000
	Ring Walls (Non Structural)				\$2,429,000	\$852,000	\$3,281	1,000
	Concrete in place	2,063	CY	\$838.50	\$1,730,000	\$ 606,000	\$ 2,33	6,000
	Clearing & Grubbing	4.3	Acres	\$21,242.00	\$92,000	\$ 32,000	\$ 12	4,000
	Excavation	4,840	CY	\$12.30	\$60,000	\$ 21,000	\$ 8	1,000
	Purchase Common Fill	3,389	CY	\$30.19	\$102,000	\$ 36,000	\$ 13	8,000
	Haul Fill - 5 miles (impervious &	3 380	CV	\$12.60	\$13,000	\$ 15,000	\$ 5	8 000
	purchased common fill)	5,509	~	φ12.09	φ <del>-1</del> 5,000	φ 13,000	ψ ,	5,000
	Haul and Disposal	4,356	CY	\$12.69	\$55,000	\$ 19,000	\$ 74	4,000

Delaware River Basin Comprehensive Flood Risk Management Interim Feasibility Study and Integrated EA for New Jersey

ACCOUNT CODE	DESCRIPTION OF ITEM	QUANTITY	UOM	UNIT PRICE	ES TIMATED AMOUNT	CONTINGENCY		TOTAL
	Dewatering	25	Days	\$1,185.08	\$30,000	\$ 11,000	\$	41,000
	Dump Charges (25% of material)	1,691	TON	\$81.87	\$138,000	\$ 48,000	\$	186,000
	Dump Charges (75% of material)	5,072	TON	\$24.58	\$125,000	\$ 44,000	\$	169,000
	Backfill of material	3,873	CY	\$3.35	\$13,000	\$ 5,000	\$	18,000
	Stripping of Topsoil	1,023	CY	\$10.06	\$10,000	\$ 4,000	\$	14,000
	6" Topsoil & Seeding	6,138	SY	\$5.03	\$31,000	\$ 11,000	\$	42,000
	Levees				\$20,000,000	\$ 7,001,000	\$	27,001,000
	Clearing & Grubbing	35.8	Acres	\$21,242.00	\$ 760,000	\$ 266,000	\$	1,026,000
	Excavation	60,985	CY	\$12.30	\$ 750,000	\$ 263,000	\$	1,013,000
	Purchase Impervious Fill	48,761	CY	\$30.19	\$ 1,472,000	\$ 515,000	\$	1,987,000
	Purchase Common Fill	140,239	CY	\$30.19	\$ 4,233,000	\$ 1,482,000	\$	5,715,000
	Haul Fill - 5 miles (impervious &							
	purchased common fill)	189,000	CY	\$12.69	\$ 2,398,000	\$ 839,000	\$	3,237,000
	Backfill of material	195,098	CY	\$3.35	\$ 654,000	\$ 229,000	\$	883,000
	Care of Water/dewatering	89	Days	\$1,185.08	\$ 105,000	\$ 37,000	\$	142,000
	Stripping of Topsoil	21,861	CY	\$10.06	\$ 220,000	\$ 77,000	\$	297,000
	6" Topsoil & Seeding	48,930	SY	\$5.03	\$ 246,000	\$ 86,000	\$	332,000
	Geotextile	173,079	SY	\$4.47	\$ 774,000	\$ 271,000	\$	1,045,000
	Vertical (wick) Drains	2,880,057	LF	\$1.50	\$ 4,315,000	\$ 1,510,000	\$	5,825,000
	Haul and Dispose	54,887	CY	\$12.69	\$ 696,000	\$ 244,000	\$	940,000
	Dump Charges (25% of material)	21,303	TONS	\$81.87	\$ 1,744,000	\$ 610,000	\$	2,354,000
	Dump Charges (75% of material)	63,908	TONS	\$24.58	\$ 1,571,000	\$ 550,000	\$	2,121,000
	Levee Surcharge Fill Volume	5,022	CY	\$12.30	\$ 62,000	\$ 22,000	\$	84,000
	Floodwalls				\$54,028,000	\$18,909,000		\$72,937,000
	Concrete in place	32,045	CY	\$838.50	\$26,870,000	\$ 9,405,000	\$	36,275,000
	Clearing & Grubbing	34.7	Acres	\$21,242.00	\$738,000	\$ 258,000	\$	996,000
	Excavation	96,548	CY	\$12.30	\$1,187,000	\$ 415,000	\$	1,602,000
	Purchase Common Fill	60,798	CY	\$33.54	\$2,039,000	\$ 714,000	\$	2,753,000
	Dewatering	345	Days	\$1,185.08	\$409,000	\$ 143,000	\$	552,000
	Haul Fill - 5 miles (impervious &	51,143	CY	\$12.69	\$649,000	\$ 227,000	\$	876,000
	Haul and Disposal	86.893	CY	\$12.69	\$1,103,000	\$ 386,000	\$	1.489.000
	Stripping of Topsoil	19.864	CY	\$10.06	\$200.000	\$ 70.000	\$	270.000
	Piles	164,729	LF	\$83,85	\$13,812,000	\$ 4,834,000	\$	18.646.000
	Sheet Piling	14 100	SE	\$60.60	\$854,000	\$ 299,000	¢ \$	1 153 000
	Toe Drain Filter	979	CY	\$32.48	\$32,000	\$ 11,000	\$	43 000
	Dump Charges (25% of materia)	22 725	TONS	\$2.40 \$21 27	\$2 761 000	\$ 966,000	φ \$	3 727 000
+	Dump Charges (75% of material)	101 176	TONS	\$01.07 \$01.59	\$2,701,000	\$ <b>970,000</b>	φ Φ	3 356 000
	Postfill of metarial	70 452	CV	\$24.30 \$2.25	\$2,400,000 \$226,000	ψ 070,000 ¢ 02,000	ф ф	210,000
	Too Drain ("Doof Dia	12 1 20		φ <sub>2</sub> .33	φ230,000 ¢52,000	φ <u>65,000</u> ¢ <u>19,000</u>	ф ф	70,000
├		13,108		\$3.91	\$52,000	→ 18,000	\$	/0,000
	6 Topsoil & Seeding	119,184	SY	\$5.03	\$600,000	\$ 210,000	\$	810,000

<b>APPENDIX A: ENGINEERING TECHNIC</b>	AL APPENDIX - ATTACHMENTS
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ACCOUNT CODE	DES CRIPTION OF ITEM	QUANTITY	UOM	UNIT PRICE	E	STIMATED AMOUNT	СС	ONTINGENCY		TOTAL
15	Floodway Control-Diversion									
15	Structure				\$	9,312,000	\$	3,260,000	\$	12,572,000
	Exacavation	5,578	CY	\$12.30	\$	69,000	\$	24,000	\$	93,000
	Backfill of material for pipe	3,953	CY	\$3.35	\$	5 13,000	\$	5,000	\$	18,000
	Manhole Frame & Cover	59	EACH	\$967.07	\$	5 57,000	\$	20,000	\$	77,000
	Concrete for Sluice Gates	1,714	CY	\$838.50	\$	1,437,000	\$	503,000	\$	1,940,000
	Concrete for inlet/outlet/MH	1,151	CY	\$463.97	\$	534,000	\$	187,000	\$	721,000
	24" RCP	2,065	LF	\$64.84	\$	134,000	\$	47,000	\$	181,000
	24" Dia. Flap Gate	59	EACH	\$4,052.75	\$	239,000	\$	84,000	\$	323,000
	24" Sluice Gate	59	EACH	\$18,558.80	\$	1,095,000	\$	383,000	\$	1,478,000
	24" x 24" Trash Rack	59	EACH	\$571.30	\$	34,000	\$	12,000	\$	46,000
	10' x 6' Sluice Gate	12	EACH	\$111,800.00	\$	1,342,000	\$	470,000	\$	1,812,000
	10'x6' Flap Gate	12	EACH	\$39,130.00	\$	470,000	\$	165,000	\$	635,000
	Piles	9,750	LF	\$83.85	\$	818,000	\$	286,000	\$	1,104,000
	Dewatering	360	DAYS	\$1,677.00	\$	604,000	\$	211,000	\$	815,000
	Haul and Disposal	1,625	CY	\$12.69	\$	5 21,000	\$	7,000	\$	28,000
	Allowance for electrical	3	EACH	\$300,000.00	\$	900,000	\$	315,000	\$	1,215,000
	Swing Gates	1,947	SF	\$793.78	\$	1,545,000	\$	541,000	\$	2,086,000
19	Buildings & Grounds				\$	3,308,560	\$	1,159,000	\$	4,467,560
	Voluntary Acquisition (approx. 17)	1	LS	\$2,485,000.00	\$	2,485,000	\$	870,000	\$	3,355,000
	Abatement	1	LS	\$170,000.00	\$	170,000	\$	60,000	\$	230,000
	Demolition	1	LS	\$331,000.00	\$	331,000	\$	116,000	\$	447,000
	Survey and Appraisal		LS	8%		\$322,560	\$	113,000		\$435,560
	Planning, Engineering, and									
30	Design	1	Job	12%	\$	16,365,000	\$	2,455,000	\$	18,820,000
31	Construction Management	1	Job	10%	\$	13,638,000	\$	2,046,000	\$	15,684,000
Total First Cost \$ 1										

