**Stephenson Design Group, LLC**
**Civil Engineering – Strategic Planning – Municipal Services**

March 15, 2011

Secretary Richard K. Sullivan Jr.
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Attn: Rick Bourré, Assistant Director

RE: Environmental Notification Form
Town Brook Enhancement Project
Quincy, Massachusetts

Dear Secretary Sullivan:

On behalf of the City of Quincy, Stephenson Design Group (SDG) is pleased to submit three (3) copies of the Environmental Notification Form (ENF) for the proposed Town Brook Enhancement Project in Quincy for your review and consideration. This ENF represents one of the first steps on the state permitting level in the City's commitment to the revitalization of Quincy Center in an environmentally sensitive and responsible manner.

This ENF has been prepared in accordance with 301 CMR 11.06 and requires review under the Massachusetts Environmental Policy Act (MEPA) regulations as the project requires a state permit under Section 401 of the federal Clean Water Act (33 USC 1341) and the Massachusetts Clean Water Act (M.G.L. Chapter 21, Sections 26-53) (state action) in conjunction with a trigger outlined in 301 CMR 11.03(3)(b)1.b., "alteration of 500 or more linear feet of bank along a fish run or inland bank". The City of Quincy is pursuing various state and federal funding sources to pay for the construction of the project, and as the project does not trigger any EIR thresholds, MEPA broad scope jurisdiction is not applicable under 301 CMR 11.01(2)(a).

The project proposes to re-align and enhance a portion of the existing Town Brook in Quincy Center, which is conveyed primarily through an enclosed culvert. The re-aligned culvert will connect to the existing Town Brook culvert alignment upstream of Quincy Center and convey the existing flow along the south side of the Concourse Roadway Improvement project, which is currently under construction. The Town Brook flow will be diverted through approximately 1,200 linear feet of 11' wide x 6' high closed and open channel sections of culvert to the proposed connection point downstream of Quincy Center where it will rejoin the existing Town Brook alignment.

The Project is designed to provide a number of enhancements to Town Brook including enhanced hydraulic conveyance and flood control of Town Brook, additional open channel/ day-lit sections with adjacent public open space, and enhanced/expanded smelt habitat and spawning areas. The Project will also take advantage of coordination with on-going construction within Quincy Center and can be constructed in a cost effective manner on land already controlled by the City of Quincy.

**51 Sleeper Street – Suite 600**
**Boston, Massachusetts 02210**
**Phone. 617.695.7799 – fax. 617.254.5513**

The proposed Town Brook alignment will redirect flow from approximately 1,700 linear feet of existing culverted sections of the Brook through Quincy Center, which are substantially aged and sections of which are structurally compromised.

We anticipate that the ENF will be noticed in the next Environmental Monitor, dated March 23, 2011, commencing the 20-day public comment period ending on April 12, 2011 and the 30-day review period ending on April 22, 2011. Copies of the ENF have been distributed to the attached distribution list in conjunction with the requirements set forth in the MEPA regulations; see Appendix A of the attached ENF. I will contact MEPA staff to coordinate a site visit and public consultation as outlined in 301 CMR 11.06(2).

We have included with the ENF substantial technical documentation, including identification of a number of alternatives and a preferred alternative that have been previously reviewed at public meetings. We are hopeful that you conclude that no further MEPA review will be required for this project. We look forward to working with you through the MEPA process. If you have any question on the enclosed, or need additional information, please feel free to contact me at 617-695-7795.

Sincerely,

Jon D. Stephenson, PE, LEED AP
Principal

CC: Dennis Harrington – Planning Director, City of Quincy
Steve Chrusciel – Street-Works Development
Lucy Wildrick – Street-Works Development
Chris Lucas – Lucas Environmental, LLC
Robert Davis – Goulston & Storrs

Attachments

SDG

# TABLE OF CONTENTS

**Executive Summary**.....
- Project Name & Location
- Proponent
- Project Summary
  - Public Environmental Benefit
- MEPA Review History
- Summary of Project Impacts and Proposed Mitigation
- Anticipated Permits and Approvals
- Project Phasing, Schedule and Cost
- Consistency with Local and Regional Plans and Public Process
  - Massachusetts Wetlands Protection Act (WPA)
  - Massachusetts Stormwater Standards
  - City of Quincy – NPDES Ph II MS4 General Permit (MAR041081)
  - City of Quincy Urban Revitalization and Development Plan
  - City of Quincy – Quincy Center Historic District Design Guidelines
  - City of Quincy – Quincy Center Historic District
  - Land Disposition Agreement
  - Metropolitan Area Planning Council
    - MetroFuture Regional Plan
  - The Commonwealth of Massachusetts Sustainable Development Principles
- Summary of Alternatives

**Environmental Notification Form**.....

**Chapter 1 – Project Description**.....
- Introduction
- Project Description
- Existing Conditions
  - Town Brook History & Town Brook Flood Control Projects
  - Rainbow Smelt (*Osmerus mordax*) Habitat
- Land Use Context and Zoning
- Wetland Resources and Waterways
  - Existing Conditions of Wetlands and Waterways
  - Proposed Impacts to Wetlands and Waterways
- Soil and Groundwater Conditions
- Historic and Archaeological Resources
- Open Space and Landscaping
  - Proposed Open Space
  - Proposed Landscaping
- Sustainable Design Features
  - Commonwealth of Massachusetts Sustainable Development Principles

- Habitat Enhancements
- Water Quality Enhancements
- Public Outreach

**Chapter 2 – Alternatives Analyses.....**

- Introduction
- Description and Comparison of Development Alternatives
  - 1. Flood Control
  - 2. Underground Conflicts
  - 3. Property Constraints (Property Control)
  - 4. Open Channel/Public Amenity
  - 5. Enhancement Smelt Fisheries Habitat
  - 6. Consistency With URDP
  - 7. Construction Scheduling and Phasing
  - 8. Cost
  - 9. Environmental Enhancements
  - 10. Code Compliance
- Town Brook Culvert Alignment Alternatives
- No-Build Alternative
  - No-Build – Evaluation Metrics Analysis
  - No-Build – Identified Constraints
  - Conclusion
- Rebuild Culvert Along Current Alignment
  - Rebuild Culvert along Existing alignment – Evaluation Metrics Analysis
  - Rebuild Culvert along Existing alignment – Identified Constraints
  - Conclusion
- Alternative A – North Side of Concourse 1
  - Alternative A – Evaluation Metrics Analysis
  - Alternative A – Identified Constraints
  - Conclusion
- Alternative B – North Side of Concourse 2
  - Alternative B – Evaluation Metrics Analysis
  - Alternative B – Identified Constraints
  - Conclusion
- Alternative C – South Side of Concourse (Preferred)
  - Alternative C – Evaluation Metrics Analysis
  - Alternative C – Identified Constraints
  - Conclusion
- Alternative D – Ross Way to Clivedon
  - Alternative D – Evaluation Metrics Analysis
  - Alternative D – Identified Constraints
  - Conclusion
- Alternative E – Adjacent to MBTA Retaining Wall
  - Alternative E – Evaluation Metrics Analysis
  - Alternative E – Identified Constraints
  - Conclusion

- Alternative F – Clivedon/Hancock
  - Alternative F – Evaluation Metrics Analysis
  - Alternative F – Identified Constraints
  - Conclusion
- Alternative G – Cottage Avenue Extension
  - Alternative G – Evaluation Metrics Analysis
  - Alternative G – Identified Constraints
  - Conclusion
- Conclusion

**Chapter 3 – Wetlands.....**
- Introduction
- Existing Resources
  - Resource Areas
    - Bank – 310 CMR 10.54 WPA
    - Land Under Water Bodies and Waterways – 310 CMR 10.56 WPA
    - Bordering Land Subject to Flooding – 310 CMR 10.57 WPA
    - Riverfront Area – 310 CMR 10.58 WPA
  - Wildlife Habitat and Rare Species
- Required Permits and Regulatory Compliance
  - Order of Conditions
  - Section 401 Water Quality Certification
  - Section 404 Federal Permit – Category 2
  - National Pollutant Discharge Elimination System Construction General Permit
- Project Related Impacts to Wetland Resource Areas
  - Wetland Impacts
    - Bank
    - Land Under Water Bodies and Waterways
    - Bordering Land Subject to Flooding
  - Buffer Zone Impacts
  - Riverfront Area Impacts
  - Wetland Impact Alternatives
- Proposed Wetland Mitigation
  - Bank
  - Land Under Water Bodies and Waterways
  - Bordering Land Subject to Flooding
  - Riverfront Area
  - Habitat Enhancements – Wildlife & Fisheries

**Chapter 4 – Wildlife & Fisheries**.....
- Introduction
- Existing Habitat – Wildlife & Fisheries
  - Wildlife
  - Fisheries
    - Smelt Life History & Study
- Project Related Impacts to Wetland Resources
  - Wildlife
  - Fisheries
- Proposed Habitat Enhancements
- Massachusetts Stream Crossing Guidelines
- Related Projects
  - Flow Restoration in Town Brook

**Chapter 5 – Stormwater and Flood Control**.....
- Introduction
- Existing Town Brook Alignment
  - Materials
  - Low Base Flow
  - Peak Flow
  - Hydraulic Capacity
- Previous Studies
  - Report to Commonwealth of Massachusetts District Commission on Flood Control Systems for Town Brook, Quincy and Braintree
  - Town Brook Local Protection design Memorandum No's 1 and 5
- Proposed Town Brook Alignment
  - Materials
  - Design Storm
  - Hydrology
  - Design Flows
  - Hydraulics
  - Floodplain Information
- Related Project – Flow Restoration in Town Brook
- Stormwater Management Policy Compliance
  - Stormwater Management Standards & Guidelines
  - Operations and Maintenance
    - Culvert and Low Flow Channel
    - Rain Garden
- Conclusion

**Chapter 6 – Soil and Groundwater Conditions (Haley & Aldrich)**.....
- Introduction
- Overview of Site Conditions
- Topography
- Geology, Hydrogeology, and Subsurface Conditions
- Limits & Extents of Known Contaminants

- Contaminated Soil & Groundwater Protocol
- Foundation/Base Recommendations
- Excavation and Excavation Support

**Chapter 7 – Construction Period Impacts.....**
- Introduction
- Construction Phasing
- National Pollutant Discharge Elimination System
  - Spill Prevention Control & Countermeasures
    - Material and Waste Inventory
    - Good Housekeeping Program
  - NPDES Inspection and Record Keeping Requirements
- Best Management Practices
  - Stormwater Management Controls
    - Potential Impacts for Stormwater Contamination
    - Avoidance and Minimization of Stormwater Impacts
    - Protection of Smelt Habitat
- Construction Period Impacts and Mitigation Measures

**Chapter 8 – Mitigation.....**
- Introduction
- Wetlands
  - Bank
  - Bordering Land Subject to Flooding
  - Land Under Waterbodies and Waterways
  - Riverfront Area
  - Habitat Enhancements – Wildlife & Fisheries
- Stormwater Management
  - Water Quality
  - Flood Control & Hydraulic Conveyance
- Soil and Groundwater Conditions
- Construction Period Impacts
- Mitigation Summary

**Appendices.....**
A. Distribution List
B. Hydrology and Hydraulics
C. Town Brook Flood Control Project History
D. Wildlife Habitat Evaluation Under WPA
E. MEPA/Permitting Correspondence
F. DVD of Town Brook Video

**List of Tables**.....

**Executive Summary**
Table E.1 Anticipated Permits and Approvals

**Chapter 1 – Project Description**
Table 1.1 Summary of Existing and Proposed Resources within Study Area
Table 1.2 Summary of Proposed Enhancement Alterations Within Existing Resource Areas
Table 1.3 Subsurface Strata Summary
Table 1.4 Soil Conditions at Proposed Inverts
Table 1.5 Public Outreach Summary

**Chapter 2 – Alternatives Analyses**
Table 2.1 Evaluation Metrics Ratings
Table 2.2 Existing Town Brook Segments

**Chapter 3 – Wetlands**
Table 3.1 Existing Town Brook Segments
Table 3.2 Anticipated Permits and Approvals
Table 3.3 Summary of Existing and Proposed Resources within Study Area
Table 3.4 Summary of Proposed Enhancement Alterations Within Existing Resource Areas
Table 3.5 Summary of Riverfront Area Impacts (square feet)

**Chapter 5 – Drainage and Flood Control**
Table 5.1 Existing Town Brook Segments
Table 5.2 MDC Study - Town Brook Tributary Areas
Table 5.3 MDC Study - Town Brook Peak Rates of Runoff
Table 5.4 USACOE Town Brook Peak Rates of Runoff
Table 5.5 Proposed Town Brook Segments
Table 5.6 Precipitation Intensity/Duration
Table 5.7 Town Brook Watershed Basin Data
Table 5.8 Town Brook Enhancement Study Peak Flows

**Chapter 6 – Soil and Groundwater Conditions**
Table 6-1 Surface Topography Summary
Table 6-2 Subsurface Strata Summary
Table 6-3 Soil Conditions at Proposed Inverts

**List of Figures**

**Chapter 1 – Project Description**

Figure 1.1.1 Project Location Map – USGS Topographic Map
Figure 1.1.2 Project Location Map – Aerial Photograph
Figure 1.2.1 Existing Town Brook Culvert Alignment
Figure 1.2.2 Existing Town Brook Segment Summary
Figure 1.3.1 Existing Site Photographs – Key Sheet
Figure 1.3.2 Existing Site Photographs
Figure 1.3.3 Existing Site Photographs
Figure 1.3.4 Existing Site Photographs
Figure 1.3.5 Existing Site Photographs
Figure 1.4.1 Existing Wetland Bank, LUWW, and BLSF Resource Areas
Figure 1.4.2 Existing Riverfront Areas
Figure 1.5 Proposed Town Brook Culvert Alignment
Figure 1.6.1 Conceptual Public Open Space Amenity Plan - Layout
Figure 1.6.2 Conceptual Public Open Space Amenity Plan & Mitigation Detail – Option 1
Figure 1.6.3 Conceptual Public Open Space Amenity Plan & Mitigation Detail – Option 2
Figure 1.7 Proposed Town Brook Culvert Alignment With URDP Building Program
Figure 1.8 Conceptual Open Space Amenity Plan – Rendering

**Chapter 2 – Alternatives Analyses**

Figure 2.1 Town Brook Alignment Alternatives – Key Sheet – Existing Conditions
Figure 2.2 Town Brook Alignment Alternatives – Key Sheet – Proposed Building Program
Figure 2.3.1 Quincy Center City Controlled Parcels
Figure 2.3.2 Quincy Center City Controlled Parcels – Alignment Locations
Figure 2.4.1 No Build Alternative – Existing Conditions
Figure 2.4.2 No Build Alternative – Future Development Plan
Figure 2.5.1 Re-construct Culvert along Existing Alignment – Existing
Figure 2.5.2 Re-construct Culvert along Existing Alignment – Future
Figure 2.A.1 Alternative A – Existing Conditions
Figure 2.A.2 Alternative A – Future Development Conditions
Figure 2.B.1 Alternative B – Existing Conditions
Figure 2.B.2 Alternative B – Future Development Conditions
Figure 2.C.1 Alternative C – Existing Conditions
Figure 2.C.2 Alternative C – Future Development Conditions
Figure 2.D.1 Alternative D – Existing Conditions
Figure 2.D.2 Alternative D – Future Development Conditions
Figure 2.E.1 Alternative E – Existing Conditions
Figure 2.E.2 Alternative E – Future Development Conditions
Figure 2.F.1 Alternative F – Existing Conditions
Figure 2.F.2 Alternative F – Future Development Conditions
Figure 2.G.1 Alternative G- Existing Conditions
Figure 2.G.1 Alternative G- Future Development Conditions
Figure 2.S.1 Alignment Alternative Sections – Section S1-S1
Figure 2.S.2 Alignment Alternative Sections – Section S2-S2
Figure 2.S.3 Alignment Alternative Sections – Section S3-S3

Figure 2.S.4 Alignment Alternative Sections – Section S4-S4
Figure 2.S.5 Alignment Alternative Sections – Section S5-S5
Figure 2.S.6 Alignment Alternative Sections – Section S6-S6
Figure 2.S.7 Alignment Alternative Sections – Section S7-S7

**Chapter 3 – Wetlands**

Figure 3.1.1 Existing Wetland Bank, LUWW, and BLSF Resource Areas
Figure 3.1.2 Existing Riverfront Areas
Figure 3.2.1 Proposed Wetland Bank, LUWW, and BLSF Mitigation – Option 1
Figure 3.2.2 Proposed Riverfront Area Mitigation – Option 1
Figure 3.2.3 Proposed Wetland Bank, LUWW, and BLSF Mitigation – Option 2
Figure 3.2.4 Proposed Riverfront Area Mitigation – Option 2
Figure 3.3.1 Proposed Wetland Mitigation
Figure 3.3.2 Proposed Wetland Mitigation Details – Option 1
Figure 3.3.3 Proposed Wetland Mitigation Details – Option 2

**Chapter 4 – Wildlife & Fisheries**

Figure 4.1 Natural Heritage & Endangered Species Map
Figure 4.2 Existing Habitat Area

**Chapter 5 – Drainage and Flood Control**

Figure 5.1 Existing Town Brook Watershed Drainage Features
Figure 5.2 Existing Town Brook Watershed
Figure 5.3 Flood Plain and Limit of Tidal Influence
Figure 5.4.1 Existing Town Brook Culvert Alignment
Figure 5.4.2 Existing Town Brook Segment Summary
Figure 5.5 Proposed Town Brook Alignment
Figure 5.6.1 Proposed Town Brook Cross Sections – Offline Smelt Resting Pool Option
Figure 5.6.2 Proposed Town Brook Cross Sections – Inline Smelt Resting Pool Option
Figure 5.7 Mitigation Measures Details
Figure 5.8 Deep Rock Tunnel Intake Plans
Figure 5.9.1 Town Brook Drainage Basin Comparison – MDC Basin Delineation
Figure 5.9.2 Town Brook Drainage Basin Comparison – ACOE Basin Delineation

**Chapter 6 – Soil and Groundwater Conditions**

Figure 6.1 Boring Location Plan
Figure 6.2 Boring Logs

**Chapter 7 – Construction Period Impacts**

Figure 7.1 Construction Phasing Diagram

**Chapter 8 – Mitigation**

Figure 8.1.1 Proposed Mitigation Overview Plan
Figure 8.1.2 Proposed Mitigation Details – Option 1
Figure 8.1.3 Proposed Mitigation Details – Option 2
Figure 8.2 Conceptual Public Open Space Amenity Plan - Rendering

# ACRONYM TABLE

| ACRONYM TABLE | |
|---|---|
| **Abbreviation** | **Description** |
| ACEC | Area of Critical Environmental Concern |
| ANRAD | Abbreviated Notice of Resource Area Delineation |
| BLSF | Bordering Land Subject to Flooding |
| BMP | Best Management Practices |
| BRP | Bureau of Resource Protection |
| BVW | Bordering Vegetated Wetland |
| NERO | Northeast Regional Office |
| CACI | Clean Air Construction Initiative |
| CGP | Construction General Permit |
| CZM | Coastal Zone Management |
| COQ | City of Quincy |
| DCR | Department of Conservation & Recreation |
| DEIR | Draft Environmental Impact Report |
| DEQE | Department of Environmental Quality Engineering |
| EEA | Executive Office of Energy and Environmental Affairs |
| EIR | Environmental Impact Report |
| EM | Environmental Monitor |
| ENF | Environmental Notification Form |
| EPA | Environmental Protection Agency |
| FEIR | Final Environmental Impact Report |
| GPD | Gallons per day |
| HAA | Hancock Adams Associates, LLC |
| LDA | Land Disposition Agreement |
| LE | Lucas Environmental, LLC |
| LSF | Land Subject to Flooding |
| LUWW | Land Under Water Bodies and Waterways |
| MassDEP | Massachusetts Department of Environmental Protection |
| MDC | Metropolitan District Commission |
| M&E | Metcalf & Eddy, Inc. |
| MEPA | Massachusetts Environmental Policy Act |
| MGD | Million Gallons per Day |
| MHC | Massachusetts Historical Commission |
| MOU | Memorandum of Understanding |
| MWRA | Massachusetts Water Resources Authority |
| NHESP | Natural Heritage and Endangered Species Program |
| NOI | Notice of Intent |
| NPC | Notice of Project Change |
| NPDES | National Pollution Discharge Elimination System |

## ACRONYM TABLE

| Abbreviation | Description |
|---|---|
| NRCS | Natural Resources Conservation Service |
| OOC | Order of Conditions |
| O&M | Operation & Maintenance |
| ORW | Outstanding Resource Waters |
| QEN | Quincy Environmental Network |
| RA | Riverfront Area |
| RAO | Request for Advisory Opinion |
| SHPO | State Historic Preservation Officer |
| SDG | Stephenson Design Group, LLC |
| SWPPP | Stormwater Pollution Prevention Plan |
| SWD | Street-Works Development, LLC |
| SOC | Superceding Order of Conditions |
| USDA | United States Department of Agriculture |
| USACOE | United States Army Corps of Engineers |
| USGS | United States Geological Survey |
| URD | Urban Revitalization District |
| URDP | Urban Revitalization and Development Plan |
| WHE | Wildlife Habitat Evaluation |
| WPC | Division of Water Pollution Control |
| WQC | Water Quality Certification |

# DOCUMENT CATALOGUE TABLE

| DOCUMENT CATALOGUE TABLE | | | | |
|---|---|---|---|---|
| **Document Reference:** | **Document Title** | **Date** | **Agency** | **Notes** |
| **TB-001** | Environmental Notification Form (ENF) Town Brook Flood Control Project | Feb 24, 1981 | Proponent MDC (DCR) | Project includes: Modifications to Old Quincy Reservoir Culvert enlargement below reservoir Box culverts and an open channel to divert flood flows to a junction structure at Centre Street A relief conduit from Centre St along Burgin Pkwy to a tunnel inlet structure just north of School St. Deep Rock Tunnel |
| **TB-002** | Town Brook – Hydrologic Analysis of Floods | Dec 1979 | USACOE | Town Brook watershed analysis |
| **TB-003** | Town Brook Local Project – Feasibility Report for Water Resources Development | Sept. 1980 | USACOE | Feasibility study from dam modifications to outfall at Town River Bay |
| **TB-004** | Town Brook Local Project – Feasibility Report for Water Resources Development | Sept. 1980 | USACOE | Technical Appendices for TB-003 |
| **TB-005** | Town Brook Local Project – Reevaluation Report | March 1984 | USACOE | Evaluation of two Deep Rock tunnel alignments 3,520 LF vs. 4,060 LF, shorter has more impact on Salt marsh (longer route was constructed) |
| **TB-006** | Town Brook Local Protection Project – Design Memorandum No. 1 General Design and Hydrology | February 1985 | USACOE | Hydrologic design from Quincy reservoir to outfall |
| **TB-007** | Town Brook Local Protection Project – Design Memorandum No. 5 Hydraulics and Water Quality | July 1985 | USACOE | Hydraulic calculations to support the Deep Rock Tunnel with design tailwater elevations |
| **TB-008** | Town Brook Local Protection Project – Operation and Maintenance Manual Volume I | Sept. 2001 | USACOE | Operations and maintenance guidelines and Forms, to include the Low Flow Augmentation Protocol to increase base flow for Smelt |
| **TB-009** | City of Quincy Town Brook Culvert Repairs | No date | City of Quincy | Repairs at #95 Revere Road |
| **TB-010** | Plan of easements and fee acquisitions – City of Quincy | Feb. 1993 | MDC (DCR) | Easement Drawings for the Deep Rock Tunnel – 4 sheets |
| **TB-011** | Town Brook Flood Control Project – Centre Street Culvert | June 1980 | MDC (DCR) | Centre Street junction box drawings and Burgin Pkwy. Culvert – 8 sheets |
| **TB-012** | Town Brook Flood Control Project – Burgin Pkwy Culvert | March 12, 1984 | MDC (DCR) | Burgin Pkwy Culvert drawings updated to show as-built conditions – 18 sheets |
| **TB-013** | Town Brook Flood control Project – Bigelow Street Relief Conduit | June 30, 1993 | MDC (DCR) | Bigelow Relief Conduit construction drawings– 12 sheets |

## DOCUMENT CATALOGUE TABLE

| Document Reference: | Document Title | Date | Agency | Notes |
|---|---|---|---|---|
| TB-014 | Centre St./ Crown Colony Drive Street Reconstruction – Drainage Control Structure Modification-Sections and details | March 27, 1989 | City of Quincy | Centre St. Junction Box |
| TB-015 | Town Brook Drainage Assessment Bigelow Street Relief Conduit | May 30, 2006 | City of Quincy | Evaluation of Bigelow Relief Conduit |
| TB-016 | City of Quincy Town Brook Improvements | Nov 1955 | City of Quincy | Proposed TB Culvert improvements from the American Legion Hall downstream to just past garage (Connection point of proposed culvert) |
| TB-017 | Town Brook Local Protection Project – Operation and Maintenance Manual Volume II | April 2003 | USACOE | Operation and Maintenance guidelines primarily for Quincy Reservoir Dam |
| TB-018 | Town Brook Local Protection Project, Design Memorandum No. 4, Tunnel, Conduits and Shafts, Site Geology | Oct 1986 | USACOE | Geotechnical and Groundwater data associated with each component of the project |
| TB-019 | Flood Control Systems for Town Brook – Quincy and Braintree, by Metcalf & Eddy, Inc. | March 1978 | MDC (DCR) | Investigations, studies and recommendations for efficient flood control systems for Town Brook |
| TB-020 | Order of Conditions (DEQE File No. 59-196) | March 17, 1989 | DEQE (MassDEP) | Deep Rock Tunnel Permitting |
| TB-021 | Decision on Request for Variance (DEQE File No. 59-196) | March 17, 1989 | DEQE (MassDEP) | Deep Rock Tunnel Permitting |
| TB-022 | Water Quality Certification | March 24, 1989 | DEQE (MassDEP) | Deep Rock Tunnel Permitting |
| TB-023 | Chapter 91 Waterways License No. 1978 | July 13, 1989 | DEQE (MassDEP) | Deep Rock Tunnel Permitting |
| TB-024 | Metcalf & Eddy, Inc. correspondence to DEQE related to the Waterways License | Feb. 26, 1987 | M&E | Deep Rock Tunnel Permitting, Location of proposed salt marsh restoration |
| TB-025 | Water Quality Certification (MassDEP File No. 059-0590 | Aug. 31, 1998 | DEQE (MassDEP) | Widening and Channelizing of Town Brook Channel near Bigelow Street, downstream of Washington Street |
| TB-026 | Preliminary Design of Flow Restoration in Town Brook, Quincy, MA | February 2011 | Gomez & Sullivan | Alternatives to improve Town Brook Flows at the Center Street Junction Box and the Deep Rock Tunnel Intake Area |
| TB-027 | Technical Report TR-30: Rainbow Smelt (*Osmerus mordax*) spawning habitat on the Gulf of Maine coast of Massachusetts | December 2006 | MA DMF | Detailed Report on Rainbow Smelt throughout the northeastern coast |

**References:**

Plans and Figures found in this document have utilized various sources of information in order to develop the conceptual design and to graphically depict the features shown on the plans. These sources include:

- City of Quincy
  - GIS mapping information
  - Photographs
  - Referenced reports
- Street-Works Development, LLC
  - Figures Information (including base AutoCAD files, Conceptual proposed AutoCAD files)
  - Renderings
  - Town Brook DVD (as prepared by Tunnel Vision)
  - Concourse Layout (as prepared by Tetra Tech)

# EXECUTIVE SUMMARY

## PROJECT NAME & LOCATION

Town Brook Enhancement Project
South side of Concourse Roadway Improvement Project, from just west of Parking Way to just east of Mechanic Street
Quincy, Massachusetts

## PROPONENT

City of Quincy
Quincy City Hall
1305 Hancock Street
Quincy, Massachusetts 02169

## PROJECT SUMMARY

The City of Quincy is proposing to enhance and re-align a portion of Town Brook (the Brook) within Quincy Center. The proposed re-alignment will remove perennial stream flow from approximately 1,700 linear feet of existing culverted sections of the Brook through Quincy Center, which are aged and sections of which are structurally compromised. The existing 1,700 linear feet of culvert will continue to convey collected surface runoff from the Quincy Center area (an approximately 50 acre watershed) and will eventually be decommissioned over time as stormwater improvements associated with the redevelopment of Quincy Center are implemented. Although the existing culvert will be decommissioned as part of the City's stormwater improvements associated with the Quincy Center redevelopment, existing illicit sanitary sewer connections that have been identified will be removed as part of this project.

The realignment will be made by connecting a new culvert to the existing culvert alignment at a point upstream of Quincy Center and conveying the existing flow, from west to east, along the south side of the Concourse Roadway Improvement project, which is currently under construction. This will divert Town Brook flow through approximately 1,200 linear feet of 11' wide x 6' high closed and open channel/day-lit sections of culvert to the proposed connection point downstream of Quincy Center where it will rejoin the existing Town Brook alignment. Refer to Figures 1.1.1 and 1.1.2 for the site location maps and Figures 1.3.1 through 1.3.5 for photos of the existing Town Brook.

The Project is designed to provide a number of enhancements to Town Brook to include: enhanced hydraulic conveyance and flood control of Town Brook; additional open channel/day-lit sections with adjacent public open space; enhanced and expanded smelt habitat and

spawning areas and will benefit from cost effective construction through coordination with on-going construction activities on land already controlled by the City of Quincy.

In order to effect the re-alignment, a permit will be required from the Army Corps of Engineers. A state Water Quality Certificate is required under Section 401 of the federal Clean Water Act (33 USC 1341) and the Massachusetts Clean Water Act (M.G.L. Chapter 21, Sections 26-53), for any activity requiring a federal permit that will result in a discharge to water subject to federal jurisdiction. The 401 state permit (state action) in conjunction with a trigger outlined in 301 CMR 11.03(3)(b)1.b., "*alteration of 500 or more linear feet of bank along a fish run or inland bank*" requires the filing of an Environmental Notification Form (ENF) with the MEPA office. The Town Brook Enhancement Project proposes to relocate approximately 3,640 linear feet of culverted Bank. No threshold for a mandatory EIR is triggered for this project. The City of Quincy is pursuing various state and federal funding sources to pay for the construction of the project. At the time of the filing of this document, public financing has yet to be secured, however the City of Quincy anticipates that public financing will be secured by the end of 2011. The public financing does not result in MEPA broad scope jurisdiction as the project does not trigger any EIR thresholds as outlined in 301 CMR 11.01(2)(a).

The Town Brook Enhancement Project is one of three Core Public Improvement projects that the City is undertaking to upgrade the aged infrastructure within Quincy Center in order to facilitate redevelopment under the "Quincy Center Urban Revitalization District Plan (URDP)". On December 20, 2010, the Quincy City Council approved the New Quincy Center Land Disposition Agreement (LDA) under the URDP, which was then executed on January 25, 2011 by the City and the selected redeveloper, which includes $289 million in public bond authorization to pay for infrastructure upgrades throughout the Quincy Center area. The City is currently pursuing federal and state funding opportunities to pay for the construction of the Town Brook improvements.

While the project will help facilitate redevelopment of the downtown and the Quincy Center Redevelopment Project, it is not exclusively for these purposes that its relocation needs to be accomplished and the project is beneficial and required regardless of the Quincy Center Redevelopment Project moving forward. These projects have been presented to the Secretary of Environmental Affairs in the form of a Request for Advisory Opinion letter, with the Secretary issuing an Advisory Opinion on March 4, 2011, clarifying the relationship between these projects. Refer to Appendix E for a copy of the EEA Advisory Opinion letter.

Over the past 150 years, extensive alterations to Town Brook within Quincy have taken place in an uncoordinated and piece-meal fashion, resulting in much of the Brook being conveyed in alternating enclosed and open channel sections of culvert through the City varying in size and material. Most recently the DCR and USACOE constructed coordinated flood control improvements along Town Brook to reduce flooding concerns, within areas historically prone to flooding. These improvements are detailed in Chapter 5 of this report.

The lower portion of the Town Brook watershed consists primarily of densely developed urban areas with limited water quality and water quantity control measures, which has resulted in poor water quality within the Brook and the EPA designating Town Brook as an impaired water body due to high levels of pathogens, most recently in 2006. The City is committed to improving water quality within the Town Brook watershed and will be commissioning a watershed master plan that will define water quality objectives to be addressed through public works projects and

by enforcing objectives identified in the master plan on new development and redevelopment projects within the watershed, with goals set above and beyond those requirements outlined in the Massachusetts Stormwater Standards.

Another key element to the project is the enhancement of the rainbow smelt (*Osmerus mordax*) habitat and spawning areas. Rainbow smelt are an anadromous fish, which are fish that spend a majority of their life cycle in the ocean and migrate to fresh water to spawn. The area just downstream of the project area south of Revere Road has been identified as a spawning area. This existing spawning area is comprised of an approximately 3' deep pool created by the failure of the artificial channel bottom, resulting in a channel section with reverse slope ending in a depression. As part of the project, this habitat and spawning area will be expanded and enhanced by incorporating design criteria provided by the Massachusetts Division of Marine Fisheries and detailed in Chapter 4, "Wildlife and Fisheries" of this report.

This project will improve a significant section of the Brook through Quincy Center and will establish a benchmark for future enhancements of the Brook within the City.

**Public Environmental Benefit**

By constructing the Town Brook Enhancement Project and associated mitigation, the City will improve the Town Brook by taking off-line sections of the existing culvert channel that:

- Are structurally compromised
- Are inconsistent in size, shape and material
- Are hydraulically limiting
- Are un-maintained and in poor condition
- Have limited access for maintenance
- Run through private property
- Run beneath existing buildings, allowing for the potential introduction of pollutants
- Provide little to no public amenity or benefit
- Provide little environmental benefit
- Connect to existing illicit sanitary sewer connections
- Connect to multiple untreated stormwater point discharges

The existing sections of Town Brook will be replaced with new culverted sections that provide significant benefit, which include:

- Proposed on City controlled property, allowing for construction without additional land acquisition and provide access for proper maintenance
- The construction of 185 linear feet of open channel section with adjacent public open space and public education opportunity (15% of proposed project)
- Provide design enhancements to improve and extend the smelt habitat and spawning areas
- Removal of direct untreated stormwater surface runoff point discharges from Quincy Center
- Removal of direct illicit sanitary sewer connections within the project limits
- Improve flood control and hydraulic conveyance of Town Brook within Quincy Center

- Construction using engineered reinforced concrete culvert section

In addition to the many public and environmental benefits associated with the project, the project has been identified as one of the three core public improvement projects that will facilitate the redevelopment of Quincy Center.

## MEPA REVIEW HISTORY

The City of Quincy requested an Advisory Opinion from the MEPA office associated with the installation of portions of the Town Brook Enhancement Project culvert sections in non-jurisdictional areas and where no state permits or actions would be required. This work was proposed in order to benefit from on-going construction associated with the Concourse Roadway Improvement project. The City of Quincy submitted the request in a letter dated December 3, 2010. Assistant Secretary, Alicia McDevitt, issued the advisory opinion on January 10, 2011, stating that *"the proposed construction of the dry culvert may proceed in advance of MEPA review for the larger Town Brook Enhancement Project."* This initial work will occur this spring with the remainder of the Town Brook culvert being installed after the completion of the MEPA process and the obtaining of all necessary local, state and federal permits. A copy of the Advisory Opinion can be found in Appendix E.

Although not directly related to this specific project but to the Town Brook upstream and downstream areas of the project limits, on February 24, 1981 an Environmental Notification Form (ENF) was submitted to the Secretary of the Executive Office of Environmental Affairs for the "Town Brook Flood Control Project" (EOEA No. 4033), by the Metropolitan District Commission (MDC, now the Department of Conservation and Recreation) as the project proponent. The filing proposed a number of projects as part of flood control plan for the Town Brook and at the completion of the MEPA process and local, state and federal permitting a number of the projects were undertaken by MDC and the USACOE associated with Town Brook to include:

- Centre Street Junction Box Project
- Deep Rock Relief Tunnel Project
- Burgin Parkway Culvert

These completed projects were evaluated as part of the hydrologic/hydraulic analysis prepared and submitted with this ENF. For a detailed description of these projects, refer to Chapter 5 of this report, "Stormwater and Flood Control" and Appendix C.

## SUMMARY OF PROJECT IMPACTS AND PROPOSED MITIGATION

While the project will result in many benefits to Town Brook, the project will require construction activities within resource areas regulated by the Wetlands Protection Act to include: Land Under Water Bodies and Waterways (LUWW); Bordering Land Subject to Flooding (BLSF); Bank; Fish Run; and Riverfront Area (RA). The project area is outside of tidally influenced sections of Town Brook and not located within an Area of Critical Environmental Concern (ACEC) or Outstanding Resource Water (ORW). The Proponent has committed to a series of mitigation measures as part of the project which include the following:

- Increasing the extent of open channel/day-lit sections in Town Brook, proposing 185 linear feet of open channel
- Riverfront Area enhancements – Active public open space adjacent to open channel sections of the Brook on City owned land
- Fish Run - rainbow smelt habitat enhancements
    - Design of culvert with low flow trapezoidal channel (coordinated with the DMF Centre Street Junction Box modifications to increase low base flow) to achieve a flow depth of at least 6 inches to 12 inches
    - Spawning substrate in low flow trapezoidal channel, proposed 6" diameter rounded stone substrate for smelt eggs to adhere to
    - Spawning riffles achieved by designing the culvert to achieve attraction velocities of between 1.6 and 3.2 feet per second during low base flow conditions
    - Smelt resting pools off-line and adjacent to spawning riffle sections (alternate in-line option is being reviewed)
    - Temperature mitigation - proposing shade trees adjacent to open channel sections
- Flood Control –A larger uniform culvert section (11' wide x 6' deep) is being proposed to convey the design storm event through the project area replacing the existing limiting hydraulic sections.
- Water Quality improvements – Proposed rain gardens in open space parcels on east and west sides of Mechanic Street to treat surface runoff
- Removal of illicit sanitary sewer connections within the project area
- Removal of direct untreated stormwater surface runoff from the Quincy Center Area
- Town Brook Watershed Master Plan – to be prepared in coordination with the selected developer of the URDP

These proposed mitigation items will reduce the environmental impacts associated with the project and will improve the regulated wetland resource areas associated with Town Brook. Refer to Chapter 8, "Mitigation" of this ENF, for a more detailed description of the proposed project mitigation.

Additionally, in order to mitigate the temporary construction related impacts the City is proposing these additional mitigation measures:

- Measures to reduce construction period impacts include controlling erosion and sedimentation, dust, and machinery traffic on local roadways
- Compliance with the EPA's National Pollution Discharge Elimination System (NPDES) General Permit Program for Stormwater Discharges from Construction Sites

## ANTICIPATED PERMITS AND APPROVALS

Table E.1 below summarizes the permits and approvals anticipated to be required for the project, and the status of each.

**Table E.1**
**Anticipated Permits and Approvals**

| Agency | Permit | Status |
|---|---|---|
| **Federal** | | |
| U.S. Army Corps of Engineers | Section 404 General Permit – Category 2 | To be filed upon completion of the MEPA process |
| U.S. Environmental Protection Agency | NPDES Construction General Permit | To be filed prior to the start of construction |
| **Commonwealth of Massachusetts** | | |
| Department of Environmental Protection | 401 Water Quality Certification | To be filed upon completion of the MEPA process |
| Massachusetts Environmental Policy Act | MEPA Certificate on the ENF | Filed March 15, 2011 |
| **City of Quincy** | | |
| Quincy Conservation Commission | Notice of Intent/Order of Conditions | To be filed |

## PROJECT PHASING, SCHEDULE AND COST

The anticipated cost of the project is approximately $11 million with the construction of the project planned in two primary phases. The City estimates that the construction of the initial non-jurisdictional section of the project, consisting of the installation of approximately 540 linear feet, as referenced in the Advisory Opinion Letter issued by the MEPA office on January 10, 2011, will begin in the Spring of 2011 and coordinated with the construction of the Concourse Roadway Improvement Project.

The Phase I work will in no way impact the existing Town Brook and no work will be performed within jurisdictional areas or buffer zones to those areas. This initial proposed culvert construction will be installed "dry" as no connection to the existing Town Brook at either the upstream or downstream locations is proposed prior to receiving all necessary permits. The Phase I construction will in no way preclude the implementation of any mitigation measures or alternatives that reduce project impacts as part of the final construction.

Phase II will consist of the remaining approximately 660 linear feet of closed and open channel sections of culvert and will be constructed after the completion of the MEPA process and

approval of all necessary local, state and federal permits. The City currently anticipates Phase II to commence in the Summer of 2012. The Phase II work will include the upstream and downstream connection points to Town Brook and all proposed work within jurisdictional areas and buffer zones.

## CONSISTENCY WITH LOCAL AND REGIONAL PLANS AND PUBLIC PROCESS

The following section describes how the project is consistent with local, regional and state land use plans and policies.

### Massachusetts Wetland Protection Act (WPA)

The existing Town Brook is regulated under the Massachusetts Wetlands Protection Act and the City of Quincy Wetlands Protection Regulations & Ordinance. The inland resource areas associated with Town Brook include Bank, Land Under Water Bodies and Waterways, and Riverfront Area along the open channel sections. Banks and Land Under the Water Bodies and Waterways that underlie Anadromous or Catadromous Fish Runs are also regulated under the WPA. Additionally, according to the May 16, 2006 FEMA Flood Insurance Rate Map for the City of Quincy, Community Panel Numbers 255219-0057D, 255219-0019D, and 255219-0076D, Town Brook contains the 100-year (BLSF) and 500-year flood, with a small area of surface flood plain adjacent to the open channel section of Town Brook on parcel D91 (currently occupied by the American Legion). The lower reaches of Town Brook are tidally influenced and outside the project area and the Massachusetts Coastal Zone. The limit of tidal influence is just downstream of Elm Street, according to the FIS, which is approximately 2,000 linear feet downstream of the proposed connection point.

The project will greatly enhance the conditions of Town Brook through the proposed re-alignment of the existing channel, by day-lighting a segment of the proposed Brook substantial riverfront area will be created. Impacts are proposed to several resource areas including Bank and LUWW as the degrading culvert will be deconstructed over time after the new alignment is installed. The existing culvert provides little value to Bank, LUWW, RA, and fisheries except to provide flood control as a conveyance structure. RA and fisheries will realize significant improvements and a portion of Town Brook will be day-lighted providing enhancements to the resources Bank, LUWW, and Fish Run.

The project is in compliance with all applicable performance standards under the WPA and the Quincy Ordinance. Chapters 3 and 4 of the ENF Report detail the compliance with the applicable standards and document the enhancements and improvements proposed to the Town Brook and fisheries. Overall, the project will provide a benefit to Town Brook and fisheries habitat for rainbow smelt.

**Massachusetts Stormwater Standards**

As part of the Project, there will be limited proposed land development activities associated with the creation of public open space adjacent to the open channel/day lit segments of the Brook at the downstream end of the project. Low impact development stormwater features will be provided on the public open space to handle surface runoff from the proposed landscaped and hardscaped areas. The City has reviewed the project for compliance with the standards. A summary of compliance with the ten stormwater standards is provided in Chapter 5.

**City of Quincy – NPDES PH II MS4 General Permit (MAR041081)**

Although the project does not propose any significant alteration of ground cover, or creation of new stormwater collection and treatment facilities, the project proposes to remove known illicit sanitary sewer connections into the Brook consistent with the goals outlined in illicit discharge detection and elimination program outlined in the permit.

**City of Quincy Urban Revitalization and Development Plan**

The City of Quincy Urban Revitalization and Development Plan was adopted in 2007. It sets forth the City's vision and strategy for the redevelopment of Quincy Center. The City has recently made strides in the advancement of the redevelopment of Quincy Center with identification of a selected developer and the City Council approval of the "New Quincy Center Land Disposition Agreement" on December 20, 2010 under the URDP.

In addition to the environmental benefits outlined in the report, the Town Brook Enhancement Project will address key goals of the URDP which include:

- Creation of *"numerous pockets of public space to beautify the Project Area and provide places for residents and shoppers to enjoy"*. The project includes the creation of public open space adjacent to the open channel/day-lit sections of the Brook on the south side of the Concourse.

**City of Quincy – Quincy Center District Design Guidelines**

The project has been reviewed for consistency with the City of Quincy's "Quincy Center District – Design Guidelines", as amended through October 2010. The guidelines outline development goals associated with redevelopment within Quincy Center. Specifically relevant to this project are goals to "*daylight some limited sections of the Town Brook, if feasible and practical*" and "*create additional smaller squares that serve as significant public spaces and attract people to different parts of the center*".

The preferred alignment achieves both of these goals by providing open channel/day-lit sections where feasible, with grading and land uses and providing public open spaces adjacent

to these open channel sections. The open space will be developed in accordance with the "Sustainability" section of the guidelines.

Additionally the project will adhere to the relevant sustainability principles outlined in the document.

**City of Quincy – Quincy Center Historic District**

Both the existing and proposed culvert alignments cross through the Quincy Center Historic District, which generally overlays the parcels along the east and west sides of Hancock Street. As the proposed culvert passes through the Historic District it is well below grade and no permanent grade alteration or impact to structures or surface features within the district is proposed as part of the project.

The City has met with the Quincy Historical Commission, who at their February 28, 2011 regularly scheduled meeting found that *"Pursuant to Chapter 40C of the General Laws of the Commonwealth of Massachusetts and the Historic District Ordinance of the City of Quincy, the Quincy Historical Commission hereby issues a Certificate of Non-Applicability with respect to the Town Brook Enhancement Project."*

A copy of the determination can be found in Appendix E.

**Land Disposition Agreement**

On December 20, 2010, the Quincy City Council approved the New Quincy Center Land Disposition Agreement under the URDP which includes $289 million in public bond authorization to pay for the construction of the Town Brook Enhancement Project and the other Core Public Improvement projects. The City is currently pursuing additional federal and state funding sources to pay for the construction of these improvements.

The LDA was then fully executed by the City and the selected developer on January 25, 2011. Under the Urban Revitalization and Development Plan the City is empowered to dispose of public land in order to stimulate economic development within the City. With the City entering into the LDA with a selected developer, the City is responsible for the enhancement and relocation of Town Brook, as described in this document, and fulfills one of the City's obligations outlined in the LDA.

**Metropolitan Area Planning Council**

The Metropolitan Area Planning Council developed the following MetroFuture Regional Plan in 2009. The following summarizes the goals and objectives of the plan.

## MetroFuture Regional Plan

MetroFuture represents a new way of planning for the future. It is based on an understanding that Metro Boston is an interconnected system: regional trends shape local conditions, and every local decision has a broader impact on our regional well-being. MetroFuture distinguishes itself by the fact that it is comprehensive, regional, and long-range. It embodies a forward-thinking, unified understanding of how different issues relate to each other, and how each municipality has a role to play in building a brighter future. The scale and complexity of the region's challenges make it clear: making a Greater Boston Region requires a transformative plan, a sustainable plan that will improve equity among our residents, strengthen the economy, protect the environment, and improve our quality of life. MetroFuture is that plan. At its heart are new patterns of growth and development that help to create choices and conserve resources. People would have more housing options and different ways to get around. The region would use less energy and water, and would spend less money extending infrastructure to new developments. The region's communities would be more sustainable as well, with stronger municipal finances and high quality education in every city and town. The changes necessary to achieve this plan will not come easily—or cheaply—but the costs of inaction are too high to let current trends continue.

The City of Quincy continues to participate in the MetroFuture Regional Plan. The detailed goals for development and preservation, and specific strategies to equitably distribute the benefits and burdens of growth assist City planners in their efforts. Perhaps the most important "product" of MetroFuture is the constituency of over 5,000 "plan builders" who helped to design MetroFuture and who are committed to its implementation.

As the enhancement and relocation of Town Brook is located in the center of a future redevelopment area, any design of the new alignment must consider these goals. As such, the MetroFuture Plan details 13 implementation strategies for future development. Several of these strategies tie directly into the Town Brook Enhancement project and include, 5) Enable Compact Growth, 6) Improve City Life, and 13) Conserve Natural Resources. Further detail of consistency with the MetroFuture Plan is detailed in Chapter 1.

## The Commonwealth of Massachusetts Sustainable Development Principles

The Commonwealth of Massachusetts Sustainable Development Principles declare that care for the built and natural environment should be considered via sustainable development through integrated energy and the environment, housing and economic development, transportation and other policies, programs, investments, and regulations. The Commonwealth encourages the coordination and cooperation of all agencies, investment of public funds in smart growth and equitable development, giving priority to investments that will deliver good jobs and good wages, transit access, housing, and open space, in accordance with several sustainable development principles. Furthermore, the Commonwealth seeks to advance these principles in partnership with regional and municipal governments, non-profit organizations, business, and other stakeholders.

The Town Brook Enhancement Project adheres to and promotes consistency with the sustainable design principles for the following: 1) Concentrate Development & Mix Uses, 4)

Protect (or Restore) Land and Ecosystems, and 5) Use Natural Resources Wisely. Further detail of consistency with the Commonwealth of Massachusetts Sustainable Development Principles is provided in Chapter 1.

## SUMMARY OF ALTERNATIVES

The City has gone through an extensive process in order to evaluate and determine a preferred alignment for the Town Brook Enhancement Project. As part of the evaluation process the City involved qualified City staff, consultants, members of the development team, and members of the Quincy Environmental Network (QEN), a local environmental advocacy group, to solicit relevant input as to the appropriate alignment and design enhancements associated with the project.

As part of the evaluation process the City evaluated seven (7) potential alignments (A through G) as well as the No-Build alternative and an alternative to re-build the culvert along its current alignment, for a total of nine (9) alternatives. In order to evaluate each of the alternative alignments, the project team developed ten (10) evaluation criteria:

1. Flood Control
2. Underground Conflicts
3. Property Constraints (Property Control)
4. Open Channel/Public Amenity
5. Enhance Smelt Fisheries Habitat
6. Consistency with URDP
7. Construction Schedule & Phasing
8. Cost
9. Environmental Enhancements
10. Code Compliance

In order to determine the preferred alternative, the nine alternatives to be considered were evaluated using the ten metrics and ranked from 1 through 9 subjectively based on the how the alternatives met the metrics, with a ranking of 9 being the best alternative for that metric and 1 being the worst. For evaluation criteria which were either a "go" or "no-go", a rating of 9 was applied to the alternative to document compliance with the metric and 1 documenting non-compliance with the metric. This methodology is a variation of the "Electre Method" for evaluating alternatives. In this evaluation of alternatives all the evaluation criteria were weighted evenly, although the Electre method algorithm allows each evaluation metric to be weighted differently. The City determined that all metrics be weighted evenly.

Through this evaluation process, the preferred alignment was determined. A detailed summary of the alternatives analysis is found in Chapter 2.

**Commonwealth of Massachusetts**
**Executive Office of Energy and Environmental Affairs**
**MEPA Office**

# ENF Environmental Notification Form

| *For Office Use Only*<br>*Executive Office of Energy & Environmental Affairs* |
|---|
| EEA No.:<br>MEPA Analyst:<br>Phone: 617-626- |

The information requested on this form must be completed to begin MEPA Review in accordance with the provisions of the Massachusetts Environmental Policy Act, 301 CMR 11.00.

| | | |
|---|---|---|
| Project Name: **Town Brook Enhancement Project** | | |
| Street: **Between Parking Way and Revere Road** | | |
| Municipality: **Quincy** | Watershed: **Boston Harbor** | |
| Universal Tranverse Mercator Coordinates:<br>**4679165(N) – 334890(E)** | Latitude: **42° 14' 50" N**<br>Longitude: **71° 00' 05" W** | |
| Estimated commencement date: May 2012 | Estimated completion date: November 2012 | |
| Approximate cost: $11,000,000 | Status of project design: 25%complete | |
| Proponent: City of Quincy – c/o Dennis Harrington – Planning Director | | |
| Street: 1305 Hancock Street | | |
| Municipality: Quincy | State: MA | Zip Code: 02169 |
| Name of Contact Person From Whom Copies of this ENF May Be Obtained:<br>Jon D. Stephenson, PE, LEED AP | | |
| Firm/Agency: Stephenson Design Group | Street: 51 Sleeper Street – Suite 600 | |
| Municipality: Boston | State: MA | Zip Code: 02210 |
| Phone: 617-695-7795 | Fax: 617-254-7721 | E-mail:jstephenson@sdg-eng.com |

Does this project meet or exceed a mandatory EIR threshold (see 301 CMR 11.03)?
☐Yes ☒No

Has this project been filed with MEPA before?
☐Yes (EOEA No._____) ☒No

Has any project on this site been filed with MEPA before?
☐Yes (EOEA No._____) ☒No

Is this an Expanded ENF (see 301 CMR 11.05(7)) requesting:

| | | |
|---|---|---|
| a Single EIR? (see 301 CMR 11.06(8)) | ☐Yes | ☒No |
| a Special Review Procedure? (see 301CMR 11.09) | ☐Yes | ☒No |
| a Waiver of mandatory EIR? (see 301 CMR 11.11) | ☐Yes | ☒No |
| a Phase I Waiver? (see 301 CMR 11.11) | ☐Yes | ☒No |

Identify any financial assistance or land transfer from an agency of the Commonwealth, including the agency name and the amount of funding or land area (in acres): **The City of Quincy is pursuing public financing to fund the construction of the Town Brook Enhancement Project. At the time of this filing the City has not secured funding from any state or federal agency for the construction. The City anticipates that some form of public financing will be identified and allocated by the end of 2011.**

Are you requesting coordinated review with any other federal, state, regional, or local agency?
☐Yes(Specify_____) ☒No

List Local or Federal Permits and Approvals:

Federal:

**U.S. Army Corps of Engineers – Section 404 General Permit – Category 2**
**U.S. Environmental Protection Agency – NPDES Construction General Permit**

Commonwealth of Massachusetts:

**Department of Environmental Protection – 401 Water Quality Certification**

City of Quincy:

**Quincy Conservation Commission – Order of Conditions**

Which ENF or EIR review threshold(s) does the project meet or exceed (see 301 CMR 11.03):

- ☐ Land
- ☐ Water
- ☐ Energy
- ☐ ACEC
- ☐ Rare Species
- ☐ Wastewater
- ☐ Air
- ☐ Regulations
- ☒ Wetlands, Waterways, & Tidelands
- ☐ Transportation
- ☐ Solid & Hazardous Waste
- ☐ Historical & Archaeological Resources

| Summary of Project Size & Environmental Impacts | Existing | Change | Total |
|---|---|---|---|
| **LAND** | | | |
| Total site acreage | NA | | |
| New acres of land altered | | 1.5+/- | |
| Acres of impervious area | NA | NA | NA |
| Square feet of new bordering vegetated wetlands alteration | | 0 | |
| Square feet of new other wetland alteration | | -640 LF Bank<br>-2,650 SF LUWW* | |
| Acres of new non-water dependent use of tidelands or waterways | | 0 | |
| **STRUCTURES** | | | |
| Gross square footage | NA | NA | NA |
| Number of housing units | NA | NA | NA |
| Maximum height (in feet) | NA | NA | NA |
| **TRANSPORTATION** | | | |
| Vehicle trips per day | NA | NA | NA |
| Parking spaces | NA | NA | NA |
| **WATER/WASTEWATER** | | | |
| Gallons/day (GPD) of water use | NA | NA | NA |
| GPD water withdrawal | NA | NA | NA |
| GPD wastewater generation/ treatment | NA | NA | NA |
| Length of water/sewer mains (in miles) | NA | NA | NA |

**State Permits & Approvals**

- ☒ Order of Conditions
- ☐ Superseding Order of Conditions
- ☐ Chapter 91 License
- ☒ 401 Water Quality Certification
- ☐ MHD or MDC Access Permit
- ☐ Water Management Act Permit
- ☐ New Source Approval
- ☐ DEP or MWRA Sewer Connection/ Extension Permit
- ☐ Other Permits (*including Legislative Approvals*) – Specify:

Chapter 3 of the ENF contains details of the wetland resource area impacts.

*Net change proposed as part of Town Brook re-alignment upon project completion. See Ch. 3 for details for calculations of impacts.

**CONSERVATION LAND:** Will the project involve the conversion of public parkland or other Article 97 public natural resources to any purpose not in accordance with Article 97?

☐Yes (Specify_____ ) ☒No

Will it involve the release of any conservation restriction, preservation restriction, agricultural preservation restriction, or watershed preservation restriction?

☐Yes (Specify_____ ) ☒No

**RARE SPECIES:** Does the project site include Estimated Habitat of Rare Species, Vernal Pools, Priority Sites of Rare Species, or Exemplary Natural Communities?

☐Yes (Specify_____ ) ☒No

**HISTORICAL /ARCHAEOLOGICAL RESOURCES**: Does the project site include any structure, site or district listed in the State Register of Historic Place or the inventory of Historic and Archaeological Assets of the Commonwealth?

☒Yes (Specify Quincy Center Historic District ) ☐No

If yes, does the project involve any demolition or destruction of any listed or inventoried historic or archaeological resources?

☐Yes (Specify_____ ) ☒No

**AREAS OF CRITICAL ENVIRONMENTAL CONCERN:** Is the project in or adjacent to an Area of Critical Environmental Concern?

☐Yes (Specify_____ ) ☒No

**PROJECT DESCRIPTION:** The project description should include **(a)** a description of the project site, **(b)** a description of both on-site and off-site alternatives and the impacts associated with each alternative, and **(c)** potential on-site and off-site mitigation measures for each alternative (*You may attach one additional page, if necessary.*)

**(a)** The City of Quincy is proposing to enhance and re-align a portion of Town Brook within Quincy Center. The proposed re-alignment will remove perennial stream flow from approximately 1,700 linear feet of existing culverted sections of the Brook through Quincy Center, which are aged and sections of which are structurally compromised.

The re-alignment will be made by connecting a new culvert to the existing culvert alignment upstream of Quincy Center and conveying the existing flow, from west to east, along the south side of the Concourse Roadway Improvement project, which is currently under construction. This will divert Town Brook flow through approximately 1,200 linear feet of 11' wide x 6' high closed and open channel/day-lit sections of culvert to the proposed connection point downstream of Quincy Center where it will rejoin the existing Town Brook alignment.

The existing and proposed Town Brook alignments run through the Quincy Center area, with the westerly boundary of the project area at the southwest intersection of the Concourse Roadway and Parkingway and the easterly boundary of the project area southeast of the intersection of Revere Road and Mechanic Street.

**(b)** The City has gone through an extensive process in order to evaluate and determine a preferred alignment for the Town Brook Enhancement Project. As part of the evaluation process the City involved qualified City staff, consultants, members of the development team, and members of the Quincy Environmental Network (QEN), a local environmental advocacy group, to solicit relevant input as to the appropriate alignment and design enhancements associated with the project.

As part of the evaluation process the City evaluated seven (7) potential alignments (A through G) as well as the No-Build alternative and an alternative to re-build the culvert along its current alignment, for a total of nine (9) alternatives. In order to evaluate each of the alternative alignments, the project team developed ten (10) evaluation criteria:

1. Flood Control
2. Underground Conflicts
3. Property Constraints (Property Control)
4. Open Channel/Public Amenity
5. Enhance Smelt Fisheries Habitat
6. Consistency with URDP
7. Construction Schedule & Phasing

8. Cost
9. Environmental Enhancements
10. Code Compliance

In order to determine the preferred alternative, the nine alternatives to be considered were evaluated using the ten metrics and ranked from 1 through 9 subjectively based on the how the alternatives met the metrics, with a ranking of 9 being the best alternative for that metric and 1 being the worst. For evaluation criteria which were either a "go" or "no-go", a rating of 9 was applied to the alternative to document compliance with the metric and 1 documenting non-compliance with the metric. This methodology is a variation of the "Electre Method" for evaluating alternatives. In this evaluation of alternatives all the evaluation criteria were weighted evenly, although the Electre method algorithm allows each evaluation metric to be weighted differently. The City determined that all metrics be weighted evenly.

Through this evaluation process, the preferred alignment was determined. A detailed summary of the alternatives analysis is found in Chapter 2.

**(b)** While the project will result in many benefits to Town Brook, the project will require construction activities within resource areas regulated by the Wetlands Protection Act to include: Land Under Water Bodies and Waterways (LUWW); Bordering Land Subject to Flooding (BLSF); Bank; Fish Run; and Riverfront Area (RA). The project area is outside of tidally influenced sections of Town Brook and not located within an Area of Critical Environmental Concern (ACEC) or Outstanding Resource Water (ORW). The Proponent has committed to a series of mitigation measures as part of the project which include the following:

- Increasing the extent of open channel/ day-lit sections in Town Brook, proposing 185 linear feet of open channel
- Riverfront Area enhancements – Active public open space adjacent to open channel sections of the Brook on City owned land
- Fish Run - rainbow smelt habitat enhancements
    - Design of culvert with low flow trapezoidal channel (coordinated with the DMF Centre Street Junction Box modifications to increase low base flow) to achieve a flow depth of at least 6 inches to 12 inches
    - Spawning substrate in low flow trapezoidal channel, proposed 6" diameter rounded stone substrate for smelt eggs to adhere to
    - Spawning riffles achieved by designing the culvert to achieve attraction velocities of between 1.6 and 3.2 feet per second during low base flow conditions
    - Smelt resting pools off-line and adjacent to spawning riffle sections (alternate in-line option is being reviewed)
    - Temperature mitigation - proposing shade trees adjacent to open channel sections
- Flood Control – A larger uniform culvert section (11' wide x 6' deep) is being proposed to convey the design storm event through the project area replacing the existing limiting hydraulic sections.
- Water Quality improvements – Proposed rain gardens in open space parcels on east and west sides of Mechanic Street to treat surface runoff
- Removal of illicit sanitary sewer connections within the project area
- Removal of direct untreated stormwater surface runoff from the Quincy Center Area
- Town Brook Watershed Master Plan

These proposed mitigation items will reduce the environmental impacts associated with the project and will improve the regulated wetland resource areas associated with Town Brook. Refer to Chapter 8, "Mitigation" of this ENF, for a more detailed description of the proposed project mitigation.

Additionally, in order to mitigate the temporary construction related impacts the City is proposing these additional mitigation measures:

- Measures to reduce construction period impacts include controlling erosion and sedimentation, dust, and machinery traffic on local roadways
- Compliance with the EPA's National Pollution Discharge Elimination System (NPDES) General Permit Program for Stormwater Discharges from Construction Sites

## LAND SECTION – all proponents must fill out this section

**I. Thresholds / Permits**

A. Does the project meet or exceed any review thresholds related to **land** (see 301 CMR 11.03(1)
___ Yes _X_ No; if yes, specify each threshold:

**II. Impacts and Permits**

A. Describe, in acres, the current and proposed character of the project site, as follows:

| | Existing | Change | Total |
|---|---|---|---|
| Footprint of buildings | NA | NA | NA |
| Roadways, parking, and other paved areas | NA | NA | NA |
| Other altered areas (describe) | NA | NA | NA |
| Undeveloped areas | NA | NA | NA |

B. Has any part of the project site been in active agricultural use in the last three years?
___ Yes _X_ No; if yes, how many acres of land in agricultural use (with agricultural soils) will be converted to nonagricultural use?

