



**US Army Corps
of Engineers** ®

New York District

Flood Risk Management and Watershed Management
Byram River Basin
Fairfield County, Connecticut
and Westchester County, New York

PROJECT MANAGEMENT PLAN

New York District
North Atlantic Division
8/1/12

Flood Risk Management
Byram River Basin
Fairfield County, Connecticut & Westchester County, New York
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Byram River Basin PROJECT MANAGEMENT PLAN

CHAPTER I – INTRODUCTION

1. BACKGROUND

Flooding on the Byram River primarily affects the Town of Greenwich, just south of the constructed project of levees at Pemberwick. Previously recommended flood damage reduction measures, which would have included the continuation of the levee features to the south, were not constructed due to local concerns about the negative aesthetic effects of the levees. Based on recent discussions with residents in the area, flooding is again of great concern. A secondary damage area was identified to the north, on Bailiwick Bridge within the Town of Greenwich. This bridge is small, with low clearance, and it consequently traps debris on the river course, effectively acting as a dam. Its stone facing was stripped by raging floodwaters during the April 2007 storm. There are also minor tidally induced flood damages at the lower end of the Byram River within the Village of Port Chester, Westchester County, New York.

Flood damages within the Byram River Basin have been recognized in previous USACE reports.¹ A previous recommendation for the construction of levees at Pemberwick was partially implemented in the 1960s, in accord with local interests, as noted above. Flood damages were investigated again in 1977, resulting in a federal recommendation for channel excavation and the construction of floodwalls and levees at the Town of Greenwich, CT, and the Village of Port Chester, NY. Although the recommended plan was subsequently authorized by Congress, it was not implemented. At the present, flood damages have been noted outside of previously documented areas in the Byram River Basin. Consequently, the study team is now pursuing a new watershed-based Feasibility Study for Flood Damage Reduction in the Byram River Basin to address current conditions and ensure a comprehensive approach.

2. DEFINITION OF A PROJECT MANAGEMENT PLAN

The Project Management Plan (PMP) defines the planning approach, activities to be accomplished, schedule, and associated costs that the federal government and the local sponsor will be supporting financially. The PMP, therefore defines a contract between the Corps and the local sponsor, and reflects an agreement on the part of the financial backers, as well as those who will be performing, and reviewing, the activities involved in the study.

The PMP is a basis for change. Because planning is an iterative process without a predetermined outcome, more or less costs and time may be required to accomplish the tasks identified. With clear descriptions of the scopes and assumptions outlined in the PMP deviations are easier to identify. The impact in either time or money is easily assessed and decisions can be made on how to proceed. The PMP provides a basis for change.

¹ U.S. Army Corps of Engineers, New York District. *Byram River and Tributaries, Design Memorandum*. 1958.
U.S. Army Corps of Engineers, New York District. *Feasibility Report for Flood Control: Mamaroneck and Sheldrake Rivers Basin (Village and Town of Mamaroneck, N.Y.) and Byram River Basin (Greenwich, CT and Port Chester, N.Y.)*. 1977.

The PMP is a basis for the review and evaluation of the draft report. Since the PMP represents a contract among study participants, it will be used as the basis to determine if the draft report has been developed in accordance with established procedures and previous agreements. The PMP reflects the mutual agreement of the Corps and the local sponsor regarding the scope, critical assumptions, methods, and level of detail for the investigations that are to be conducted during the study. Review of the draft report will be to insure that the study has been developed consistent with this agreement. The objective is to provide early assurance that the study is developed in a way that is acceptable to the local sponsor.

The PMP is a study management tool. It includes scopes of work that are used for funds allocation by the Project Manager. It forms the basis for identifying commitments to the non-federal sponsor and serves as a basis for performance measurement.

3. SUMMARY OF PROJECT MANAGEMENT PLAN REQUIREMENTS

This PMP comprises the following chapters:

- Chapter I - Introduction: This chapter includes the definition of the PMP and a summary of the PMP requirements.
- Chapter II – Background: This chapter provides a background of the project area and approach.
- Chapter III - Scopes of Work: A detailed scope of the tasks and activities that describe the work to be accomplished, in narrative form, that answers the questions: "what, how, and how much."
- Chapter IV - Responsibility Assignment: The parties responsible for various aspects of the work are outlined in this chapter.
- Chapter V - Study Schedule: The schedule will define "when" key decision points.
- Chapter VI - Cost Estimate: This is the baseline estimate for the study.
- Chapter VII - Quality Management Plan: This chapter supplements the District's Quality Management Plan. It highlights any deviations to the district's plan and lists the members of the study team and the independent review team.

CHAPTER II - BACKGROUND

1. STUDY AUTHORITY

This study was authorized by the Resolution of the Committee on Transportation and Infrastructure, Docket 2779, dated May 2nd, 2007, which reads as follows:

Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, That the Secretary of the Army review the report of the Chief of Engineers on the Streams in Westchester County, New York, and the Mamaroneck and Sheldrake Rivers Basin and Byram River Basin, New York and Connecticut published as House Document 98-112, and other pertinent reports on the Hutchinson, Mamaroneck and Sheldrake Rivers to determine whether modifications to the recommendations contained therein are advisable at the present time in the interest of water resources development, including flood damage reduction, storm damage reduction, environmental restoration, navigation, watershed management, water supply, and other allied purposes.

A reconnaissance report dated June 2008 presents the results of the investigation into the flooding problems in the study area, Westchester County Streams, in Westchester County, NY, and Fairfield County, CT. The Byram River Basin is one of the river basins covered in the reconnaissance report.

2. STUDY PURPOSE

The purpose of the feasibility phase study is to describe and evaluate potential solutions and alternative plans that will address the flooding problems in the study area, and to select a recommended project for design and implementation. The 2008 Westchester County Streams Reconnaissance Study resulted in the finding that there is a federal interest in continuing the study into the feasibility phase. In a letter dated February 2008, the Town of Greenwich has expressed its intent to serve as the non-federal partner for the Feasibility Phase of this study. The New York State Department of Environmental Conservation, during meetings to discuss this effort, has committed to being an active member of the Project Delivery Team (PDT). This partnering relationship exists because most of the damage and benefit areas are within the boundaries of the Town of Greenwich, CT, however, some portion of the solution may lie within the State of New York.

3. LOCATION OF STUDY, NON-FEDERAL SPONSOR AND CONGRESSIONAL DISTRICTS

- a. The study area is located primarily in Fairfield County, CT, and partly in Westchester County, NY. The Byram River Basin occupies 31.0 square miles, and encompasses areas in the Town of Greenwich, Connecticut, and to a lesser extent areas in the Towns of North Castle, Bedford, New Castle, and Rye in New York (Attachment A). The neighborhoods of Byram, Pemberwick, Glenville and a significant portion of northern Greenwich, Connecticut along with portions of Armonk and Port Chester, New York compose the basin. The watershed of the Byram River is roughly triangular in shape, and its maximum length extends 13.5 miles in a north-south orientation, while its width varies from 0.5 to 4.5 miles. The highest peaks are

along the northerly ridges and attain elevations up to 760 feet. Its many branching tributaries uniformly drain the basin.

- b. The non-federal partner for the feasibility phase of the study is the Town of Greenwich in CT.
- c. The study area lies within the jurisdiction of the following Congressional Districts:
 - 1) Connecticut – District 4 (Jim Himes)
 - 2) New York – District 18 (Nita Lowey)

4. PRIOR REPORTS AND EXISTING PROJECTS

The Byram River and its tributaries were the subject of a General Design Memorandum in 1958, which recommended 3000 ft of levees on the Byram River mainstream at Pemberwick, Town of Greenwich, Fairfield County, Connecticut. Only part of the project at Pemberwick was constructed in the 1960s. The recommendation for flood damage reduction was reinforced in the 1977 Westchester County Streams Feasibility Report, titled “Feasibility Report for Flood Control, Mamaroneck and Sheldrake Rivers Basins, and Byram River Basin,” which recommended channel excavation and the construction of floodwalls and levees at Port Chester, NY and the Town of Greenwich, CT. Although the previous 1977 Feasibility Report recommendation was authorized by Congress, the project was never constructed. The study team is pursuing a new Feasibility Study because there are new damage areas within the Byram River Basin that were not covered in the previous study and authorization, and to reassess the 1977 recommendation.

5. PLAN FORMULATION

During the feasibility study, six planning steps that are set forth in the Water Resource Council’s Principles and Guidelines are repeated to focus the planning effort and eventually to select and recommend a plan for authorization. The six planning steps are: 1) specify problems and opportunities, 2) inventory and forecast conditions, 3) formulate alternative plans, 4) evaluate effects of alternative plans, 5) compare alternative plans, and 6) select recommended plan. The iterations of the planning steps typically differ in the emphasis that is placed on each of the steps. In the early iterations, those conducted during the reconnaissance phase, the step of specifying problems and opportunities is emphasized. That is not to say, however, that the other steps are ignored since the initial screening of preliminary plans that results from the other steps is very important to the scoping of the follow-on feasibility phase studies. The sub-paragraphs that follow present the results of the initial iterations of the planning steps that were conducted during the reconnaissance phase. This information will be refined in future iterations of the planning steps that will be accomplished during the feasibility phase.

- a. National Objectives: The national or federal objective of water and related land resources planning is to contribute to national economic development consistent with protecting the nation’s environment, pursuant to national environmental statutes, applicable executive orders, and other federal planning requirements. Contributions to national economic development (NED) are increases in the net value of the national output of goods and services, expressed in

monetary units. Contributions to NED are the direct net benefits that accrue in the planning area and the rest of the nation.

- b. **Public Concerns:** A number of public concerns have been identified during the course of the reconnaissance study. Additional input was received through coordination with the (potential) sponsor(s), and some initial coordination with other agencies. The public concerns that are related to the establishment of planning objectives and planning constraints are:
 - 1) The need for a comprehensive approach to solving the problem of flood damages. To date, constructed projects have focused on select areas yielding the highest benefit to cost ratios, without a thorough consideration of the effects to the entire watershed.
 - 2) A perceived lack of transparency in the Corps planning process.
 - 3) The aesthetics of proposed flood damage reduction measures (levees of blocking views of river, concrete flumes and channels) may be visually unappealing and adversely affect real estate values.
- c. **Problems and Opportunities:** The evaluation of public concerns often reflects a range of needs, which are perceived by the public. This section describes these needs in the context of typical problems and opportunities that can be addressed through water and related land resource management. For each problem and opportunity, the existing conditions and the expected future conditions are described, as follows:
 - 1) Reduced stream capacity due to channel constrictions. Development may have led to reductions in the width of riverbeds and streambeds, as land has been claimed for \ commercial or residential use. Sedimentation of streams and rivers may reduce the carrying capacity of watercourses. There is little or no natural storage of flood waters within this basin. *Opportunity: restore stream capacity where appropriate.*
 - 2) Obstructions (culverts and bridges). Culverts and bridges may become obstructions to the water flow either because their openings are not large enough to accommodate heavy flows, or because debris accumulates around them, effectively creating a dam. *Opportunity: remove obstructive capability of culverts and bridges while maintaining functionality.*
 - 3) Development in the floodplain. Current development will be reviewed with respect to projections of economic growth from past reports (USACE 1942, 1977).² Development decreases the amount of permeable land surface in a watershed, and people live and work within the floodplain, which, by definition, will flood. *Opportunity: mitigate flood damages.*
- d. **Planning Objectives:** The national objectives of national economic development and national ecosystem restoration (NER) are general statements and not specific enough for direct use in

² USACE – New York District. *Byram River and Tributaries Preliminary Examination*. 1942

USACE – New York District. *Feasibility Report for Flood Control: Mamaroneck & Sheldrake Rivers Basin and Byram River Basin*. 1977.

plan formulation. The water and related land resource problems and opportunities identified in this study are stated as specific planning objectives to provide focus for the formulation of alternatives. These planning objectives reflect the problems and opportunities and represent desired positive changes in the without project conditions. The planning objectives are specified as follows:

- 1) To reduce threat of loss of life due to flooding within the study area.
 - 2) To mitigate financial losses incurred by municipal, residential, industrial, agricultural, and commercial establishments in the Byram River Basin due to flooding while satisfying constraints for economical feasibility.
 - 3) Assure a minimum reasonable negative impact of the flood damage reduction plan upon the existing environmental conditions found within the study area.
 - 4) Allow the current land use of Greenwich & other municipalities within the Byram River Basin to continue functioning as a government, business, commercial, and residential district.
 - 5) Continue to manage the land use within the floodplain to prevent and mitigate for future induced flood damages.
- e. Planning Constraints: Unlike planning objectives that represent desired positive changes, planning constraints represent restrictions that should not be violated. The planning constraints identified in this study are as follows:
- 1) Compliance with local land use plans and initiatives for storm water management;
 - 2) Avoid negative effects on habitat of federal and State threatened and endangered species within the study area;
 - 3) Flood damage reduction measures must not induce flooding to other unprotected areas either upstream or downstream.
- f. Measures to Address Identified Planning Objectives. A management measure is a feature or activity at a site, which address one or more of the planning objectives. A wide variety of measures will be considered in the Feasibility study. The description of the measures considered in this study are presented below:
- 1) No Action. The Corps is required to consider “No Action” as one of the alternatives in order to comply with the requirements of the National Environmental Policy Act (NEPA). No Action assumes that no project would be implemented by the federal Government or by local interests. No Action, which is synonymous with the Without Project Condition, forms the basis from which all other alternative plans are measured.
 - 2) Non-Structural. Various non-structural alternatives, including buy-outs, elevating structures

and flood-proofing will be considered.

- 3) Structural. Measures such as road raising, snagging and clearing, floodwalls and levees, and re-channelization may be examined. For stream bank stabilization and erosion control, a combination of hard, bio-engineering and soft stabilization measures may be studied as well as in-stream control structures.
- 4) Additional Measures for Complete Alternatives. The feasibility-level analysis may identify measures that might be required to generate a “complete” alternative. These may also include elements of an overall project in which the Corps does not presently have authority to become a cost-sharing participant. Stormwater management efforts within local municipalities may be included in several alternatives for which there is no existing Corps authority, but their inclusion may be required to generate a “complete” plan.

6. FEDERAL INTEREST

Since a project purpose is an output with a high budget priority and that project purpose is the primary output of the alternatives to be evaluated in the feasibility phase, there is a strong federal interest in conducting the feasibility study. There is also a federal interest in other related outputs of the alternatives including other project purposes that could be developed within existing policy. Based on the preliminary screening of alternatives, there appears to be potential project alternatives that would be consistent with Army policies, costs, benefits, and environmental impacts.

7. PRELIMINARY FINANCIAL ANALYSIS

As the local sponsor, the Town of Greenwich will be required to provide 50 percent of the cost of the feasibility phase. The local sponsor is also aware of the cost sharing requirements for potential project implementation. A letter of intent from the local sponsor stating a willingness to pursue the feasibility study and to share in its cost, and an understanding of the cost sharing that is required for project construction is included as Attachment B.

8. STUDY PROCESS

As stated in section 2.1, the USACE feasibility study process requires six steps:

- 1) specify problems and opportunities,
- 2) inventory and forecast conditions,
- 3) formulate alternative plans,
- 4) evaluate effects of alternative plans,
- 5) compare alternative plans, and
- 6) select recommended plan.

In recognition of this difficult economic climate, the Byram River Project Delivery Team has identified in-progress review (IPR) points in the study, where study team members can identify whether it is worth continuing to invest resources in the study to reach the next IPR point. These IPR points are:

- 1) Study Initiation Meeting
- 3) Feasibility Scoping Meeting – Existing and Future Without Project Conditions (USACE milestone)
- 4) Detailed Evaluation of Alternatives to reach Alternative Formulation Briefing (USACE milestone)

Below, the three IPR points are described in greater detail by: the tasks involved, the reason behind their designation, and the desired outcome before proceeding to the next phase. The cost estimates associated with each of these are presented in Appendix C.

IPR #1 - Study Initiation Meeting

The purpose of the Study Initiation Meeting is to facilitate input from the public and private communities early in the planning phase to identify significant issues and concerns. The study team is proposing to discuss the types of alternatives that are typically evaluated, and present preliminary estimates of the anticipated benefits in the form of avoided damages and generic, conceptual costs based on similar projects.

Preparation for the Study Initiation Meeting will include a review of existing documents and site visits. Since Greenwich has completed an H&H model, it is proposed that some of the surveying activities (flood marks, update of maps, stream surveys) be completed at this phase to refine the maps to be used as the basis for structure inventory.

The structure inventory includes locating and numbering all structures affected on aerial maps and delineating the affected area into economic/hydrologic reaches. This inventory will define the structures as to construction condition, age, number of stories, first floor elevations, and square footage. Other important structures such as outbuildings, landscaping, etc. will also be inventoried. Current structure depreciated replacement values will be estimated using "Means" or similar real estate valuation publications. Residential content value will be assumed to be 50% of structure value for residential structures.

This task is critical because the structure inventory establishes the value of the structures damaged during flood events, giving us the upper limit of benefits for the benefit-to-cost ratio in our alternatives evaluation. Depending on the size of the damage/benefit pool, the study team may need to focus on non-structural solutions or a lower level of protection, or recognize that there might not be a positive recommendation from the study.

Traditionally, there has been a communication gap with the public on potential flooding solutions, resulting in poor public support for the results of alternatives analysis. The goal is for the public to have a clear understanding of the structural and non-structural solutions commonly considered in this type of study. At a minimum, the study team would be seeking input on which structural or non-structural measures would be unacceptable to the local community. It is anticipated that one of the alternatives to be investigated in this study will be similar to the Recommended Plan from the 1977 report for comparison purposes. This step is important to managing public expectations and maintaining vital public support for what will be a significant investment of resources. A

formal record will be made of discussions with the public that define major concerns related to the evaluation of project.

The study team will include the public input on proposed alternatives in its development of Without Project Conditions. The Problem Identification/Without Project Conditions summary will serve as the discussion point for an In-Progress Review. It may be necessary to coordinate with the USACE vertical chain at this point if public opinion appears to be at odds with the results of the USACE planning process.

This phase includes the following tasks:

IPR #1 Study Initiation Meeting	
1	Study Initiation Meeting
2.1	a. Surveying and Mapping
2.1	a.i. Flood Mark Survey
2.1	a.ii. Stream Survey
2.2	a. Preliminary Hydrology and Hydraulics
2.2	b. Existing and Future Project Conditions
2.2	c. Existing Conditions Hydraulics
2.8	Engineering Management (30%)
3.2	h. Env. Coordination with PDT (25%)
3.6	g. IS Support (20%)
4.1	a. Structure Inventory & Structure Value Survey
4.1	b. Flood Damage Analysis without project
4.1	c. Evaluation of Impacts & Mitigation Analysis
5.1	Establish Without Project Conditions
5.7	a. Plan Formulation Management (20%)
6.2	Rights of Entry
7	Life Cycle Project Management (25%)

IPR #2 - Feasibility Scoping Meeting - Existing and Future Without Project Conditions

Assuming concurrence to proceed from the Study Initiation Meeting, the PDT would complete data collection of existing conditions and identify alternatives to be evaluated in detail. The Feasibility Scoping Meeting is the first major USACE milestone in the feasibility study process. The goal is for the PDT to ensure policy compliance and to obtain concurrence from its review team on the direction of the study: problem identification, without project future conditions, and proposed solutions.

This phase includes the following tasks:

Phase 2: Formulation Scoping Meeting	
2.3	Geotechnical Information (p. 26)
2.4	a. Conceptual Plan - Dev of Alternatives
2.5	a. Cost Engineering (~50%)
2.7	EN District Quality Control (30%)
2.8	Engineering Management (25%)
3.2	a. Environmental Resource Inventory report (p. 31)
3.2	b. Review and Update Impact Assessment Models (p. 32)
3.2	c. Evaluation of Impacts and Mitigation Analysis
3.2	d. Threatened & Endangered Species (p.33)
3.2	h. Env. Coordination with PDT (50%)
3.4	a. HTRW Assessment Report (p. 36)
3.4	b. HTRW Data Review (p. 36)
3.5	a. Site Survey Field Report (p. 37)
3.6	GIS Support (30%)
5.2	Preliminary Formulation and Screening of Alternatives (p. 45)
5.3	Formulation Scoping Meeting - Vertical Team (p. 46)
5.7	a. Plan Formulation Management (20%)
5.9	Agency Technical Review (30%)
7	Life Cycle Project Management (25%)

The study team is assuming that there will be a maximum of four (4) alternatives to be investigated, including No Action and a non-structural alternative. Pending the successful resolution of the Feasibility Scoping Meeting, the next step is the Alternatives Formulation Briefing.