Table Alt #2: Incremental Alternative Plan Costs for Site 8: Floodwall, Gibbstown, NJ											
	(Greenwich and Logan Toy	vnships)									
Location:	Between Delaware River and develop	bed areas		Price Level: N	/Iay 2014						
Measure:	21,339 LF of floodwall (100% floodwa	all ),excluding	the ring l	evees, ring walls	and their entranc	es. Ring walls are	not i	included in this ler			
	Top height is 12 feet NAVD88.										
	Includes nonstructural protection for 1	7 buildings out	tside LO	P and 3 manufac	cturing facilities						
ACCOUNT	DES CRIPTION OF ITEM	QUANTITY	UOM	UNIT PRICE	ESTIMATED	CONTINGENCY		TOTAL			
CODE		-			AMOUNT						
01	Lands and Damages				\$4,787,000	\$1.675.000		\$6.462.000			
	Permanent Easement	56.8	Acres	\$62,500,00	\$3 548 000	\$1,242,000		\$4 790 000			
	Temporary Easement	12.3	Acres	\$62,500.00	\$772,000	\$270,000		\$1.042.000			
	Survey and Appraisal	12.5	Tieres	8.00%	\$467,000	\$163,000		\$630.000			
					+,	+		+ + + + + + + + + + + + + + + + + + + +			
02	Utility relocation	1	LS	\$3,000,000.00	\$3,000,000	\$1,050,000		\$4,050,000			
06	Fish and Wildlife Facilities				\$ 2,700,000	\$945,000	\$	3,645,000			
	Floodwall Mitigation	1	LS	\$2,699,750.00	\$ 2,700,000	\$945,000	\$	3,645,000			
11	Levees and Floodwalls				\$101,341,000	\$35,474,000		\$136,815,000			
	Mob & Demob	1	LS	\$75,000.00	\$75,000	\$26,000		\$101,000			
	Tempoary Access Road	20,850	LF	\$80.00	\$1,668,000	\$584,000		\$2,252,000			
	Contractor Staging Areas	3	EA	\$25,000.00	\$75,000	\$26,000		\$101,000			
	Maintenance of Traffic	1	LS	\$1,000,000.00	\$ 1,000,000	\$350,000	\$	1,350,000			
					<b>*= = 1</b> 0,000	<b>*</b> • • • • • • • •		<b>*= = 10</b> 000			
	<u>Ring Levee</u>			****	\$5,740,000	\$2,009,000	<b>.</b>	\$7,749,000			
	Clearing & Grubbing	10.3	Acres	\$21,242.00	\$220,000	\$77,000	\$	297,000			
	Excavation	16,269	CY	\$12.30	\$200,000	\$70,000	\$	270,000			
	Purchase Impervious Fill	20,944		\$30.19	\$632,000	\$221,000	\$	853,000			
	Purchase Common Fill	66,026	CY	\$30.19	\$1,993,000	\$698,000	\$	2,691,000			
	numerate a subsect a subsection of the subsect a subsect	85 242	CV	\$12.60	\$1,082,000	\$270,000	¢	1 462 000			
	Haul and Disposal	14 642		\$12.09	\$1,085,000	\$65,000	φ \$	251,000			
	Backfill of material	88 597	CY	\$3.35	\$180,000	\$104,000	\$ \$	401,000			
	Dump Charges (25% of material)	5 683	CY	\$81.87	\$465,000	\$163,000	\$	628,000			
	Dump Charges (25% of material)	17.049	CY	\$24.58	\$419,000	\$147,000	\$	566.000			
	Care of Water/dewatering	39	Davs	\$1,185.08	\$46,000	\$16,000	\$	62,000			
	Stripping of Topsoil	9.437	CY	\$10.06	\$95.000	\$33.000	\$	128.000			
	6" Topsoil & Seeding	20,741	SY	\$5.03	\$104,000	\$36,000	\$	140,000			
	Ring Walls (Non Structural)				\$2,501,000	\$878,000		\$3,379,000			
	Concrete in place	2,063	CY	\$838.50	\$1,730,000	\$606,000	\$	2,336,000			
	Clearing & Grubbing	4.3	Acres	\$21,242.00	\$92,000	\$32,000	\$	124,000			
	Excavation	4,840	CY	\$12.30	\$60,000	\$21,000	\$	81,000			
	Purchase Common Fill	3,389	CY	\$30.19	\$102,000	\$36,000	\$	138,000			
	Haul Fill - 5 miles (impervious &	2 202	CV	¢10 -0	¢ 10 000	#1 = 000	¢	<b>FO 000</b>			
	purchased common fill)	3,389	UY Dem	\$12.69	\$43,000	\$15,000	\$	58,000			
	Dewatering	25	Days	\$1,185.08	\$30,000	\$11,000	۵ ۵	41,000			
	Backfill Of Material	2,905		\$3.33 \$10.00	\$10,000	\$4,000	ф Ф	14,000			
L	Stripping of Topsoil	1,023	UΥ	\$10.06	\$10,000	\$4,000	\$	14,000			

Delaware River Basin Comprehensive Flood Risk Management Interim Feasibility Study and Integrated EA for New Jersey

ACCOUNT CODE	DES CRIPTION OF ITEM	QUANTITY	UOM	UNIT PRICE	ESTIMATED AMOUNT	CONTINGENCY		TOTAL
	Haul and Disposal	5,379	CY	\$12.69	\$68,000	\$24,000	\$	92,000
	Dump Charges (25% of material)	2,088	Tons	\$81.87	\$171,000	\$60,000	\$	231,000
	Dump Charges (75% of material)	6,263	Tons	\$24.58	\$154,000	\$54,000	\$	208,000
	6" Topsoil & Seeding	6,138	SY	\$5.03	\$31,000	\$11,000	\$	42,000
							-	
	<u>Floodwalls</u>				\$90,282,000	\$31,601,000	-	\$121,883,000
	Concrete in place	54,214	CY	\$838.50	\$45,459,000	\$15,911,000	\$	61,370,000
	Clearing & Grubbing	54.4	Acres	\$21,242.00	\$1,157,000	\$405,000	\$	1,562,000
	Excavation	160,696	CY	\$12.30	\$1,976,000	\$692,000	\$	2,668,000
	Purchase Common fill	100,105	CY	\$33.54	\$3,358,000	\$1,175,000	\$	4,533,000
	Haul Fill - 5 miles (impervious & purchased common fill)	100,105	CY	\$12.69	\$1,270,000	\$445,000	\$	1,715,000
	Dewatering	574	Days	\$1,185.08	\$680,000	\$238,000	\$	918,000
	Haul and Disposal	144,626	CY	\$12.69	\$1,835,000	\$642,000	\$	2,477,000
	Backfill of material	116,175	CY	\$3.35	\$390,000	\$137,000	\$	527,000
	Stripping of Topsoil	32,324	CY	\$10.06	\$325,000	\$114,000	\$	439,000
	Piles	279,157	LF	\$83.85	\$23,407,000	\$8,192,000	\$	31,599,000
	Sheet Piles	9,600	SF	\$60.60	\$582,000	\$204,000	\$	786,000
	Dump Charges (25% of material)	56,133	Tons	\$81.87	\$4,595,000	\$1,608,000	\$	6,203,000
	Dump Charges (75% of material)	168,399	Tons	\$24.58	\$4,139,000	\$1,449,000	\$	5,588,000
	Toe Drain Filter	1,579	CY	\$32.48	\$51,000	\$18,000	\$	69,000
	Toe Drain 6" Perf. Pipe	21,054	LF	\$3.91	\$82,000	\$29,000	\$	111,000
	6" Topsoil & Seeding	193,946	SY	\$5.03	\$976,000	\$342,000	\$	1,318,000
15	Floodway Control-Diversion							
10	Structure				\$ 9,312,000	\$3,260,000	\$	12,572,000
	Exacavation	5,578	CY	\$12.30	\$ 69,000	\$24,000	\$	93,000
	Backfill of material for pipe	3,953	CY	\$3.35	\$ 13,000	\$5,000	\$	18,000
	Manhole Frame & Cover	59	EACH	\$967.07	\$ 57,000	\$20,000	\$	77,000
	Concrete for sluice gate	1,714	CY	\$838.50	\$ 1,437,000	\$503,000	\$	1,940,000
	Concrete for inlet/outlet/MH	1,151	CY	\$463.97	\$ 534,000	\$187,000	\$	721,000
	24" RCP	2,065	LF	\$64.84	\$ 134,000	\$47,000	\$	181,000
	24" Dia. Flap Gate	59	EACH	\$4,052.75	\$ 239,000	\$84,000	\$	323,000
	24" Sluice Gate	59	EACH	\$18,558.80	\$ 1,095,000	\$383,000	\$	1,478,000
	24" x 24" Trash Rack	59	EACH	\$571.30	\$ 34,000	\$12,000	\$	46,000
	10' x 6' Sluce Gate	12	EACH	\$111,800.00	\$ 1,342,000	\$470,000	\$	1,812,000
		12	EACH	\$39,130.00	\$ 470,000	\$165,000	\$	635,000
	Piles	9,750	LF	\$83.85	\$ 818,000	\$286,000	\$	1,104,000
	Lewatering	360	DAYS	\$1,677.00	\$ 604,000	\$211,000	\$	815,000
		1,625		\$12.69	\$ 21,000 \$ 000,000	\$7,000	\$ ¢	28,000
	Swing Cotos	1 047	CACH SE	\$300,000.00 \$702.79		\$315,000	\$ \$	1,215,000
	Swing Gates	1,947	эг	\$/95./8	φ 1, <b>343,000</b>	\$341,000	¢	2,080,000
L								