C. Is any part of the project site currently or proposed to be in active forestry use?
___ Yes _X_ No; if yes, please describe current and proposed forestry activities and indicate whether any part of the site is the subject of a DEM-approved forest management plan:

D. Does any part of the project involve conversion of land held for natural resources purposes in accordance with Article 97 of the Amendments to the Constitution of the Commonwealth to any purpose not in accordance with Article 97? ___ Yes _X_ No; if yes, describe:

E. Is any part of the project site currently subject to a conservation restriction, preservation restriction, agricultural preservation restriction or watershed preservation restriction? ___Yes _X_ No; if yes, does the project involve the release or modification of such restriction? ___ Yes ___ No; if yes, describe:

F. Does the project require approval of a new urban redevelopment project or a fundamental change in an existing urban redevelopment project under M.G.L.c.121A? ___ Yes _X_ No; if yes, describe:

G. Does the project require approval of a new urban renewal plan or a major modification of an existing urban renewal plan under M.G.L.c.121B? Yes ___ No _X_ ; if yes, describe:

H. Describe the project's stormwater impacts and, if applicable, measures that the project will take to comply with the standards found in DEP's Stormwater Management Policy:

**As part of the Project, there will be limited proposed land development activities associated with the creation of public open space adjacent to the open channel/ day lit sections of the Brook at the downstream end of the project. Low impact development stormwater features will be provided on the public open space to handle surface runoff from the proposed landscaped and hardscaped areas. The City has reviewed the project for compliance with the standards. A summary of compliance with the ten stormwater standards is documented in Chapter 5 of this report.**

I. Is the project site currently being regulated under M.G.L.c.21E or the Massachusetts Contingency Plan? Yes ___ No _X_ ; if yes, what is the Release Tracking Number (RTN)?

J. If the project is site is within the Chicopee or Nashua watershed, is it within the Quabbin, Ware, or Wachusett subwatershed? ___ Yes ___ No; if yes, is the project site subject to regulation under the Watershed Protection Act? ___ Yes _x__ No

K. Describe the project's other impacts on land:

**The project involves the construction of approximately 1,200 linear feet of 11' wide x 6' high culvert through properties owned or controlled by the City of Quincy. Land disturbance activities for a majority of the project will be temporary, with the exception of the proposed open channel sections of culvert, where permanent alteration of ground cover on City owned property is proposed. Adjacent to the open channel sections of proposed culvert, the creation of public open space is proposed on previously developed land, where the ground cover will be modified from impervious to landscaped area. The total temporary and permanent land alteration is approximately one (1) acre.**

## III.. Consistency

A. Identify the current municipal comprehensive land use plan and the open space plan and describe the consistency of the project and its impacts with that plan(s):

**City of Quincy Urban Revitalization and Development Plan**

The City of Quincy Urban Revitalization and Development Plan (URDP) was adopted in 2007. It sets forth the City's vision and strategy for the redevelopment of Quincy Center. The City has recently made strides in the advancement of the redevelopment of Quincy Center with identification of a selected developer and the City Council approval of the "New Quincy Center Land Disposition Agreement" on December 20, 2010 under the URDP.

In addition the environmental benefits outlined in the report, the Town Brook Enhancement Project will address goals of the URDP which include:

- Creation of *"numerous pockets of public space to beautify the Project Area and provide places for shoppers and residents to enjoy"*. The project includes the creation of public open space adjacent to the open channel sections of the Brook on the south side of the Concourse.

B. Identify the current Regional Policy Plan of the applicable Regional Planning Agency and describe the consistency of the project and its impacts with that plan:

**Metropolitan Area Planning Council**

The Metropolitan Area Planning Council developed the following MetroFuture Regional Plan in 2009. The following summarizes the goals and objectives of the plan.

**MetroFuture Regional Plan**

MetroFuture represents a new way of planning for the future. It is based on an understanding that Metro Boston is an interconnected system: regional trends shape local conditions, and every local decision has a broader impact on our regional well-being. MetroFuture distinguishes itself by the fact that it is comprehensive, regional, and long-range. It embodies a forward-thinking, unified understanding of how different issues relate to each other, and how each municipality has a role to play in building a brighter future. The scale and complexity of the region's challenges make it clear: making a Greater Boston Region requires a transformative plan, a sustainable plan that will improve equity among our residents, strengthen the economy, protect the environment, and improve our quality of life. MetroFuture is that plan. At its heart are new patterns of growth and development that help to create choices and conserve resources. People would have more housing options and different ways to get around. The region would use less energy and water, and would spend less money extending infrastructure to new developments. The region's communities would be more sustainable as well, with stronger municipal finances and high

quality education in every city and town. The changes necessary to achieve this plan will not come easily—or cheaply—but the costs of inaction are too high to let current trends continue.

The City of Quincy continues to participate in the MetroFuture Regional Plan. The detailed goals for development and preservation, and specific strategies to equitably distribute the benefits and burdens of growth assist City planners in their efforts. Perhaps the most important "product" of MetroFuture is the constituency of over 5,000 "plan builders" who helped to design MetroFuture and who are committed to its implementation.

As the enhancement and relocation of Town Brook is located in the center of a future redevelopment area, any design of the new alignment must consider these goals. As such, the MetroFuture Plan details 13 implementation strategies for future development. Several of these strategies tie directly into the Town Brook Enhancement project and include, 5) Enable Compact Growth, 6) Improve City Life, and 13) Conserve Natural Resources. Further detail of consistency with the MetroFuture Plan is detailed in Chapter 1 of the ENF report.

C. Will the project require any approvals under the local zoning by-law or ordinance (i.e. text or map amendment, special permit, or variance)? Yes _X_ No ___ ; if yes, describe:

**The project will require review under the City of Quincy Wetlands Protection Regulations and Ordinance.**

D. Will the project require local site plan or project impact review?
___ Yes _X_ No; if yes, describe:

## RARE SPECIES SECTION

**I. Thresholds / Permits**

A. Will the project meet or exceed any review thresholds related to **rare species or habitat** (see 301 CMR 11.03(2))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **rare species or habitat**? ___ Yes _X_ No

C. If you answered "No" to both questions A and B, proceed to the **Wetlands, Waterways, and Tidelands Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Rare Species section below.

**II. Impacts and Permits**

A. Does the project site fall within Priority or Estimated Habitat in the current Massachusetts Natural Heritage Atlas (attach relevant page)? ___ Yes ___ No. If yes,

1. Which rare species are known to occur within the Priority or Estimated Habitat (contact: Environmental Review, Natural Heritage and Endangered Species Program, Route 135, Westborough, MA 01581, allowing 30 days for receipt of information):
2. Have you surveyed the site for rare species? ___ Yes ___ No; if yes, please include the results of your survey.
3. If your project is within Estimated Habitat, have you filed a Notice of Intent or received an Order of Conditions for this project? ___ Yes ___ No; if yes, did you send a copy of the Notice of Intent to the Natural Heritage and Endangered Species Program, in accordance with the Wetlands Protection Act regulations? ___ Yes ___ No

B. Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? ___ Yes ___ No; if yes, describe:

C. Will the project alter "significant habitat" as designated by the Massachusetts Division of Fisheries and Wildlife in accordance with M.G.L. c.131A (see also 321 CMR 10.30)? ___ Yes ___ No; if yes, describe:

D. Describe the project's other impacts on rare species including indirect impacts (for example, stormwater runoff into a wetland known to contain rare species or lighting impacts on rare moth habitat):

## WETLANDS, WATERWAYS, AND TIDELANDS SECTION

**I. Thresholds / Permits**

A. Will the project meet or exceed any review thresholds related to **wetlands, waterways, and tidelands** (see 301 CMR 11.03(3))? _X_ Yes ___ No; if yes, specify, in quantitative terms:

**The Town Brook Enhancement project is proposing to relocate approximately 3,640 linear feet of Bank and therefore exceeds the threshold outlined in 301 CMR 11.03(3)(b)1.b., *"alteration of 500 or more linear feet of bank along a fish run or inland bank"* and requires the filing of an ENF. No threshold for a mandatory EIR is triggered for this project. Chapter 3, "Wetlands" provides a detailed quantitative assessment of wetland resource area impacts.**

B. Does the project require any state permits (or a local Order of Conditions) related to **wetlands, waterways, or tidelands**? _X_ Yes ___ No; if yes, specify which permit:

**A state Water Quality Certificate is required under Section 401 of the federal Clean Water Act (33 USC 1341) and the Massachusetts Clean Water Act (M.G.L. Chapter 21, Sections 26-53). An Order of Conditions from the Quincy Conservation Commission is required under the Wetlands Protection Act (M.G.L. c. 131, § 40 and 310 CMR 10:00) and the City of Quincy Wetland Protection Regulations (Chapter 18.08) and Wetlands Protection Ordinance (Order No. 401 of 1987).**

C. If you answered "No" to both questions A and B, proceed to the **Water Supply Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Wetlands, Waterways, and Tidelands Section below.

**II. Wetlands Impacts and Permits**

A. Describe any wetland resource areas currently existing on the project site and indicate them on the site plan:

**The inland resource areas associated with the Town Brook Enhancement Project include Bank, Bordering Land Subject to Flooding, Land Under Water Bodies and Waterways, and Riverfront Area.**

B. Estimate the extent and type of impact that the project will have on wetland resources, and indicate whether the impacts are temporary or permanent:

| Coastal Wetlands | Area (in square feet) or Length (in linear feet) |
|---|---|
| Land Under the Ocean | 0 |
| Designated Port Areas | 0 |
| Coastal Beaches | 0 |
| Coastal Dunes | 0 |
| Barrier Beaches | 0 |
| Coastal Banks | 0 |
| Rocky Intertidal Shores | 0 |
| Salt Marshes | 0 |
| Land Under Salt Ponds | 0 |
| Land Containing Shellfish | 0 |
| Fish Runs | 0 |
| Land Subject to Coastal Storm Flowage | 0 |
| **Inland Wetlands** | |
| Bank | 3,640 linear feet |
| Bordering Vegetated Wetlands | 0 |
| Land under Water | 17,840 square feet |

| | |
|---|---|
| Isolated Land Subject to Flooding | 0 |
| Bordering Land Subject to Flooding | 0 |
| Riverfront Area | 13,315 s.f. enhanced; 6,680 s.f. relocated |

C. Is any part of the project

1. a limited project? ___ Yes _X_ No
2. the construction or alteration of a dam? ___ Yes _X_ No; if yes, describe:
3. fill or structure in a velocity zone or regulatory floodway? ___ Yes _X_ No
4. dredging or disposal of dredged material? ___ Yes _X_ No; if yes, describe the volume of dredged material and the proposed disposal site:
5. a discharge to Outstanding Resource Waters? ___ Yes _X_ No
6. subject to a wetlands restriction order? ___ Yes _X_ No; if yes, identify the area (in square feet):

D. Does the project require a new or amended Order of Conditions under the Wetlands Protection Act (M.G.L. c.131A)? _X_ Yes ___ No; if yes, has a Notice of Intent been filed or a local Order of Conditions issued? ___ Yes _X_ No; if yes, list the date and DEP file number:_____. Was the Order of Conditions appealed? ___ Yes ___ No. Will the project require a variance from the Wetlands regulations? ___ Yes _X_ No. **The NOI will be filed with the Quincy Conservation Commission.**

E. Will the project:

1. be subject to a local wetlands ordinance or bylaw? _X_ Yes ___ No
2. alter any federally-protected wetlands not regulated under state or local law? ___ Yes _X_ No; if yes, what is the area (in s.f.)?

F. Describe the project's other impacts on wetlands (including new shading of wetland areas or removal of tree canopy from forested wetlands): **Chapter 3, "Wetlands" provides a detailed quantitative assessment of wetland resource area impacts.**

## III. Waterways and Tidelands Impacts and Permits

A. Is any part of the project site waterways or tidelands (including filled former tidelands) that are subject to the Waterways Act, M.G.L.c.91? ___ Yes _X_ No; if yes, is there a current Chapter 91 license or permit affecting the project site? ___ Yes ___ No; if yes, list the date and number:

B. Does the project require a new or modified license under M.G.L.c.91? ___ Yes _X_ No; if yes, how many acres of the project site subject to M.G.L.c.91 will be for non-water dependent use?
Current ___ Change ___ Total ___

C. Is any part of the project

1. a roadway, bridge, or utility line to or on a barrier beach? ___ Yes _X_ No; if yes, describe:
2. dredging or disposal of dredged material? ___ Yes _X_ No; if yes, volume of dredged material _____
3. a solid fill, pile-supported, or bottom-anchored structure in flowed tidelands or other waterways? ___ Yes _X_ No; if yes, what is the base area? _____
4. within a Designated Port Area? ___ Yes _X_ No

D. Describe the project's other impacts on waterways and tidelands: **NA**

## IV. Consistency:

A. Is the project located within the Coastal Zone? ___ Yes _X_ No; if yes, describe the project's consistency with policies of the Office of Coastal Zone Management:

B. Is the project located within an area subject to a Municipal Harbor Plan? ___ Yes _x_ No; if yes, identify the Municipal Harbor Plan and describe the project's consistency with that plan:

## WATER SUPPLY SECTION

**I. Thresholds / Permits**

A. Will the project meet or exceed any review thresholds related to **water supply** (see 301 CMR 11.03(4))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **water supply**? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Wastewater Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Water Supply Section below.

**II. Impacts and Permits**

A. Describe, in gallons/day, the volume and source of water use for existing and proposed activities at the project site:

| | Existing | Change | Total |
|---|---|---|---|
| Withdrawal from groundwater | _____ | _____ | _____ |
| Withdrawal from surface water | _____ | _____ | _____ |
| Interbasin transfer | _____ | _____ | _____ |
| Municipal or regional water supply | _____ | _____ | _____ |

B. If the source is a municipal or regional supply, has the municipality or region indicated that there is adequate capacity in the system to accommodate the project? ___ Yes ___ No

C. If the project involves a new or expanded withdrawal from a groundwater or surface water source,

1. have you submitted a permit application? ___ Yes ___ No; if yes, attach the application
2. have you conducted a pump test? ___ Yes ___ No; if yes, attach the pump test report

D. What is the currently permitted withdrawal at the proposed water supply source (in gallons/day)? _____Will the project require an increase in that withdrawal?___ Yes ___ No

E. Does the project site currently contain a water supply well, a drinking water treatment facility, water main, or other water supply facility, or will the project involve construction of a new facility? ___ Yes ___ No. If yes, describe existing and proposed water supply facilities at the project site:

| | Existing | Change | Total |
|---|---|---|---|
| Water supply well(s) (capacity, in gpd) | _____ | _____ | _____ |
| Drinking water treatment plant (capacity, in gpd) | _____ | _____ | _____ |
| Water mains (length, in miles) | _____ | _____ | _____ |

F. If the project involves any interbasin transfer of water, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or proposed?

G. Does the project involve

1. new water service by a state agency to a municipality or water district? ___ Yes ___ No
2. a Watershed Protection Act variance? ___ Yes ___ No; if yes, how many acres of alteration?
3. a non-bridged stream crossing 1,000 or less feet upstream of a public surface drinking water supply for purpose of forest harvesting activities? ___ Yes ___ No

H. Describe the project's other impacts (including indirect impacts) on water resources, quality, facilities and services:

**III. Consistency** -- Describe the project's consistency with water conservation plans or other plans to enhance water resources, quality, facilities and services:

## WASTEWATER SECTION

**I. Thresholds / Permits**

A. Will the project meet or exceed any review thresholds related to **wastewater** (see 301 CMR 11.03(5))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **wastewater**? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Transportation -- Traffic Generation Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Wastewater Section below.

**II. Impacts and Permits**

A. Describe, in gallons/day, the volume and disposal of wastewater generation for existing and proposed activities at the project site (calculate according to 310 CMR 15.00):

| | Existing | Change | Total |
|---|---|---|---|
| Discharge to groundwater (Title 5) | _____ | _____ | _____ |
| Discharge to groundwater (non-Title 5) | _____ | _____ | _____ |
| Discharge to outstanding resource water | _____ | _____ | _____ |
| Discharge to surface water | _____ | _____ | _____ |
| Municipal or regional wastewater facility | _____ | _____ | _____ |
| TOTAL | _____ | _____ | _____ |

B. Is there sufficient capacity in the existing collection system to accommodate the project? ___ Yes ___ No; if no, describe where capacity will be found:

C. Is there sufficient existing capacity at the proposed wastewater disposal facility?___ Yes ___ No; if no, describe how capacity will be increased:

D. Does the project site currently contain a wastewater treatment facility, sewer main, or other wastewater disposal facility, or will the project involve construction of a new facility? ___ Yes ___ No. If yes, describe as follows:

| | Existing | Change | Total |
|---|---|---|---|
| Wastewater treatment plant (capacity, in gpd) | _____ | _____ | _____ |
| Sewer mains (length, in miles) | _____ | _____ | _____ |
| Title 5 systems (capacity, in gpd) | _____ | _____ | _____ |

E. If the project involves any interbasin transfer of wastewater, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or proposed?

F. Does the project involve new sewer service by an Agency of the Commonwealth to a municipality or sewer district? ___ Yes ___ No

G. Is there any current or proposed facility at the project site for the storage, treatment, processing, combustion or disposal of sewage sludge, sludge ash, grit, screenings, or other sewage residual materials? ___ Yes ___ No; if yes, what is the capacity (in tons per day):

| | Existing | Change | Total |
|---|---|---|---|
| Storage | _____ | _____ | _____ |
| Treatment, processing | _____ | _____ | _____ |
| Combustion | _____ | _____ | _____ |
| Disposal | _____ | _____ | _____ |

H. Describe the project's other impacts (including indirect impacts) on wastewater generation and treatment facilities:

**III. Consistency** -- Describe measures that the proponent will take to comply with federal, state, regional, and local plans and policies related to wastewater management:

A. If the project requires a sewer extension permit, is that extension included in a comprehensive wastewater management plan? ___ Yes ___ No; if yes, indicate the EOEA number for the plan and describe the relationship of the project to the plan

## TRANSPORTATION -- TRAFFIC GENERATION SECTION

**I. Thresholds / Permits**

A. Will the project meet or exceed any review thresholds related to **traffic generation** (see 301 CMR 11.03(6))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **state-controlled roadways**? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Roadways and Other Transportation Facilities Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Traffic Generation Section below.

**II. Traffic Impacts and Permits**

A. Describe existing and proposed vehicular traffic generated by activities at the project site:

| | Existing | Change | Total |
|---|---|---|---|
| Number of parking spaces | _____ | _____ | _____ |
| Number of vehicle trips per day | _____ | _____ | _____ |

ITE Land Use Code(s):

B. What is the estimated average daily traffic on roadways serving the site?

| Roadway | Existing | Change | Total |
|---|---|---|---|
| 1. _____ | _____ | _____ | _____ |
| 2. _____ | _____ | _____ | _____ |
| 3. _____ | _____ | _____ | _____ |

C. Describe how the project will affect transit, pedestrian and bicycle transportation facilities and services:

**III. Consistency** -- Describe measures that the proponent will take to comply with municipal, regional, state, and federal plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services:

## ROADWAYS AND OTHER TRANSPORTATION FACILITIES SECTION

**I. Thresholds**

A. Will the project meet or exceed any review thresholds related to **roadways or other transportation facilities** (see 301 CMR 11.03(6))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **roadways or other transportation facilities**? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Energy Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Roadways Section below.

**II. Transportation Facility Impacts**

A. Describe existing and proposed transportation facilities at the project site:

| | Existing | Change | Total |
|---|---|---|---|
| Length (in linear feet) of new or widened roadway | _____ | _____ | _____ |
| Width (in feet) of new or widened roadway | _____ | _____ | _____ |

Other transportation facilities:

B. Will the project involve any

1. Alteration of bank or terrain (in linear feet)? _____
2. Cutting of living public shade trees (number)? _____
3. Elimination of stone wall (in linear feet)? _____

**III. Consistency --** Describe the project's consistency with other federal, state, regional, and local plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services, including consistency with the applicable regional transportation plan and the Transportation Improvements Plan (TIP), the State Bicycle Plan, and the State Pedestrian Plan:

## ENERGY SECTION

**I. Thresholds / Permits**

A. Will the project meet or exceed any review thresholds related to **energy** (see 301 CMR 11.03(7))?
___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **energy**? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Air Quality Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Energy Section below.

**II. Impacts and Permits**

A. Describe existing and proposed energy generation and transmission facilities at the project site:

| | Existing | Change | Total |
|---|---|---|---|
| Capacity of electric generating facility (megawatts) | _____ | _____ | _____ |
| Length of fuel line (in miles) | _____ | _____ | _____ |
| Length of transmission lines (in miles) | _____ | _____ | _____ |
| Capacity of transmission lines (in kilovolts) | _____ | _____ | _____ |

B. If the project involves construction or expansion of an electric generating facility, what are
1. the facility's current and proposed fuel source(s)?
2. the facility's current and proposed cooling source(s)?

C. If the project involves construction of an electrical transmission line, will it be located on a new, unused, or abandoned right of way?___ Yes ___ No; if yes, please describe:

D. Describe the project's other impacts on energy facilities and services:

**III. Consistency** -- Describe the project's consistency with state, municipal, regional, and federal plans and policies for enhancing energy facilities and services:

## AIR QUALITY SECTION

**I. Thresholds**

A. Will the project meet or exceed any review thresholds related to **air quality** (see 301 CMR 11.03(8))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **air quality**? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Solid and Hazardous Waste Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Air Quality Section below.

**II. Impacts and Permits**

A. Does the project involve construction or modification of a major stationary source (see 310 CMR 7.00, Appendix A)?___ Yes ___ No; if yes, describe existing and proposed emissions (in tons per day) of:

| | Existing | Change | Total |
|---|---|---|---|
| Particulate matter | _____ | _____ | _____ |
| Carbon monoxide | _____ | _____ | _____ |
| Sulfur dioxide | _____ | _____ | _____ |
| Volatile organic compounds | _____ | _____ | _____ |
| Oxides of nitrogen | _____ | _____ | _____ |
| Lead | _____ | _____ | _____ |
| Any hazardous air pollutant | _____ | _____ | _____ |
| Carbon dioxide | _____ | _____ | _____ |

B. Describe the project's other impacts on air resources and air quality, including noise impacts:

**III. Consistency**

A. Describe the project's consistency with the State Implementation Plan:

B. Describe measures that the proponent will take to comply with other federal, state, regional, and local plans and policies related to air resources and air quality:

## SOLID AND HAZARDOUS WASTE SECTION

**I. Thresholds / Permits**

A. Will the project meet or exceed any review thresholds related to **solid or hazardous waste** (see 301 CMR 11.03(9))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **solid and hazardous waste**? _ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Historical and Archaeological Resources Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Solid and Hazardous Waste Section below.

**II. Impacts and Permits**

A. Is there any current or proposed facility at the project site for the storage, treatment, processing, combustion or disposal of solid waste? ___ Yes ___ No; if yes, what is the volume (in tons per day) of the capacity:

| | Existing | Change | Total |
|---|---|---|---|
| Storage | _____ | _____ | _____ |
| Treatment, processing | _____ | _____ | _____ |
| Combustion | _____ | _____ | _____ |
| Disposal | _____ | _____ | _____ |

B. Is there any current or proposed facility at the project site for the storage, recycling, treatment or disposal of hazardous waste? ___ Yes ___ No; if yes, what is the volume (in tons or gallons per day) of the capacity:

| | Existing | Change | Total |
|---|---|---|---|
| Storage | _____ | _____ | _____ |
| Recycling | _____ | _____ | _____ |
| Treatment | _____ | _____ | _____ |
| Disposal | _____ | _____ | _____ |

C. If the project will generate solid waste (for example, during demolition or construction), describe alternatives considered for re-use, recycling, and disposal:

D. If the project involves demolition, do any buildings to be demolished contain asbestos?
___ Yes ___ No

E. Describe the project's other solid and hazardous waste impacts (including indirect impacts):

**III. Consistency**--Describe measures that the proponent will take to comply with the State Solid Waste Master Plan:

## HISTORICAL AND ARCHAEOLOGICAL RESOURCES SECTION

**I. Thresholds / Impacts**

A. Is any part of the project site a historic structure, or a structure within a historic district, in either case listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? _X_ Yes ___ No; if yes, does the project involve the demolition of all or any exterior part of such historic structure? ___ Yes _X_ No; if yes, please describe:

B. Is any part of the project site an archaeological site listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? ___ Yes _X_ No; if yes, does the project involve the destruction of all or any part of such archaeological site? ___ Yes ___ No; if yes, please describe:

C. If you answered "No" to all parts of both questions A and B, proceed to the **Attachments and Certifications** Sections. If you answered "Yes" to any part of either question A or question B, fill out the remainder of the Historical and Archaeological Resources Section below.

D. Have you consulted with the Massachusetts Historical Commission? ___ Yes _X_ No; if yes, attach correspondence

E. Describe and assess the project's other impacts, direct and indirect, on listed or inventoried historical and archaeological resources:

**The proposed culvert alignment crosses through the Quincy Center Historic District, which generally overlays the parcels along the east and west sides of Hancock Street. The culvert as it passes through the Historic District is well below grade and no permanent grade alteration or impact to structures within the district is proposed as part of the project.**

**The City has met with the Quincy Historical Commission, who at their February 28, 2011 regularly scheduled meeting found that *"Pursuant to Chapter 40C of the General Laws of the Commonwealth of Massachusetts and the Historic District Ordinance of the City of Quincy, the Quincy Historical Commission hereby issues a Certificate of Non-Applicability with respect to the Town Brook Enhancement Project."***

**II. Consistency** -- Describe measures that the proponent will take to comply with federal, state, regional, and local plans and policies related to preserving historical and archaeological resources:

**The City has met with the Quincy Historic Commission, who has determined the project has no negative impact to the Quincy Historic District. MHC has been issued a copy of this ENF for review.**

## ATTACHMENTS:

1. Plan, at an appropriate scale, of existing conditions of the project site and its immediate context, showing all known structures, roadways and parking lots, rail rights-of-way, wetlands and water bodies, wooded areas, farmland, steep slopes, public open spaces, and major utilities. **See Figures 1.1 and 1.2**

2. Plan of proposed conditions upon completion of project (if construction of the project is proposed to be phased, there should be a site plan showing conditions upon the completion of each phase). **See Figure 1.5**

3. **Original** U.S.G.S. map or good quality **color** copy (8-½ x 11 inches or larger) indicating the project location and boundaries. **See Figure 1.1.1**

4 List of all agencies and persons to whom the proponent circulated the ENF, in accordance with 301 CMR 11.16(2). **See Appendix A of the attached Report ("Distribution List")**

5. Other:
   **Appendix B – Drainage Technical Appendix;**
   **Appendix C – Town Brook Flood Control Project History;**
   **Appendix D – Wildlife Habitat Assessment under WPA;**
   **Appendix E – MEPA/ Permitting Correspondence**
   **Appendix F – DVD of Town Brook video**

## CERTIFICATIONS:

1. The Public Notice of Environmental Review has been/will be published in the following newspapers in accordance with 301 CMR 11.15(1):

| | |
|---|---|
| Patriot Ledger | March 18, 2011 |
| Name | Date |

2. This form has been circulated to Agencies and Persons in accordance with 301 CMR 11.16(2).

| | |
|---|---|
| Dennis E Harrington | |
| Date Signature of Responsible Officer or Proponent | Date Signature of person preparing ENF (if different from above) |
| Dennis Harrington<br>Community Development Director | Jon D. Stephenson, PE, LEED AP |
| Name (print or type) | Name (print or type) |
| City of Quincy | Stephenson Design Group, LLC |
| Firm/ Agency | Firm/ Agency |
| 1305 Hancock Street | 51 Sleeper Street – Suite 600 |
| Street | Street |
| Quincy, Massachusetts 02169 | Boston, Massachusetts 02210 |
| Municipality/ State/ Zip | Municipality/ State/ Zip |
| 617-376-1365 | 617-512-7095 |
| Phone | Phone |

# CHAPTER 1
# PROJECT DESCRIPTION

## INTRODUCTION

This Chapter provides a summary of the proposed Town Brook Enhancement Project (the Project), detailing the existing conditions of the Brook and the proposed enhancement and re-alignment. The Project proposes the diversion of the existing Town Brook, a perennial stream, from a connection point upstream of Quincy Center along the south side of the Concourse Roadway Improvement project, which is currently under construction, through 1,200 linear feet of closed and open channel culvert sections to the proposed connection point downstream of Quincy Center, where it will rejoin the existing Town Brook alignment. Refer to Figures 1.1.1 and 1.1.2 for the project location maps. Figure 1.2.1 depicts the existing culvert alignment of Town Brook. Photographs of the existing Town Brook within the project area are shown in Figures 1.3.1 through 1.3.5. Figure 1.5 depicts the proposed preferred culvert alignment.

The Town Brook Enhancement Project is one of three Core Public Improvement projects that the City of Quincy (the City) is undertaking to upgrade the aged infrastructure within Quincy Center to facilitate redevelopment under the "Quincy Center Urban Revitalization District Plan (URDP)". On December 20, 2010, the Quincy City Council approved the New Quincy Center Land Disposition Agreement (LDA) under the URDP, which was then executed on January 25, 2011 by the City and the selected redeveloper, which includes $289 million in public bond authorization to pay for infrastructure upgrades throughout the Quincy Center area. The City is currently pursuing federal and state funding opportunities to pay for the construction of the Town Brook improvements.

In addition to the Town Brook Enhancement project, the other core public improvement projects to be undertaken by the City include the Adams Green Transportation Improvement and open space enhancement projects and the Clivedon Street Extension bridge, connecting Clivedon Street to Burgin Parkway over the MBTA Red Line and commuter rail tracks. These core public improvements have been discussed with and presented to MEPA staff. These Core Public Improvement projects have been presented to the Secretary of Environmental Affairs in the form of a Request for Advisory Opinion letter, with the Secretary issuing an Advisory Opinion on March 4, 2011, clarifying the relationship between these projects (Appendix E).

When completed, the Project will provide significant environmental benefits to Town Brook, while being integrated into the urban context of Quincy Center and consistent with the City's environmental and sustainable planning objectives. The Project will mark a milestone for the City of Quincy, as the initial core public improvement within Quincy Center.

## PROJECT DESCRIPTION

The City of Quincy is proposing to enhance and re-align a portion of Town Brook within Quincy Center. The proposed re-alignment will remove perennial stream flow from approximately 1,700 linear feet of existing culverted sections of the Brook through Quincy Center, which are aged and sections of which are structurally compromised. The existing 1,700 linear feet of culvert will continue to convey collected surface runoff from the Quincy Center area (an approximately 50 acre watershed) and will eventually be decommissioned over time as stormwater improvements associated with the redevelopment of Quincy Center are implemented. Although the existing culvert will be decommissioned as part of the City's stormwater improvements associated with the Quincy Center redevelopment, the existing illicit sanitary sewer connections that have been identified will be removed as part of the initial phase of this project.

The re-alignment will be made by connecting the proposed culvert to the existing culvert alignment at a proposed connection point upstream of Quincy Center and conveying the existing flow, from west to east, along the south side of the Concourse Roadway Improvement project, which is currently under construction. This will divert Town Brook flow through approximately 1,200 linear feet of 11' wide x 6' high closed and open channel/day-lit sections of culvert to the proposed connection point downstream of Quincy Center where the proposed culvert alignment will rejoin the existing Town Brook alignment.

The Project is designed to provide a number of enhancements to Town Brook to include: enhanced hydraulic conveyance and flood control of Town Brook, additional open channel/day-lit sections with adjacent public open space, enhanced and expanded smelt habitat and spawning areas, and benefits from cost effective construction through coordination with on-going construction activities on land already controlled by the City of Quincy. As part of the preferred alternative, two options have been developed associated with the proposed low flow channel and fisheries enhancements. The two options are depicted in Figures 1.6.2 and 1.6.3.

In order to effect the re-alignment a permit will be required from the Army Corps of Engineers. A state Water Quality Certification is required under Section 401 of the federal Clean Water Act (33 USC 1341) and the Massachusetts Clean Water Act (M.G.L. Chapter 21, Sections 26-53), for any activity requiring a federal permit that will result in a discharge to water subject to federal jurisdiction. The 401 state permit (state action) in conjunction with a trigger outlined in 301 CMR 11.03(3)(b)1.b., "*alteration of 500 or more linear feet of bank along a fish run or inland bank*" requires the filing of an Environmental Notification Form (ENF) with the MEPA office. The Town Brook Enhancement Project proposes to divert flow from the section of existing Brook within the project area and therefore "de-commission" approximately 3,640 linear feet of existing culverted Bank. No threshold for a mandatory EIR is triggered for this project. The City of Quincy is pursuing various state and federal funding sources to pay for the construction of the project. At the time of the filing of this document, public financing has yet to be secured, however the City of Quincy anticipates that public financing will be secured by the end of 2011. The public financing does not result in MEPA broad scope jurisdiction as the project does not trigger any EIR thresholds as outlined in 301 CMR 11.01(2)(a).

## EXISTING CONDITIONS

Town Brook is a perennial stream which originates in Braintree at the Old Quincy Reservoir, adjacent to the South Shore Parking Plaza, approximately two miles upstream of the project area. The reservoir was reconstructed by the USACOE with outlet control structures regulating discharges into Town Brook. Controlled flow from the Old Quincy Reservoir discharges into the Brook and flows downstream through Braintree and into Quincy where the Brook then flows through areas of commercial development, dense residential development, various flow control structures, and the project area, where it eventually discharges into the Town River and Town River Bay. A vast majority of the Brook in Quincy is conveyed through an artificial channel which alternates between open channel and enclosed sections of culverts of varying materials and dimensions. Approximately 55% of Town Brook is conveyed in the enclosed culvert from the outlet of the Old Quincy Reservoir to Town River Bay.

The Town Brook watershed is a total of approximately 4.7 square miles with approximately 4.46 square miles of the watershed contributing to the project study point just downstream of the project area as measured at the USGS gauging station (USGS gauge 01105585) adjacent to Miller Stile Road (according to the Flood Insurance Study, dated May 16, 2006). The 4.46 square mile watershed upstream of the USGS gauging station has been used as the study area for the hydrologic evaluation of the watershed and in the determination of peak flows for use in the hydraulic evaluation of the existing and proposed Town Brook culverts.

The Brook within the project area consists of approximately 1,700 linear feet of culverted section, which is completely enclosed with the exception of a 16 linear foot open channel segment at the rear of parcel DU65 (the Hong Kong Eatery restaurant) adjacent to the existing City of Quincy Hancock surface parking lot. The culvert is severely degraded with illicit connections evident as documented in the Town Brook Video included in Appendix F. Refer to Figures 1.1.1 and 1.1.2 for project location map and depiction of the existing culvert alignment. The existing culvert varies widely in size, shape, material and structural integrity, with 11 different segments of culvert identified within the project area. Refer to Figures 1.2.1 and 1.2.2 for a summary, description and hydraulic properties of the existing culvert sections and parcel designations within Quincy Center.

### Town Brook History & Flood Control Projects

As previously indicated, City records found on file at the Engineering Department document, with photos and reports, flooding associated with Town Brook dating back to 1885. In the same file the City has records of numerous requests, sketches and copies of permits to re-align and culvert sections of Town Brook through various impacted properties. These numerous projects were likely intended to mitigate flood impacts and optimize land use potential on the properties adjacent to Town Brook. No Town Brook watershed master plan was found in the City files, which addressed flood control and environmental concerns on a City wide basis.

Numerous studies have been performed by the City of Quincy, U.S. Army Corps of Engineers (USACOE) and the Metropolitan District Commission (MDC) to identify flooding problems associated with Town Brook and proposed potential feasible solutions to mitigate the flooding.

Refer to the "Table of Contents" for a catalogue summary of record reports and studies developed for Town Brook that were reviewed during the development of this document.

The most significant and comprehensive studies were performed by the USACOE. The USACOE reports analyzed a number of potential projects that were designed to reduce flooding impacts associated with Town Brook. Based on recommendations from feasibility studies, the USACOE and MDC moved forward with the design, permitting and construction of the following Town Brook flood control projects (Ref. TB-017):

- Town Brook Relief Tunnel and Appurtenance Structures (aka "Deep Rock Relief Tunnel")
- Improvements to the Old Quincy Dam for Flood Control
- Centre Street Junction Box, Burgin Parkway and Braintree Culverts

These flood improvement projects were authorized by the Water Resources Development Act of 1986, authorized by legislation enacted on November 17, 1986 through H. Doc. 39, 99th cong., 1st session.

The Deep Rock Relief Tunnel work included the construction of the relief tunnel, intake and outlet areas (shafts), channel improvements within Town River, and an aeration system. The improvements to the Old Quincy Dam included the dam embankment and dike work, spillway and permanent pool structure and outlet works.

The work to complete the Deep Rock Relief Tunnel and the Town River widening and channel improvements has been completed. Based upon discussions with the DCR, the salt marsh restoration work authorized under this project would have been included with construction of other flood control improvements, which were not completed. Another phase of the flood control work is related to the Brook Road Diversion project which has not been constructed.

Of the flood control projects completed, the Centre Street Junction Box and the Deep Rock Tunnel have direct impacts to the low flow and peak flows in Town Brook through the project area. A detailed evaluation of the design low flows and peak flows can be found in Chapter 5 of this Report.

Since the construction of the Deep Rock Relief Tunnel, the number of flooding complaints received by the City from citizens in areas prone to flooding associated with Town Brook has reduced significantly, as documented in the "Town Brook Drainage Assessment – Bigelow Relief Conduit", dated May 30, 2006, prepared by Rizzo Associates (Ref. TB-015).

The Massachusetts Division of Marine Fisheries is currently undertaking a study to review modifications to the Centre Street Junction Box and Deep Rock Tunnel intake area in order to increase low base flow in Town Brook to improve the spawning habitat of the rainbow smelt. The City has an ongoing dialogue with both the Massachusetts Division of Marine Fisheries and the National Marine Fisheries and will incorporate these agencies input and the findings of the report into the final design of the Project.

Additionally, the Advisory Opinion Letter issued by the MEPA office, dated March 4, 2011, identifies three separate projects in the downtown Quincy area that may be subject to MEPA review. The City, along with the City's designated redeveloper under the City's Urban Renewal

and Development Plan, will be submitting an ENF for the redevelopment envisioned under the URDP (the "Redevelopment Project"). The City expects that the scope issued in response to the ENF for the Redevelopment Project will be comprehensive and will require review of a range of environmental impacts or conditions within the Redevelopment Project site. The City will specifically request that certain environmental impacts or conditions be included in the scope issued for the Redevelopment Project, including those identified for evaluation in the Land Disposition Agreement entered into by the City with the designated developer, such as the evaluation of the historic flooding issues associated with the "Bigelow Pool" area, the residential neighborhoods adjacent to the Town Brook off of Bigelow Street and Miler Stile Road, downstream of the project area. This ENF document will specifically focus on the impacts of the Town Brook Enhancement Project, with the anticipation that other flooding issues associated with Town Brook beyond the project area will be addressed at a later date in a separate MEPA filing associated with the Quincy Center Redevelopment Project.

### Rainbow Smelt (*Osmerus mordax*) Habitat

Another key element to the Project is the enhancement of the rainbow smelt (*Osmerus mordax*) habitat and spawning areas. Rainbow smelt are an anadromous fish, which are fish that spend a majority of their life cycle in the ocean and migrate to fresh water to spawn. The area just downstream of the project site, south of Revere Road, has been identified as a spawning area. A key feature in the spawning area is a pool comprised of an approximately 3' deep pool caused by the failure of the artificial channel bottom, resulting in a channel section with reverse slope ending in a depression. As part of the Project, this habitat and spawning area will be expanded and enhanced by incorporating design criteria provided by the Massachusetts Division of Marine Fisheries and detailed in Chapter 4, "Wildlife & Fisheries" of this report.

## LAND USE CONTEXT AND ZONING

The project area is located within Quincy Center, a commercial urban center where the City of Quincy has implemented numerous planning initiatives in recent years in order to facilitate its redevelopment and return its historic vitality as a commercial center and regional destination. The project area limits are defined to the west by the upstream connection point to the existing Town Brook at the southwest intersection of the Concourse Roadway and Parkingway and to the east by the downstream connection point into the existing open channel section of Town Brook south of Revere Road on parcel D91 (currently occupied by the American Legion). Within the project area the existing Brook alignment runs through commercially developed property and parking facilities that support the Quincy Center commercial uses. The preferred re-alignment will run along the south side of the Concourse Roadway Improvement project (currently under construction) through City owned land that has limited commercial development potential, but represents valuable opportunities for public open space adjacent to open channel/day-lit sections of the Brook.

### MetroFuture Regional Plan

MetroFuture represents a new way of planning for the future. It is based on an understanding that Metro Boston is an interconnected system: regional trends shape local conditions, and

every local decision has a broader impact on our regional well-being. MetroFuture distinguishes itself by the fact that it is comprehensive, regional, and long-range. It embodies a forward-thinking, unified understanding of how different issues relate to each other, and how each municipality has a role to play in building a brighter future. The scale and complexity of the region's challenges make it clear: making a Greater Boston Region requires a transformative plan, a sustainable plan that will improve equity among our residents, strengthen the economy, protect the environment, and improve our quality of life. MetroFuture is that plan. At its heart are new patterns of growth and development that help to create choices and conserve resources. People would have more housing options and different ways to get around. The region would use less energy and water, and would spend less money extending infrastructure to new developments. The region's communities would be more sustainable as well, with stronger municipal finances and high quality education in every city and town. The changes necessary to achieve this plan will not come easily—or cheaply—but the costs of inaction are too high to let current trends continue.

The City of Quincy continues to participate in the MetroFuture Regional Plan. The detailed goals for development and preservation, and specific strategies to equitably distribute the benefits and burdens of growth assist City planners in their efforts. Perhaps the most important "product" of MetroFuture is the constituency of over 5,000 "plan builders" who helped to design MetroFuture and who are committed to its implementation.

As the enhancement and relocation of Town Brook is located in the center of a future redevelopment area, any design of the new alignment must consider these goals. As such, the MetroFuture Plan details 13 implementation strategies for future development. Several of these strategies tie directly into the Town Brook Enhancement project and include Strategy 5 – Enable Compact Growth, Strategy 6 – Improve City Life, and Strategy 13 – Conserve Natural Resources. A discussion of the appropriate implementation strategies follows.

**Enable Compact Growth**

*MetroFuture calls for a return to more historic growth patterns, which are considerably more compact than what would occur if current trends continue. By focusing growth in city and town centers, near transit and infrastructure, the region will help to preserve both environmental and financial resources that would be lost to sprawling, low density development.*

These compact patterns of growth can only be achieved if the region's communities have the tools and resources to plan and support that growth. In order to help the City to focus growth and redevelop Quincy Center in the future, barriers to redevelopment need to be removed through a design and evaluation process, which will inevitably lead to an increase in the vitality of the area. When considering the preferred alignment for the Town Brook Enhancement project, impacts to existing and proposed infrastructure and appropriate development density potential were two of the evaluation metrics taken into consideration when determining the appropriate culvert alignment.

**Improve City Life**

*Urban communities in Massachusetts offer a wealth of history, diversity, convenience, and infrastructure and are critical to the success of MetroFuture's land use and economic goals. In order to foster revitalized interest in urban living and a trend of growth in urban communities,*

*the region must reinvest in urban quality of life and place. This reinvestment will also help to ensure that all of the region's residents benefit from the same access to its resources.*

In order to accomplish this goal, the community needs to foster sustainable neighborhood redevelopment and improve urban services, maintenance, and accessibility as part of the future Quincy Center redevelopment. The project seeks to improve urban open space and the urban environment with a portion of the relocated culvert conveyed through a day-lit channel with public open space improvements surrounding the area.

**Conserve Natural Resources**

*The MetroFuture plan envisions dramatic reductions in the use of energy and water, through conservation and the use of alternative sources. More efficient use of resources is critical to the local and global environment, as well as to the regional economy, and contributes to America's national security by reducing its dependence on foreign oil. This strategy addresses the efficient use of our resources, the natural "green infrastructure" that supports existing communities and new development, and the natural heritage and ecology of wildlife habitats. The region must conserve energy, use renewable resources, better manage its water demand and treatment of its aquatic resources, and produce less solid waste to meet ambitious goals.*

Although natural resources within Quincy Center and the project area are limited, the Town Brook Enhancement project will lead to the removal of known illicit sanitary sewer discharges polluting the Brook and downstream areas, provide additional open channel sections within the proposed culvert, enhance the fisheries habitat associated with rainbow smelt, and provide open space areas adjacent to the brook for public access and recreational use.

## WETLAND RESOURCES AND WATERWAYS

The existing Town Brook is regulated under the Massachusetts Wetlands Protection Act and the City of Quincy Wetlands Protection Regulations & Ordinance. The inland resource areas associated with Town Brook include Bank, Land Under Water Bodies and Waterways, and Riverfront Area along the open channel sections. Banks and Land Under the Water Bodies and Waterways that underlie Anadromous or Catadromous Fish Runs are also regulated under the WPA. Additionally, according to the May 16, 2006 FEMA Flood Insurance Rate Map for the City of Quincy, Community Panel Numbers 255219-0057D, 255219-0019D, and 255219-0076D, Town Brook conveys the 100-year (BLSF) and 500-year flood, with a small area of surface flood plain adjacent to the open channel section of Town Brook on parcel D91 (currently occupied by the American Legion). The lower reaches of Town Brook are tidally influenced and outside the project area and the Massachusetts Coastal Zone. The limit of tidal influence is just downstream of Elm Street, according to the FIS, which is approximately 2,000 linear feet downstream of the proposed connection point. Refer to Figure 1.4 for an inventory of Wetland Resource areas in the vicinity of the project area.

## Existing Conditions of Wetlands and Waterways

As stated above, several resource areas are associated with Town Brook. Town Brook contains Bank along the limit of the stream including the culverted sections through Quincy Center. The existing Town Brook alignment is approximately 1,700 linear feet long through the project area, therefore there is approximately 3,640 linear feet of Bank proposed for relocation (Bank is located along each side of the culvert). The extent of Bank associated within Town Brook is identified on Figure 1.4 within the limits of the Project Area.

Town Brook is also identified as a perennial stream and contains Land Under Water Bodies and Waterways, including the culverted sections through Quincy Center and the project site. As noted above, the existing Town Brook alignment is approximately 1,700 linear feet and varies in width from 7.9' to 12.5' through the project area. Therefore, there is approximately 17,840 square feet of LUWW proposed for relocation. LUWW is depicted on Figure 1.4 as within the limits of Town Brook. Riverfront Area is located on the project site and is associated with the existing open channel portions of Town Brook. The approximate 16-foot open channel section behind parcel DU65, the Hong Kong Eatery restaurant, contains Riverfront Area extending from both sides of the channel. Riverfront Area also extends from the open section of Town Brook south of Revere Road. Figure 1.4 depicts the extent of Riverfront Area on the project site. The existing Riverfront Area within the project area is within developed areas, with a vast majority of the ground cover within the Riverfront Area paved and in poor condition with little to no vegetation.

Bordering Land Subject to Flooding is located at the downstream connection point to the existing open channel section of Town Brook. Proposed grading alterations will result in the net increase of flood storage on an incremental basis, as the grade will be lowered at this location for the creation of approximately 5,500 square feet public open space. No temporary or permanent displacement of BLSF flood storage is proposed within the project area.

Banks and Land Under the Water Bodies and Waterways that underlie Anadromous or Catadromous Fish Runs are regulated under the WPA. This resource area is referred to as a "Fish Run" and is located within the limits of Town Brook, known to support rainbow smelt (*Osmerus mordax*) and American eel (*Anguilla rostrata*). A discussion of the existing wildlife and fisheries habitat, as well as proposed enhancements is detailed in Chapter 4.

A review of the current Mass GIS data layer for the Massachusetts Natural Heritage Atlas (effective October 1, 2008) under the Natural Heritage and Endangered Species Program (NHESP) indicates that site is not located within Estimated Habitat for rare wildlife or Priority Habitat for rare species. No certified or potential vernal pools under the jurisdiction of the Wetlands Protection Act (310 CMR 10.00) or the Massachusetts Endangered Species Act (321 CMR 10.00) occur on or near the proposed work area.

**Proposed Impacts to Wetlands and Waterways**

The project will greatly enhance the conditions of Town Brook through the proposed re-alignment of the existing channel, by day-lit segments of the proposed Brook, creating substantial Riverfront Area, with adjacent open space. Impacts are proposed to several resource areas including Bank and LUWW as the section of degraded culvert through the project area will be decommissioned over time after the Brook is diverted to the proposed alignment. The existing culvert provides little value to Bank, LUWW, RA, and fisheries except to provide flood control as a conveyance structure (See DVD of Town Brook Video, Appendix F). RA and fisheries will realize significant improvements and a portion of Town Brook will be day-lit providing enhancements to the resources Bank, LUWW, and Fish Run. Overall, the project will provide a benefit to Town Brook and fisheries habitat for rainbow smelt.

Approximately 13,315 square feet of developed Riverfront Area associated with the open channel section of Town Brook south or Revere Road will be altered within the project area. As part of these alterations, existing paved areas will be converted into public open space, with permeable ground cover, adjacent to proposed day-lit sections of the proposed culvert. Approximately 6,680 square feet of developed Riverfront Area, with a vast majority of the former Riverfront Area ground cover consisting of pavement and buildings, is associated with parcel DU65 (Hong Kong Eatery restaurant). This existing developed Riverfront Area will no longer be regulated after the Brook is diverted to its proposed alignment.

The existing resource areas within the project area associated with the existing Town Brook culvert alignment and proposed resource areas associated with the preferred alternative are summarized in Table 1.1. Associated with the proposed preferred alternative are two options for associated with the low flow channel and fisheries enhancements, the proposed resource areas associate with those options are presented below.

**Table 1.1**
**Summary of Existing and Proposed Resources Within Study Area**

| Resource Area | Existing | Preferred Alternative Option 1 | Preferred Alternative Option 2 | Net Change (Option 1) | Net Change (Option 2) |
|---|---|---|---|---|---|
| Square feet of new BVW alteration | 0 | 0 | 0 | 0 | 0 |
| Square feet of new other wetland alteration | | | | | |
| • Linear Feet of Bank | 3,640 | 3,000 | 2,660 | -640 | -980 |
| • Square Feet of LUWW | 17,840 | 15,190 | 14,350 | -2,650 | -3,490 |
| • Linear Feet of Open Channel Sections of T.B. | 200 | 385 | 315 | +185 | +115 |
| • Square Feet of Open Channel Section of T.B. | 1,565 | 3,345 | 3,170 | +1,780 | +1,605 |
| Total Square Feet of Riverfront Area | 91,670 | 179,900 | 166,275 | +88,230 | +74,605 |
| • 100-Foot Inner Riparian Zone | 43,115 | 91,635 | 84,400 | +48,520 | +41,285 |
| • 200-Foot Outer Riparian Zone | 48,555 | 88,265 | 81,875 | +39,710 | +33,320 |
| Square feet of Bordering Land Subject to Flooding | 69,275 | 4,850* | 4,275* | 0* | 0* |
| Acres of new non-water dependent use of tidelands or waterways | 0 | 0 | 0 | 0 | 0 |

***No temporary or permanent displacement of flood storage is proposed within the project area within BLSF. The alteration of BLSF is entirely for restoration of the brook along the American Legion parcel and the total BLSF within the project area will remain the same.**

Table 1.2 identifies the alterations within the existing resource areas in order to construct the proposed enhancement areas. The alterations are summarized for each option associated with the preferred alternative.

| Table 1.2<br>Summary of Proposed Enhancement<br>Alterations Within Existing Resource Areas | | |
|---|---|---|
| **Resource Area** | **Preferred Alternative Option 1 (square feet)** | **Preferred Alternative Option 2 (square feet)** |
| **Total Square Feet of Riverfront Area** | 13,315 | 13,315 |
| • **Existing 100-Foot Inner Riparian Zone** | 6,545 | 6,545 |
| • **Existing 200-Foot Outer Riparian Zone** | 6,770 | 6,770 |
| **Existing LUWW** | 1,400 | 940 |
| **Existing BLSF** | 4,850 | 4,275 |

## SOIL AND GROUNDWATER CONDITIONS

Soil conditions in Quincy Center and specifically in the vicinity of the proposed Town Brook alignment were derived primarily from the most recent glacial advance and retreat, which deposited a broad range of soil types. Naturally-deposited soils in the area of the proposed alignment typically consist of sands and gravels which may overlie fine-grained glacial lake bed sands, silts and possibly clays at depth. Following glaciation, compressible organic deposits accumulated locally along stream valleys and within low-lying depressions. Historical construction and industrial activities modified the landscape with the placement of fill soils and the construction of various building foundations and other civil infrastructure.

Nine test borings (designated B-TB1 through B-TB8 including B-TB3A) were conducted along the proposed alignment in December 2010, ranging in depths from 15 to 30 ft. Typically, the test borings were terminated near or below the proposed culvert invert.

The test borings disclosed the following general sequence of subsurface strata, proceeding from ground surface downward. The encountered conditions were consistent with the area geology. Refer to Table 1.3 for a summary of subsurface strata.

| Table 1.3<br>Subsurface Strata Summary | |
|---|---|
| **Stratum** | **Range in Encountered Thickness, Feet** |
| Pavement, Loam and MISCELLANEOUS FILL | 4 to 15.5 |
| PEAT | 0 to 3.5 |
| SAND with varying amounts of gravel, cobbles | 6.5 to 20 |

Peat was encountered in B-TB6 and B-TB7 at approximately Sta. 30+11 and Sta. 31+16, at locations of relatively low topography along Converse Street in the general vicinity of the historic abandoned Town Brook alignment. The SAND stratum, typically dense to very dense, was not fully penetrated in any of the test borings.

Based on the test borings, conditions at the proposed culvert inverts are anticipated to typically consist of the following:

| Table 1.4<br>Soil Conditions at Proposed Inverts | |
|---|---|
| **Approximate Station** | **Soil Conditions at Invert** |
| Sta. 33+29 to Sta. 30+50 | FILL or PEAT |
| Sta. 30+50 to Sta. 29+50 | FILL or SAND |
| Sta. 29+50 to Sta. 21+91 | SAND |

Water was reported in seven of the nine test borings (not encountered in B-TB1 and B-TB2) at depths ranging from 11.5' to 25'. The recorded water levels were typically below the planned culvert invert elevations. Accordingly, significant dewatering is not anticipated to be required for culvert installation.

Refer to Chapter 6 of this Report for a detailed discussion of soil, groundwater and environmental conditions within the project area.

## HISTORIC AND ARCHAEOLOGICAL RESOURCES

The proposed culvert alignment crosses through the Quincy Center Historic District, which generally overlays the parcels along the east and west sides of Hancock Street. The culvert, as it passes through the Historic District, is well below grade and no permanent grade alteration or impact to structures within the district is proposed as part of the project.

The City has met with the Quincy Historical Commission, who at their February 28, 2011 regularly scheduled meeting found that *"Pursuant to Chapter 40C of the General Laws of the Commonwealth of Massachusetts and the Historic District Ordinance of the City of Quincy, the Quincy Historical Commission hereby issues a Certificate of Non-Applicability with respect to the Town Brook Enhancement Project."*

A copy of the determination is on file at the Quincy Historical Commission and included in Appendix E.

## OPEN SPACE AND LANDSCAPING

The existing Town Brook within the project area is completely conveyed in an enclosed culvert, with the exception of a 16 linear foot open channel section behind parcel DU 65, the Hong Kong Eatery restaurant (See DVD of Town Brook Video, Appendix F). Town Brook through Quincy Center is generally not visible to the public until the open channel portion of the Brook downstream of the project area south of Revere Road on Parcel D91, the American Legion.

The Existing Town Brook within the project area is beneath existing roadways, parking garages, buildings and parking lots and is not adjacent to any public open space or landscaping. The existing Town Brook has little aesthetic value. Refer to Figures 1.3.1 through 1.3.5 for site photographs.

### Proposed Open Space

The re-alignment of Town Brook, generally running west to east, is proposed along the south side of the proposed Concourse Roadway project right-of-way (currently under construction). It will run through properties acquired by the City of Quincy through eminent domain takings in order to secure the right-of-way for the new Concourse roadway. With City control of these parcels, there is opportunity to provide public open space and amenity areas adjacent to proposed open channel sections of Town Brook. These parcels allow for the creation of approximately 5,500 square feet of public amenity open space in an urban context where none exists today, in line with the visions and goals of the URDP.

The open space will be developed to incorporate at a minimum the following design goals:

- Consistency with the Quincy Center District Design Guidelines, as amended October 2010

- Consistency with the Urban Revitalization District Plan, as amended
- Appropriate treatment of the interface of the public space and open channel section of culvert
- Incorporation of a smelt resting pool between the public open space and brook
- Incorporation of a rain garden as a low impact development stormwater feature to collect and treat stormwater runoff from the open space area and discharge into the smelt resting pool
- Provide shade trees along the south side of the open channel sections to provide temperature mitigation to support smelt habitat
- Provide public education plaques with information regarding Town Brook and the rainbow smelt spawning
- Incorporate appropriate input from the public

Refer to Figures 1.6.1, 1.6.2 and 1.6.3 for a conceptual sketch of the Open Space Amenity Area.

### Proposed Landscaping

As part of the proposed open channel/day-lit sections of Town Brook, landscaping elements will be incorporated to provide public amenity space adjacent to the Brook, providing active open space. Additionally landscaping will be provided to shade the open channel sections to mitigate temperatures of the Brook, impacting the smelt spawning. The landscape provided in the open space will be selected in accordance with the "Sustainability" section of the "Quincy Center District Design Guidelines". During the final design, the open space will be evaluated and reviewed for consistency with the Downtown Public Art and Place Making Commission.

## SUSTAINABLE DESIGN FEATURES

This section discusses the project's compliance with the Commonwealth of Massachusetts Sustainable Development Principles, habitat and water quality enhancements, and hydraulics conductivity.

### Commonwealth of Massachusetts Sustainable Development Principles

As part of the Project certain design features were incorporated that address the heart of the Commonwealth of Massachusetts Sustainable Development Principles. These principles declare that care for the built and natural environment should be considered via sustainable development through integrated energy and the environment, housing and economic development, transportation and other policies, programs, investments, and regulations. The Commonwealth encourages the coordination and cooperation of all agencies, investment of public funds in smart growth and equitable development, giving priority to investments that will deliver good jobs and good wages, transit access, housing, and open space, in accordance with several sustainable development principles. Furthermore, the Commonwealth seeks to advance these principles in partnership with regional and municipal governments, non-profit organizations, business, and other stakeholders.

Although not a land development project, the Town Brook Enhancement project adheres to and promotes consistency with the following sustainable design principles:

**Concentrate Development and Mix Uses**

Under the Commonwealth of Massachusetts Sustainable Development Principles, the goal of this principle is to *support the revitalization of city and town centers and neighborhoods by promoting development that is compact, conserves land, protects historic resources, and integrates uses. Encourage remediation and reuse of existing sites, structures, and infrastructure rather than new construction in undeveloped areas. Create pedestrian friendly districts and neighborhoods that mix commercial, civic, cultural, educational, and recreational activities with open spaces and homes.*

The enhancement and relocation of Town Brook will improve the water quality and fisheries habitat associated with a degraded culvert system. Open space is planned along the proposed day-lit sections of the proposed culvert. The project also provides the benefit of facilitating the implementation of City development goals for the Quincy Center area.

**Protect Land and Ecosystems**

The goal of this sustainable design principle is to *protect and restore environmentally sensitive lands, natural resources, agricultural lands, critical habitats, wetlands and water resources, and cultural and historic landscapes. Increase the quantity, quality and accessibility of open spaces and recreational opportunities.*

One of the primary goals of the Town Brook Enhancement project is to enhance fisheries habitat by improving and extending the existing known habitat area of the rainbow smelt by:

- Coordinating with the Massachusetts Division of Marine fisheries to incorporate into the design increases in low flow associated with the modifications to the Centre Street junction box and/or Deep Rock Tunnel intake area
- Providing additional open channel/day-lit sections with resting pools and spawning riffles
- Improving water quality through the removal of known direct illicit sanitary sewer connections to the Brook within the project area
- Provide treatment of future stormwater discharges

In addition, Public open space is proposed adjacent to the open channel sections presenting public recreational opportunities.

**Use Natural Resources Wisely**

The goal of this principle is to *construct and promote developments, buildings, and infrastructure that conserve natural resources by reducing waste and pollution through efficient use of land, energy, water, and materials.* The existing Town Brook culvert serves as a flood conveyance structure and will be significantly improved through this project. The numerous illicit discharges in the stream will be addressed through construction of the new culvert, improving the water quality of Town Brook in the long-term.

## Habitat Enhancements

As part of the project, a number of enhancements will be incorporated into the design which will benefit the habitat and spawning area of the rainbow smelt. The fisheries habitat will be improved along the proposed open channel sections of Town Brook. The habitat enhancements will include:

- Low flow trapezoidal channel within the open channel sections of the proposed culvert, with the channel design coordinated with the Massachusetts Division of Marine fisheries plans to increase low flow in the brook through proposed modifications to the Centre Street junction box and/or Deep Rock Tunnel intake area
- Spawning substrate within the low flow channel
- Spawning riffles and resting pools
- Temperature mitigation

The proposed wildlife and fisheries habitat enhancements have been detailed in Chapter 4, "Wildlife & Fisheries".

Two viable options have been identified for the location of the low flow channel for the proposed re-alignment of Town Brook. Option 1 consists of a separate low flow channel that ties into the existing channel upstream of the re-aligned culvert. This option allows the restoration of existing channel within Town Brook that can continue to be utilized by the smelt population. Option 2 consists of the low flow channel within the culvert and will tie into the existing Town Brook further downstream. Both options will provide additional day-lit sections and improved fisheries habitat, with adjacent open space on parcel D91, the American Legion parcel.

## Water Quality Enhancements

As part of the project, the City is proposing to implement the following water quality enhancements:

- Installation of rain gardens on the proposed public open space parcels, to treat surface runoff
- Remove known direct illicit sanitary sewer connections to the Brook within the project area
- Identify potential unknown illicit connections within the project area and remove/disconnect
- Develop a Town Brook Watershed Master Plan to address potential water quality improvements within the watershed through public works projects and development of water quality objectives for development and redevelopment projects, plan to be developed by the selected developer

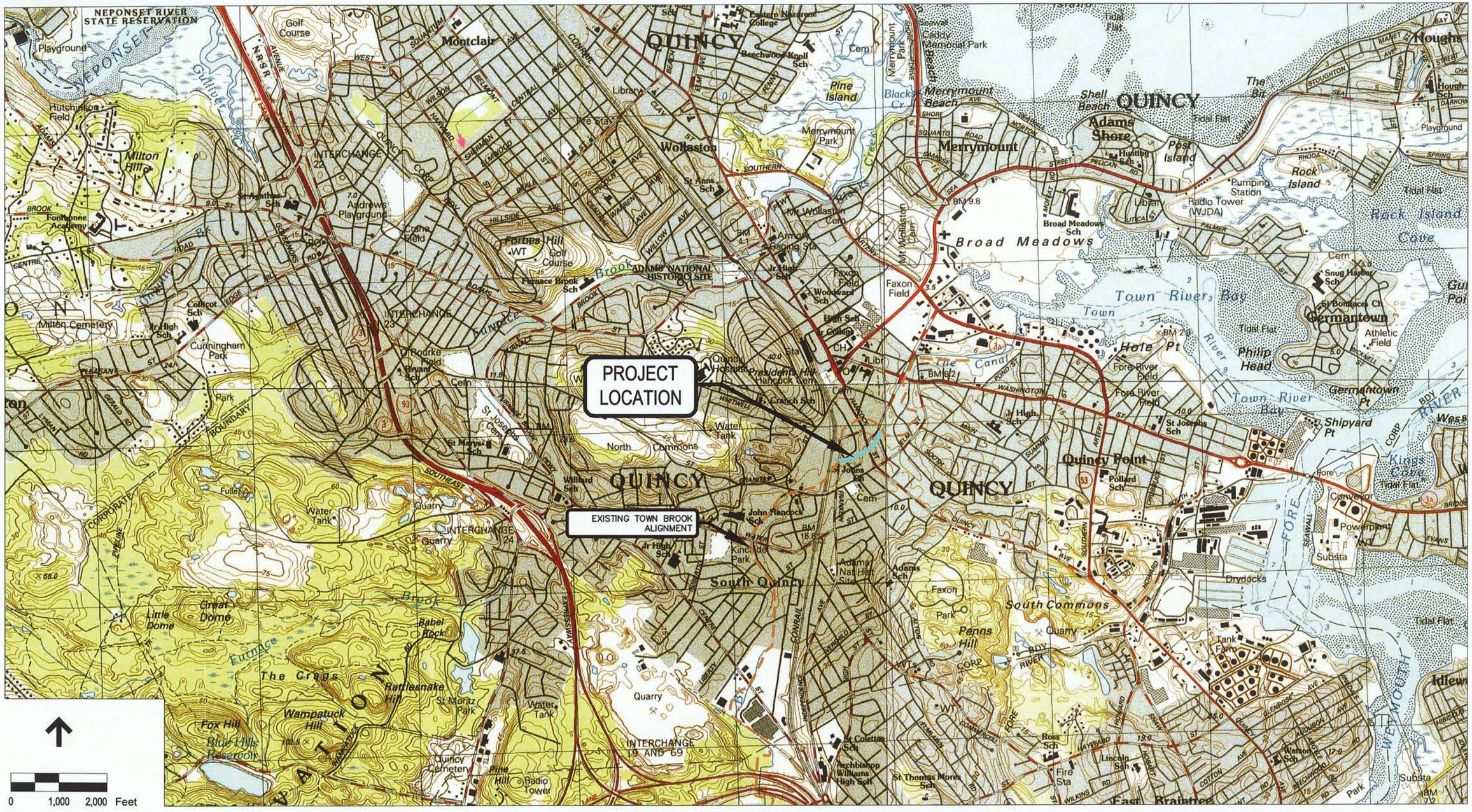
## PUBLIC OUTREACH

In order to advance the Conceptual design of the Town Brook Enhancement Project presented in this document, the City and its design team has met with local, state and federal agency staff as well as members of the general public in order to solicit preliminary feedback on the Project. During these numerous meetings, preliminary feedback from members of the Quincy Environmental Network, on design priorities and objectives were ascertained and were incorporated into the evaluation metrics used in the alternatives analysis. These QEN prioritized metrics, in order of importance are: 1- Flood Control; 2- Smelt Habitat Enhancements; and 3- Open Channel/Public Amenities. Additionally, key design parameters for enhancing smelt habitat were received from the Massachusetts Division of Marine Fisheries. As a result of these meetings the conceptual design presented in this report was developed. The City will continue to meet with agency staff and members of the general public through the design and permitting process in order to incorporate relevant input into the design. Table 1.5 provides a summary of the public outreach to date.