IPR #3 - Detailed Evaluation of Alternatives to reach Alternative Formulation Briefing

Assuming a positive outcome of the Feasibility Scoping Meeting, the next steps are detailed modeling of alternatives and the Alternatives Formulation Briefing. Most of the plan formulation, engineering, and real estate work will be completed by this point, including a detailed cost estimate for the “Tentatively Selected Plan” (TSP). A major portion of the environmental documentation will also have been included, except for ongoing environmental compliance coordination. A successful AFB will lead to a draft Feasibility Report and the necessary reviews to complete the study.

Preparation for the Alternatives Formulation Briefing includes:

Phase 3: Alternatives Formulation Briefing	
2.2	d. Improved Conditions Hydrology (p. 21)
2.2	e. Improved Conditions Hydraulics (p. 22)
2.2	f. H&H Risk Uncertainty
2.2	g. Non-Structural Plan
2.2	h. Interior Drainage Hydrology (p. 23)
2.2	i. Interior Drainage Hydraulics (p. 24)
2.4	b. Conceptual Design
2.5	a. Cost Engineering (~50%)
2.7	EN District Quality Control (30%)
2.8	Engineering Management (25%)
3.2	e. Section 404(b)(1) Analysis report (p. 33)
3.2	f. 401 State Water Quality certification (p. 33)
3.2	g. Environmental Assessment (80%)
3.2	h. Env. Coordination with PDT (25%)
3.2	i. Coordination Documents with other agencies (50%)
3.2	j. Other Environmental Documents (50%)
3.3	FWCAR (80%)
3.5	e. All other Cultural resources Studies/Reports (p. 38)
3.6	GIS Support (30%)
4.1	d. Flood Damage Analysis with Project (p. 42)
4.1	e. Internal Technical Review (p. 43)
5.4	Detailed Evaluation of Alternatives (p. 46)
5.5	AFB Project Documentation (p. 47)
5.7	a. Plan Formulation Management (40%)
5.9	Agency Technical Review ~(40%)
6.3	Prepare Right of Way Maps
6.4	Gross Appraisal
6.5	Prepare Real Estate Plan
6.7	Local Coordination & Site Visits
7	Life Cycle Project Management (30%)

IPR 4: Produce Feasibility Report

Pending a successful Alternatives Formulation Briefing, the next step is to complete documentation to produce a draft Feasibility Report. Once the draft Feasibility Report is released, public comments are solicited and addressed for the final Feasibility Report. The final Feasibility Report is released again to public before it is then subjected to USACE vertical chain review, culminating in the Civil Works Review Board in at HQ USACE and production of a Chief’s Report.

The tasks include:

IPR #4 Produce Feasibility Report	
2.4	c. Engineering Appendix (p. 27)
2.5	b. Cost Risk Analysis
2.6	Value Engineering (p. 28)
2.7	EN District Quality Control (40%)
2.8	Engineering Management (20%)
3.2	g. Environmental Assessment (p. 34) (20%)
3.2	i. Coordination Documents with other agencies (50%)
3.2	j. Other Environmental Documents (50%)
3.3	FWCAR (20%)
3.6	GIS Support (20%)
3.7	Environmental Technical Review (p. 40)
4.2	a. Draft Economic Appendix (p. 43)
4.2	b. Response to NAD/HQ, QA/QC (p. 44)
4.2	c. Final Economic Appendix (p. 44)
4.2	Economic Appendix (p. 43)
4.3	Ability to Pay Analysis (p. 44)
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5.17	Chief of Engineer's Report (p. 52)
5.18	ASA(CW) Transmittal to Congress (p. 52)
5.7	a. Plan Formulation Management and Appendix (20%)
5.8	Report Preparation (p. 49)
5.9	Agency Technical Review (~30%)
7	Life Cycle Project Management (20%)
	b. District Quality Control (p. 49)

8. CRITICAL ASSUMPTIONS

The following are the critical assumptions that went into the development of the PMP and the schedule leading to the completion of the project:

- a. All appropriated funds will be available when needed.
- b. The Non-Federal share will be provided wholly as in-kind services.
- c. No work will begin until the Feasibility Cost-Sharing Agreement (FCSA) is signed.
- d. A discussion with the non-federal sponsor would be required to identify their minimum level of protection for the Project and/or each identified reach.
- e. Alternatives to be examined will be locally acceptable.
- f. The Feasibility Report will be accompanied by an Environmental Assessment. If it is determined during the course of study that an Environmental Impact Statement is warranted, the study team will reassess the scope of the study.
- g. A maximum of four (4) alternatives will be investigated, in addition to the No Action plan and a Non-Structural Plan.
- h. Subsurface investigations will be conducted during the Plans & Specifications Phase (for Geotechnical Data, HTRW, and Cultural Resources).
- i. In-Progress Review checkpoints will be resolved within 60 days.
- j. The USACE review process for the Feasibility Scoping Meeting, Alternative Formulation Briefing, and the draft and final Feasibility Report will be accomplished within 3 months for each review (District Quality Control, Agency Technical Review, and vertical chain review).
- k. A placeholder has been used for IEPR, however, the schedule assumes based on the scale of the project and the existing information from the 1977 Feasibility Report that Independent External Peer Review (IEPR) will not be necessary. The study team is reserving determination until the Feasibility Scoping Meeting.
- l. Either to TOG or the ACOE may agree to terminate the Contract at any time.
- m. The initial signing of this PMP authorizes both groups to complete work on IPR #1. No work will proceed on any IPRs until agreed in writing by both parties.

CHAPTER III – SCOPES OF WORK

The Feasibility study work plan has a multitude of detailed tasks. The following is a list and description of the tasks required to conduct the feasibility study. USACE and the Town of Greenwich will collaborate to complete the required tasks. Ultimately, however, USACE is responsible for ensuring that the resulting products conform to applicable laws, statutes, regulations, and guidance memoranda.

1. PUBLIC INVOLVEMENT

Public involvement entails the continuation and expansion of the public involvement started during the reconnaissance phase. Initially, it will involve introducing and explaining the reconnaissance study results and the direction and goals of the feasibility phase. It will then continue by conducting meetings and coordination with a broad range of public and private agencies. Scoping efforts are required for coordination between federal, state and environmental agencies. There will also be meetings between citizens committees and other groups. The Town of Greenwich and NYSDEC will share in the responsibility of these meetings, particularly those involving state agencies and groups. Newsletters will also be issued periodically to keep all interested parties updated on the study status and relevant issues. The Corps will provide the Greenwich and NYSDEC with minutes of meetings similarly as the reconnaissance study. Public involvement will also consist of notifying concerned parties (newspapers, police, property owners, etc.) of personnel who may be involved in on-site data collection.

The Town of Greenwich will be responsible for providing representatives at the public meetings, meetings with other agencies and officials, and participation in other local coordination efforts. NYSDEC will also provide representatives for public meetings and facilitate coordination on matters affecting New York State. The Town of Greenwich will also be responsible for providing the facilities for public meetings.

1. Study Initiation Meeting

The purpose of this meeting is to facilitate input from the public and private communities early in the planning phase to identify potential solutions and significant issues and concerns. The minutes will be prepared and made available to federal, state, county and municipal agencies and officials, as well as to the general public located in the project area.

Subtasks are as follows:

- Within 60 days after the Feasibility Cost Sharing Agreement is executed, a Public Notice of study initiation will be mailed to the general public located in the project area.
- Pending collection of relevant data (described in Section 2.8 of this PMP), develop a presentation on the types of alternatives that are typically evaluated, and present preliminary estimates of the anticipated benefits in the form of avoided damages and generic, conceptual costs based on similar projects.
- Assemble a public meeting invitation and mail the invitation to everyone on the mailing list for the Public Notice. Prepare an advertisement that announces the study initiation meeting and submit announcement for publication in local newspapers. Secure a facility to hold the study

Task 1.1.	Study Initiation Meetings	\$30,000
	TOG Contribution	\$24,000
	ACOE Contribution	\$6,000

2. ENGINEERING ANALYSIS AND DESIGN

An Engineering Appendix will be prepared that supports the formulation of alternative plans for flood risk management and the development of the Tentatively Selected Plan (TSP) for the Feasibility Report. The Engineering Appendix will be prepared at a level of detail necessary to develop a defensible baseline cost estimate that addresses all pertinent cost factors with adequate contingency factors. The Engineering Appendix will document the existing information available and the results of the engineering investigations conducted during the feasibility phase, including: surveying and mapping, hydrology and hydraulics studies, geotechnical investigations, site investigations, design analysis on levee, floodwall, channel modification, highway and bridge modifications, major retention infrastructures, and all related cost estimating. The Engineering Appendix will be prepared by the local project sponsor as per ER 1110-2-1150 “Engineering and Design for Civil Works Projects,” and reviewed by New York District’s Engineering Division. It will be scheduled for completion in time to be incorporated into the draft Feasibility Report. The content and cost of required engineering technical investigations are detailed below.

2.1 Surveying

2.1.a *Surveying and Mapping*

Mapping is required as input to hydrologic and hydraulic routing, to define limits of flooding, for civil and hydraulic design, and for the economic analysis activities. Aerial photography is also required for evaluation, screening, and design of potential mitigation projects. Prior aerial, topographic, and utility surveys and plans prepared by others will be used and topographic mapping will be developed at a scale of 1” = 200’. The U.S. Geological Survey (USGS), Natural Resources Conservation Service (NRCS), State and County planning agencies, and universities will be contacted to locate and obtain any existing surveying and mapping data. The District will coordinate with the NRCS to ensure that surveying and mapping efforts are not duplicated. Recent and historical aerial photography will also be obtained from available sources, including Westchester County, New York, and the town of Greenwich, Connecticut. Surveying and mapping activities required by the Corps of Engineers New York District or the local sponsors to conduct the general re-evaluation are described below. ***The aerial, topographic and utility mapping tasks have been completed by the Town of Greenwich and are currently available for use. The Town of Greenwich must check with the regulations that all mappings are up to Corps standards. These standards are described as follows:*** EM 1110-1-1002 (Survey Markers and Monumentation), EM 1110-1-1003 (NAVSTAR Global Positioning System Survey), EM 1110-1-1005 (Topographic Surveying), EM 1110-1-2909 (Geospatial Data and Systems); ER 1110-1-12 (Quality Management, dated 1 June 1993) and Spatial Data Standards for Facilities, Infrastructure and Environmental (SDSFIE); and A/E/C CADD Workspace. The EM’s and ER’s can be found at the website <http://www.hnd.usace.army.mil>. SDSFIE and A/E/C WS can be found at the website <http://tsc.wes.army.mil>.

2.1.a.i Flood Mark Survey

The flood mark survey will consist of research and site inspection to obtain approximately 10 flood marks for historic flooding events since the last significant event included in previous analyses (October 1955 for hydraulics, September 1975 for hydrology). Preferably, the most recent major floods caused by the storms of April 15-16, 2007 and August 28, 2011 (Tropical Storm Irene) will be documented with narratives and photographic descriptions, as available. Subtasks include:

- Total number of flood marks to be collected for the two events stated above should be no less than 5 floodmarks for April 2007 and 5 floodmarks for Irene.
- The selected survey contractor will coordinate with the assigned hydraulic engineer to accurately collect these floodmarks.
- Floodmark locations will include a horizontal coordinate, vertical elevation and other descriptive information (i.e. description of floodmarks, physical location of floodmark, etc.)
Flood marks will be surveyed and referenced for the same horizontal coordinate system to the mapping described above.

Task 2.1.a.i	Flood Mark Survey	\$10,500
	TOG Contribution	\$9,500
	ACOE Contribution	\$1,000

2.1.a.ii Stream Surveys

This task will include in-water cross section elevations along the Byram River at Port Chester, NY and Greenwich, CT, from approximately 1,000 feet downstream of the Mill Street Bridge, upstream to the Bailiwick Road Bridge in Riversville, CT, a distance of approximately 19,000 feet, or 3.6 miles. Approximately 190 sections (roughly 1 section every 100 feet) will be required plus two at each of the 10 bridges, weirs, and pipe crossings on the Byram River (approximately 210 in total). In general, cross sections will be spaced no more than 100 feet apart in order to adequately define the hydraulic characteristics of the Byram River. Channel sections will be extended from the left top of bank to the right top of bank. Overbank sections extending from the survey limit to a point approximately three (3) feet above the 500-year flood stage shall be digitized from aerial mapping. Elevations in sections will be taken at changes in slope where elevation changes are more than one foot. Within the channel area, as a minimum, field surveys will include top of bank, bottom of bank, thalweg, and one-quarter (1/4) points across the channel. There will be x, y, and z coordinates provided for each survey point. Stream cross section data will be included on the topographic survey and incorporated into the DTM.

The Town of Greenwich has partially completed this task, which was originally estimated at \$110,000. The remainder of this task includes:

- Total amount of channel cross-section to be surveyed is approximately 50 and these cross-sections will be supplemented in the section of the Byram River HEC-RAS model (800 feet upstream of Comly Avenue to West Putnam Avenue).

- We will also include channel and bridge cross-sections for the Bailiwick Road Bridge, if not done already. This will be a total of 4 cross-sections (two on the upstream and downstream face of bridge and two additional cross-sections within the channel).
- Each channel cross-section will contain at a minimum of 8 points to define channel and any additional points to define all significant breaks in slope.
- All channel cross-sectional data will be provided in “x,y” distance-elevations pairs and have horizontal and vertical references.
- Channel cross sections will be defined in digital format (with x, y, and z coordinates) for use with HEC-RAS, Micro Station, and GIS.

Task 2.1.a.ii.	Stream Survey	\$40,500
	TOG Contribution	\$39,000
	ACOE Contribution	\$1,500

The total cost of 2.1 Surveying is \$ 51,000, summarized below:

Task	Total Cost	TOG	ACOE
2.1.c. Flood Mark Survey	\$10,500	\$9,500	\$1,000
2.1.d. Stream Survey	\$40,500	\$39,000	\$1,500
Total	\$51,000	\$48,500	\$2,500

2.2. Hydrology and Hydraulics Investigations

The hydrology and hydraulics (H&H) tasks includes developing the HEC-HMS computer model, HEC-RAS computer model, HEC-HMS models for interior drainage analysis, and H&H studies of the potential wetlands creation/restoration sites.

Activities to be documented in the H&H component of the Engineering Appendix:

- Development of input data to hydrologic and hydraulic models.
- Development, calibration and verification of hydrologic and hydraulic models.
- Establishment of existing and future condition water surface profiles for a full range of flow frequencies (1 to 500 year).
- Hydrology and water balances for proposed groundwater recharge areas and wetland creation sites.
- Characterization of surface drainage patterns.
- Model input parameters for future without project conditions.
- Flood risk management alternative screening.
- Detailed analyses of four flood risk management alternatives in addition to “no action” and
- Risk and uncertainty analysis (as applicable).
- Hydraulic design of alternatives.
- Refinement of with-project hydrologic engineering analysis.
- Interior drainage analysis.
- Activity estimate for PE&D phase.

The activities stated above shall be done in accordance with Engineering Regulations (ER 1110-2-1150, ER 1110-2-1405, ER 1110-2-1450, ER 1110-2-1464) and Engineering Manual (EM 1110-2-1205, EM 1110-2-1415, EM 1110-2-1416, EM 1110-2-1417, EM 1110-2-1419, EM 1110-2-1601) for the H&H analysis.

Hydrology, (HEC-HMS) and hydraulic (HEC-RAS) numerical computer models will be used to further define channel stability problems in the watershed and evaluate the effectiveness of alternative flood risk management, storm water management, groundwater recharge and stream alternatives. Natural, existing, and future flow rates, depths, and widths will be graphed. Grade controls; top-of-bank frequencies; and problem reaches will be mapped. Bank stability will be analyzed, and bank resistance, bank stress, and critical bank heights will be calculated. Hydrology and hydraulic parameters will be revised using existing HEC-HMS & HEC-RAS models. Events will be selected and floodplains will be delineated for the Byram River Basin within the project area. Peak discharge and stage vs. frequency curves will be developed for existing and improved conditions.

2.2 a. Preliminary Hydrology and Hydraulics Tasks- Model documentation

Preliminary H & H tasks include preliminary data collection and field reconnaissance necessary for the development of the hydrologic and hydraulic models used in the study, particularly data related to the storms of April 2007 and August 28, 2011 (Irene) will be collected, if at all possible. Also included in this task is the development of Hydrologic Engineering Management Plan (HEMP), which will guide the H&H analysis. The HEMP is a technical study plan used to define the hydrologic and hydraulic information required to evaluate the NED contribution of the selected plan(s) and to ascertain the satisfaction of environmental-protection and performance standards. It is used to define the methods to be used to provide the information and identifies the institutions responsible for developing and/or employing the methods. *This task has been completed by the Town of Greenwich.*

Task 2.2.a.	Preliminary Hydrology and Hydraulics	\$0
	TOG Contribution	\$0
	ACOE Contribution	\$0

2.2.b. Existing and Future Without Project Conditions Hydrology

For existing and future project conditions, HEC-HMS models of the Byram River watershed will be developed for existing conditions, future unimproved conditions and future improved conditions, based on the need and peak discharge-frequency information at proposed improvement locations and reaches (i.e. the Pemberwick reach, from the October 1977 feasibility study, and the Bailiwick Road Bridge further upstream, in Riversville, which caused flooding problems in the April 2007 northeaster flood) and calibration points (US Route 1 bridges). This major task includes delineation of sub-basins and land use determinations, determination of unit hydrograph parameters for the un-gauged hydrologic sub-basins, identification of routing reaches and Muskingum routing reach parameters to assemble a hydrologic model. The resulting stream network of the model will be checked, and it will be run and de-bugged until it runs to a normal stop.

- *Calibration of Model.* Historic rainfall data (totals and hourly distributions) of Tropical Storm Irene (August 2011) and the April 2007 northeaster, or whatever recent storms produced recent floods on the Byram River, and historic flood data will be applied to the HEC-HMS model of this watershed. (USGS Gage No. 01212500 was operational in the Byram River on September 29, 2009.) There was very close reproduction of the October 1955 flood high water marks, with the water surface profile hydraulic computer model of the October 1977 Feasibility Report, and the peak discharge of the October 1955 flood from the hydrology Report of the same Feasibility Report. Therefore, the calibration of the hydrologic (HEC-HMS) computer model of the Byram River watershed will begin with the October 1955 storm and flood. The October 1955 storm rainfall will be taken from the Feasibility Report, and applied to the hydrologic model developed as described above, and run, with adjustment of sub-basin unit hydrograph, routing reach, and infiltration loss parameters, until the 4,520 cfs peak of the Byram River at Route 1 from the Feasibility Report is reproduced, with a reasonable-looking hydrograph, similar, though not identical to, the computed hydrograph in the Feasibility Report. The final adopted values of basin-averaged total rain, total loss, and total excess should also be close to the values in the Feasibility Report.

This process will be repeated with the June 1972 and September 1975 storms and floods from the hydrology report of the Feasibility Report. This completes the first part of the hydrologic model calibration process. The basin-specific input parameters of the hydrologic model, such as sub-basin drainage areas, unit hydrographs, and percent impervious area, and routing reach input parameters, will then be considered to be calibrated, suitable for reproduction of more recent historic floods, and specific-frequency hypothetical floods, as described below.

In the second part, available high water marks on the Byram River from the two recent large floods caused by the storms of April 2007 and August 28, 2011 (Irene), will be used to enter all available rating (stage-discharge) data for the Byram River, and to determine peak discharges of the Byram River at any and all available calibration points for these two large recent floods. The HEC-HMS models will be run, and infiltration loss input parameters adjusted, until the storms of April 2007 and Tropical Storm Irene peak flows, developed as described above, are closely reproduced. The existing conditions HEC-HMS model of the Byram River watershed will then be considered calibrated, and suitable for use in computing specific-frequency hypothetical flood hydrographs at needed points of interest, as described below, for existing conditions. Recent historic flood discharges will be furnished to hydraulics for HEC-RAS water surface profile calibration to recent historic flood marks.