ACCOUNT CODE	DES CRIPTION OF ITEM	QUANTITY	UOM	UNIT PRICE	F	STIMATED AMOUNT	CONTINGENCY		TOTAL
19	Buildings & Grounds				\$	3,308,560	\$1,159,000	\$	4,467,560
	Voluntary Acquisition (approx. 17)	1	LS	\$2,485,000.00	\$	2,485,000	\$870,000	\$	3,355,000
	Abatement	1	LS	\$170,000.00	\$	170,000	\$60,000	\$	230,000
	Demolition	1	LS	\$331,000.00	\$	331,000	\$116,000	\$	447,000
	Survey and Appraisal			8.00%		\$322,560	\$113,000		\$435,560
	Planning, Engineering, and								
30	Design	1	Job	12%	\$	18,900,000	\$2,835,000	\$	21,735,000
31	Construction Management	1	Job	10%	\$	15,750,000	\$2,363,000	\$	18,113,000
Total First Cost									

Table Al	t #3: Incremental Alternative	e Plan Cos	sts for	Site 8: Leve	e/Floodwall,	Gibbstown, NJ	ſ
	(Greenwich and Logan Tow	vnships)					
Location:	Between Delaware River and develpe	ed areas		Price Level: I	May 2014		
Measure:	21,339 LF levee and floodwall, exclude	ing the ring le	vees, ring	g walls and their	entrances; 78.6%	6 (16,765 LF) of the s	structure would be
	floodwall (concrete T-wall and I-S wa	ll with piles).	The ring	walls and levees	s are not included	l	
	Top height is 12 feet NAVD88.						
	Includes nonstructural protection for 1	7 buildings ou	tside LO	P and 3 manufa	cturing facilities		
ACCOUNT CODE	DES CRIPTION OF ITEM	QUANTITY	UOM	UNIT PRICE	ES TIMATED AMOUNT	CONTINGENCY	TOTAL
01	Lands and Damages				\$4,810,000	\$1,683,000	\$6,493,000
	Permanent Easement	57.1	Acres	\$62,500.00	\$3,569,000	\$1,249,000	\$4,818,000
	Temporary Easement	12.3	Acres	\$62,500.00	\$772,000	\$270,000	\$1,042,000
	Survey and Appraisal			\$0.08	\$469,000	\$164,000	\$633,000
02	Relocations						
	Utility relocations	1	LS	\$3,000,000.00	\$3,000,000	\$1,050,000	\$4,050,000
06	Fish and Wildlife Facilities				\$ 2,971,000	\$1,040,000	\$4,011,000
	Levee/Floodwall Mitigation	1	LS	\$2,971,000.00	\$ 2,971,000	\$1,040,000	\$4,011,000
11	Levees and Floodwalls				\$91 009 000	\$31 855 000	\$122 864 000
11					φ/1,007,000	ψ51,055,000	φ <b>122,004,000</b>
	Mob & Demob			\$75,000.00	\$75,000	\$26,000	\$101,000
	Temporary Access Roads	19,390	LF	\$80.00	\$1,551,000	\$543,000	\$2,094,000
	Contractor Staging Areas	3	EA	\$25,000.00	\$75,000	\$26,000	\$101,000
	Maintenance of Traffic	1	LS	\$1,000,000.00	\$1,000,000	\$350,000	\$1,350,000
	Ring Lavee				\$5 740 000	\$2,000,000	\$7 740 000
	Charing & Crubbing	10.2	Aaraa	\$21,242,00	\$5,740,000	\$2,009,000	\$7,749,000
		16.3	CV	\$21,242.00	\$220,000	\$77,000	\$297,000
	Excavation Purchase Impervious Fil	20.044		\$12.50	\$200,000	\$70,000	\$270,000
	Purchase Common Fill	20,944 66,026		\$30.19	\$1,993,000	\$221,000	\$2 691 000
	Haul Fill - 5 miles (impervious &	00,020	CI	\$50.17	\$1,775,000	\$078,000	\$2,071,000
	nurchased common fill)	85 343	CY	\$12.69	\$1,083,000	\$379,000	\$1 462 000
	Haul and Disposal	14.642	CY	\$12.69	\$186.000	\$65,000	\$251,000
	Dump Charges (25% of material)	5.683	Tons	\$81.87	\$465,000	\$163,000	\$628,000
	Dump Charges (75% of material)	17.049	Tons	\$24.58	\$419.000	\$147.000	\$566.000
	Backfill of material	88,597	CY	\$3.35	\$297.000	\$104,000	\$401,000
	Dewatering	39	Days	\$1,185.08	\$46,000	\$16,000	\$62,000
	Stripping of Topsoil	9,437	ĊŶ	\$10.06	\$95,000	\$33,000	\$128,000
	Topsoil (6") & Seeding	20,741	SY	\$5.03	\$104,000	\$36,000	\$140,000
	Ding Wolls (Non Structure)				¢2 644 000	¢1 277 000	\$1 031 000
		2062	CV	¢020 E0	\$3,044,000 \$1,720,000	\$1,277,000 \$606,000	\$2,226,000
	Charing & Cryching	2,003	L I	\$838.3U	\$1,730,000 \$02,000	\$000,000	\$2,330,000 \$124,000
		4.5	CV	φ21,242.00 \$12.20	\$92,000 \$60,000	\$32,000 \$21,000	\$124,000 \$81,000
	Purchase Common Fill	3 3 8 0		\$12.30 \$20.10	\$102,000 \$102,000	\$21,000	\$01,000 \$138,000
	r urchase Common Fill	5,509	U	\$30.19	\$102,000	\$30,000	\$156,000

Delaware River Basin Comprehensive Flood Risk Management Interim Feasibility Study and Integrated EA for New Jersey