**Table 1.5**
**Public Outreach Summary**

| Meetings | Date | Organization(s) | Location | Organization Representation |
|---|---|---|---|---|
| 1 | November 2009 | QEN Representatives | Quincy City Hall | Steve Perdios, Richard Joyce |
| 2 | January 13, 2010 | Massachusetts Division of Marine Fisheries | Quincy | Brad Chase |
| 3 | May 26, 2010 | Massachusetts Division of Marine Fisheries | Quincy City Hall | Brad Chase |
| 4 | August 23, 2010 | Massachusetts Environmental Policy Act Staff | MEPA Office | Rick Bourre, Alicia McDevitt |
| 5 | October 5, 2010 | Public Meeting | Quincy City Hall | General Public |
| 6 | October 20, 2010 | MassDEP, USACOE, EPA | MassDEP NERO | Phil DiPietro, Nancy Baker, Heidi Davis, Rachel Freed, Kevin Kotelly, Ed Reiner |
| 7 | October 25, 2010 | QEN Representatives | Quincy City Hall | Steve Perdios, Richard Joyce |
| 8 | November 18, 2010 | QEN Representatives | Quincy City Hall | Steve Perdios, Richard Joyce |
| 9 | December 2, 2010 | QEN Representatives | Quincy City Hall | Steve Perdios, Richard Joyce |
| 10 | January 25, 2011 | QEN Representatives | Quincy City Hall | Steve Perdios, Richard Joyce |
| 11 | February 7, 2011 | QEN Representatives | Quincy City Hall | Steve Perdios, Richard Joyce |
| 12 | February 14, 2011 | Massachusetts Environmental Policy Act Staff | MEPA Office | Rick Bourre, Alicia McDevitt |
| 13 | March 7, 2011 | QEN Representatives | Quincy City Hall | QEN Town Brook Subcommittee |
| 14 | March 9, 2011 | Public Meeting | Crane Library Quincy, MA | Over 100 Members of General Public |
| 15 | March 11, 2011 | MassDEP, USACOE, EPA, MA DMF, NMF, | MassDEP NERO | Nancy Baker, Heidi Davis, Mike Johnson, Tay Evans, Kevin Kotelly, Ed Reiner, Brad Chase |

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 1.1.1 USGS.dwg




NOTES:

1. USGS TOPOGRAPHIC MAPS FROM THE OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MassGIS). COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

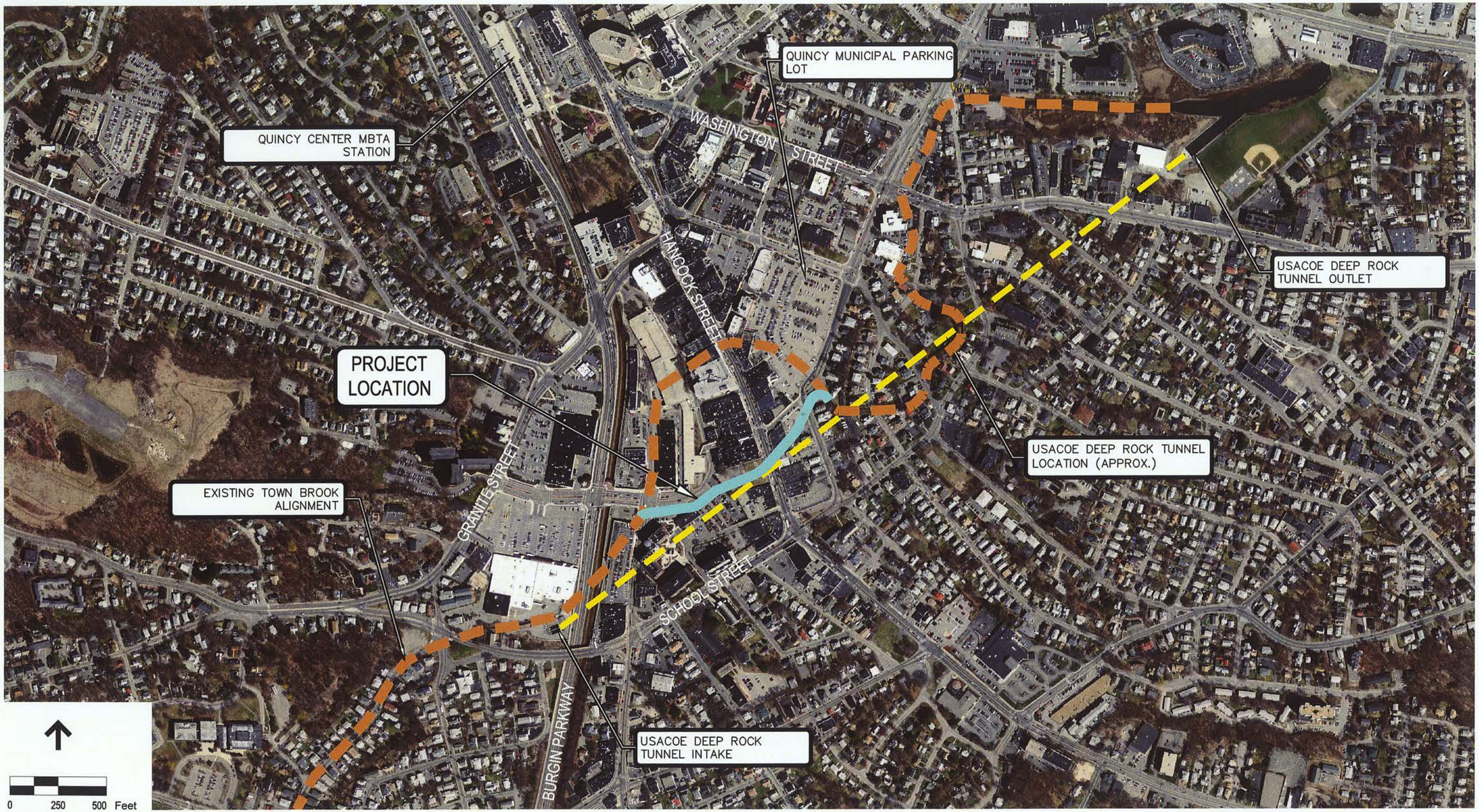
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 1.1.1 March 15, 2011

Project Location Map
USGS Topographic Map
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 1.1.2 AERIAL.dwg




NOTES:

1. AERIAL MAPPING FROM THE OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MassGIS). COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

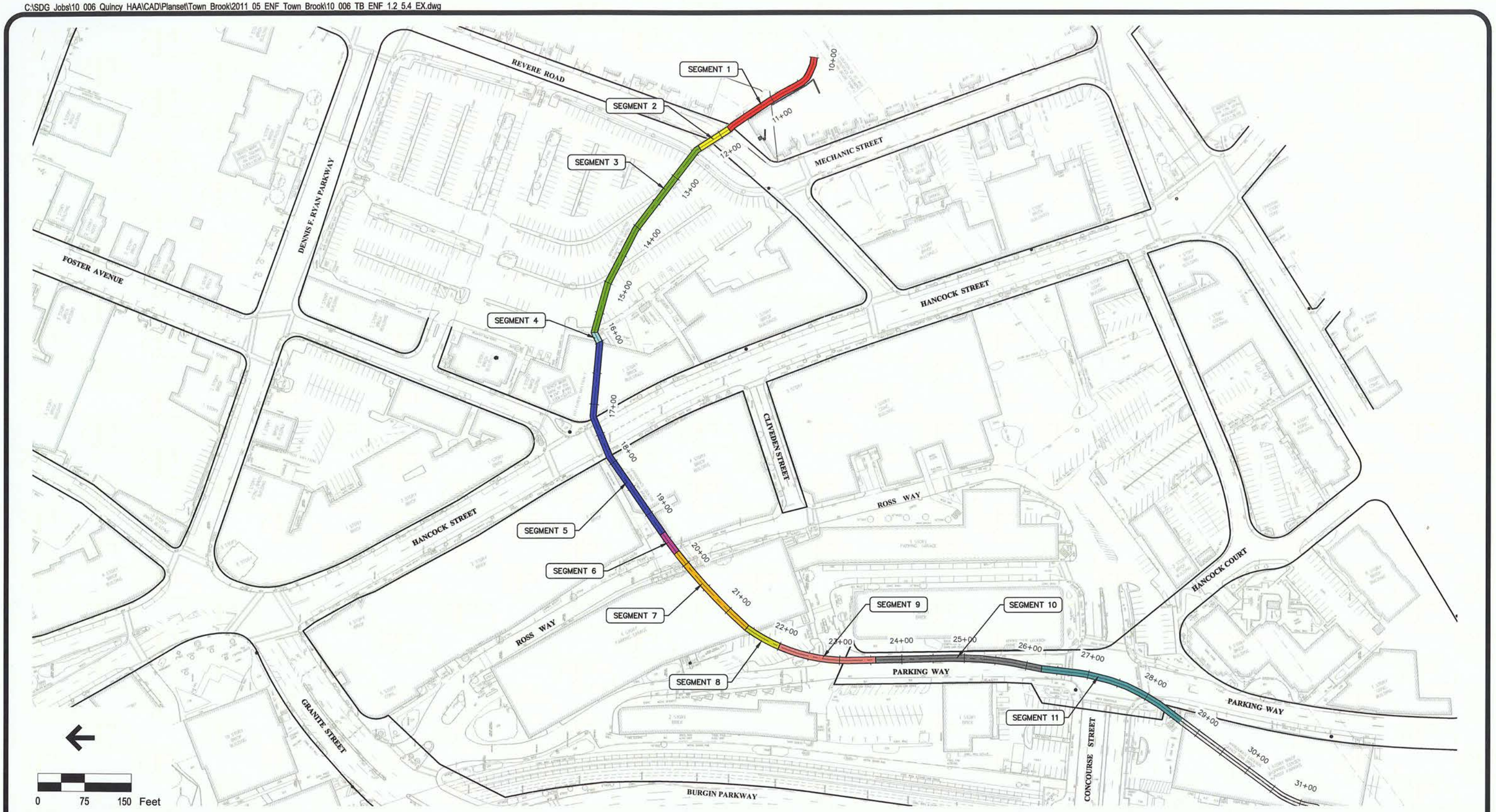
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 1.1.2 March 15, 2011

Project Location Map
Aerial Photograph
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 1.2 5.4 EX.dwg




NOTES:
REFER TO FIGURE NO. 1.2.2 FOR EXISTING TOWN BROOK SEGMENT SUMMARY

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 1.2.1 March 15, 2011

Existing Town Brook
Culvert Alignment
Town Brook Enhancement Project
Quincy, Massachusetts

APPROXIMATE EXISTING TOWN BROOK CULVERT ALIGNMENT:

SEGMENT 1 - STA 10+00 (EL.=8.2±) TO 11+84 (EL=10.2±)- OPEN CHANNEL
AVERAGE SLOPE THROUGH SEGMENT 1 = 1.10%
GRANITE/CONCRETE SIDEWALLS, CHANNEL BOTTOM VARIABLE MATERIAL
CHANNEL WIDTH VARIES 7.3' TO 8.5' WIDTH.
$Q_{full}$=785± cfs

SEGMENT 2 - STA 11+84 (EL=10.2±) TO STA 12+39 (EL=10.3±)- CULVERTED SECTION
AVERAGE SLOPE THROUGH SEGMENT 2 = 0.20%
TWIN 6'-3" WIDE BY 4'-3" HIGH - CONCRETE BOX CULVERTS
$Q_{full}$=318± cfs

SEGMENT 3 - STA 12+39 (EL=10.3±) TO STA 15+82 (EL=12.7±) - PIPED SECTION
AVERAGE SLOPE THROUGH SEGMENT 3 = 0.70%
ARCHED CORRUGATED METAIL PIPE (CMP-ARMCO) 6'-7" HIGH X 9'-9" WIDE
$Q_{full}$=416± cfs

SEGMENT 4 - STA 15+82 (EL=12.7±) TO STA 16+00 (EL=13.0±) - OPEN CHANNEL
AVERAGE SLOPE THROUGH SEGMENT 4 = 1.67%
CONCRETE SIDEWALLS, CHANNEL BOTTOM VARIABLE MATERIAL
CHANNEL WITH VARIES 8.2' TO 10' WIDE
$Q_{full}$=449± cfs

SEGMENT 5 - STA 16+00 (EL=13.0±) TO STA 19+38 (EL=12.3±) CULVERTED SECTION
AVERAGE SLOPE THROUGH SEGMENT 5 = -0.20%
CONCRETE/ GRANITE CHANNEL WITH VARIABLE DIMENSIONS/ MATERIALS
$Q_{full}$=686± cfs

SEGMENT 6 - STA 19+38 (EL=12.3±) TO STA 19+76 (EL=12.39±) CULVERTED SECTION
AVERAGE SLOPE THROUGH SEGMENT 6 = 0.25%
STONE CULVERT 6'-6" HIGH X 9' WIDE
$Q_{full}$=221± cfs

SEGMENT 7 - STA 19+76 (EL=12.30±) TO STA 21+40 (EL=12.8±) CULVERTED SECTION
AVERAGE SLOPE THROUGH SEGMENT 7 = 0.25%
STONE CULVERT 5'-6" HIGH X 9' WIDE
$Q_{full}$=175± cfs

SEGMENT 8 - STA 21+40 (EL=12.8±) TO STA 22+00 (EL=12.94±) CULVERTED SECTION
AVERAGE SLOPE THROUGH SEGMENT 8 = 0.23%
CONCRETE CULVERT 5'-6" HIGH X 9' WIDE
$Q_{full}$=404± cfs

SEGMENT 9 - STA 22+00 (EL=12.94±) TO STA 23+58 (EL=13.3±) CULVERTED SECTION
AVERAGE SLOPE THROUGH SEGMENT 9 = 0.23%
CONCRETE CULVERT 5'-6" HIGH X 9' WIDE
$Q_{full}$=404± cfs

SEGMENT 10 - STA 23+58 (EL=13.3±) TO STA 26+25 (EL=13.5±) CULVERTED SECTION
AVERAGE SLOPE THROUGH SEGMENT 10 = 0.075%
CONCRETE CULVERT 5'-6" HIGH X 9' WIDE
$Q_{full}$=221± cfs

SEGMENT 11 - STA 26+25 (EL=13.5±) TO STA 28+67 (EL=14.2±) CULVERTED SECTION
AVERAGE SLOPE THROUGH SEGMENT 11 = 0.29%
CONCRETED CULVERT 5'-6" HIGH X 9' WIDE
$Q_{full}$=435± cfs

NOTES:
REFER TO FIGURE NO. 1.2.1 FOR THE SEGMENTED EXISTING TOWN BROOK CULVERT ALIGNMENT

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

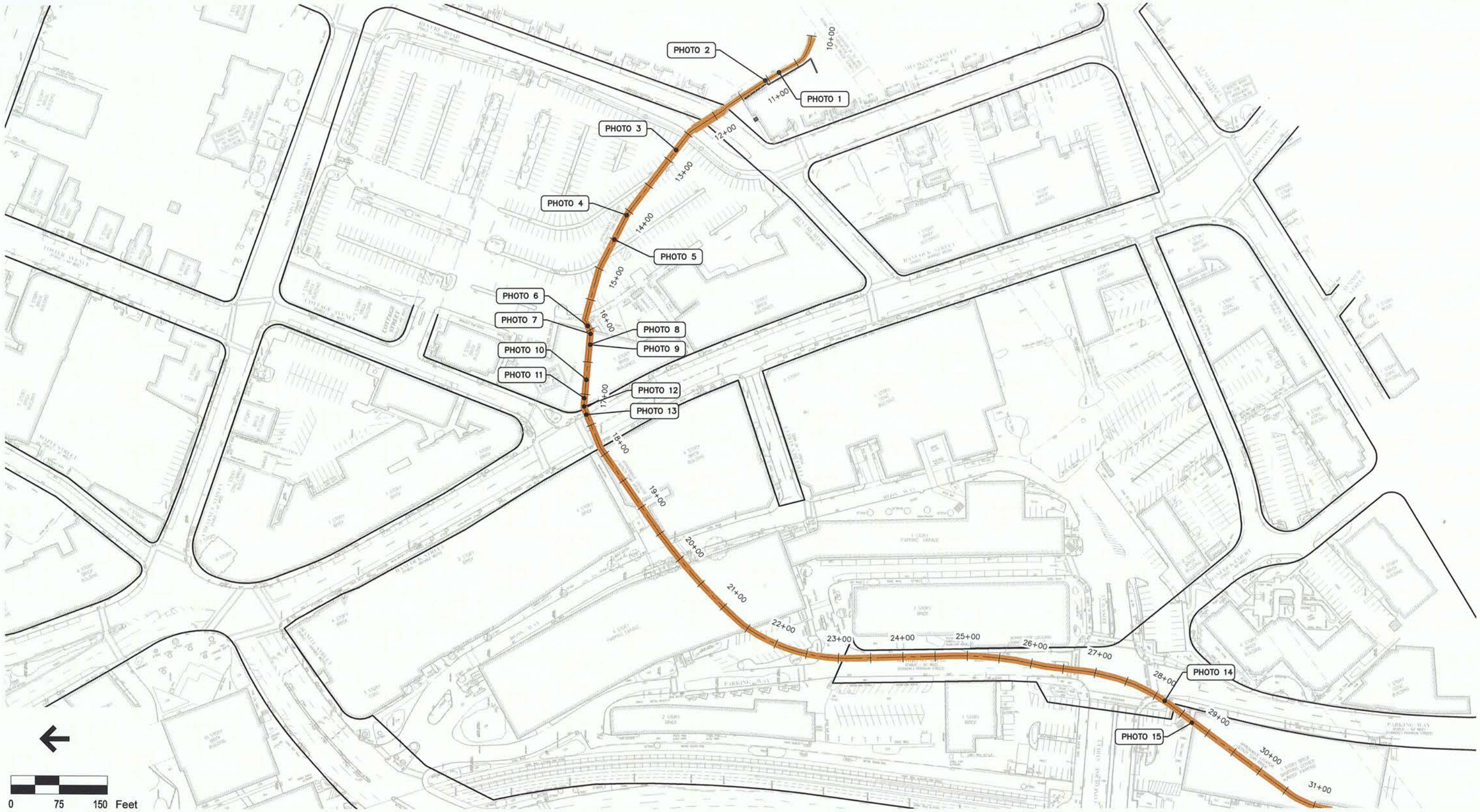
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 1.2.2 March 15, 2011

Existing Town Brook
Segment Summary
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 1.3 PHOTO.DWG




NOTES:
PHOTOGRAPHS TAKEN BY SDG BETWEEN JUNE 2010 & FEBRUARY 2011, THE CITY OF QUINCY BETWEEN JUNE 2010 & FEBRUARY 2011, AND SCREEN SHOTS FROM A VIDEO PREPARED BY TUNNEL VISION IN JULY 2008, PROVIDED BY STREET-WORKS DEVELOPMENT, LLC..

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 1.3.1 March 15, 2011

Existing Site Photographs
Key Sheet
Town Brook Enhancement Project
Quincy, Massachusetts

PHOTO 1 - AT STATION 10+80± LOOKING DOWSTREAM INTO SEGMENT 1 TO STA 10+00±

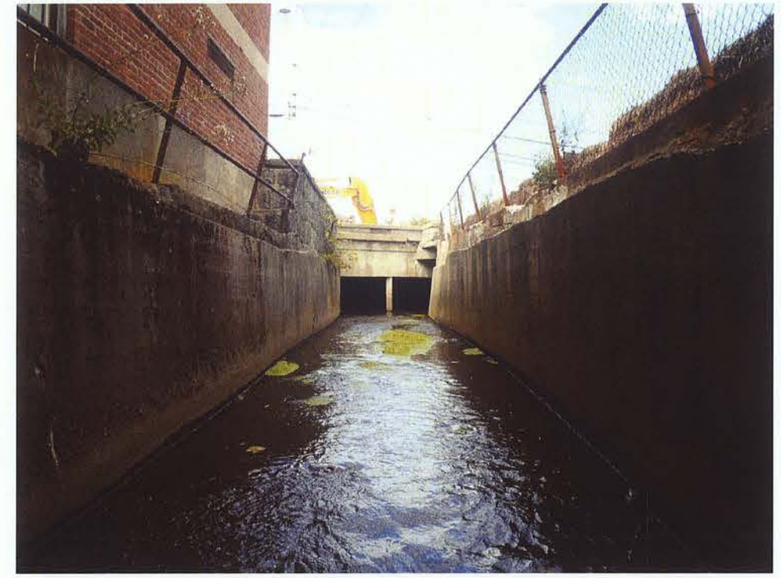


PHOTO 2 - AT STATION 11+00± LOOKING UPSTREAM TO SEGMENT 2 CULVERT OUTLET AT STA 12+39

PHOTO 3 - EXISTING TOP OF CMP CULVERT SECTION BETWEEN STA 12+50 AND 13+00

PHOTO 4 - INSIDE DMH AT STA 14+05± - NOTE DETERIORATION OF CMP CULVERT SECTION

NOTES:
PHOTOGRAPHS TAKEN BY SDG BETWEEN JUNE 2010 & FEBRUARY 2011, THE CITY OF QUINCY BETWEEN JUNE 2010 & FEBRUARY 2011, AND SCREEN SHOTS FROM A VIDEO PREPARED BY TUNNEL VISION IN JULY 2008, PROVIDED BY STREET-WORKS DEVELOPMENT, LLC..

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 1.3.2 March 15, 2011

Existing Site Photographs

Town Brook Enhancement Project
Quincy, Massachusetts

PHOTO 5- AT STA 14+50± - EXISTING WATER MAIN THROUGH CMP CULVERT SECTION

PHOTO 6 - EXISTING OPEN CHANNEL SECTION BETWEEN STA 15+82 AND 16+00 - REAR OF HONG KONG EATERY - PARCEL DU65

PHOTO 7- AT STA 16+05± - LOOKING UPSTREAM UNDER HONG KONG EATERY - PARCEL DU65

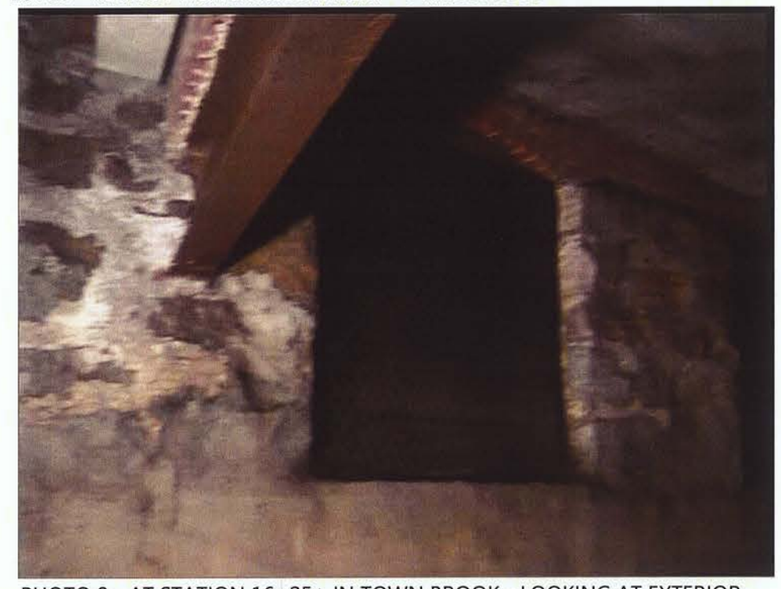


PHOTO 8 - AT STATION 16+25± IN TOWN BROOK - LOOKING AT EXTERIOR WALL OF HONG KONG EATERY - PARCEL DU65

NOTES:
PHOTOGRAPHS TAKEN BY SDG BETWEEN JUNE 2010 & FEBRUARY 2011, THE CITY OF QUINCY BETWEEN JUNE 2010 & FEBRUARY 2011, AND SCREEN SHOTS FROM A VIDEO PREPARED BY TUNNEL VISION IN JULY 2008, PROVIDED BY STREET-WORKS DEVELOPMENT, LLC..

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 1.3.3 March 15, 2011

Existing Site Photographs

Town Brook Enhancement Project
Quincy, Massachusetts

PHOTO 9 - AT STA 16+25± - IN HONG KONG EATERY LOOKING AT EXTERIOR WALL OF TOWN BROOK

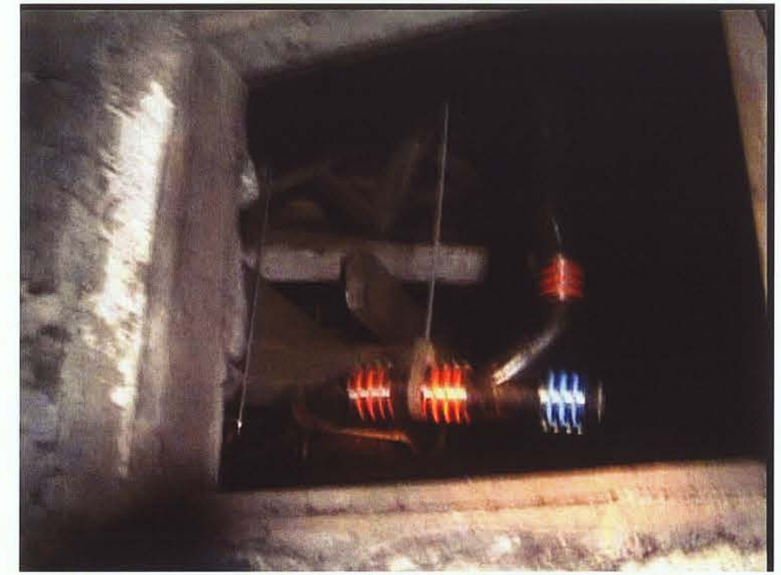


PHOTO 10 - AT STA 16+75± IN TOWN BROOK LOOKING INTO BASEMENT WINDOW OF BUILDING

PHOTO 11 - AT STA 17+00± IN TOWN BROOK LOOKING TOWARDS HANCOCK STREET

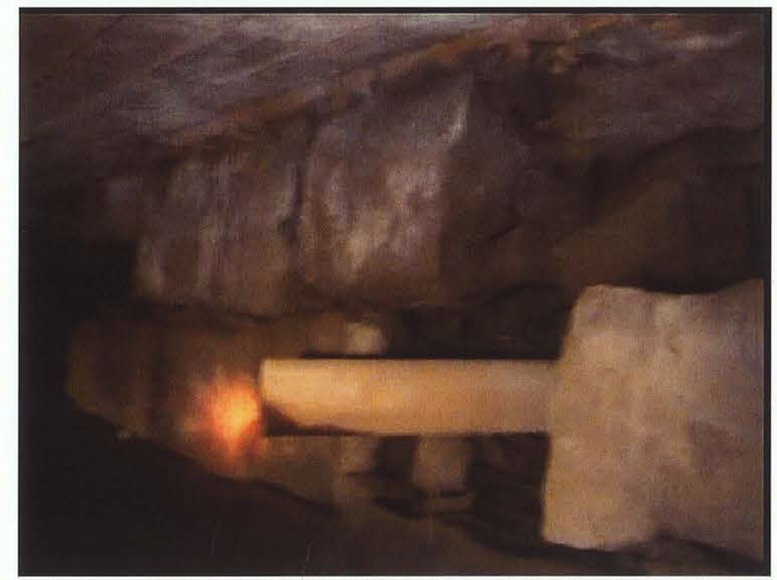


PHOTO 12 - EXISTING ILLICIT SANITARY SEWER CONNECTION BETWEEN STA 17+00 AND 18+00

NOTES:
PHOTOGRAPHS TAKEN BY SDG BETWEEN JUNE 2010 & FEBRUARY 2011, THE CITY OF QUINCY BETWEEN JUNE 2010 & FEBRUARY 2011, AND SCREEN SHOTS FROM A VIDEO PREPARED BY TUNNEL VISION IN JULY 2008, PROVIDED BY STREET-WORKS DEVELOPMENT, LLC..

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 1.3.4 March 15, 2011

Existing Site Photographs

Town Brook Enhancement Project
Quincy, Massachusetts

PHOTO 10 - AT STATION 17+20± IN TOWN BROOK - PRIOR TO CROSSING UNDER HANCOCK STREET

PHOTO 13 - AT STA 28+20 - GROUND COVER OVER EXISTING COVER AT CONNECTION POINT

PHOTO 14 - ENCLOSURE OVER DMH AT STA 28+67 - TOWN BROOK THEN RUNS UNDER BUILDING

NOTES:
PHOTOGRAPHS TAKEN BY SDG BETWEEN JUNE 2010 & FEBRUARY 2011, THE CITY OF QUINCY BETWEEN JUNE 2010 & FEBRUARY 2011, AND SCREEN SHOTS FROM A VIDEO PREPARED BY TUNNEL VISION IN JULY 2008, PROVIDED BY STREET-WORKS DEVELOPMENT, LLC..

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

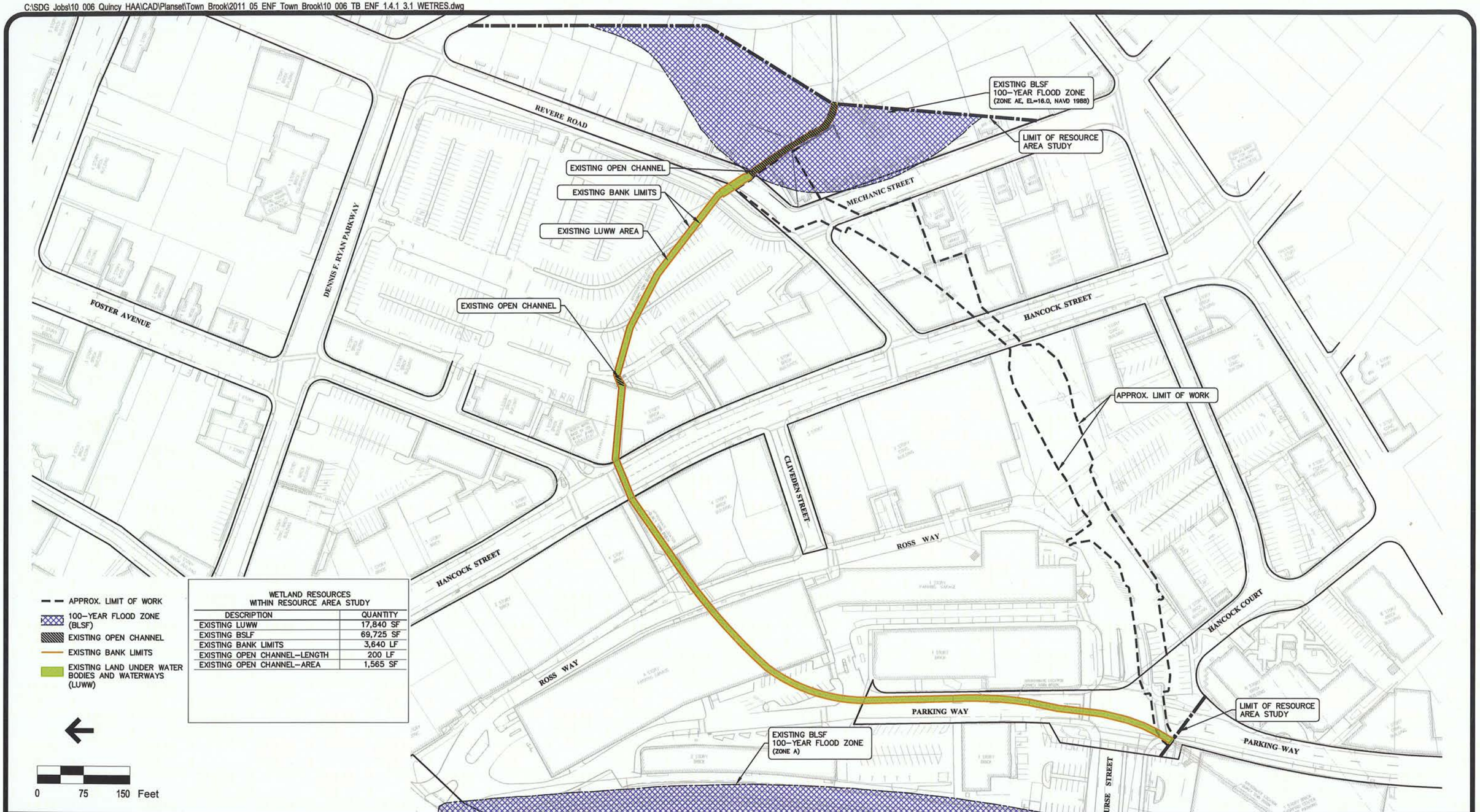
STEPHENSON DESIGN GROUP

Figure 1.3.5 March 15, 2011

Existing Site Photographs

Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 1.4.1 3.1 WETRES.dwg




WETLAND RESOURCES
WITHIN RESOURCE AREA STUDY

| DESCRIPTION | QUANTITY |
|---|---|
| EXISTING LUWW | 17,840 SF |
| EXISTING BSLF | 69,725 SF |
| EXISTING BANK LIMITS | 3,640 LF |
| EXISTING OPEN CHANNEL–LENGTH | 200 LF |
| EXISTING OPEN CHANNEL–AREA | 1,565 SF |

NOTES:

1 WETLAND RESOURCE AREAS FIELD VERIFIED BY LUCAS ENVIRONMENTAL, LLC IN SEPTEMBER 2010.

2. 100-YEAR FLOOD PLAIN LIMITS (BLSF) AS DEPICTED ON THE FEMA FLOOD INSURANCE RATE MAPS 2552190019D, 2552190057D, 2552190076D, DATED MAY 16, 2006, NAVD 1988. OBTAINED FROM THE OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MassGIS). COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS. ZONE AE (EL. 16) LIMITS TO BE CONFIRMED WITH FIELD SURVEY.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

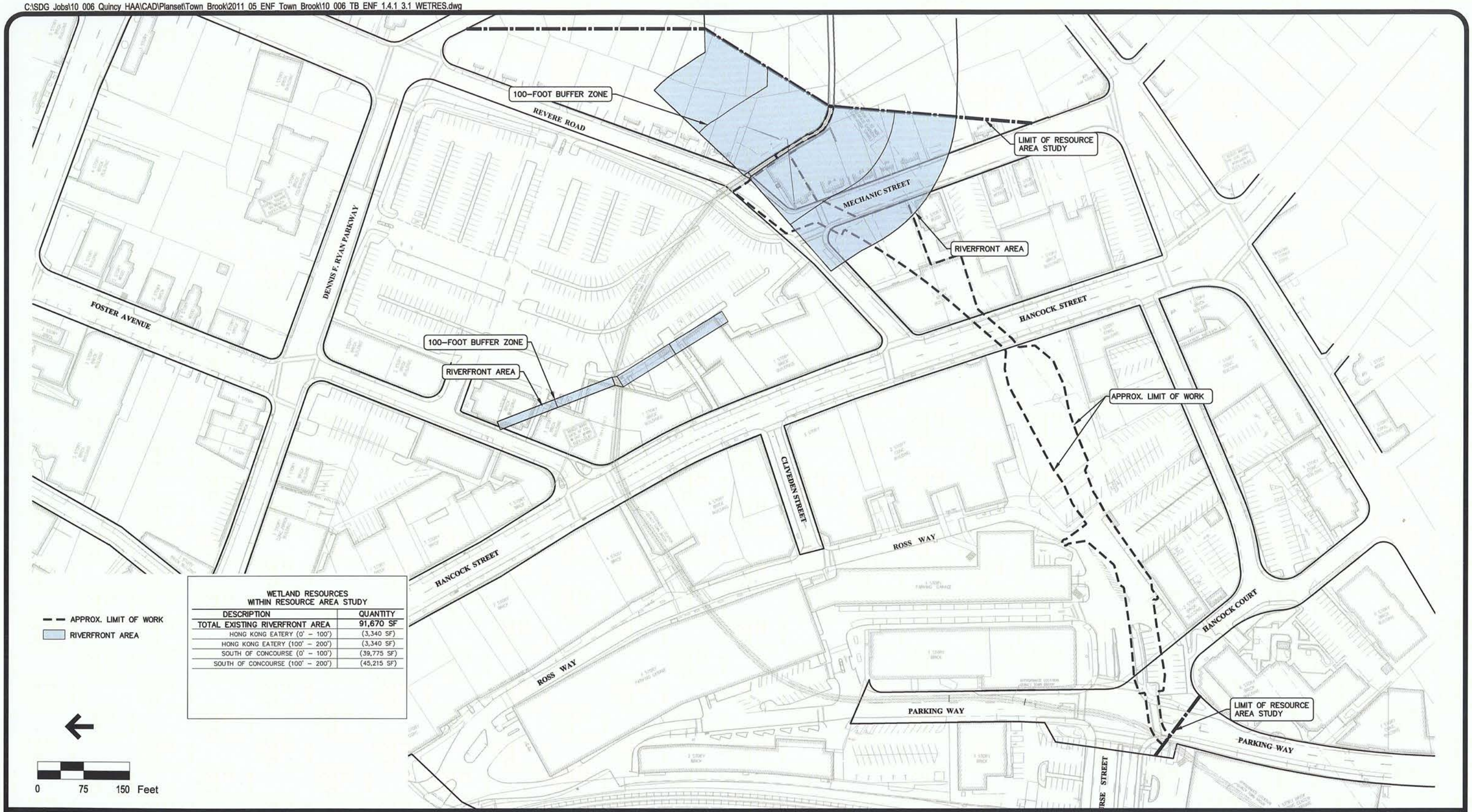
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 1.4.1 March 15, 2011

Existing Wetland Bank, LUWW, and BLSF Resource Areas
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 1.4.1 3.1 WETRES.dwg




WETLAND RESOURCES
WITHIN RESOURCE AREA STUDY

| DESCRIPTION | QUANTITY |
|---|---|
| TOTAL EXISTING RIVERFRONT AREA | 91,670 SF |
| HONG KONG EATERY (0' – 100') | (3,340 SF) |
| HONG KONG EATERY (100' – 200') | (3,340 SF) |
| SOUTH OF CONCOURSE (0' – 100') | (39,775 SF) |
| SOUTH OF CONCOURSE (100' – 200') | (45,215 SF) |

NOTES:

1 WETLAND RESOURCE AREAS FIELD VERIFIED BY LUCAS ENVIRONMENTAL IN SEPTEMBER 2010.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 1.4.2 March 15, 2011

Existing Riverfront Areas

Town Brook Enhancement Project
Quincy, Massachusetts

PROPOSED TOWN BROOK CULVERT ALIGNMENT:

SEGMENT 1 - STA 20+00 (EL.=8.2±) TO 20+93 (EL=10.3±)- OPEN CHANNEL
AVERAGE SLOPE THROUGH SEGMENT 1 = 1.14%
GRANITE/CONCRETE SIDEWALLS, CHANNEL BOTTOM VARIABLE MATERIAL
CHANNEL WIDTH VARIES 7.3' TO 8.5' WIDTH, CHANNEL DEPTH
$Q_{(full)}$=785± cfs

SEGMENT 2 - STA 20+93 (EL=10.3±) TO STA 22+05 (EL=10.6±)- VARIES (SEE OPTIONS)
AVERAGE SLOPE THROUGH SEGMENT 2 = 0.33%
11' WIDE BY 6' HIGH - CONCRETE BOX CULVERT - OPEN TOP
$Q_{(full)}$=875± cfs

OPTION 1
OPEN CHANNEL SECTION AND OPEN CHANNEL LOW FLOW STREAM SECTION WITH HIGH FLOW ENCLOSED BYPASS CULVERT (11' WIDE BY 6' HIGH)

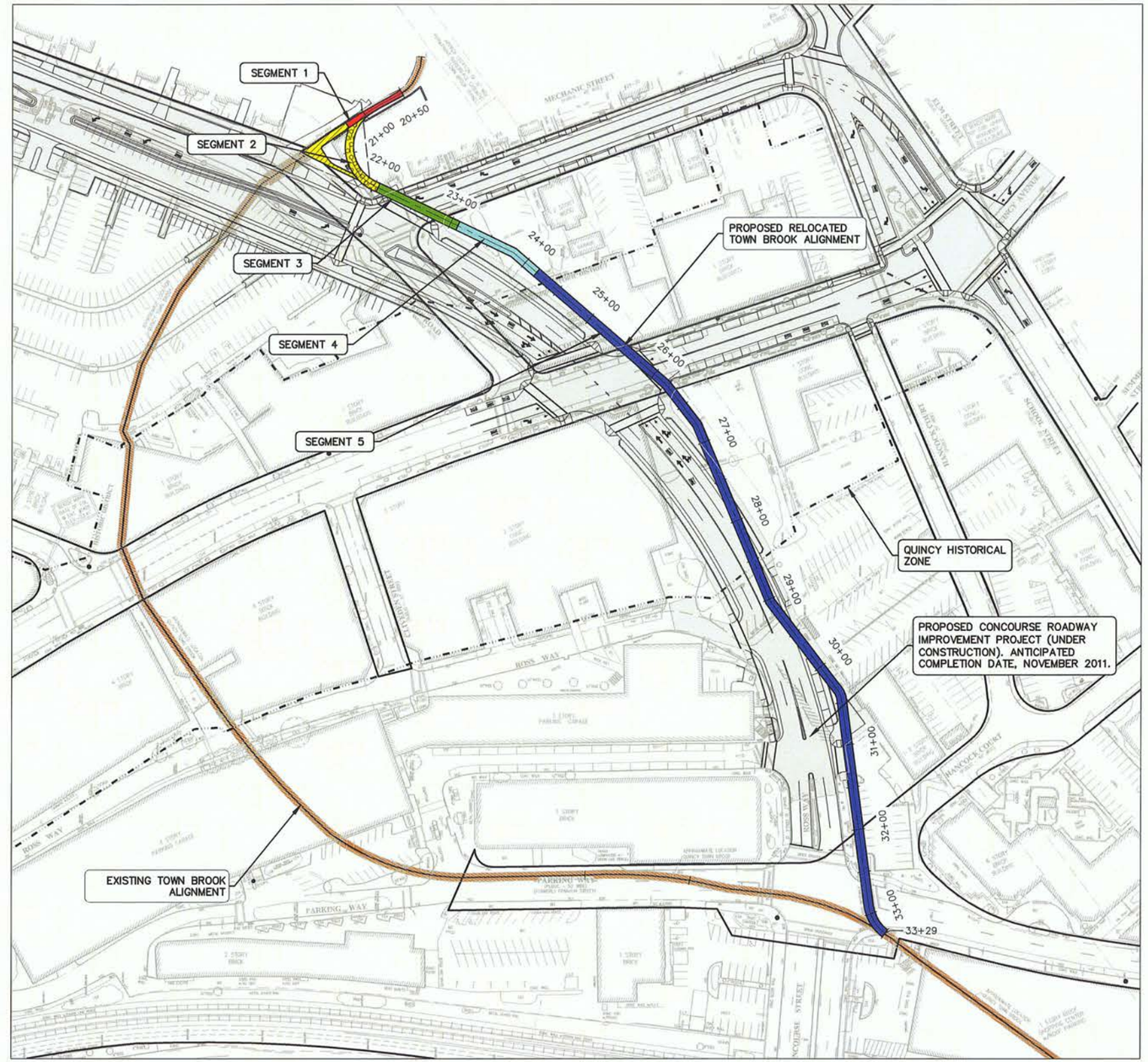
OPTION 2
OPEN CHANNEL SECTION - 11' WIDE BY 6' HIGH - CONCRETE BOX CULVERT - OPEN TOP

SEGMENT 3 - STA 22+05 (EL=10.6±) TO STA 23+09 (EL=10.9±) - BOX CULVERT
AVERAGE SLOPE THROUGH SEGMENT 3 = 0.33%
11' WIDE BY 6' HIGH - CONCRETE BOX CULVERT
$Q_{(full)}$=674± cfs

SEGMENT 4 - STA 23+09 (EL=10.9±) TO STA 24+17 (EL=11.3±) - OPEN CHANNEL
AVERAGE SLOPE THROUGH SEGMENT 4 = 0.33%
11' WIDE BY 6' HIGH - CONCRETE BOX CULVERT - OPEN TOP
$Q_{(full)}$=875± cfs

SEGMENT 5 - STA 24+17 (EL=11.3±) TO STA 33+29 (EL=14.2±) CULVERTED SECTION
AVERAGE SLOPE THROUGH SEGMENT 5 = 0.33%
11' WIDE BY 6' HIGH - CONCRETE BOX CULVERT
$Q_{(full)}$=674± cfs

0 75 150 Feet




NOTES:

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

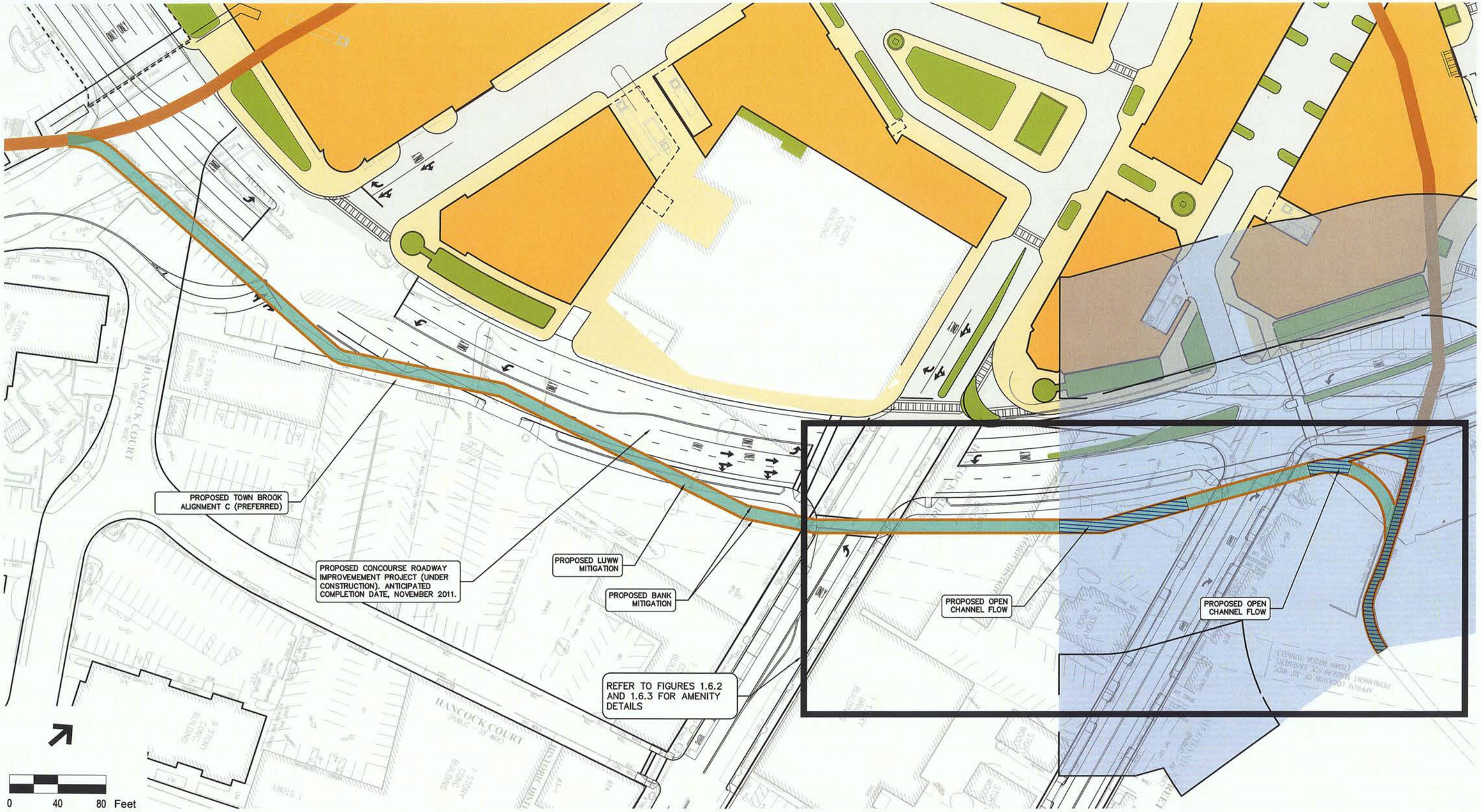
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 1.5 March 15, 2011

Proposed Town Brook
Culvert Alignment
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 3.3 WET MIT PR.dwg




NOTES:

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

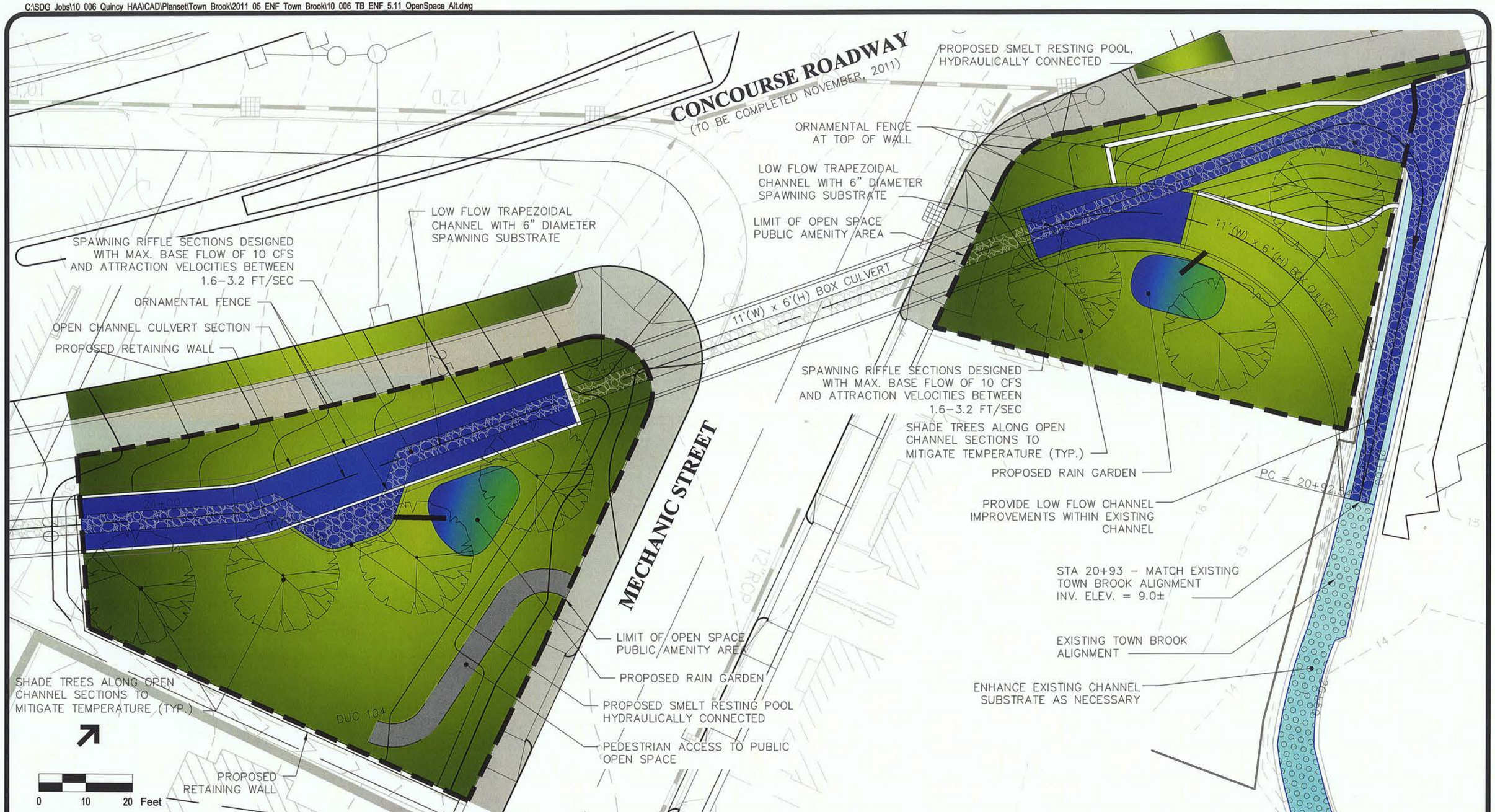
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 1.6.1 March 15, 2011

Conceptual Public Open Space
Amenity Plan - Layout
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 5.11 OpenSpace Alt.dwg




NOTES:

1. MAINTAIN DESIGN VELOCITY OF 1.6-3.2 FT/SEC ("ATTRACTION VELOCITY" WITHIN SPAWNING RIFFLE SECTIONS
2. DAY LIT CULVERT SECTIONS AND RESTING POOLS SHALL HAVE 6" DIAMETER STONE SUBSTRATE SECURED TO CULVERT BOTTOM
3. PROVIDE SHADE TREES ALONG DAY LIT SECTIONS OF CULVERT.
4. MAINTAIN FLOW DEPTH OF 6"-12" IN SPAWNING RIFFLES DURING LOW/ BASE FLOW

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

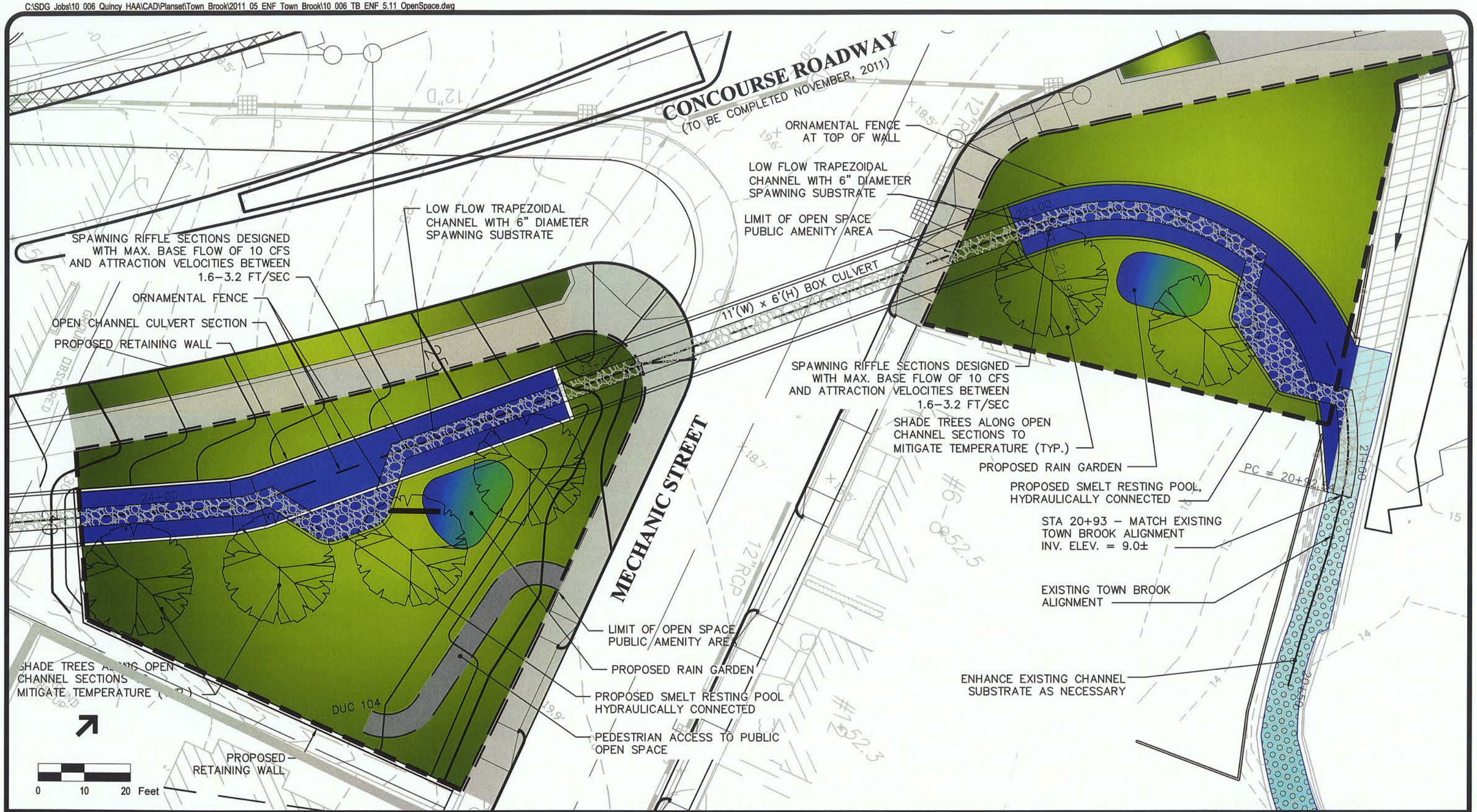
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 1.6.2 March 15, 2011

Conceptual Public Open Space Amenity Plan & Mitigation Detail - Option 1
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 5.11 OpenSpace.dwg




NOTES:

1. MAINTAIN DESIGN VELOCITY OF 1.6-3.2 FT/SEC ("ATTRACTION VELOCITY" WITHIN SPAWNING RIFFLE SECTIONS
2. DAY-LIT CULVERT SECTIONS AND RESTING POOLS SHALL HAVE 6" DIAMETER STONE SUBSTRATE SECURED TO CULVERT BOTTOM
3. PROVIDE SHADE TREES ALONG DAY-LIT SECTIONS OF CULVERT.
4. MAINTAIN FLOW DEPTH OF 6"-12" IN SPAWNING RIFFLES DURING LOW/ BASE FLOW

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

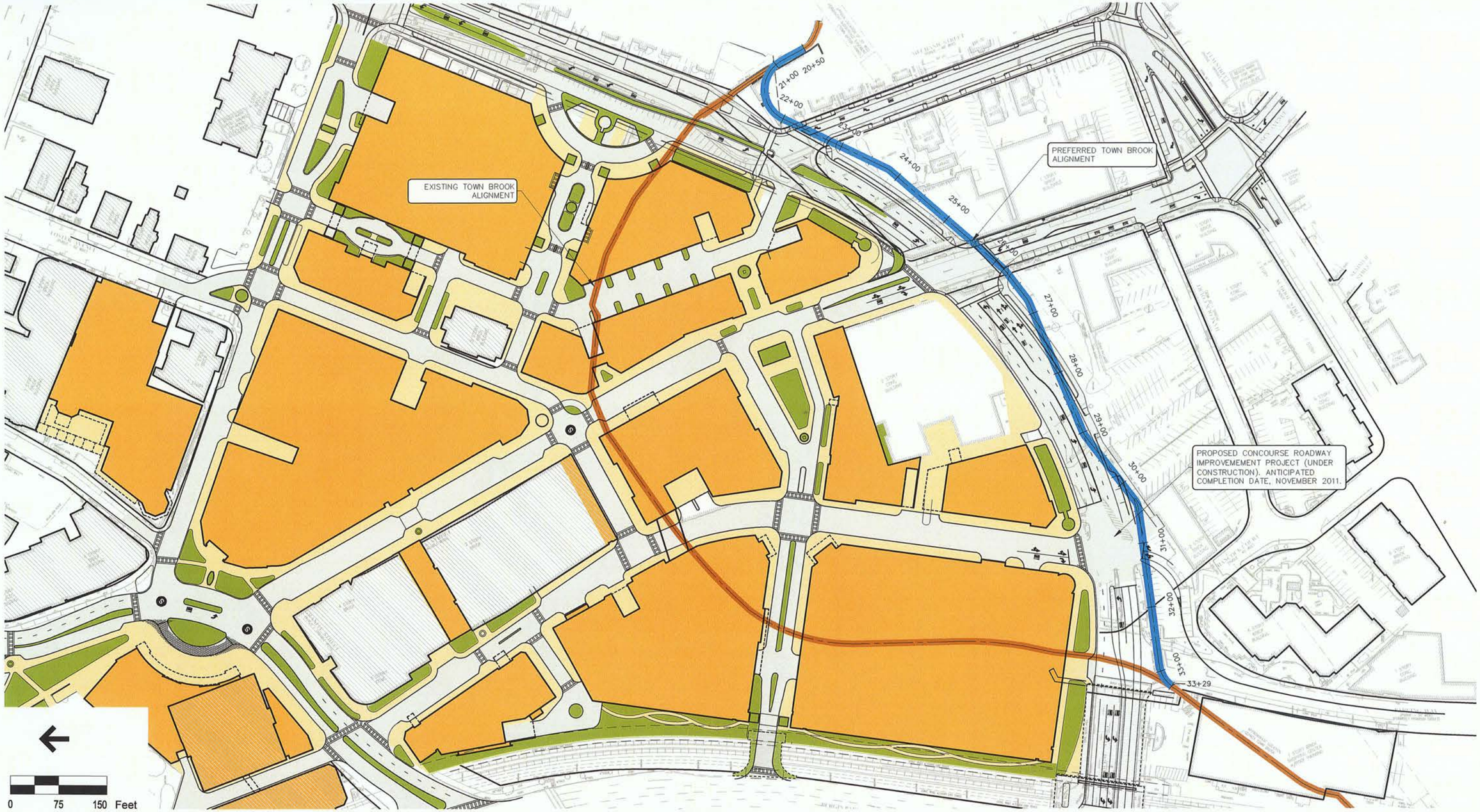
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 1.6.3 March 15, 2011

Conceptual Public Open Space Amenity Plan & Mitigation Detail - Option 2
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 1.7 PR FB.dwg




NOTES:

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

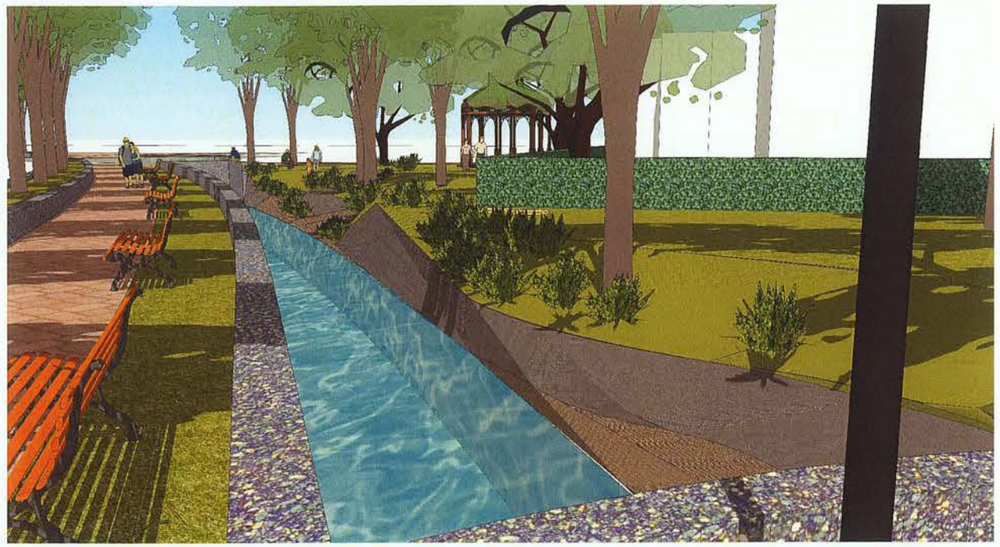
LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

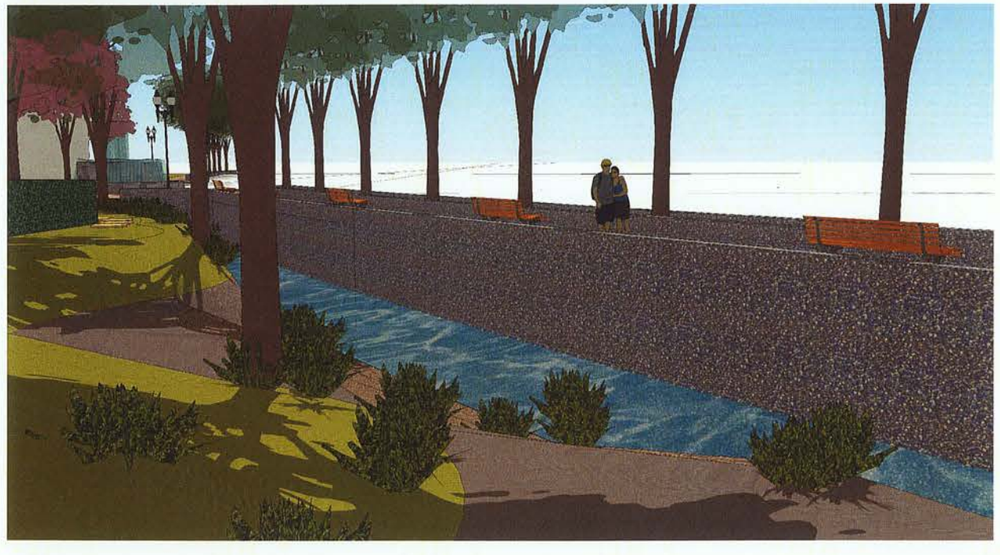
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 1.7 March 15, 2011

Preferred Town Brook Culvert Alignment
With URDP Building Program
Town Brook Enhancement Project
Quincy, Massachusetts





NOTES:

PLAN REPRESENTS A CONCEPTUAL VIEW OF POTENTIAL FUTURE CONDITIONS. ACTUAL SITE FEATURES AND MATERIALS TO BE DETERMINED THROUGH A PUBLIC DESIGN PROCESS AND REQUIRE PERMITTING THROUGH THE QUINCY CONSERVATION COMMISSION.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 1.8 March 15, 2011

Conceptual Public Open Space
Amenity Plan - Rendering
Town Brook Enhancement Project
Quincy, Massachusetts

# CHAPTER 2
# ALTERNATIVES ANALYSIS

## INTRODUCTION

This chapter outlines the process that the City of Quincy went through in order to evaluate and determine a preferred alignment for the Town Brook Enhancement Project. As part of the conceptual design and evaluation process the city involved qualified City staff, state and federal agency staff, consultants, members of the Quincy Environmental Network (QEN), a local environmental advocacy group, and the general public to solicit relevant input as to the appropriate alignment and design enhancements associated with the project. Refer to the public outreach summary found in Chapter 1.