- *Existing conditions peak discharge vs. frequency analysis.* USGS Gauge No. 01212500 was operational in the Byram River on September 29, 2009. Therefore, correlation with, and transposition of recorded peak flow data from the adjacent USGS-gauged New York watershed, Blind Brook at Rye, NY, used in the hydrology of the October 1977 Feasibility Report, and the newer nearby USGS-gauged Connecticut watersheds, Norwalk River at South Wilton, Connecticut, and Saugatuck River near Redding, CT will be used. The master calibration point for the specific-frequency hypothetical floods will be the Byram River at U.S. Route 1, as it was for the historic floods as described above, and as it was for the October 1977 Feasibility Report. A relation will be sought between peak flows of the Byram River at U.S. Route 1 and the current on-line gage location: the Comly Avenue bridge, 6,180 feet upstream of Route 1.

- *Existing conditions hypothetical flood calibration of hydrologic model.* Specific-frequency (1, 2, 5, 10, 25, 50, 100, 250 and 500 year) hypothetical rain data will be developed for the Byram River watershed using either standard hard copy references Hydro-35 and TP-40 (Rainfall Frequency Atlas of the United States) or, if possible, the newer on-line N.O.A.A. Atlas 14. The hypothetical rain data thus developed will be applied to the historic-flood-calibrated HEC-HMS model of the Byram River watershed as driving input. Infiltration loss parameters will be adjusted in a trial and error process until the hypothetical peak discharges computed for the Byram River at U.S. Route 1 in the existing conditions peak discharge vs. frequency analysis described above are exactly reproduced by the HEC-HMS model. The infiltration loss parameters that achieve this will then be adopted as final existing conditions parameters, and will remain unchanged for the future without-project, and present and future improved (with-project) conditions hydrologic analyses that will follow, and which are described below.
- *Determination of final existing conditions historic and hypothetical peak discharges.* Existing conditions historic and hypothetical flood peak and (if necessary) coincidental discharges will be computed, tabulated, plotted and checked as necessary for all points of interest and analysis on the Byram River (i.e. Comly Avenue gage between U.S. Route 1, Bailiwick Road Bridge, and other hydrograph combining points, reaches and points of proposed improvements) and furnished to hydraulics personnel for HEC-RAS program water surface profile runs. The calibrated HEC-HMS model, equipped with the final existing conditions storage-discharge data, will be used to establish the storms of April 2007 and Tropical Storm Irene final historic peak discharges, and the full range (1 to 500 year frequency) of final hypothetical peak discharges, for the Byram River, not only in the project area, but downstream to the mouth (confluence with Port Chester Harbor and Long Island Sound) using the hypothetical peak flow data at the US Route 1 bridge as the master calibration point, and incorporating the final existing conditions storage-discharge relationships, to be able to study the downstream impacts of all proposed Byram River improvements, for incorporation into the hydraulics, and then into the economics, analyses.
- *Development of HEC-HMS model input parameters for future without-project conditions.* Future projected land use data for the Byram River watershed for the selected future year of analysis (2070 A.D.) will be developed and used to determine these input parameters. They will then be used to generate a series of future without-project conditions HEC-HMS models of the Byram River watershed, which will then be run to generate future without-project peak and coincidental discharges for the Byram River watershed points of interest and analysis.

The only change in the hydrologic model input from existing conditions to future without-project conditions will be sub-basin percent impervious areas, and perhaps unit hydrograph parameters. No other changes will be made.

The future without-project discharges will be tabulated, plotted, checked, and compared with existing conditions as necessary for all points of interest and analysis on the Byram River (i.e. U.S. Route 1, Bailiwick Road Bridge, and other hydrograph combining points, reaches and points of proposed improvements), the same as existing conditions, and furnished to hydraulics personnel for HEC-RAS program water surface profile runs.

The Town of Greenwich has completed work that partially fulfills the requirements of this task. New York District has identified the following sub-tasks, which once completed by the Town of Greenwich, will satisfy the requirements for the Existing & Future Unimproved Conditions Hydrology tasks:

Update Existing Conditions Hydrology - This subtask includes:

- The April 15-16, 2007 Northeaster and Tropical Storm Irene (August 27-28 2011) floods will be modeled. Antecedent conditions (basin saturation) will be identified, and hourly and total rainfall data will be obtained, for these two storms. Observed hydrographs for Tropical Storm Irene will be obtained from the USGS Gage (01212500) along Byram River at Pemberwick, CT. For the April 15-16, 2007 flood (USGS Gage 01212500 was not in existence at this time), the peak flow data will be estimated by using all available high water marks for this flood, with rating curves. The Byram River Watershed is approx. 31 square miles.
- Obtain annual and partial peak flow data at USGS stream gages for selected locations in Connecticut and New York for watersheds similar and/or adjacent to the Byram River watershed, such as Blind Brook at Rye, NY and Norwalk River at South Wilton, CT. The USGS Gage (01212500) at Pemberwick has insufficient period of record (less than 10 years of data recorded) for a meaningful peak discharge vs. frequency relation at this gage. The peak discharge vs. frequency relation will be determined from other gauged watershed similar and/or adjacent to the Byram River watershed, and then transposed to the Byram River watershed to develop a synthetic peak discharge vs. frequency curve. The approach to develop this synthetic peak discharge vs. frequency curve is in the “Feasibility Report for Flood Control Mamaroneck and Sheldrake Rivers Basin and Byram River Basin”, Volume 2, October 1977, pgs. A9 to A12.
- Modify HMS schematic physical components (i.e. routing methods and data).
- Calibrate HMS model to observed data (peak discharge and approx. shape of hydrograph) for selected flood events (April 2007 and Tropical Storm Irene).
- Specific frequency (1-yr, 2-yr, 5-yr, 10-yr, 25-yr, 50-yr, 100-yr, 250-yr, and 500-yr) hypothetical rainfall will be determined for the Byram River watershed using appropriate data sources. The hypothetical rainfall will be applied to the historical flood-calibrated HEC-HMS model. The infiltration loss parameters of the calibrated HEC-HMS model will be adjusted in a trial and error process to come up with acceptable loss parameters for each hypothetical event.
- Run hypothetical flood events with calibrated HMS model and re-calibrate peak flow vs. frequency curves developed above. This will include:
 - Giving preliminary peak discharges from HMS runs to hydraulics (RAS).
 - Providing storage vs. discharge data from RAS to hydrology (HMS) to update routing data.

- Re-calibrate HMS model using updated storage-discharge relations from hydraulics.
- Rerun hypothetical flood events to develop final hydrographs. The peak flows for the final hydrographs for all the hypothetical flood events must be close or the same to the statistically computed existing conditions peak discharge vs. frequency curve at the USGS Gage (01212500) at Pemberwick.
- Determine risk and uncertainty parameters for existing conditions.
- Write-up of existing conditions (input into Hydrology Appendix).

Update Future Without Project Conditions Hydrology - This subtask includes:

- Coordinate with locals to determine likely future development.
- Determine future conditions unit graphs and percent impervious values.
- Update HMS model for future unimproved conditions.
- Run future unimproved conditions HMS model for hypothetical flood events.
- Determine risk and uncertainty parameters for future unimproved conditions.
- Write-up of future unimproved conditions (input into Hydrology Appendix).

Task 2.2.b.	Existing and Future Project Conditions Hydrology	\$62,500
	TOG Contribution	\$60,000
	ACOE Contribution	\$2,500

2.2.c Existing & Future Without Project Conditions Hydraulics

A HEC-RAS model for existing conditions of the Byram River from Mill Street upstream to the Bailiwick Road Bridge will be developed. This task will include calibration of the model to replicate observed/measured flow and water surface elevations in the Byram River. The HEC-RAS model output will provide information for the economic analysis. Sub-tasks to be conducted to complete hydraulic modeling include development of a preliminary existing conditions HEC-RAS model, calibration of the model against flood marks for at least two historic events, including the storms of April 2007 and Hurricane Irene in August 2011, and analysis of special hydraulic conditions observed during extreme flooding events, including backwater flooding and bridges and diversion.

The HEC-RAS model will be used to develop backwater profiles for the 1-, 2-, 5-, 10-, 25-, 50-, 100-, 250-, and 500-year events. Final calibration of the existing conditions HEC-RAS model will be completed using the revised flows for existing conditions. This task will include running the range of final, existing conditions hypothetical flows through the model. In the final HEC-RAS, model and base profiles of existing conditions will be developed and will include special hydraulic conditions. Rating curves & stage-frequency curves will be developed. Inundation maps of both existing and future unimproved conditions will be developed.

The Town of Greenwich has completed work that partially fulfills the requirements of this task. New York District has identified the following sub-tasks, which once completed by the Town of Greenwich, will satisfy the requirements for the Existing & Future Unimproved Conditions Hydraulics tasks:

Update Existing Conditions Hydraulics - This subtask includes:

- Modify an existing conditions HEC-RAS model developed from Geo-RAS (HEC-RAS geometry file). This will include:
 - Adding in additional channel cross-sections where the spacing is over 500 feet and substituting any channel in the HEC-RAS model that is defined as “rectangular” or “trapezoid” shape with actual channel data.
 - Modifications to any bridges, culverts and dam/weirs, if necessary.
- Calibrate HEC-RAS models based upon selected historical flood events (Irene and April 2007) and develop its water surface profiles.

- Correlation Analysis (Tidal & Fluvial Events).
- Developing preliminary water surface profiles for hypothetical events using calibrated HEC-RAS geometry.
 - Providing storage vs. discharge data from RAS to hydrology (HMS) to update routing data.
- Final existing (hypothetical) conditions HEC-RAS model (1-yr, 2-yr, 5-yr, 10-yr, 25-yr, 50-yr, 100-yr, 250-yr, and 500-yr) and developing its water surface profiles.
- Developing Inundation Mapping
 - Inundation mapping must also be geo-referenced and be imported into ArcGIS. The inundation mapping will consist of selected historical events (Irene and/or April 2007) and hypothetical events (10-yr, 50-yr, 100-yr, and 500-yr).
- Determine risk and uncertainty parameters for existing conditions.
- Write-up of existing conditions (input into Hydraulic Report).

Future Unimproved Conditions Hydraulics - This subtask includes:

- Future Unimproved Conditions HEC-RAS model with water surface profiles.
- Developing Inundation Mapping
 - Inundation mapping must also be geo-referenced and be imported into ArcGIS. The inundation mapping will consist of future unimproved hypothetical events (10-yr, 50-yr, 100-yr, and 500-yr).
- Determine risk and uncertainty parameters for future unimproved conditions.
- Write-up of future unimproved conditions (input into Hydraulic Report).

Task 2.2.c.	Existing and Future Unimproved Conditions Hydraulics	\$71,500
	TOG Contribution	\$69,000
	ACOE Contribution	\$2,500

2.2.d. Improved Conditions Hydrology

This task includes the development of improved conditions storage-discharge and diversion relationships, and the preparation of the hydrology appendix. The improved conditions hydrology will be incorporated into the improved conditions hydraulic modeling and economic analysis for alternative optimization. Residual and induced flooding data will be developed for reaches of the Byram River and its tributaries in which flood risk management alternatives are proposed. The HMS model will be used to evaluate and model flood risk management alternatives in the Byram River watershed, by replacement of existing conditions storage-discharge relations with those for the flood risk management alternatives. Downstream impacts, such as peak flow increases, due to loss of natural flood plain storage from construction of levees and floodwalls, and increased culvert capacity, will be computed, evaluated, and documented.

A HEC-HMS model of improved conditions will be generated using improved conditions storage-discharge and diversion relationships, developed as described above, in order to compute preliminary improved conditions hypothetical flows. The improved conditions HEC-HMS model will be equipped with the final improved conditions storage-discharge and diversion relationships in order to compute final improved conditions hypothetical flows. The final improved conditions hypothetical flows and water surface elevations and inundation limits will be analyzed to determine any project area, or downstream residual or induced flooding.

Hydrology Report. The hydrology appendix will include a description of the watershed, climatology, rainfall, stream flow, historic floods, flood frequencies and analyses, a discussion of the HEC-HMS model development including input data, calibration and verification, an analysis of existing (without-project) conditions, characterization of surface drainage patterns, analyses of alternatives, and risk and uncertainty. The documentation will include study cost estimates for the next phase of study, input to PMP, and development and implementation of the QA/QC plan.

Task 2.2.d.	Improved Conditions Hydrology	\$25,000
	TOG Contribution	\$23,000
	ACOE Contribution	\$2,000

2.2.e. Improved Conditions Hydraulics

This task includes utilizing the HEC-RAS model in the hydraulic evaluation for only two proposed structural alternatives which will include assistance to PL for the formulation of the four alternatives (two structural, one non-structural and no-action), scoping, risk analysis, and evaluation. This task also includes the preparation of the Hydraulics Report for the Engineering Appendix. Subtasks include development of preliminary plans for plan alternatives/improved conditions and field investigations to confirm whether the proposed alternatives are hydraulically viable. Next steps include preparation of cross-sections for the HEC-RAS model and development of HEC-RAS models for each alternative using the preliminary improved conditions hypothetical flows. Special hydraulic conditions will be analyzed, including bridge removal/redesign and modifications to the Bailiwick Road Bridge. For the two alternatives, improved conditions storage-discharge data and base profiles will be developed for use in the improved conditions hydrology. Profiles, frequency curves and inundation maps will be developed. For the Tentatively Selected Plan, erosion control features, including riprap, will be designed.

The improved conditions design for the Recommended Alternative will be optimized to determine the Tentatively Selected Plan. Following optimization, the final improved conditions model will be developed and run. The improved conditions HEC-RAS model will be used to develop water surface profiles & frequency curves for the 1-, 2-, 5-, 10-, 25-, 50-, 100-, 250-, and 500-year floods. A final hydraulic layout will be developed for the Tentatively Selected Plan.

- *Preliminary quantities:* Preliminary quantities will be developed for two structural plans during the Alternatives screening phase.
- *Improved conditions floodplain map:* The improved conditions 10-, 50-, 100-, and 500-year floodplains for the Byram River will be delineated digitally using the water surface elevations (WSELs) calculated in the improved conditions HEC-RAS model for the Tentatively Selected Plan.
- *OMRR & R requirements for hydraulic features will include the following:* This subtask includes developing detailed operation, maintenance, repair, rehab and replacement (OMRR & R) requirements for the hydraulic features of the Tentatively Selected Plan.

- *Hydraulics Report:* This will include a discussion of the hydraulic basis of design, design methodologies, without-project conditions, HEC-RAS model development, including development of input data, calibration and verification, proposed plans and plan hydraulic features, stability analyses, water surface profiles for historic and hypothetical floods, and for existing (without project) and improved conditions. The documentation will include study cost estimates for the hydraulics of the next phase of study (DDR's), input to PMP, and development and implementation of the QA/QC plan.

The development of improved conditions storage-discharge data, base profiles and the model, a range of hypothetical flow should be performed for all structural plans. Also, the design of preliminary erosion control features must be done for all structural plans.

Task 2.2.e.	Improved Conditions Hydraulics	\$80,000
	TOG Contribution	\$70,000
	ACOE Contribution	\$10,000

2.2.f. Hydrology and Hydraulics Risk & Uncertainty.

Hydrology and Hydraulics input parameters for risk and uncertainty will also be developed for incorporation into the economic analysis. Risk and uncertainty must be included for existing conditions, future unimproved and future improved conditions for up to two (2) potential alternatives. For the two alternatives, preliminary Rough Order of Magnitude (ROM) sensitivity analysis will be done to determine confidence bands and in-depth sensitivity analysis will be done on the optimized plan.

A sensitivity analysis will be performed to evaluate the sensitivity of the selected plan and/or locally preferred plan to key hydrologic and hydraulic parameters.

Task 2.2.f.	Hydrology and Hydraulic Risk and Uncertainty	\$25,000
	TOG Contribution	\$0
	ACOE Contribution	\$25,000

2.2.g Non Structural Plan

One nonstructural alternative will be developed for this project area. Using a structure inventory (if available), topographic mapping, and floodplain delineations developed for this study in other tasks, nonstructural protection will be developed for three floodplains (e.g., 500-yr, 100-yr, and 10-yr). Results will include three layouts of non-structural features, each structure with its type of protection (i.e. flood proofing, raising, etc) and report. This information will then be provided to New York District’s Cost Engineering Branch to develop rough order of magnitude construction cost estimates.

Note: The Town of Greenwich, CT may have some of the information needed as input for the following sub-task.

Task 2.2.g	Non-Structural Plan	\$22,000
	TOG Contribution	\$20,000
	ACOE Contribution	\$2,000

2.2.h Interior Drainage Hydrology

Note: The Town of Greenwich, CT may have some of the information needed as input for the following two sub-tasks. Also note that this task will only be required if a levee or floodwall is the selected alternative.). The goal of this task is to come up with a preliminary evaluation of what interior drainage features might be needed from minimum facility analysis results.

- *Interior Drainage Hydrologic Model:* The Interior Drainage Hydrologic Model will be developed HEC-HMS. The interior drainage analysis in the Hydraulics Report of the October 1977 Feasibility Report will be used to the maximum extent possible. Proposed levee and floodwall reaches will define the interior drainage sub-basins needed. Infiltration loss function will either be initial loss + constant loss rate, consistent with the riverine hydrology, or NRCS runoff curve number (Cn). Each interior drainage area will be evaluated for potential crossover of flow between it and adjacent interior drainage areas. Inflow hydrographs of both historic and hypothetical floods, to the minimum facility, and any and all proposed interior drainage flood risk management measures (gravity outlets, and / or ponds and pumps) will be computed by the interior drainage HEC-1/HMS model for the appropriate method of analysis, as determined by EM 1110-2-1413, Hydrologic Analysis Of Interior Areas.

The boundaries of interior sub-basins will be laid out on topographic mapping, and HEC-HMS will be defined for the interior model structure. The sub-basin sizes will be measured and tabulated. There were 10 (ten) interior sub-basins in the October 1977 Feasibility Report defined by the proposed line of protection, ranging in size from 3.2 to 97.3 acres. Input parameters to be developed include existing conditions sub-basin NRCS CN (run-off curve numbers), existing

conditions sub-basin SCS dimensionless unit hydrograph lags, and HEC-HMS model channel routing parameters.

Historic and/or hypothetical rain data for required storms will be determined over the interior areas, the interior inflow HEC-HMS model will be run with historic and/or hypothetical rain data to compute runoff inflow hydrographs for the requisite events.

Task 2.2.h.	Interior Drainage Hydrology	\$17,000
	TOG Contribution	\$16,000
	ACOE Contribution	\$1,000

2.2.i. Interior Drainage Hydraulics

(Note: The town of Greenwich, CT may have some of the information needed as input for these tasks. Also note that this task will only be required if a levee or floodwall is the selected alternative.) The goal of this task is to come up with a preliminary evaluation of what interior drainage features might be needed from minimum facility analysis results.

Initial subtasks for interior drainage hydraulics include preliminary sub-basin delineation based on preliminary levee and/or floodwall layout, acquisition of field data for use in interior sub-basin delineation, and final interior sub-basin delineation. The existing storm drainage system will be evaluated to determine capacities for gravity and pressure flow. Field investigations, possibly conducted during rain events, will be performed to confirm drainage assumptions. If needed, sub-basin delineations will be revised accordingly and incorporated into the interior drainage hydrology described above.

- *Analysis and development of minimum facility plans.* The minimum facility will be designed for each drainage area in accordance with EM 1110-2-1413. In general, it will consist of extending the existing storm drainage pipes, or providing additional pipes, which will extend through the levee/floodwall. The intent of the minimum facility is to convey the capacity of the existing drainage system through the levee without producing interior flooding beyond the level of design of the existing interior system. The historic and/or hypothetical interior floods will be routed through the minimum facility using the interior drainage capability of program HEC-HMS, against exterior stage hydrographs according to the method of interior analysis selected according to EM 1110-2-1413. Minimum facility / existing conditions interior stage-frequency curves will be developed for each interior drainage area point of analysis.

Using the minimum facility as a starting point, it will be determined if any additional facilities (i.e. ponds, pumps, etc.) will be needed for each interior drainage area to reduce the residual interior flooding. If additional facilities are needed, a preliminary analysis (i.e. hand calculations) will be done to determine conceptual improvements to reduce residual flooding.

Interior Drainage. The Interior Drainage Report will be included in the H&H portion of the Engineering Appendix and will document the work accomplished in Interior Drainage Hydrology and Interior Drainage Hydraulics.