ACCOUNT CODE	DESCRIPTION OF ITEM	QUANTITY	UOM	UNIT PRICE	ESTIMATED AMOUNT	CONTINGENCY	TOTAL
	Haul Fill - 5 miles (impervious &	76711	CV	¢12.60	¢072.000	\$241,000	¢1 214 000
	purchased common fill)	/0,/11		\$12.09	\$973,000	\$341,000	\$1,314,000
	Stripping of Topsoil	1.022		\$1,163.06	\$30,000	\$11,000	\$41,000
	Haul and Disposal	1,025		\$10.00	\$10,000	\$4,000 \$19,000	\$14,000
	Backfill of material	4,330		\$12.09	\$298,000	\$19,000	\$74,000
	Dump Charges (25% of material)	1 691	Tons	\$81.87	\$138,000	\$48,000	\$186,000
	Dump Charges (75% of material)	5.072	Tons	\$24 58	\$125,000	\$44,000	\$169,000
	Topsoil (6") & Seeding	6.138	SY	\$5.03	\$31,000	\$11,000	\$42,000
		-,			1 - 9		7
	Levees				\$9,053,000	\$3,168,000	\$12,221,000
	Clearing & Grubbing	22.5	Acres	\$21,242.00	\$478,000	\$167,000	\$645,000
	Excavation	21,869	CY	\$12.30	\$269,000	\$94,000	\$363,000
	Purchase Impervious Fill	16,184	CY	\$30.19	\$489,000	\$171,000	\$660,000
	Purchase Common Fill	44,948	CY	\$30.19	\$1,357,000	\$475,000	\$1,832,000
	Haul Fill - 5 miles (impervious &						
	purchased common fill)	58,945	CY	\$12.69	\$748,000	\$262,000	\$1,010,000
	Backfill of material	63,319	CY	\$3.35	\$212,000	\$74,000	\$286,000
	Dewatering	29	Days	\$1,185.08	\$34,000	\$12,000	\$46,000
	Stripping of Topsoil	8,225	CY	\$10.06	\$83,000	\$29,000	\$112,000
	Topsoil (6") & Seeding	40,887	LF	\$5.03	\$206,000	\$72,000	\$278,000
	Geotextile	109,017	SY	\$4.47	\$488,000	\$171,000	\$659,000
	Vertical (wick) Drains	2,037,907	LF	\$1.50	\$3,053,000	\$1,069,000	\$4,122,000
	Haul and Dispose	21,869	CY	\$12.69	\$278,000	\$97,000	\$375,000
	Dump Charges (25% of material)	8,488	TONS	\$81.87	\$695,000	\$243,000	\$938,000
	Dump Charges (75% of material)	25,464	TONS	\$24.58	\$626,000	\$219,000	\$845,000
	Levee Surcharge Fill Volume	2,998	CY	\$12.30	\$37,000	\$13,000	\$50,000
					-		
	<u>Floodwalls</u>				\$69,871,000	\$24,456,000	\$94,327,000
	Concrete in place	40,978	CY	\$838.50	\$34,360,000	\$12,026,000	\$46,386,000
	Clearing & Grubbing	42.6	Acres	\$21,242.00	\$905,000	\$317,000	\$1,222,000
	Excavation	122,309	CY	\$12.30	\$1,504,000	\$526,000	\$2,030,000
	Purchase Common Fill	76,711	CY	\$33.54	\$2,573,000	\$901,000	\$3,474,000
	Haul Fill - 5 miles (impervious &	76711	<u>av</u>	¢12 co	<b>4072</b> 000	¢2.41.000	¢1 01 1 000
	purchased common fill)	/6,/11		\$12.69	\$973,000	\$341,000	\$1,314,000
	Dewatering	438	Days	\$1,185.08	\$519,000	\$182,000	\$701,000
		24,024		\$10.00	\$230,000	\$00,000 \$6 759,000	\$358,000
		230,281		\$63.63	\$19,309,000	\$0,738,000	\$20,007,000
	Sheet Piling	11,478	SF	\$60.60	\$695,000	\$243,000	\$938,000
	Haul and Disposal	110,078	CY	\$12.69	\$1,397,000	\$489,000	\$1,886,000
	Backfill of material	88,942	CY	\$3.35	\$298,000	\$104,000	\$402,000
	Dump Charges (25% of material)	42,724	Tons	\$81.87	\$3,498,000	\$1,224,000	\$4,722,000
	Dump Charges (75% of material)	128,172	Tons	\$24.58	\$3,150,000	\$1,103,000	\$4,253,000
	Toe Drain Filter	922	CY	\$32.48	\$30,000	\$11,000	\$41,000
	Toe Drain 6" Perf. Pipe	12,127	LF	\$3.91	\$47,000	\$16,000	\$63,000
	Topsoil (6") & Seeding	72,248	SY	\$5.03	\$363,000	\$127,000	\$490,000

<b>APPENDIX A: EI</b>	<b>NGINEERING TECHNICA</b>	LAPPENDIX -	ATTACHMENTS
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ACCOUNT CODE	DESCRIPTION OF ITEM	QUANTITY	UOM	UNIT PRICE	E	STIMATED AMOUNT	CONTINGENCY	TOTAL
15	Floodway Control-Diversion							
15	Structure				\$	57,767,000	\$2,719,000	\$12,572,000
	Exacavation	5,578	CY	\$12.30	\$	69,000	\$24,000	\$93,000
	Backfill of material for pipe	3,953	CY	\$3.35	\$	13,000	\$5,000	\$18,000
	Manhole Frame & Cover	59	EACH	\$967.07	\$	57,000	\$20,000	\$77,000
	Concrete for sluice gates	1,714	CY	\$838.50	\$	1,437,000	\$503,000	\$1,940,000
	Concrete for inlet/outlet/MH	1,151	CY	\$463.97	\$	534,000	\$187,000	\$721,000
	24" RCP	2,065	LF	\$64.84	\$	134,000	\$47,000	\$181,000
	24" Dia. Flap Gate	59	EACH	\$4,052.75	\$	239,000	\$84,000	\$323,000
	24" Sluice Gate	59	EACH	\$18,558.80	\$	1,095,000	\$383,000	\$1,478,000
	24" x 24" Trash Rack	59	EACH	\$571.30	\$	34,000	\$12,000	\$46,000
	10' x 6' Sluice Gate	12	EACH	\$111,800.00	\$	1,342,000	\$470,000	\$1,812,000
	10'x6' Flap Gate	12	EACH	\$39,130.00	\$	470,000	\$165,000	\$635,000
	Piles	9,750	LF	\$83.85	\$	818,000	\$286,000	\$1,104,000
	Dewatering	360	DAYS	\$1,677.00	\$	604,000	\$211,000	\$815,000
	Haul and Disposal	1,625	CY	\$12.69	\$	21,000	\$7,000	\$28,000
	Allowance for electrical	3	EACH	\$300,000.00	\$	900,000	\$315,000	\$1,215,000
	Swing Gates	1,947	SF	\$793.78	\$	1,545,000	\$541,000	\$2,086,000
19	Buildings & Grounds				\$	3,309,000	\$1,159,000	\$4,468,000
	Voluntary Acquisition (approx. 17)	1	LS	\$2,485,000.00	\$	2,485,000	\$870,000	\$3,355,000
	Abatement	1	LS	\$170,000.00	\$	170,000	\$60,000	\$230,000
	Demolition	1	LS	\$331,000.00	\$	331,000	\$116,000	\$447,000
	Survey and Appraisal		LS	8%		\$323,000	\$113,000	\$436,000
	Planning, Engineering, and							
30	Design	1	Job	12%	\$1	7,270,000	\$2,591,000	\$19,861,000
31	Construction Management	1	Job	10%	\$ 1	4,392,000	\$2,159,000	<b>\$16,551,000</b>
							Total First Cost	\$190,870, <mark>000</mark>



Figure A1: Geotechnical Subsurface Exploration, Gibbstown, New Jersey – Test Boring Location Sketch

Delaware River Basin Comprehensive Flood Risk Management Interim Feasibility Study and Integrated EA for New Jersey