With the objective of identifying a preferred alternative that would provide the maximum environmental benefit and minimize environmental impacts associated with the project, the City evaluated seven (7) potential alignments (A through G) as well as the "No-Build" alternative and an option to re-build the culvert along its current alignment, for a total of nine (9) alternatives. The City developed several alternatives and developed others through suggestions received from representatives of the Quincy Environmental Network (QEN). In order to evaluate each of the alternative alignments, the project team developed ten (10) evaluation metrics that were analyzed in detail to determine the best feasible location.

In order to determine the preferred alternative, the nine alternatives were evaluated using the ten metrics and ranked from 1 through 9 subjectively based on the how the alternatives met the metrics, with a ranking of 9 being the best alternative for that metric and 1 being the worst. For evaluation metrics which were either a "go" or "no-go", a 9 or 1 was assigned for that metric. This methodology is a variation of the "Electre Method" for evaluating alternatives, with a rating of 9 documenting compliance with the metric and 1 non-compliance. In this evaluation of alternatives, all the evaluation criteria were weighted evenly, although the Electre method algorithm allows you to weigh each evaluation criteria differently. The City determined that all metrics be weighted equally.

Through this evaluation process the preferred alignment was determined. The intensive level of review is a reflection of the complexity of the project and the effort to address environmental constraints with the enhancement and relocation of the Brook. The alternatives analysis was conducted to address the requirements for the 401 Water Quality Certificate, the ACOE 404 Category II permit, and the Wetlands Protection Act. A detailed summary of the alternatives analysis is documented in the following sections. (See Table 2.1 – Evaluation Metrics)

Based on this extensive evaluation process, the City is confident that the preferred culvert re-alignment identified is the appropriate project to replace the existing Town Brook culvert through the project area.

## DESCRIPTION AND COMPARISON OF DEVELOPMENT ALTERNATIVES

The evaluation of conceptual alternatives for the enhancement and relocation of Town Brook utilized the following ten evaluation metrics:

1. Flood Control
2. Underground Conflicts
3. Property Constraints (Property Control)
4. Open Channel/Public Amenity
5. Enhance Smelt Fisheries Habitat
6. Consistency with URDP
7. Construction Schedule & Phasing
8. Cost
9. Environmental Enhancements \ Compliance
10. Code Compliance

The evaluation metrics were determined by the City of Quincy, its project team consultants and input from the QEN. These metrics accurately reflect the complexity and numerous considerations that must be evaluated for each alternative. The alternatives were examined to identify the best available option for each of the metrics. A wide range of options have been evaluated for the scope of the overall project. Refer to Table 2.1 for the Evaluation Metric Ratings.

The alternatives have been compared to demonstrate that the preferred alternative does not have more adverse environmental impacts than any other option. Avoidance of impacts to Bank and LUWW are not feasible with any proposed alternative due to the degraded nature of the existing culvert. All of the alternatives will provide improvements over the existing environmental conditions, however, impacts to the Bank and LUWW will be approximately equivalent amongst the alternatives. The No-Build option will continue to provide little environmental benefit and degrade water quality due to existing illicit sanitary sewer discharges. The scope of alternatives is commensurate with the scale and purpose of the proposed project and has encompassed review of the entire Quincy Center area.

The following provides a description of each design metric used in the alternatives analysis:

### 1. Flood Control

Flood control and hydraulic conveyance is one of the key benefits achieved by replacing the existing Town Brook culvert through the project area. The existing Brook is conveyed by 11 distinct segments of culvert through the project area with varying hydraulic capacity, with some sections at negative slopes. A summary of the existing culvert segments is provided in Figures 1.2.1 and 1.2.2. All proposed alternatives evaluated will include the construction of reinforced concrete box culvert, with a positive downstream slope. All proposed alternatives will be designed to convey the appropriate design storm, for a detailed description of the methodology and determination of design flows refer to Chapter 5 of this report.

The Wetlands Protection Act best defines flood control as the *prevention or reduction of flooding and flood damage*. As the existing Town Brook conveys the 1% annual chance floodplain, or 100-year storm event (according to the FIS), each alternative requires proper analysis to ensure the proposed culvert alignment will not result in the creation of a limiting hydraulic section in the conveyance of 1% annual chance storm event through the project area. Each of the proposed alternatives has been designed to accommodate the appropriate design storm.

**2. Underground Conflicts**

An extensive array of existing above ground and underground utilities are located throughout Quincy Center and within the project area consisting of transmission lines and service connection utilities. The primary utilities within the project area include:

- National Grid electric duct banks
- Sanitary sewer trunk lines and service connections
- Storm drainage trunk lines and catch basin connections
- Water main and service connections
- Verizon tel/data duct bank
- National Grid gas main with service connections

Cross-sections have been developed at critical locations along the proposed alignments to analyze the impacts to the existing utility infrastructure and the conflicts with known utility infrastructure improvements the City is planning, to support the Quincy Center redevelopment. The sections associated with the alternatives will identify significant impacts/ conflicts with the utility infrastructure.

Additionally, conflicts with existing buildings and known proposed buildings associated with the Quincy Center Redevelopment, to include below grade basements, structured parking and foundation systems has been evaluated in order to identify the total impacts with each alternative.

**3. Property Constraint (Property Control)**

One of the largest obstacles to the feasibility associated with each alternative is the determination of property control along the proposed alignment. The evaluation of property constraints (property control) directly relates to the constructability of each alternative. The City of Quincy has limited control of parcels within the Quincy Center area, Figures 2.3.1 and 2.3.2 depict the location of City controlled parcels within the Project area. The path of each Town Brook culvert alignment alternative has been evaluated based on the property constraints with the relevant impacts discussed for each alternative.

**4. Open Channel/Public Amenity**

The potential creation of open channel (commonly referred to as "day-lit") sections of Town Brook with adjacent public open space and amenity areas has been evaluated for each alternative and is a key component to the success of this project and the environmental and sustainable design objectives of the City of Quincy which are referenced in the Executive Summary. The opportunity for the construction of open channel sections is primarily attainable

on the easterly portion of the project where the existing grades in relation to the proposed culvert inverts will accommodate reasonable open channel sections with a grade to invert of less than 15 vertical feet. Open channel sections were evaluated at the area of the upstream connection point, but existing land uses and limited environmental benefit limit the opportunity for open channel sections and public open space in this area.

### 5. Enhance Smelt Fisheries Habitat

The existing fish run is located south of Revere Road just downstream of the project area. The ability to enhance fisheries habitat and spawning areas of the Rainbow Smelt, was evaluated and rated for each alternative. The fisheries habitat improvements that were evaluated for each alternative include: creation of a low-flow trapezoidal channel to increase depth of flow during base flow conditions; incorporating spawning substrate within the low flow channel to allow for eggs to adhere; creation of spawning riffles with appropriate design attraction velocities during base flow conditions; smelt resting pools adjacent to the spawning riffles; the creation of additional open channel sections of Town Brook; temperature mitigation through the placement of shade trees adjacent to open channel sections.

As part of each of the alternatives, with the exception of the no-build, the existing open channel section of Town Brook south of Revere Road will be modified to incorporate a low flow channel with spawning substrate. As this design enhancement will be incorporated into each of the alternatives, it is not specifically referenced in the analysis of each alternative.

### 6. Consistency with URDP

The Quincy Center Urban Revitalization and Development Plan (URDP) establishes the Quincy Center Urban Revitalization District as a 55-acre urban renewal area, comprising a portion of the New Quincy Center redevelopment project. The Town Brook Enhancement Project is located within the planned URDP redevelopment area. The conceptual mixed use redevelopment building program and sustainable design objectives associated with the URDP have been reviewed for consistency with the alternatives.

Two of the key urban redevelopment objectives outlined in the URDP are to create *"numerous pockets of public space to beautify the Project Area and provide places for residents and shoppers to enjoy"* and to achieve higher mixed use development density on larger lots. To achieve the larger lots required the area infrastructure must be able to accommodate this higher intensity development. URDP proposed land disposition and assemblage will foster the creation of sites of sufficient size and with appropriate access and improvements, so that new construction is encouraged and sound redevelopment is facilitated. The relocation and reconstruction of Town Brook at an appropriate location, where open space and environmental benefits can be maximized and integrated into the redevelopment project, are key components of this plan.

### 7. Construction Schedule and Phasing

In order to determine the feasibility and the timely construction of each of the alternatives, the impacts associated with the physical implementation of each alternative was evaluated taking into consideration existing constraints to construction such as: utility infrastructure; buildings; building foundation systems and basements; and property control. In addition the timely

acquisition of properties and easements in order to implement the various alternatives must be taken into consideration when evaluating the construction schedule. Obtaining property control can result in significant construction delay.

**8. Cost**

The relative cost for each alternative was considered in the analysis and was primarily driven by the other constraints associated with construction of the project. Cost premiums associated with each alternative have been identified in the evaluation summaries.

**9. Environmental Enhancements**

The project offers the opportunity to enhance and improve a severely degraded stream in a densely developed downtown urban context. The potential to implement the following factors were considered in the analysis:

- Potential for Open-channel/ Day-lit Sections
- Potential for Wildlife & Fisheries Habitat Enhancements
- Land Under Water Bodies and Waterways (LUWW)
- Potential for open space within Riverfront Area that can provide habitat suitable for urban wildlife

**10. Code Compliance**

As part of the evaluation process each alternative was evaluated for compliance with the state building code (780 CMR) and state plumbing code (248 CMR 10.00). The existing culvert alignment through the project area runs beneath buildings and adjacent to foundation walls and although a pre-existing conditions, is not consistent with current requirements outlined in the codes. As part of any realignment, compliance with current codes will be required to address current building, plumbing and public safety standards.

---

## TOWN BROOK CULVERT ALIGNMENT ALTERNATIVES

The City of Quincy has evaluated the following alternatives utilizing the design metrics developed and previously discussed, they include:

- No-Build
- Rebuild culvert along existing alignment
- Alternative A – North Side of Concourse 1
- Alternative B – North Side of Concourse 2
- Alternative C – South Side of Concourse **(Preferred)**
- Alternative D – Ross Way to Clivedon
- Alternative E – Adjacent to MBTA Retaining Wall
- Alternative F – Clivedon/ Hancock
- Alternative G – Cottage Avenue Extension

Figure 2.1 depicts the existing project area conditions with each of the alignment alternatives. Figure 2.2 depicts the preliminary layout associated with the Quincy Center redevelopment building program within the URDP. Alignment Alternatives A through E were originally examined by the City to find the ideal location based upon the various evaluation metrics. Alternatives F and G were developed through several public outreach meetings with members of the Quincy Environmental Network. A discussion of each alternative is then presented with specific reference to design constraints.

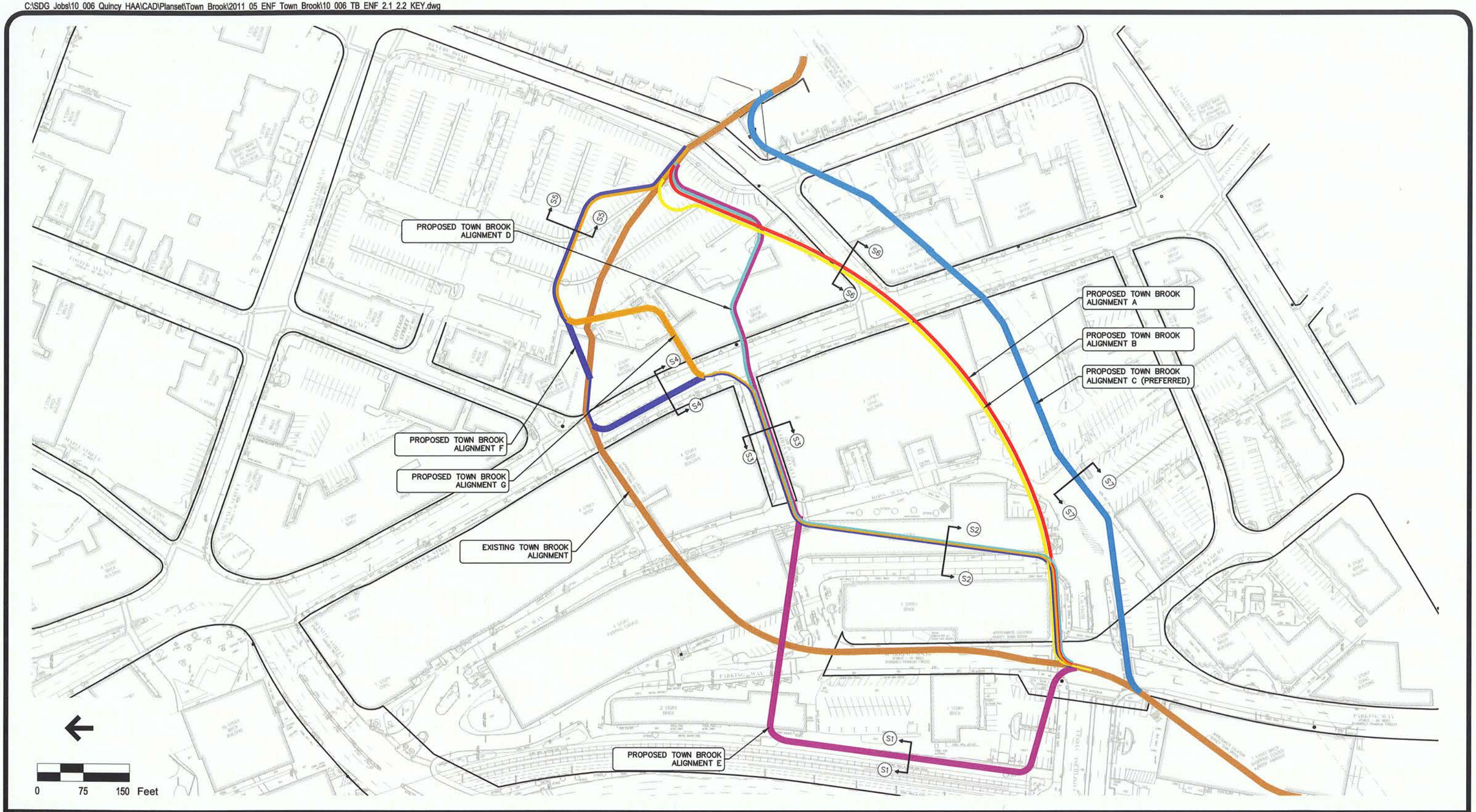
Environmental compliance has been reviewed for each alternative and has been determined that impacts to LUWW, bank, existing open channel, BLSF, and Riverfront Area are comparable for each alternative, therefore, differences in environmental enhancements will be described in more detail below.

## NO-BUILD ALTERNATIVE

The No-Build alternative would result in no change to the existing conditions of the Town Brook culvert through the project area. The No-Build alternative is being evaluated under the alternatives analysis to establish a baseline for comparing the impacts from multiple build alternatives. It assumes that the existing Town Brook culvert which has been relocated and covered throughout its history will remain in place indefinitely without alteration.

The Brook within the project area consists of approximately 1,700 linear feet of culverted section, which is completely enclosed with the exception of a 16 linear foot open channel segment at the rear of Parcel DU65 (the Hong Kong Eatery) adjacent to the existing City of Quincy Hancock surface parking lot. For this analysis, an additional 184 linear feet of open channel section is included in the project area (Segment 1). This area is included for consistency with addressing the same study area for proposed enhancements within this area. Figure 1.2.1 depicts the project area and the existing culvert alignment. The existing culvert within the project limits varies widely in size, shape, material and structural integrity, with 11 different segments of culvert identified within the project limits. Table 2.2 details the size, shape, material and location of each segment of the existing Town Brook.

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.1 2.2 KEY.dwg




EXISTING TOWN BROOK ALIGNMENT
PROPOSED TOWN BROOK ALIGNMENT A
PROPOSED TOWN BROOK ALIGNMENT B
PROPOSED TOWN BROOK ALIGNMENT C (PREFERRED)

PROPOSED TOWN BROOK ALIGNMENT D
PROPOSED TOWN BROOK ALIGNMENT E
PROPOSED TOWN BROOK ALIGNMENT F
PROPOSED TOWN BROOK ALIGNMENT G

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 2.1 March 15, 2011

Town Brook Alternatives - Key Sheet
Existing Conditions
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.1 2.2 KEY.dwg

EXISTING TOWN BROOK ALIGNMENT
PROPOSED TOWN BROOK ALIGNMENT A
PROPOSED TOWN BROOK ALIGNMENT B
PROPOSED TOWN BROOK ALIGNMENT C (PREFERRED)

PROPOSED TOWN BROOK ALIGNMENT D
PROPOSED TOWN BROOK ALIGNMENT E
PROPOSED TOWN BROOK ALIGNMENT F
PROPOSED TOWN BROOK ALIGNMENT G

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

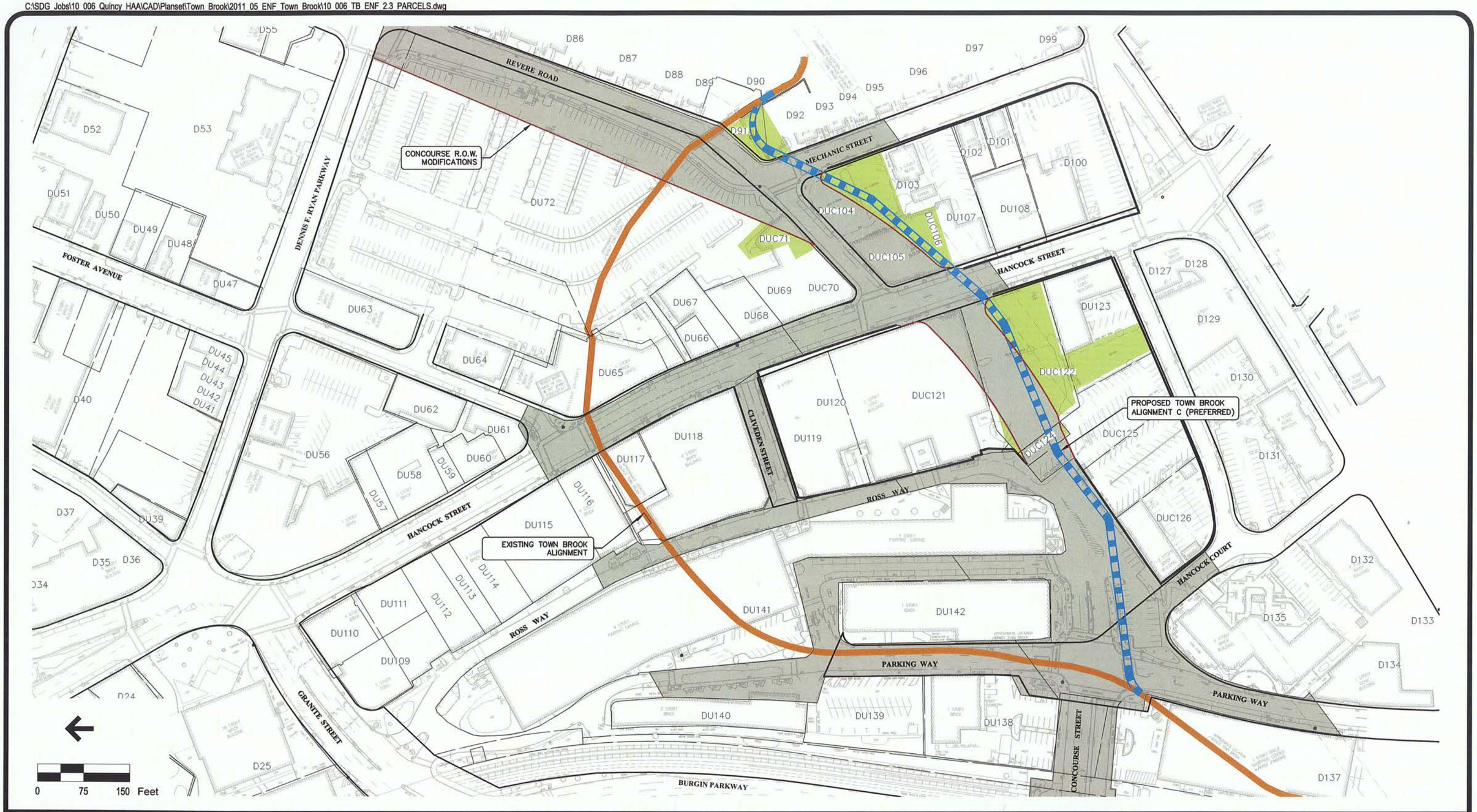
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 2.2 March 15, 2011

Town Brook Alternatives - Key Sheet
Proposed Building Program
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.3 PARCELS.dwg




CITY CONTROLLED PARCELS
PUBLIC RIGHT OF WAY
ALIGNMENT C (PREFERRED)
EXISTING TOWN BROOK
CONCOURSE R.O.W.
D# PROPERTY ID

NOTES:
CONCOURSE R.O.W. REPRESENTS CITY TAKENS AS PART OF THE CONCOURSE ROADWAY IMPROVEMENT PROJECT

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

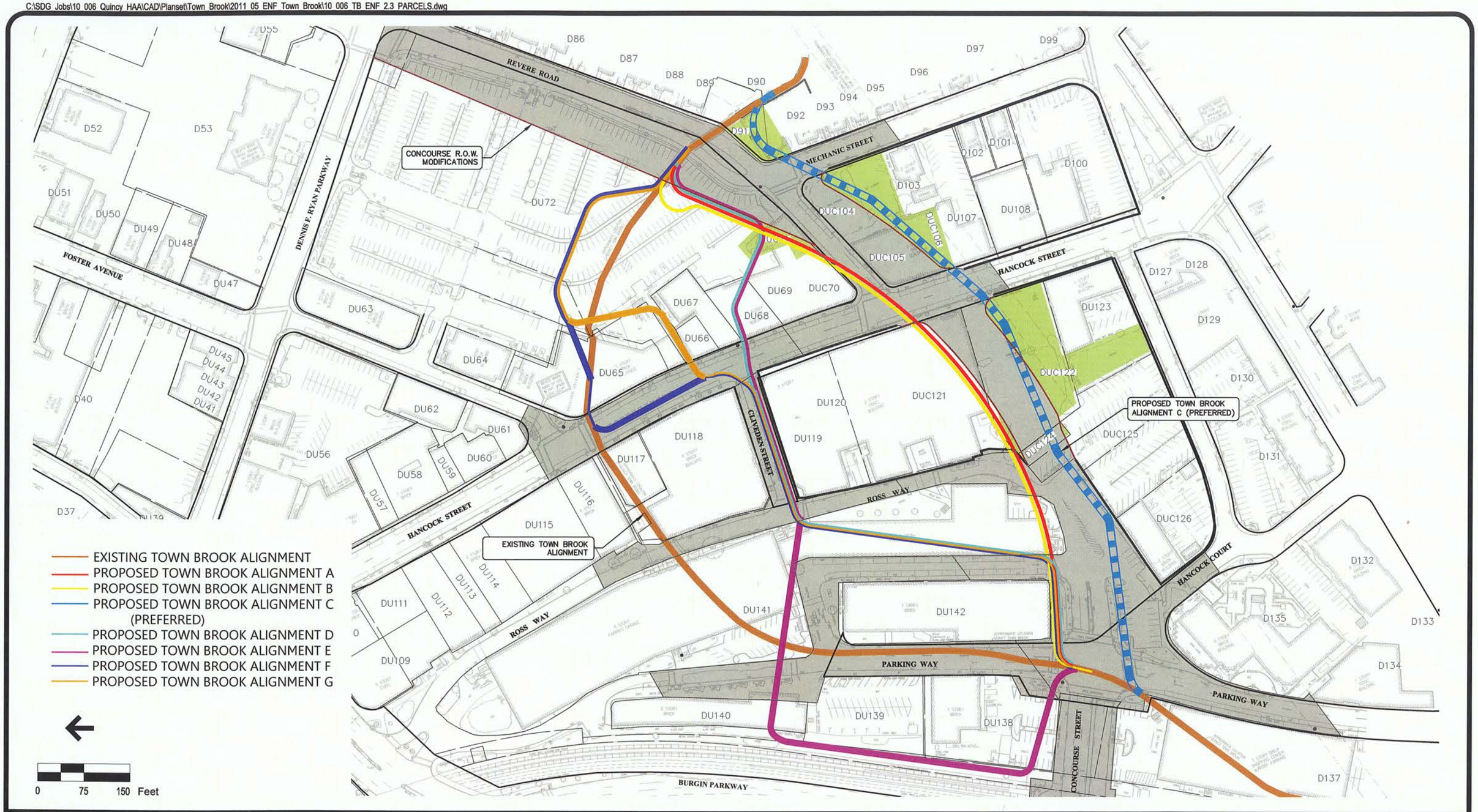
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 2.3.1 March 15, 2011
Quincy Center City Controlled Parcels

Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.3 PARCELS.dwg




CITY CONTROLLED PARCELS
PUBLIC RIGHT OF WAY
ALIGNMENT C (PREFERRED)
EXISTING TOWN BROOK
CONCOURSE R.O.W.
D# PROPERTY ID

NOTES:
CONCOURSE R.O.W. REPRESENTS CITY TAKENS AS PART OF THE CONCOURSE ROADWAY IMPROVEMENT PROJECT

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 2.3.2 March 15, 2011

Quincy Center City Controlled Parcels
Alignment Locations
Town Brook Enhancement Project
Quincy, Massachusetts

**Table 2.1**
**Evaluation Metrics Ratings**

| Evaluation Metric | No-Build | Reconstruct Along Existing Alignment | Alternative A | Alternative B | Alternative C | Alternative D | Alternative E | Alternative F | Alternative G |
|---|---|---|---|---|---|---|---|---|---|
| Flood Control | 1 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 2 |
| Underground Conflicts | 2 | 1 | 8 | 7 | 9 | 5 | 6 | 3 | 4 |
| Property Constraints | 1 | 1 | 1 | 1 | 9 | 1 | 1 | 1 | 1 |
| Open Channel/ Public Amenity | 1 | 2 | 8 | 7 | 9 | 3 | 4 | 5 | 6 |
| Enhance Smelt Fisheries Habitat | 1 | 2 | 8 | 7 | 9 | 3 | 4 | 5 | 6 |
| Consistency with URDP | 1 | 2 | 8 | 7 | 9 | 6 | 5 | 4 | 3 |
| Construction Schedule & Phasing | 8 | 1 | 6 | 7 | 9 | 3 | 2 | 5 | 4 |
| Cost | 9 | 1 | 6 | 7 | 8 | 5 | 2 | 3 | 4 |
| Environmental Enhancements | 1 | 2 | 5 | 6 | 9 | 3 | 4 | 8 | 7 |
| Code Compliance | 1 | 1 | 9 | 9 | 9 | 9 | 9 | 1 | 9 |
| **Total:** | **26** | **22** | **68** | **67** | **89** | **47** | **46** | **44** | **46** |

| Ranks | Alternative | Total Points |
|---|---|---|
| 1 | C | 89 |
| 2 | A | 68 |
| 3 | B | 67 |
| 4 | D | 47 |
| 5 | G | 46 |
| 6 | E | 46 |
| 7 | F | 44 |
| 8 | No-Build | 26 |
| 9 | Reconstruct | 22 |

**Table 2.2 Existing Town Brook Segments**

| Segment | From Station (ft) | To Station (ft) | Height (ft) | Width (ft) | Slope | Capacity[1] Q (cfs) | Material & Shape |
|---|---|---|---|---|---|---|---|
| 1 | 10+00 | 11+84 | 6.5 | 7.9 | 1.10% | 785 | Granite & Concrete Sidewalls with Variable Material Channel Bottom |
| 2 | 11+84 | 12+39 | 4.25 | 12.5 | 0.20% | 318 | Twin 6'-3" W x 4'-3" H Concrete Box Culverts |
| 3 | 12+39 | 15+82 | 6.583 | 9.75 | 0.70% | 416 | Arched Corrugated Metal Pipe (CMP-ARMCO) 6'-7"H x 9'-9"W |
| 4 | 15+82 | 16+00 | 6.5 | 9.1 | 1.67% | 449 | Variable Material Channel |
| 5 | 16+00 | 19+38 | 6.5 | 9 | -0.20% | 686 | Concrete & Granite Channel with Variable Dimensions and Materials |
| 6 | 19+38 | 19+76 | 6.5 | 9 | 0.25% | 221 | Stone Culvert |
| 7 | 19+76 | 21+40 | 5.5 | 9 | 0.25% | 175 | Stone Culvert |
| 8 | 21+40 | 22+00 | 5.5 | 9 | 0.23% | 404 | Concrete Culvert |
| 9 | 22+00 | 23+58 | 5.5 | 9 | 0.23% | 404 | Concrete Culvert |
| 10 | 23+58 | 26+25 | 5.5 | 9 | 0.075% | 221 | Concrete Culvert |
| 11 | 26+25 | 28+16 | 5.5 | 9 | 0.29% | 435 | Concrete Culvert |

[1] Capacity of Culvert Sections determined by Manning's Equation for full flow conditions. (See Calculations in Appendix B)

The existing culvert will continue to convey collected surface stormwater runoff from the Quincy Center area (an approximately 50-acre watershed), with known illicit sanitary sewer discharges and water quality issues. There are no hard costs associated with the No-Build alternative under the existing conditions, however the negative impacts to City of Quincy's the fisheries habitat and water quality will continue unabated.

## No-Build – Evaluation Metrics Analysis

### Flood Control

Leaving the existing culvert through the project area un-altered will not improve the hydraulic properties of the limiting segments of the existing alignment. Based on the analysis of the existing culvert segments the limiting hydraulic sections within the project area will not convey the peak flow from the design storm outlined the drainage evaluation, refer to Chapter 5 of this report.

The No-Build alternative does not meet the flood control objectives of the project.

### Underground Conflicts

The existing culvert alignment conflicts with existing utilities at several locations along its alignment. The utility conflicts run through the culvert, obstructing the hydraulic section, and allowing for the potential introduction of contaminants into the Brook.

The existing culvert alignment will conflict with the proposed foundation systems of several of the mixed use buildings associated with the Quincy Center redevelopment. Refer to Figure 2.4.2.

Although no construction activities are proposed under this alternative, existing utility conflicts will remain and the existing alignment will conflict with the proposed redevelopment objectives. Refer to video of the existing Town Brook, found in Appendix F.

**Property Constraints (Property Control)**
The City of Quincy does not control the underlying property along the existing Town Brook culvert alignment. Although no construction activities are proposed under this alternative, the lack of property ownership or easements, does not allow for access and proper maintenance of the culvert.

**Open Channel/Public Amenity**
As no construction activities are proposed under this alternative, the existing open channel sections within the project area will remain. These existing open channel sections provide little public amenity with no public open space adjacent to the open channel sections and no landscaping adjacent to the open channel sections. These open channel sections consist of concrete bottom channels with concrete and granite lined vertical side walls, the existing ground cover adjacent to these sections consists of pavement. Refer to Figures 1.3.1 through 1.3.5 in Chapter 1 of this report for photos.

**Enhance Smelt Fisheries Habitat**
As no construction activities are proposed under this alternative, no enhancements to the fisheries habitat are proposed.

The No-Build alternative does not provide any enhancements.

**Consistency with URDP**
This existing alignment provides limited potential for the creation of open channel sections with public open space and therefore does not address the objectives of the URDP as it pertains to the creation of public open space. This alignment runs through some of the larger parcels, which the City of Quincy has identified in the Urban Revitalization and Development Plan as appropriate for high density mixed use redevelopment. As a result, the ability to incorporate open channel sections with public open space is limited as the Brook will remain culverted through these areas. This alternative will also conflict with proposed subsurface parking planned within the development area and may impact the City of Quincy's URDP mixed use redevelopment density objectives.

**Construction Schedule & Phasing**
No construction activities are proposed under this alternative.

**Cost**
There are no direct construction costs associated with this alternative.

**Environmental Enhancements**
There no direct construction activities associated with this alternative and no proposed environmental enhancements.

**Code Compliance**
The No-build alternative is a pre-existing condition, which conveys the flood waters of Town Brook beneath and adjacent to habitable structures. Issues associated with conveying flood waters through a building are not consistent with current building or plumbing codes.

The existing segments along Hancock Street have known direct illicit sanitary sewer connections and through its direct exposure with structures, utilities and utility service connections allow for the potential intentional or un-intentional introduction of contaminants.

**No-Build – Identified Constraints**

The constraints and conflicts associated with this alternative were reviewed for its implementation under existing conditions and conflicts with the implementation of the City of Quincy's URDP mixed use redevelopment building program and sustainable design objectives. Refer to Figures 2.4.1 and 2.4.2 for locations of the constraints identified below.

**Existing Conditions Constraints**

Location 1

- Code Compliance: The existing alignment runs beneath the buildings on parcels DU65, DU117, DU118 and DU141. Although this is a pre-existing condition, existing illicit sanitary sewer connections are connected to the Brook at this location and utilities run above and through the Brook allowing for the potential introduction of contaminants.

**Proposed Conditions Constraints**

Location 2, 3, 4 and 5

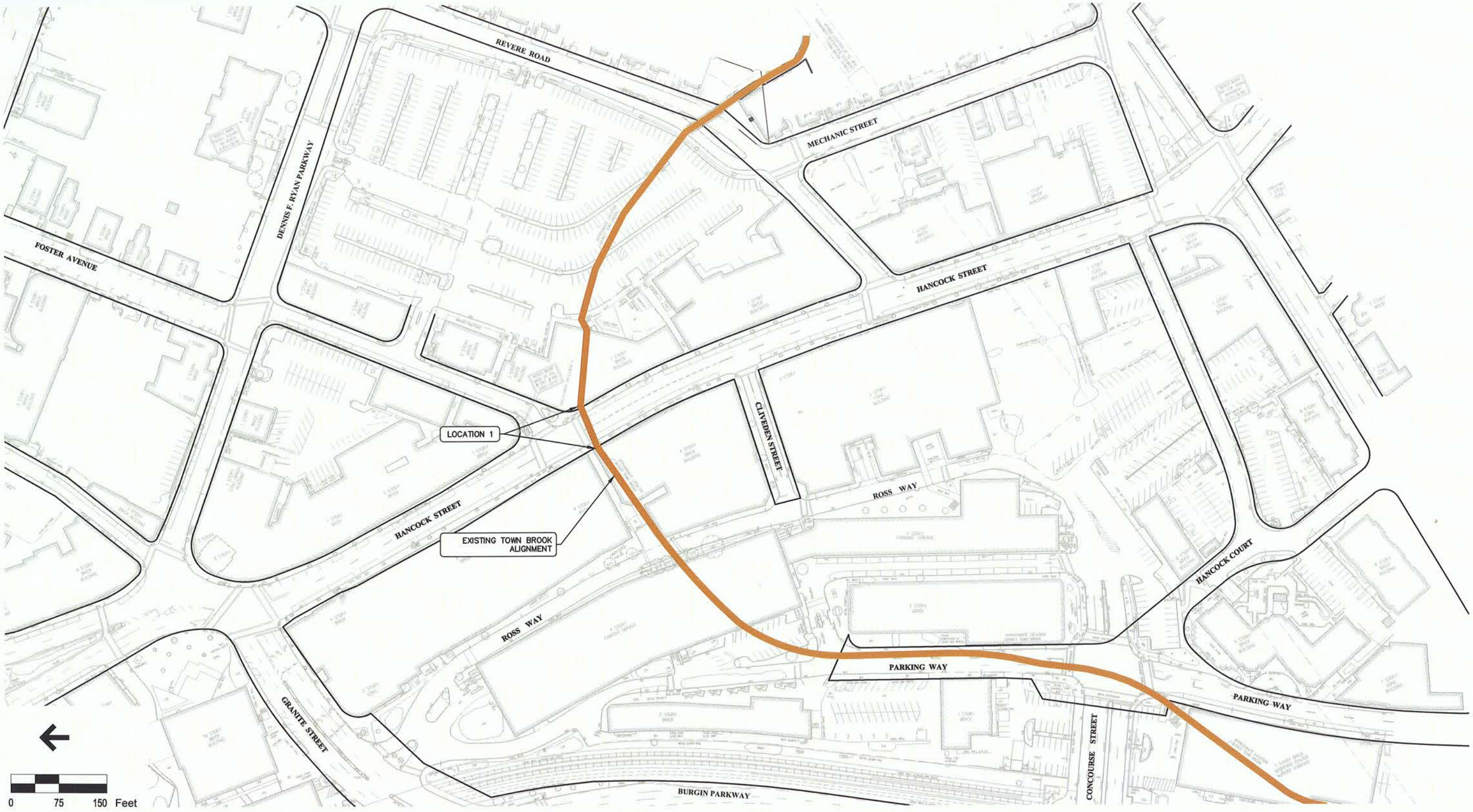
- Property Constraints: the existing alignment runs through parcels DU65, DU72, DU117, DU118 and DU141 that are not owned by the City of Quincy and which proposed redevelopment activities associated with the Quincy Center redevelopment are proposed. In order to maintain access and maintenance to the culvert through these parcels easements and means of access must be obtained.
- Consistency with URDP: The existing culvert alignment runs through some of the larger parcels, which the City of Quincy has identified in the Urban Revitalization and Development Plan as appropriate for high density mixed use redevelopment. As a result, the ability to incorporate open channel sections with public open space is limited as the Brook will remain culverted through these areas. This alternative will also conflict with proposed subsurface parking planned within the development area and may impact the City of Quincy's URDP mixed use redevelopment density objectives.

- Code Compliance: The existing alignment runs beneath the proposed mixed use redevelopment building program on parcels DU65, DU72, DU117, DU118 and DU141. The conveyance of flood water through proposed buildings is not compliant with the building code.

## Conclusion

The No-Build alternative does not satisfy the goal of enhancing Town Brook and associated fisheries habitat nor is it consistent with the City's goals and objectives associated with the implementation of the City's Urban Redevelopment Plan. Therefore, the No-Build alternative was eliminated as a viable option.

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.4 NOBUILD.dwg




NOTES:
REFER TO CHAPTER 2 OF THE ENF REPORT FOR A SUMMARY OF THE LOCATIONS SHOWN ON THIS PLAN.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

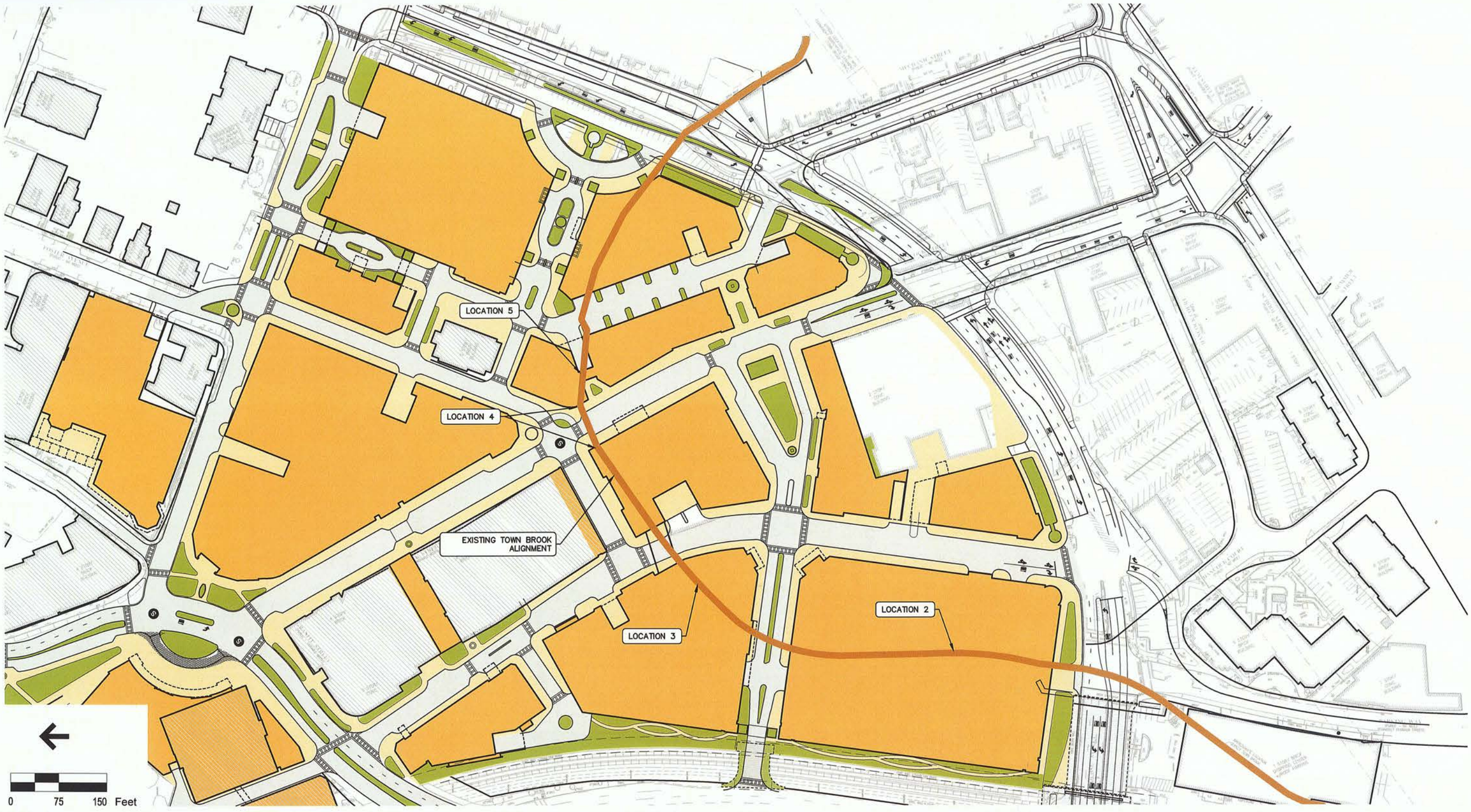
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure No. 2.4.1 March 15, 2011

No Build Alternative
Existing Conditions
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.4 NOBUILD.dwg




NOTES:
REFER TO CHAPTER 2 OF THE ENF REPORT FOR A SUMMARY OF THE LOCATIONS SHOWN ON THIS PLAN.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure No. 2.4.2 March 15, 2011

No Build Alternative
Future Development Plan
Town Brook Enhancement Project
Quincy, Massachusetts

## REBUILD CULVERT ALONG EXISTING ALIGNMENT

This alternative proposes to reconstruct the Town Brook culvert along its current alignment, while maintaining the existing flow. There are a number of issues associated with doing this which are described below in the evaluation metrics categories:

### Rebuild Culvert along Existing alignment – Evaluation Metrics Analysis

**Flood Control**
Constructing a new reinforced concrete culvert sized to convey the appropriate design storm event will result in an improvement over the existing conditions, which consists of culvert segments with limiting hydraulic segments through the project area.

**Underground Conflicts**
This alternative runs beneath existing structures on: Parcel DU141, the Ross Parking Garage for a length of approximately 150 feet; Parcels DU117 and 118 for length of approximately 180 feet; and Parcel DU65 for approximately 135 feet, which presents an obstacle to its construction. In order to construct beneath these buildings either these structures would have to be razed prior to or in conjunction with the installation of the culvert or the culvert would have to be constructed beneath the buildings.

**Property Constraints (Property Control)**
The City of Quincy does not control the underlying property along the existing Town Brook culvert alignment, therefore in order to construct this alternative the City would have to purchase or obtain easements in order to construct and maintain the Town Brook Culvert under this alternative.

**Open Channel/Public Amenity**
This alternative provides little practical opportunity for the creation of open channel segments with adjacent open space as the constraints under existing conditions and lack of integration with the planned public open space and pocket parks associated with the URDP.

**Enhance Smelt Fisheries Habitat**
Construction of this alternative provides limited opportunity for the creation of open channel sections with public open space. A low flow channel with spawning substrate, spawning riffles with designed attraction velocities and in-line resting pools can be constructed extending upstream into the proposed enclosed culvert to extend the spawning habitat, if deemed appropriate by the DMF.

**Consistency with URDP**
This alignment provides limited potential for the creation of open channel sections with public open space and therefore does not address these objectives of the URDP as it pertains to the creation of public open space. The alignment runs through some of the larger parcels within the downtown area, which the City of Quincy has identified in the Urban Revitalization and Development Plan as appropriate for high density mixed use redevelopment. As a result, the

ability to incorporate open channel sections with public open space is limited as the Brook will remain culverted through these areas. This alternative will also conflict with proposed subsurface parking planned within the development area and may impact the City of Quincy's URDP mixed use redevelopment density objectives.

**Construction Schedule & Phasing**
Constructing a new culvert along the existing alignment presents many construction and phasing challenges which include:

- Working in a live perennial stream, would result in invasive construction period impacts to Town Brook.
- Maintaining base flow and storm event flow through the work area will result in a longer duration of construction and environmental impact.
- Constructing the culvert under existing building and structures presents concerns regarding structural impacts to the existing buildings.
- The construction schedule of this alternative would rely upon the demolition of parking garages, under which a significant portion of the alignment runs through.

**Cost**
Cost premiums associated with the construction of this alignment:

- Acquisition of property or obtaining easement rights
- Demolition of existing structures within alignment, or construction of culvert beneath the existing structures
- Construction activities associated with working within an active resource area

**Environmental Enhancements**
Construction of this alternative will result in limited: potential for additional open channel sections, limited potential for habitat enhancements and limited potential for enhancement of Riverfront Area.

**Code Compliance**
This alternative proposes to convey the flood waters of Town Brook beneath and adjacent to habitable structures. Issues associated with conveying flood waters through a building are not consistent with current building or plumbing codes.

---

**Rebuild Culvert along Existing alignment – Identified Constraints**

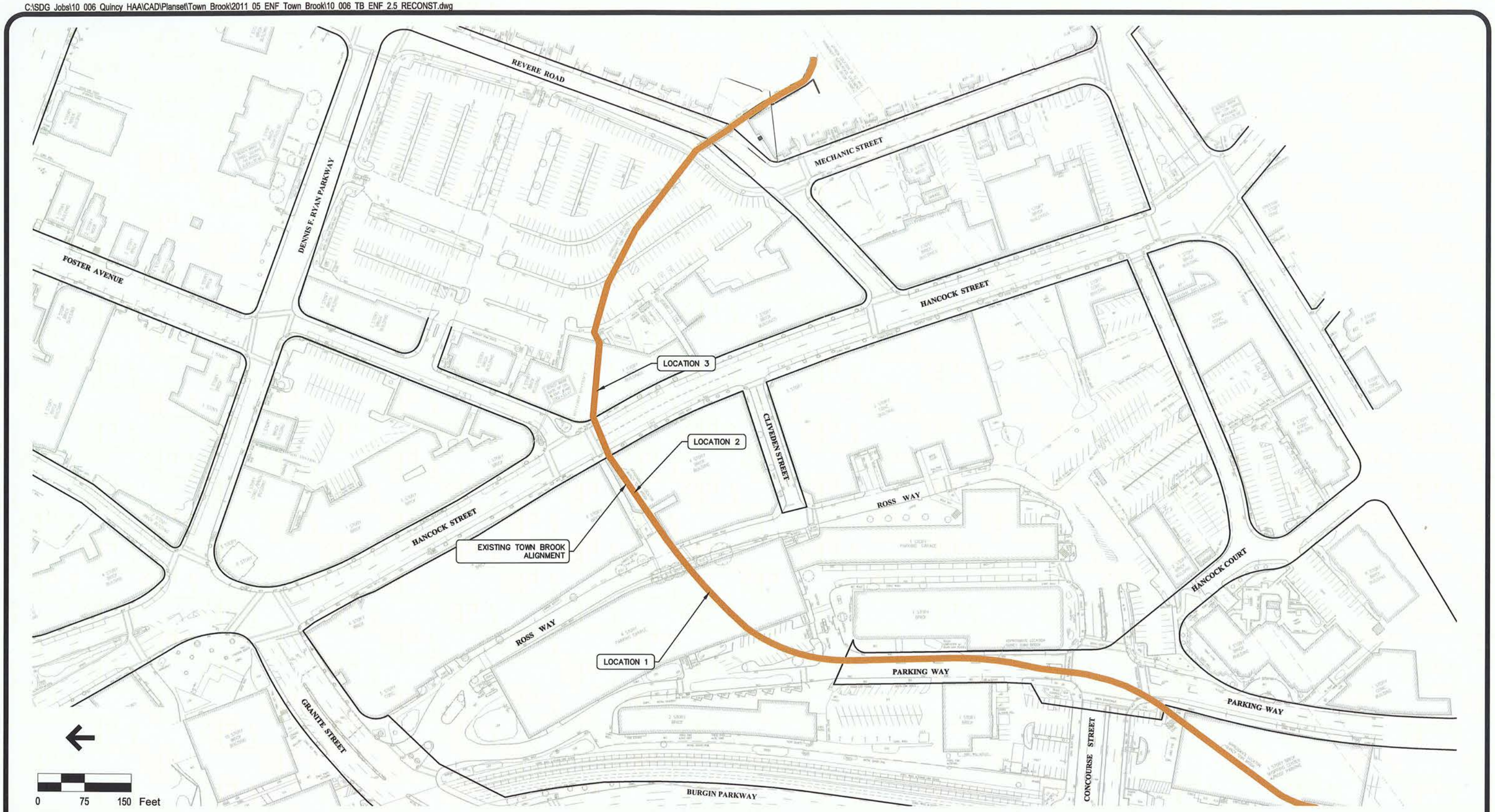
The constraints and conflicts associated with this alternative were reviewed for its implementation under existing conditions and conflicts with the implementation of the City of Quincy's URDP mixed use redevelopment building program and sustainable design objectives. Refer to Figures 2.5.1 and 2.5.2 for locations of the constraints identified below.

**Existing Conditions Constraints**

Locations 1, 2 and 3

- Property Constraints: the alignment requires construction activities on parcels DU141, DU117, DU118, DU65 and DU72 which are not owned by the City of Quincy.

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.5 RECONST.dwg




NOTES:
REFER TO CHAPTER 2 OF THE ENF REPORT FOR A SUMMARY OF THE LOCATIONS SHOWN ON THIS PLAN.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

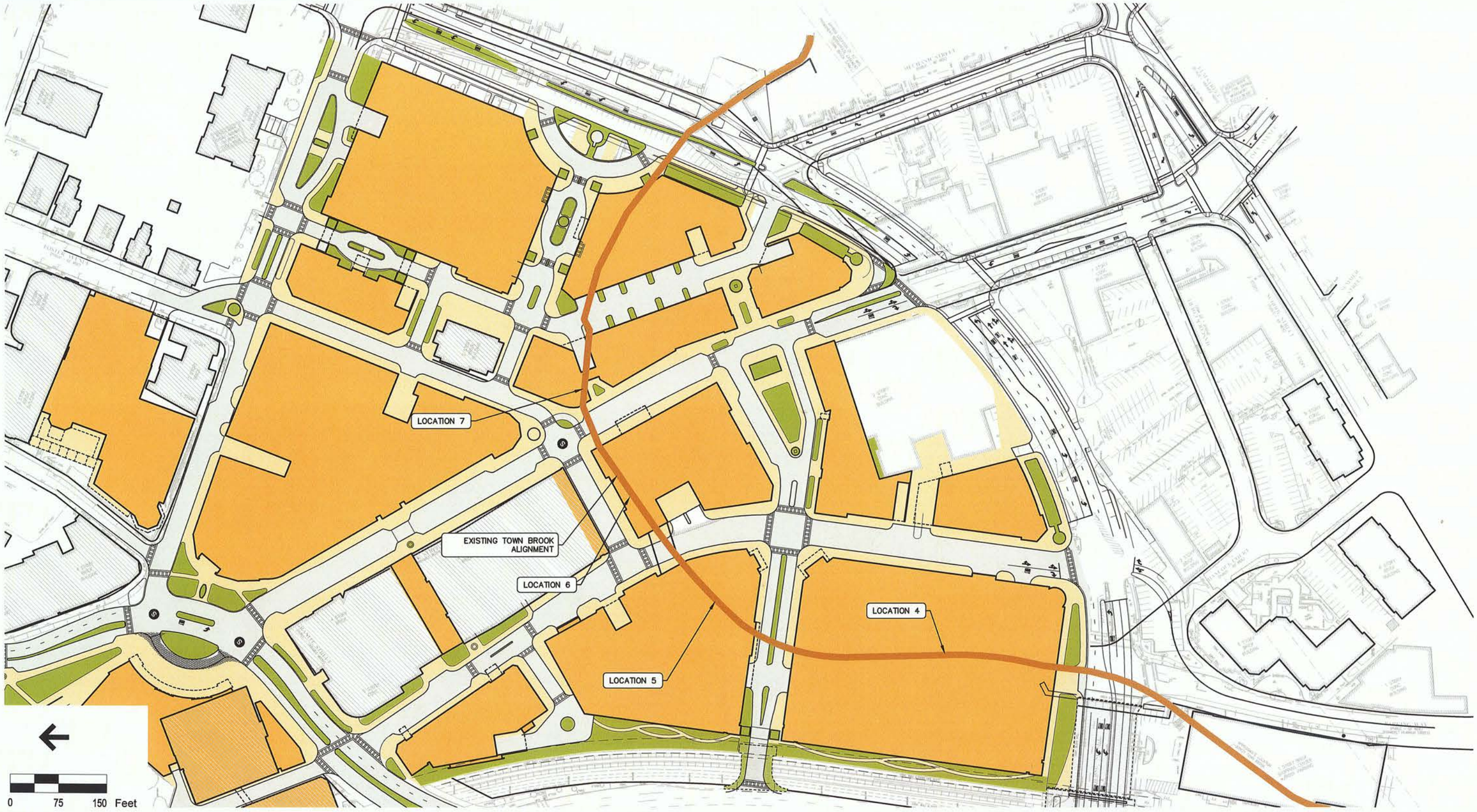
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 2.5.1 March 15, 2011

Re-construct Culvert Along Existing Alignment - Existing Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.5 RECONST.dwg




NOTES:

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure No. 2.5.2 March 15, 2011

Re-construct Culvert Along
Existing Alignment - Future
Town Brook Enhancement Project
Quincy, Massachusetts

- Construction Schedule & Phasing: The construction of this alignment through parcels with existing buildings and parking structures requires that the structures be razed
- Underground Conflicts: There are various underground utility conflicts in this area associated with this Alternative. Relocation of sewer, water and gas are required.

**Proposed Conditions Constraints**

Location 4, 5, 6 and 7

- Property Constraints: the proposed alignment runs through parcels DU65, DU72, DU117, DU118 and DU141 that are not owned by the City of Quincy and which proposed redevelopment activities associated with the Quincy Center redevelopment are proposed. In order to maintain access and maintenance to the proposed culvert through these parcels easements and means of access must be obtained.
- Consistency with URDP: This alignment runs through some of the larger parcels, which the City of Quincy has identified in the Urban Revitalization and Development Plan as appropriate for high density mixed use redevelopment. As a result, the ability to incorporate open channel sections with public open space is limited as the Brook will remain culverted through these areas. This alternative will also conflict with proposed subsurface parking planned within the development area and will impact the City of Quincy's URDP mixed use redevelopment density objectives.

- Code Compliance: This alignment runs beneath the proposed mixed use redevelopment building program on parcels DU65, DU72, DU117, DU118 and DU141. The conveyance of flood water through proposed buildings is not compliant with the building code.

**Conclusion**

This alternative does not satisfy the goal of enhancing the Town Brook and associated fisheries habitat nor is it consistent with the City's goals and objectives associated with the implementation of the City's Urban Redevelopment Plan. Therefore, this alternative was eliminated as a viable option.

## ALTERNATIVE A – NORTH SIDE OF CONCOURSE 1

This alternative proposes the construction of approximately 1,120 linear feet of new 11' wide x 6' high reinforced concrete box culvert along the north side of the Concourse Roadway Improvement Project. The Alternative evaluation metrics evaluation and Identified constraints are detailed below:

### Alternative A – Evaluation Metrics Analysis

**Flood Control**
Constructing a new reinforced concrete culvert sized to convey the appropriate design storm event will result in an improvement over the existing conditions, which consists of culvert segments with limiting hydraulic segments through the project area.

**Underground Conflicts**
This alternative conflicts with the structure on Parcel DUC70 and will require the relocation of existing utilities to accommodate its construction.

**Property Constraints (Property Control)**
The City of Quincy does not control the underlying property along this culvert alignment, therefore in order to construct this alternative the City would have to acquire property or obtain easements to construct and maintain the Town Brook Culvert.

Alternative A is approximately three feet off the Concourse right of way. Construction of this alternative will require construction easements and potential rebuilding of the sidewalk/pedestrian amenity areas that are currently under construction.

**Open Channel/Public Amenity**
This alternative provides an opportunity to create approximately 100 linear feet of open channel amenity at the easterly end of the alignment near the downstream connection point. At this location the existing grade to invert elevation difference is approximately 8 to 10 feet. The location of these open channel locations would be between the Concourse and the future building footprint.

**Enhance Smelt Fisheries Habitat**
The proposed open channel section of culvert on the north side of the Concourse roadway will be approximately 100 feet from the open channel section south of Revere Road and will be connected by the existing twin reinforced concrete box culverts. This proposed open channel section could be constructed with a low flow channel with spawning substrate, spawning riffles with designed attraction velocities and in-line resting pools extending the spawning habitat as appropriate.

**Impacts to URDP Density Objectives**
This alternative is at a location where open channel section could be integrated into the URDP public open space, however the adjacent open space area would be minimal due to the Quincy Center mixed use redevelopment building program and proximity to the Concourse.

**Construction Schedule & Phasing**
This alternative would require extensive phasing and coordination associated with the demolition of four existing buildings on the current alignment.

**Cost**
Construction premiums associated with this alternative include:

- Acquisition of property or obtaining easement rights
- Demolition or partial demolition of existing structures along proposed alignment

**Environmental Enhancements**
This alignment provides an opportunity to create an open channel section of culvert just prior to the downstream connection point to the existing Town Brook culvert. Adjacent, limited public open space and habitat suitable for urban wildlife can be provided in the area between the culvert and the Concourse roadway. Smelt habitat enhancements can be incorporated into the design of the proposed channel to expand and extend the smelt spawning habitat as appropriate.

**Code Compliance**
This alternative can be constructed in compliance with state building, plumbing and sanitary codes.

---

**Alternative A– Identified Constraints**

**Existing Conditions Constraints**

Refer to Figure 2.A.1 for the existing conditions layout view for Alternative A which depicts the locations described below.

Locations 1, 2, 3, 4, 5 and 6

- Property Constraints: the alignment requires construction activities on parcels DU141, DU142, DUC121, DU70, DU71 and DU72 which are not owned by the City of Quincy.
- Construction Schedule & Phasing: the foundation support required for construction adjacent to the existing buildings on parcels DU141, DU142, DU70 and DU71 will be cost prohibitive.
- Underground Conflicts: There are various underground utility conflicts in this area associated with Alternative A. Relocation of sewer, water and gas are required.

Location 4

- Depth of Construction: the proposed alignment is approximately twenty feet below grade, which will incur significant construction costs.
- Underground Conflicts: the proposed alignment will cross Hancock Street, which contains a number of underground utilities in close proximity to one another. Due to the depth of construction, support systems for these utilities will likely be required.

Location 6

- Open Channel/Public Amenity: the construction of the culvert through an active parking lot results in limited opportunity for open channel sections and public amenity space.