Task 2.2.i.	Interior Drainage Hydraulics	\$26,000
	TOG Contribution	\$24,000
	ACOE Contribution	\$2,000

The total cost of Major Task 2.2 Hydrology and Hydraulics is \$329,000, summarized below:

Task	Total Cost	TOG	ACOE
2.2.a Preliminary Hydrology and Hydraulics	\$0	\$0	\$0
2.2.b Existing and Future Project Conditions Hydrology	\$62,500	\$60,000	\$2,500
2.2.c Existing and Future Unimproved Conditions Hydraulics	\$71,500	\$69,000	\$2,500
2.2.d Improved Conditions Hydrology	\$25,000	\$23,000	\$2,000
2.2.e Improved Conditions Hydraulics	\$80,000	\$70,000	\$10,000
2.2.f Hydrology and Hydraulics Risk and Uncertainty	\$25,000	\$0	\$25,000
2.2.g Non-Structural Plan	\$22,000	\$20,000	\$2,000
2.2.h Interior Drainage Hydrology	\$17,000	\$16,000	\$1,000
2.2.i Interior Drainage Hydraulics	\$26,000	\$24,000	\$2,000
Total	\$329,000	\$282,000	\$47,000

2.3 Geotechnical Literature Survey

A Geotechnical Literature Survey will be conducted to characterize soils in the affected areas and areas in consideration for flood risk management measures in Greenwich, CT. Based on the available data, the Geotechnical/Geologic report will include a discussion of geology, soil parameters, soil analysis and dredged material characteristics. Public and private sources, including the NRCS, will be contacted in order to determine the availability of existing subsurface data. Existing boring logs and reports shall be attached to the Geotechnical/Geologic report. Significant information such as the soil/rock type and depth shall be noted. Additional subsurface sample collection and analysis will not be performed during the Feasibility phase but will be performed during the PED phase.

The activities stated above shall be done in accordance with the following references:

EM 1110-1-1802 Geophysical Exploration

EM 1110-1-1804 Geotechnical Investigations

ER 1110-2-1150 Engineering and Design of Civil Works Projects

ER 1110-1-1901 Engineering and Design - Project Geotechnical and Concrete Materials Completion Report for Major USACE Projects

EM 1110-2-1906 Laboratory Soils Testing CH 1-2

Task 2.3.	Geotechnical Literature Survey	\$25,000
	TOG Contribution	\$20,000
	ACOE Contribution	\$ 5,000

Note: Assumptions at current stage are the existing soil information is sufficient for the development of the conceptual plan and no additional soil borings, soil sampling or testing will be obtained this time. Additional geotechnical investigation will be included in the future phase.

2.4 Engineering and Design Analysis Report

This work will include effort for both the development of the alternatives and the design of the selected plan once it is optimized for the Civil, Geotechnical, Structural, Mechanical and Electrical Engineering disciplines.

2.4.a. Conceptual Plan – Development of Alternatives

During the development of alternatives the Civil, Geotechnical, Structural, Mechanical and Electrical Engineering disciplines will assist the team during the evaluation of alternatives that include the following features and to develop the O&M requirements for each alternative so that they may be estimated.

- a) Extension of existing levee
- b) Floodwall
- c) Channel modification
- d) Flood-proofing
- e) Modifications of two highway bridges (Route 1)
- f) Retention infrastructures for large pond
- g) Possible modifications to dams in the project area.

Structural engineers will collect existing data and reports on major infrastructures and facilities such as bridges, railroads, highways, hospitals, power plants, large commercial buildings, etc. within the affected project area that may be impacted or that may have significant impact to the construction of the proposed alternatives. This information will be brought to the attention of the PDT to determine if this should be reflected in the cost estimates.

Geotechnical Engineering will evaluate the subsurface information and identify areas of concern based on the information presented from the Geotechnical Literature Survey. This information will be brought to the attention of the PDT to determine if this should be reflected in the cost estimates.

Electrical and Mechanical Engineering shall identify changes to the electrical and mechanical infrastructure within the affected project area that may be impacted or that may have significant impact to the construction of the proposed alternatives. This information will be brought to the attention of the PDT to determine if this should be reflected in the cost estimates.

Civil Engineering shall develop conceptual drawings for each alternative on an appropriate scale for use at public meetings. The plans shall depict the integral features of each alternative. The conceptual drawings, including typical cross-sections shall be developed at a level of detail sufficient to develop conceptual level cost estimates and aid in the screening of alternatives. Sketches shall be prepared at a level of detail sufficient to convey the approaches to flood risk management. Renderings, photographs, and cross-sections posters of typical project features, i.e. pump stations, flood-proofing, etc, shall also be generated for use at public meetings.

Task 2.4.a.	Conceptual Plan Development of Alternatives	\$125,000
	TOG Contribution	\$110,000
	ACOE Contribution	\$ 15,000

2.4.b. Conceptual Plan – Selected Plan

Once the selected plan has been optimized the Civil, Geotechnical, Structural, Mechanical and Electrical Engineering disciplines shall perform preliminary designs for the features of the selected plan. The design approach shall be in accordance with the following USACE criteria and guidance.

EM 1110-2-1614 Design of Coastal Revetments, Seawalls, and Bulkheads
EM 1110-2-1906 Laboratory Soils Testing
EM 1110-2-2503 Design of Sheet Pile Cellular Structures
EM 1110-2-2906 Design of Pile Foundations
EM 1110-2-3800 Systematic Drilling and Blasting for Surface Excavations
EM 385-1-1 Corps of Engineers Safety Manual
EM 1110-2-1205 Environmental Engineering and Local Flood Control Channels
EM 1110-2-1415 Hydrologic Frequency Analysis
EM 1110-2-1416 River Hydraulics
EM 1110-2-1417 Flood Run-off Analysis
EM 1110-2-1419 Hydrologic Engineering Requirements for Flood Damage Reduction Studies
EM 1110-2-1601 Hydraulic Design of Flood Control Channels Change 1 ENG 4794-R
ER 1110-2-1150 Engineering and Design of Civil Works Projects
ER 1110-2-1405 Hydraulic Design for Local Flood Protection Projects
ER 1110-2-1450 Hydrologic Frequency Estimates
ER 1110-2-1464 Hydrologic Analysis of Watershed Runoff
ER 1110-2-1806 Earthquake Design Analysis for Corps of Engineers
ER 1110-2-8154 Water Quality & Environmental Management of Civil Works Projects
ER 385-1-92 Safety and Occupational Health Requirements for Hazardous, Toxic, and Radioactive Waste
ETL 1110-1-142 Blasting Vibration Damage and Noise Prediction and Control

The conceptual drawings for the optimized selected plan shall be on an appropriate scale for use at public meetings and to be included in the Engineering Appendix. The plans shall depict the integral features of optimized selected plan. The conceptual drawings, including typical cross-sections shall be developed at a greater level of detail based on the results of the preliminary design and sufficient to develop the fully funded cost estimate. Sketches shall be prepared at a level of detail sufficient to convey the approaches to flood risk management for the selected plan. Renderings, photographs, and cross-sections posters of typical project features, i.e. pump stations, flood-proofing, etc, shall also be generated for use at public meetings and the Engineering Appendix.

The Civil, Geotechnical, Structural, Mechanical and Electrical Engineering disciplines shall develop the O&M requirements for the optimized selected plan and coordinate those requirements with the Local Sponsor and communities so that they may be estimated.

The Civil, Geotechnical, Structural, Mechanical and Electrical Engineering disciplines shall participate in the Cost & Schedule Risk Analysis.

Task 2.4.b.	Conceptual Design	\$ 248,000
	TOG Contribution	\$216,500
	ACOE Contribution	\$ 31,500

2.4.c. Engineering Appendix

An Engineering Appendix to the feasibility report will be prepared. This appendix will describe the basis of design for the alternatives considered, design methodologies and assumption. Typical design analysis and drawings such as slope stability analysis, levee design, flood wall design, bridge modification design, dam modification design, and design of major retention infrastructures will be included. The documentation will also include study cost estimate for the next phase of study (Detailed Design Reports), input to PMP and implementation of QA/QC plan.

The Engineering Appendix is going to be completed by TOG and reviewed by ACOE. TOG and its engineers will develop the Engineering Appendix per the project scope of work and criteria in compliance with ACE and state standards and requirements. ACOE will review the work based on the same USACE standards and guidelines.

Task 2.4.c.	Engineering Appendix	\$112,000
	TOG Contribution	\$ 97,000
	ACOE Contribution	\$ 15,000

The total cost for Major Task 2.4 Engineering and Design Analysis Report is \$81,500, summarized below:

Task	Total Cost	TOG	ACOE
2.4.a. Conceptual Plan – Development of Alternatives	\$125,000	\$110,000	\$15,000
2.4.b. Conceptual Plan – Selected Plan	\$248,000	\$216,500	\$31,500
2.4.c. Engineering Appendix	\$112,000	\$97,000	\$15,000
Total	\$485,000	\$423,500	\$61,500

2.5 Cost Engineering

2.5.a. Engineering Costs

- Infrastructure Costs: Define replacement cost of existing infrastructure for the without project conditions.
- Preliminary Cost Estimates: Develop preliminary construction cost estimates for various project alternatives for screening purposes.
- Selected Plan Costs: Produce an MII baseline preliminary construction cost estimate to establish the NED plan and the selected plan (if different). Provide estimates of average annual maintenance costs and operation costs and the Fully Funded Cost Estimate. This work will be completed prior to approval of PMP for project implementation.
- Meetings, Report Preparation and Site Visits: Attend without Project Conditions and With Project Conditions meetings and site visits to determine project and estimate's parameters. Prepare sections for draft and final report.
- Address Higher Authority Review Comments: Provide revisions in both the final design and construction cost estimate, if necessary in accordance with guidance from reviewers. Metadata must be created by team members or included as a deliverable on contracts.
- For the Cost Engineering Appendix, the final decision document will include cost summary estimate that reflect the current budget year. The cost summary tables shall be reviewed by Cost Engineering Branch, EN to determine if the estimate is within a 2-year period, will an escalation update suffice or will additional work be required to bring the cost estimate to a fair and reasonable level to reflect the current market conditions.

Task 2.5.a.	Cost Engineering	\$45,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$45,000

2.5.b. Cost Risk Analysis:

Cost & Schedule Risk Analysis shall comply with Cost and Schedule Risk Analysis Guidance

dated 17 May 2009 prepared by US Army Corps of Engineers Directory of Expertise for Civil Works Cost Engineering. If the selected plan is more than \$40 million, then a cost-risk analysis must be prepared.

Task 2.5.b.	Cost Risk Analysis	\$20,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$20,000

The total cost for Major Task 2.5 Cost Engineering is \$65,000, summarized below:

Task	Total Cost	TOG	ACOE
2.5.a Engineering Costs	\$45,000	\$ 0	\$45,000
2.5.b Cost Risk Analysis	\$20,000	\$ 0	\$20,000
Total	\$65,000	\$ 0	\$65,000

2.6 Value Engineering Study

A Value Engineering (VE) Study shall be performed on the final design of the Tentatively Selected Plan. The Corps of Engineers’ VE Policy is to provide VE studies on Construction General Projects, with estimated costs of \$2 million and greater. It is anticipated that the estimated project cost will exceed \$2 million. The New York District’s Engineering Division (or its A/E) will perform this task at a cost of \$18,000.

Task 2.6.	Value Engineering Study	\$18,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$18,000

2.7 District Quality Control

Internal technical review will be conducted on all work products generated under Sub-Product of the Engineering Appendix.

Task 2.7.	District Quality Control	\$30,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$30,000

2.8 Engineering Management Documentation

This task includes engineering management, coordination of the design between the engineering disciplines, project schedule and status, meetings, coordination with other divisions, A/E contracting actions, assembly of internal review documentation and QA/QC reviews, and assembly of correspondences for dissemination of information to other divisions.

Task 2.8.	Engineering Management Documentation \$50,000	
	TOG Contribution	\$ 0
	ACOE Contribution	\$50,000

The total cost of Major Task 2. Engineering and Design Activities is \$1,053,000 summarized below:

Task	Total Cost	TOG	ACOE
2.1. Surveying	\$51,000	\$48,500	\$2,500
2.2. Hydrology and Hydraulics	\$329,000	\$282,000	\$47,000
2.3. Geotechnical Literature Survey	\$25,000	\$20,000	\$5,000
2.4. Engineering and Design Analysis Report	\$485,000	\$423,500	\$61,500
2.5. Cost Engineering	\$65,000	\$ 0	\$65,000
2.6. Value Engineering Study	\$18,000	\$ 0	\$18,000
2.7. District Quality Control	\$30,000	\$ 0	\$30,000
2.8. Engineering Management Documentation	\$50,000	\$ 0	\$50,000
Total	\$1,053,000	\$774,000	\$279,000

3. ENVIRONMENTAL STUDIES

Work under this sub-account will be performed by the Environmental Analysis Branch in combination with the Town of Greenwich. The purposes of environmental tasks during feasibility studies are to satisfy the National Environmental Policy Act of 1969 (NEPA) and other compliance requirements, and to provide environmental technical support during plan formulation. Technical support will be provided throughout the feasibility study with regard to ecological resources. Tasks will include identification and evaluation of both "with-" and "without-project" environmental conditions, report preparation, participation in plan formulation, and in the development of conceptual and detailed project plans.

Compliance requirements are outlined within the provisions of the NEPA, the Council on Environmental Quality (CEQ) regulations 40 CFR 1500-1508, and the U.S. Army Corps of Engineers regulation 200-2-2, "Procedures for Implementing NEPA." These requirements include documentation and assessment of the effects of a proposed federal action on significant resources. The focus of NEPA compliance is to provide information to other agencies and the public on the study, and to ensure that the report adequately addresses environmental requirements. Other laws and regulations that require environmental compliance actions include Sections 401 and 404 of the Clean Water Act, Section 7 of the Endangered Species Act, Section 106 of the National Historic Preservation Act of 1966, as amended, the Clean Air Act, and the Fish and Wildlife Coordination Act. NEPA documentation will be coordinated with federal and state agencies, the non-federal sponsor, stakeholders, the general public and non-governmental organizations (NGOs).

3.1 NEPA Scoping Meetings

A NEPA Scoping Meeting would be required if the study were to be accompanied by an environmental impact statement. Currently, the study team is assuming that the study will have an environmental assessment, which does not require a NEPA scoping meeting. If required, several interagency and public meetings will be held to identify the need for the project, potential solutions, existing environment and possible impacts. The purpose of scoping is to facilitate input from the public and private communities early in the planning phase to identify potential solutions and significant issues and concerns. The minutes of the scoping meetings will be prepared and made available to federal, state, county and municipal agencies and officials, as well as to the general public located in the project area. A formal record will be made of discussions with the public and resource agencies that define the environmental concerns related to the evaluation of project. This task also includes the review of preliminary existing documents and site visits. To reiterate, it is currently assumed that an environmental assessment will be conducted for the Byram River Basin study. If evidence indicating otherwise is discovered during the course of the study, the study team will assess impacts to the study scope, schedule, and budget. Accordingly, the budget for this task is \$0.

3.2 Environmental Studies

3.2.a. Environmental Resource Inventory (ERI) Report

An inventory will be prepared describing the existing biological, ecological and natural resources within the project area. This will be accomplished via literature review, reconnaissance, wetland delineation, aquatic, benthic, and terrestrial surveys with a subsequent report for each. This will be incorporated into the Environmental Assessment (EA).

Subtasks are as follows:

- Conduct a wetland delineation to identify all wetland areas in the project area. This task includes fieldwork, report preparation, survey and plotting the wetland boundary line and Right-of-Entry (ROE) notification. This will be done concurrently with the terrestrial, benthic, and finfish fieldwork.

To the extent practical to establish the existing terrestrial, benthic and finfish resources, review of published information and aerial photographs will be engaged.

Site verification and resource inventory sampling will be conducted. This includes fieldwork and report preparation and ROE notification. There are three distinct time frames for these tasks (i.e. spring, summer, and fall surveys). The spring surveys should occur between March and May; the summer surveys between June and August; and the fall surveys between September and November. Anticipated ecological resources to be inventoried include riparian and estuary benthos and fish. At this time, an Endangered Species Act (ESA), Biological Assessment (BA) is not expected to be prepared, and the cost identified to accomplish this task does not reflect the need for a BA.

The Town of Greenwich and New York District will collaborate to produce the deliverables associated with this task, in the following distribution:

- 1) Town of Greenwich:
 - a. Literature survey
 - b. Field Data Collection
 - c. First draft of ERI
 - d. Print and assemble ERI
- 2) New York District:
 - a. Provide outline of ERI for first draft
 - b. Review and revise ERI

Task 3.2.a.	Environment Resource Inventory Report	\$80,000
	TOG Contribution	\$64,000
	ACOE Contribution	\$16,000

3.2.b. Review and Update Impact Assessment Models

Review procedure(s) or models for use in environmental impact assessment. An inventory of the study area attributes and problems will be accomplished and the required attributes of the impact assessment methodology will be determined. An inventory of existing models, as well as models currently under development, will be completed. If appropriate, criteria for a new impact assessment model will be specified.

Select Impact Assessment Method - Meet with the local sponsors, U.S. Fish and Wildlife Service (USFWS), NYSDEC and Connecticut Department of Energy and Environmental Protection (CTDEEP) to determine the impact assessment method to be used to evaluate specific environmental responses to project alternatives in the Fish and Wildlife Coordination Act Report (FWCAR).

Initial Assessment - Evaluate project sites and influences according to impact assessment method. All work will be done cooperatively with the USFWS and FWC. Input for Preliminary Assessment of Alternatives - Conduct analysis to reduce project impacts with USFWS and NYSDEC and provide feed back into project design process.

The Town of Greenwich and New York District will collaborate to produce the deliverables associated with this task, in the following distribution:

- 1) Town of Greenwich:
 - a. Initial Assessment
 - b. Input for Preliminary Assessment of Alternatives
- 2) New York District:
 - a. Coordination with other agencies
 - b. Coordination with USACE Ecosystem Center of Expertise

Task 3.2.b.	Review and Update Impact Assessment Models	\$40,000
	TOG Contribution	\$20,000
	ACOE Contribution	\$20,000

3.2.c Evaluation of Impacts and Mitigation Analysis Report

A detailed evaluation of the impacts of alternatives will be conducted. If adverse environmental consequences cannot be avoided or minimized, a mitigation plan will be developed. It is anticipated that mitigation to offset impacts to wetlands may be necessary. The impacts of operation and maintenance activities during the project life will be analyzed. Mitigation measures required to obtain permits for O&M activities will be incorporated into a mitigation plan. If the proposed alternatives will result in significant impacts, an environmental impact statement will be prepared instead of an environmental assessment.

The Town of Greenwich and New York District will collaborate to produce the deliverables associated with this task, in the following distribution:

- 1) Town of Greenwich:
 - a. Detailed evaluation of impacts of alternatives
 - b. Development of mitigation plan, if required

- 2) New York District:
 - a. Coordination with other agencies
 - b. Review of deliverables

Task 3.2.c.	Evaluation of Impacts and Mitigation Analysis Report	\$50,000
	TOG Contribution	\$40,000
	ACOE Contribution	\$10,000

3.2.d. Threatened and Endangered Species

Pursuant to the ESA, the District will initiate informal consultation and coordinate with the USFWS, NYSDEC and CTDEEP to assess the presence of federal and/or state threatened or endangered flora and fauna within and adjacent to the project area. This work will include a review of information on species listed as threatened or endangered that may occur in the study area and coordination with the federal and state resource agencies. Based on the results of this coordination, a biological assessment (BA) may be prepared to address potential impacts to threatened and endangered species. Based on the information provided in the BA, a determination will be made as to whether the proposed action may affect any listed species. If any listed species may be affected, then consultation with the USFWS will be initiated and a biological opinion will be requested of the USFWS. No funds are provided to the USFWS for completion of a biological opinion because it is assumed that the Feasibility Report will be accompanied by an environmental assessment, which does not require a biological opinion.

The Town of Greenwich and New York District will collaborate to produce the deliverables associated with this task, in the following distribution:

- 1) Town of Greenwich:
 - a. Data review
- 2) New York District:
 - a. Coordination with USFWS, NYSDEC, and CTDEEP
 - b. Review of deliverables

Task 3.2.d.	Threatened and Endangered Species	\$15,000
	TOG Contribution	\$10,500
	ACOE Contribution	\$ 4,500

3.2.e. Section 404(b)(1) Analysis Report

A report will be prepared as required by the Clean Water Act which presents an analysis of any water quality impacts associated with the placement of fill material in the waters of the United States.

The products will be reviewed by the Corps of Engineers New York District as part of the Environmental Assessment.

Task 3.2.e.	Section 404 (b)(1) Analysis Report	\$5,000
	TOG Contribution	\$5,000
	ACOE Contribution	\$ 0

3.2.f. 401 State Water Quality Certification

Water Quality Certification and other applicable permit such as freshwater wetland and stream encroachment permits will be obtained from the NYSDEC and CTDEEP that proposed actions will not result in a violation of state regulations. The task will involve coordination and preparation of permit applications and the associated support documents.