	$\langle \rangle \rangle$	DI AS Consu	UFF SOCI	ATES Geosciences		TES	ST E	BORIN	NG GIB-1	(Pa	ge 1 of 1)		LG	$\langle \rangle$	DI AS Consu	UFF SOCI	IELD IATES e Geosciences		TES	ST E	BORI	NG GIB-2	(Pa	ge 1 of 1)
US	eotechr G ACE Co	nical S ibbsto Project ntract Task	ubsurface wn, New J t No. 8919 No. W912 Order 00	Exploration - ersey .GG BU-11-D-0005 .07	Date Starte Date Comp Logged by Weather Driller/Agen	d January 17, 2013 leted January 17, 2013 ADK Cloudy, 30s cy. A Leavy/Granese Drillin	g, Inc.	Dri Dri Su No Ea	illing Equipment illing Methods inface Elevation infhing isting.	: Truck-m : 3.25" H.3 : 8.5 feet f : 357,685 : 263,609	ounted Gefco StrataStar 15 S.A. NAVD 88 NJSPFT NAD83 NJSPFT NAD83		U	Geolech C SACE C	nical S ibbstor Project ontract Task	ubsurface wn, New J No. 8919 No. W912 Order 00	Exploration - Jersey J.GG 2BU-11-D-0005 07	Date Starte Date Comp Logged by Weather Dritter/Age	nd January 21, 2013 January 21, 2013 ADK P Sunny, 30s noy A Leavy/Granese Drills	og, Inc	D D S N E	illing Equipment illing Methods vrface Elevation orthing isting	: Truck-mi : 3.25" H.3 : 9.8 feet 1 : 360,208 : 265,816	ounted Getco StrataStar 15 5.A. VAVD 88 NJSPFT NAD83 NJSPFT NAD83
		Q		Sample Condition		Water Levels	ES					LEVEL	Douth	0.4	Q		Sample Condition	n Ings Id	Water Levels	ES		Plaure par		
in feet	Elev. 8.5 ft	GRAPH	nscs		DESCR	RIPTION	SAMPL	Sample Number	6 inches or Fluid Pressure	Recovery (fi)	Remarks	WATER	in feet	Elev. 9.8 ft	GRAPH	uscs		DESCI	RIPTION	SAMPL	Sample Number	6 inches or Fluid Pressure	Recovery (ft)	Remarks
0-	8.0	302.3	SM	TOPSOIL AND R Very pale brown f coarse sand, trac- appearance) (dan SAME (very pale	OOT MATE ine SAND, li e silt, trace p ip) brown to bro	RIAL ttle medium sand, trace bebbles (sl. laminated/bedded wn color) (trace to little silt)	X	1A 1B 2	3-3-4-3	1.0	Apparent top of Cap May Formation, Unit 2.	0	0	8.8		(*	ASPHALT (2+ la APPARENT FILL sand, trace fine ( SAME (damp to	iyers) L [yellow fine gravel, little t moist)	to medium sand, little coarse o trace silt (damp)]	X	1	6-9 9-5-5-5	0.8 1.4	
5 -	3.6			SAME (trace silt) Reddish yellow fir sand, trace to little light brown mottle	(wet) ie SAND, litt clay, trace s) (saturate	le silt, trace to little medium coarse sand (common faint 1 to wel)		3A 3B	2-1-1-1	1.8		¥	5	-			SAME (mostly fir	ne sand) (me	sist)		3	5-3-4-5	1.9	
-			SC	SAME (saturated)	T 4. 9.0		Ø	4	1-1-1-1	0.9							SAME (moist)	5.473		Ø	4	4-3-3-3	1.6	
10 -	-1.5		SP-SM	Very pale brown f trace very coarse	ine SAND, ti sand, trace	ace medium to coarse sand, pebbles, trace to no silt (few	K	5	3-3-3-5	1.4			10				SAME (change i	n shoe to lig	nt brownish gray color) (wet)	R	6	1-1-3-2	1.4	
	-3.5 -4.0 -4.4	崭	SM SC	SAME (trace to lit (wet) Light brownish gra	tle silt) (little ay very fine	fine to coarse quartz gravel) SAND and SILT/CLAY	MX	6A 6B 6C	5-7-7-14	1.5				-2.2	Ĩ	SM	Light brownish g coarse sand, trac mineral laminatio	ray to grayis ce silt (trace cns) (saturat	h brown fine SAND. trace organic material) (few heavy ed)		7	4-4-4-4	1.4	Apparent top of stream alluvium.
15 -			SP-SM	Reddish yellow co sand, trace to no (saturated)	arse to med silt (trace thi	velow motiles) (wet) ium SAND, little very coarse n lenses with some silt/clay)	X	7	10-10-10-12	1.2	Driller washed out augers with drilling mud.		15			SP SM	SAME (trace to r with saturated le	no silt) (trace nses)	to little pebble quartz) (wet	A	8	2-3-4-3	1.9	Driller reports wet or
-	-9.5 -10.0	$\prod_{n \in \mathbb{N}}$	SM	fine to medium se granular sand) (tr Light gray fine SA	nd with thin ace to no sil ND, trace m stringers) (	lenses of very coarse to t) (saturated) edium to coarse sand, trace few wellow to reddish vellow	A	8 9A	10-8-7-6 3-2-2-6	1.6 1.2	Apparent top of			-8.2 -8.5	22222	CL	SAME (very pare stratified) (wel) Dark gray to blac (some slag/meta	k CLAY/SIL I flakes) (sl.	T, little fine to coarse sand odor) (saturated)		9 10A 10B	2-5-4-3 6-7-9-9	1.7 1.8	rods at 17' +/- b.e.g.s.
20 -	-12.3		SC CL	Jenses) (saturated Very pale brown f medium sand (ma mottles) (wet to s	I) ine SAND, s iny to comm aturated)	ome silt, trace clay, trace		96 10A 10B	3-3-3-4	1.3	Magothy Formation.		20			OL	Dark brown PEA	T (moist) ST-1: 20.0'	22.0' - SHELBY TUBE		ST-1		2.0	
-	-13.5		SM	Greenish gray SIL (little to some org SAME (few light of Dark brown to dar	T/CLAY. litt anic materia ray fine san k grayish br	le to some very fine sand Vlignite) (micaceous) (wet) d lenses) (wet to moist) own CLAY/SILT, trace fine	X	11A 11B	2-2-2-4	1.2				-12.2		SP-SM	Pale brown to lig little to trace med silt (trace roots)	ht greenish ( fium sand, tr (mod. well-so	gray (with depth) fine SAND, ace coarse sand, trace to no orted) (saturated) used sequences from first to	X	11	3-4-5-7	1.7	
25 -			CL	Sand (sl. micaceo Gray fine SAND, sand (some to littl Dark brown CLAY	us) (little org little to some e lignite) (sa //SILT, trace	anic material) (moist to wet) silt, trace medium to coarse iturated to wet) fine sand (little to some	A	12 13A	3-4-6-5 5-6-7-8	1.1			25 -		-	SP-SM	coarse, sub-rour lens cap) (satura	ided quartz g ited)	ravel to fine sand and clay/silt	A	12	4-5-5-3	1.7	
30	-18,7 -19,5 -21,5		OL CL	lignite) (sl. hydrog SAME (micaceou SAME (wet to sat Very dark brown F Dark brown CLA) (micaceous) (wet	en sulfide o s) (wet to da urated with PEAT (satur /SILT, trace to saturated	dor) (wet to moist) imp with depth) depth) ated) very fine sand (some lignite)	X	13B 14	7-7-7-9	1.8			30 -	-18.2		SP-SM	Greenish gray fir sand, trace fine ( (trace organic m clauconitic) (sat)	ne SAND, litt gravel, trace aterial) (trace irated)	le to trace medium to coarse to no slit (mod. well-sorted) a clay/slit clasts) (sl.		13	1-1-4-5	1.7	
NOTES 1. Test 2. Satu	boring to	ermina	ited at 30 ered at ap	leet +/- below existing	ground surfa	5. Standard, ace (b.e.g.s.), for Penetr 6. Location d	split-ba ative Te ata bas	arrel samp est and Sp sed on GP	ling performed in lit-Barrel Samplir S survey perform	general ac ig (ASTM I ed by Duff	cordance with the Meth D 1586). eld Associates.	hod	NOTE 1. Tes 2. Sati	S: t boring uration e	ermina	ited at 30 ared at ap	feet +/- below existin proximately 12 feet b	ig ground sur	Practice f ace (b.e.g.s.). 5. Standard, for Penetic	or Desc split-ba ative Te	ription an arrel samp est and Sp	d Identification of ling performed in lit-Barrel Samplir	Solls (Visu general ac g (ASTM I	al-Manual Procedure), cordance with the Meth 0 1586).