**Proposed Conditions Constraints**

Refer to Figure 2.A.2 for the proposed conditions layout view for Alternative A which depicts the locations described below. Refer to Figure 2.S.6 for a section view of Alternative A.

Location 7

Construction of an open channel section through the proposed Clivedon Street public common area would result in the following impacts:

- Open Channel/Public Amenity: creation of approximately 100 feet of eleven foot wide open channel section. The limited space within this area to accommodate adequate sidewalk and pedestrian amenities and the close proximity to the Concourse Roadway may require guardrails. A wall and/or fence system will also be required for pedestrian safety.

Location 8

The proposed alignment runs adjacent to the future development building footprint.

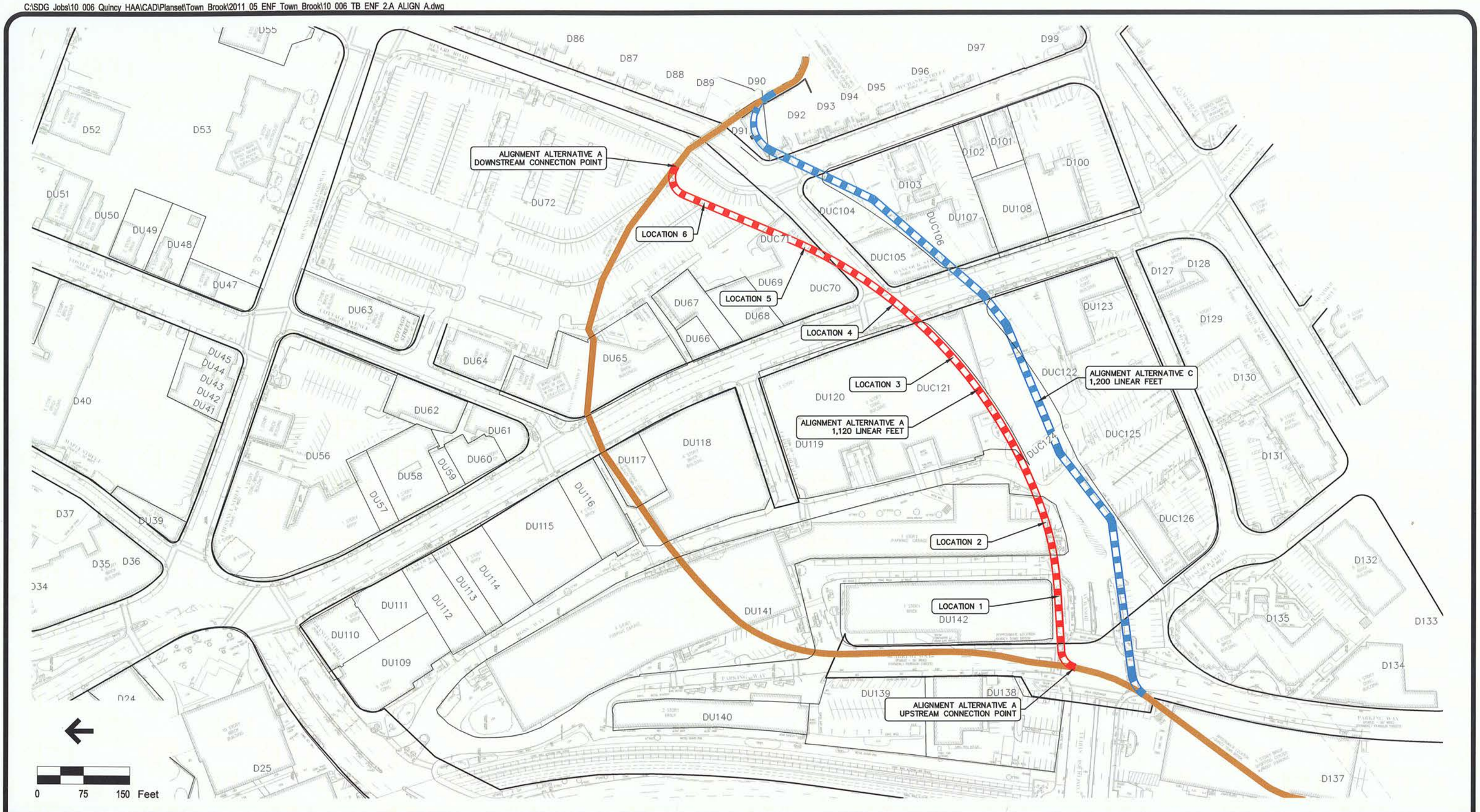
- Open Channel/Public Amenity: creation of approximately 100 feet of eleven foot wide open channel section. The limited space within this area to accommodate adequate sidewalk and pedestrian amenities and the close proximity to the Concourse Roadway may require guardrails. A wall and/or fence system will also be required for pedestrian safety.
- Construction Schedule & Phasing: the channel at this location will add significant complexity to the building foundation system due to the close proximity to the future building location.

---

**Conclusion**

This alternative provides flood control and environmental benefits, although not as significant as the preferred alternative. The feasibility of implementing this alternative is limited by lack of property control.

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.A ALIGN A.dwg




EXISTING TOWN BROOK ALIGNMENT
ALTERNATIVE A
ALTERNATIVE C (PREFERRED)

NOTES:
REFER TO CHAPTER 2 OF THE ENF REPORT FOR A SUMMARY OF THE LOCATIONS SHOWN ON THIS PLAN.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

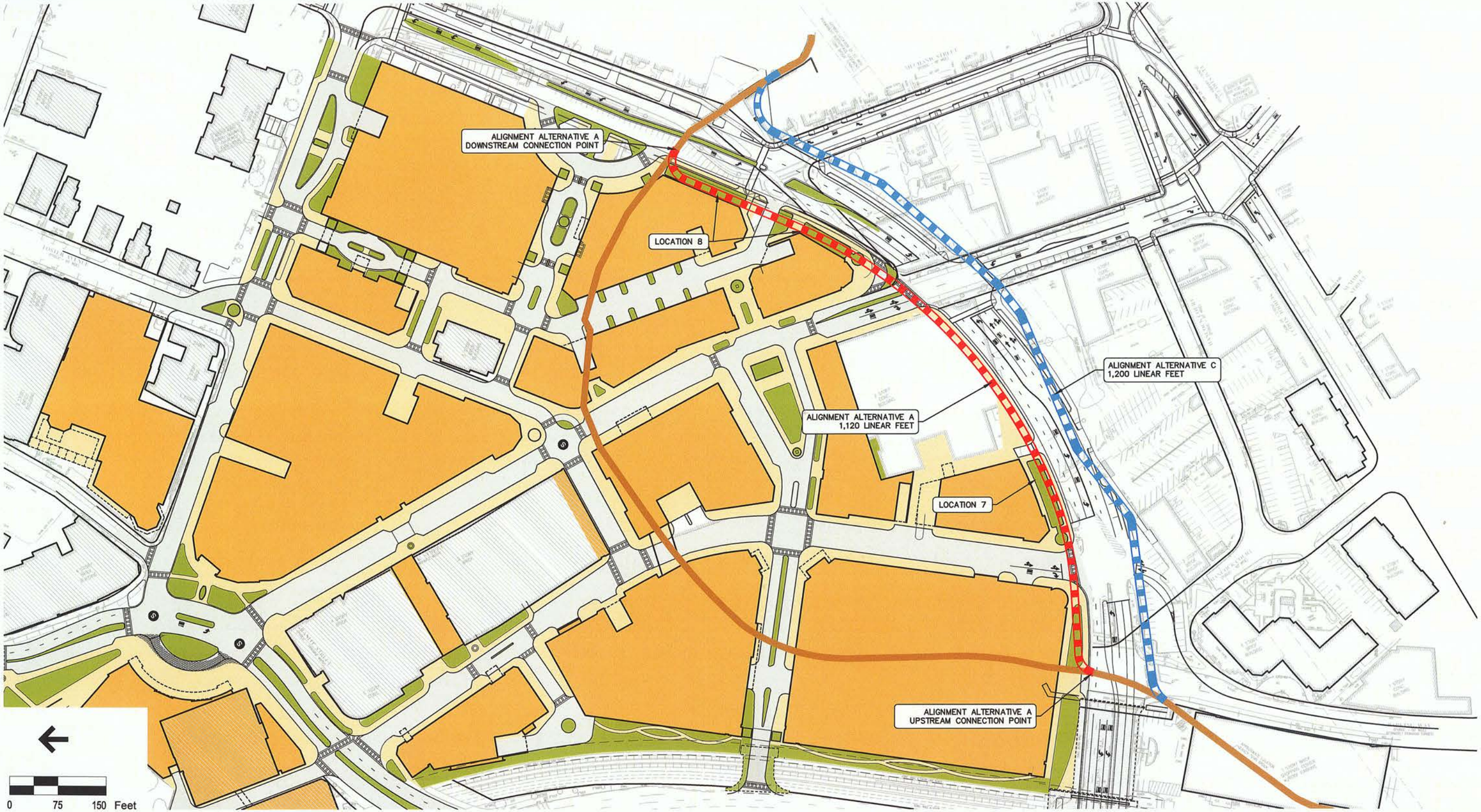
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 2.A.1 March 15, 2011

Alternative A
Existing Conditions
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.A ALIGN A.dwg




EXISTING TOWN BROOK ALIGNMENT
ALTERNATIVE A
ALTERNATIVE C (PREFERRED)

NOTES:
REFER TO CHAPTER 2 OF THE ENF REPORT FOR A SUMMARY OF THE LOCATIONS SHOWN ON THIS PLAN.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 2.A.2 March 15, 2011

Alternative A
Future Development Plan
Town Brook Enhancement Project
Quincy, Massachusetts

## ALTERNATIVE B – NORTH SIDE OF CONCOURSE 2

This alternative proposes the construction of approximately 1,170 linear feet of new 11' wide x 6' high reinforced concrete box culvert along the north side of the Concourse Roadway Improvement Project. It differs from alternative A in that it attempts to minimize intrusion into the Concourse Roadway right of way. The Alternative evaluation metrics evaluation and Identified constraints are detailed below:

### Alternative B – Evaluation Metrics Analysis

**Flood Control**
Constructing a new reinforced concrete culvert sized to convey the appropriate design storm event will result in an improvement over the existing conditions, which consists of culvert segments with limiting hydraulic segments through the project area.

**Underground Conflicts**
This alternative conflicts with the structure on Parcel DUC70 and will require the relocation of existing utilities to accommodate its construction.

**Property Constraints (Property Control)**
The City of Quincy does not control the underlying property along this culvert alignment, therefore in order to construct this alternative the City would have to acquire property or obtain easements to construct and maintain the Town Brook Culvert under this alternative.

Alternative B is approximately 10 feet off the Concourse right of way. Construction of this alternative will require construction easements and potential rebuilding of the sidewalk/pedestrian amenity areas that are currently under construction.

**Open Channel/Public Amenity**
This alternative provides an opportunity to create approximately 100 linear feet of open channel amenity at the easterly end of the alignment near the downstream connection point. At this location the existing grade to invert elevation difference is approximately 8 to 10 feet. The location of these open channel locations would be between the Concourse and the future building footprint.

**Enhance Smelt Fisheries Habitat**
The proposed open channel section of culvert on the north side of the Concourse roadway will be approximately 100 feet from the open channel section south of Revere Road and will be connected by the existing twin reinforced concrete box culverts. This proposed open channel section could be constructed with a low flow channel with spawning substrate, spawning riffles with designed attraction velocities and in-line resting pools extending the spawning habitat as appropriate.

**Consistency with URDP**
This alternative is at a location where open channel section could be integrated into the URDP public open space, however the adjacent open space area would be minimal due to the Quincy Center mixed use redevelopment building program and proximity to the Concourse.

This alternate would require that the mixed use redevelopment program associated with the Quincy Center redevelopment be moved further to the north to accommodate the alignment.

**Construction Schedule & Phasing**
This alternative would require extensive phasing and coordination associated with the demolition of four existing buildings on the current alignment.

**Cost**
Construction premiums associated with this alternative include:

- Acquisition of property or obtaining easement rights
- Demolition or partial demolition of existing structures along proposed alignment

**Environmental Enhancements**
This alignment provides an opportunity to create an open channel section of culvert just prior to the downstream connection point to the existing Town Brook culvert. Adjacent, limited public open space and habitat suitable for urban wildlife can be provided in the area between the culvert and the Concourse roadway. Smelt habitat enhancements can be incorporated into the design of the proposed channel to expand and extend the smelt spawning habitat as appropriate.

**Code Compliance**
This alternative can be constructed in compliance with state building, plumbing and sanitary codes.

---

**Alternative B– Identified Constraints**

**Existing Conditions Constraints**

Refer to Figure 2.B.1 for the existing conditions layout view for Alternative B which depicts the locations described below.

Location 1, 2, 3, 4, 5 and 6

- Property Constraints: the alignment requires construction activities on parcels DU141, DU142, DUC121, DU70, DU71 and DU72 which are not owned by the City of Quincy.
- Construction Schedule & Phasing: the foundation support required for construction adjacent to the existing buildings on parcels DU141, DU142, DU70 and DU71 will be cost prohibitive.
- Underground Conflicts: There are various underground utility conflicts in this area associated with Alternative B. Relocation of sewer, water and gas are required.

Location 4

- Cost: the proposed alignment is approximately twenty feet below grade, which will incur significant construction costs.
- Underground Conflicts: the proposed alignment will cross Hancock Street, which contains a number of underground utilities in close proximity to one another. Due to the depth of construction, support systems for these utilities will likely be required.

Location 6

- Open Channel/Public Amenity: the construction of the culvert through an active parking lot results in limited opportunity for open channel sections and public amenity space.

**Proposed Conditions Constraints**

Refer to Figure 2.B.2 for the proposed conditions layout view for Alternative B which depicts the locations described below. Refer to Figure 2.S.6 for a section view of Alternative B.

Location 7

Construction of an open channel section along the Concourse would result in the following impacts:

- Open Channel/Public Amenity: creation of approximately 100 feet of eleven foot wide open channel section. The limited space within this area to accommodate adequate sidewalk and pedestrian amenities and the close proximity to the Concourse Roadway may require guardrails. A wall and/or fence system will also be required for pedestrian safety.

Location 8

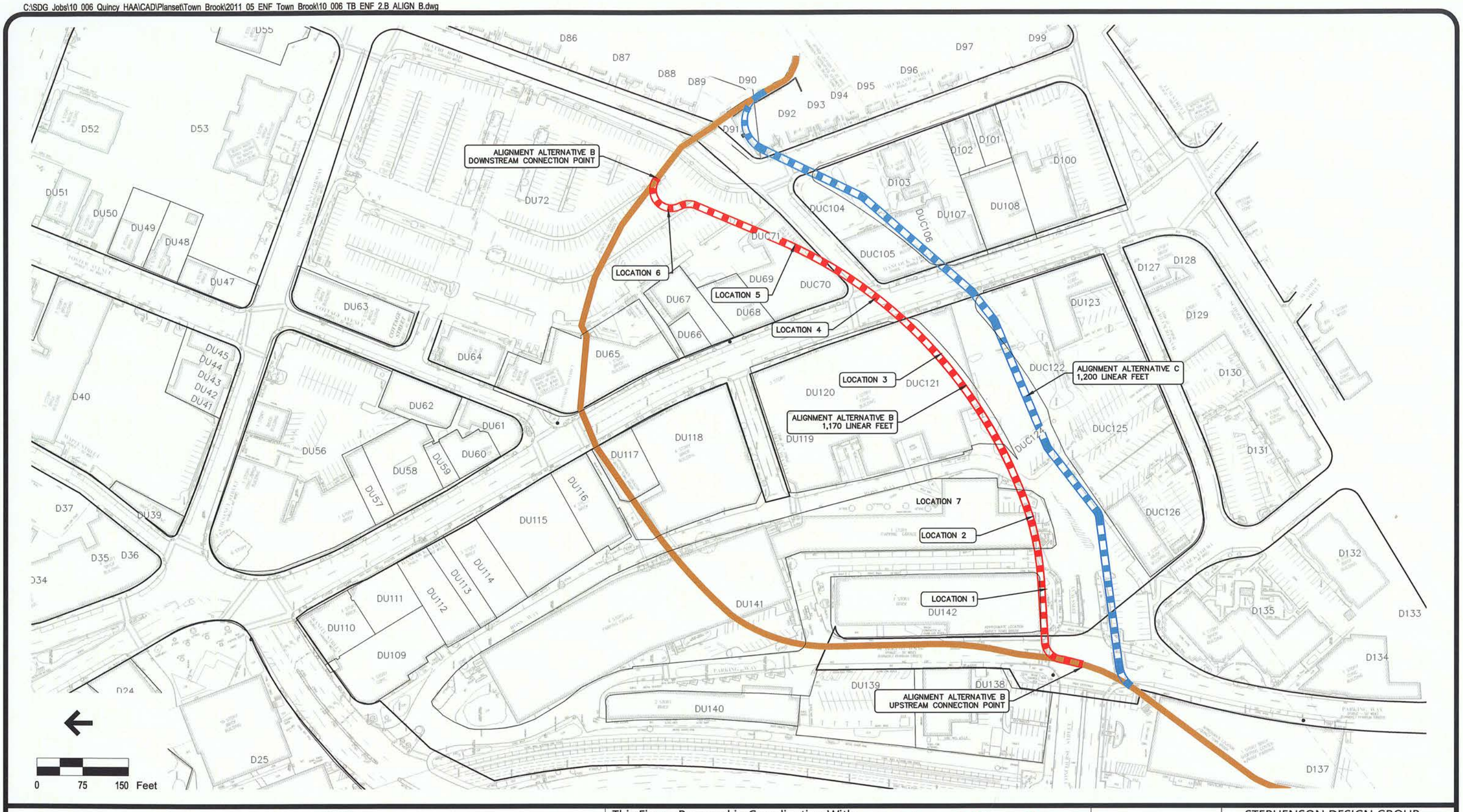
The proposed alignment runs adjacent to the future development building footprint.

- Open Channel/Public Amenity: creation of approximately 100 feet of eleven foot wide open channel section. The limited space within this area to accommodate adequate sidewalk and pedestrian amenities and the close proximity to the Concourse Roadway may require guardrails. A wall and/or fence system will also be required for pedestrian safety.
- Construction Schedule & Phasing: the channel at this location will add significant complexity to the building foundation system due to the close proximity to the future building location.
- Impacts to URDP Density Objectives: the inability to construct a building at this location is inconsistent with the City of Quincy's goals outlined in the URDP, which are to achieve a desired mixed use density for the Hancock lot parcel.
- Flood Control: series of tight radii result in adverse hydraulic conditions, leading to head losses that would reduce capacity of the culvert section and tailwater impacts that would negatively affect upstream storm drainage collection systems within the Quincy Center area.

## Conclusion

This alternative provides flood control and environmental benefits, although not as significant as the preferred alternative. The feasibility of implementing this alternative is limited by lack of property control.

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.B ALIGN B.dwg




EXISTING TOWN BROOK ALIGNMENT
ALTERNATIVE B
ALTERNATIVE C (PREFERRED)

NOTES:
REFER TO CHAPTER 2 OF THE ENF REPORT FOR A SUMMARY OF THE LOCATIONS SHOWN ON THIS PLAN.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

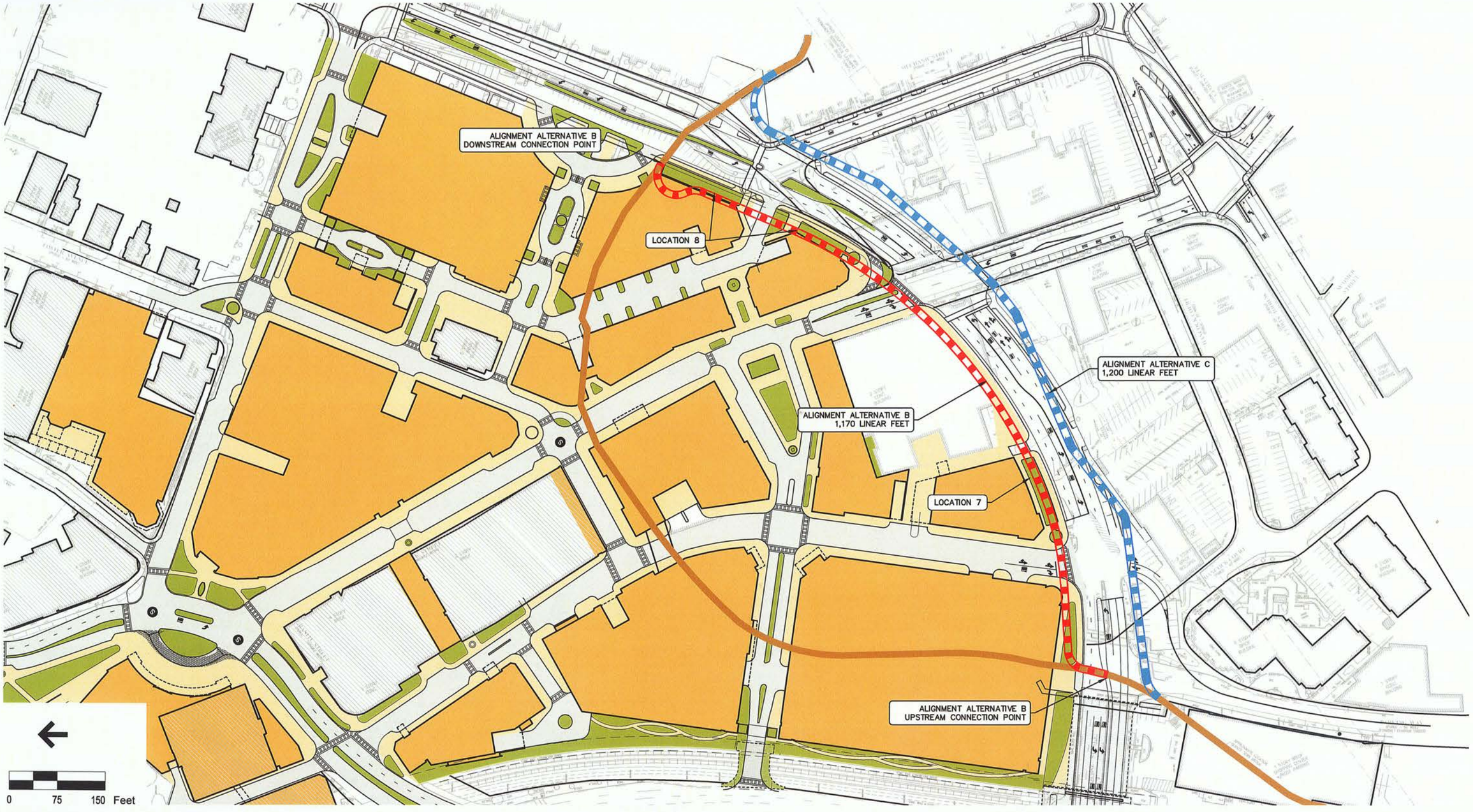
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 2.B.1 March 15, 2011

Alternative B
Existing Conditions
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.B ALIGN B.dwg




EXISTING TOWN BROOK ALIGNMENT
ALTERNATIVE B
ALTERNATIVE C (PREFERRED)

NOTES:
REFER TO CHAPTER 2 OF THE ENF REPORT FOR A SUMMARY OF THE LOCATIONS SHOWN ON THIS PLAN.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 2.B.2 March 15, 2011

Alternative B
Future Development Program
Town Brook Enhancement Project
Quincy, Massachusetts

## ALTERNATIVE C– SOUTH SIDE OF CONCOURSE (Preferred)

This alternative proposes the construction of approximately 1,200 linear feet of new 11' wide x 6' high reinforced concrete box culvert along the south side of the Concourse Roadway Improvement Project. Refer to Figures 2.C.1 and 2.C.2. The Alternative evaluation metrics evaluation and Identified constraints are detailed below:

### Alternative C – Evaluation Metrics Analysis

**Flood Control**
Constructing a new reinforced concrete culvert sized to convey the appropriate design storm event will result in an improvement over the existing conditions, which consists of culvert segments with limiting hydraulic segments through the project area.

**Underground Conflicts**
The construction of this alignment would require the relocation of a number of utilities along the proposed route.

**Property Constraints (Property Control)**
The City of Quincy controls the underlying property along this alignment. No additional properties would need to be acquired and no additional easements obtained in order to construct this alignment.

**Open Channel/Public Amenity**

This alternative provides an opportunity to create approximately 185 linear feet of new open channel amenity at the easterly end of the alignment near the downstream connection point. Adjacent to these open channel sections public open space will be constructed on City owned land. During the creation of this open space area the existing grade of parcels DUC104 and D91 will be dropped so the elevation difference between the public open space and culvert invert will be approximately 7 to 10 feet.

**Enhance Smelt Fisheries Habitat**

The proposed open channel sections of culvert on the south side of the Concourse roadway will be directly connected to the existing open channel section of Town Brook south of Revere Road, providing a continuous extension and enhancement of the fisheries habitat. This proposed open channel section will be constructed with a low flow channel with spawning substrate, spawning riffles with designed attraction velocities and either in-line or off-line resting pools extending the spawning habitat as appropriate. The final design of the channel will be coordinated with the Massachusetts Division of Marine Fisheries, in order to provide optimal fisheries enhancements.

**Consistency with URDP**
This alternative is at a location where open channel sections will be integrated into the URDP public open space and series of interconnected pocket parks. The open space adjacent to the

proposed open channel sections will be developed in accordance with the City's sustainable design objectives outlined in the URDP and the City of Quincy's – "Quincy Center District – Design Guidelines".

**Construction Schedule & Phasing**

This alternative would not require extensive phasing and coordination. In order to benefit from cost effective construction the City is phasing the project to coordination construction efforts with the Concourse Roadway Improvement Project.

**Cost**

Construction premiums associated with this alternative include:

- Utility relocations associated with construction
- Trenchless construction of culvert beneath Hancock Street

**Environmental Enhancements**

This alternative provides an opportunity to create the most new open channel section of culvert within the project area, when compared with the other alternatives presented in this chapter. The proposed open channel sections are just upstream of the downstream connection point to the existing Town Brook culvert. Adjacent, public open space and habitat suitable for urban wildlife can be provided on the City owned open space parcels. Smelt habitat enhancements are incorporated into the design of the proposed channel to expand and extend the smelt spawning habitat.

**Code Compliance**

This alternative can be constructed in compliance with state building, plumbing and sanitary codes.

---

**Alternative C– Identified Constraints**

**Existing Conditions Constraints**

Refer to Figure 2.C.1 for the existing conditions layout view for Alternative C which depicts the locations described below.

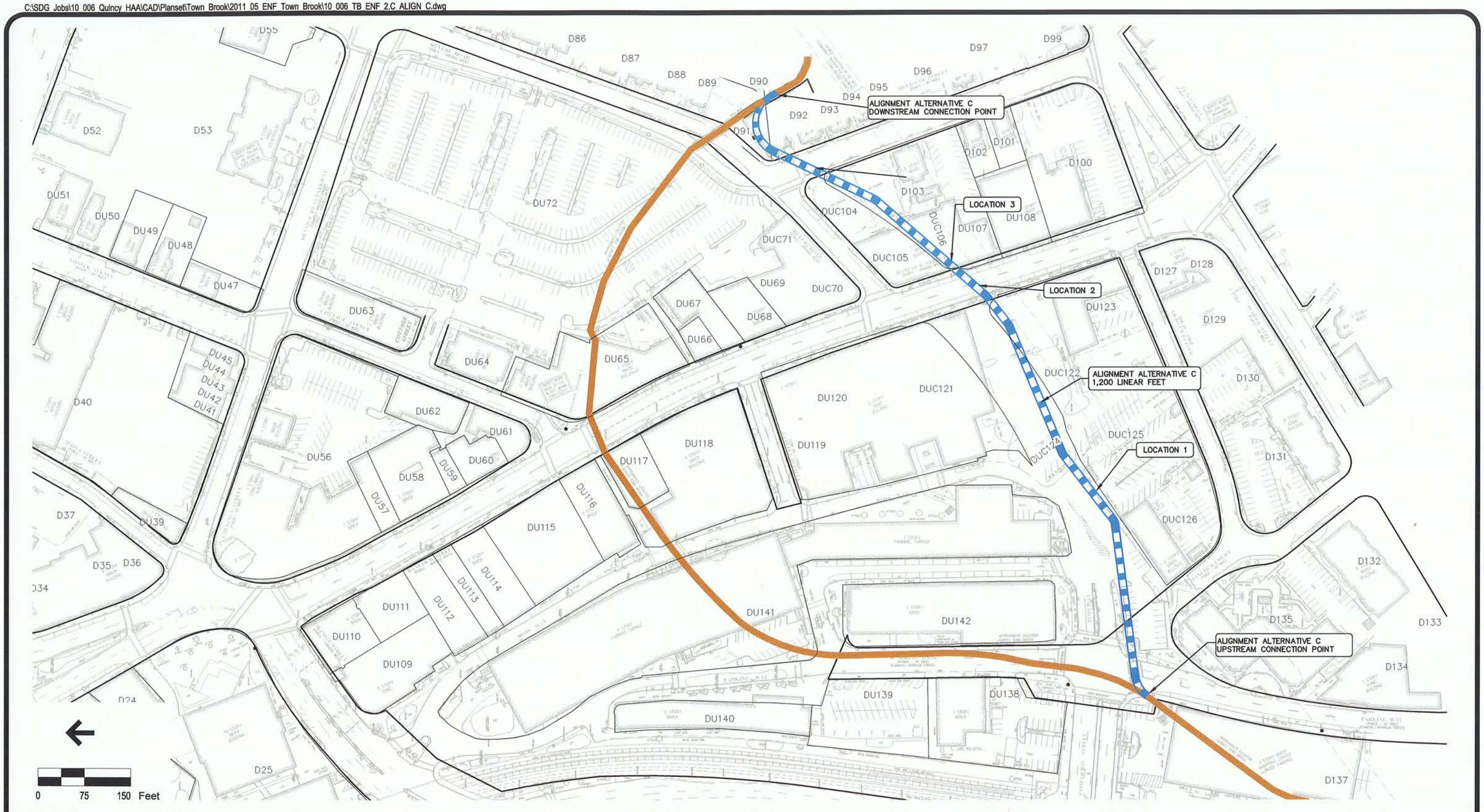
Location 1

- Construction Schedule & Phasing: the foundation support required for construction adjacent to the existing building on parcel DUC125 and DUC126 will have cost premiums associated with construction.
- Underground Conflicts: partial sewer relocation is required to cross beneath the proposed Town Brook alignment. The cost for this improvement is minimal.

Location 2

- Construction Schedule and Phasing: the proposed alignment is approximately 25 feet below grade as it crosses Hancock Street at this location. Construction through this location will likely be done through trenchless construction methods.

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.C ALIGN C.dwg




EXISTING TOWN BROOK ALIGNMENT

ALTERNATIVE C (PREFERRED ALIGNMENT)

NOTES:
REFER TO CHAPTER 2 OF THE ENF REPORT FOR A SUMMARY OF THE LOCATIONS SHOWN ON THIS PLAN.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

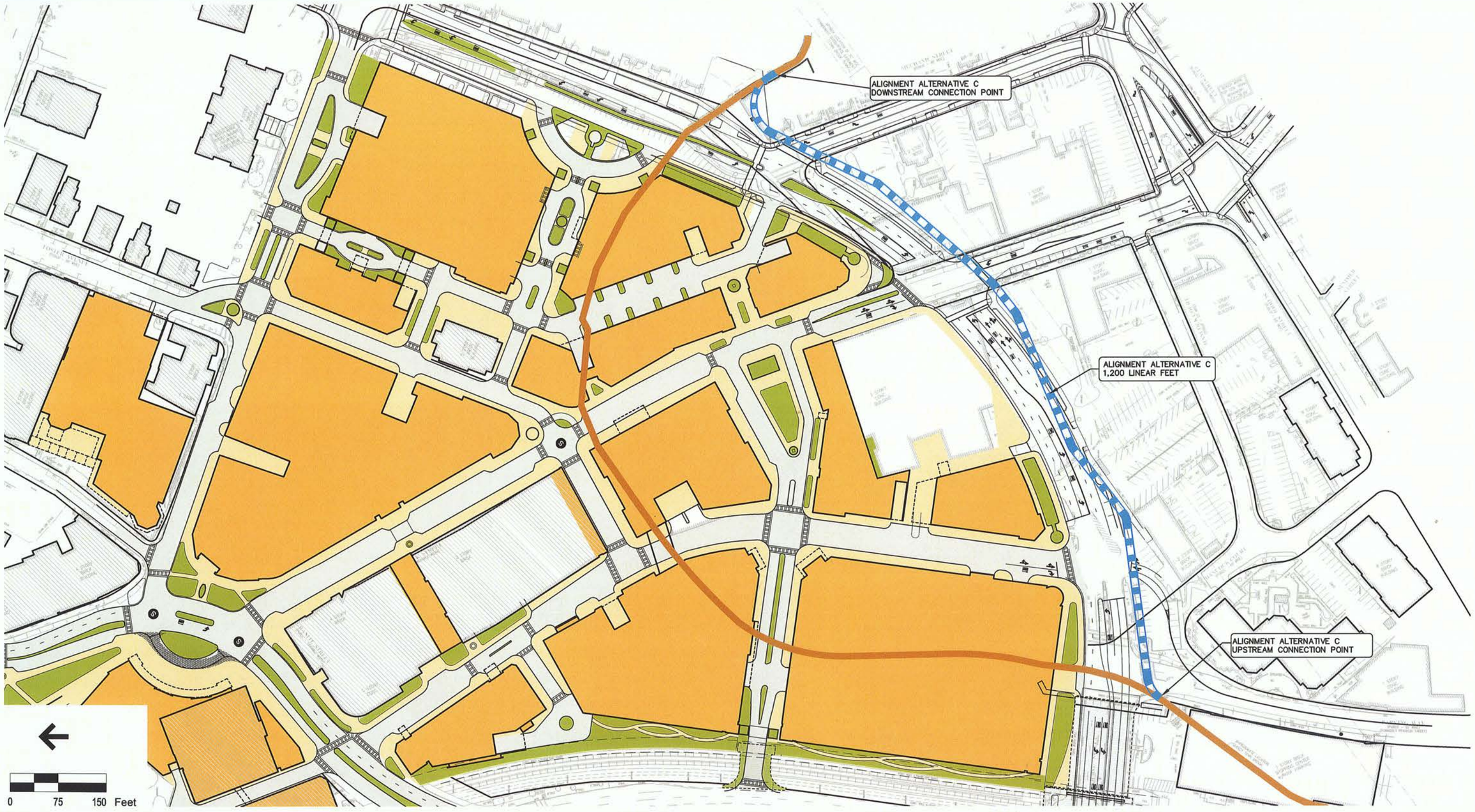
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 2.C.1 March 15, 2011

Alternative C (Preferred Alignment)
Existing Conditions
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.C ALIGN C.dwg




EXISTING TOWN BROOK ALIGNMENT

ALTERNATIVE C (PREFERRED ALIGNMENT)

NOTES:
REFER TO CHAPTER 2 OF THE ENF REPORT FOR A SUMMARY OF THE LOCATIONS SHOWN ON THIS PLAN.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 2.C.2 March 15, 2011

Alternative C (Preferred Alignment)
Future Development Program
Town Brook Enhancement Project
Quincy, Massachusetts

- Underground Conflicts: the proposed alignment will cross Hancock Street, which contains a number of underground utilities in close proximity to one another. Due to the depth of construction, support systems for these utilities will likely be required; however, use of trenchless construction will limit conflicts in this area.

Location 3

- Construction Schedule & Phasing: the foundation support required for construction adjacent to the existing building on parcel DU107 will have cost premiums associated with construction.

Location 4

Construction of an open channel section through parcels DUC105 and DUC104 would result in the following impacts:

- Open Channel/Public Amenity: The proposed open channel section west of Mechanic Street is eleven feet wide with an invert elevation 8-10 feet below proposed grade and a water surface elevation of Town Brook approximately 7.5 feet below proposed grade. The grade in the area decreases as the channel moves east, with the open channel section to the east of Mechanic Street approximately 7 feet below grade. The additional open space surrounding the open channel creates a public amenity that will include sitting areas and shade trees. Rain gardens are proposed within the open space areas which will provide a visual yet functional amenity, providing water quality benefits and contributing to the low impact development design standards the City is striving to achieve.
- Enhance Smelt Fisheries Habitat: Alternative C provides the opportunity for the creation of enhanced smelt habitat, including resting pools and spawning riffles. The proposed substrate for the stream bed shall be designed with a minimum 6" diameter rock bed to promote ideal spawning habitat and the resting pools will provide a safe, calm spawning area away from (but connected) to the potential storm event flows of the channel.

**Proposed Conditions Constraints**

There are no proposed constraints associated with Alternative C. Refer to Figure 2.C.2 for the proposed conditions layout of Alternative C. Refer to Figure 2.S.7 for a section view of Alternative C.

**Conclusion**

This alternative has been identified as the preferred alternative as it creates the greatest environmental benefit to Town Brook, while minimizing its environmental impacts. Specifically, the alternative has been identified by the City as the preferred due to: City control of all parcels along its route; predictable and feasible construction schedule due to ownership; opportunities to create the maximum amount of new open channel segments; opportunities to provide the maximum amount of fisheries enhancements; opportunities to create the maximum amount of public open space adjacent to the Brook; and consistency with the sustainability design objectives and ability for the integration into the network of public open space and pocket parks planned for Quincy Center under the URDP objectives.

## ALTERNATIVE D – ROSS WAY TO CLIVEDON

This alternative proposes the construction of approximately 1,285 linear feet of new 11' wide x 6' high reinforced concrete box culvert through the downtown redevelopment area. Refer to Figures 2.D.1 and 2.D.2. The Alternative evaluation metrics evaluation and Identified constraints are detailed below:

### Alternative D – Evaluation Metrics Analysis

**Flood Control**
Constructing a new reinforced concrete culvert sized to convey the appropriate design storm event will result in an improvement over the existing conditions, which consists of culvert segments with limiting hydraulic segments through the project area.

**Underground Conflicts**
This alternative conflicts with existing structures on Parcels DU142, DU141, DU68, DU69 and DUC71 and will require the relocation of existing utilities to accommodate its construction.

**Property Constraints (Property Control)**
The City of Quincy does not control the underlying property along this culvert alignment, therefore in order to construct this alternative the City would have to acquire property or obtain easements to construct and maintain the Town Brook Culvert under this alternative.

**Open Channel/Public Amenity**
This alternative provides an opportunity to create approximately 100 linear feet of open channel amenity at the easterly end of the alignment near the downstream connection point. At this location the existing grade to invert elevation difference is approximately 8 to 10 feet. The location of these open channel locations would be between the Concourse and the future Quincy Center redevelopment building program.

**Enhance Smelt Fisheries Habitat**
The proposed open channel section of culvert on the north side of the Concourse roadway will be approximately 100 feet from the open channel section south of Revere Road and will be connected by the existing twin reinforced concrete box culverts. This proposed open channel section could be constructed with a low flow channel with spawning substrate, spawning riffles with designed attraction velocities and in-line resting pools extending the spawning habitat as appropriate.

**Consistency with URDP**
This alternative is at a location where open channel section could be integrated into the URDP public open space, however the adjacent open space area would be minimal due to the Quincy Center mixed use redevelopment building program and proximity to the Concourse.

**Construction Schedule & Phasing**
This alternative would require extensive phasing and coordination associated with the demolition or partial demolition of multiple buildings along the proposed alignment.

**Cost**
Construction premiums associated with this alternative include:

- Acquisition of property or obtaining easement rights
- Demolition or partial demolition of existing structures along proposed alignment
- Significant utility relocations associated with construction across Hancock Street

**Environmental Enhancements**
This alignment provides an opportunity to create an open channel section of culvert just prior to the downstream connection point to the existing Town Brook culvert. Adjacent, limited public open space and habitat suitable for urban wildlife can be provided in the area between the culvert and the Concourse roadway. Smelt habitat enhancements can be incorporated into the design of the proposed channel to expand and extend the smelt spawning habitat as appropriate.

**Code Compliance**
This alternative can be constructed in compliance with state building, plumbing and sanitary codes.

---

**Alternative D – Identified Constraints**

**Existing Conditions Constraints**

Refer to Figure 2.D.1 for the existing conditions layout view for Alternative D which depicts the locations described below.

Location 1

- Property Constraints: the alignment requires construction activities on parcel DU142 which is not controlled by the City of Quincy.
- Construction Schedule & Phasing: the foundation support required for construction adjacent to the existing building on parcel DU142 will be cost prohibitive.

Location 2

- Construction Schedule & Phasing: the approximately 400 linear feet of the alignment is proposed within the existing Ross Garage footprint. Construction along this alignment would require the demolition of the Ross Garage.

Location 3

- Underground Conflicts: the proposed alignment will cross Hancock Street, which contains a number of underground utilities in close proximity to one another including (Refer to Figures 2.S.2 and 2.S.4 for a depiction of underground utility conflicts):
    - National Grid electric duct bank (4-5" conduits);
    - Sanitary sewer trunk lines and service connections (18" trunk line);

- Storm drainage trunk lines and catch basin connections (18" trunk line);
- Water main and service connections (12" main);
- Verizon tel/data duct bank (8-4" conduits);
- National Grid gas main with service connections (8" main).

Location 4

- Property Constraints: the alignment requires construction activities on parcels DU67, DU68, and DU69, none of which are currently controlled by the City of Quincy.
- Construction Schedule & Phasing: construction would require acquisition of properties and demolition of building and temporary construction easements in order to perform the work.

Location 5

- Open Channel/Public Amenity: the construction of the culvert through an active parking lot results in limited opportunity for open channel sections and public amenity space.

**Proposed Conditions Constraints**

Refer to Figure 2.D.2 for the proposed conditions layout view for Alternative D which depicts the locations described below. Refer to Figures 2.S.2 and 2.S.3 for section views of Alternative D.

Location 6

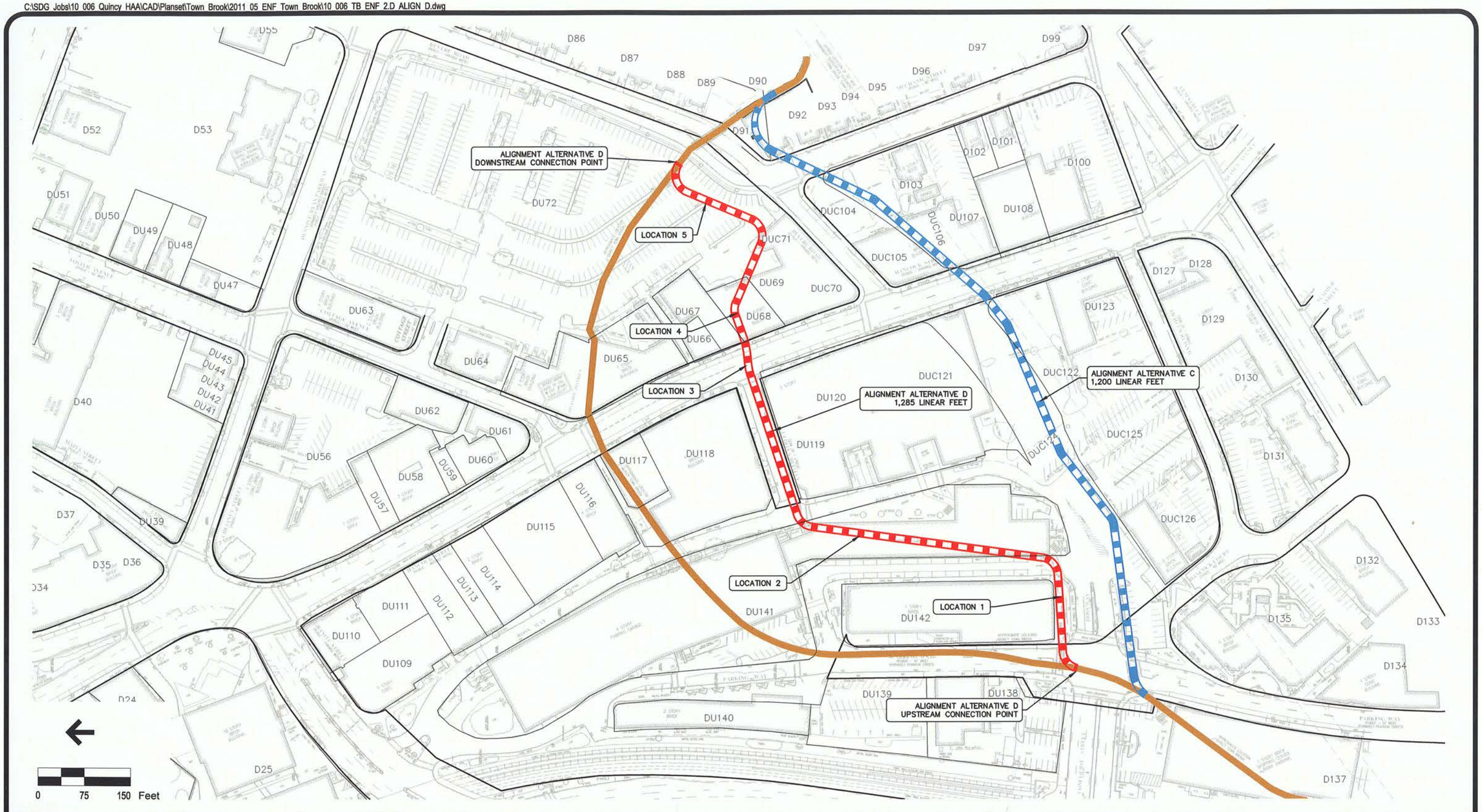
Construction of an open channel section through the proposed Clivedon Street public common area would result in the following impacts (Refer to Figure 2.S.3):

- Open Channel/Public Amenity: creation of an open channel section eleven feet wide with an invert elevation 18 feet below proposed grade and a water surface elevation of Town Brook approximately 17.5 feet below proposed grade. The significant depth to height ratio in combination with the addition of a minimum 42" high fence to address fall hazard issues results in a public amenity of questionable value.
- Open Channel/Public Amenity: an open channel section at the proposed public common area would present a significant barrier to pedestrian foot traffic across the common and would negatively impact the ability to create a cohesive public space with market stalls, seasonal ice skating rinks, cafés and public seating areas, consistent with the objectives of the URDP.

Location 7

- Open Channel/Public Amenity: creation of approximately 100 feet of eleven foot wide open channel section. This open channel sections with associated public open space will be situated between the Concourse roadway and the future Quincy Center mixed use redevelopment building program. The close proximity to the Concourse may require guardrails and wall and/or fence system for pedestrian safety.

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.D ALIGN D.dwg




EXISTING TOWN BROOK ALIGNMENT
ALTERNATIVE D
ALTERNATIVE C (PREFERRED)

NOTES:
REFER TO CHAPTER 2 OF THE ENF REPORT FOR A SUMMARY OF THE LOCATIONS SHOWN ON THIS PLAN.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

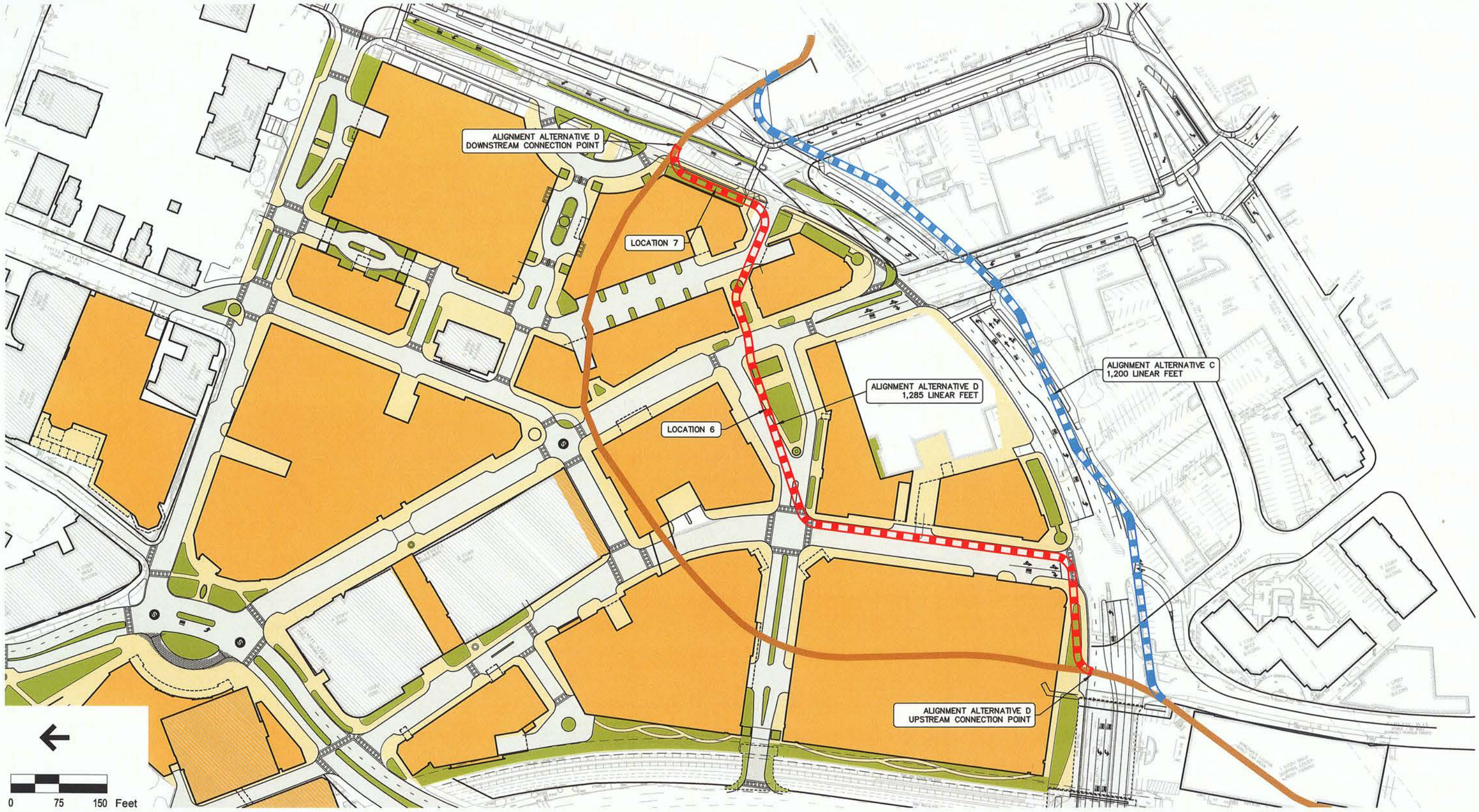
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 2.D.1 March 15, 2011

Alternative D
Existing Conditions
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.D ALIGN D.dwg




EXISTING TOWN BROOK ALIGNMENT
ALTERNATIVE D
ALTERNATIVE C (PREFERRED)

NOTES:
REFER TO CHAPTER 2 OF THE ENF REPORT FOR A SUMMARY OF THE LOCATIONS SHOWN ON THIS PLAN.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 2.D.2 March 15, 2011

Alternative D
Future Development Program
Town Brook Enhancement Project
Quincy, Massachusetts

- Construction Schedule & Phasing: an underground culvert at this location will need to be coordinated with the foundation system of the adjacent building.

**Conclusion**

This alternative provides flood control and environmental benefits, although not as significant as the preferred alternative. The feasibility of implementing this alternative is limited by lack of property control and construction scheduling issues associated with property acquisition and demolition.

## ALTERNATIVE E– ADJACENT TO MBTA RETAINING WALL

Alternative E has been derived from discussions and meetings with representatives from the QEN. This alternative proposes the construction of approximately 1,680 linear feet of new 11' wide x 6' high reinforced concrete box culvert through the downtown redevelopment area. Refer to Figures 2.E.1 and 2.E.2. The Alternative evaluation metrics evaluation and Identified constraints are detailed below:

### Alternative E – Evaluation Metrics Analysis

**Flood Control**
Constructing a new reinforced concrete culvert sized to convey the appropriate design storm event will result in an improvement over the existing conditions, which consists of culvert segments with limiting hydraulic segments through the project area.

**Underground Conflicts**
This alternative conflicts with existing structures on Parcels DU140, DU141, DU67, DU68, DU69 and DUC71 and will require the relocation of existing utilities to accommodate its construction. This proposed alignment runs adjacent to an MBTA retaining wall, separating Parcels DU138, DU139 and DU140 from the MBTA Red Line and commuter rail tracks, which are approximately 18 feet lower in grade than the existing grade along the proposed alignment. The gravity concrete retaining wall has a significant footing that extends beneath the proposed culvert alignment, Refer to Figure 2.S.1 for a section through this location.

**Property Constraints (Property Control)**
The City of Quincy does not control the underlying property along this culvert alignment, therefore in order to construct this alternative the City would have to acquire property or obtain easements to construct and maintain the Town Brook Culvert under this alternative.

**Open Channel/Public Amenity**
This alternative provides an opportunity to create approximately 100 linear feet of open channel amenity at the easterly end of the alignment near the downstream connection point. At this location the existing grade to invert elevation difference is approximately 10 to 12 feet. This open channel section would be located between the Concourse and the future building footprint.

**Enhance Smelt Fisheries Habitat**
The proposed open channel section of culvert on the north side of the Concourse roadway will be approximately 100 feet from the open channel section south of Revere Road and will be connected by the existing twin reinforced concrete box culverts. This proposed open channel section could be constructed with a low flow channel with spawning substrate, spawning riffles with designed attraction velocities and in-line resting pools extending the spawning habitat as appropriate.

**Consistency with URDP**
This alternative is at a location where open channel sections could be integrated into the URDP public open space; however the adjacent open space area would be minimal due to the Quincy Center mixed use redevelopment building program and proximity to the Concourse.

**Construction Schedule & Phasing**
This alternative would require extensive phasing and coordination associated with the demolition or partial demolition of multiple buildings along the proposed alignment and the coordination with construction of the retaining wall within an active rail line.

**Cost**
Construction premiums associated with this alternative include:

- Acquisition of property or obtaining easement rights
- Demolition or partial demolition of existing structures along proposed alignment
- Significant utility relocations associated with construction across Hancock Street
- Potential reconstruction of approximately 500 linear feet of 18' high retaining wall along the MBTA right-of-way.
- Reconstruction of the foundation system associated with the "Paul Harold Concourse Bridge"

**Environmental Enhancements**
This alignment provides an opportunity to create an open channel section of culvert just prior to the downstream connection point to the existing Town Brook culvert. Adjacent, limited public open space and habitat suitable for urban wildlife can be provided in the area between the culvert and the Concourse roadway. Smelt habitat enhancements can be incorporated into the design of the proposed channel to expand and extend the smelt spawning habitat as appropriate.

**Code Compliance**
This alternative could be constructed to comply with state building and plumbing codes if phased to do so.

---

**Alternative E– Identified Constraints**

**Existing Conditions Constraints**

Refer to Figure 2.E.1 for the existing conditions layout view for Alternative E which depicts the locations described below.

Location 1

- Property Constraints: the alignment requires construction activities on parcel DU138 which is not controlled by the City of Quincy.
- Construction Schedule & Phasing: the alignment passes through the foundation system of the existing "Paul Harold Concourse Bridge" overpass of the MBTA rail tracks. Reconstructing this foundation would require coordination with MassDOT, and MBTA. This is likely to be cost prohibitive.

Location 2

- Construction Schedule & Phasing: the alignment is adjacent to the MBTA structural retaining wall. Construction at this location may compromise the structural integrity of the retaining wall and would require the reconstruction of the wall within the project limits. The schedule impacts and costs associated with this option would be significant. Construction would impact MBTA operations and require approval from the MBTA.

Location 3

- Property Constraints: the alignment requires construction activities on parcel DU140 which is not controlled by the City of Quincy.

Location 4

- Construction Schedule & Phasing: the alignment is proposed within the existing Ross Garage footprint.

Location 5

- Underground Conflicts: the proposed alignment will cross Hancock Street, which contains a number of underground utilities in close proximity to one another including, Refer to Figure 2.S.4 for a depiction of the utilities within Hancock Street:
    - National Grid electric duct bank (4-5" conduits);
    - Sanitary sewer trunk lines and service connections (18" trunk line);
    - Storm drainage trunk lines and catch basin connections (18" trunk line);
    - Water main and service connections (12" main);
    - Verizon tel/data duct bank (8-4" conduits);
    - National Grid gas main with service connections (8" main).

Location 6

- Property Constraints: the alignment requires construction activities on parcels DU67, DU68, and DU69, none of which are currently owned by the City of Quincy or their selected developer.
- Construction Schedule & Phasing: construction would require temporary construction easements in order to access the work area.

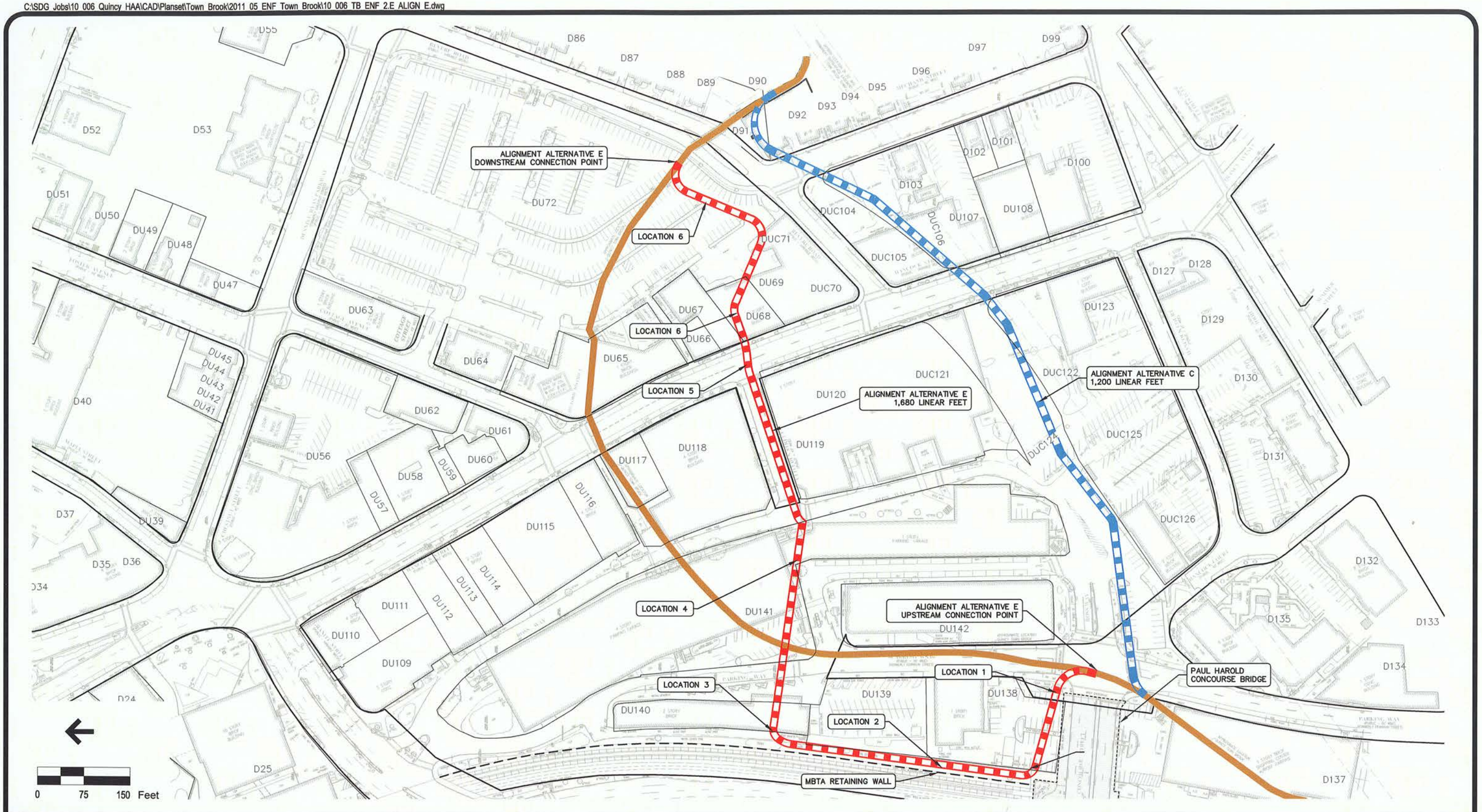
Location 7

- Open Channel/Public Amenity: the construction of the culvert through an active parking lot results in limited opportunity for open channel sections and public amenity space.

**Proposed Conditions Constraints**

Refer to Figure 2.E.2 for the proposed conditions layout view for Alternative E which depicts the locations described below. Refer to Figures 2.S.1 and 2.S.3 for section views of Alternative E.

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.E ALIGN E.dwg




EXISTING TOWN BROOK ALIGNMENT
ALTERNATIVE E
ALTERNATIVE C (PREFERRED)

NOTES:
REFER TO CHAPTER 2 OF THE ENF REPORT FOR A SUMMARY OF THE LOCATIONS SHOWN ON THIS PLAN.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

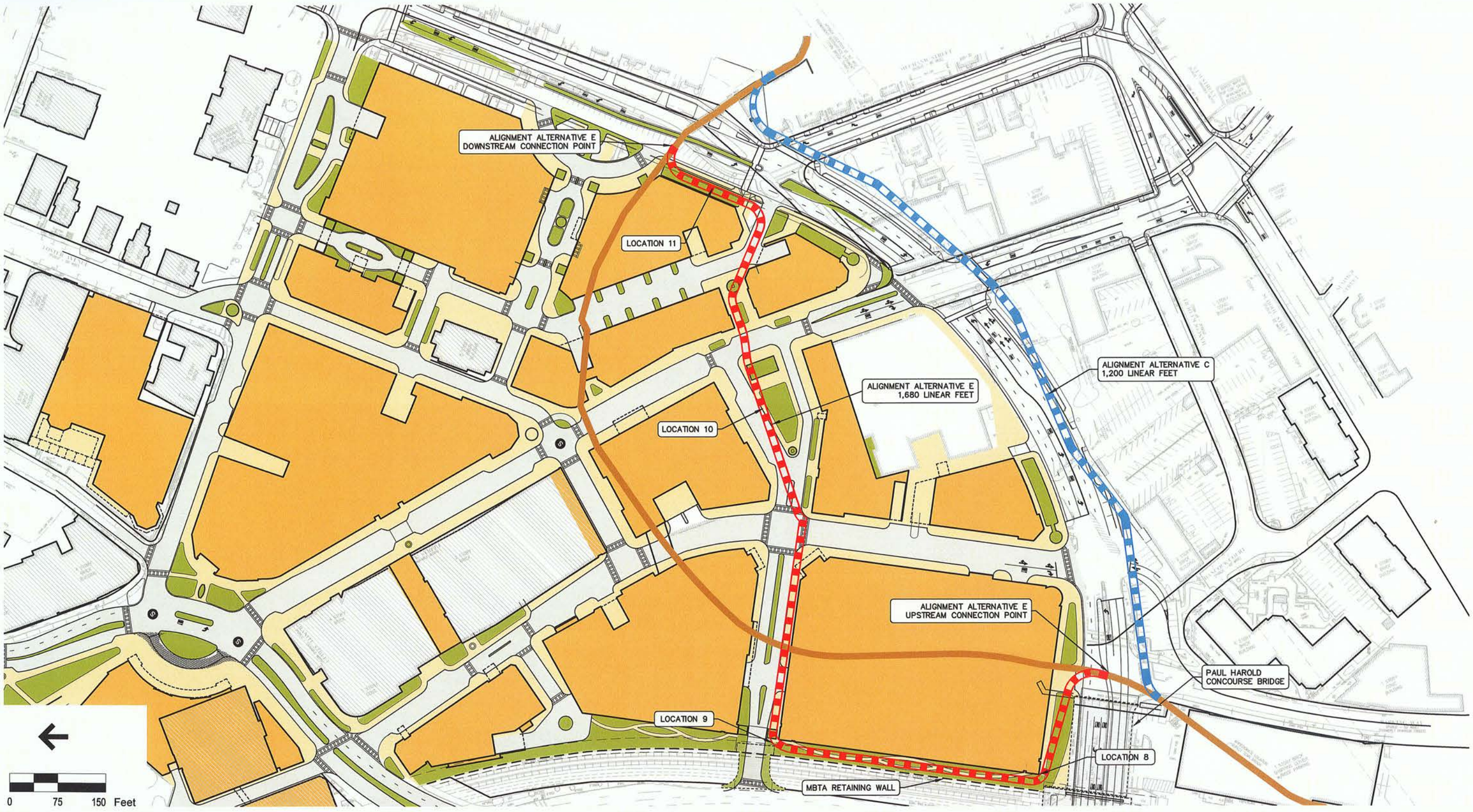
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 2.E.1 March 15, 2011

Alternative E
Existing Conditions
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.E ALIGN E.dwg




EXISTING TOWN BROOK ALIGNMENT
ALTERNATIVE E
ALTERNATIVE C (PREFERRED)

NOTES:
REFER TO CHAPTER 2 OF THE ENF REPORT FOR A SUMMARY OF THE LOCATIONS SHOWN ON THIS PLAN.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 2.E.2 March 15, 2011

Alternative E
Future Development Program
Town Brook Enhancement Project
Quincy, Massachusetts

Location 8

- Construction Schedule & Phasing: the alignment passes between a proposed building footprint and the existing bridge abutment for the Concourse bridge over the MBTA tracks and the MBTA wall system.