The products will be reviewed by the Corps of Engineers New York District as part of the Environmental Assessment.

Task 3.2.f.	401 State Water Quality Certification	\$5,000
	TOG Contribution	\$5,000
	ACOE Contribution	\$ 0

3.2.g. Environmental Assessment

The preparation of an environmental assessment (EA) is anticipated to meet requirements of the NEPA that evaluates the impacts of project alternatives on the human environment. The Draft Environmental Assessment (DEA) and Final Environmental Assessment (FEA) will contain descriptions of the Need and Objectives of the Action, Alternatives, Existing Conditions, Effects of Proposed Actions, and Findings and Conclusions. This will be accomplished through agency and public coordination, literature research, field observations, and terrestrial, benthic and aquatic surveys.

Subtasks are as follows:

- Prepare Draft Report/NEPA Documentation: A draft EA will be prepared to meet requirements of the federal regulations listed above and appended to the Feasibility Report.
- Environmental Coordination of NEPA Document: The draft Feasibility Report and EA will be coordinated with federal and State resource agencies, appropriate local groups and interested individuals. A public notice announcing the availability of the draft document will be prepared and distributed. Letters of comment will be solicited during coordination of the draft report.

- Prepare Final Report/NEPA Documentation: All comments received during coordination of the draft report will be considered during preparation of the final document. All comment letters will be included in an appendix to the final Feasibility Report, and all comments and recommendations will be addressed in a comment/response format.
- Write the DEA and FEA and FONSI. Reproduce the DEA and FEA and distribute them to the general public, agencies, stakeholders, NGOs, etc. Review and provide responses to DEA and FEA.
- Coordinate with the Project Delivery Team (PDT) and review technical documents and electronic files prepared by other District divisions, and District contractors and subcontractors to provide input to NEPA documents. Review feasibility formulation and engineering documents and provide environmental input to them. This task includes conversion of electronic files into GIS format and administrative costs.
- Perform internal QA/QC of the DEA and FEA, and their supporting appendices.

The Town of Greenwich and New York District will collaborate to produce the deliverables associated with this task, in the following distribution:

- 1) Town of Greenwich:
 - a. Prepare first draft of EA
 - b. Print & assembly of revised EA
 - c. Distribution of draft and final EA
- 2) New York District:
 - a. Environmental coordination
 - b. Review & revision EA

Task 3.2.g.	Environmental Assessment	\$80,000
	TOG Contribution	\$56,000
	ACOE Contribution	\$24,000

3.2.h. Coordination with PDT During Feasibility Study

It is expected that the Environmental Analysis Branch will be involved in coordination with internal and external PDT members during the Feasibility Study Phase. This includes preparation for the Vertical Team Scoping Meeting, the Alternatives Formulation Briefing as well as other meetings. This also includes providing input for Final Alternatives, where additional beneficial environmental features are identified and included in the final project design.

Task 3.2.h.	Coordination with PDT During Feasibility Study	\$35,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$35,000

3.2.i. Coordination Documents with Other Agencies

Coordinate and meet with other federal, State and local agencies, the non-federal sponsor, stakeholders, NGOs, etc. as necessary. Assemble correspondence and minutes of meetings. Hold interagency/public scoping meetings as needed, to include permit coordination. Funds shall be provided for fostering technical competency and transfer of technology through lessons learned, partnering sessions, and other meetings as necessary (subject to specific approvals).

Task 3.2.i.	Coordination Documents with Other Agencies	\$30,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$30,000

3.2.j. Other Environmental Documents

This task includes the preparation of a Coastal Zone Management Consistency Statement, and review and preparation other applicable environmental document as needed, such as addressing Long Island Sound Study (LISS) issues and requirements. This task also includes a CAA emissions evaluation, input to the M-II, and preparation of the PED PMP.

Task 3.2.j.	Other Environmental Documents	\$40,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$40,000

The total cost of Major Task 3.2 Environmental Studies is \$380,000, summarized below:

Task	Total Cost	TOG	ACOE
3.2.a. Environmental Resource Inventory Report	\$80,000	\$64,000	\$16,000
3.2.b. Review and Update Impact Assessment Model	\$40,000	\$20,000	\$20,000
3.2.c. Evaluation of Impacts and Mitigation Analysis	\$50,000	\$40,000	\$10,000
3.2.d. Threatened and Endangered Species	\$15,000	\$10,500	\$4,500
3.2.e. Section 401 (b)(1) Analysis Report	\$5,000	\$5,000	\$ 0
3.2.f. 401 State Water Quality Certification	\$5,000	\$5,000	\$ 0
3.2.g. Environmental Assessment	\$80,000	\$56,000	\$24,000
3.2.h. Coordination with PDT	\$35,000	\$ 0	\$35,000
3.2.i. Coordination Documents with other agencies	\$30,000	\$ 0	\$30,000
3.2.j. Other Environmental Documents	\$40,000	\$ 0	\$40,000
Total	\$380,000	\$200,500	\$179,500

3.3 Fish and Wildlife Coordination Act Report (FWCAR)

A Fish and Wildlife Coordination Act Report (FWCAR) will be prepared by the USFWS to accompany the DEA and FEA. The District will coordinate with the USFWS and supervise the interagency contract as part of this task. The document will identify fish and wildlife concerns, determine the significant of fish and wildlife resources, and quantify anticipated impacts.

Task 3.3.	Fish and Wildlife Coordination Act Report (FWCAR)	\$40,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$40,000

3.4 Hazardous/Toxic/Radioactive/Waste (HTRW) Studies/Reports

Conduct a Phase One Environmental Site Assessment to identify all potentially impacted sites within the project area. This task involves the researching for existing reports on sites with environmental impacts and listing all that information into one document. This effort will be accomplished through literature/library searches, conducting field inspections to field check and confirm reports and conduct interviews.

If the Phase One Assessment identifies locations that may have an impact on any proposed structural flood damage reduction measures or watershed management opportunities, then a focused Phase Two Environmental Assessment may be conducted on those locations during the Plans and Specifications phase.

This task will be performed by the New York District’s Environmental Analysis Branch (or its Contractor) broken down as follows:

3.4.a. HTRW Assessment Report

An assessment report will be prepared describing the existing conditions of impacted sites within the project area. This will be accomplished via literature review, field visits, interviews, delineating locations of impacted sites and the levels of impact upon each site. This report will be based upon the results of the Phase One and Two Environmental Site Assessments. A summary of the results of this report will be included in sections of the Feasibility Report and EA.

Task 3.4.a.	HTRW Assessment Report	\$23,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$23,000

3.4.b. HTRW Data Review

Coordinate with the PDT, QA/QC review of technical documents and electronic files prepared by other District divisions, and District contractors and subcontractors and assemble HTRW input to Engineering Reports, NEPA documents and all applicable Appendices. This task includes administrative costs.

Task 3.4.b.	HTRW Data Review	\$22,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$22,000

The total cost of 3.4 HTRW Studies/Reports is \$45,000, summarized below:

Task	Total Cost	TOG	ACOE
3.4.a HTRW Assessment Report	\$23,000	\$ 0	\$23,000
3.4.b HTRW Data Review	\$22,000	\$ 0	\$22,000
Total	\$45,000	\$ 0	\$45,000

3.5 Cultural Resources Studies/Documents

Section 106 of the National Historic Preservation Act of 1966, as amended, requires federal agencies or project sponsors seeking federal funding and/or permits to take into account the effect of any undertaking on any cultural resources included in, or eligible for inclusion in, the National Register of Historic Places. During feasibility cultural resource surveys will be conducted to identify resources and evaluate their eligibility for inclusion on the National Register of Historic Places. Project plans will be modified to avoid or minimize any impacts to eligible resources. An evaluation of the impact of alternative plans on eligible properties will be developed in consultation with the Connecticut State Historical Preservation Office (CT SHPO). If eligible resources cannot be avoided a Memorandum of Agreement (MOA) will be developed in consultation with the CT SHPO to mitigate for unavoidable impacts. Any work stipulated in the MOA will be undertaken prior to initiation of project construction unless otherwise agreed with the CT SHPO. If any additional alternatives are considered cultural resource studies will be required at additional costs.

3.5.a. Site Survey Field Report

A reconnaissance level (Phase I) cultural resource investigation was conducted during the feasibility phase for the project based on plans included in the 1977 feasibility report, entitled, Reconnaissance level survey of Cultural Resources, Mamaroneck and Sheldrake River Basin and Byram River Basin Flood Control Projects (Westchester County, NY and Fairfield County, CT) Karen D. Zuckerman and Nan A. Rothschild. Documentary research and limited field investigations were carried out for the proposed plan. Due to the time that has lapsed since this survey was undertaken, the changes that have been made to the plan or that will be made to the plan in this effort, and the minimal level of field testing that was undertaken in 1977, a new Phase I cultural resources survey will have to be undertaken. The survey will include background research and focus on determining what additional work has been conducted in the area since the original report. This will be followed by fieldwork consisting primarily of pedestrian and shovel test surveys. The site survey field report will provide information on potential cultural resources and will guide the need for, and direction of, further cultural resource investigations.

Task 3.5.a.	Site Survey Field Report	\$80,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$80,000

3.5.b. Data Collection and Analysis/Report

Locations identified as sensitive for cultural resources will be investigated further through additional research and fieldwork. Fieldwork may entail intensive subsurface testing and in certain locations may require mechanical excavation. The fieldwork will be tailored to each alternative proposed and will be based on site topography, fill depths, anticipated resources, and proposed project actions. If resources are identified their eligibility for listing on the National Register of Historic Places will be evaluated. Recommendations will be made for avoiding significant sites and possible mitigation measures will be suggested, if sites cannot be avoided. Topographic maps with preliminary project designs will be needed before a scope of work for cultural resource work can be developed.

This task will be performed during the Plans and Specifications phase.

Task 3.5.b.	Data Collection and Analysis/Report	\$0
	TOG Contribution	\$0
	ACOE Contribution	\$0

3.5.c. Mitigation Plan Report

The mitigation plan report will document the need for mitigating any adverse effects on historic properties listed or eligible for listing on the National Register of Historic Places, and will include plans and cost estimates for mitigation or other treatment of historic properties affected by the project.

This task will be performed during the Plans and Specifications phase (not included in this project).

Task 3.5.c.	Mitigation Plan Report	\$0
	TOG Contribution	\$0
	ACOE Contribution	\$0

3.5.d. Memorandum of Agreement

If eligible resources are encountered, and cannot be avoided by project plans, then a Memorandum of Agreement (MOA), must be developed based on the results of the cultural resource studies conducted for the project and on project plans as they develop. MOA preparation will be conducted by the New York District and will require coordination with the CT SHPO and, possibly, the Advisory Council on Historic Preservation. Other interested parties may also be consulted. This task may not be required if no historic properties are encountered.

This task will be performed during the Plans and Specifications phase (not included in this phase).

Task 3.5.d.	Memorandum of Agreement	\$0
	TOG Contribution	\$0
	ACOE Contribution	\$ 0

One Percent Waiver

If archaeological data recovery costs are expected to exceed one percent of the total estimated federal appropriation required for construction of a project and Congress has not specifically authorized expenditures in excess of this amount, a waiver request in the form of a letter report submitted through channels to HQ, USACE should be prepared. The waiver must then be submitted to the Secretary of the Interior, through the Department of Consulting Archaeologist, for concurrence and Congressional notification. The One Percent Waiver applies only to archaeological data recovery (Phase III). It is not expected that a one percent waiver will be required for this project.

3.5.e All Other Cultural Resources Studies/Reports

This account will be conducted in-house and includes, but is not limited to, attendance of Corps, interagency and public meetings and QA/QC review of Corps and other relevant project documents. This account also includes the preparation of contracting documents, review of A/E submissions, preparation of input to the report, preparing mitigation plans and cost estimates, but does not include the costs to prepare and coordinate a Memorandum of Agreement or implementation of evaluation or mitigation plans. Cultural resources study management will be on-going throughout the study and will include updating these costs and the PMP description if the project changes or evolves and cultural resources tasks change.

Task 3.5.e.	All Other Cultural Resources Studies/Reports	\$20,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$20,000

The total cost of Major Task 3.5 Cultural Resources Studies/Documents is \$100,000, summarized below:

Task	Total Cost	TOG	ACOE
3.5.a. Site Survey Field Report	\$80,000	\$0	\$80,000
3.5 b. Data Collection Analysis/Report	\$0	\$0	\$0
3.5.c. Mitigation Plan Report	\$0	\$0	\$0
3.5.d. Memorandum of Agreement	\$0	\$0	\$0
3.5.e. All Other Cultural Resources Studies/Reports	\$20,000	\$0	\$20,000
Total	\$100,000	\$0	\$100,000

3.6 Geographic Information Systems Support

A geographic information system (GIS) will be used as a tool for modeling potential project sites in the Byram River Basin. A Data Management Plan will be developed to guide the use of GIS for this study. GIS will be used to assist the study team in assessing problems, formulating and evaluating solutions, and presenting study findings. It is anticipated that all aspects of the feasibility study will benefit from and contribute to the GIS modeling. Information to be included in the GIS includes: soils, vegetative cover, wetlands, topography, hydrology, property ownership, land use, floodplain boundaries, stream cross-sections, hazardous/toxic/radioactive wastes (HTRW), and historic properties. Other mapping information needs will be developed in the initial screening process.

GIS coverage will be developed using the base map and structure survey data obtained through topographic Surveys, which will integrate existing GIS data. The GIS will be used to develop a hydrologic rainfall runoff model (HEC-1 or HEC-HMS) for the analysis of flood control measures and for the purpose of estimating wetland surface inflows. The location(s) of wetlands in the basin may necessitate a complex (20 to 20 sub-basin) HEC-1 or HEC-HMS model of the Byram River Basin, such as was done in 1983 for the adjacent Mamaroneck and Sheldrake Rivers Basin, to adequately capture wetlands behavior and response. Digital geo-referenced soils and land use data will be obtained from the NRCS and the USGS. Prior to implementing the GIS system, the New York District will contact the National Geospatial Data Clearinghouse for available GIS data, per the requirements of ER 1110-1-8156. Any data collected during the study will also be posted on the Corps node of the Clearinghouse by the New York District. If applicable, data collection should utilize the Spatial Data Standards, Release 1.95 (CADD/GIS Technology Center). All work shall comply with the federal Geographic Metadata Standard compliment metadata. (http://geodata.usace.army.mil/corpsmet_95).

The Town of Greenwich and New York District will collaborate to produce the deliverables associated with this task, in the following distribution:

1) Town of Greenwich:

a. GIS support – must include:

- i. Vegetative Cover
- ii. Wetlands
- iii. Property ownership
- iv. Land use
- v. Hydrology- water bodies
- vi. HTRW (Hazardous/Toxic/Radioactive Waste)
- vii. Floodplain boundaries
- viii. Historic Properties
- ix. Tax map data

b. GIS support – Metadata needed to be able to review Digital Elevation Models (DEMs). Also Metadata for soil and land use data from NRCS and USGS

2) New York District:

- a. Development of Data Management Plan, including a data sharing agreement between USACE and Greenwich
- b. Coordination with National Geospatial Data Clearinghouse
- c. Posting new data onto Corps node of Clearinghouse

Task 3.6.	Geographic Information Systems Support	\$95,000
	TOG Contribution	\$66,500
	ACOE Contribution	\$28,500

3.7 Technical Review

This account incorporates both quality control and quality assurance for both technical and policy issues relating to the project. New York District will perform quality control on the technical issues; North Atlantic Division will perform quality assurance on technical issues and quality control on policy issues; and, USACE Headquarters will perform quality assurance on policy issues. All technical review certification and independent technical review will be consistent with EC 1165-2-203.

An independent technical review team of New York District personnel will be established that will represent all technical elements providing significant input to the feasibility report. The team members will be selected based on their experience and knowledge relative to the subject matters under review. The technical review team (TRT) has the credentials and experience necessary to provide a comprehensive review, particularly as it relates to plan formulation, environmental, economic, engineering, and public involvement matters. The team members will not have been involved in the technical products under review.

The technical managers from each division will coordinate the quality control reviews in accordance with guidance. The comments will be consolidated by each division and provided to the study manager.

- All members of the TRT will sign the Quality Control Review report (reference sample certification provided as Appendix A of EC 1165-2-203).
- All major and significant assumptions during the study process will be discussed with, validated by, and documented by the Technical Review Team

Task 3.7.	Technical Review	\$10,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$10,000

The total cost of Major Task 3 Environmental Studies is \$670,000, summarized below:

Task	Total Cost	TOG	ACOE
3.1 NEPA Scoping Meeting	\$0	\$0	\$0
3.2 Environmental Studies	\$380,000	\$200,500	\$179,500
3.3.FWCAR	\$40,000	\$ 0	\$40,000
3.4.HTRW Studies/Reports	\$45,000	\$ 0	\$45,000
3.5.Cultural Resources Studies/Documents	\$100,000	\$ 0	\$100,000
3.6.GIS Support	\$95,000	\$66,500	\$28,500
3.7.Technical Review	\$10,000	\$ 0	\$10,000
Total	\$670,000	\$267,000	\$403,000

4. ECONOMIC STUDIES

The purpose of these tasks is to identify and ensure that the proposed solution(s) to the water resources problems are in the federal Interest and economically justified. The major sub-tasks are detailed below.

4.1 Socioeconomic Analysis/Report

This analysis includes a review of the PMP, previous reports, recommendations and other relevant existing information. Additional requirements for completion of this report follow:

4.1.a. Structure Inventory & Structure Value Survey

Locate and number all structures affected on aerial maps and delineate the affected area into economic/hydrologic reaches. Conduct a 100% inventory of study area structures to determine total residential and non-residential structures. This inventory will define the structures as to construction condition, age, number of stories, first floor elevations, and square footage. Other important structures such as outbuildings, landscaping, etc. will also be inventoried. Current structure depreciated replacement values will be estimated using "Means" or similar real estate valuation publications. Residential content value will be assumed to be 50% of structure value for residential structures.

The Town of Greenwich and New York District will collaborate to produce the deliverables associated with this task, in the following distribution:

- 1) Town of Greenwich:
 - a. Provide tax assessor data to pre-populate field data sheets
 - b. Field collection of structure inventory data
 - c. Enter data sheets into Microsoft Excel format
- 2) New York District:
 - a. Determine number of structures to be inventoried
 - b. Pre-populate field data sheets
 - c. Guide data collection
 - d. Estimate structure value & residential content

Task 4.1.a.	Structure Inventory and Structure Value Survey	\$70,000
	TOG Contribution	\$42,000
	ACOE Contribution	\$28,000

4.1.b. Flood Damage Analysis without project

Damages per storm frequency event for existing conditions without project will be determined. These damages will be determined for both residential and non-residential structures and contents, as well as for roads, utilities, and other infrastructure for a range of storm frequencies (2yr, 5yr, 10yr, 25yr, 50yr, 100yr, 250yr, and 500yr) under existing conditions without project for up to 20 reaches.

Using future changes in hydrology, “without project” storm damages to structures and contents; infrastructure; roads; and utilities will be analyzed for the base year and at 10 year increments over the project life of 50 years, by reach. Buildings over 50% damaged will be assumed totally lost and considered replaced meeting current FEMA floodplain construction regulations.

These inundation damages without project will be processed using the latest HEC Flood Damage Analysis computer package and expressed as expected annual damages, by 10-year increments, over the life of the project, by reach. The expected annual inundation damages without project will be converted to present-worth damages as of the base year and then amortized over the project life using the current discount rate. The analysis will incorporate risk and uncertainty.

Task 4.1.b.	Flood Damage Analysis without Project	\$60,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$60,000

4.1.c. Flood Damage Analysis Economic Screening of Alternatives

Economics will analyze an array of preliminary alternatives, using preliminary damages prevented, design data, costs, and H&H, to enable a judgment to be made, using primarily professional economic and engineering judgment, as to which alternative plan(s) to be carried forward for more detailed analysis. The following additional analyses will be conducted as part of the screening of alternatives:

- a. Public emergency and clean-up costs will be estimated for a range of storm events.
- b. Emergency evacuation, relocation and subsistence expenses will also be estimated for a range of storm events.
- c. Expected annual emergency and clean-up costs as well as emergency evacuation and subsistence costs will be computed for both existing and future conditions, expressed as base year values and amortized over the project life.
- d. Flood Insurance Administration (FIA) costs saved will be determined by assessing the number of policies without project and multiplying the current average administrative cost per policy by the estimated number of policies reduced with the project.
- e. A non-structural analysis will be conducted to ascertain the viability of flood proofing and relocation of some or all of the flood-affected structures using the latest Corps guidance on determination of benefits.