Gentechnical Suburifice Exploration Gribbitom, New Jensy USACE EXPRESS No. 8919.0005 Task Order 0007         Date Sumits Logad by Mainter Samay 18, 2012 Date Summy 18, 2013 Date Summy 18, 2013 D			Comu	itants in the	Genoieven						(Pag	ge 1 of 2)	
Surf. Intent         Sample Condition Surf. Box. 9 2 ft         Sample Condition Surf. 9 2 ft         Water Levels Sumple         Sample Sumple         Boxe per Bit chears or Pluid Pressure         Recovery (ft)           0         8.7         CPSOIL AND ROOT MATERIAL APPARENT FILL (below to yellowish brown fine sand, some sit, trace day trace time to medium gravel (little organic material) (motot to wet)         1A         3-5-5-4         1.5           5         APPARENT FILL (below to yellowish brown fine sand, some sit, trace day trace time to medium gravel (little organic material) (motot to wet)         3         10-13-16-11         1.5           5         SAME (motot to wet)         SAME (motot to wet)         3         10-13-16-11         1.5           10         -0.8         SC (g3.3 +i-lines of apparent toyster shalls) (wet)         4         13-14-22-34         1.4           10         -0.8         SC (g3.3 +i-lines of apparent oyster shalls) (wet)         5         44-34-35-10         1.5           10         -0.8         SC (g3.3 +i-lines of apparent oyster shalls) (wet)         5         44-34-35-10         1.5           11         -0.8         SC (g3.3 +i-lines of apparent oyster shalls) (wet)         5         44-34-35-10         1.5           12         APPARENT FILL (black coal slag, mostly fine sand strate (g3.3 +i-lines of apparent shalls) (wet)         5         44-34-35-10	US	Geolechn Gi F SACE Co	ical S bbstov Project ntract Task	ubsurface I wn, New Je No. 8919. No. W912I Order 000	Exploration - ensey GG BU-11-D-0005 I7	Date Started Date Comple Logged by Weather Deiller/Agenc	January 18, 2013 January 18, 2013 ADK Sunny, 30s y A. Leovy/Gianose Driftin	g. inc.	Dri Dri Su No Ea	lling Equipment lling Methods rface Elevation rthing sting	Thuck-me 3.25° H.3 9.2 feet N 361,5701 267,025 J	ounted Gefco StrataStar 16 5.A. IAVD 86 NJSPFT NAD83 NJSPFT NAD83	
0       8.7       TOPSOIL AND ROOT MATERIAL APPARENT FILL (jellow to jellowish brown fine sand, some sit, trace clay, trace fine to medium gravel (liftle organic material) (most to wel) SAME (greenism gray color) (liftle sitt) (moist)       1A       3-5-5-4       1.5         5       -<	epth in eet	Surf. Elev. 9.2 ft	GRAPHIC	uscs	Sample Condition	DESCRI	Water Levels  During Drilling  PTION	SAMPLES	Sample Number	Blows per 6 inches or Fluid Pressure	Recovery (ft)	Remarks	the second to be the second second
5       SAME (pale yellow and greenish gray) (sl. glauconitic) (moist to wel)       3       10-13-16-11       1.5         10       -0.8       SAME (trace silt) (wet)       4       13-14-22-34       1.4         10       -0.8       Graysh brown fine SAND, some to and silt, little medium sand, little to trace clay (few laminations of organic material) (wel)       5       44-34-35-10       1.5         10       -0.8       SC       Graysh brown fine SAND, some to and silt, little medium sand, little to trace clay (few laminations of organic material) (wel)       6       7-8-4-7       1.1         15       -2.8       Light gray to pale yellow fine SAND, trace medium sand, trace to no silt (sl. glauconitic) (saturated)       7       44-5-5       1.1         15       SP-SM       SAME (fine to very fine sand, trace to no silt) (well-sorted) (saturated)       8       4-4-4-4       1.4         20       -8.8       Greenish gray, olive yellow and brownish yellow fine SAND, trace silt (glauconitic) (many gray-greenish gray clay/silt lenses) (saturated)       10       2-2-9.9       1.2       Apparent top of Magethy Formation         20       -113.3       CL       Greenish gray, olive yellow and brownish yellow fine SAND, trace silt (glauconitic) (many gray-greenish gray clay/silt lenses) (saturated)       10       2-2-9.9       1.2       Apparent top of Magethy Formation         213.4       CL	0 -	8.7			TOPSOIL AND R APPARENT FILL some silt, trace cl organic material) SAME (moist to w SAME (greenish g	OOT MATER (yellow to yel ay, trace fine (moist to wet) vet) gray color) (lit	IAL lowish brown fine sand, to medium gravel (little ) Itle sitt) (moist)	XXXXX	1A 1B 2A 2B	3-5-5-4 4-4-5-8	1.5 1.4		
1.2       APPARENT FILL [black coal slag, mostly fine sand size (@9.3 ** - lens of apparent cyster shells) (wet])       5       44-34-35-10       1.5         10       -0.8       SC       Grayish brown line SAND, some to and sit, little medium sand, little to trace clay (tew laminations of organic material) (wet)       6       7-8-4-7       1.1       Apparent top of stream alluvium.         15       -2.8       Light gray to pale yellow fine SAND, trace medium sand, trace to no sill (sl. glauconitic) (saturated)       7       4-4-5-5       1.1         15       SAME (fine to very fine sand, trace to no sill) (well-sorted) (saturated)       8       4-4-4.4       1.4         20       -8.8       Greenish gray, claysilt tens) (saturated)       9       7-6-3-5       1.5         20       SC       Greenish gray, claysilt tens) (saturated)       10       2-2-9-9       12       Apparent top of Magothy Formation         20       SC       SAME (charge in shoe to granular sand stringer over greenish gray, claysilt tens) (saturated)       10       2-2-9-9       1.2       Apparent top of Magothy Formation         21       -13.3       CL       Greenish gray, clay-greenish gray claysilt lenses) (saturated)       11       4-4-3-3       0.9         22       -15.3       Grey Link (trace lignite and mica in clay/silt lenses) (saturated)       12A       2-2-3-2       1.4	5 -				SAME (pale yellow (moist to wet) SAME (trace silt)	w and greenis (wet)	ah gray) (sl. glauconitic)	X	3	10-13-16-11 13-14-22-34	1.5 1.4		
28       SC       sand, little to trace clay (few laminations of organic material) (well)       6       7-8-4-7       1.1       Apparent top of stream alluvium.         15       -2.8       Light gray to pale yellow fine SAND, trace medium sand, trace to no sill (s. ] glauconitic) (saturated)       7       4-4-5-5       1.1       Apparent top of stream alluvium.         15       -8.8       SAME (fine to very fine sand, trace to no sill) (well-sorted) (saturated)       8       4-4-4-4       1.4         20       -8.8       Greenish gray, clavysiit tens) (saturated)       9       7-6-3-5       1.5         20       -5.8       Greenish gray, clavysiit tens) (saturated)       10       2-2-9-9       12       Apparent top of Magethy Formation         20       -13.3       Greenish gray, clavysiit tens) (saturated)       10       2-2-9-9       12       Apparent top of Magethy Formation         21       -15.3       CL       Gray CLAV/SLT, trace fine sand (micaceous) (trace organic material) (medium plasticity) (wel to saturated)       11       4-4-3-3       0.9         25       -16.3       CL       Gray fine to medium SAND, trace to no sill (st. glauconitic)       13A       8-5-14-12       1.9         26       -16.3       Gray fine to medium sand, trace to no sill (st. glauconitic)       13B       13B       13B   <	10 -	-0.8			APPARENT FILL (@9.3' +/- lens of	[black coal sl apparent oys	ag, mostly fine sand size ter shells) (wet)]	X	5	44-34-35-10	1.5		
15     SP-SM     SAME (fine to very fine sand, trace to no sill) (well-sorted) (saturated)     8     4-4-4-4     1.4       20     -8.8     Greenish gray clay/silt lens) (saturated)     9     7-6-3-5     1.5       20     -8.8     Greenish gray, clive yellow and brownish yellow fine SAND, trace silt (glauconic) (many gray-greenish gray clay/silt lenses) (saturated)     10     2-2-9.9     12     Apparent top of Magethy Formation       20     -13.3     SAME (thinly-bedded) (trace lignite and mica in clay/silt lenses) (saturated)     11     4-4-3-3     0.9       -15.3     CL     Gray CLAY/SILT, trace fine sand (micaceous) (trace very coarse to granular sand, trace to no silt (st. glauconitic) (common this lenses) (raturated)     13A     8-5-14-12     1.9       25     -16.3     Gray fine to medium SAND, trace to no silt (st. glauconitic) (common this lenses) (raturated)     13A     8-5-14-12     1.9	1 0 1	-2.8		SC	sand, little to trace (wet) Light gray to pale trace to no silt (sl.	yellow fine Sy glauconitic)	ninations of organic material) AND, trace medium sand, (saturated)	Ŕ	6 7	7-8-4-7	1.1	Apparent top of stream alluvium.	
-8.8     SAME (change in shoe to granular sand stringer over greenish gray caysist itens) (saturated)     9     7-6-3-5     1.5       -8.8     Greenish gray, olive yellow and brownish yellow fine SAND, trace silt (glauconiic) (many gray-greenish gray clay/silt lenses) (saturated)     10     2-2-9-9     1.2     Apparent top of Magothy Formation       -13.3     SAME (trinity-bedded) (trace lignite and mica in clay/silt lenses) (saturated)     11     4-4-3-3     0.9       -15.3     CL     Gray CLAY/SILT, trace to fine sond (micaecous) (trace organic material) (medium plasticity) (wet to saturated)     12A     2-2-3-2     1.4       25     -15.3     SAME (saturated)     13A     8-5-14-12     1.9	15 -			SP-SM	SAME (fine to ver (saturated)	y fine sand, t	race to no sill) (well-sorted)	A	8	4-4-4-4	1.4		
20     Sc     trace sit (glauconitic) (many gray-greenish gray clay/silt lenses) (saturated)     10     2-2-9-9     1.2     Apparent top of Magothy Formation       20     Sc     SAME (thinly-bedded) (trace lignife and mica in clay/silt lenses) (saturated)     11     4-4-3-3     0.9       -13.3     SAME (saturated)     12A     2-2-3-2     1.4       -15.3     CL     Gray CLAY/SILT, trace fine sand (micaceous) (trace organic material) (medium plasticity) (well to saturated)     13A     8-5-14-12     1.9       25     -15.3     Gray fine to medium SAND, trace to no silt (sl. glauconitic) (common thin lenses) gray very fine to fine sing wery fine to fine sing wery fine to fine sing wery fine to fine to medium sand, trace to no silt (sl. glauconitic)     13B     13B		-8,8			SAME (change in greenish gray clay Greenish gray oli	shoe to gran /silt lens) (sa	ular sand stringer over turated) brownish velicw fine SAND	A	9	7-6-3-5	1.5		
-13.3 SAME (saturated) -13.3 SAME (saturated) -15.3 CL V (saturated) -15.3 SAME (saturated) -15.3	- 00			SC	trace silt (glaucon lenses) (saturated	itic) (many gr 1) ded) (trans lis	ay-greenish gray clay/silt	A	10	2-2-9-9	1.2	Apparent top of Magothy Formation.	
-15.3 -15.3	1.1	-13.3			Inny-bed Ienses) (saturated SAME (saturated)	1) )	june and mice in Gelysin	Å	11 12A	4-4-3-3 2-2-3-2	0.9 1.4		
very coarse to granular sand, trace to no silt (sl. glauconitic) 13B (common thin lenses of greenish gray very fine to fine silty	25 -	-15.3		CL	Gray CLAY/SILT, organic material) SAME (saturated Gray fine to medi	trace fine sai (medium plas ) um SAND, tra	nd (micaceous) (trace tlicity) (wet to saturated) ace to little coarse sand, trace	X	12B 13A	8-5-14-12	1.9		
SP-SM SAME (finer than above: mostly fine sand) (saturated) 14 5-10-11-14 1.3				SP-SM	very coarse to gra (common thin len sand) (saturated) SAME (finer than	nular sand, tr ses of greenis above: mostl	race to no silt (sl. glauconitic) sh gray very fine to fine silty y fine sand) (saturated)		138	5-10-11-14	1.3		
SAME (mostly medium to fine sand, trace to no silt) (sl. 15 2-5-9-12 1.7 micaceous) (saturated)	10 -				SAME (mostly me micaceous) (satur	edium to fine : rated)	sand, trace to no silt) (si.	X	15	2-5-9-12	1.7	_	