Location 9

- Construction Schedule & Phasing: the alignment passes between a proposed building footprint and a potential future bridge abutment for the Clivedon Street Extension bridge over the MBTA tracks and the MBTA wall system.

Location 10

Construction of an open channel section through the proposed Clivedon Street public common area would result in the following impacts: (Refer to Figure 2.S.3)

- Open Channel/Public Amenity: creation of an open channel section eleven feet wide with an invert elevation 18 feet below proposed grade and a water surface elevation of Town Brook approximately 17.5 feet below proposed grade. The significant depth to height ratio in combination with the addition of a minimum 42" high fence to address fall hazard issues results in a public amenity of questionable value.
- Open Channel/Public Amenity: an open channel section at the proposed public common area would present a significant barrier to pedestrian foot traffic across the common and would negatively impact the ability to create a cohesive public space with market stalls, seasonal ice skating rinks, cafés and public seating areas consistent with the URDP.

Location 11

- Open Channel/Public Amenity: creation of approximately 100 feet of eleven foot wide open channel section. This open channel sections with associated public open space will be situated between the Concourse roadway and the future Quincy Center mixed use redevelopment building program. The close proximity to the Concourse may require guardrails and wall and/or fence system for pedestrian safety.
- Construction Schedule & Phasing: an underground culvert at this location will need to be coordinated with the foundation system of the adjacent building.

**Conclusion**

This alternative provides flood control and environmental benefits, although not as significant as the preferred alternative. The feasibility of implementing this alternative is limited by lack of property control and construction scheduling issues associated with property acquisition and demolition of buildings as well as the significant additional construction associated with the MBTA retaining wall.

## ALTERNATIVE F – CLIVEDON/ HANCOCK

### Clivedon/ Hancock

Alternative F has been derived from discussions and meetings with representatives from the QEN. This alternative proposes the construction of approximately 1,770 linear feet of new 11' wide x 6' high reinforced concrete box culvert through the downtown redevelopment area. Refer to Figures 2.F.1 and 2.F.2. The Alternative evaluation metrics evaluation and Identified constraints are detailed below:

### Alternative F – Evaluation Metrics Analysis

**Flood Control**
Constructing a new reinforced concrete culvert sized to convey the appropriate design storm event will result in an improvement over the existing conditions, which consists of culvert segments with limiting hydraulic segments through the project area.

**Underground Conflicts**
This alternative runs beneath the existing structures on DU65 and will require the relocation of significant existing utility infrastructure within Hancock Street to accommodate its construction. This proposed alignment runs along Hancock Street for approximately 240 linear feet, which results in substantial impacts to the existing utility infrastructure and the known utility infrastructure improvements the City is planning to support the Quincy Center redevelopment. Refer to Figure 2.S.4 for a depiction of the utility conflicts in this area.

**Property Constraints (Property Control)**
The City of Quincy does not control the underlying property along this culvert alignment, therefore in order to construct this alternative the City would have to acquire property or obtain easements to construct and maintain the Town Brook Culvert under this alternative.

**Open Channel/Public Amenity**
This alternative provides little practical opportunity for the creation of open channel segments with adjacent public open space as the constraints under existing conditions and lack of integration with the planed public open space and pocket parks associated with the URDP limit this opportunity.

**Enhance Smelt Fisheries Habitat**
Construction of this alternative provides limited opportunity for the creation of open channel sections with public open space. A low flow channel with spawning substrate, spawning riffles with designed attraction velocities and in-line resting pools can be constructed extending upstream into the proposed enclosed culvert to extend and spawning habitat, if deemed appropriate by the DMF, however without additional open channel/ day-lit sections the potential for extending Fisheries Enhancements north of the Concourse may be limited.

**Consistency with URDP**
This alignment provides limited potential for the creation of open channel sections with public open space and therefore does not address these objectives of the URDP as it pertains to the creation of public open space. The alignment runs through some of the larger parcels within the downtown area, which the City of Quincy has identified in the Urban Revitalization and Development Plan as appropriate for high density mixed use redevelopment. As a result, the ability to incorporate open channel sections with public open space is limited as the Brook will remain in an enclosed culverted through these areas.

**Construction Schedule & Phasing**
This alternative would require extensive phasing and coordination associated with the demolition or partial demolition of multiple buildings along the proposed alignment and the construction along Hancock Street.

**Cost**
Construction premiums associated with this alternative include:

- Acquisition of property or obtaining easement rights
- Demolition or partial demolition of existing structures along proposed alignment
- Significant utility relocations associated with construction along Hancock Street

**Environmental Enhancements**
Construction of this alternative will result in limited potential for additional open channel sections, limited potential for habitat enhancements and limited potential for enhancement of Riverfront Area.

**Code Compliance**
This alternative proposes to convey the flood waters of Town Brook beneath and adjacent to habitable structures. Issues associated with conveying flood waters through a building are not consistent with current building or plumbing codes.

---

**Alternative F – Identified Constraints**

**Existing Conditions Constraints**

Refer to Figure 2.F.1 for the existing conditions layout view for Alternative F which depicts the locations described below.

Location 1

- Property Constraints: the alignment requires construction activities on parcel DU142 which is not controlled by the City of Quincy.
- Construction Schedule & Phasing: the foundation support required for construction adjacent to the existing building on parcel DU142 will be cost prohibitive.

Location 2

- Construction Schedule & Phasing: approximately 400 linear feet of the alignment is proposed within the existing Ross Garage footprint. In order for the alignment to be constructed the Ross garage must be razed.

Location 3

- Underground Conflicts: the proposed alignment will partially cross and then follow Hancock Street, which significant underground utilities in close proximity to one another including:
  - National Grid electric duct bank (4-5" conduits);
  - Sanitary sewer trunk lines and service connections (18" trunk line);
  - Storm drainage trunk lines and catch basin connections (18" trunk line);
  - Water main and service connections (12" main);
  - Verizon tel/data duct bank (8-4" conduits);
  - National Grid gas main with service connections (8" main).

Location 4

- Flood Control: series of tight radii result in adverse hydraulic conditions, leading to head losses that would reduce capacity of the culvert section and tailwater impacts that would negatively affect upstream storm drainage collection systems within the Quincy Center area.

Location 6

- Open Channel/Public Amenity: the construction of the culvert through an active parking lot results in limited opportunity for open channel sections and public amenity space.

**Proposed Conditions Constraints**

Refer to Figure 2.F.2 for the proposed conditions layout view for Alternative F which depicts the locations described below. Refer to Figures 2.S.2, 2.S.3 and 2.S.4 for section views of Alternative F.

Location 7

Construction of an open channel section through the proposed Clivedon Street public common area would result in the following impacts: (Refer to Figure 2.S.3)

- Open Channel/Public Amenity: creation of an open channel section eleven feet wide with an invert elevation 18 feet below proposed grade and a water surface elevation of Town Brook approximately 17.5 feet below proposed grade. The significant depth to height ratio results in a public amenity of questionable value.
- Open Channel/Public Amenity: an open channel section at the proposed public common area would present a significant barrier to pedestrian foot traffic across the

common and would negatively impact the ability to create a cohesive public space with market stalls, seasonal ice skating rinks, cafés and public seating areas consistent with the open space objectives of the URDP.

Location 8

- Underground Conflicts: the proposed alignment will partially cross and then follow Hancock Street, which contains a number of underground utilities in close proximity to one another including:
  - National Grid electric duct bank (4-5" conduits);
  - Sanitary sewer trunk lines and service connections (18" trunk line);
  - Storm drainage trunk lines and catch basin connections (18" trunk line);
  - Water main and service connections (12" main);
  - Verizon tel/data duct bank (8-4" conduits);
  - National Grid gas main with service connections (8" main).

- Flood Control: series of tight radii result in adverse hydraulic conditions, leading to head losses that would reduce capacity of the culvert section and tailwater impacts that would negatively affect upstream storm drainage collection systems within the Quincy Center area.

Location 9

The proposed alignment runs through the proposed future Quincy Center redevelopment program.

- Property Constraints: locating the City-owned culvert on private property under new construction will present approval challenges from investors, lenders, insurers, and code officials as well as creating access issues for future maintenance.
- Construction Schedule & Phasing: an underground culvert at this location will add need to be coordinated with the future building foundation system.
- Impacts to URDP Density Objectives: the potential impact to the Quincy Center mixed use redevelopment building program at this location is inconsistent with the City of Quincy's goals outlined in the URDP, which are to achieve a desired mixed use density for the Hancock lot parcel.

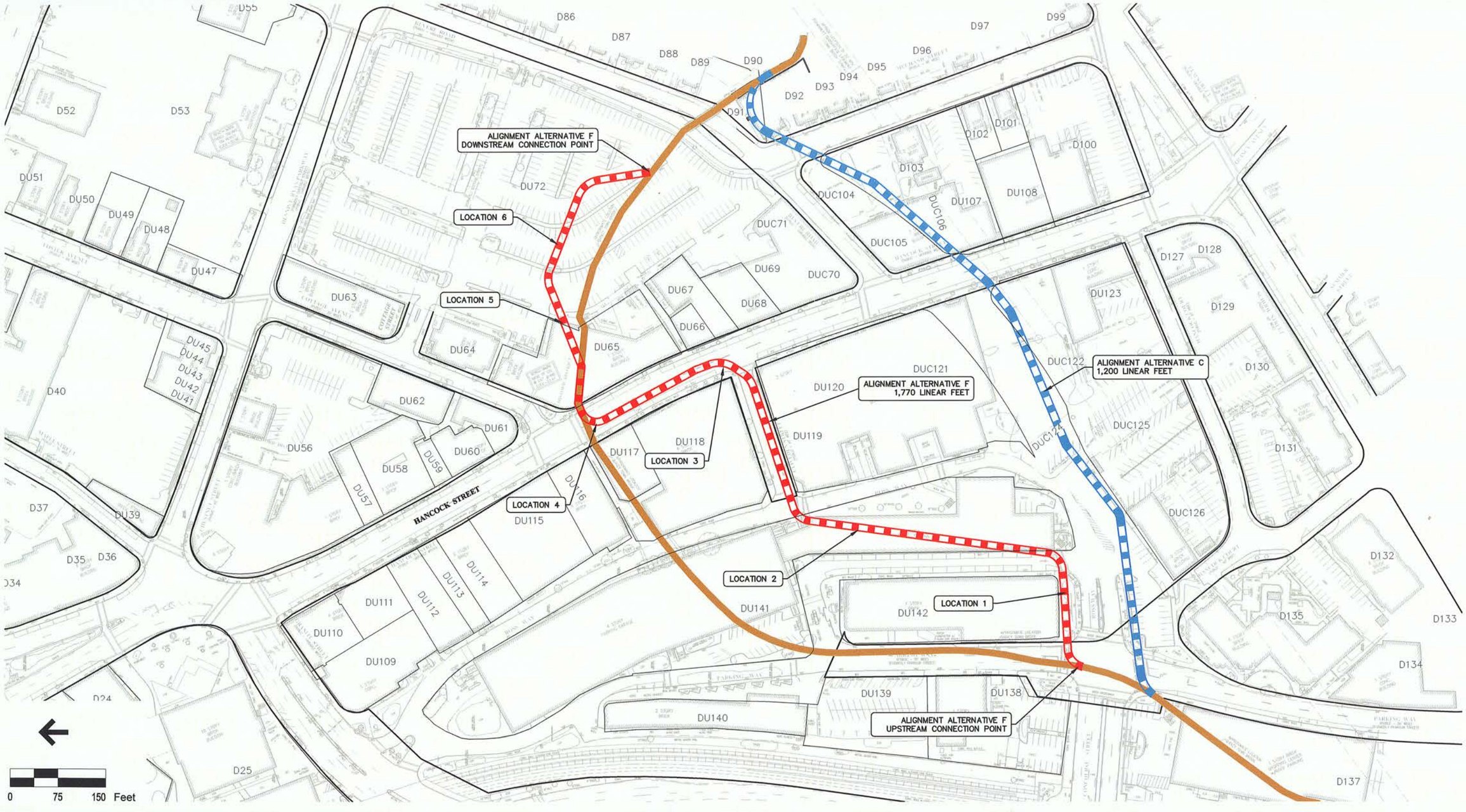
Location 10

- Underground Conflicts: conflicts with proposed gravity utility infrastructure within "primary utility corridor". The proposed primary utility corridor will provide key utility trunk line connections for the Quincy Center Redevelopment Project to the surrounding utility infrastructure grid. This corridor is critical in providing service for all public and private utilities for the redevelopment project, Refer to Figure 2.S.5.
- Open Channel/Public Amenity: limited opportunity for open channel section with public open space without significant impact to the future URDP building program density and vehicular circulation.

## Conclusion

This alternative provides flood control benefits, but limited environmental benefits. The feasibility of implementing this alternative is limited by lack of property control and construction scheduling issues associated with property acquisition and demolition of buildings as well as the significant utility relocations associated with the proposed work on Hancock Street. Therefore, this alternative was eliminated as a viable option.

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.F ALIGN F.dwg




EXISTING TOWN BROOK ALIGNMENT
ALTERNATIVE F
ALTERNATIVE C (PREFERRED)

NOTES:
REFER TO CHAPTER 2 OF THE ENF REPORT FOR A SUMMARY OF THE LOCATIONS SHOWN ON THIS PLAN.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

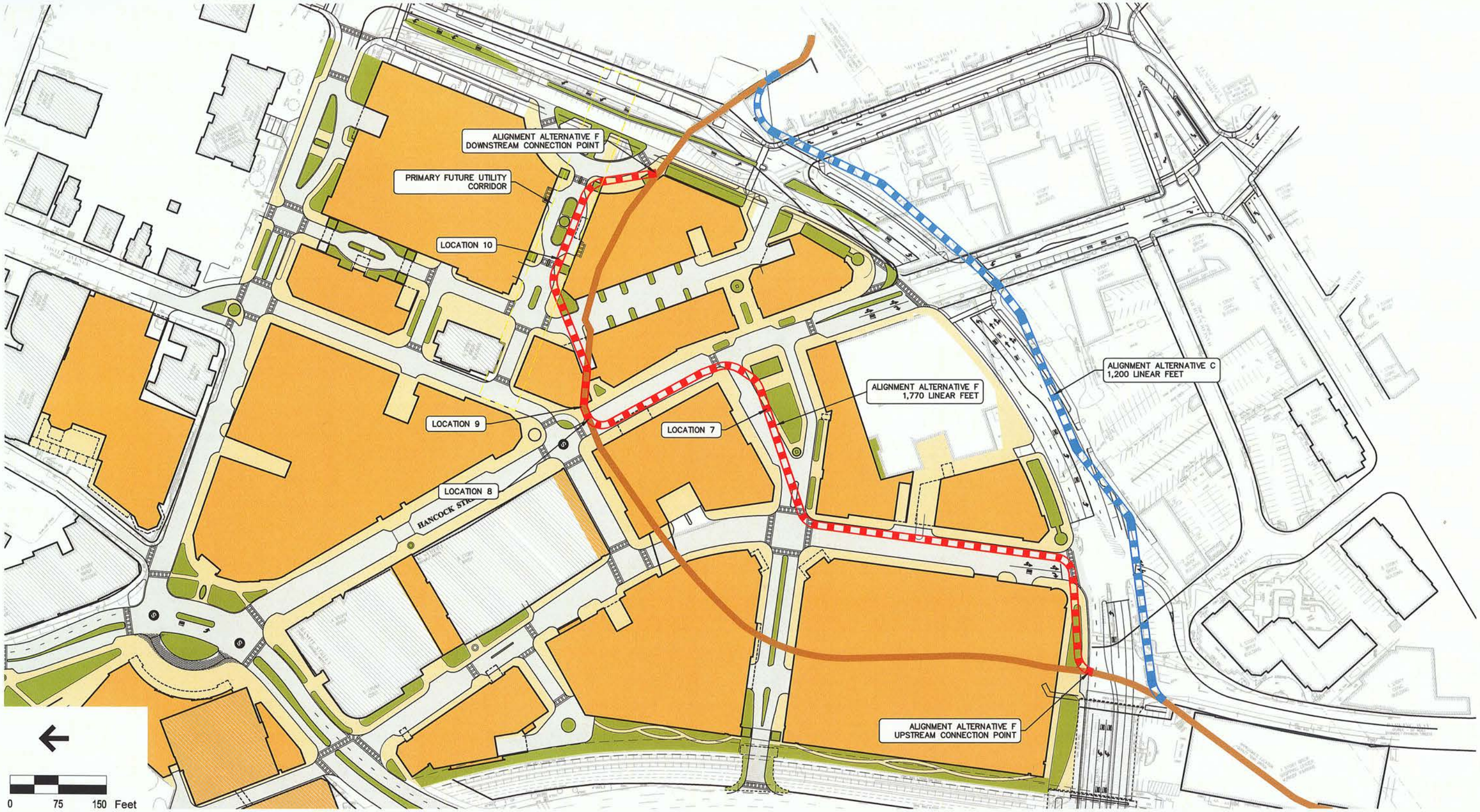
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 2.F.1 March 15, 2011

Alternative F
Existing Conditions
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.F ALIGN F.dwg




EXISTING TOWN BROOK ALIGNMENT
ALTERNATIVE F
ALTERNATIVE C (PREFERRED)

NOTES:
REFER TO CHAPTER 2 OF THE ENF REPORT FOR A SUMMARY OF THE LOCATIONS SHOWN ON THIS PLAN.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 2.F.2 March 15, 2011

Alternative F
Future Development Program
Town Brook Enhancement Project
Quincy, Massachusetts

## ALTERNATIVE G– COTTAGE AVENUE EXTENSION

Alternative G has been derived from discussions and meetings with representatives from the QEN. The alignment was evaluated for implementation under the existing conditions and for the potential future redevelopment of Quincy Center. Figure 2.G1 shows the existing conditions of Quincy Center with the overlay of the alignment of Alternative G. Figure 2.G2 shows a conceptual plan of the potential future redevelopment of Quincy Center with the overlay of the alignment of Alternative G. The existing culverted location of Town Brook and the preferred alignment are shown for reference.

### Alternative G – Evaluation Metrics Analysis

**Flood Control**
Constructing a new reinforced concrete culvert sized to convey the appropriate design storm event will result in an improvement over the existing conditions, which consists of culvert segments with limiting hydraulic segments through the project area.

**Underground Conflicts**
This Alternative runs between the existing structures on parcels DU65 and DU66 that are approximately 9.5' apart and will therefore conflict with the existing structures on these parcels. The alignment also runs beneath the Ross parking garage for a length of approximately 400 linear feet, in order to construct this alignment the garage must be razed. The alignment will require the relocation of significant existing utility infrastructure within Hancock Street to accommodate its construction. This proposed alignment runs across Hancock Street for approximately 100 linear feet, which results in substantial impacts to the existing utility infrastructure and the known utility infrastructure improvements the City is planning to support the Quincy Center redevelopment. Refer to Figure 2.S.4 for a depiction of the utility infrastructure in this area.

**Property Constraints (Property Control)**
The City of Quincy does not control the underlying property along this culvert alignment, therefore in order to construct this alternative the City would have to acquire property or obtain easements to construct and maintain the Town Brook Culvert under this alternative.

**Open Channel/Public Amenity**
This alternative provides little practical opportunity for the creation of open channel segments with adjacent public open space as the constraints under existing conditions and lack of integration with the planed public open space and pocket parks associated with the URDP limit this opportunity.

**Enhance Smelt Fisheries Habitat**
Construction of this alternative provides limited opportunity for the creation of open channel sections with public open space. A low flow channel with spawning substrate, spawning riffles with designed attraction velocities and in-line resting pools can be constructed extending upstream into the proposed enclosed culvert to extend and spawning habitat, if deemed

appropriate by the DMF, however without additional open channel/ day-lit sections the potential for extending Fisheries Enhancements north of the Concourse may be limited.

**Consistency with URDP**
This alignment provides limited potential for the creation of open channel sections with public open space and therefore does not address these objectives of the URDP as it pertains to the creation of public open space. The alignment runs through some of the larger parcels within the downtown area, which the City of Quincy has identified in the Urban Revitalization and Development Plan as appropriate for high density mixed use redevelopment. As a result, the ability to incorporate open channel sections with public open space is limited as the Brook will remain in an enclosed culverted through these areas.

**Construction Schedule & Phasing**
This alternative would require extensive phasing and coordination associated with the demolition or partial demolition of multiple buildings along the proposed alignment and the construction across Hancock Street.

**Cost**
Construction premiums associated with this alternative include:

- Acquisition of property or obtaining easement rights
- Demolition or partial demolition of existing structures along proposed alignment
- Significant utility relocations associated with construction along Hancock Street

**Environmental Enhancements**
Construction of this alternative will result in limited potential for additional open channel sections, limited potential for habitat enhancements and limited potential for enhancement of Riverfront Area.

**Code Compliance**
This alternative proposes to convey the flood waters of Town Brook beneath and adjacent to habitable structures. Issues associated with conveying flood waters through a building are not consistent with current building or plumbing codes.

**Existing Conditions Constraints**

Location 1

- Property Constraints: the alignment requires construction activities on parcel DU142 which is not controlled by the City of Quincy.
- Construction Schedule & Phasing: the foundation support required for construction adjacent to the existing building on parcel DU142 will result in cost premiums.

Location 2

Construction Schedule & Phasing: the approximately 400 linear feet of the alignment is proposed within the existing Ross Garage footprint.

Location 3

- Underground Conflicts: the proposed alignment will cross Hancock Street, which contains a number of underground utilities in close proximity to one another including:
  - National Grid electric duct bank (4-5" conduits);
  - Sanitary sewer trunk lines and service connections (18" trunk line);
  - Storm drainage trunk lines and catch basin connections (18" trunk line);
  - Water main and service connections (12" main);
  - Verizon tel/data duct bank (8-4" conduits);
  - National Grid gas main with service connections (8" main).

Location 4

- Flood Control: Construction through this location requires the culvert be installed between two existing buildings approximately 9.5 feet apart, which would require the following:
  - The reduction in width of the proposed culvert section to a maximum interior width of six feet. Reducing the width of the channel section will result in the creation of a limiting hydraulic section creating an adverse tailwater condition, resulting in a negative impact on flood control and hydraulic conveyance.
  - The adverse tailwater impacts would cause surcharging in Town Brook, impacting the surface drainage collection system within the Quincy Center area upstream of the contraction.
  - Construction the culvert along this alignment would require the reinforcement and support of the two existing building foundation systems adjacent to the alignment.

- Property Constraints: the alignment requires construction activities on parcels DU65, DU66, and DU67, none of which are controlled by the City of Quincy.
- Construction Schedule & Phasing: construction would require temporary construction easements in order to access the work area.

Location 5

- Flood Control: series of tight radii result in adverse hydraulic conditions, leading to head losses that would reduce capacity of the culvert section and tailwater impacts that would negatively affect upstream storm drainage collection systems within the Quincy Center area.

Location 6

- Open Channel/Public Amenity: the construction of the culvert through an active parking lot results in limited opportunity for open channel sections and public amenity space.

**Proposed Conditions Constraints**

Location 7

Construction of an open channel section through the proposed Clivedon Street public common area would result in the following impacts: (Refer to Figure 2.S.3)

- Open Channel/Public Amenity: creation of an open channel section eleven feet wide with an invert elevation 18 feet below proposed grade and a water surface elevation of Town Brook approximately 17.5 feet below proposed grade. The significant depth to height ratio results in a public amenity of questionable value.
- Open Channel/Public Amenity: an open channel section at the proposed public common area would present a significant barrier to pedestrian foot traffic across the common and would negatively impact the ability to create a cohesive public space with market stalls, seasonal ice skating rinks, cafés and public seating areas consistent with the open space objectives outlined in the URDP.

Location 8

The proposed alignment runs through the proposed future URDP development program.

- Construction Schedule & Phasing: an underground culvert at this location will require coordination with the construction of the future building foundation system.
- Impacts to URDP Density Objectives: the inability to construct a building at this location is inconsistent with the City of Quincy's goals outlined in the URDP, which are to achieve a desired mixed use density for the Hancock lot parcel.

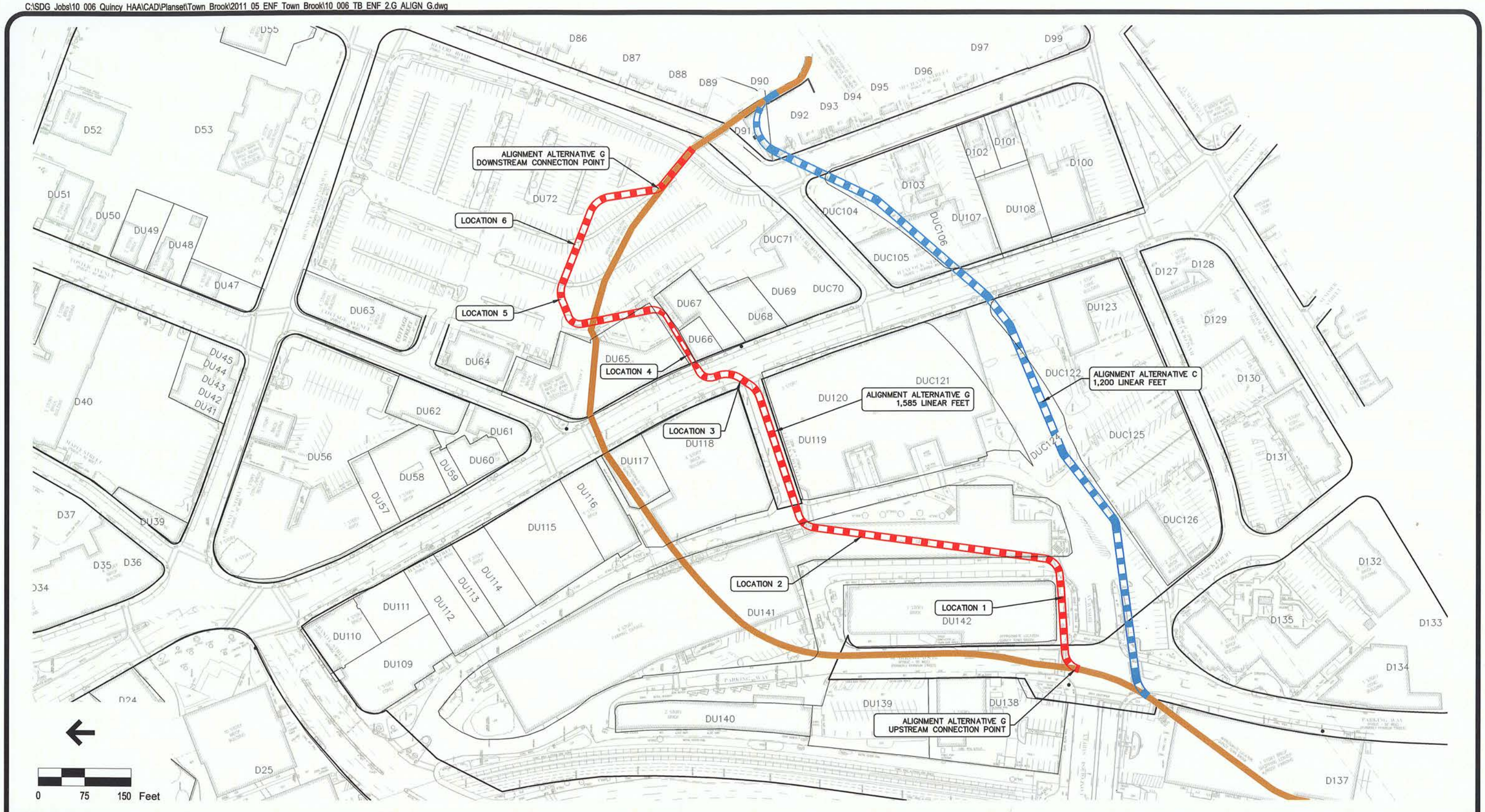
Location 9

- Underground Conflicts: conflicts with proposed gravity utility infrastructure within "primary utility corridor". The proposed primary utility corridor will provide key utility trunk line connections for the Quincy Center Redevelopment Project to the surrounding utility infrastructure grid. This corridor is critical in providing service for all public and private utilities for the redevelopment project, Refer to Figure 2.S.5.
- Open Channel/Public Amenity: limited opportunity for open channel section with public open space without significant impact to URDP building program density and vehicular circulation.

**Conclusion**

This alternative presents limited environmental benefits and results in a limiting hydraulic section of culvert with the Quincy Center area. The feasibility of implementing this alternative is limited by lack of property control and construction scheduling issues associated with property acquisition and demolition of buildings as well as the significant utility relocations associated with the proposed work on Hancock Street. Therefore, this alternative was eliminated as a viable option.

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.G ALIGN G.dwg




EXISTING TOWN BROOK ALIGNMENT
ALTERNATIVE G
ALTERNATIVE C (PREFERRED)

NOTES:
REFER TO CHAPTER 2 OF THE ENF REPORT FOR A SUMMARY OF THE LOCATIONS SHOWN ON THIS PLAN.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

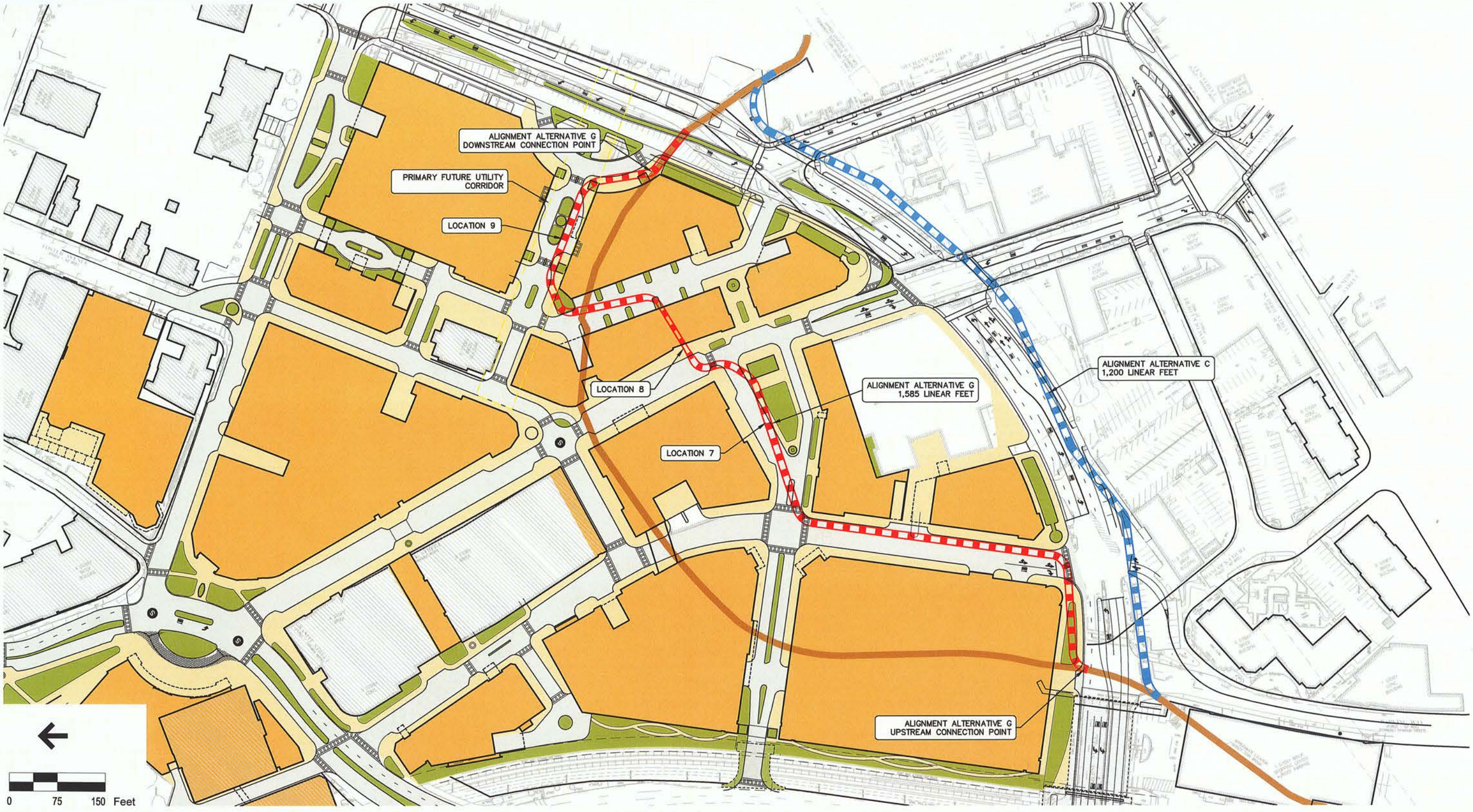
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 2.G.1 March 15, 2011

Alternative G
Existing Conditions
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.G ALIGN G.dwg




EXISTING TOWN BROOK ALIGNMENT
ALTERNATIVE G
ALTERNATIVE C (PREFERRED)

NOTES:
REFER TO CHAPTER 2 OF THE ENF REPORT FOR A SUMMARY OF THE LOCATIONS SHOWN ON THIS PLAN.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

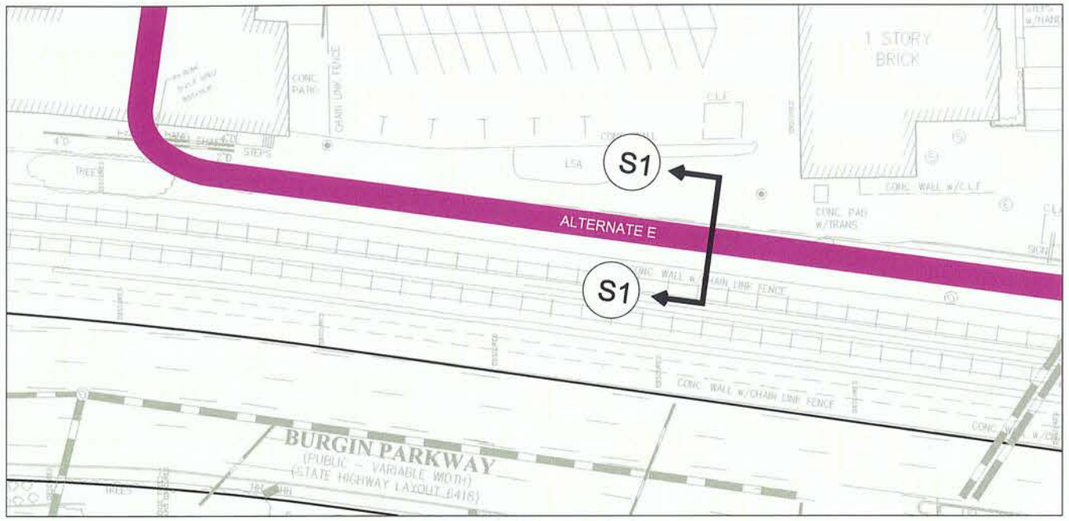
LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

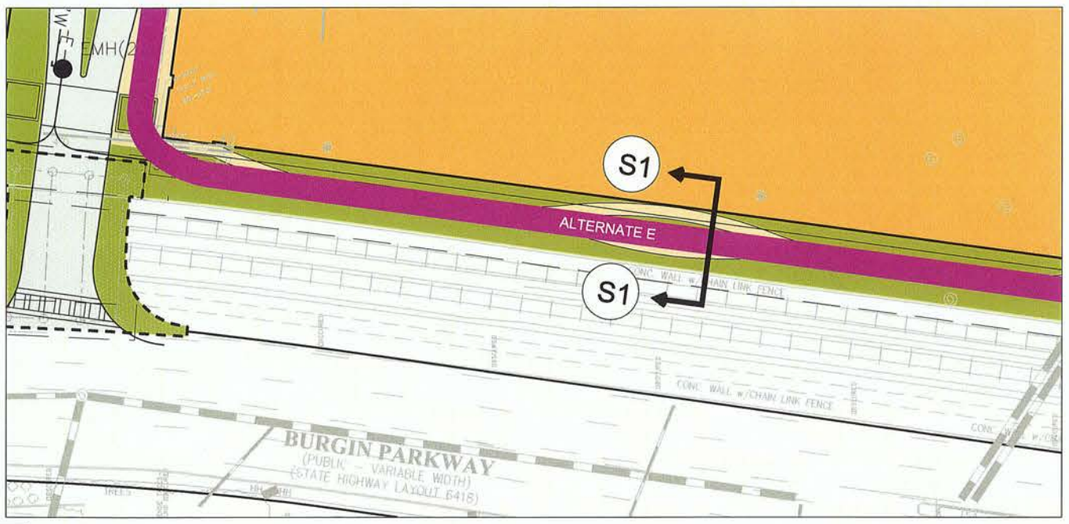
STEPHENSON DESIGN GROUP

Figure 2.G.2 March 15, 2011

Alternative G
Future Development Program
Town Brook Enhancement Project
Quincy, Massachusetts

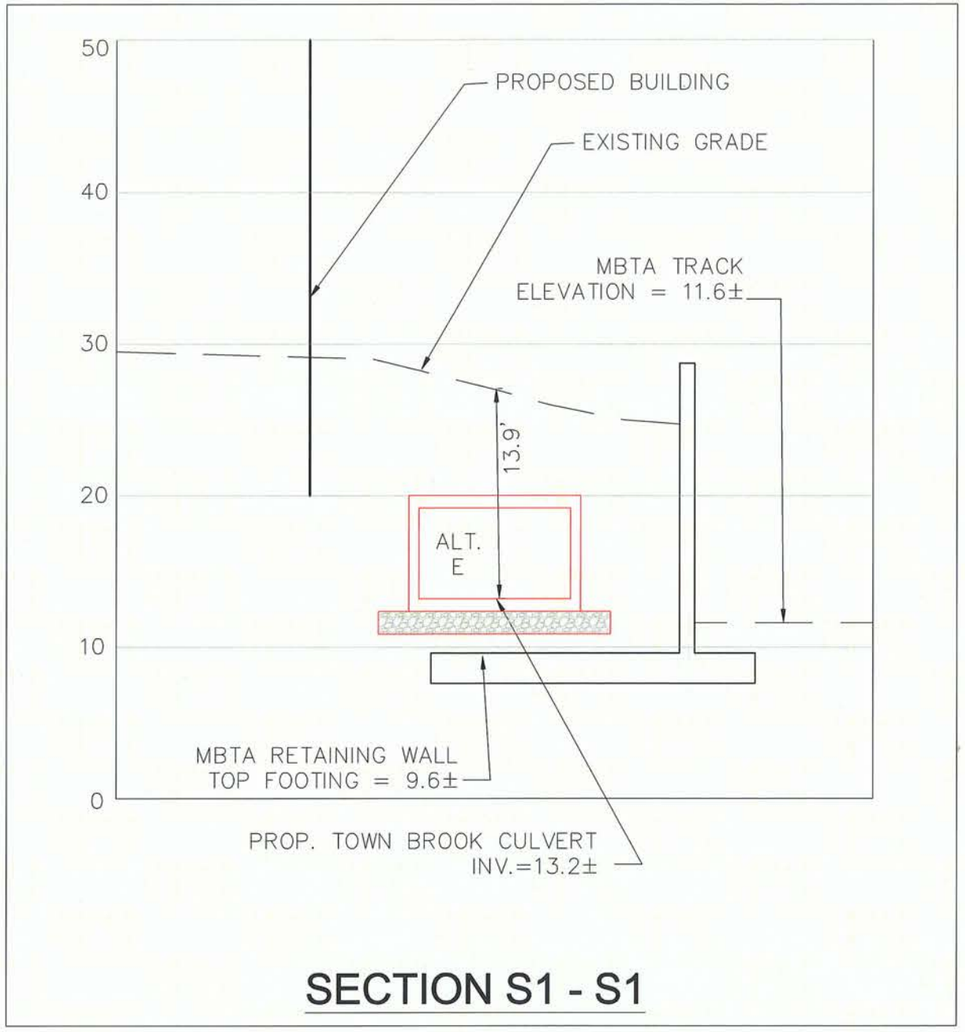



EXISTING CONDITIONS




FUTURE CONCEPT

0 30 60 Feet




SECTION S1 - S1

Vertical 0 5 10 Feet
Horizontal 0 5 10 Feet

NOTES:
1. SECTION S1-S1 REPRESENTS A SECTION THROUGH ALTERNATE E.
2. PROPOSED UTILITY LAYOUT FROM PRELIMINARY CONCEPTS
3. FIGURE 2.1.2 KEY SHEET SHOWS LOCATION S1 IN REFERENCE TO THE ALIGNMENT

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

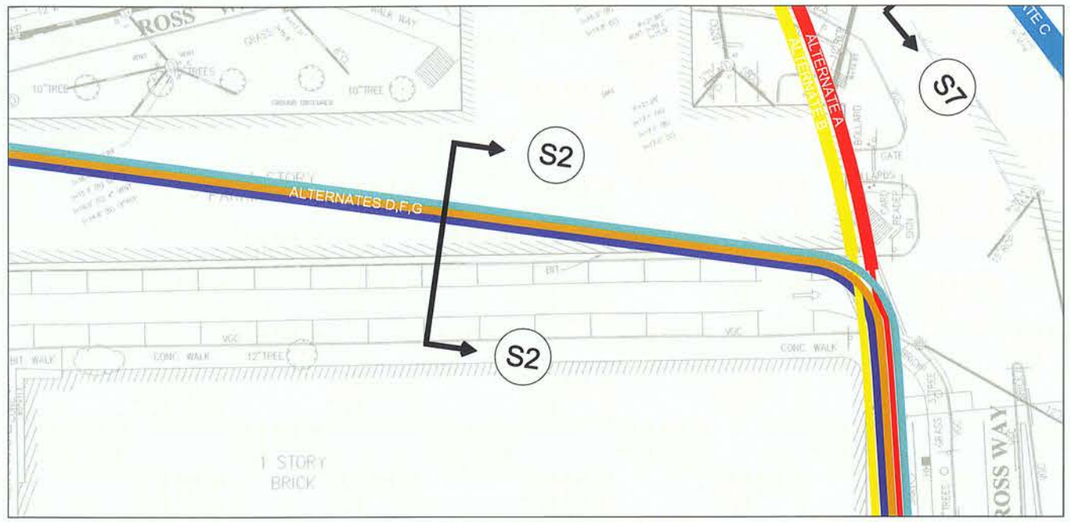
LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

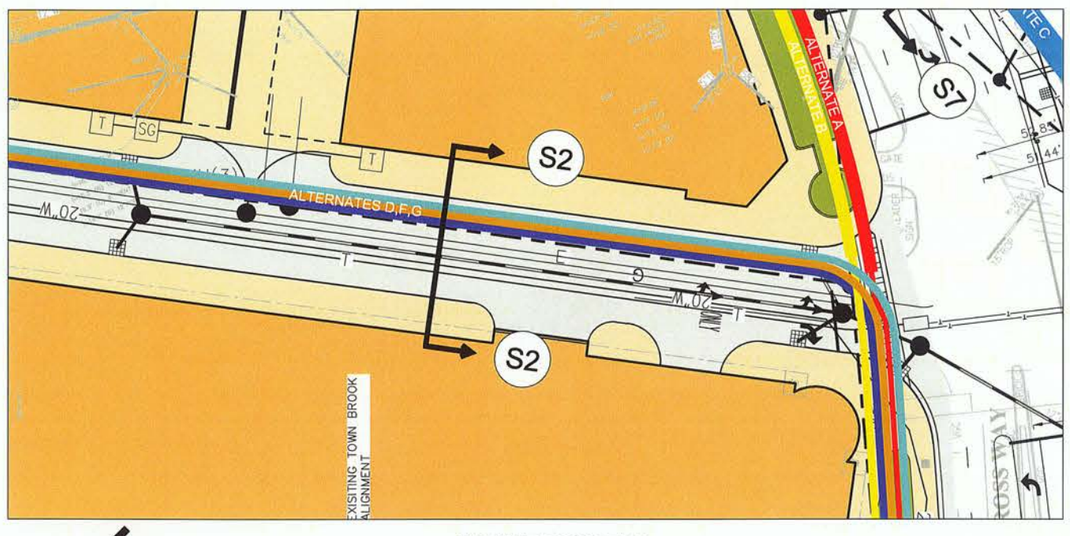
STEPHENSON DESIGN GROUP

Figure 2.S.1 March 15, 2011

Alignment Alternative Sections
Section S1-S1
Town Brook Enhancement Project
Quincy, Massachusetts

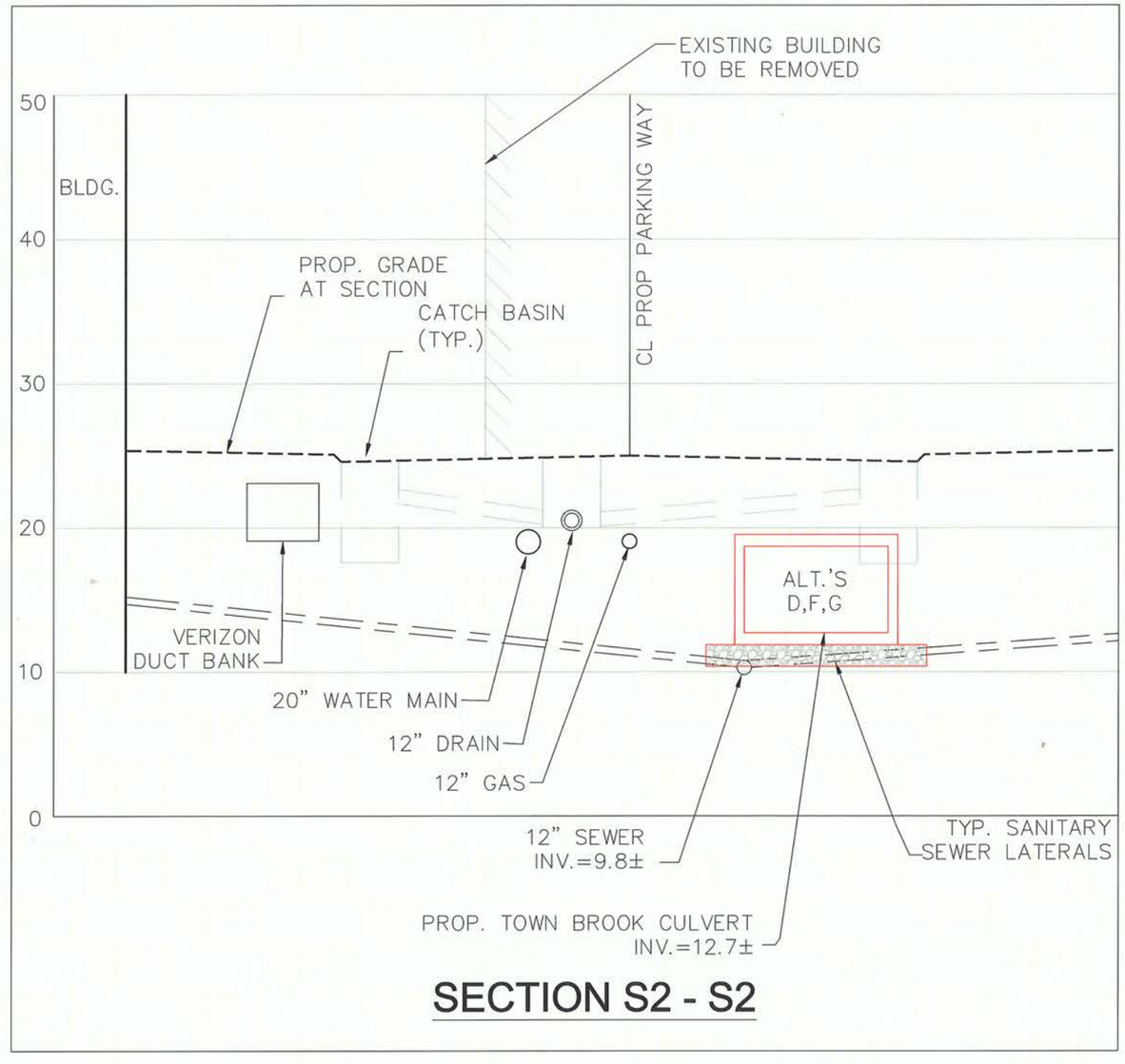



EXISTING CONDITIONS




FUTURE CONCEPT

0 30 60 Feet




SECTION S2 - S2

Vertical 0 5 10 Feet
Horizontal 0 5 10 Feet

NOTES:
1. SECTION S2-S2 REPRESENTS A SECTION THROUGH ALTERNATES D, F AND G.
2. PROPOSED UTILITY LAYOUT FROM PRELIMINARY CONCEPTS
3. FIGURE 2.1.2 KEY SHEET SHOWS LOCATION S2 IN REFERENCE TO THE ALIGNMENT

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

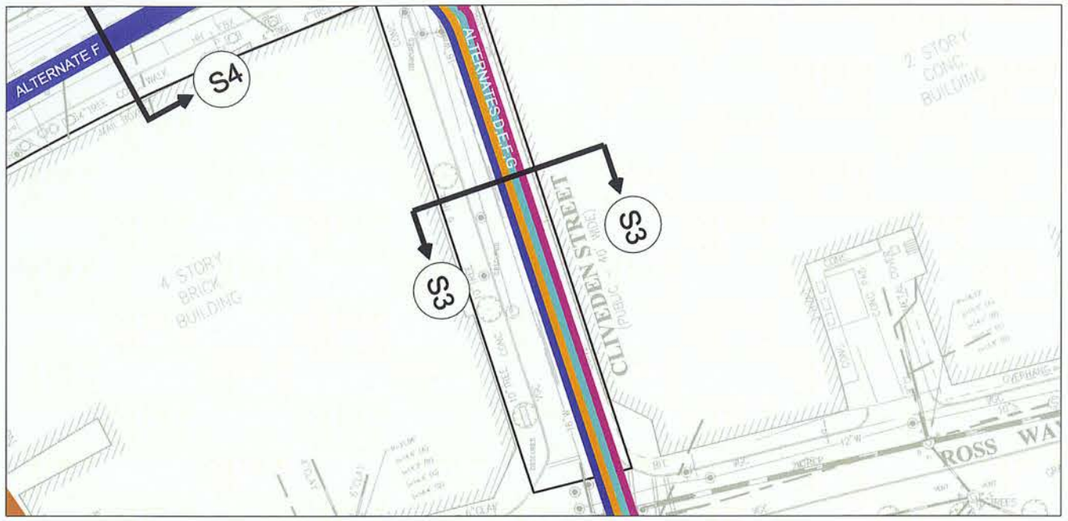
LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

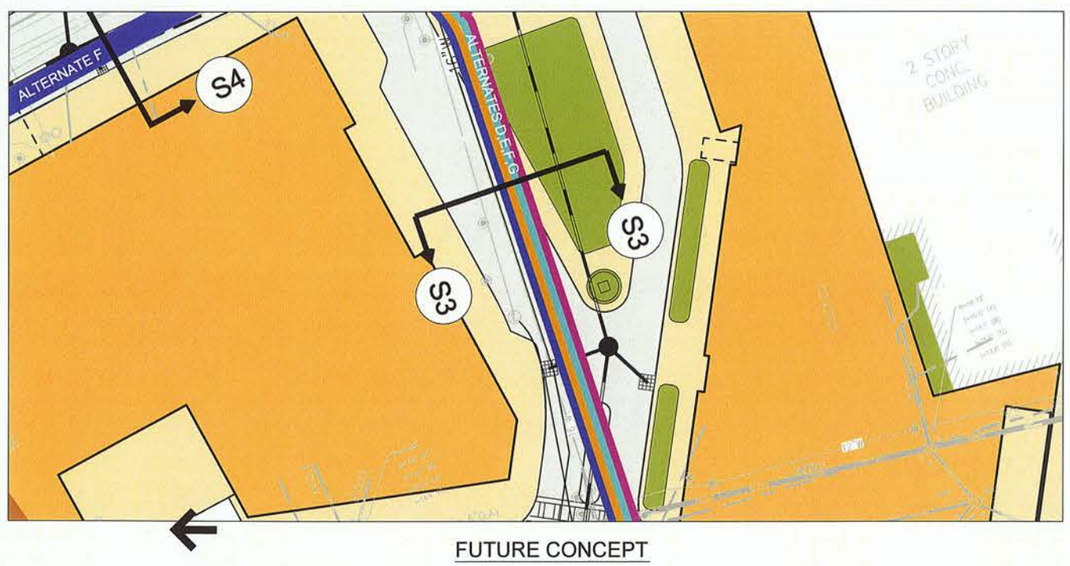
STEPHENSON DESIGN GROUP

Figure 2.S.2 March 15, 2011

Alignment Alternative Sections
Section S2-S2
Town Brook Enhancement Project
Quincy, Massachusetts

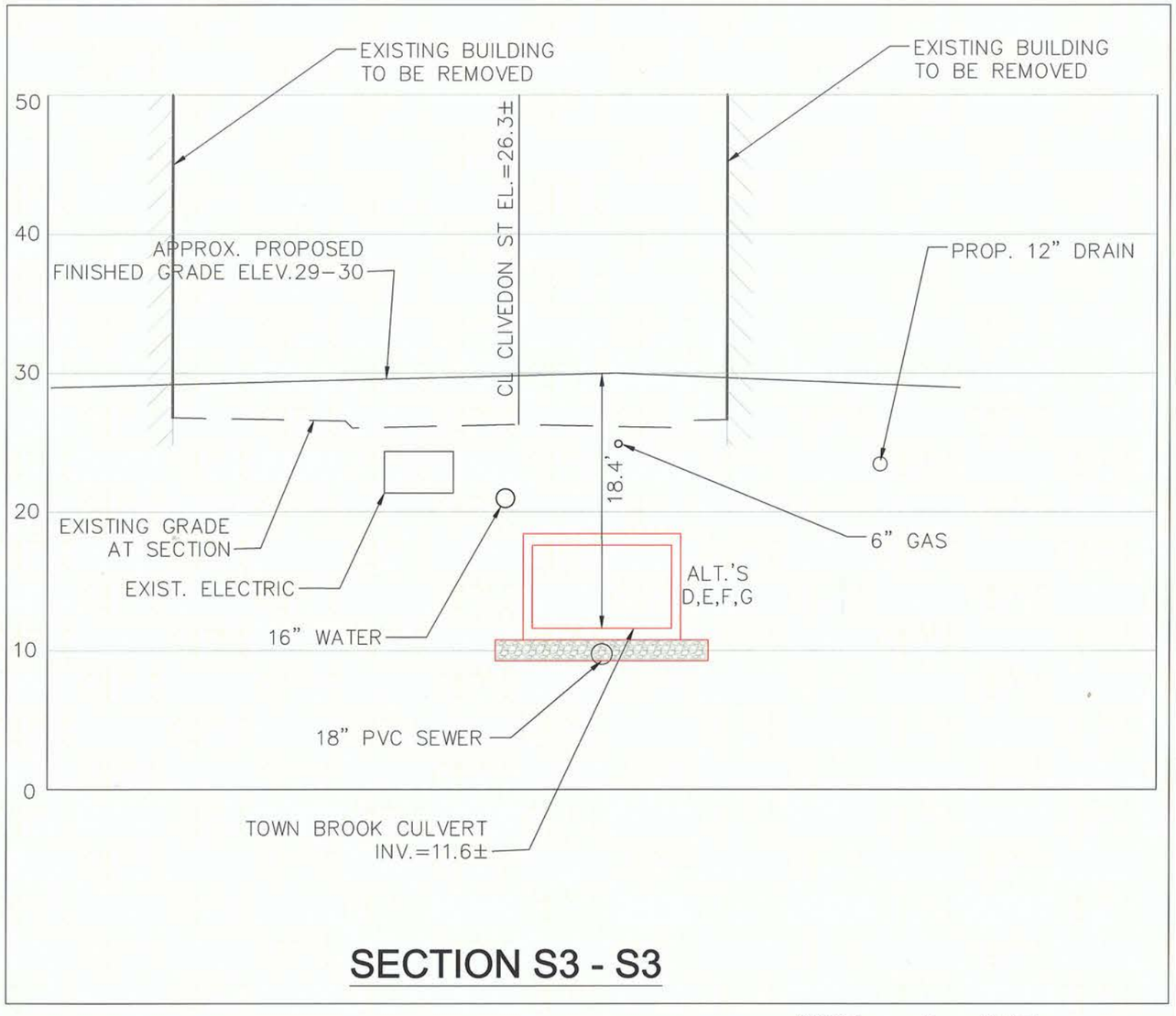



EXISTING CONDITIONS




FUTURE CONCEPT

0 30 60 Feet




SECTION S3 - S3

Vertical 0 5 10 Feet
Horizontal 0 5 10 Feet

NOTES:
1. SECTION S3-S3 REPRESENTS A SECTION THROUGH ALTERNATES D, E, F AND G.
2. PROPOSED UTILITY LAYOUT FROM PRELIMINARY CONCEPTS
3. FIGURE 2.1.2 KEY SHEET SHOWS LOCATION S3 IN REFERENCE TO THE ALIGNMENT

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

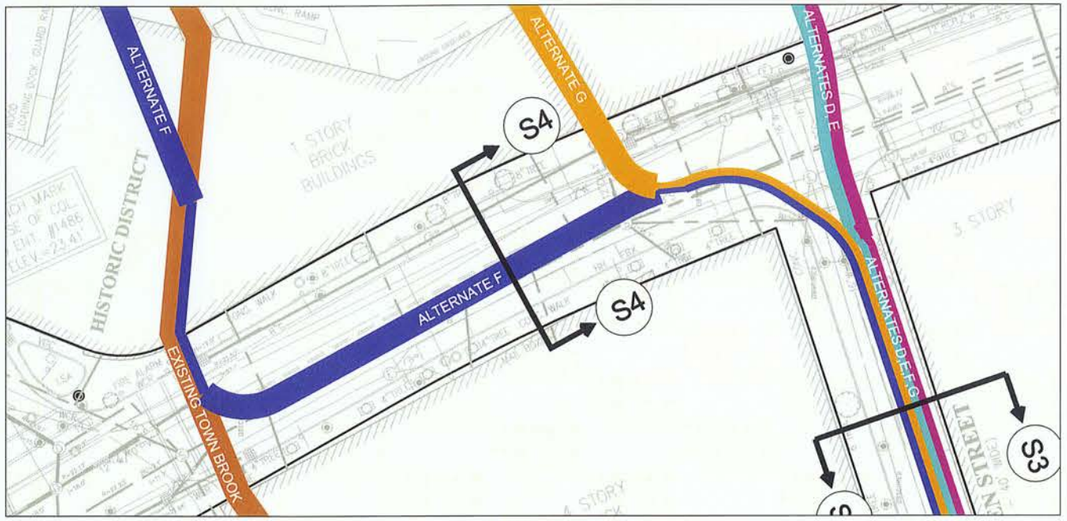
LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

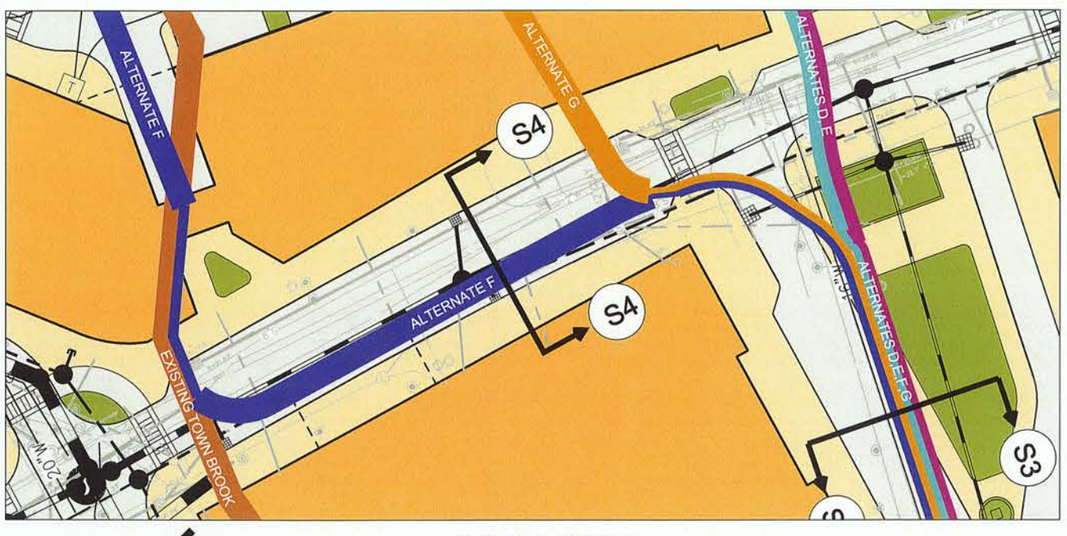
STEPHENSON DESIGN GROUP

Figure 2.S.3 March 15, 2011

Alignment Alternative Sections
Section S3-S3
Town Brook Enhancement Project
Quincy, Massachusetts