Task 4.1.c.	Flood Damage Analysis Economic Screening of Alternatives	\$25,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$25,000

4.1.d. Flood Damage Analysis with Project

Damages per storm frequency event for with project will be determined for up to 13 reaches and 4 alternatives. These damages will be determined for both residential and non-residential structures and contents, as well as for roads, utilities and other infrastructure for a range of storm frequencies

(2yr, 5yr, 10yr, 25yr, 50yr, 100yr, 250yr, and 500yr) under base-year conditions with project for up to 13 reaches and 4 alternative plans.

Using future changes in hydrology inundation damages to structures and contents; infrastructure; roads; and utilities, will be analyzed for the base year and at 10 year increments over the period of economic analysis of 50 years, by reach and by plan alternative. Buildings over 50% damaged will be assumed to be totally lost and considered replaced meeting current FEMA floodplain construction regulations.

These inundation damages with project will be processed by HEC Flood Damage Analysis computer program and expressed as expected annual damages, by 10-year increments, over the life of the project, by reach and by alternative. The expected annual storm damages with project will be converted to present-worth damages as of the base year and then amortized over the project life using the current discount rate. The analysis will reflect risk and uncertainty in the models and analyses. In addition to building uncertainty into the analysis, the analysis will identify the various sources of risk and uncertainty that arise and seek to reduce the uncertainty when possible.

Using average annual costs and benefits for all structural and non-structural alternatives, the benefit-cost ratios and net benefits will be determined for an array of 4 alternative plans. Excess benefits over costs for each alternative plan will be analyzed and the plan which maximizes net benefits selected as the NED plan.

Optimization of the NED Plan

Subsequent to selection of the NED Plan, this plan will be evaluated to determine the optimal design, which includes an iterative analysis of benefits, costs, and net benefits.

Task 4.1.d.	Flood Damage Analysis with Project	\$30,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$30,000

4.1.e. Internal Technical Review - Economics

Technical review of the economic analysis will be conducted in four stages throughout the feasibility study: (1) after the windshield surveys have been conducted and the results tabulated; (2) after the without project damages have been computed; (3) after with project damages have been analyzed; and (4) after all benefits have been computed, preliminary BCR's have been computed, and the draft economic appendix has been completed.

Task 4.1.e.	Internal Technical Review – Economics	\$15,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$15,000

The total cost of Task 4.1 Socioeconomic Analysis/Report is \$200,000, summarized below:

Task	Total Cost	TOG	ACOE
4.1.a Structure Inventory Survey	\$70,000	\$42,000	\$28,000
4.1.b Flood Damage Analysis without Project	\$60,000	\$0	\$60,000
4.1.c Flood Damage Analysis Economic Screening	\$25,000	\$0	\$25,000
4.1.d Flood Damage Analysis with Project	\$30,000	\$0	\$30,000
4.1.e Internal Technical Review - Economics	\$15,000	\$0	\$15,000
Total	\$200,000	\$42,000	\$158,000

4.2 Economic Appendix

4.2.a. Draft Economic Appendix

Draft Economic Appendix write-up will include text, tables, graphs, and all relevant damages, benefits, and BCRs. The economic base study included in the appendix will describe the study area in terms of existing development (residential, commercial, industrial, and recreational) municipalities, local economy, population, income, and employment. This includes historical, existing, and future projected trends. Base data will be presented in tabular display. Benefits will be adjusted for current interest rates and price levels upon submission of draft and final reports.

Task 4.2.a.	Draft Economic Appendix	\$50,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$50,000

4.2.b. Respond to NAD and HQ Policy Review, QA/QC comments

Responses to higher level authority will be drafted in a format suitable for inclusion in the Feasibility Report QA / QC documents.

Task 4.2.b.	Respond to NAD and HQ Policy Review, QA/QC	\$15,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$15,000

4.2.c. Final Economics Appendix

The final economics appendix will incorporate changes that result from higher level authority comment responses, and will incorporate any changes in the analysis due to additional information or changes in federal discount rates from fiscal year changes.

Task 4.2.c.	Final Economics Appendix	\$10,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$10,000

The total cost of Task 4.2 Economic Appendix is \$82,000, summarized below:

Task	Total Cost	TOG	ACOE
4.2.a Draft Economic Appendix	\$50,000	\$0	\$50,000

4.2.b	Respond to NAD/HQ QA/QC	\$15,000	\$0	\$15,000
4.2.c	Final Economic Appendix	\$10,000	\$0	\$10,000
Total		\$75,000	\$0	\$75,000

4.3 Ability to Pay Analysis

“Ability to Pay Analysis” of the non-federal sponsor will be conducted prior to completion of the Feasibility Report.

Task 4.3.	Ability to Pay Analysis	\$4,800
	TOG Contribution	\$ 0
	ACOE Contribution	\$4,800

4.4 Economic Updates (as required)

The final decision document should include an economic analysis that is no older than three (3) years. Therefore, an economic update of benefits and price levels, including the preparation of economic support data for budgetary purposes will be required. The new requirements for feasibility phase dictate completion of the feasibility report within three years of initiation. Accordingly, an economic update is not anticipated for this study.

Task 4.4.	Economic Updates	\$0
	TOG Contribution	\$0
	ACOE Contribution	\$0

The total cost of Major Task 4. Socioeconomic Analysis/Report is \$237,800, summarized below:

Task	Total Cost/	TOG	ACOE
4.1 Socioeconomic Analysis/Report	\$200,000	\$42,000	\$158,000
4.2. Economic Appendix	\$75,000	\$ 0	\$75,000
4.3. Ability to Pay Analysis	\$4,800	\$ 0	\$4,800
4.4. Economic Updates	\$0	\$ 0	\$0
Total	\$279,800	\$42,000	\$237,800

5. **PLAN FORMULATION**

Plan formulation refers to the formulation and evaluation of alternative solutions to the problems initially identified during the reconnaissance study and subsequently refined during the Feasibility study, namely watershed management and flood damage reduction. The future "without project" condition for each problem area will be established to serve as the basis for comparison of "with project" alternatives. The plan formulation effort will follow the six step planning process specified in ER 1105-2-100. Steps in the plan formulation process will include:

- a. The specific problems and opportunities that will be addressed in the study will be identified, and the causes of the problems will be discussed and documented. Planning goals will be set, objectives will be established, and constraints will be identified.
- b. Existing and future without-project conditions will be identified, analyzed and forecast. Existing conditions of resources, problems and opportunities critical to plan formulation, impact assessment, and evaluation will be characterized and documented.
- c. The study team will formulate alternative plans that address the planning objectives. An initial set of alternatives will be screened and evaluated at a preliminary level of detail. The alternative plan selected from the screening process will be further developed and evaluated as the National Economic Development (NED) plan.
- d. Alternative project plans will be evaluated for effectiveness, efficiency, completeness and acceptability. The impacts of alternative plans will be evaluated using the system of accounts framework (NED, EQ, RED, OSE) specified in the Principles and Guidelines and ER 1105-2-100.
- e. Alternative plans will be compared. A cost effectiveness and incremental cost analysis will be conducted where applicable to evaluate and compare alternatives. The public involvement program will be used to obtain public input to the alternative screening process.
- f. A plan will be selected for recommendation and a justification for plan selection will be prepared.

The following tasks will be completed by the Planning Division Project Planner (or designee) in collaboration the Town of Greenwich. The costs of participation in plan formulation activities by the rest of the study team are included in their technical study estimates under the appropriate Sub-Products.

5.1 Establish Without-Project Conditions

Without-project conditions will be developed and refined in the early stages of the Feasibility Study based on environmental, hydrologic, institutional and socioeconomic input. Under this task, watershed management and flooding problems and opportunities in the Byram River Basin, specifically within the Town of Greenwich, CT will be assessed.

Task 5.1.	Establish Without-Project Conditions	\$20,000
	TOG Contribution	\$10,000
	ACOE Contribution	\$10,000

5.2 Preliminary Formulation and Screening of Alternatives

The project planner will lead the study team in identifying and screening alternative projects for flood damage reduction and watershed management opportunities. Structural and nonstructural flood damage reduction measures will be considered, including floodplain management. Based on review of existing data, including information developed in the 1977 Feasibility Study as well as limited field reconnaissance, the study team will identify potential alternatives, develop concept level designs and venture level cost estimates, and conduct cost effectiveness and incremental cost analyses of alternatives. This information, plus information obtained from public views, will be used to screen alternatives to the final set which will be subject to detailed evaluation.

The Town of Greenwich and New York District will collaborate to produce the deliverables associated with this task, in the following distribution:

- 1) Town of Greenwich:
 - a. Identification and screening of alternatives
 - b. First draft of documentation
- 2) New York District:
 - a. Identification and screening of alternatives
 - b. Review & revision of draft

Task 5.2.	Preliminary Formulation and Screening of Alternatives	\$40,000
	TOG Contribution	\$20,000
	ACOE Contribution	\$20,000

5.3 Formulation Scoping Meeting – Vertical Team

As per ER 1105-2-100, Appendix H, Amendment #1, dated November 20, 2007, the purpose of the FSM is to bring the vertical team, the non-federal sponsor, and resource agencies together to agree on the problems and solutions to be investigated and the scope of analyses required. An FSM will address the problems, opportunities, and needs; refine study constraints; identify the key alternatives; and further define the scope, depth, and methods of analyses required.

The Town of Greenwich and New York District will collaborate to produce the deliverables associated with this task, in the following distribution:

- 1) Town of Greenwich:
 - a. Produce first draft of package
 - b. Print and assemble packages for vertical team review
- 2) New York District:
 - a. Review & revise FSM package
 - b. Transmit FSM package
 - c. Coordinate with vertical chain

d. FSM presentation to vertical chain

Task 5.3.	Formulation Scoping Meeting – Vertical Team	\$20,000
	TOG Contribution	\$ 8,000
	ACOE Contribution	\$12,000

5.4 Detailed Evaluation of Alternatives

The final set of proposed actions for the Byram River Basin will be formulated from a variety of flood damage reduction and watershed management measures to display an array of alternative plans for flood damage reduction and watershed management opportunities, assess the preferred alternative(s) performance under various flood events, identify the NED plan (as well as the NER plan if applicable), and satisfy NEPA requirements. As part of the formulation process, the study will consider technical feasibility, economic feasibility, avoidance and minimization of potential environmental impacts, real estate acquisition, induced flooding, and views of the public. The alternatives that pass the initial screening process described in “Preliminary Formulation and Screening of Alternatives” will be analyzed in terms of costs and benefits to determine an NED plan. Locally preferred plans will also be evaluated, if different from the NED.

The Town of Greenwich and New York District will collaborate to produce the deliverables associated with this task, in the following distribution:

- 1) Town of Greenwich:
 - a. Identification and screening of alternatives
 - b. First draft of documentation
- 2) New York District:
 - a. Identification and screening of alternatives
 - b. Review & revision of draft

Task 5.4.	Detailed Evaluation of Alternatives	\$60,000
	TOG Contribution	\$30,000
	ACOE Contribution	\$30,000

5.5 AFB Project Documentation - All Other AFB Project Documents

A checkpoint conference will be scheduled when appropriate to evaluate alternative plans, to insure that the Corps and the non-federal sponsor focus their resources on alternatives that are in the federal interest. The checkpoint conference will take the form of an Alternative Formulation Briefing (AFB), in accordance with Planning Guidance Letter (PGL) #24.

The Alternative Formulation Briefing will be attended by the New York District, the non-federal sponsor, the North Atlantic Division, the Flood Damage Reduction Planning Center of Expertise and HQ, USACE (if necessary). The purpose of the AFB is to review study findings concerning problems and needs; to evaluate the array of alternatives and determine their consistency with the federal interest; and to review the preliminary analysis of the impacts of alternatives. This meeting will be a key decision point in determining whether alternatives meet federal and non-federal policies and budgetary criteria and should be recommended for project implementation. If the non-

federal sponsor has a preferred alternative which differs from the federally recommended plan, it will be identified and reviewed at this time.

The AFB will be scheduled when technical studies such as hydrologic modeling and baseline economic and environmental investigations have progressed to the point where a determination can be made as to whether potential alternatives are in the federal interest.

Background material in the form of the Alternative Formulation Report will be sent to NAD and the Flood Risk Management at least four (4) weeks prior to the conference. The designs and costs presented at the AFB will be at a preliminary level of detail sufficient to screen alternatives and select the plans, which will be subject to a detailed analysis.

The Town of Greenwich and New York District will collaborate to produce the deliverables associated with this task, in the following distribution:

- 1) Town of Greenwich:
 - a. Identification and screening of alternatives
 - b. First draft of documentation
- 2) New York District:
 - a. Identification and screening of alternatives
 - b. Review & revision of draft
 - c. AFB presentation to vertical chain

Task 5.5.	Project Documentation – All other AFB Project Documents	\$20,000
	TOG Contribution	\$10,000
	ACOE Contribution	\$10,000

5.6 Technical Review of AFB Documents

Technical review documents will be prepared by the New York District.

- **Policy Compliance Review of AFB Documents**

Policy compliance review documents will be prepared by HQ, USACE. This task will be performed by HQ, USACE and will be funded through GE appropriations, which are not cost-shared nor considered as part of the total project cost.

- **AFB Guidance Memorandum**

An AFB Guidance Memorandum will be prepared by HQ, USACE documenting directions provided to the New York District for completion of the reevaluation study. This task will be performed by HQ, USACE and will be funded through GE appropriations, which are not cost-shared nor considered as part of the total project cost.

Task 5.6.	Technical Review of AFB Documents	\$0
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5.7 Management and Appendix

5.7.a. Plan Formulation Management and Appendix

This task involves management of the plan formulation effort and will include such activities as coordinating technical team meetings, upward reporting, preparation of study documents, and integration of all technical investigations.

The project planner will summarize the results of the technical studies leading to plan selection in the Plan Formulation Appendix. The Plan Formulation Appendix will document the alternative formulation, evaluation and selection process that was used to identify the NED plan for flood damage reduction and watershed management and the tentatively selected plans. Costs of alternative plans and anticipated ecological effects will be developed at the feasibility level of detail, although the detailed, technical appendices will not be prepared by this time.

The annual and periodic activities and responsibilities for operating and maintaining the completed project will be described in the Plan Formulation Appendix. The magnitude of these activities will be described for the alternative recommended for implementation. All requirements of 33 CFR 208.10 (Local Flood Protection Works; Maintenance and Operation of Structures and Facilities) and other federal regulations specifying operation and maintenance requirements will be clearly described so that the local sponsor will be aware of its future O&M responsibilities.

The Town of Greenwich and New York District will collaborate to produce the deliverables associated with this task, in the following distribution:

- 1) Town of Greenwich:
 - a. First draft of documentation
 - b. Print and assemble Plan Formulation appendix
- 2) New York District:
 - a. Provide Table of Contents to guide draft of appendix
 - b. Review & revision of Plan Formulation appendix

Task 5.7.a.	Plan Formulation Management and Appendix	\$60,000
	TOG Contribution	\$30,000
	ACOE Contribution	\$30,000

5.7.b. District Quality Control

Technical review will be conducted on all work products generated under Sub-Product: Plan Formulation and Evaluation Report. A report will be prepared detailing the results of the technical review including comments, issue and resolutions. This task also involves reviewing and preparing responses to comments received from the New York District’s Divisions review of the Draft FR and Draft NEPA document. Responses to the comments will be documented in the Final FR and Final NEPA document.

Task 5.7.b.	District Quality Control	\$10,800
	TOG Contribution	\$ 0
	ACOE Contribution	\$10,800

The total cost of 5.7 Management and Appendix is \$70,800, summarized below:

Task	Total Cost	TOG	ACOE
5.7.a. Plan Formulation Management and Appendix	\$60,000	\$30,000	\$30,000
5.7.b. District Quality Control	\$10,800	\$0	\$10,800
Total	\$70,800	\$30,000	\$40,800

5.8 Report Preparation

The purpose of this task is to create an outline for work to be performed in order to create a draft Feasibility Report, (FR) to perform the required external independent technical review (EITR) and external peer review (EPR) of said draft, provide the draft report to Division for comments, revise the draft for public review, present the draft for public review, and upon completion of public review; finalize the FR.

- **Draft Report Document**

A draft FR will be prepared following the guidance contained in ER 1105-2-100. With minor revisions, the AFB report will be suitable for incorporation into the FR as the main report section. Detailed appendices will be prepared that document the results of the technical analyses. The costs of preparing report appendices are contained under each of the technical elements described previously. The contents of the FR are summarized below:

- Main report summarizing the study’s technical findings, conclusions and recommendations;
- A draft National Environmental Policy Act document (assume Environmental Assessment);
- Technical appendices presenting the detailed backup and results of individual work tasks;
- A Quality Control Report containing the results of District Quality Control, Agency Technical Review, and documentation of vertical chain review; and
- An appendix containing the sponsor's financial capability statement and preliminary financing plan; and
- Other supporting documentation including the Project Management Plan (PMP) for the next phase of the project.

Preparation of the draft FR includes assembling, writing, editing, typing, drafting, reviewing, reproducing and distributing the draft FR, draft NEPA document, and other related documentation required for transmittal to USACE and higher authorities for use as a decision document.

The Town of Greenwich and New York District will collaborate to produce the deliverables associated with this task, in the following distribution:

- 1) Town of Greenwich:
 - a. First draft for planning elements developed after the AFB
 - b. Print and assemble Feasibility Report, including appendices
 - c. Distribute copies to mailing list provided by New York District
- 2) New York District:
 - a. Provide Table of Contents to guide assembly of FR
 - b. Review & revision of FR
 - c. Coordination with other agencies and vertical chain
 - d. Provide mailing list for distribution

Task 5.8.	Report Preparation	\$70,000
	TOG Contribution	\$52,500
	ACOE Contribution	\$17,500

5.9 Agency Technical Review (ATR)

Pursuant to EC 1105-2-410, scientific and engineering information that underlies decisions and recommendations in decision documents, that are to be disseminated to the public, will be reviewed to ensure its technical quality. Internal review by subject matter experts by ATR is required for all work products of the Civil Works program. This includes the draft report, final report and interim work products that may be considered controversial or contentious. ATR is intended to confirm that work was done in accordance with clearly established professional principles, codes and criteria. Plan Formulation Branch will conduct all required coordination for both ATR and External Peer Review (task below) with the Planning Center of Expertise.

Task 5.9.	Agency Technical Review	\$150,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$150,000

5.10 External Peer Review (EPR)

In accordance with Section 2034 of the Water Resources Development Act of 2007 (P.L. 110-114), Independent External Peer Review shall be conducted for all projects with an estimated total cost of greater than \$45M dollars. We do not expect the total project costs for this project will be in excess of this amount. However, other criteria, such as innovative solutions and life safety issues could also trigger the requirement for EPR. Therefore, if necessary, EPR would be conducted to identify, explain, and comment upon assumptions that underlie economic, engineering, and environmental analyses, as well as to evaluate the soundness of models and planning methods. This task would be supported by the New York District’s Planning Division (**this task is 100% federal Cost**) if necessary.

Task 5.10.	External Peer Review	\$500,000*NOT COST SHARED*
	TOG Contribution	\$ 0
	ACOE Contribution	\$500,000

5.11 Release Draft FR

This task involves the release of the draft FR for full public review. The draft FR will include all NEPA documentation and all technical appendices documenting all studies, plans, design, cost, public involvement, and findings to date. Costs for this task are included in the draft document task above. This task will be performed by the New York District’s Plan Formulation Branch (or it’s Contractor) and is included in the draft document task above.

Task 5.11.	Release Draft FR	\$0
	TOG Contribution	\$0
	ACOE Contribution	\$0

5.12 Public Review Comments

This task involves reviewing and preparing responses to letters received from agencies and the public in response to the Draft FR and Draft NEPA document. Responses to the comments will be included in the Final FR and Final NEPA document.

Task 5.12.	Public Review Comments	\$10,000
	TOG Contribution	\$ 5,000
	ACOE Contribution	\$ 5,000

5.13 Final FR and NEPA Documents

- Final Report Documentation

The final FR will document the final findings of each study area as well as existing conditions, studies and modeling results which have lead to the final findings. The final FR will incorporate comments from agencies, the public and higher authority review. The steps in producing a Final FR include the following:

- Finalize Draft FR;
- Revise the Draft FR in response to NAD and HQ, USACE comments;
- Modify the Draft FR in response to comments received during the agency and public comment period;
- Coordinate with the non-federal sponsor and internal District elements.