Figure A2: Geotechnical Subsurface Exploration, Gibbstown, New Jersey – Test Boring Logs

99	$\langle \rangle$	D AS Cons	UF SSC sultants	FFI OCI	ELD ATES Geosciences		TES	ST E	BORIN	NG GIB-3	(Pa	ige 2 of 2)		į	(~)	DI AS	JFF SOC	IELD IATES		TE	STE	BORIN	NG GIB-4	4 (Pa	ge 1 of 1)
g US	ieotechi G ACE Co	nical S libbsto Projec ontract Tas	Subsu own, Mo. t No. t No. t No. t No.	Inface E New Je 8919.0 W912E Jer 0007	Exploration - rsey GG BU-11-D-0005 7	Date Started Date Compl Logged by Weather Driller/Agen	J January 16, 2013 eted January 18, 2013 ADK Sunny, 30s cy A Leavy/Granese Drittin	g, Inc.	Dri Dri Su No Ea	illing Equipment illing Methods urface Elevation wrthing asting	: Truck-m : 3.25" H. : 9.2 feet : 361,570 : 267,025	ounted Gefco StrataStar 15 S.A. NAVD 00 NJSPFT NAD83 NJSPFT NAD83		Ű	Geotech G SACE C	nical Su ibbstov Project ontract I Task	ibsurface m. New No. 891 No. W91 Order 00	e Exploration - Jersey 9.GG 2BU-11-D-0005 007	Date Start Date Comp Logged by Weather Dniler/Age	nd Jamuary 17, 2013 Jaiotad January 17, 2013 ADK Cloudy, 30s noy A. Leavy/Granear Drill	ing, linc,	Dr Dr Šk No Ez	Illing Equipment Illing Methods Inface Elevation arthing Isling	Truck-m 3.25" H 4.9 feet 363,601	ounted Gefoo StrataStar 15 S.A. NAVD 88 NJSPFT NADB3 NJSPFT NADB3
					Sample Condition Remoted		Water Levels						E					Sample Conditio	1	Water Levels					
Depth in feet	Surf. Elev. 9.2 ft	GRAPHIC		nscs		DESCR	IPTION	SAMPLES	Sample Number	Blows per 6 inches or Fluid Pressure	Recovery (ft)	Remarks	WATER LEV	Depth in feet	Surf. Elev. 4.9 ft	GRAPHIC	nscs		DESC	RIPTION	SAMPLES	Sample Number	Blows per 6 inches of Fluid Pressure	Recover (ft)	Remarks
35 -					(saturated) SAME (light gray o SAME (well-sorted silt) (trace fine qua	color) (satur d greenish g artz gravel) (	ated) ray fine sand, no silt to trace saturated)		16 17 18	7-7-10-12 8-9-9-18 16-15-15-14	1.5 1.4 1.0	Driller washed out augers with drilling mud; heaving sands.		5	4.4 3.9	***	SM	TOPSOIL AND I APPARENT FILI (fragments/glass/ Very pale brown medium to coars Yellow to reddist trace coarse sam SAME (coarser I coarse sand) (tra	ROOT MATE [black fine slag) (moist) to yellow fine e sand (moist) yellow fine d, trace to lit han above; f ice heavy m	RIAL sand, some silt (some coal ) SAND, little silt, trace st to wet) SAND, little medium sand, tte silt, little fine gravel (wet) ine to medium sand, little neratls) (wet)	MXXXX	1A 1B 1C 2 3	3-5-5-4 4-4-4-6 9-11-15-14	1.2 1.1 0.9	Apparent top of Cap May Formation, Unit 2.
40			SP	P-SM	SAME (saturated) SAME (fine to ven SAME (40-40.5' +	y fine sand) /- lens with	(saturated) trace to little clay) (saturated)		19 20 21	7-8-9-9 10-10-10-7 4-4-8-12	1.2 1.7			10 -	-2.1 -3.1		SM	SAME (coarsens gravel) (saturate Light gray fine S heavy mineral la Pinkish gray to p quartz gravel (int	with depth d) AND, trace s minations) (s ink CLAY/SI ensely mottl	to coarse to fine sand, little fine itt (mod. well-sorted) (few iaturated) LT, trace fine sand, trace ed reddish gray) (dry to damp)		4A 4B 5	6-16-17-14 8-9-12-15	1.1 1.3	Apparent top of Potomac Formation.
45 -	-34.8		5	SM	SAME (coarser the sand) (saturated) Gray to dark gray coarse sand, trace gray sandy clay/sil SAME (color chan	an above; tra fine SAND, e silt (comme lt) (trace lign nee to green	ace coarse to very coarse little medium sand, trace on very thin lenses of dark ite) (wet to saturated) ish gray in shoe) (wet to	X	22 23	7-9-12-12	1.7			- - 15 -											
50 -	-39.6				saturated) SAME (saturated to Dark gray CLAY/S lignite) (wet) SAME (dark brown (few fine sand lam	with wet len: SILT, trace fi n color) (trac ninations) (lit	ses) ne sand (micaceous) (trace ce medium to coarse sand) ttle lignite) (wet)		25A 25B 26	6-8-7-8 2-3-4-8	1.4														
- 55 -			(	CL	SAME (many lami	nations of o	rganic material) (wet) ance) (damp to dry; crumbly)	A	27 28	7-7-17-18 7-9-11-11	1.0 0.9			- 25 -											
60 -	-49,3 -50.8		SW	V-SM	SAME (wet to satu SAME (wet) Light gray very cor sand, trace silt (m 58.5-58.7' +/-) (sa	urated) arse to gran od. poorly-si iturated)	ular SAND, little fine to coarse orted) (thin hardpan		29 30A 30B	10-10-9-8 38-42-22-18	0.8 0.9	Apparent top of Potomac Formation.		30 -											
NOTES 1. Test 2. Satur 3. Borel 4. Soil ( Practice)	boring t ation er hole bar lescript	termin ncount ckfilled ions p	ated a tered d with perform	at 60 fe at appr bentor med in	et +/- below existing roximately 12 feet b of ite-amended portlar general accordance entification of Solie 0	ground surfa c.g.s nd cement up with ASTM E	5. Standard, for Penetra 6. Location d on completion. 2468, the al Procedure)	split-ba ative Te ata bas estimat	irrel samp est and Sp ied on GP ed by Duff	ling performed in hit-Barrel Samplin S survey perform field Associates u	general a g (ASTM ed by Duff sing 2010	ccordance with the Meth D 1586). Ield Associates. LiDAR data.	od 1	NOTES 1. Test Wor 2. Satu 3. Bore 4. Sati	S: t boring k was st ration e shole ba	ermina opped a ncounte ckfilled	ted at 10 at the rec red at ap with bent	feet +/- below existin quest of DuPont Repo pproximately 6 feet b. tonite-amended porti in general	g ground sun uno Station p e.g.s and cement u	Practice lace (b,e.g.s.), 5. Standard for Periet 6, Location pon completion, 7. Elevation D.2488 the	for Desi , split-b rative T data ba estima	cription and arrel samp 'est and Sp ised on GP ited by Duff	I identification of ling performed in lit-Barrel Sampli S survey perform leid Associates u	Soils (Vising general ang (ASTM ned by Duft using 2010)	al-Manual Procedure). coordance with the Meth D 1586). leld Associates. LIDAR data.