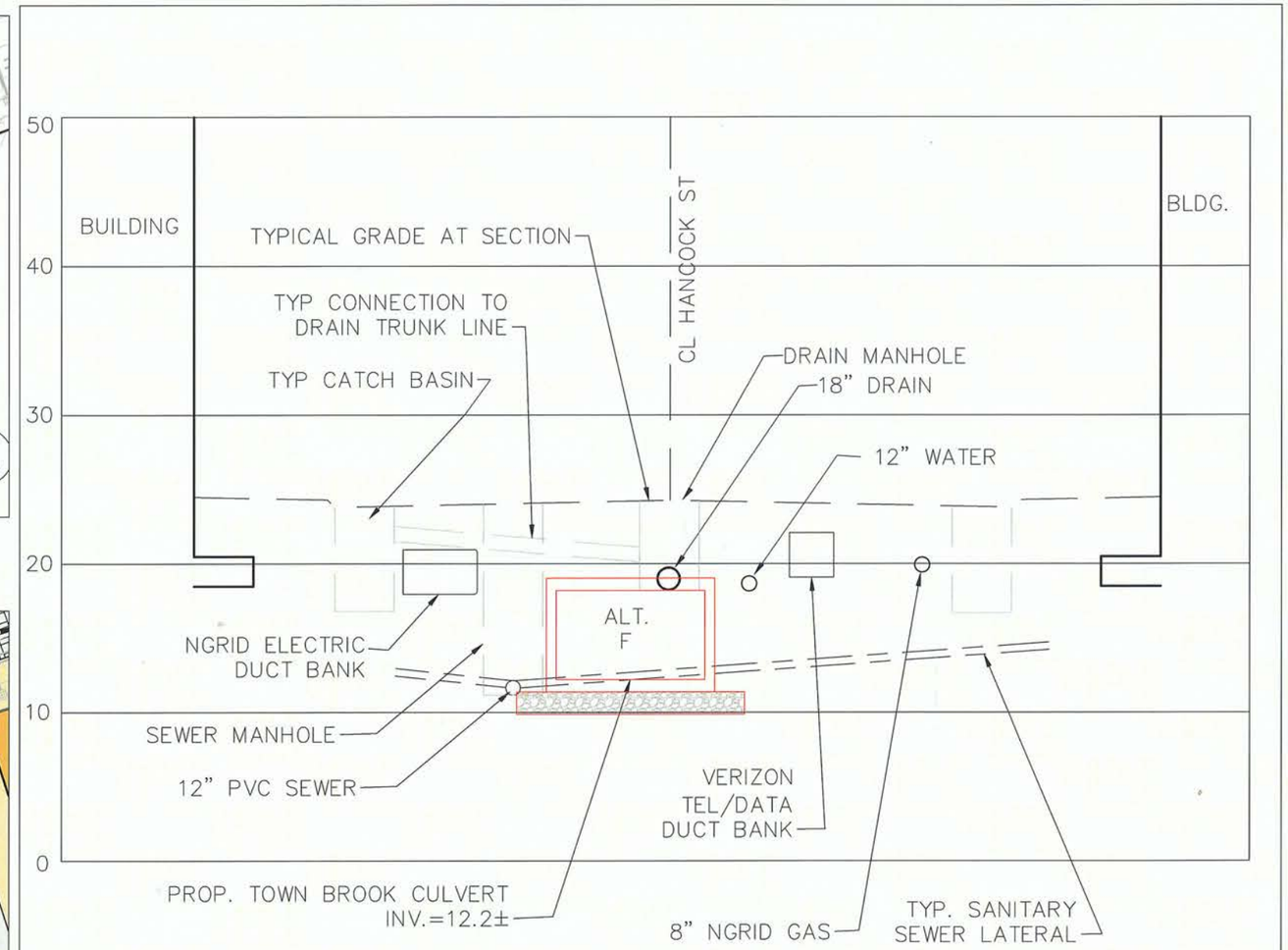



EXISTING CONDITIONS




FUTURE CONCEPT

0 30 60 Feet




## SECTION S4 - S4

Vertical 0 5 10 Feet

Horizontal 0 5 10 Feet

NOTES:
1. SECTION S4-S4 REPRESENTS A SECTION THROUGH ALTERNATE F.
2. PROPOSED UTILITY LAYOUT FROM PRELIMINARY CONCEPTS
3. FIGURE 2.1.2 KEY SHEET SHOWS LOCATION S4 IN REFERENCE TO THE ALIGNMENT

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

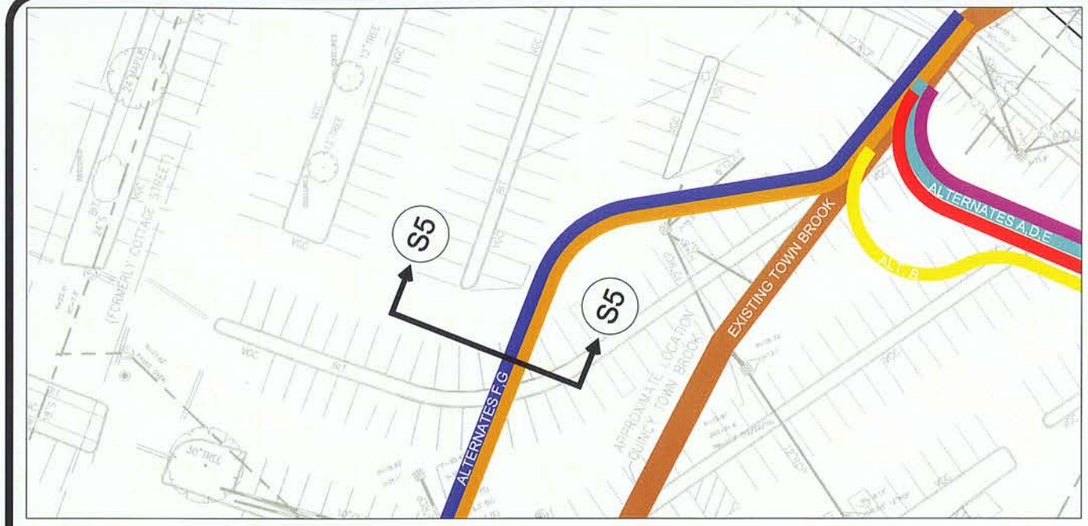
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

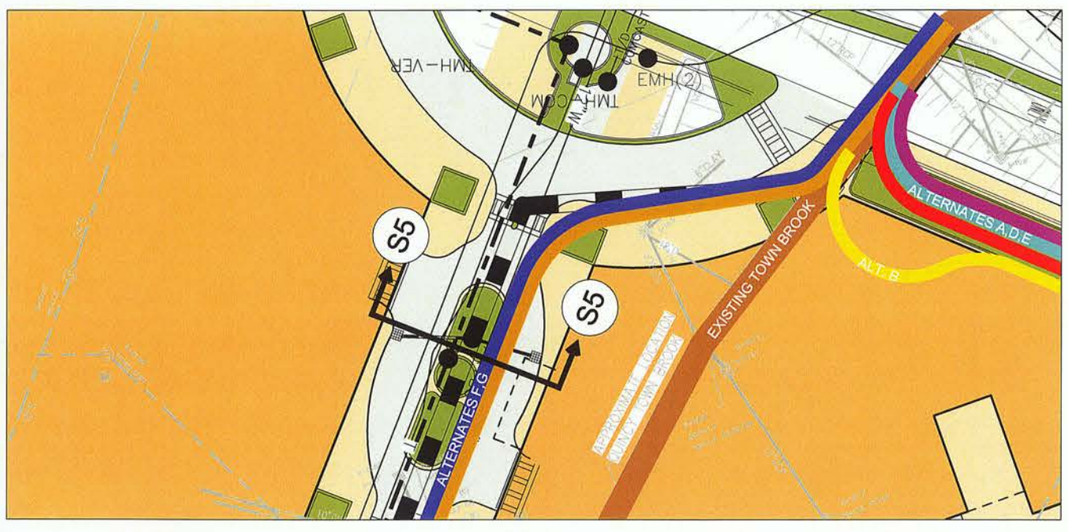
Figure 2.S.4 March 15, 2011

Alignment Alternative Sections
Section S4-S4
Town Brook Enhancement Project
Quincy, Massachusetts

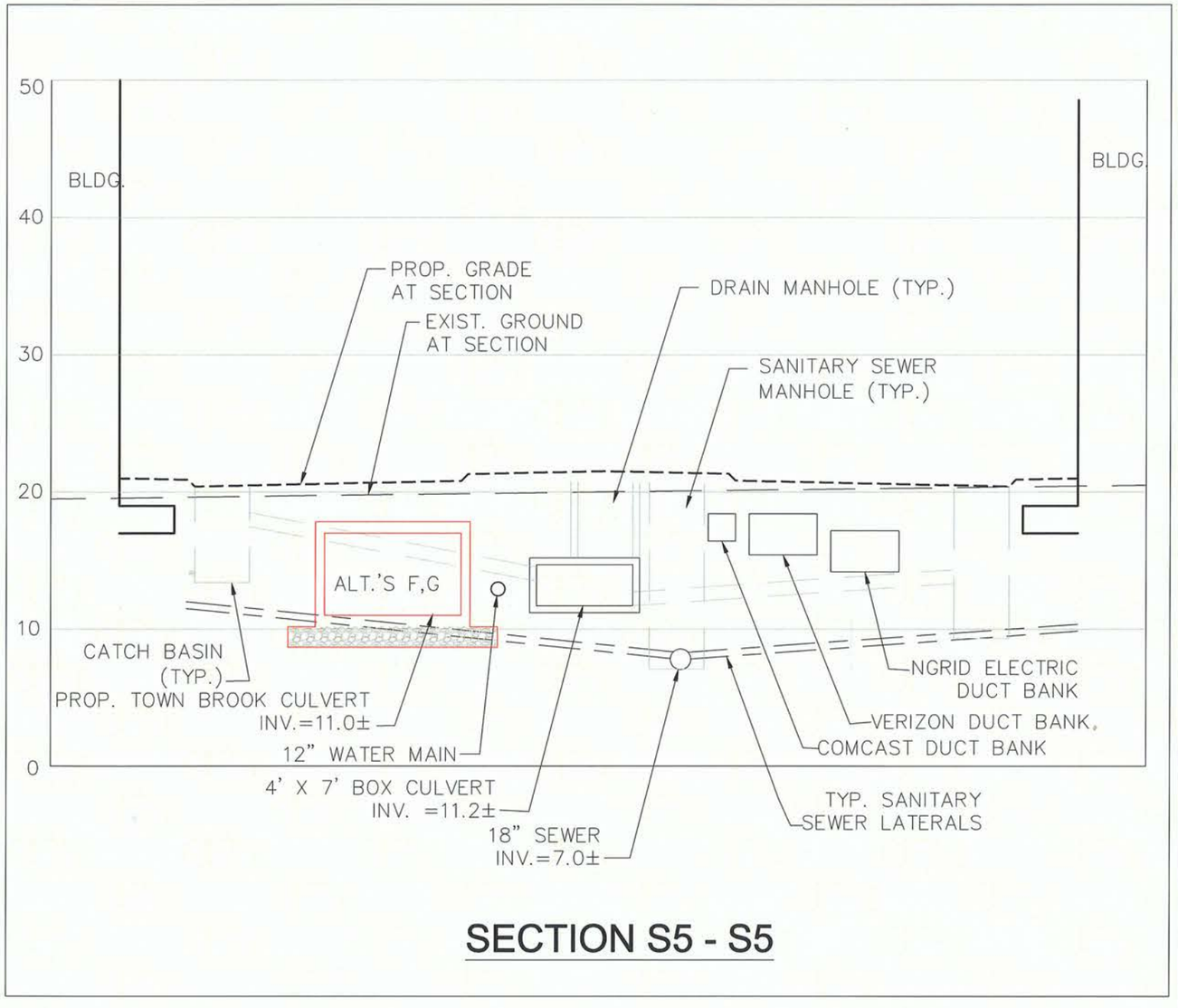
C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.XS SECTIONS.dwg




EXISTING CONDITIONS




FUTURE CONCEPT




SECTION S5 - S5

0 30 60 Feet

Vertical 0 5 10 Feet
Horizontal 0 5 10 Feet

NOTES:
1. SECTION S5-S5 REPRESENTS A SECTION THROUGH ALTERNATES F AND G.
2. PROPOSED UTILITY LAYOUT FROM PRELIMINARY CONCEPTS
3. FIGURE 2.1.2 KEY SHEET SHOWS LOCATION S5 IN REFERENCE TO THE ALIGNMENT

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

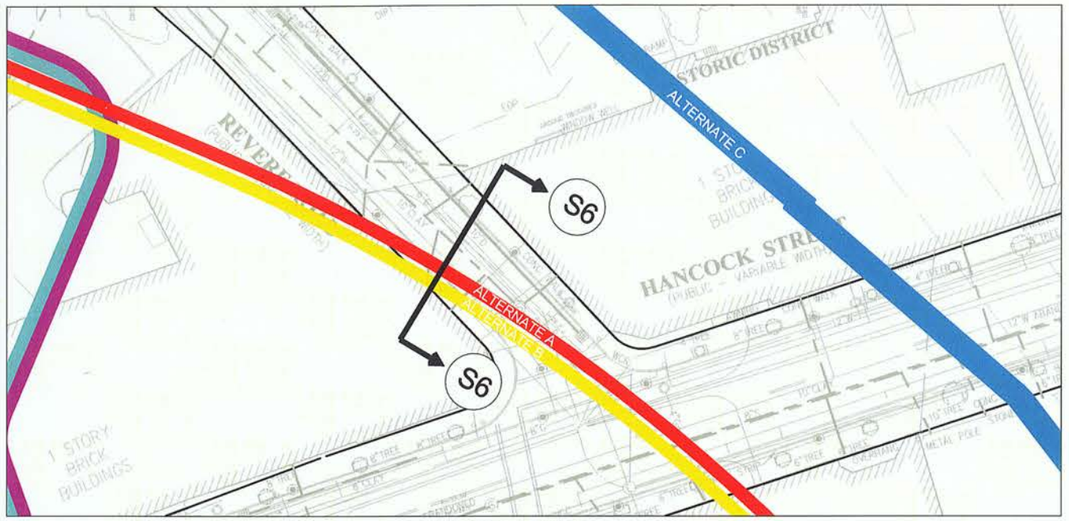
Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

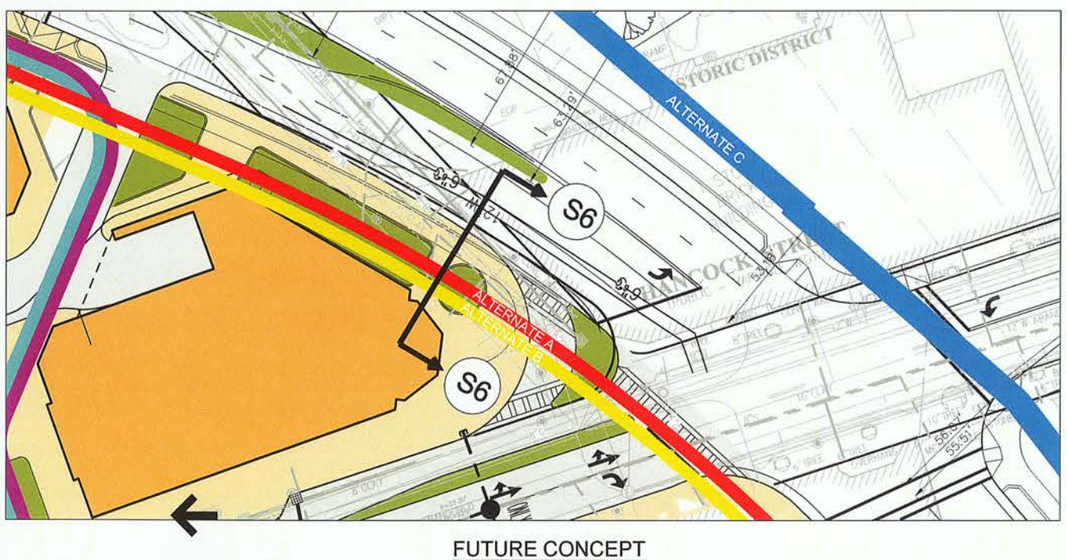
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 2.S.5 March 15, 2011
Alignment Alternative Sections
Section S5-S5
Town Brook Enhancement Project
Quincy, Massachusetts

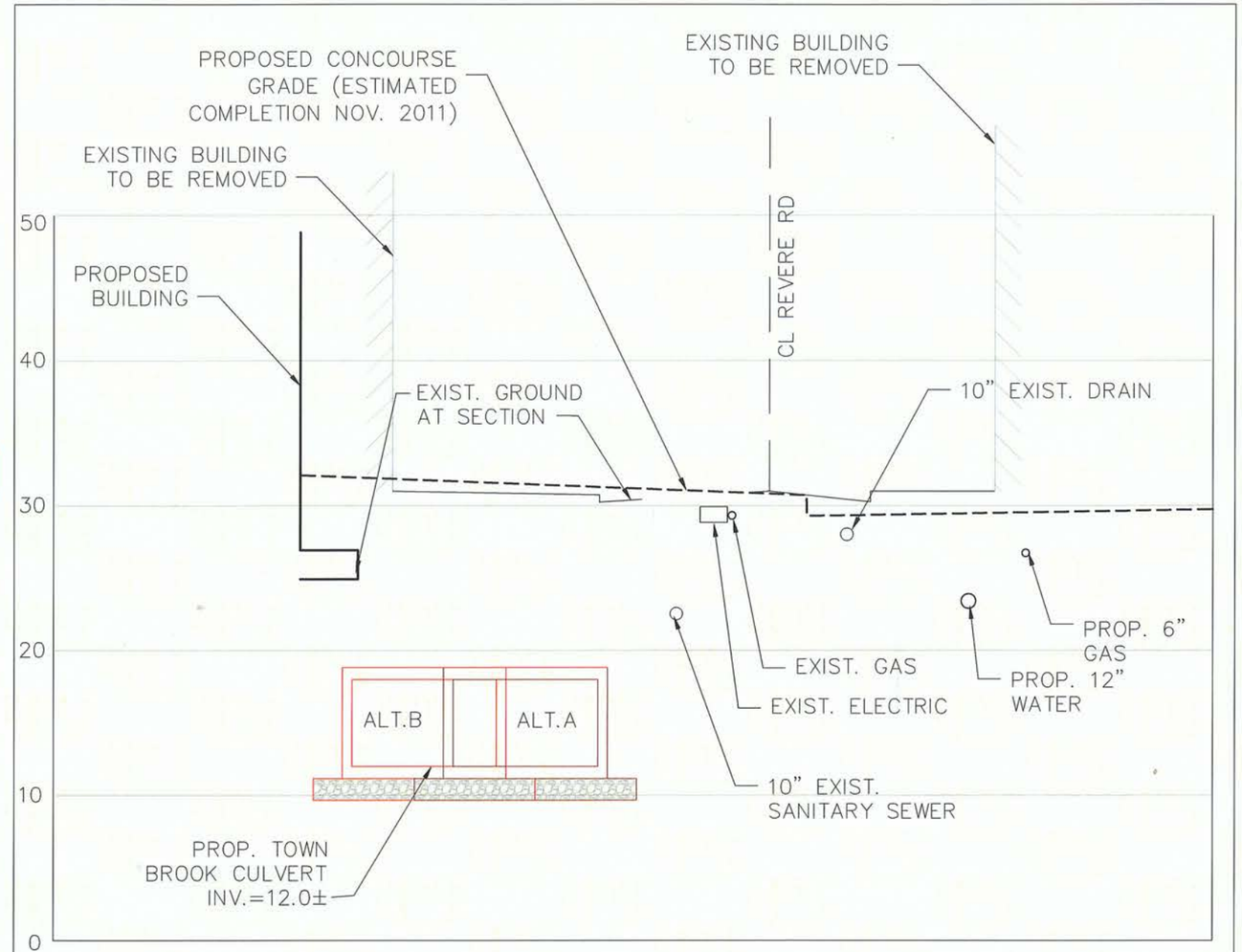



EXISTING CONDITIONS




FUTURE CONCEPT

0 30 60 Feet




SECTION S6 - S6

Vertical 0 5 10 Feet

Horizontal 0 5 10 Feet

NOTES:
1. SECTION S6-S6 REPRESENTS A SECTION THROUGH ALTERNATES A AND B.
2. PROPOSED UTILITY LAYOUT FROM PRELIMINARY CONCEPTS
3. FIGURE 2.1.2 KEY SHEET SHOWS LOCATION S6 IN REFERENCE TO THE ALIGNMENT

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

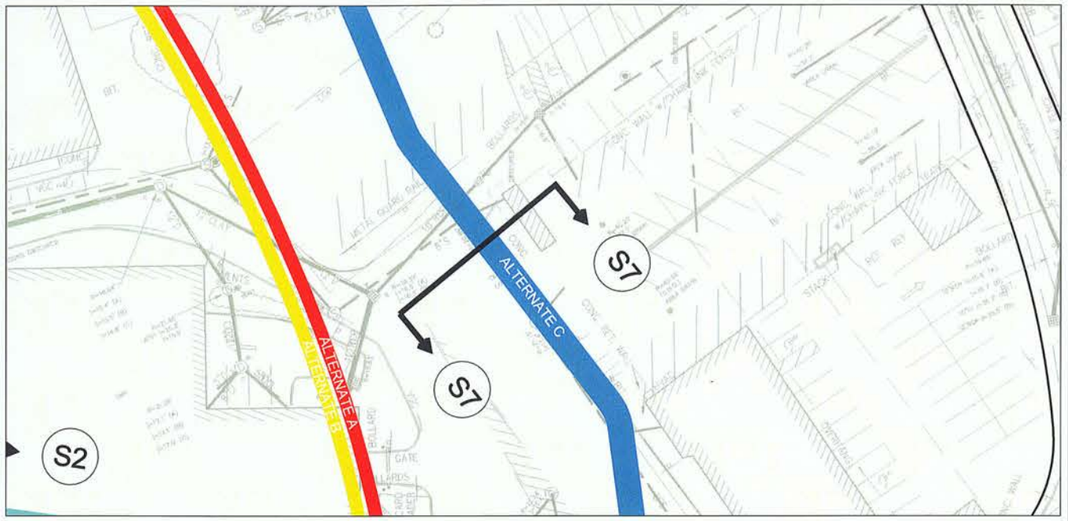
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

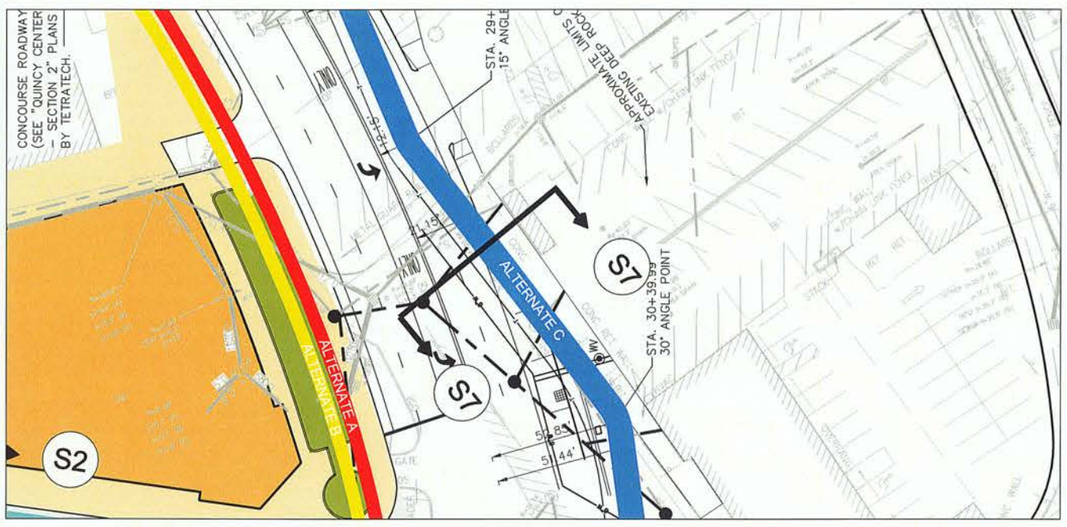
Figure 2.S.6 March 15, 2011

Alignment Alternative Sections
Section S6-S6
Town Brook Enhancement Project
Quincy, Massachusetts

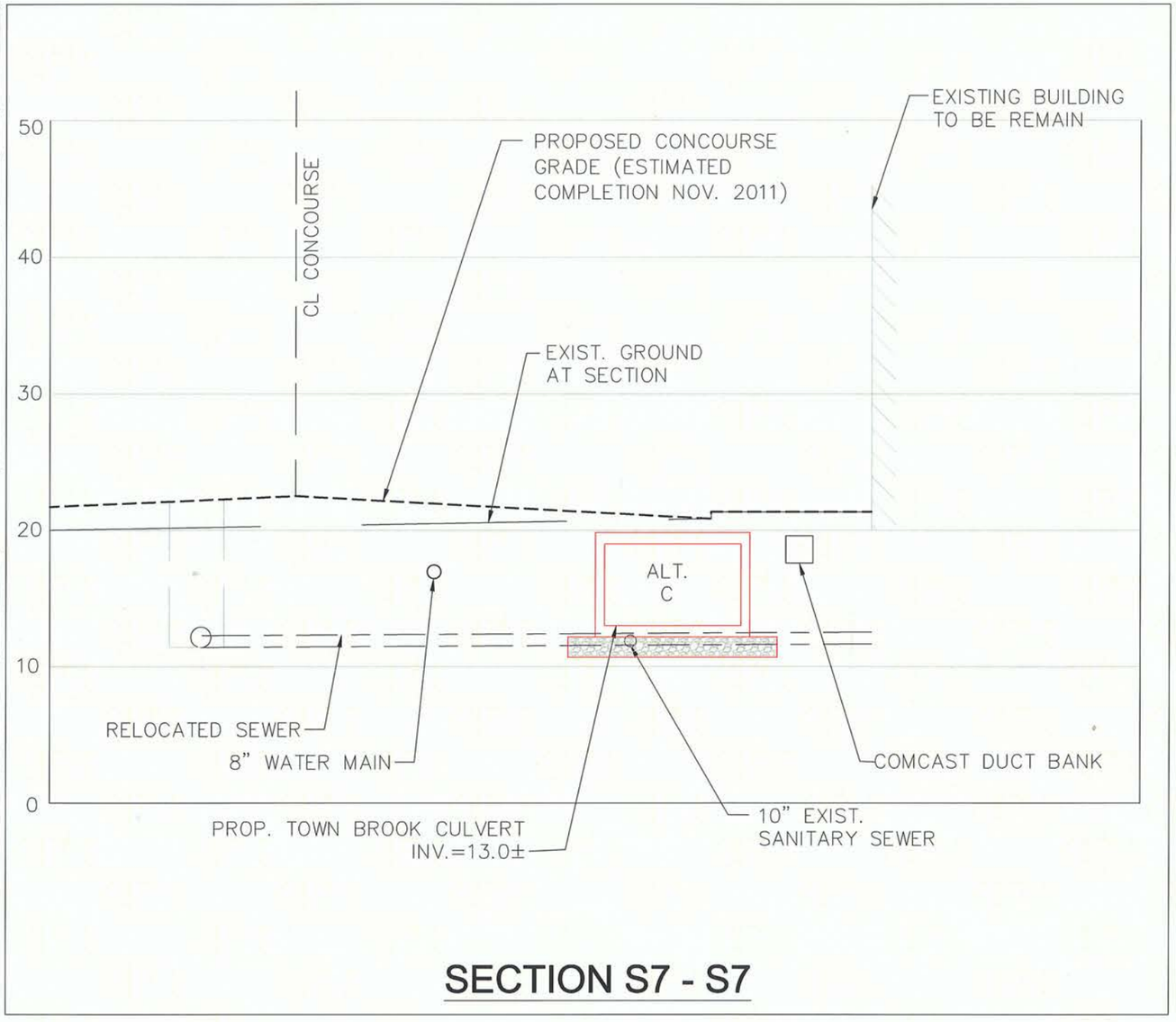
C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 2.XS SECTIONS.dwg




EXISTING CONDITIONS




FUTURE CONCEPT




SECTION S7 - S7

0 30 60 Feet

Vertical 0 5 10 Feet
Horizontal 0 5 10 Feet

NOTES:
1. SECTION S7-S7 REPRESENTS A SECTION THROUGH ALTERNATE C.
2. PROPOSED UTILITY LAYOUT FROM PRELIMINARY CONCEPTS
3. FIGURE 2.1.2 KEY SHEET SHOWS LOCATION S7 IN REFERENCE TO THE ALIGNMENT

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 2.S.7 March 15, 2011

Alignment Alternative Sections
Section S7-S7
Town Brook Enhancement Project
Quincy, Massachusetts

## CONCLUSION

The preferred alternative (Alternative C) presents a balance to achieving: maximum environmental enhancements, minimizing environmental impacts and achieving the goals and objectives of the City of Quincy related to the numerous sustainable planning measures in place for Quincy Center and addressing the evaluation metrics presented and outlined in this chapter. Refer to Table 2.1.

The preferred Alternative has been designed to provide the maximum extent of practicable environmental mitigation within City controlled property and the densely developed urban context of Quincy Center, while providing immediate environmental and public benefit.

Analysis of the nine (9) alternatives evaluated in this chapter utilizing the ten (10) evaluation metrics, did not identify a practical alternative that would significantly reduce the environmental impacts of the preferred alternative. Therefore, the City of Quincy has concluded that the preferred alternative presents the best option for both near term and long term City planning goals and environmental benefits to the Town Brook Watershed.

# CHAPTER 3
# WETLANDS

## INTRODUCTION

The Quincy Town Brook is a perennial stream originating in Braintree and flowing through Quincy to the Town River Bay. It starts in the Blue Hills Reservation as an upland stream, tributary to the Old Quincy Reservoir in Braintree. The Old Quincy Reservoir served as the former water supply source for the City of Quincy and is now used for industrial water supply. The Brook flows through Braintree for a short distance and is then contained within underground culverts for most of its length to Quincy Center and the project site. The Brook is culverted through various sections, consisting of various materials and sizes as outlined in this ENF, with an approximate 16-foot long open channel section on parcel DU65, (consisting of the Hong Kong Eatery restaurant). The lower reaches of the Brook are tidally influenced, although located approximately 2,000 linear feet downstream and off-site. Town Brook widens to become Town River and eventually discharges into Town River Bay, with bordering saltmarsh systems.

The existing watershed area for Town Brook evaluated as part of this project is approximately 4.46 square miles as measured at the USGS gauging station adjacent to Miller Stile Road. The Brook has been altered from its original location and existing conditions via culverts and rerouting of various sections based on records dating back to the 1950's.

The culverted sections of Town Brook serve as a flood conveyance structure for the 500-year storm. Areas adjacent to Town Brook have experienced flooding issues dating back to 1886 and have increased as development expanded surrounding Quincy Center and adjacent areas. A flood control study was conducted in the 1970's by the Metropolitan District Commission (currently the Department of Conservation & Recreation). The purpose of the study was to identify potential methods to reduce flooding impacts. Channel improvements, diversion structures, and culvert and embankment protection were examined as part of this study.

The Deep Rock Relief Tunnel overflow diversion structure was realized as part of this study. This flood control structure was designed and constructed by the U.S. Army Corps of Engineers and consisted of a 4,100-foot long, 12-foot diameter tunnel, approximately 150 feet below grade in some locations. The structure diverts high storm flows from Town Brook and Burgin Parkway directly to the Town River Bay at the outlet control structure. This allows significant storm flows to circumvent Quincy Center and adjacent areas. A more detailed history of the Deep Rock Relief Tunnel and Town Flood Control Project is included in Appendix C.

## EXISTING RESOURCES

An inventory of existing wetland resource areas was examined for the project site and areas surrounding Quincy Center. Town Brook is the only regulated resource area within the proposed limit of work and contains several resources regulated under the Massachusetts Wetlands Protection Act (M.G.L. c. 131, § 40; 310 CMR 10.00) and the City of Quincy Wetlands Protection Regulations & Ordinance (Chapter 18.08; Order No. 401 of 1987). The inland resource areas associated with Town Brook include Bank, Land Under Water Bodies and Waterways, and Riverfront Area along the open channel sections of the channel. Banks and Land Under the Water Bodies and Waterways that underlie Anadromous or Catadromous Fish Runs are also regulated under the WPA. The Town Brook culvert conveys the 100-year flood (BLSF) and 500-year flood, with a small area of surface floodplain adjacent to the open channel section of the brook on parcel D91 (currently occupied by the American Legion). The lower reaches of Town Brook are tidally influenced and outside the project site and the Massachusetts Coastal Zone.

According to the Surface Water Quality Standards (314 CMR 4.00) and the 1990 Designated Outstanding Resource Waters of Massachusetts, the site is not located within an ORW. In addition, the project area is not located within an Area of Critical Environmental Concern, Zone II or Interim Wellhead Protection Area, or Zone A, B, or C Surface Water Protection Area.

### Resource Areas

As noted above, the WPA defines wetland resource areas and the performance standards for each. The following sections describe each resource area on the site for Town Brook, as regulated by the Wetlands Protection Act and the City of Quincy local regulations.

### Bank – 310 CMR 10.54 WPA

Section 310 CMR 10.54(2) of the Wetlands Protection Act defines a Bank *as the portion of the land surface which normally abuts and confines a water body. It occurs between a water body and a vegetated bordering wetland and adjacent flood plain, or, in the absence of these, it occurs between a water body and an upland. The upper boundary of a Bank is the first observable break in the slope or the mean annual flood level, whichever is lower. The lower boundary of a Bank is the mean annual low flow level.*

By definition, a Bank abuts a stream channel and includes a stream or river that flows through a culvert. Town Brook contains Bank along the limit of the stream including the culverted sections through Quincy Center. The existing Town Brook alignment is approximately 1,700 linear feet long through the project area, therefore there is approximately 3,640 linear feet of Bank proposed for relocation (Bank is located along each side of the culvert). The extent of the existing Bank is identified on Figure 3.1.1 within the limits of Town Brook.

### Land Under Water Bodies and Waterways – 310 CMR 10.56 WPA

Section 310 CMR 10.56 (2) of the WPA states that Land Under Water Bodies and Waterways *is the land beneath any creek, river, stream, pond or lake* and the boundary *is the mean annual low water level.*

Town Brook is identified as a perennial stream and contains LUWW, including the culverted sections through Quincy Center and the project site. As noted above, the existing Town Brook alignment is approximately 1,700 linear feet and varies in width from 7.9' to 12.5' through the project area, therefore there is approximately 17,840 square feet of LUWW proposed for relocation. The existing LUWW is depicted on Figure 3.1.1 within the limits of Town Brook.

Refer to Table 3.1 below and Figures 1.2.1 and 1.2.2 for a summary and description of the existing culvert sections within Quincy Center and the project area.

**Table 3.1**
**Existing Town Brook Segments**

| Segment | From Station (ft) | To Station (ft) | Height (ft) | Width (ft) | Material & Shape |
|---|---|---|---|---|---|
| 1 | 10+00 | 11+84 | 6.5 | 7.9 | Granite & Concrete Sidewalls with Variable Material Channel Bottom |
| 2 | 11+84 | 12+39 | 4.25 | 12.5 | Twin 6'-3" W x 4'-3" H Concrete Box Culverts |
| 3 | 12+39 | 15+82 | 6.583 | 9.75 | Arched Corrugated Metal Pipe (CMP-ARMCO) 6'-7"H x 9'-9"W |
| 4 | 15+82 | 16+00 | 6.5 | 9.1 | Variable Material Channel |
| 5 | 16+00 | 19+38 | 6.5 | 9 | Concrete & Granite Channel with Variable Dimensions & Materials |
| 6 | 19+38 | 19+76 | 6.5 | 9 | Stone Culvert |
| 7 | 19+76 | 21+40 | 5.5 | 9 | Stone Culvert |
| 8 | 21+40 | 22+00 | 5.5 | 9 | Concrete Culvert |
| 9 | 22+00 | 23+58 | 5.5 | 9 | Concrete Culvert |
| 10 | 23+58 | 26+25 | 5.5 | 9 | Concrete Culvert |
| 11 | 26+25 | 28+16 | 5.5 | 9 | Concrete Culvert |

### Bordering Land Subject to Flooding – 310 CMR 10.57 WPA

Bordering Land Subject to Flooding is defined by the WPA (310 CMR 10.57(2)(a)(1) *as an area with low, flat topography adjacent to and inundated by flood waters rising from creeks, rivers, streams, ponds or lakes. It extends from the banks of these waterways and water bodies; where a bordering vegetated wetland occurs, it extends from said wetland.* Section 310 CMR 10.57(2)(a)(3) of the WPA states that *the boundary of Bordering Land Subject to Flooding is the estimated maximum lateral extent of flood water which will theoretically result from the statistical 100-year frequency storm. Said boundary shall be that determined by reference to the*

*most recently available flood profile data prepared for the community within which the work is proposed under the National Flood Insurance Program (NFIP, currently administered by the Federal Emergency Management Agency [FEMA], successor to the U.S. Department of Housing and Urban Development). Said boundary, so determined, shall be presumed accurate. This presumption may be overcome only by credible evidence from a registered professional engineer or other professional competent in such matters.*

The limit of BLSF has been identified based on the effective FEMA Flood Insurance Rate Map. According to the May 16, 2006 FEMA Flood Insurance Rate Map for the City of Quincy, Community Panel Numbers 255219-0057D, 255219-0019D, and 255219-0076D, the project area is located within Zone X as identified in Figure 3.1.1. Zone X is classified as an area outside the 0.2% annual chance floodplain (500-year storm event).

Zone AE is identified near Revere Road on the southern portion of the project area and is classified as an area subject to the 100-year flood (1% annual chance flood) with base flood elevations determined. The limit of Zone AE has been identified at Elevation 16, based on NAVD 1988. However, based on the ground topography near Revere Road, the floodplain does not extend onto the northern side of the Concourse roadway as the area is above elevation 16. The extent of the 100-year flood zone has been identified based on the MassGIS datalayer for the purposes of this report. Spot elevations and limited survey of the American Legion parcel indicate that the actual floodplain is likely smaller than estimated herein. A detailed survey will be completed for the review of the regulatory permitting of this project.

The area within the Town Brook culvert has been identified as containing and conveying the 0.2% annual flood (500-year storm event).

Zone A is identified within the MBTA tracks west of the site and is classified as an area subject to the 100-year flood where base flood elevations have not been determined. This area would be regulated as BLSF at an undetermined elevation above 28 feet based on NAVD 1988, however it is located off-site.

**Riverfront Area – 310 CMR 10.58 WPA**

*The Riverfront Area is the area of land between a river's mean annual high-water line measured horizontally outward from the river and a parallel line located 200 feet away.* Under 310 CMR 10.58 (2)(a), the Mean Annual High Water line of a river *is the line that is apparent from visible markings or changes in the character of soils or vegetation due to the prolonged presence of water and that distinguishes between predominantly aquatic and predominantly terrestrial land. Field indicators of bankfull conditions shall be used to determine the mean annual high-water line. Bankfull field indicators include but are not limited to: changes in slope, changes in vegetation, stain lines, top of pointbars, changes in bank materials, or bank undercuts.*

Section 310 CMR 10.58(2)(a) further states that *where a river runs through a culvert more than 200 feet in length, the riverfront area stops at a perpendicular line at the upstream end of the culvert and resumes at the downstream end.*

Riverfront Area is located on the project site and is associated with the existing day-lighted portions of Town Brook. The approximate 16-foot open channel section on parcel DU65 behind the exiting Hong Kong Eatery restaurant contains the 200-foot Riverfront Area extending from both sides of the channel. Riverfront Area also extends from the open section of Town Brook south of Revere Road. Figure 3.1.2 shows the extent of Riverfront Area on the project site. Approximately 91,670 feet of Riverfront Area is located within previously developed areas consisting of paved and degraded urban areas within the limit of work.

### Wildlife Habitat and Rare Species

Banks and Land Under the Water Bodies and Waterways that underlie Anadromous or Catadromous fish runs are regulated under the WPA. This resource area is referred to as a "Fish Run" and is located within the limits of Town Brook, known to support rainbow smelt (*Osmerus mordax*) and American eel (*Anguilla rostrata*). Section 310 CMR 10.60 of the WPA outlines the standards for wildlife habitat and Section 310 CMR 10.35 outlines the standards for Fish Runs. A discussion of the existing wildlife and fisheries habitat, as well as proposed enhancements is detailed in Chapter 4, "Wildlife & Fisheries.

A review of the current Mass GIS data layer for the Massachusetts Natural Heritage Atlas (effective October 1, 2008) under the Natural Heritage and Endangered Species Program (NHESP) indicates that site is not located within Estimated Habitat for rare wildlife or Priority Habitat for rare species. No certified or potential vernal pools under the jurisdiction of the Wetlands Protection Act or the Massachusetts Endangered Species Act (321 CMR 10.00) occur on or near the proposed work area

## REQUIRED PERMITS AND REGULATORY COMPLIANCE

Several local, state and federal permits and approvals are required prior to the start of construction. Table 3.2 below summarizes the permits and approvals anticipated to be required for the Project, and the status of each.

| Table 3.2<br>Anticipated Permits and Approvals | | |
|---|---|---|
| **Agency** | **Permit** | **Status** |
| **Federal** | | |
| U.S. Army Corps of Engineers | Section 404 General Permit – Category 2 | To be filed upon completion of the MEPA process |
| U.S. Environmental Protection Agency | NPDES Construction General Permit | To be filed prior to the start of construction |
| **Commonwealth of Massachusetts** | | |
| Department of Environmental Protection | 401 Water Quality Certification | To be filed upon completion of the MEPA process |
| Massachusetts Environmental Policy Act | MEPA Certificate on the ENF | Filed March 15, 2011 |
| **City of Quincy** | | |
| Quincy Conservation Commission | Notice of Intent/ Order of Conditions | To be filed upon |

**Order of Conditions**

Local Conservation Commissions and the Massachusetts Department of Environmental Protection administer the Wetlands Protection Act. Certain resource areas are protected because they fulfill the public interest to protect public and private water supply, protect fisheries, protect groundwater supply, provide flood control, protect land containing shellfish, prevent storm damage, protect wildlife habitat, and prevent pollution. These interests are protected by a "no net loss of wetlands" policy. Projects that affect wetland resource areas are required to avoid impacts where possible, minimize unavoidable impacts, and mitigate for unavoidable impacts. Performance standards define the levels of environmental impacts that cannot be exceeded.

Projects proposed in wetland resource areas or in the buffer zone must obtain a local Order of Conditions under the state and local jurisdiction. Wetland resources areas within the project area include Bank, LUWW, RA, BLSF and Fish Run, with Town Brook serving as a floodway conveyance for the 500-year storm event.

The City of Quincy has a local Wetland Protection Regulations (Chapter 18.08) and Wetlands Protection Ordinance (Order No. 401 of 1987). Work within resource areas and the 100-Foot Buffer Zone will require the filing of a Notice of Intent. The resource areas regulated under the local Regulations and Ordinance are similar to those within the WPA. An alternatives analysis is required as part of the local review process for any work within resource areas, including buffer zones and is detailed in Chapter 2 of this ENF. The NOI will be filed with the Quincy Conservation Commission.

## Section 401 Water Quality Certification

A Water Quality Certification is required under Section 401 of the federal Clean Water Act (33 USC 1341) and the Massachusetts Clean Water Act (M.G.L. Chapter 21, Sections 26-53) for any activity requiring a federal permit that will result in a discharge to water subject to federal jurisdiction. The 401 WQC is issued by MassDEP. A "discharge" includes the filling of "waters of the United States" requiring a Section 404 permit under the Clean Water Act. The implementing regulations under 314 CMR 9.00 regulate activities under Section 401.

Certain activities identified in 314 CMR 9.04 require a 401 Water Quality Certification application and are subject to the Criteria for Evaluation of Applications for the Discharge of Dredged or Fill Material. Under Section 314 CMR 9.04(1) *any activity in an area subject to 310 CMR 10.00 which is also subject to 33 U.S.C. 1251, et seq.* [that] *will result in the loss of more than 5000 square feet cumulatively of bordering and isolated vegetated wetlands and land under water* requires a 401 WQC review.

The relocation of Town Brook will alter approximately 17,840 linear feet of LUWW and therefore will require 401 WQC review by MassDEP. The project will require review under the category for Major Fill/Excavation Project Certification (BRP WW 10) which includes projects with *a cumulative loss of more than 5,000 square feet of bordering and isolated vegetated wetland and land under water, except for routine maintenance projects meeting the criteria of 314 CMR 9.04(5) and agricultural limited projects meeting the criteria of 314 CMR 9.04(1).*

The 401 WQC application will be submitted to MassDEP upon completion of the MEPA review process. The ENF details the alternatives analysis, measures to enhance Town Brook via the proposed relocation, and measures to mitigate existing impacts and potential issues during construction.

## Section 404 Federal Permit – Category 2

Inland waters and wetlands are regulated under Section 404 of the Clean Water Act administered by the U.S. Army Corps of Engineers (USACOE), and include rivers, streams, lakes, ponds and wetlands, excluding Section 10 Navigable Waters of the U.S. The jurisdictional limits are the ordinary high water (OHW) mark in the absence of adjacent wetlands, beyond the OHW mark to the limit of adjacent wetlands when adjacent wetlands are present, and the wetland limit when only wetlands are present. There are three types of categories for permitting with the Army Corps of Engineers under the Massachusetts General Permit. Category 2 reporting is required for projects involving 5,000 square feet to one (1) acre of inland waterway and/or wetland fill and associated secondary impacts (e.g., areas drained, flooded, cleared or excavated). Fill area includes all temporary and permanent fill, and excavation discharges (except for incidental fallback).

Any alteration to Town Brook, including culverted sections with artificial channels, will be subject to Section 404 review and permitting by the USACOE. The approximate alteration to the culvert below the OHW is approximately 17,840 feet, which exceeds the threshold of 5,000 square feet of impact and will require Category 2 review under the Massachusetts General

Permit. The application will be submitted to the USACOE concurrently with the 401 WQC application upon completion of the MEPA review process.

### National Pollution Discharge Elimination System Construction General Permit

Under the NPDES provisions of the Clean Water Act, the U.S. Environmental Protection Agency regulates water quality, sediment, and pollutant discharge of stormwater runoff from construction sites. Construction projects that propose the alteration of one or more acres of land must obtain coverage under the NPDES Stormwater Construction General Permit (CGP). The project proponent must submit a one page registration form known as a Notice of Intent to the EPA and must develop and implement a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP details construction activities, erosion control measures, and inspection schedules to be implemented during construction to ensure that the construction activities do not have an adverse impact on wetlands and waterways. A Construction General Permit will be obtained prior to the start of construction for related impacts. Chapter 7 provides a detailed discussion of construction related impacts and the CGP.

## PROJECT RELATED IMPACTS TO WETLAND RESOURCE AREAS

The project will greatly enhance the conditions of Town Brook through the proposed environmental enhancements and the realignment of the existing channel. Impacts are proposed to several resource areas including Bank and LUWW as the degraded culvert will be deconstructed over time after the new culvert is installed and the Brook diverted to the new alignment. The existing culvert provides little value to Bank, LUWW, RA, and fisheries except to provide flood control as a conveyance structure. Riverfront Area and fisheries will realize significant improvements and a portion of Town Brook will be day-lighted providing enhancements to the resources Bank and LUWW. Overall, the project will provide a benefit to Town Brook and fisheries habitat for rainbow smelt.

### Wetland Impacts

This section details the projects compliance for the resource areas Bank, Land Under Water Bodies and Waterways, Bordering Land Subject to Flooding, the 100-Foot Buffer Zone, and Riverfront Area under the WPA and City of Quincy Wetlands Ordinance and Regulations. Compliance with the resource area Fish Run is detailed in Chapter 4. Table 3.3 summarizes the resource area impacts and benefits associated with the proposed enhancement project. The area of the existing resource is identified in addition to the proposed relocated resources associated with the re-aligned culvert for each option under the preferred design. Chapter 1 describes the differences between Option 1 and Option 2 of the preferred alternative. The net change in the resource area has also been provided for comparison of the two options.

Two viable options have been identified for the location of the low flow channel for the proposed re-alignment of Town Brook. Option 1 consists of a separate low flow channel that ties into the existing channel upstream of the re-aligned culvert. This option allows the

restoration of existing channel within Town Brook that can continue to be utilized by the smelt population. Option 2 consist of the low flow channel within the culvert and will tie into the existing Town Brook further downstream. Both options will provide additional day-lit sections and improved fisheries habitat, with adjacent open space on parcel D91, the American Legion parcel. Refer to Figure 3.2 for a depiction of the two options.

**Table 3.3**
**Summary of Existing and Proposed Resources Within Study Area**

| Resource Area | Existing | Preferred Alternative Option 1 | Preferred Alternative Option 2 | Net Change (Option 1) | Net Change (Option 2) |
|---|---|---|---|---|---|
| **Square feet of new BVW alteration** | 0 | 0 | 0 | 0 | 0 |
| **Square feet of new other wetland alteration** | | | | | |
| • **Linear Feet of Bank** | 3,640 | 3,000 | 2,660 | -640 | -980 |
| • **Square Feet of LUWW** | 17,840 | 15,190 | 14,350 | -2,650 | -3,490 |
| • **Linear Feet of Open Channel Sections of T.B.** | 200 | 385 | 315 | +185 | +115 |
| • **Square Feet of Open Channel Section of T.B.** | 1,565 | 3,345 | 3,170 | +1,780 | +1,605 |
| **Total Square Feet of Riverfront Area** | 91,670 | 179,900 | 166,275 | +88,230 | +74,605 |
| • **100-Foot Inner Riparian Zone** | 43,115 | 91,635 | 84,400 | +48,520 | +41,285 |
| • **200-Foot Outer Riparian Zone** | 48,555 | 88,265 | 81,875 | +39,710 | +33,320 |
| **Square feet of Bordering Land Subject to Flooding** | 69,275 | 4,850* | 4,275* | 0* | 0* |
| **Acres of new non-water dependent use of tidelands or waterways** | 0 | 0 | 0 | 0 | 0 |

***No temporary or permanent displacement of flood storage is proposed within the project area within BLSF. The alteration of BLSF is entirely for restoration of the brook along the American Legion parcel and the total BLSF within the project area will remain the same.**

The following table identifies the existing resource areas and the approximate size of the proposed enhancement areas for each of the options for the re-alignment of the Town Brook under the preferred design.

| Table 3.4<br>Summary of Proposed Enhancement<br>Alterations Within the Existing Resource Areas | | |
|---|---|---|
| **Resource Area** | **Preferred Alternative Option 1 (square feet)** | **Preferred Alternative Option 2 (square feet)** |
| **Total Square Feet of Riverfront Area** | 13,315 | 13,315 |
| • **Existing 100-Foot Inner Riparian Zone** | 6,545 | 6,545 |
| • **Existing 200-Foot Outer Riparian Zone** | 6,770 | 6,770 |
| **Existing LUWW** | 1,400 | 940 |
| **Existing BLSF** | 4,850 | 4,275 |

**Bank – 310 CMR 10.54 WPA**

Banks are likely to be significant to public or private water supply, to ground water supply, to flood control, to storm damage prevention, to the prevention of pollution and to the protection of fisheries and wildlife habitat. Under the WPA, when Banks *are composed of concrete, asphalt or other artificial impervious material, said Banks are likely to be significant to flood control and storm damage prevention.* As the project will impact the culverted sections of Town Brook, the Bank is significant to flood control and storm damage prevention only. Fisheries and wildlife habitat improvements have also been considered in the design, particularly for rainbow smelt and associated habitat enhancements along the day-lighted portions of Town Brook. Figures 3.2.1 and 3.2.3 show the proposed Bank mitigation.

The performance standards for Bank under 310 CMR 10.54(4)(a) require that the proposed project not impair the following (standard presented in italics, response in bold):

*1. the physical stability of the Bank;*

**As part of the proposed enhancement project, the current alignment of Town Brook will be relocated to the southern edge of the new Concourse Roadway. The existing culvert consists of a multitude of materials in various states of condition and varying dimensions. The entire section of Town Brook within the impacted Project area is degraded with artificial channel and bank. The stability of the existing Bank is questionable at this time and the proposed culvert will be constructed of reinforced concrete and will provide stability.**

*2. the water carrying capacity of the existing channel within the Bank;*

**As detailed in Chapter 5, "Stormwater and Flood Control", the water carrying capacity of the new channel will be maintained and improved. Currently, the flows within Town Brook are below normal to support a viable smelt population, due to inadvertent diversions into the Deep Rock Relief Tunnel (discussed in detail in Appendix C).**

*3. ground water and surface water quality;*

**The relocated portion of Town Brook will not impair ground water and surface water quality. The existing culvert through the Project area consists of an artificial concrete lined channel, with the base flow derived from upstream surface runoff and not from groundwater hydrology. The relocation will improve water quality due to the removal illicit sanitary sewer discharges within the existing channel. Stormwater compliance is detailed in Chapter 5, groundwater conditions in Chapter 6, and construction impacts in Chapter 7.**

*4. the capacity of the Bank to provide breeding habitat, escape cover and food for fisheries;*

**Currently, the culverted sections of Town Brook provide little habitat for smelt populations, particularly to provide breeding habitat, escape cover, or food. The proposed enhancements detailed in Chapter 4 will significantly improve a section of Town Brook to provide these values at the current location of the American Legion building on parcel D91.**

*5. the capacity of the Bank to provide important wildlife habitat functions. A project or projects on a single lot, for which Notice(s) of Intent is filed on or after November 1, 1987, that (cumulatively) alter(s) up to 10% or 50 feet (whichever is less) of the length of the bank found to be significant to the protection of wildlife habitat, shall not be deemed to impair its capacity to provide important wildlife habitat functions. Additional alterations beyond the above threshold may be permitted if they will have no adverse effects on wildlife habitat, as determined by procedures contained in 310 CMR 10.60.*

**Due to the proposed relocation of Town Brook, the project will exceed the thresholds for Bank. However, the site provides little to no important wildlife habitat functions and therefore will not impair the capacity to provide such. A draft Wildlife Habitat Evaluation has been provided in Appendix D. Compliance with 310 CMR 10.60 is detailed in Chapter 4.**

The performance standards for Bank under 310 CMR 10.54(4)(b) and (c) do not apply.

**Land Under Water Bodies and Waterways – 310 CMR 10.56 WPA**

Land Under Water Bodies and Waterways is likely to be significant to public and private water supply, to ground water supply, to flood control, to storm damage prevention, to prevention of pollution and to protection of fisheries and wildlife habitat. Under the WPA, when LUWW *is composed of concrete, asphalt or other artificial impervious material, said land is likely to be significant to flood control and storm damage prevention.* As the project will impact the culverted sections of Town Brook, LUWW is significant to flood control and storm damage

prevention. Fisheries and wildlife habitat improvements have also been considered in the design, particularly for rainbow smelt enhancements.

Approximately 1,400 square feet of the existing LUWW downstream of the re-aligned culvert will be enhanced within the project area as result of construction activities under Option 1. Alternatively, Option 2 proposes to enhance approximately 940 square feet of LUWW. Figures 3.2.1 and 3.2.3 show the proposed LUWW mitigation. Table 3.4 contains a summary of the proposed enhancements within the existing LUWW. Note that the enhancement calculations are included in the total LUWW alterations for this project.

The performance standards for LUWW under 310 CMR 10.56(4)(a) require that the proposed project not impair the following (standard presented in italics, response in bold):

1. *The water carrying capacity within the defined channel, which is provided by said land in conjunction with the banks;*

**Compliance with this standard is addressed under the Bank standard above, reiterated as follows: as detailed in Chapter 5, "Stormwater and Flood Control", the water carrying capacity of the new channel will be maintained and improved. Currently, the flows within Town Brook are below normal to support a viable smelt population, due to inadvertent diversions into the Deep Rock Relief Tunnel (discussed in detail in Appendix C).**

*2. Ground and surface water quality;*

**Compliance with this standard is addressed under the Bank standard above, reiterated as follows: the relocated portion of Town Brook will not impair ground water and surface water quality. The existing culvert through the Project area consists of an artificial concrete lined channel, with the base flow derived from upstream surface runoff and not from groundwater hydrology. The relocation will improve water quality due to the removal illicit sanitary sewer discharges within the existing channel. Stormwater compliance is detailed in Chapter 5, groundwater conditions in Chapter 6, and construction impacts in Chapter 7.**

*3. The capacity of said land to provide breeding habitat, escape cover and food for fisheries; and*

**Compliance with this standard is addressed under the Bank standard above, reiterated as follows: currently, the culverted sections of Town Brook provide little habitat for smelt populations, particularly to provide breeding habitat, escape cover, or food. The proposed enhancements detailed in Chapter 4 will significantly improve a section of Town Brook to provide these values at the current location of the American Legion building on parcel D91.**

4. *The capacity of said land to provide important wildlife habitat functions. A project or projects on a single lot, for which Notice(s) of intent is filed on or after November 1, 1987, that (cumulatively) alter(s) up to 10% or 5,000 square feet (whichever is less) of land in this resource area found to be significant to the protection of wildlife habitat,*

*shall not be deemed to impair its capacity to provide important wildlife habitat functions. Additional alterations beyond the above threshold may be permitted if they will have no adverse effects on wildlife habitat, as determined by procedures established under 310 CMR 10.60.*

**Due to the proposed relocation of Town Brook, the project will exceed the thresholds for LUWW impacts. However, the site provides little to no important wildlife habitat functions and therefore will not impair the capacity to provide such. A draft Wildlife Habitat Evaluation has been provided in Appendix D. Compliance with 310 CMR 10.60 is detailed in Chapter 4.**

The performance standards for LUWW under 310 CMR 10.56(4)(b) and (c) do not apply.

**Bordering Land Subject to Flooding – 310 CMR 10.57 WPA**

Town Brook conveys the 100-year (BLSF) and 500-year flood, with a small area of surface flood plain adjacent to the open channel section of Town Brook on parcel D91 (currently occupied by the American Legion). The proposed enhancements and relocation of the existing Town Brook will not negatively impact Town Brook or this resource area upon completion of the project.

Approximately 4,850 square feet of the existing BLSF along the existing channel will be enhanced within the project area as result of construction activities under Option 1. Alternatively, Option 2 proposes to enhance approximately 4,275 square feet of BLSF. The project does not propose any filling at this location and will in fact provide additional flood storage volume on an incremental basis as part of the construction of the open space adjacent to the proposed day-lit section of Town Brook. Figures 3.2.1 and 3.2.3 show the proposed BLSF mitigation. Table 3.4 contains a summary of the proposed enhancements within the existing BLSF.

The performance standards for BLSF under 310 CMR 10.57(4)(a) require that the proposed project not impair the following (standard presented in italics, response in bold):

*1. Compensatory storage shall be provided for all flood storage volume that will be lost as the result of a proposed project within Bordering Land Subject to Flooding, when in the judgment of the issuing authority said loss will cause an increase or will contribute incrementally to an increase in the horizontal extent and level of flood waters during peak flows.*

*Compensatory storage shall mean a volume not previously used for flood storage and shall be incrementally equal to the theoretical volume of flood water at each elevation, up to and including the 100-year flood elevation, which would be displaced by the proposed project. Such compensatory volume shall have an unrestricted hydraulic connection to the same waterway or water body. Further, with respect to waterways, such compensatory volume shall be provided within the same reach of the river, stream or creek.*

**The existing Town Brook is a flood conveyance structure that contains the 0.2% annual chance flood or 500-year storm event. The relocated Town Brook has been designed to provide more hydraulic capacity than the existing Town Brook culvert**

**for the conveyance of storm events. At the downstream connection point, adjacent to the open channel section of the existing culvert south of Revere Road, there is BLSF which extends beyond the banks of the existing culvert. The project does not propose any filling at this location and will in fact provide additional flood storage volume on an incremental basis as part of the construction of the open space adjacent to the proposed day-lit section of Town Brook.**

*2. Work within Bordering Land Subject to Flooding, including that work required to provide the above-specified compensatory storage, shall not restrict flows so as to cause an increase in flood stage or velocity.*

**The proposed relocation of Town Brook will not restrict flows leading to an increase in the flood stage or velocity. Chapter 5 details the drainage and flood control design and Appendix B contains the Hydrology and Hydraulics Study.**

*3. Work in those portions of bordering land subject to flooding found to be significant to the protection of wildlife habitat shall not impair its capacity to provide important wildlife habitat functions. Except for work which would adversely affect vernal pool habitat, a project or projects on a single lot, for which Notice(s) of Intent is filed on or after November 1, 1987, that (cumulatively) alter(s) up to 10% or 5,000 square feet (whichever is less) of land in this resource area found to be significant to the protection of wildlife habitat, shall not be deemed to impair its capacity to provide important wildlife habitat functions. Additional alterations beyond the above threshold, or altering vernal pool habitat, may be permitted if they will have no adverse effects on wildlife habitat, as determined by procedures contained in 310 CMR 10.60.*

**The site provides little to no important wildlife habitat functions and therefore will not impair the capacity to provide such. A draft Wildlife Habitat Evaluation has been provided in Appendix D. Compliance with 310 CMR 10.60 is detailed in Chapter 4.**

---

### Buffer Zone Impacts

The 100-Foot Buffer Zone extends from the limit of Bank and LUWW on the project site from the open channel portions of Town Brook. The Buffer Zone does not extend from the limit of Bank or LUWW for culverted sections of a stream or brook. The limit of the 100-Foot Buffer Zone is identified on Figure 3.1.2. As the site is entirely developed, impacts are not anticipated from work within the buffer zone. As Town Brook is being relocated with enhancements to the open channel portions of the Brook, the current alignment will be kept in place and decommissioned as Quincy Center is redeveloped over the next ten years.

---

### Riverfront Area Impacts

The Wetlands Protection Act Regulations, under 310 CMR 10.58(3), presume that the Riverfront Area is significant to the protection of private or public water supply, protection of groundwater, provision of flood control, prevention of storm damage, prevention of pollution, protection of

land containing shellfish, protection of wildlife and the protection of fisheries. As Town Brook is located within a culvert, Riverfront Area extends from the limit of the open portions of the channel as described above within previously developed areas. No new development is proposed within the Riverfront Area on the site as the area has been completely developed and contains predominantly impervious surfaces and structures under existing conditions. As such, the WPA presumes the existing Riverfront Area is significant to the protection for flood control, the prevention of storm damage, and protection of fisheries, however that is not the case, due to the developed and degraded nature of the existing Riverfront Area, as further described below.

Table 3.5 provides a detail of the Riverfront Area at the two existing open channel locations, one area on Parcel DU65 (Hong Kong Eatery) and the other near the Hancock Lot along Revere Road. The table also identifies the proposed Riverfront Area which will be created upon the completion of the channel re-alignment and relocation of day-lit sections under Option 1 and Option 2 of the preferred alternative. Figures 3.2.2 and 3.2.4 show the proposed Riverfront Area creation and mitigation.

**Table 3.5**
**Summary of Riverfront Area Impacts (square feet)**

| Resource Area | Existing | Preferred Alternative Option 1 | Preferred Alternative Option 2 | Net Change (Option 1) | Net Change (Option 2) |
|---|---|---|---|---|---|
| **Parcel DU65 RA (Hong Kong Eatery )** | | | | | |
| • **100-Foot Inner Riparian Zone** | 3,340 | 0 | 0 | -3,340 | -3,340 |
| • **200-Foot Outer Riparian Zone** | 3,340 | 0 | 0 | -3,340 | -3,340 |
| • **Total** | 6,680 | 0 | 0 | -6,680 | -6,680 |
| **Revere Road RA (South of Concourse)** | | | | | |
| • **100-Foot Inner Riparian Zone** | 39,775 | 91,635 | 84,400 | +51,860 | +44,625 |
| • **200-Foot Outer Riparian Zone** | 45,215 | 88,265 | 81,875 | +43,050 | +36,660 |
| • **Total** | 84,990 | 179,900 | 166,275 | +88,230 | +74,605 |
| **Total Square Feet of Riverfront Area** | | | | | |
| • **100-Foot Inner Riparian Zone** | 43,115 | 91,635 | 84,400 | +48,520 | +41,285 |
| • **200-Foot Outer Riparian Zone** | 48,555 | 88,265 | 81,875 | +39,710 | +33,320 |
| **Total Square Feet of Riverfront Area** | 91,670 | 179,900 | 166,275 | +88,230 | +74,605 |

The existing Riverfront Area associated with existing open channel sections of Town Brook at the Hong Kong Eatery will be eliminated when the brook is re-aligned and the resource area is removed from the existing culvert. Approximately 13,315 square feet of the previously developed Riverfront Area will no longer be regulated as Riverfront Area upon relocation of the culvert. In contrast, approximately 91,670 square feet of proposed Riverfront Area associated with the proposed open channel sections of culvert will be created as a result of the re-alignment as detailed in the following sections. Table 3.4 contains a summary of the proposed enhancements within the existing Riverfront Area.