Task 5.13.	Final FR and NEPA Documents	\$20,000
	TOG Contribution	\$15,000
	ACOE Contribution	\$ 5,000

5.14 Civil Works Review Board

This task includes preparation for and attendance at the required Civil Works Review Board in HQ, USACE.

Task 5.14.	Civil Works Review Board	\$30,000
	TOG Contribution	\$ 9,900
	ACOE Contribution	\$20,100

5.15 Division Commanders Notice

A public notice will be prepared to announce the completion of the Division Commander’s Report, based on his endorsement of the findings and recommendations of the District Commander. The public notice will indicate that the report has been submitted for Washington Level Review. This task will be performed by the North Atlantic Division and will be **funded through GE appropriations**, which are not cost-shared nor considered as part of the total project cost.

5.16 Policy Compliance Review Approval

A written assessment of the final Re-evaluation Report will be prepared by the HQ, USACE to document the Feasibility Report’s compliance with current policy. This task will be **funded through GE appropriations**, which are not cost-shared nor considered as part of the total project cost.

5.17 Chief of Engineer’s Report

A brief summary of the FR, signed by the Chief of Engineers, will be prepared to transmit recommendations to the Assistant Secretary of the Army for Civil Works. This task will be performed by HQ, USACE and will be **funded through GE appropriations**, which are not cost-shared nor considered as part of the total project cost.

5.18 ASA(CW) Transmittal to Congress

A letter will be prepared from ASA(CW) transmitting the FR to Congress. This task will be performed by ASA (CW) and will be **funded through other appropriations**, which are not cost-shared nor considered as part of the total project cost.

The total cost of 5. Plan Formulation is \$510,800, summarized below:

Task	Total Cost	TOG	ACOE
5.1 Establish without Project Conditions	\$20,000	\$10,000	\$10,000
5.2 Preliminary Formulation and Screening of Alternatives	\$40,000	\$20,000	\$20,000
5.3 Formulation Scoping Meeting – Vertical Team	\$20,000	\$8,000	\$12,000
5.4 Detailed Evaluation of Alternatives	\$60,000	\$30,000	\$30,000
5.5 AFB Project Documentation	\$20,000	\$10,000	\$10,000
5.6 Technical Review of AFB Documents	\$0	\$0	\$0
5.7a.Plan Formulation Management and Appendix	\$60,000	\$30,000	\$30,000
5.7b.District Quality Control	\$10,800	\$0	\$10,800
5.8 Report Preparation	\$70,000	\$52,500	\$17,500
5.9 Agency Technical Review	\$150,000	\$0	\$150,000
5.10 External Peer Review	\$500,000*	\$0	\$500,000*
5.11 Release Draft	\$0	\$0	\$0
5.12 Public Review Comments	\$10,000	\$5,000	\$5,000
5.13 Final FR & NEPA Documents	\$20,000	\$15,000	\$5,000
5.14 Civil Works Review Board	\$30,000	\$9,900	\$20,100
Total	\$510,800	\$190,400	\$320,400

*** NOTE: Task 5.10 External Peer Review was not included in the total as this amount is a 100% Federal Share and only completed if necessary.**

6. REAL ESTATE STUDIES

The objectives of the tasks performed as part of this subaccount are: 1) develop a comprehensive plan identifying the real estate requirements for the project and the estimated costs associated therewith; and 2) develop a realistic acquisition schedule in coordination with the non-federal sponsor.

6.1 ID Landowners:

Real estate-related work includes the development of ownership data, which is obtained by researching the property records in our database using the proposed site plans to define the property owners that are within the project limits. The proposed site plans are reviewed to determine the lands, easements, rights-of-way, and temporary work areas/staging areas required for the project.

This will be completed at part of Section 4.1.a Structure Inventory.

Task 6.1	IDLand Owners	\$0
	TOG Contribution	\$0
	ACOE Contribution	\$0

6.2 Obtain Rights of Entry:

Rights-of-entry will be obtained, if required, for cultural, environmental, HTRW, or geotechnical analyses for the Feasibility study.

Task 6.2	Obtain Rights of Entry	\$8,000
	TOG Contribution	\$6,400
	ACOE Contribution	\$1,600

6.3 Prepare Right-of-Way Maps:

Right-of-way maps will be prepared by utilizing any available aerial photogrammetric mapping, tax maps, topographic survey information, and design plans. Mapping is for depicting types of estates required for the project, property data and extent of ownerships for calculating land areas and value of properties required for the project.

Task 6.3	Prepare Right of Way Maps	\$10,000
	TOG Contribution	\$ 5,000
	ACOE Contribution	\$ 5,000

6.4 Gross Appraisal:

A Gross Appraisal will be prepared which provides a detailed estimate of all real estate costs associated with acquisition of real property interests.

Task 6.4.	Gross Appraisal	\$50,000
	TOG Contribution	\$25,000
	ACOE Contribution	\$25,000

6.5 Prepare Real Estate Plan:

An overall Real Estate Plan (REP) describing the real estate requirements for the project will be prepared. As part of the REP, a preliminary real estate cost estimate will be prepared in the MCACES format. The cost estimate will include a value estimate for real property required, PL 91-646 relocation payments, the non-federal sponsor administrative costs to accomplish the Project's real property requirements, and the Corps' administrative costs to assist and monitor the non-federal sponsor real property acquisition program. Attorney's Opinions of Compensability will be prepared as part of the REP for each relocation associated with the Project, to determine whether the owner has interest, and what the best measure of just compensation would be. A detailed acquisition schedule will also be developed and included in the REP.

Task 6.5.	Prepare Real Estate Plan	\$35,000
	TOG Contribution	\$27,000
	ACOE Contribution	\$ 8,000

6.6 Review PPA:

A draft Project Partnership Agreement (PPA) for the construction of selected alternatives will be reviewed for inclusion in the Feasibility report. The PPA is a legally binding agreement that sets forth the terms of the relationship between the federal Government and the non-federal sponsor for construction, operation, and maintenance of projects approved through the Feasibility process. This task is accomplished in the Plans & Specifications phase.

Task 6.6.	Review PPA	\$0
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6.7 Local Coordination and Site Visits:

Coordination includes, but is not limited to, Real Estate participation in team meetings, site visits, negotiation of work agreements, coordination with other offices on project data needed for Real Estate's major study products, and monitoring of progress and findings associated with Real Estate study products.

Task 6.7.	Local Coordination and Site Visits	\$10,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$10,000

6.8 Report Preparation:

A separate real estate appendix will be prepared by the Corps for the Feasibility report, and detailed real estate costs will be a part of the baseline cost estimate for the recommended project. The appendix will also include ownership data, acreage, gross appraisal, and preliminary right-of-way maps. The non –federal sponsor will be responsible for assisting federal government personnel during field surveys of affected properties in the study area. Additionally, the sponsor will work with government personnel to establish the sponsor's administrative costs for acquiring LERRD.

Task 6.8.	Report Preparation	\$0
	TOG Contribution	\$0
	ACOE Contribution	\$0

The total cost of 6. Real Estate Studies is \$113,000, summarized below:

Task	Total Cost	TOG	ACOE
6.1 Land Owners	\$0	\$0	\$0
6.2 Obtain Right of Entry	\$8,000	\$6,400	\$1,600
6.3 Prepare Right-of-Way Maps	\$10,000	\$5,000	\$5,000
6.4 Gross Appraisal	\$50,000	\$25,000	\$25,000
6.5 Prepare Real Estate Plan	\$35,000	\$27,000	\$8,000
6.6 Review PCA	0	\$0	\$0
6.7 Local Coordination and Site Visits	\$10,000	\$0	\$10,000
6.8 Report Preparation	\$0	\$0	\$0
Total	\$113,000	\$63,400	\$49,600

7. LIFE CYCLE PROJECT MANAGEMENT

The Project Manager (PM) is responsible for reporting to the District's Project review Board and for preparation of required Life Cycle Project Management (LCPM) reports. In addition, PM responsibilities include the monitoring of project schedules and finances, processing of schedule and cost change requests, management of contingencies, review of budget documents, coordination of the FCSA and PCA, and identification of problems and issues.

Task 7	Life Cycle Project Management	\$65,000
	TOG Contribution	\$ 0
	ACOE Contribution	\$65,000

The non-federal sponsors will also contribute to the supervision and administration, study management, attendance at meetings, public and technical; as well as overhead and indirect costs which are directly related to this Feasibility Study.

Summary of Total Project Costs

The sub-total cost of the feasibility study is \$2,721,600, summarized below:

Task	Total Cost	TOG	ACOE
1. Public Involvement	\$30,000	\$24,000	\$6,000
2. Engineering	\$1,053,000	\$774,000	\$279,000
3. Environmental Studies	\$670,000	\$267,000	\$403,000
4. Economics	\$279,800	\$42,000	\$237,800
5. Plan Formulation	\$510,800	\$190,400	\$320,400
6. Real Estate Studies	\$113,000	\$63,400	\$49,600
7. Life Cycle Project Management	\$65,000	\$0	\$65,000
Total	\$2,721,600	\$1,360,800	\$1,360,800

With the addition of a 10% contingency in the amount of \$272,160, the total estimated cost for the Byram River Basin Feasibility Study is \$2,993,760.

These tasks are presented in spreadsheet form in Attachment C, by task performing organization and organized by the interim study phases as discussed in Section 2.8.

CHAPTER IV – RESPONSIBILITY ASSIGNMENT

1. Study Team Members

The PDT is responsible and accountable for delivering quality results. The PDT is a multi-discipline project team with responsibility for assuring that the project stays focused, first and foremost on the public interest, and on the sponsor’s needs and expectations and that all work is integrated and done in accordance with the PMP and approved business and quality management processes. The team focuses on the quality project delivery, with heavy reliance on partnering and relationship development to achieve better performance. The PM will assure sponsor involvement throughout the process and ensures mutual understanding, utilizing the PDT regularly occurring meetings per the USACE PMBP, of the sponsor’s role in project success. The PDT’s relationship with the sponsor is pivotal to achieving project success. The PM’s active role is essential to ensure that the sponsor’s quality objectives are clearly articulated to the PDT in a timely manner and that the customer understands the essential professional standards, laws, and codes, as well as public trust issues that the PDT must incorporate into the project. The PDT works with the sponsor early in the project scoping process to determine initially what the sponsor needs and to ensure that what the sponsor needs is consistent with the needs of the public and does not violate the public trust, and to refine those requirements in light of safety, fiscal, schedule, legal and other constraints. Study team members are identified in the table below. Attachment D contains the signature sheet for this Project Management Plan.

<i>USACE - NY District</i>	<i>Individual</i>
Project Manager	Rifat Salim
Project Planner	Olivia Cackler
Economist	Caroline McCabe
Project Engineer	Elena Manno
Hydrology & Hydraulics Engineer	Andre Chauncey
Geotechnical Specialist	Gennaro Cimmino
Project Biologist/NEPA Coordinator	Matthew Voisine
Cultural Resources Specialist	Carissa Scarpa
HTRW Specialist	Richard Dabal
Cost Engineer	Mukesh Kumar
Real Estate Specialist	David Andersen
Office of Counsel	Ellen Simon
<i>Non Federal Sponsor -Greenwich</i>	<i>Individual</i>
Chief Engineer	James Michel
Sr. Civil Engineer	Scott Marucci
Commissioner of Public Works	Amy Siebert
Consultant – CDM Smith	Cindy Baumann
<i>Other Agency/Other Corps</i>	<i>Individual</i>
NYSDEC	TBD
USFWS	TBD
CTDEEP	TBD
CT SHPO	TBD

Project Manager

The Project Manager (PM) manages all project resources, information and commitments, and leads and facilitates the PDT towards effective project development and execution. The customer's primary "door" to the Corps is the PM, who must seamlessly integrate USACE efforts to deliver the best possible solutions for the sponsor. The PM is the primary interface with the customer for the specific project. So that the organization speaks with one voice, the PM coordinates all matters relating to the project, and ensures that the sponsor's requirements are conveyed and understood. In performing such functions, the PM must operate consistently with their responsibilities as a public servant (federal official). The PM will encourage and facilitate team members in communicating directly with the sponsor organization on issues related to execution of their specialty area of the project. It is critical that the PDT members keep the PM and other PDT members informed of issues, and more critical that the PM keep the PDT informed of issues or changes to the sponsor concerns and circumstances for the project. In addition, the PM's responsibilities include: leading the PDT, the monitoring of project schedules and finances, processing of schedule and cost change requests, management of contingencies, review of budget documents, development of the Project Partnership Agreement, and identification of problems and issues. Reporting requirements are listed below in the section entitled "Reporting Requirements."

Project Delivery Team Members

Individual PDT members are responsible to the PM for accomplishing their assigned tasks, identifying issues for resolution, documenting issues for quality control, maintaining schedule and informing the PM when schedules or costs are not going to be met. They do this with the assistance of the team leaders or section chiefs, branch chiefs and division chiefs, who are responsible for providing trained, competent and motivated members to the PDT.

District Offices

In general, the individual divisions are responsible for scope of work preparation, contract negotiation, and performance of any work to be completed by contractors or other federal agencies.

The Program and Project Management Division is responsible for assigning a Project Manager, preparing program and budget documents, and in coordination with the Public Affairs Office, communicating with the public sector. It serves as the primary contact with the sponsor and the public. It is responsible to raise those policy issues to the North Atlantic Division for resolution that are beyond the scope of the District.

Planning Division is responsible for the preparation of all environmental documentation to support the construction of the project, NEPA documents, threatened and endangered species compliance, cultural resources coordination, compiling the material for and enforcement of the water quality certificate applications/certificates, the Clean Air Act evaluation and compliance documents, providing input into the plans specifications and construction oversight for the mitigation sites, preparation of mitigation completion and monitoring reports, accomplishing environmental compliance and HTRW assessment. Planning Division is also responsible for formulation and

economics work as it will continue to arise in a project of this extent. Planning Division is also responsible for the preparation of the GRR.

Engineering Division is responsible for performing geotechnical and structural investigations, performing engineering designs of channel improvements, preparing project and construction cost estimates and construction schedules.

In addition, Engineering Division will support Planning Division's permit compliance project impact and potential mitigation information. Engineering will support the reconfirmation effort by supplying quantity and cost data to Planning Division. Engineering Division will also support Real Estate Division by producing the required easement drawings.

The Operations Division will provide all necessary surveying and mapping.

The Construction Division is responsible for reviewing and approving the construction schedule, performing Bidability, Constructability and Operability (BCO) reviews, and developing Supervision and Administration costs.

The Real Estate Division is responsible for maintaining the Real Estate Plan, revising real estate costs and preparing the necessary information required for the Attorney's Opinion of Compensability.

The Contracting Division is responsible for the issuance of all contract documents, making contract awards.

The Office of Counsel is responsible for review of contracting documents, assisting with the negotiation of the Project Partnership Agreement and reviewing project related documents for legal sufficiency. It is also responsible for the Attorneys' Opinion of Compensability.

The Division Chiefs work at the operational level of the District, with a focus on executing the current year's mission and planning for the next year. They work as a team to provide adequate resources and delegate authority commensurate with responsibilities to PMs and PDT members to enable project success. They also provide adequate resources and delegate authority commensurate with responsibilities to supervisors to allow for establishment and maintenance of a quality workforce. Senior leadership ensures that the quality management processes are developed, maintained, and followed. Senior leaders evaluate performance and facilitate improvements through application of these principles.

Supervisors at all echelons of the organization lead their staffs in implementing the Project Management Business Process (PMBP) and in achieving professional excellence and continuous improvement. They work as a management team to assign work, balance workload and resolve resource conflicts on an ongoing basis. The Civil Works Team (CWT) is the middle management team created to take the load of daily resourcing issues off the Corporate Board, and fully engage middle management in supporting PDTs. Supervisors actively coach and mentor PDT members and facilitate process improvements through the life cycle of projects. Supervisors maintain a high

level of professional expertise, and facilitate access to subject matter experts. Supervisors work with their subordinates to ensure a thorough understanding of USACE policies and procedures.

North Atlantic Division

The North Atlantic Division is responsible for the resolution of policy issues identified to it by the District. In addition, it is responsible for the testimony to Congress during the annual budget defense. This testimony is developed with input from the District. It is responsible for the auditing of quality control at the District.

HQ USACE

HQ USACE is responsible for providing the necessary funds and policy guidance to the District in order to carry out this PMP. It has organized a team similar to that of the PDT in order to provide responsive assistance to the District. It is responsible for all coordination with the Administration and Congress.

The Town of Greenwich (TOG)

The Town of Greenwich, as the non-federal sponsor, is a member of the PDT and is responsible for providing all the required items of local cooperation as specified in the Project Partnership Agreement and PMP. It is also responsible for providing all lands, easement, rights of way and relocations. As a regulatory agency, they are responsible for obtaining any required state permits necessary to execute the project construction.

U.S. Environmental Protection Agency (USEPA)

Region 1 of the U.S. Environmental Protection Agency (USEPA) is responsible for the review of any NEPA document produced by the District, within the timeframes required by law, regulation, or this document. It is also responsible to the oversight of implementation of the CAA by the two state governments involved in this project and provides guidance on its implementation to the District.

U.S. Fish and Wildlife Service (USFWS)

The USFWS is responsible to the completion of the Fish and Wildlife Coordination Act Report or the Planning Aid Report, if requested by the District. It is also responsible for the implementation of the Endangered Species Act, and coordinates any related matters with the District.

CHAPTER V – STUDY SCHEDULE

1. SCHEDULE DEVELOPMENT

All schedules are developed using a Network Analysis System (NAS). The network is based upon the tasks that are listed in the detailed scopes of work.

2. FUNDING CONSTRAINTS

Funding for the first Fiscal Year of the study is normally limited because of the uncertainty in the initiation of the feasibility phase. This constraint has been reflected in the development of the study schedule. Following the first year, an optimum schedule based upon unconstrained funding has been assumed for subsequent Fiscal Years.

3. SCHEDULE

Feasibility Phase Milestones	Projected Date
District & Non-Federal Sponsor Sign & Execute FCSA	August 2012
Initiation of Feasibility Phase Study	August 2012
Public Workshop/Initial Scoping Meeting	October 2012
Feasibility Scoping Meeting (FSM) (Existing Conditions & Without Project)	August 2013
Alternative Formulation Briefing (AFB)	June 2014
Draft Feasibility Report & NEPA Document for Review	December 2014
Public Meeting	March 2015
Final Report to NAD	April 2015
Division Engineer's Public Notice	June 2015

CHAPTER VI – FEASIBILITY COST ESTIMATE

The feasibility cost estimate is based upon a summation of the costs that were identified for the individual tasks in the detailed scopes of work. Study cost estimates include allowances for inflation so that the non-federal sponsor is fully aware of its financial commitment.

Appropriate contingencies and contingency management are included to adequately deal with the uncertainty in the elements of the study. Experience has shown that approximately 10 percent of the study costs should be reserved for activities after the release of the draft report. Contingencies in the amount required to raise the costs of activities after the draft report this amount have been added to the cost estimate.

The feasibility cost estimate is contained in Attachment C.

Appendix A – Communication Plan

The communication plan addresses internal project delivery team (PDT) and external communications.

1. Internal PDT Communications: PDT distribution lists will be established that include all in-house team members, Sponsors, and other stakeholders. All general project notifications will be delivered using these distribution lists. The project manager will determine which correspondence is appropriate for each audience. Email will be the primary mode of communication within the PDT. The Town of Greenwich Project Manager will be included in all correspondence.

2. External communications: Any news releases will be coordinated with the Public Affairs Offices of New York District and New England District. An initial release announcing the start of the study will be made after the cost-sharing agreement is signed. Subsequent releases to announce public meetings will be made as needed. Other releases will be considered as the study develops. Postings on the New York District's and New England District's websites will also be used to communicate to the general public. The Town of Greenwich Project Manager will be included in all correspondence.

3. Public Involvement: Public involvement will be an integral part of the study. This will likely include one or more meetings for public input. These meetings may be planned, facilitated, publicized and documented by the Sponsor as work-in-kind. Additional public involvement will include hosting additional meetings as appropriate, and preparing news releases, on-line newsletter articles, and/or providing information via the web. The Sponsor may perform the majority of these activities as work-in-kind and coordinate with the Public Affairs Offices of New York District and New England District.