Figure A2 con't: Geotechnical Subsurface Exploration, Gibbstown, New Jersey – Test Boring Logs

		CONTRA	itants in the	OFCSCHERES						(Pag	ge 1 of 1)	
US	Beotechn Gi F ACE Co	ical Si bbstow roject tract Task	ubsurface I vn, New Je No. 8919. No. W9128 Order 000	Exploration - riscy GG BL-11-D-0005 I7	Date Starter Date Compl Logged by Weather Driller/Agen	d : March 26, 2013 leted : March 26, 2013 ; ADK : P Cloudy, 40s cy : A. Leavy/Granese I	Drilling, Inc.	Dr Dr Su No Ea	Illing Equipment Illing Methods Inface Elevation Infhing Isting	: Truck-mo : 3.25" H.S : 5.2 feet f : 363,560 : 269,891	unted Getco StrataStar 15 .A. IAVD 88 NJSPFT NAD83 NJSPFT NAD83	,
epth in	Surf. Elev. 5.2 ft	SRAPHIC	SOS	Sample Condition	DESCR	Water Levels	SAMPLES	Sample Number	Blows per 6 inches or Fluid Pressure	Recovery (ft)	Remarks	VATER LEVEL
0 -		~	-	C ZERVOV BO				-				1
	4.3 4.2 3.5			ASPHALT STONE BASE APPARENT FILL to very fine sand, laver) (demo)	[very pale bi trace silt (1.4	rown to brownish yellow fin 4-1.7" black slag and cinde		1A 1B	8-8	1.0	Apparent top of Cap May Formation, Unit 2.	e
	1.2			Brownish yellow f	ine to very find (damp to r	ne SAND, trace to little silt. moist)	-10	2	0-0-0-0	1,0		
5 -			SM	SAME (very pale to coarse sand, tr	brown to yell ace fine qua	low fine sand, trace mediur rtz gravel) (few distinct ver	7 1 X I	3	4-4-5-9	1.5		
	-0.8	Щ	SP-SM	Very pale brown t	o yellow fine	to medium SAND, little		4A	5-7-8-10	1.5	Apparent top of	Γ
	-2.8	4	SC SD.SM	clay, trace coarse	to fine quar	tz gravel (common lenses)	sf 🖉	4B 5A	4-6-13-23	15	Potomac Formation.	
1	-3.2	11	OF-OW	lenses)	modium C/	ND little gegree good tree		5B	401020	1,0		
10 -	.5.8		30	very coarse sand, Brownish yellow,	trace silt (sa very pale bro	aturated) wm and light gray fine to w		6A	18-22-13-14	1.3		
	-0.0		CL	fine SAND, little of Pale yellow media sand, trace fine s	lay/silt (char im SAND, lit and, trace to	rge in drive shoe) (wet) tle very coarse to granular no silt (saturated)		68		2.0		
	-8.8			Yellow, brownish SAND, some silt,	yellow and s little to trace	trong brown fine to mediun clay, trace coarse sand, tr	ace	51-1		2,0		1
15 -	-9.3		50	fine quartz gravel SAME (coarsens	(wet) with depth; 1	10.7-11' coarse clayey grav	el 🕅	7B	10-14-14-16	1.9		
1	12.0		SP	Pink, pinkish whit fine sand (very sti SHELBY TUBE S	e. and gray ( ff consistend T-1: 12.0' -	CLAY/SILT. trace fine to ve cy) (damp) 14.0' - SHELBY TUBE	" X	8	10-13-15-22	1.3		
- 20 -	-12.6			White and pinkish (moist) Pale yellow to yell	ow medium	ne SAND and CLAY/SILT to fine SAND, little to some	ΞŊ	9	19-17-20-21	0.6		
1.1			SW-SM	(saturated) SAME (coarsens Yellow to olive yellow	with depth to low granular	o granular sand) (saturated to very coarse SAND, little	:- A	10	10-15-16-12	1.1		
	.18.9			little silt, trace coa	rse quartz g	ravel (saturated)	A	11	11-13-14-16	1.3		
25 -	-19.5	T	SP	(saturated) SAME (some to a	nd medium t	to fine to coarse gravel)		12A	10-17-25-26	1.3		
			SM	(saturated) White fine SAND sand, trace to no Pale olive fine SA	trace mediu silt (mod. we ND, trace cla	im sand, trace very coarse ell-sorted) (saturated) ay/silt, trace medium sand (clau/eilt) (saturated)	-12	13	18-26-35-36	0.7	Shelby tube attempt unsuccessful due to heaving sand within auger stem.	
30	-24.8			SAME (fine to me pea-size to fine gr SAME (saturated	idium sand, t ravel) (satura )	trace silt) (trace thin lenses ated)	of	14	16-30-34-30	0.4		

Figure A2 con't: Geotechnical Subsurface Exploration, Gibbstown, New Jersey – Test Boring Logs



Figure A3: Geotechnical Subsurface Exploration, Lambertville, New Jersey – Test Boring Location Sketch



Figure A4: Geotechnical Subsurface Exploration, Lambertville, New Jersey – Test Boring Logs

PA	INSTALL	TION		SHEET 1	ETC
	10. SIZE	AND TYPE O	FBIT	4 25" AUGER BIT	215
	11. DATU MSI	M FOR ELEN	ATION SHO	WN (TBM or MSL)	
3759 W 74.9493	12 MAN	FACTURER	S DESIGNA	TION OF DRILL	-
	CME 13 TOTA	55LC	FRANCING	DISTURBED IMPORTUGED	_
1414.02	SAMP	LES TAKEN		12 0	
LAM-03	14 TOTA	L NUMBER O	ORE BOXE	s N/A	_
	15. ELEV	ATION GROU	IND WATER	61.5 ARTED COMPLETED	-
DEG. FROM VERT.	16 DATE	HOLE		8/21/2014 8/21/2014	_
22.3	17. ELEV	ATION TOP (	OF HOLE	+70.0	-
N/A	18. TOTA	DGIST	JUVERY FO	RECHING	76
22.3	1	3.7000	1 BOX OD	Neb Dedic	_
(Description) d	5	RECOV- ERY e	SAMPLE NO.	(Dalling time, water loss, depth weathering, etc., if significant) 9	1
er, white stone, tan sand	dium	64	0.1	blowcount 3 B 10 10	
oose		34	0.3	N=18	
e @8.6'			2.3		
			1.5		
		0	\$.2	blownount 7-7-3-4	
		ų	2.0	N=10	
			4.0		
		58	S-3	blowcount 3-1-1-1	
			6.0	14-2	
			_		
				arrest a big t	
		54	S-4 6.0	N=3	
			8.0		
		100	S-5	blowcount 2-2-2-1	
			8.0 10.0	N=4	
				and the second second	
		88	S-6 10.0	blowcount 1-1-1-1 N=2	
			12.0		
		96	S-7	blowcount WH-1-1-1	
		10	12.0	N=2	
			14.0		
ND, gravelly, dark gray 8	brown,	83	S-8	blowcount 1-2-1-1	
ealum densé			14.0	N=a	
		100	0.0	Manufacture MALL & A.	
		100	5-9 16.0	N=2	
			18.0		
		100	S-10	blowcount 2-9-9-7	
		1.00	18.0	N=18	
			2404	the second se	



Figure A4 con't: Geotechnical Subsurface Exploration, Lambertville, New Jersey – Test Boring Logs



Figure A4 con't: Geotechnical Subsurface Exploration, Lambertville, New Jersey – Test Boring Logs