Appendix B – Quality Control Plan

Byram River Basin

Flood Risk Management and Watershed Management

Fairfield County, Connecticut and Westchester County, New York

1. Introduction

Effective 1 Oct. 1995, the North Atlantic Division and HQUSACE no longer review planning reports for technical adequacy. This responsibility has been placed with the District producing the report. Although NAD and HQUSACE will not conduct a technical review they will review reports for conformance to current policy. As such, the New York District is responsible to ensure that its report conforms to all current professional practices and standards by conducting an internal technical review of the report, prior to its submission to NAD and HQUSACE. Policies and procedures defining the quality control / internal technical review process are specified in EC 1165-2-209, “Civil Works Review Policy,” 31 January 2010.

2. Quality Control / Internal Technical Review Responsibilities

The goal of the technical review process is to ensure that the report and its sub-components meet the technical standards and regulations of the Corps of Engineers. The New York District is responsible for the independent technical review of the feasibility study and its products and will develop and implement a QC plan for the project. The QC plan includes the independent technical review of decision and implementation documents, consistent with established criteria, guidance, procedures, and policy; and identifies how the district plans to ensure compliance with technical and policy requirements.

3. Technical Review Process

Technical review is part of the overall development of implementation and decision documents and is the systematic execution of actions, decisions, and reviews taken during the concept development, formulation of alternatives, and project design phases to ensure conformance with laws and Administration policy. An independent technical review is conducted for all decision and implementation documents and is independent of the technical production of the project/product.

The selected independent technical review methods are identified in this QC plan. The technical review team members have the proper knowledge, skills, and experience necessary to perform their tasks and are independent of the study team responsible for the development of the project/product. The QC/QA process is described herein will be fully documented in the feasibility study. Documentation and certification of technical/legal review will accompany the feasibility report that is submitted to NAD and HQUSACE for policy compliance review.

The New York District will apply all appropriate technical and policy guidance in developing Byram River Basin feasibility study. Since the district is responsible for both conducting the work and providing the technical review of the work, the technical review will be independent. Independent review will include review of all the technical work and products from plan formulation, environmental, economics, engineering, cost estimating, real estate, and other

disciplines that are essential to achieving a quality feasibility report. A QC plan has been prepared for this project and is documented in this PMP. The QC plan includes the following items:

- (1) Discussion of the selected independent technical review option which identifies the review team members, qualifications, and the rationale for selection.
- (2) Schedule of in-progress technical and/or policy reviews.
- (3) Description of the process for documenting decisions, issues, and issue resolution.
- (4) Discussion of the methods to be used to resolve significant technical and other policy issues.
- (5) Discussion of the lessons learned process.
- (6) Legal review of the decision document and associated NEPA compliance document by district counsel.
- (7) Any issues that cannot be resolved within the district will be forwarded to NAD and HQUSACE for resolution.

It is the responsibility of each technical division within the District to establish its own quality control plan. Based on their input, the following actions will take place during the feasibility study:

3.1. Planning Division

Environmental Resources: Work performed to produce the environmental analysis and NEPA document may be done, in part, using a contractor. As such, the quality control process will be in two steps. This first will be by the contractor, who will conduct the review in accordance with their internal QA/QC procedures. A copy of EC 1105-2-410 will be provided to the contractor to ensure that their internal QA/QC procedures conform to Corps of Engineers' requirements.

The second step in the QA/QC process will be performed by the District planning review team members, who will review the contractor's work to ensure that it meets the requirements of the contract and conforms to the requirements set forth in the PMP and other Corps regulations. For work performed under contract, **QC Team Member** is designated as the primary reviewer for environmental work.

Economic and Social Analysis: Quality control and technical review of the economic, social analysis and financial analysis work will be performed by **QC Team Member**. For cultural resources work, **QC Team Member** will be the primary reviewer.

Plan Formulation: Plan formulation and preparation of the Feasibility Report will be performed under the direction of the Chief of the Plan Formulation Branch. **QC Team Member** has significant experience in plan formulation and will not be involved in the day-to-day progress of the study, which will be managed by the Plan Formulation Branch. The main report will also be reviewed by the Chief, Planning Division for compliance with policy.

3.2 Engineering Division

The draft Engineering Appendix will be reviewed by the Engineering Division. A back check review of the final engineering appendix will be conducted. The review team will consist of

individuals from the following fields: civil design, structural, geotechnical, cost estimating, hydraulics and hydrology. Corps of Engineers criteria will be used to judge the technical adequacy of the products and documentation will be accomplished by written comments, responses and correspondence.

3.3 Review Process

Each technical element will schedule sufficient time for a technical review to allow their appendix to be submitted in accordance with the currently approved PMP. In order to accomplish this, each technical element will conduct its quality control on a continual basis with each major sub-product serving as a check point in the quality control process. This will ensure that any technical mistakes are found early and resolved while the material is fresh in the minds of those working on it. For work performed by a contractor, each contract scope of work will require several work progress updates and submissions prior to the submission of the draft report and final report. These progress updates will serve to ensure that the contractor is proceeding in the direction that the District wishes to pursue and raise any issues that may need to be resolved.

Checklists will be used in the quality control process to assist the reviewer, but will not be used to replace that person's technical expertise or judgment. The checklists are designed to assist the reviewer in ensuring that the report contains the minimum amount of material necessary to make decisions and that any conclusions drawn in the report are based on the information provided.

Each reviewer will document their comments on review sheets. At a minimum, each comment will refer to the page and paragraph in question, the nature of the problem, where guidance can be found which applies to the problem, and if possible, a suggested solution to the problem. The comments and any checklist used will be returned to the person responsible for the product to resolve. Responses to each comment will provide, at a minimum, what was done to correct the deficiency and where the deficiency was corrected, or a justification for why the deficiency was not corrected. The package of comments and responses will be attached to the final submission as a sub-appendix. It is the responsibility of the section supervisor responsible for the product to review the comments and responses to ensure that all issues are resolved.

Each line supervisor has the responsibility for the day-to-day quality control of those they supervise. As such, they are directly responsible for checking the day-to-day work of their subordinates and resolving any issues that the review team members may raise.

3.4. District Quality Control (DQC)

This task involves reviewing and preparing responses to comments received from the New York District's Divisions review of the Draft Report and Draft NEPA document. Responses to the comments will be documented in the Final Report and Final NEPA Document.

3.5. Agency Technical Review (ATR)

Pursuant to EC 1165-2-209, scientific and engineering information that underlies decisions and recommendations in decision documents, that are to be disseminated to the public, will be reviewed

to ensure its technical quality. Internal review by subject matter experts for ATR is required for all work products of the Civil Works Program. This includes the draft report, final report and interim work products that may be considered controversial or contentious. ATR is intended to confirm that work was done in accordance with clearly established professional principles, codes and criteria. Plan Formulation Branch will conduct all required coordination for both ATR and Independent External Peer Review (task below) with the Planning Center of Expertise.

3.6. Independent External Peer Review (IEPR)

In accordance with Section 2034 of the Water Resources Development Act of 2007 (P.L. 110-114), independent External Peer Review shall be conducted for all projects with an estimated total cost of greater than \$45M dollars. We fully expect that the total project costs for this project will be in excess of this amount. EPR by independent subject matter experts outside the Corps is a requirement for decision documents. EPR will be conducted to identify, explain, and comment upon assumptions that underlie economic, engineering, and environmental analyses, as well as to evaluate the soundness of models and planning methods.

4. Additional Quality Control Measures

In addition to the steps described above, three quality control meetings will be held during the course of the study. The purpose of these meetings will be for the Branch Chiefs and other team members to gain an understanding of what the study team has produced and provide comments and raise issues at the appropriate time. The review team members will provide their written comments on the main report at this time. The three briefings are:

Without-Project Conditions;

With-project conditions; and

Alternative Selection (Note, this briefing will also include participants from NAD, HQUSACE, the non-federal sponsor, and federal and state environmental agencies).

5. Approval of Quality Control/Internal Technical Review Plan

Approval of the quality control/internal technical review plan will be done concurrently with the approval of the Project Management Plan. Each person who is named in this plan as a reviewer or alternate will provide their acknowledgment of this responsibility on the attached form.

**QUALITY CONTROL REPORT
NEW YORK DISTRICT - PLANNING DIVISION
BYRAM RIVER BASIN, CONNECTICUT & NEW YORK**

1. I certify that the study and project review was performed and that the study and recommended project meet all Corps regulations and requirements related to water resources planning.

Planning Review Team

Chief, Engineering Division Date

Chief, Environmental Analysis Branch Date

2. I certify that the study and project review process required to be performed under my responsibility has been completed and the subject study and recommended project meet all Corps regulations, requirements and customer expectations.

Chief, Plan Formulation Branch Date

**STUDY REVIEW CERTIFICATION
PLANNING DIVISION
BYRAM RIVER BASIN, CONNECTICUT & NEW YORK**

1. I certify that the study and project review process required to be performed under my responsibility has been completed and that the study and recommended project meet all Corps regulations, requirements, and customer expectations.

Chief, Planning Division Date

Chief, Engineering Division Date

Chief, Real Estate Division Date

District Counsel Date

Colonel, Corps of Engineers Date Date
District Engineer

**QUALITY CONTROL PLAN
NEW YORK DISTRICT - PLANNING DIVISION
OVERVIEW, BASIC CONCEPTS AND APPLICABILITY**

I. Quality Control Plan Overview

This Quality Control Plan (QCP) has broad application to most of the New York District Planning Division General Investigations (GI) functions. This QCP may be expanded, contracted, or otherwise modified based on the risk, cost, complexity and uniqueness of the effort being undertaken. However, this model and each variation is expected to:

- A. Explain the concept of how the QCP is integrated with and complements existing structures such as the Project Review Board and existing management tools such as Project Management Plans (PMPs) without usurping the functional responsibilities of PM's, TM's, or their chains of command.
- B. Establish a concept and process for identifying a specific set of assignments for an independent Technical Review Team not directly involved in the production of the work products to participate in the life-cycle progress of the study/project.
- C. Provide a "checklist" or similar tool to aid the Technical Review Team in their mission of assuring that significant items and issues are not overlooked.

II. Basic Quality Control Concept

Quality control is assured by a multi-discipline, multi-layer, life-cycle approach. Successful Planning products are the result of the insights and expertise of a diverse array of professionals, including the active participation of local sponsors and representatives from other pertinent agencies. Work efforts are conducted either by A-E, other districts or by in-house technical staff. If the primary technical work is conducted outside the District, one layer of review will take place by the contractor before transmission the report is transmitted to the New York District.

The District Study/Project Team members will conduct a second layer review of the contractor's work products. The next layer of review involves the Group Leaders or Section Chiefs of the Study Team members to assure some degree of completeness, correctness, and consistency since a portion of the functional responsibility for the end-product lies with the technical worker's first line leader or supervisor. This first-line supervisor is intimately involved in the progress of the effort and will not serve as the Technical Review Team Member for his/her discipline. Branch Chief and Division Chief level (overview/policy) reviews are also conducted and they tend to exhibit a greater degree of independence and objectivity than previous layers since they are not involved in the day-to-day production activities. This layer is routinely accomplished as Division Chiefs provide PRB recommendations and approvals. This QCP establishes a separate, independent Review Team as specified on a subsequent page.

The Quality Control Team (QCT) participates in the entire life-cycle of the study/project:

1. The QCT contributes to and reviews the PMP at its inception.
2. QCT provides an intermediate review as major interim products/decision are reached.
3. Specific interim points requiring QCT review are:
 - i)Definition of without-project conditions:
 - ii)Definition of with-project conditions
 - iii)Alternative Formulation and screening of alternative plans.
4. The QCT will provide a thorough review of Draft and Final products and identify and resolve problems in conjunction with the Study Team before recommending PRB approval. Written comments from the QCT will be addressed to the Study Team for resolution. These comments are compiled as part of the Quality Control Report to indicate the issues and concerns which were raised and addressed along the course of the study. Unusual issues or conflicts which cannot be resolved by the Study and Review Teams may be addressed to an appropriate resource in SAD for guidance.

III. Responsibility

The Review Team is required to certify the results of their review as indicated on the enclosed Certification Form within the Quality Control Report.

Study Team members, Technical Managers, Project Managers and Functional Chiefs still retain responsibility for the quality and timely execution of study / project tasks in accordance with milestones, costs and commitments as identified in the PMP. The Review Team provides ancillary quality control, not replacement of existing responsibility for technically accurate, high-quality work products.

IV. Technical Review Team

The Technical Review Team will focus on:

- A. Assumptions.
- B. Methods, procedures and material used in the analysis based on the study /project scope.
- C. Alternatives evaluated.
- D. Appropriateness of data used and level of data obtained.
- E. Reasonableness of the results, including whether the product meets the customers needs consistent with law and existing policy.

V. Checklists

A checklist for review of Feasibility Reports is enclosed in this Quality Control Plan. It is meant to be an available tool to assist the Review Team Member, not to replace his/her technical expertise or judgment.

CHECKLIST FOR REVIEW OF FEASIBILITY REPORTS

1. Has the study been conducted in accordance with and fully responsive to the study authority?
2. Is the study area, as defined, reasonable and consistent with the study authority?
3. Have the aerial extent and severity of the water-resources problems and without-project conditions been clearly documented?
4. Are current findings consistent with prior phases of study? Have intervening external factors (such as regulation changes, significant storm events, etc.) jeopardized previous logic, analyses and conclusions?
5. Have the assumptions and rationale for the without-project condition been explicitly stated and are they reasonable?
6. Are planning objectives clearly identified?
7. Were the views of non-federal interests solicited and considered in the plan formulation process?
8. Have all reasonable structural and non-structural plans, including a no-action plan, been considered? Do they fully address the identified problems and needs?
9. Was the plan formulation analysis conducted in accordance with accepted techniques and appropriate guidelines and regulations?
10. Was the environmental work conducted in accordance with appropriate techniques, guidelines and regulations?
11. Was the economic/benefit analysis conducted in accordance with accepted techniques, guidelines and regulations?
12. Has the NER plan been identified? Is it the selected/recommended plan?
13. For environmental restoration efforts, was a cost effectiveness and incremental analysis accomplished? Was resource significance defined?
14. Is there a rationale for a locally-preferred plan or non NER recommended plan?
15. Does the recommended plan meet the customer's needs and has the position of the sponsor been explicitly conveyed?
16. Have upstream and downstream effects of the recommended plan been identified?
17. Have all known benefits been included in the benefit estimate? Have high-priority benefits been identified?
18. Have economic methodologies and assumptions been explained in sufficient detail?
19. Is the evaluation of each alternative based on the difference between the without-project and with-project conditions?
20. Have risk and uncertainty been addressed in accordance with ER 1105-2-101?
21. Has the necessary coordination been conducted and documented in accordance with the National Environmental Policy Act of 1969 (NEPA) and ER 200-2-2?
22. Have HTRW considerations been addressed?
23. Is the proposed project recommendation consistent with current administration policies?
24. Does the over-all Planning report adequately display study assumptions, and findings, as well as and clearly represent a firm basis for the recommendation?

VI Planning Review Team Assignments

Standing assignments for the most common planning products have already been in place within Planning Division with a plan formulation technical specialist and a regional economist already fulfilling this quality control function. The plan for independent review of environmental products is to have a senior environmentalist/archaeologist with significant Corps experience, but with little or no involvement in working on the specific study's day-to-day activities. Specific team member names will be provided at the inception of the study as Study Team and Review Team members are identified. Review team assignments for technical support outside of Planning Division must be provided by those other offices at the appropriate time.

**QUALITY CONTROL REPORT
 NEW YORK DISTRICT - PLANNING DIVISION
 BYRAM RIVER BASIN, CONNECTICUT & NEW YORK**

Quality Control Report Overview

This report synthesizes the Quality Control and Review Process to be employed during the conduct of the Byram River Basin feasibility study. In light of the changes in review functions on the Division and Headquarters levels in recent years, the responsibility for review of technical products rests with the District. Each operating Division in the District has developed its own functional procedures and identified its own study Team and Review Team members for quality control of its areas of technical expertise.

Study Team and Review Team Assignments

Discipline	Study Team Member (Name)	Review Team Member (Name)
Plan Formulation / Report Preparation	Project Planner	
Economic Analyses	Planning Economist	
Cultural Analysis	Planning Archeologist	
Environmental Analysis	Planning Biologist	
Real Estate	R.E. Specialist	
H&H	Hydraulic Engineer	
Prelim. Layout/Design	Design Engineer	
Geotechnical	Geotechnical Engineer	
Cost Estimating	Cost Engineer	

**QUALITY CONTROL REPORT
 NEW YORK DISTRICT - PLANNING DIVISION
 BYRAM RIVER BASIN, CONNECTICUT & NEW YORK**

Documentation of Technical Review Process

Meetings Attended by Review Team

Date	Review Team Member	Issue MFR Attached
1.		
2.		
3.		
4.		

Review Team Comments for Interim and Final Submittals

Date	Review Team Member	Issue MFR Attached
1.		
2.		
3.		
4.		

**Additional Comments Attached
 Key Items Addressed by Review Team**

- a) Validity of technical assumptions
- b) Methods and procedures used in the analyses
- c) Reasonable alternatives were addressed
- d) Appropriateness of data used
- e) Reasonableness of the results and responsiveness to customer needs

If a formal checklist has been used by the reviewer, it is attached.

**QUALITY CONTROL REPORT
NEW YORK DISTRICT - PLANNING DIVISION
BYRAM RIVER BASIN, CONNECTICUT & NEW YORK**

Certification by Review Team Members

I certify that the study and review process required to be performed under my responsibility has been completed and the technical work is generally in accord with Corps regulations, standard report requirements and customer expectations.

Review Team Member Date

**QUALITY CONTROL REPORT
NEW YORK DISTRICT - PLANNING DIVISION
BYRAM RIVER BASIN, CONNECTICUT & NEW YORK**

Endorsement by Office Chiefs

My staff and I have reviewed the report and the recommendations of the Study and Review Teams. I endorse the report and recommend its signature by the District Engineer and its continued processing through the Corps approval process.

Chief, Planning Division

Chief, Engineering Division

Chief, Real Estate

Office of Counsel

Byram River Basin Flood Risk Management Feasibility Study
August 2012
Project Management Plan Errata Sheet

1) Real Estate Studies Resource Allocation

- Task 6.4 Gross Appraisal task is currently budgeted for \$50,000, which is allocated:

\$25,000	Town of Greenwich
<u>\$25,000</u>	<u>ACOE</u>
\$50,000	Total

Task 6.4 Gross Appraisal resource allocation should be updated to:

\$35,000	Town of Greenwich
<u>\$15,000</u>	<u>ACOE</u>
\$50,000	Total

2) Real Estate Studies Resource Allocation

-Task 6.5 Prepare Real Estate Plan is currently budgeted for \$35,000, which is allocated:

\$27,000	Town of Greenwich
<u>\$ 8,000</u>	<u>ACOE</u>
\$35,000	Total

Task 6.5 Prepare Real Estate Plan resource allocation should be updated to:

\$12,000	Town of Greenwich
<u>\$ 23,000</u>	<u>ACOE</u>
\$35,000	Total

The text of Task 6.5 will be revised to clarify that ACOE is responsible for producing the Real Estate Plan, and the Town of Greenwich will assist through data collection efforts for this task.

3) Engineering Tasks – Clarification of Process. The following text will be added to the end of introductory paragraph to Section 2. Engineering Analysis and Design:

Work identified to be performed by a Local Sponsor (TOG) will be subjected to quality control standards as if it were accomplished by an Architect/Engineer regardless of whether the Local Sponsor performs the work with in-house resources or through an A/E. In either case the Local Sponsor is responsible to manage their services and products.

The PMP identifies those tasks that will be performed by the Local Sponsor. If the Local sponsor decides to hire a Architect/Engineer to perform any portion of their identified work the local sponsor shall be responsible for the management of the AE performed work. The PMP identifies In-Kind sub-product and interim product submissions along with the technical references and assumptions used to generate the Level Of Effort estimate.

Prior to the actual start of a task, the Corps will issue a Scope of Work to the Local Sponsor. The SOW shall describe the activities that shall be accomplished for the development of the product along with the background information, assumptions, Corps' regulations/guidance that shall be

used to complete the task and submission requirements along with their respective milestone dates.

The Local Sponsor is responsible for responding to comments generated by the review process (meetings and review submissions (DQC, ATR, etc.) and for addressing/updating their products as necessary in response to the comments.