The performance standards for Riverfront Area under 310 CMR 10.58(4)(a) require that the proposed project address the following (standard presented in italics, response in bold):

*(4) General Performance Standard. Where the presumption set forth in 310 CMR 10.58(3) is not overcome, the applicant shall prove by a preponderance of the evidence that there are no practicable and substantially equivalent economic alternatives to the proposed project with less adverse effects on the interests identified in M.G.L. c.131 § 40 and that the work, including proposed mitigation, will have no significant adverse impact on the riverfront area to protect the interests identified in M.G.L. c. 131 § 40.*

**As noted above, the limit of work area contains a total of approximately 91,670 square feet of Riverfront Area, of which the majority consists of impervious surfaces. The proposed design will significantly reduce the amount of impervious surface within the Riverfront Area and considerably improve the area surrounding the relocated resource area on parcel D91 (currently the American Legion building). Green space through landscaping, improvements along the Banks of the brook, and fisheries habitat enhancements will be incorporated into the design within the new Riverfront Area. The preferred alternative, as described in Chapter 2, details the design of the new brook re-alignment and enhancements, as well as Chapter 8, "Mitigation". Review of the alternatives indicates that the redevelopment of the site and the improvements proposed are the best available option.**

> *(a.) Protection of Other Resource Areas. The work shall meet the performance standards for all other resource areas within the riverfront area, as identified in 310 CMR 10.30 (coastal bank), 10.32 (salt marsh), 10.55 (Bordering Vegetated Wetland), and 10.57 (Land Subject to Flooding). When work in the riverfront area is also within the buffer zone to another resource area, the performance standards for the riverfront area shall contribute to the protection of the interests of M.G.L. c. 131, § 40 in lieu of any additional requirements that might otherwise be imposed on work in the buffer zone within the riverfront area.*
>
> **The existing Riverfront Area on the site consists of previously developed impervious surfaces within a dense urban center. The proposed work is located within previously developed areas of the Riverfront Area and is classified as a redevelopment project as defined under 310 CMR 10.58(5). Proposed work is also located within other resource areas and the compliance with applicable performance standards is addressed in previous sections of this Chapter.**
>
> *(b) Protection of Rare Species. No project may be permitted within the riverfront area which will have any adverse effect on specified habitat sites of rare wetland or upland,*

*vertebrate or invertebrate species, as identified by the procedures established under 310 CMR 10.59 or 10.37, or which will have any adverse effect on vernal pool habitat certified prior to the filing of the Notice of Intent.*

**Not applicable – The site is not located in rare species habitat.**

*(c) Practicable and Substantially Equivalent Economic Alternatives. There must be no practicable and substantially equivalent economic alternative to the proposed project with less adverse effects on the interests identified in M.G.L. c. 131 § 40.*

**The project is proposed as a redevelopment of an existing site, however, a detailed Alternatives Analysis has been prepared to demonstrate that the proposed work is the best economically viable environmental alternative feasible for this site and to address the requirements for each permit required for the proposed project. The Alternative Analysis is presented in Chapter 2.**

*(d) No Significant Adverse Impact. The work, including proposed mitigation measures, must have no significant adverse impact on the riverfront area to protect the interests identified in M.G.L c. 131, § 40.*

**Work is proposed within previously developed Riverfront Area with significant improvements and enhancements proposed on parcel D91, the site of existing American Legion building, therefore, no significant adverse impact is expected with this project. The project is in compliance with the interests of the Wetlands Protection Act and the City of Quincy Wetlands Protection Ordinance & Regulations.**

*(5) Redevelopment Within Previously Developed Riverfront Areas; Restoration and Mitigation. Notwithstanding the provisions of 310 CMR 10.58(4)(c) and (d), the issuing authority may allow work to redevelop a previously developed riverfront area, provided the proposed work improves existing conditions. Redevelopment means replacement, rehabilitation or expansion of existing structures, improvement of existing roads, or reuse of degraded or previously developed areas.*

*A previously developed riverfront area contains areas degraded prior to August 7, 1996 by impervious surfaces from existing structures or pavement, absence of topsoil, junkyards, or abandoned dumping grounds. Work to redevelop previously developed riverfront areas shall conform to the following criteria:*

*(a) At a minimum, proposed work shall result in an improvement over existing conditions of the capacity of the riverfront area to protect the interests identified in M.G.L. c. 131 § 40. When a lot is previously developed but no portion of the riverfront area is degraded, the requirements of 310 CMR 10.58(4) shall be met.*

**The interests of the WPA to be considered include provisions for flood control, prevention of storm damage, and protection of fisheries. The proposed enhancements to Town Brook within the RA include day-lighting a net new 185 linear feet (1,780 square feet) of the brook under Option 1, providing new green space and landscaping along the day-lighted portions of the Banks, and improving fisheries habitat as detailed in Chapters 2 and 8. Option 2 will day-light**

**approximately 115 new linear feet (1,605 square feet) of brook. Overall, the project will result in a net reduction of impervious surface within the relocated Riverfront Area and provide improvements that will protect the applicable interests of the WPA.**

*(b) Stormwater management is provided according to standards established by the Department.*

**The City has reviewed the project for compliance with the stormwater management standards. A summary of compliance with the ten stormwater standards is documented in Chapter 5 of this report.**

*(c) Within 200 foot riverfront areas, proposed work shall not be located closer to the river than existing conditions or 100 feet, whichever is less, or not closer than existing conditions within 25 foot riverfront areas, except in accordance with 310 CMR 10.58(5)(f) or (g).*

**As the entire Riverfront Area is degraded with impervious surfaces and is fully developed, the proposed project will create improved Riverfront Area on the City owned open space parcels adjacent to the proposed day-lit sections of Town Brook.**

*(d) Proposed work, including expansion of existing structures, shall be located outside the riverfront area or toward the riverfront area boundary and away from the river, except in accordance with 310 CMR 10.58(5)(f) or (g).*

**As the entire Riverfront Area is degraded with impervious surfaces and is fully developed, the proposed project will create improved Riverfront Area on parcel D91 (American Legion) where Town Brook will be relocated.**

*(e) The area of proposed work shall not exceed the amount of degraded area, provided that the proposed work may alter up to 10% if the degraded area is less than 10% of the riverfront area, except in accordance with 310 CMR 10.58(5)(f) or (g).*

**The area of proposed work will not exceed the amount of degraded areas as the entire site is developed. A reduction in the amount of impervious surface will be realized through completion of this project.**

*(f) When an applicant proposes restoration on-site of degraded riverfront area, alteration may be allowed notwithstanding the criteria of 310 CMR 10.58(5)(c), (d), and (e) at a ratio in square feet of at least 1:1 of restored area to area of alteration not conforming to the criteria. Areas immediately along the river shall be selected for restoration. Alteration not conforming to the criteria shall begin at the riverfront area boundary.*

**Riverfront Area will be created along the new alignment of Town Brook. Approximately 5,500 square feet of public green space and landscaping is proposed along the Banks of Town Brook and will restore the functions and values to the extent practicable.**

*(g) When an applicant proposes mitigation either on-site or in the riverfront area within the same general area of the river basin, alteration may be allowed notwithstanding the criteria of 310 CMR 10.58(5)(c), (d), or (e) at a ratio in square feet of at least 2:1 of mitigation area to area of alteration not conforming to the criteria or an equivalent level of environmental protection where square footage is not a relevant measure. Alteration not conforming to the criteria shall begin at the riverfront area boundary. Mitigation may include off-site restoration of riverfront areas, conservation restrictions under M.G.L. c. 184, §§ 31 to 33 to preserve undisturbed riverfront areas that could be otherwise altered under 310 CMR 10.00, the purchase of development rights within the riverfront area, the restoration of bordering vegetated wetland, projects to remedy an existing adverse impact on the interests identified in M.G.L. c. 131, § 40 for which the applicant is not legally responsible, or similar activities undertaken voluntarily by the applicant which will support a determination by the issuing authority of no significant adverse impact. Preference shall be given to potential mitigation projects, if any, identified in a River Basin Plan approved by the Secretary of the Executive Office of Environmental Affairs.*

**Riverfront Area will be created along the new alignment of Town Brook. Approximately 5,500 square feet of public green space and landscaping is proposed along the Banks of Town Brook and will restore the functions and values to the extent practicable. Significant improvement to the 100-Foot Inner Riparian zone will also be realized upon completion of the project.**

*(h) The issuing authority shall include a continuing condition in the Certificate of Compliance for projects under 310 CMR 10.58(5)(f) or (g) prohibiting further alteration within the restoration or mitigation area, except as may be required to maintain the area in its restored or mitigated condition. Prior to requesting the issuance of the Certificate of Compliance, the applicant shall demonstrate the restoration or mitigation has been successfully completed for at least two growing seasons.*

**The City of Quincy accepts this provision and will prohibit further alteration within the restored Riverfront Area except for regular maintenance of the area to prevent degradation of the functions and values.**

---

**Wetland Impact Alternatives**

The evaluation of the alternatives includes a detailed assessment based on ten criteria discussed in Chapter 2. The evaluation of wetland impacts under each alternative is not necessary, as all options will impact environmental resource areas. The nine alternatives for relocation and the option to rebuild the brook in its current alignment will impact the same resource areas and result in an equivalent environmental impact. Although the no-build alternative will not physically alter the resource areas, water quality within the Brook is poor due to numerous illicit discharges which would remain under the existing conditions.

## PROPOSED WETLAND MITIGATION

Mitigation is proposed to account for the impacts to Bank, LUWW, RA, and fisheries (discussed in Chapter 4). Alteration to BLSF is proposed but the project does not propose any filling at this location and will in fact provide additional flood storage volume on an incremental basis as part of the construction of the open space adjacent to the proposed day-lit section of Town Brook. A summary of proposed mitigation for Bank, Land Under Water Bodies and Waterways, Bordering Land Subject to Flooding, and Riverfront Area is outlined below, with a more detailed discussion provided in Chapter 8. Figure 3.3 shows the proposed mitigation areas and details.

### Bank

The interests of the WPA applicable to Bank include flood control, prevention of storm damage, and protection of fisheries. As stated above, approximately 1,700 linear feet of the existing channel (which varies in width through the project area) will be decommissioned, therefore approximately 3,640 linear feet of Bank is proposed for relocation. The diverted flow will be directed through approximately 1,200 linear feet of closed and open channel sections, therefore approximately 3,000 linear feet of Bank will be created to compensate for the loss of the existing, degraded culvert under Option 1 of the preferred alternative. As part of this realignment, approximately 185 linear feet of the new open channel sections of culvert will be provided. Alternatively, approximately 2,660 square feet of Bank will be created under Option 2, with approximately 115 linear feet of new open channel sections of culvert. To provide additional flood control and compensate for the linear difference in channel length, the width of the brook has been expanded.

Additional mitigation measures include water quality improvements through the construction of rain gardens on the open space parcels for surface water runoff. The rain gardens will serve to filter stormwater prior to discharge into the Town Brook relocated culvert system. The relocation of the Town Brook will remove the existing illicit sanitary sewer connections that currently discharge into the culvert. The DVD of the video of Town Brook included in Appendix F demonstrates the numerous illicit connections. Another mitigation measure includes the commitment to prepare a Town Brook Watershed Master Plan for future developments in Quincy Center and the surrounding neighborhoods adjacent to Town Brook. Chapter 8 provides greater detail of specific mitigation design components.

### Land Under Water Bodies and Waterways

The interests of the WPA applicable to LUWW are similar to Bank and include flood control, prevention of storm damage, and protection of fisheries. As stated above, approximately 1,700 linear feet (and varying in width through the project area) of the existing channel will be decommissioned, therefore approximately 17,840 square feet of LUWW is proposed for the relocation. The diverted flow will be directed through approximately 1,200 linear feet of closed and open channel sections (approximately 11 feet wide), therefore approximately 15,190 square feet of LUWW will be created to compensate for the loss of the existing, degraded culvert under

Option 1 of the preferred design. Alternatively, under Option 2 approximately 14,350 square feet of LUWW will be created. To provide additional flood control and compensate for the linear difference in channel length, the width of the brook has been expanded to a uniform channel width of eleven feet wide.

The day-lighted portions of the relocated brook will provide fisheries habitat enhancements, create a culvert with a low flow trapezoidal channel (coordinated with the Division of Marine Fisheries Flow Restoration project), new spawning substrate within this low flow trapezoidal channel, spawning riffles, and smelt resting pools. Temperature mitigation via the planting of shade trees adjacent to open channel sections will also improve habitat. The substrate of the culvert in the day-lit sections will provide significant improvements to the resource area LUWW and more specifically, the fisheries habitat. Chapter 8 provides greater detail of specific mitigation design components.

**Bordering Land Subject to Flooding**

The Town Brook culvert conveys the 100-year flood (BLSF) and 500-year flood through the project area, with a small area of surface floodplain adjacent to the open channel section of the brook on parcel D91 (currently occupied by the American Legion) at the downstream end of the project area. Alteration to BLSF is proposed but the project does not propose any filling at this location and will in fact provide additional flood storage volume on an incremental basis as part of the construction of the open space adjacent to the proposed day-lit section of Town Brook. Approximately 4,850 square feet of the existing BLSF along the existing channel will be enhanced within the project area as result of construction activities under Option 1. Alternatively, Option 2 proposes to enhance approximately 4,275square feet of BLSF. The proposed culvert has been designed to provide additional hydraulic capacity for the conveyance of storm events. Chapter 5 details the Stormwater and Flood Control Study with technical criteria provided in Appendix B.

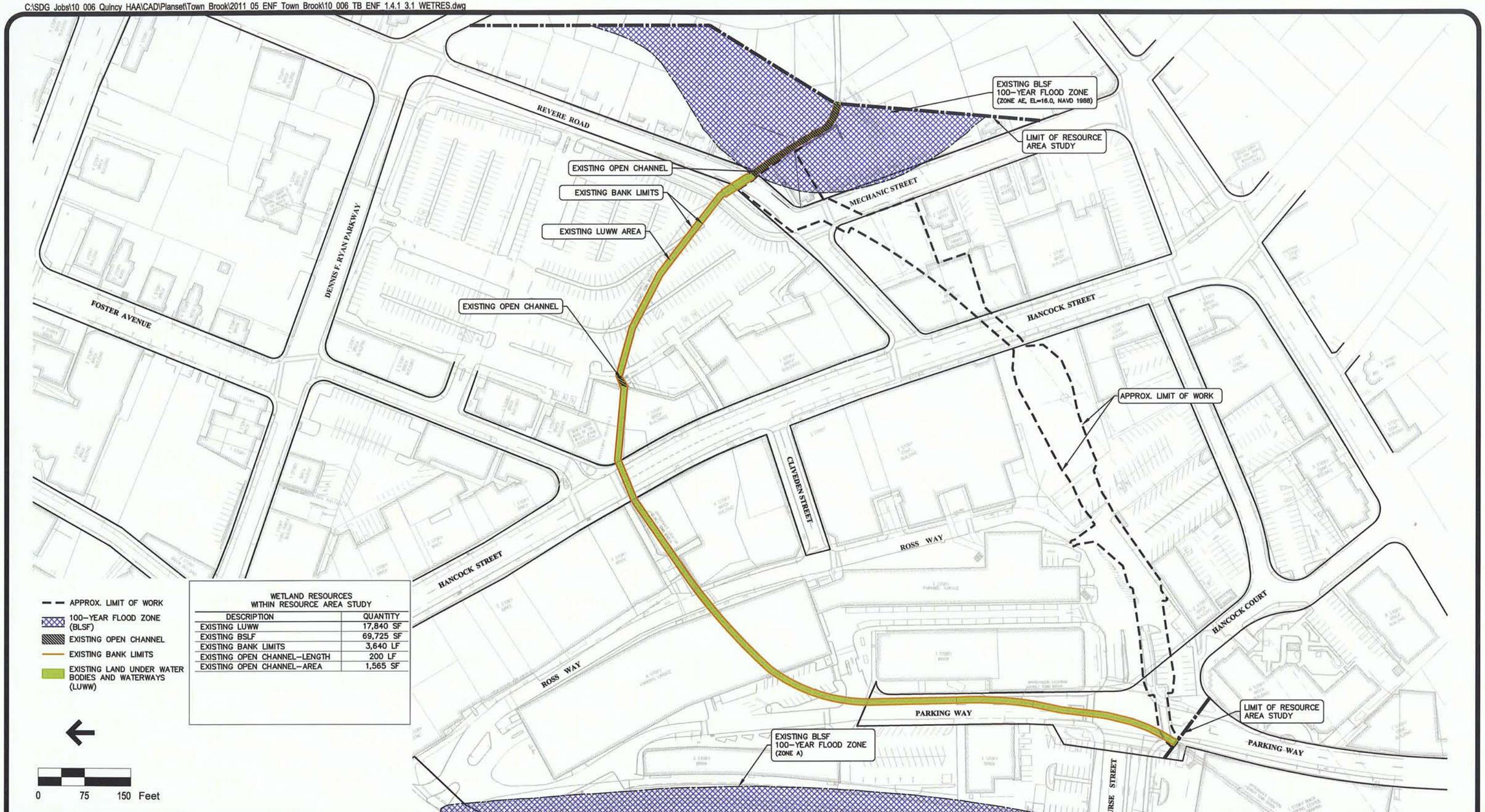
**Riverfront Area**

The mitigation measures discussed in the previous two sections are proposed to significantly restore the Riverfront Area in the new location. Overall, the area will be restored via fisheries habitat enhancements, the low flow trapezoidal channel, spawning substrate, spawning riffles, and smelt resting pools. In addition to these enhancements, new open space will be created adjacent to the open channel sections of the relocated brook, providing additional shade trees and landscaping.

## Habitat Enhancements – Wildlife & Fisheries

The fisheries habitat for rainbow smelt will be improved along the proposed sections of Town Brook planned for day-lighting. The habitat enhancements will include the low flow trapezoidal channel within the culvert, spawning substrate within this channel, spawning riffles, smelt resting pools, and temperature mitigation. The proposed wildlife and fisheries habitat enhancements have been detailed in Chapter 4, "Wildlife & Fisheries".

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 1.4.1 3.1 WETRES.dwg




WETLAND RESOURCES WITHIN RESOURCE AREA STUDY

| DESCRIPTION | QUANTITY |
|---|---|
| EXISTING LUWW | 17,840 SF |
| EXISTING BSLF | 69,725 SF |
| EXISTING BANK LIMITS | 3,640 LF |
| EXISTING OPEN CHANNEL–LENGTH | 200 LF |
| EXISTING OPEN CHANNEL–AREA | 1,565 SF |

NOTES:

1 WETLAND RESOURCE AREAS FIELD VERIFIED BY LUCAS ENVIRONMENTAL, LLC IN SEPTEMBER 2010.

2. 100-YEAR FLOOD PLAIN LIMITS (BLSF) AS DEPICTED ON THE FEMA FLOOD INSURANCE RATE MAPS 2552190019D, 2552190057D, 2552190076D, DATED MAY 16, 2006, NAVD 1988. OBTAINED FROM THE OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MassGIS). COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS. ZONE AE (EL. 16) LIMITS TO BE CONFIRMED WITH FIELD SURVEY.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

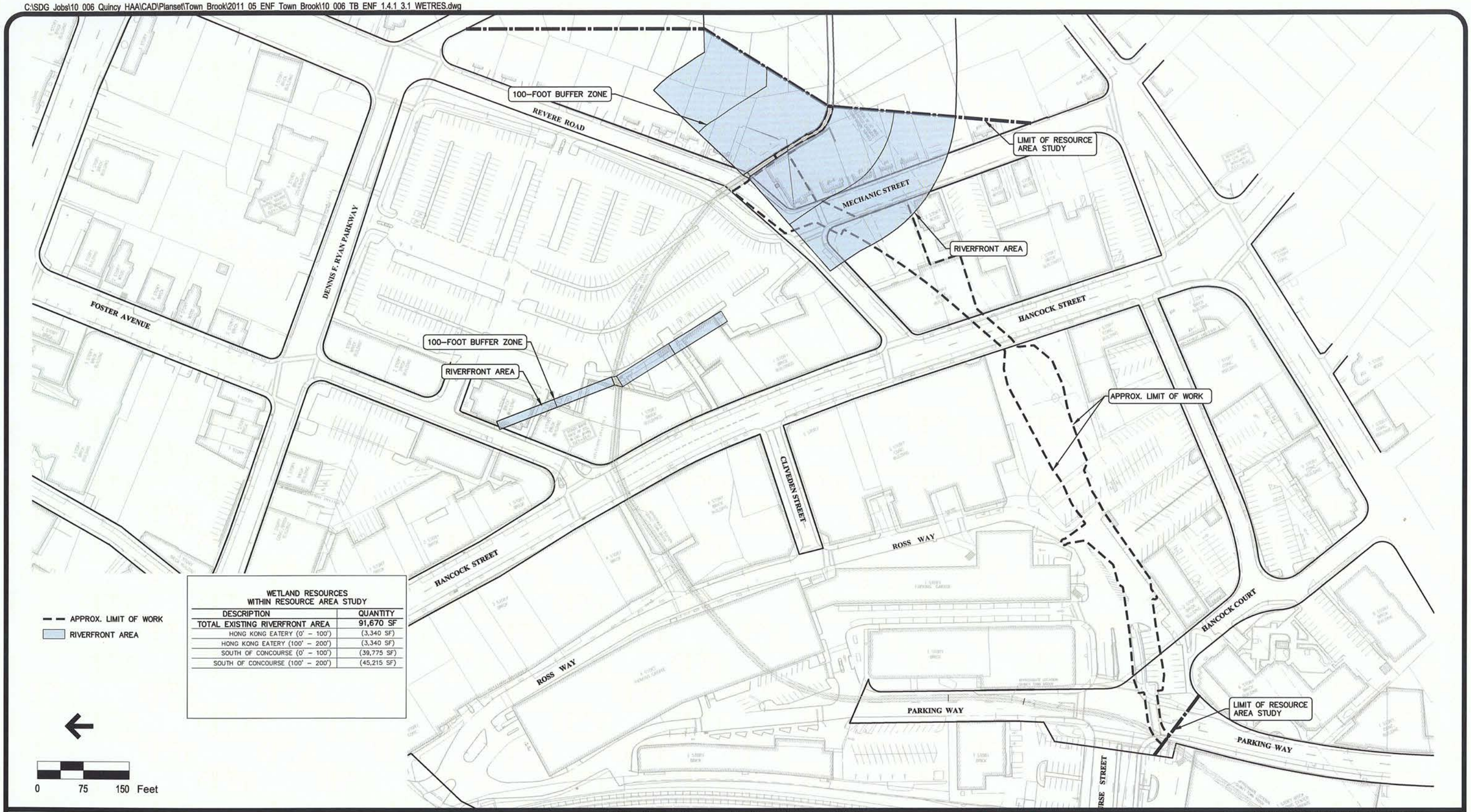
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 3.1.1 March 15, 2011

Existing Wetland Bank, LUWW, and BLSF Resource Areas
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 1.4.1 3.1 WETRES.dwg




WETLAND RESOURCES
WITHIN RESOURCE AREA STUDY

| DESCRIPTION | QUANTITY |
|---|---|
| TOTAL EXISTING RIVERFRONT AREA | 91,670 SF |
| HONG KONG EATERY (0' – 100') | (3,340 SF) |
| HONG KONG EATERY (100' – 200') | (3,340 SF) |
| SOUTH OF CONCOURSE (0' – 100') | (39,775 SF) |
| SOUTH OF CONCOURSE (100' – 200') | (45,215 SF) |

NOTES:

1 WETLAND RESOURCE AREAS FIELD VERIFIED BY LUCAS ENVIRONMENTAL IN SEPTEMBER 2010.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

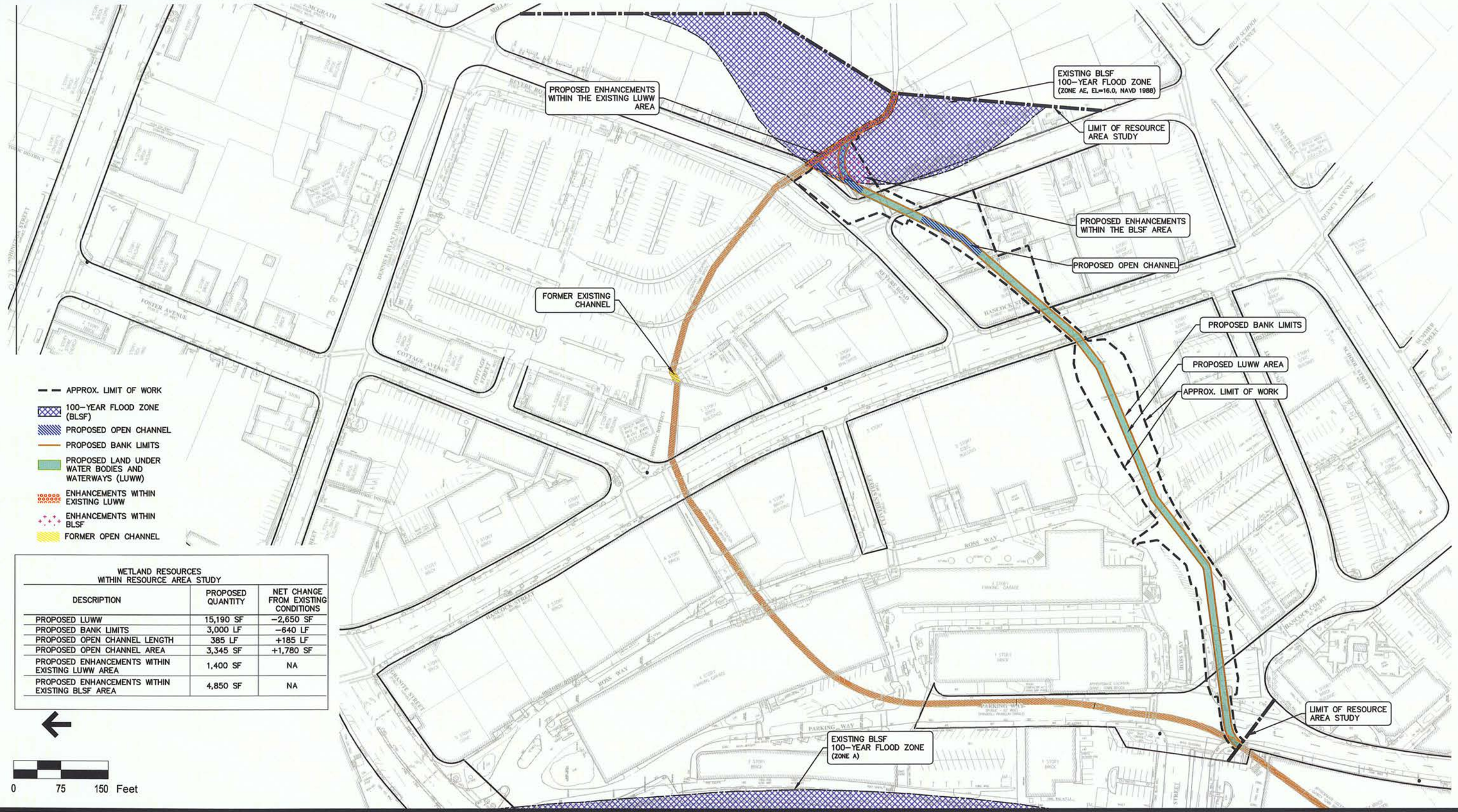
STEPHENSON DESIGN GROUP

Figure 3.1.2 March 15, 2011

Existing Riverfront Areas

Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 3.2.1 WETRES PR.dwg




WETLAND RESOURCES WITHIN RESOURCE AREA STUDY

| DESCRIPTION | PROPOSED QUANTITY | NET CHANGE FROM EXISTING CONDITIONS |
|---|---|---|
| PROPOSED LUWW | 15,190 SF | −2,650 SF |
| PROPOSED BANK LIMITS | 3,000 LF | −640 LF |
| PROPOSED OPEN CHANNEL LENGTH | 385 LF | +185 LF |
| PROPOSED OPEN CHANNEL AREA | 3,345 SF | +1,780 SF |
| PROPOSED ENHANCEMENTS WITHIN EXISTING LUWW AREA | 1,400 SF | NA |
| PROPOSED ENHANCEMENTS WITHIN EXISTING BLSF AREA | 4,850 SF | NA |

NOTES:

1. 100 YEAR FLOOD PLAIN LIMITS (BLSF) AS DEPICTED ON THE FEMA FLOOD INSURANCE RATE MAPS 2552190019D, 2552190057D, 2552190076D, DATED MAY 16, 2006, NAVD 1988. OBTAINED FROM THE OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MassGIS). COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS. ZONE AE (EL. 16) LIMITS TO BE CONFIRMED WITH FIELD SURVEY.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

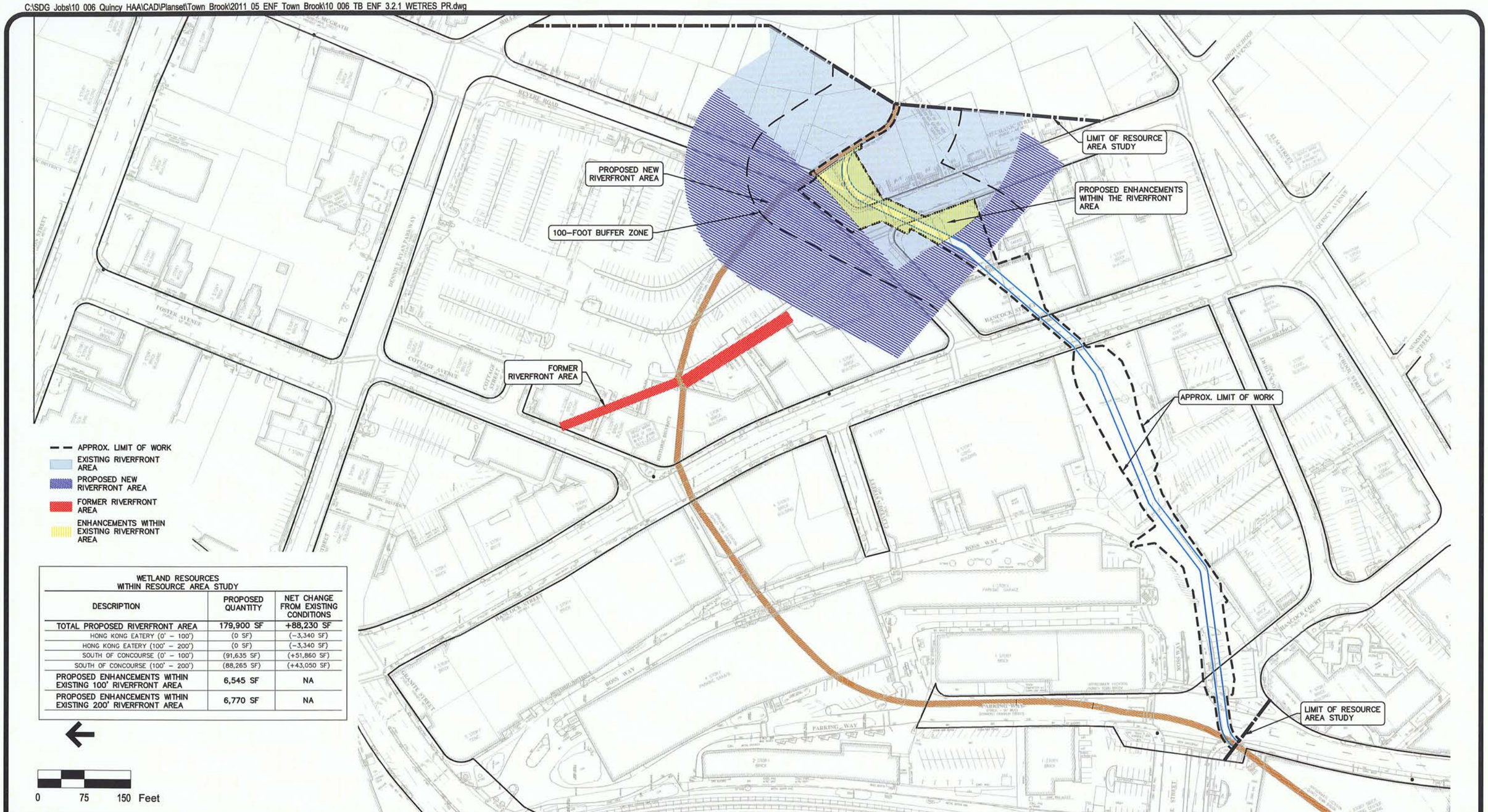
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 3.2.1 March 15, 2011

Proposed Wetland Bank, LUWW, and BLSF Mitigation - Option 1
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 3.2.1 WETRES PR.dwg




WETLAND RESOURCES WITHIN RESOURCE AREA STUDY

| DESCRIPTION | PROPOSED QUANTITY | NET CHANGE FROM EXISTING CONDITIONS |
|---|---|---|
| TOTAL PROPOSED RIVERFRONT AREA | 179,900 SF | +88,230 SF |
| HONG KONG EATERY (0' – 100') | (0 SF) | (–3,340 SF) |
| HONG KONG EATERY (100' – 200') | (0 SF) | (–3,340 SF) |
| SOUTH OF CONCOURSE (0' – 100') | (91,635 SF) | (+51,860 SF) |
| SOUTH OF CONCOURSE (100' – 200') | (88,265 SF) | (+43,050 SF) |
| PROPOSED ENHANCEMENTS WITHIN EXISTING 100' RIVERFRONT AREA | 6,545 SF | NA |
| PROPOSED ENHANCEMENTS WITHIN EXISTING 200' RIVERFRONT AREA | 6,770 SF | NA |

NOTES:

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

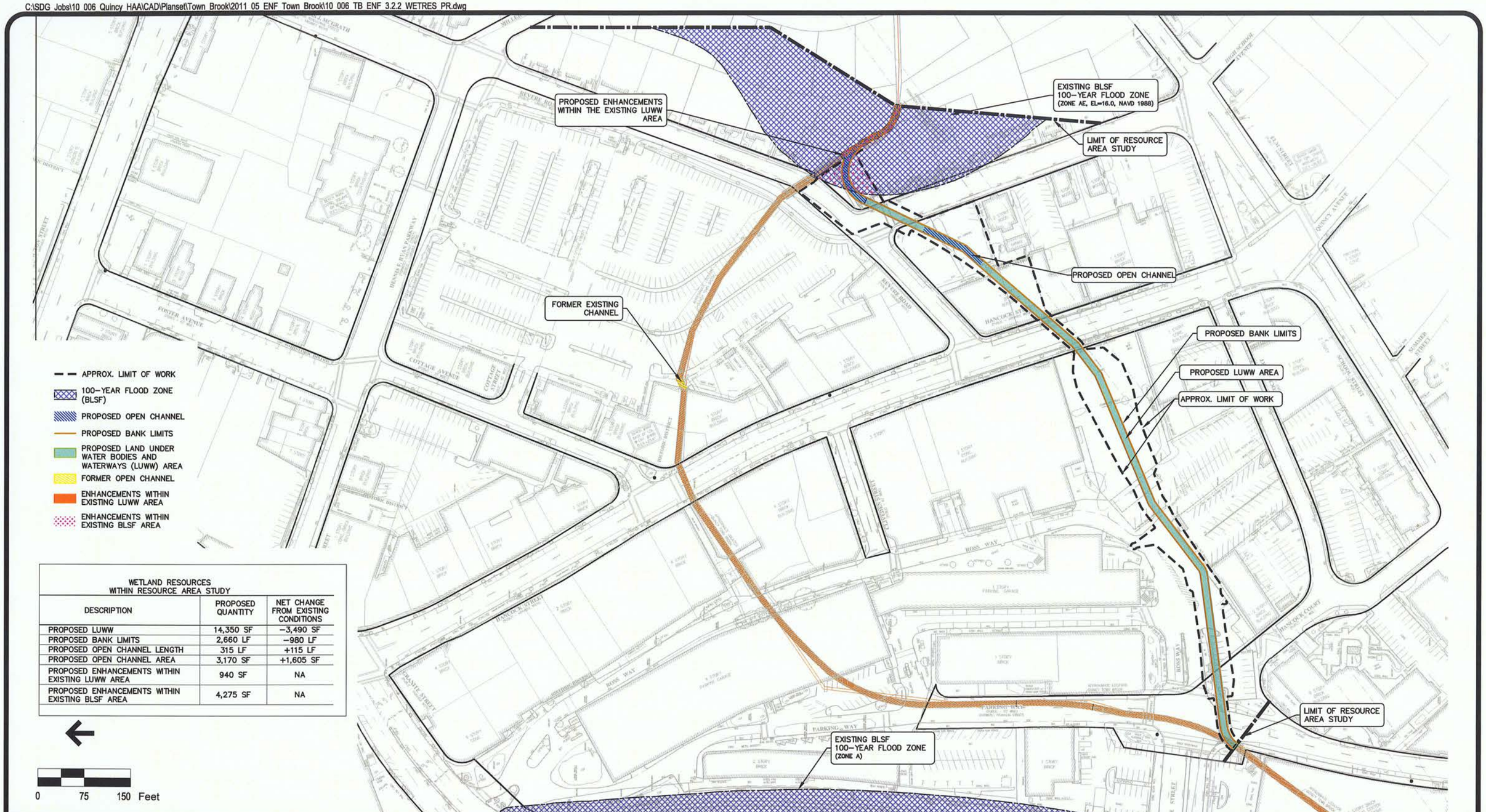
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 3.2.2 March 15, 2011

Proposed Riverfront Mitigation
Option 1
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 3.2.2 WETRES PR.dwg




WETLAND RESOURCES WITHIN RESOURCE AREA STUDY

| DESCRIPTION | PROPOSED QUANTITY | NET CHANGE FROM EXISTING CONDITIONS |
|---|---|---|
| PROPOSED LUWW | 14,350 SF | −3,490 SF |
| PROPOSED BANK LIMITS | 2,660 LF | −980 LF |
| PROPOSED OPEN CHANNEL LENGTH | 315 LF | +115 LF |
| PROPOSED OPEN CHANNEL AREA | 3,170 SF | +1,605 SF |
| PROPOSED ENHANCEMENTS WITHIN EXISTING LUWW AREA | 940 SF | NA |
| PROPOSED ENHANCEMENTS WITHIN EXISTING BLSF AREA | 4,275 SF | NA |

NOTES:

1. WETLAND RESOURCE AREAS FIELD VERIFIED BY LUCAS ENVIRONMENTAL, LLC IN SEPTEMBER 2010.
2. 100 YEAR FLOOD PLAIN LIMITS (BLSF) AS DEPICTED ON THE FEMA FLOOD INSURANCE RATE MAPS 2552190019D, 2552190057D, 2552190076D, DATED MAY 16, 2006, NAVD 1988. OBTAINED FROM THE OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MassGIS). COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS. ZONE AE (EL. 16) LIMITS TO BE CONFIRMED WITH FIELD SURVEY.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

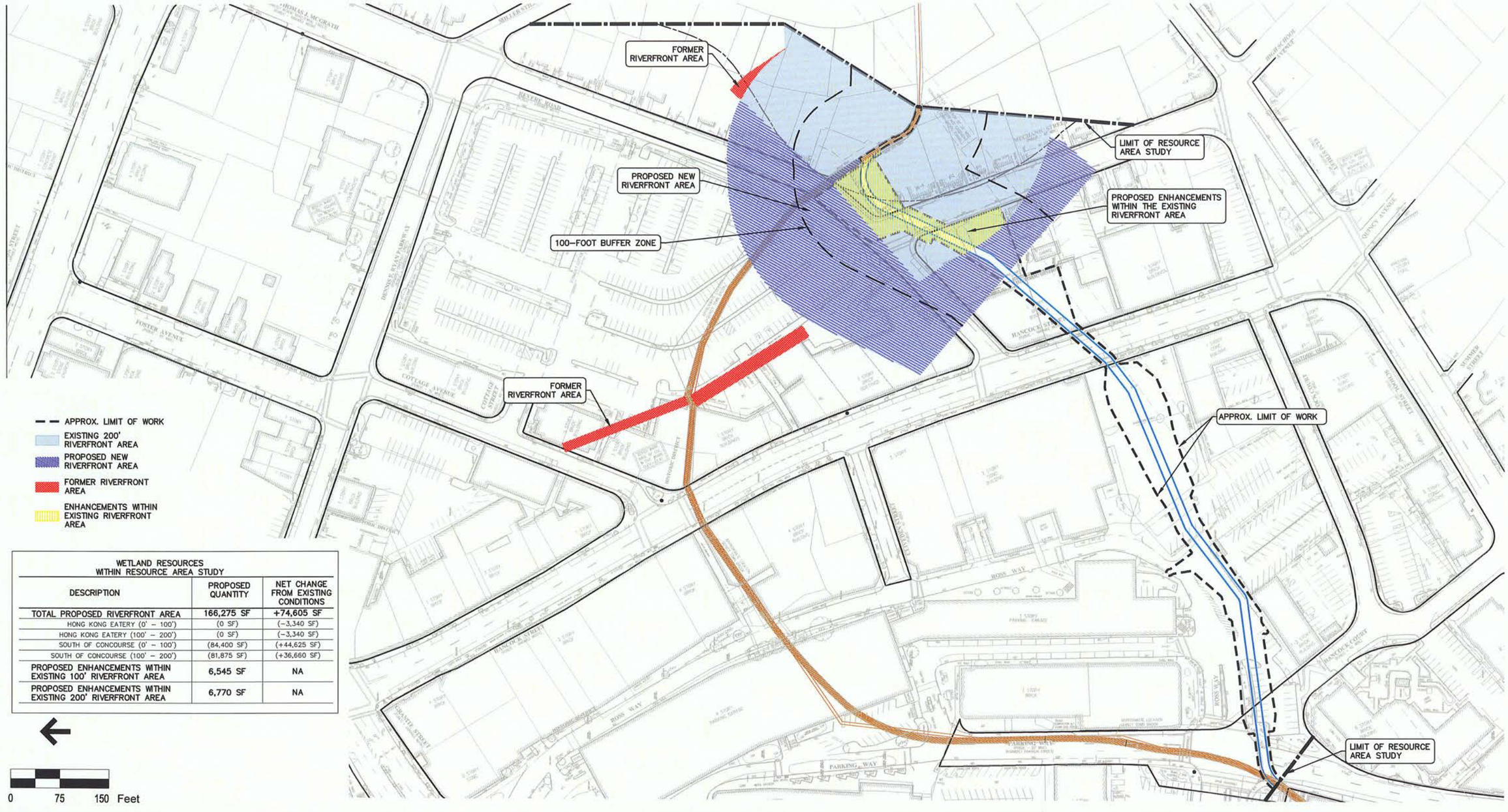
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 3.2.3 March 15, 2011

Proposed Wetland Bank, LUWW, and BLSF Mitigation - Option 2
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 3.2.2 WETRES PR.dwg




WETLAND RESOURCES WITHIN RESOURCE AREA STUDY

| DESCRIPTION | PROPOSED QUANTITY | NET CHANGE FROM EXISTING CONDITIONS |
|---|---|---|
| TOTAL PROPOSED RIVERFRONT AREA | 166,275 SF | +74,605 SF |
| HONG KONG EATERY (0' – 100') | (0 SF) | (–3,340 SF) |
| HONG KONG EATERY (100' – 200') | (0 SF) | (–3,340 SF) |
| SOUTH OF CONCOURSE (0' – 100') | (84,400 SF) | (+44,625 SF) |
| SOUTH OF CONCOURSE (100' – 200') | (81,875 SF) | (+36,660 SF) |
| PROPOSED ENHANCEMENTS WITHIN EXISTING 100' RIVERFRONT AREA | 6,545 SF | NA |
| PROPOSED ENHANCEMENTS WITHIN EXISTING 200' RIVERFRONT AREA | 6,770 SF | NA |

NOTES:

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

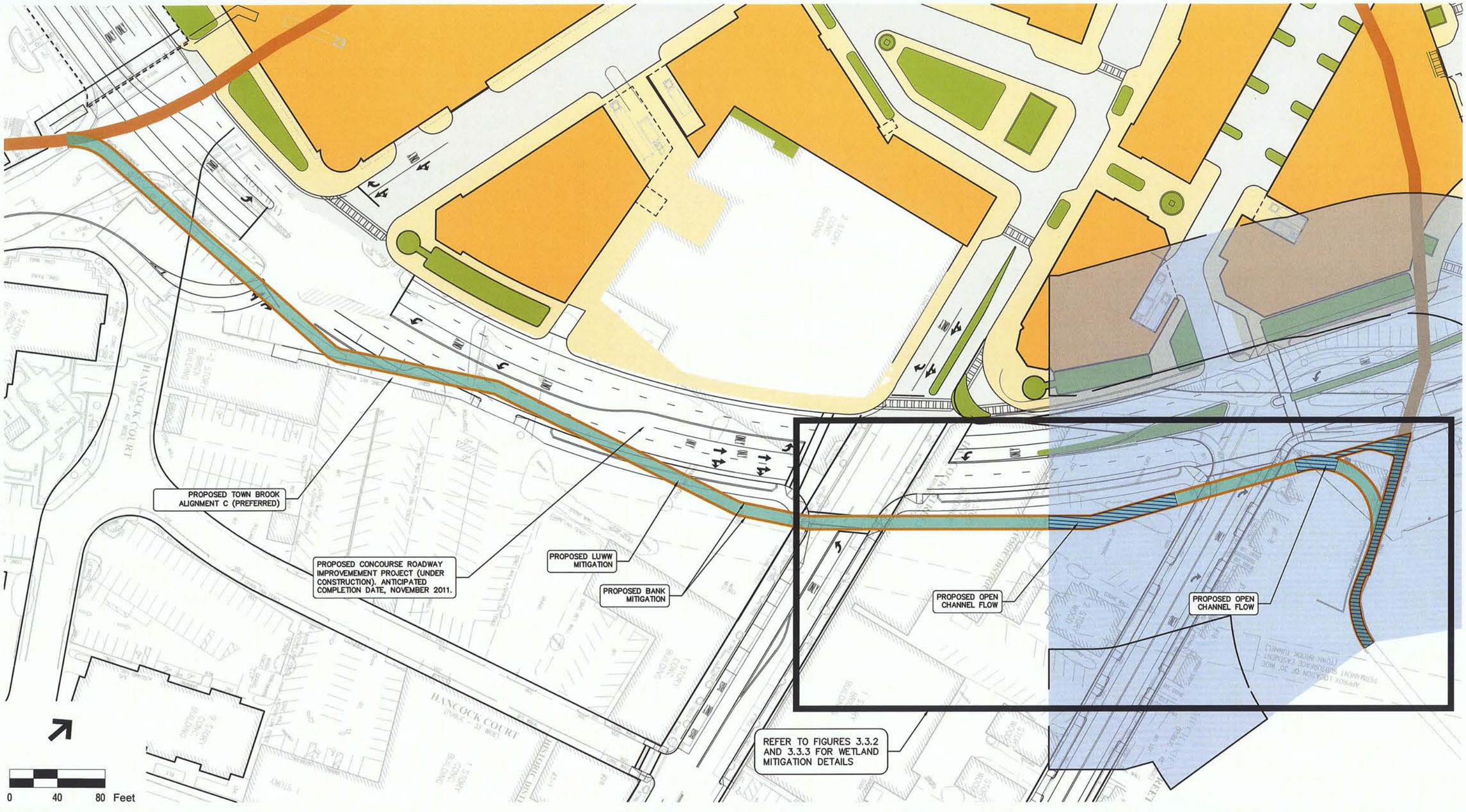
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 3.2.4 March 15, 2011

Proposed Riverfront Mitigation
Option 2
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 3.3 WET MIT PR.dwg




NOTES:

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

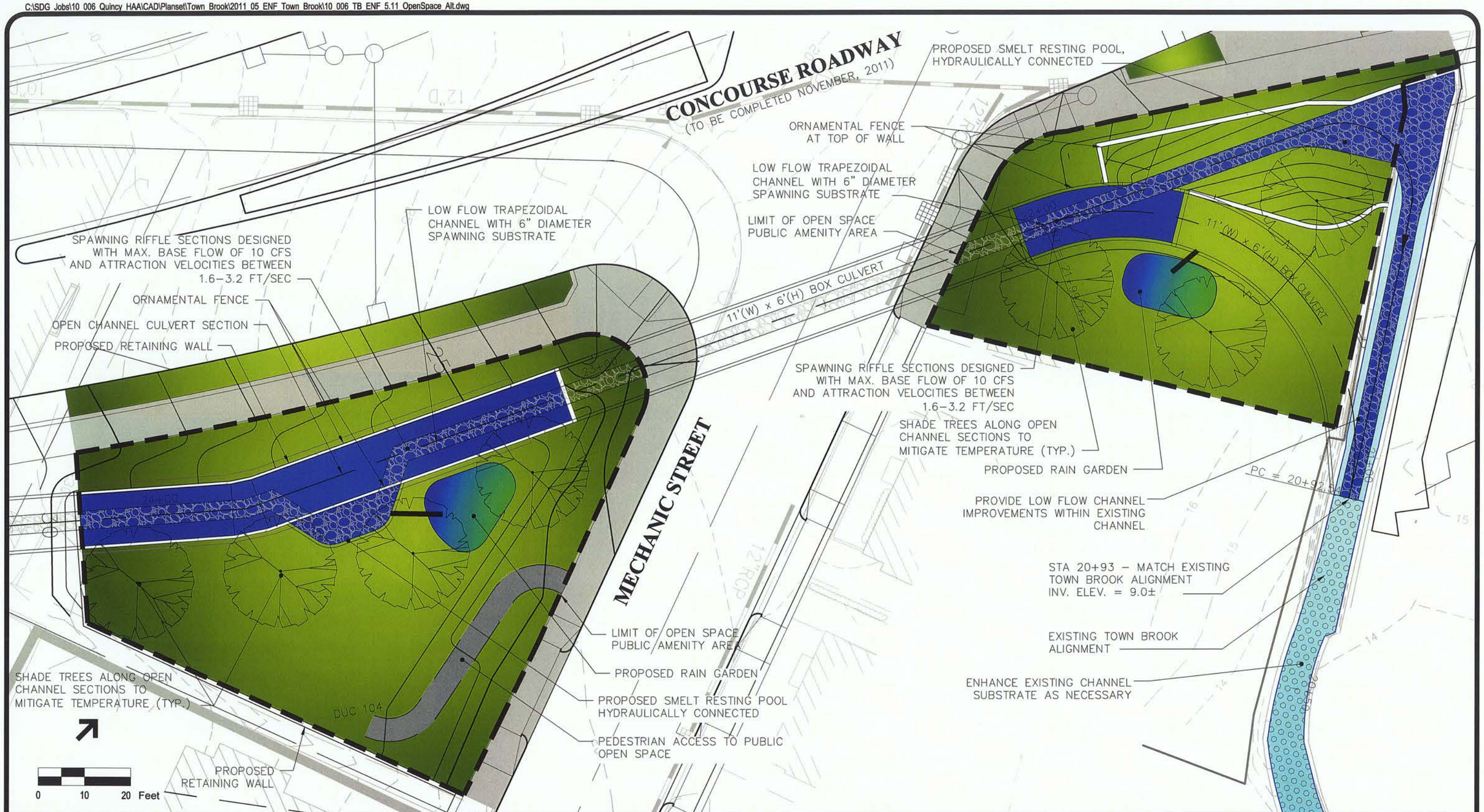
STEPHENSON DESIGN GROUP

Figure 3.3.1 March 15, 2011

Proposed Wetland Mitigation

Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 5.11 OpenSpace Alt.dwg




NOTES:

1. MAINTAIN DESIGN VELOCITY OF 1.6-3.2 FT/SEC ("ATTRACTION VELOCITY" WITHIN SPAWNING RIFFLE SECTIONS
2. DAY LIT CULVERT SECTIONS AND RESTING POOLS SHALL HAVE 6" DIAMETER STONE SUBSTRATE SECURED TO CULVERT BOTTOM
3. PROVIDE SHADE TREES ALONG DAY LIT SECTIONS OF CULVERT.
4. MAINTAIN FLOW DEPTH OF 6"-12" IN SPAWNING RIFFLES DURING LOW/ BASE FLOW

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 3.3.2 March 15, 2011

Proposed Wetland Mitigation Details
Option 1
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 5.11 OpenSpace.dwg

NOTES:

1. MAINTAIN DESIGN VELOCITY OF 1.6-3.2 FT/SEC ("ATTRACTION VELOCITY" WITHIN SPAWNING RIFFLE SECTIONS
2. DAY LIT CULVERT SECTIONS AND RESTING POOLS SHALL HAVE 6" DIAMETER STONE SUBSTRATE SECURED TO CULVERT BOTTOM
3. PROVIDE SHADE TREES ALONG DAY LIT SECTIONS OF CULVERT.
4. MAINTAIN FLOW DEPTH OF 6"-12" IN SPAWNING RIFFLES DURING LOW/ BASE FLOW

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 3.3.3 March 15, 2011

Proposed Wetland Mitigation Details
Option 2
Town Brook Enhancement Project
Quincy, Massachusetts

# CHAPTER 4
# WILDLIFE & FISHERIES

## INTRODUCTION

A key element to the Project is the enhancement of the rainbow smelt (*Osmerus mordax*) habitat and spawning areas. Rainbow smelt are an anadromous fish, which are fish that spend a majority of their life cycle in the ocean and migrate to fresh water to spawn. The area just downstream of the project site, south of Revere Road has been identified as a spawning area. This existing spawning area is comprised of an approximately three foot deep pool caused by the failure of the artificial channel bottom, resulting in a channel section with reverse slope ending in a depression. As part of the project, this habitat and spawning area will be expanded and enhanced by incorporating design criteria provided by the Massachusetts Division of Marine Fisheries and the National Marine Fisheries.

A review of the current Mass GIS data layer for the Massachusetts Natural Heritage Atlas (effective October 1, 2008) under the Natural Heritage and Endangered Species Program indicates that site is not located within Estimated Habitat for rare wildlife or Priority Habitat for rare species. No certified or potential vernal pools under the jurisdiction of the Wetlands Protection Act (310 CMR 10.00) or the Massachusetts Endangered Species Act (321 CMR 10.00) occur on or near the site as shown on Figure 4.1.

## EXISTING HABITAT – WILDLIFE & FISHERIES

The next two sections discuss the wildlife features and fisheries habitat present on and near the site, and compliance with the applicable standards.

### Wildlife

Section 310 CMR 10.60 of the WPA outlines the standards for wildlife habitat and the requirements for a wildlife habitat evaluation.

Section 310 CMR 10.60(1)(a) states that *to the extent that a proposed project on inland Banks, Land Under Water, Riverfront Area, or Land Subject to Flooding will alter vernal pool habitat or will alter other wildlife habitat beyond the thresholds permitted under 310 CMR 10.54(4)(a)5., 10.56(4)(a)4., 10.57(4)(a)3. and 10.58(4)(d)1., such alterations may be permitted only if they will have no adverse effects on wildlife habitat. Adverse effects on wildlife habitat mean the alteration of any habitat characteristic listed in 310 CMR 10.60(2), insofar as such alteration will, following two growing seasons of project completion and thereafter (or, if a project would eliminate trees, upon the maturity of replanted saplings) substantially reduce its capacity to provide the important wildlife habitat functions listed in 310 CMR 10.60(2).*

Wildlife habitat of the Bank, Land Under Water Bodies and Waterways, Bordering Land Subject to Flooding, Riverfront Area, and the 100-Foot Buffer Zone was examined to determine the quality and value of such areas. Due to the developed nature of the site, there is little wildlife habitat present within the Riverfront Area, Bordering Land Subject to Flooding and the 100-Foot Buffer Zone to resource areas. The Wildlife Habitat Evaluation per MassDEP guidelines is included in Appendix D. The forms were prepared by Lucas Environmental, LLC and meet the requirements of Section 310 CMR 10.60(1)(b).

---

**Fisheries**

**Banks of or Land Under the Ocean, Ponds, Streams, Rivers, Lakes, or Creeks that Underlie an Anadromous/Catadromous Fish Run ("Fish Run") – 310 CMR 10.35 WPA**

The Banks of and LUWW that underlie an Anadromous/Catadromous Fish Run are significant to the protection of marine fisheries. Anadromous and catadromous fish ("the fish") provide recreational, aesthetic and commercial benefits and are an important feature of freshwater, estuarine, and marine environments as well as a food source for other organisms. The spawning migrations of these fish also provide a direct link between the marine and freshwater systems.

Anadromous fish refer to fish that enter fresh water from the ocean to spawn, such as smelt, alewives, shad and salmon. Catadromous fish are fish that enter salt water from fresh water to spawn, such as eels. Under 310 CMR 10.35(2) of the WPA, Anadromous/Catadromous "Fish Run" are areas *within estuaries, ponds, streams, creeks, rivers, lakes or coastal waters, which is a spawning or feeding ground or passageway for anadromous or catadromous fish and which is identified by DMF or has been mapped on the Coastal Atlas of the Coastal Zone Management Program. Such fish runs shall include those areas which have historically served as fish runs and are either being restored or are planned to be restored at the time the Notice of Intent is filed.*

*For the purposes of 310 CMR 10.21 through 10.37, such fish runs shall extend inland no further than the inland boundary of the coastal zone.* However, the Department of Fish and Game (DFG) GIS Program working in conjunction with biologists from the Massachusetts Division of Marine Fisheries (DMF) and the Massachusetts Division of Fisheries and Wildlife compiled and automated a point coverage of anadromous fish data. This data includes all known coastal anadromous fish runs and spawning habitat. Based upon the MassGIS data, a fish run is identified to the limit of the open channel sections of Town Brook to Revere Road. Although this data layer should not be considered definitive in determining the presence or absence of fish runs and spawning habitat, discussions with the DMF and review of available documents has confirmed the presence of this fish run.

The issuing authority presumes that a Fish Run within Bank or LUWW is significant to the protection of marine fisheries. Under the WPA, *this presumption may be overcome only upon a clear showing that such bank or land does not play a role in the protection of marine fisheries, and if the issuing authority makes a written determination to that effect. If a Fish Run is significant to the protection of marine fisheries, the following factors are critical to the protection of such interest:*

*(a) the fish,*
*(b) accessibility of spawning areas,*
*(c) the volume or rate of the flow of water within spawning areas and migratory routes,*
*(d) spawning and nursery grounds.*

Town Brook contains a Fish Run known to support rainbow smelt (*Osmerus mordax*) and American eel (*Anguilla rostrata*). The Fish Run is located south of Revere Road outside the project area. It is possible (and likely) that some smelt will enter the Town Brook culvert, but the substrate is of poor quality for egg laying and providing food for this fishery.

**Smelt Life History & Study**

Rainbow smelt are anadromous fish that inhabit the Atlantic coast as far north as Newfoundland south to New Jersey. Smelt are a small fish that rarely exceed 25 cm in length and only live to five years of age. Smelt are fully mature and return to spawn by the age of two. This fishery is important to the local coastal food chains as they serve prey to a range of fish and other wildlife and are predators of zooplankton, fish, and small crustaceans. Smelt will mature in coastal waters and estuaries and enter freshwater streams and drainage areas in the spring to spawn. The smelt utilize the coastal rivers for spawning habitat in the spring as the temperatures are appropriate for egg survival and predation is less likely. It is believed smelt typically return to the river or stream they were born in. The spawning period begins in early March and lasts to mid-June, but many factors may affect the exact window (Ref. TB-027).

The fertilized eggs of smelt are negatively buoyant and usually adhere to the substrate and vegetation within the stream/river. Eggs are approximately one millimeter in diameter when laid and are transparent. The incubation period of the eggs is directly correlated to the water temperature. Warmer water reduces the incubation period. In Massachusetts, the smelt eggs typically hatch within 10 to 21 days of fertilization and deposition. Fish larvae are immediately transported downstream to the tidal zone upon hatching and begin feeding (Ref. TB-027).

Based on a large scale study conducted along the east coast, it appears that the smelt fishery in Massachusetts had a sharp decline over a ten year period beginning in the 1970's. Based upon this decline and reduced smelt catches, the Division of Marine Fisheries initiated a monitoring project to document the temporal, spatial, and biological characteristics of smelt spawning within the state, including Town Brook (Ref. TB-027).

The DMF released a report on rainbow smelt in December of 2006 documenting the decline and issues in Town Brook (Technical Report TR-30: Rainbow Smelt (*Osmerus mordax*) spawning habitat on the Gulf of Maine coast of Massachusetts). Smelt egg deposition was identified up to the limit of the open channel section south of the culvert opening at Revere Road in 1988. In 1989, a small amount of eggs were identified at the opening behind the Hong Kong Eatery in a year with a larger than usual fish spawning event. Based upon discussions with the DMF, this was the only year eggs were observed at that opening and it appears that the fish spawning now ends at the Revere Road culvert opening.

The study indicates that flows within the brook were greater prior to the Town Brook Flood Control Project completion. In addition to loss of flow from this project, certain aspects including the Route 3A culvert, channel improvements for the Town River marsh upstream of Route 3A, and the Deep Rock Relief Tunnel led to destruction of smelt spawning habitat.

The ability to increase flows in the Town Brook due to the increased storage capacity at the Old Quincy Reservoir is a good fail-safe to ensure adequate flows during spawning, however, additional work is needed. According to the study, "*the negative impacts have been seen since the tunnel was constructed in 1997 both in the form of acute affects on egg mortality from low water and the affects of sedimentation and periphyton growth on spawning substrate from chronic lower flows.*"

The Centre Street junction box was designed to divert flows from the Town Brook and inevitably into the Deep Rock Relief Tunnel. At this time, this structure is diverting flows below design specifications and impacting the low flow of Town Brook (Ref. TB-027). The Centre Street junction box and the Deep Rock Relief Tunnel intake are being analyzed at this time to determine the best course of action to restore flows to the Town Brook. A brief discussion of the current review of the Flow Restoration Project is included at the end of this chapter.

## PROJECT RELATED IMPACTS TO WILDLIFE & FISHERIES

### Wildlife

The wildlife characteristics important to the project for wildlife habitat within a resource area vary and are outlined in the WPA for Bank, LUWW, BLSF, and RA. The important features include, but are not limited to, food, shelter and migratory, breeding, and overwintering areas for wildlife (mammals, birds, reptiles, and amphibians). This may include turtle nesting areas, nesting sites for birds which typically reuse specific nesting sites and cavity trees, and unimpeded wildlife movement within the Riverfront Area.

Overall, due the developed nature of the site, primarily from structures and impervious surfaces, and that Town Brook now flows through a degraded culvert with illicit discharges, most of these characteristics are lacking, including the presence of wildlife. Fisheries habitat is located near the existing open channel section near Revere Road and is the focus of proposed enhancements.

The important characteristics for wildlife habitat under 310 CMR 10.60(2) follow (standard presented in italics, response in bold):

> *(a) Banks. The topography, soil structure, and plant community composition and structure of banks can provide the following important wildlife habitat functions:*
> *1. Food, shelter and migratory and breeding areas for wildlife*
> *2. Overwintering areas for mammals and reptiles.*
>
> **The Bank of Town Brook is located within a culvert and provides little to no value for wildlife. There is no natural substrate along the bottom of the brook and the plant community is lacking as only a small portion (approximately 16 linear feet) on parcel DU65 near the Hong Kong Eatery restaurant is currently open channel.**

*(b) Land Under Water Bodies or Waterways. The plant community and soil composition and structure, hydrologic regime, topography and water quality of land under water bodies or waterways can provide the following important wildlife habitat functions:*

*1. Food, shelter and breeding areas for wildlife;*
*2. Overwintering areas for mammals, reptiles and amphibians.*

**As noted above for Bank, the wildlife value is limited due to the brook being culverted through Quincy Center. In addition, there are numerous illicit discharges currently affecting the water quality of Town Brook.**

*(c) Vernal Pool Habitat...*

**Not applicable – vernal pool habitat is not located on the project site.**

*(d) Lower Floodplains. The hydrologic regime, plant community and soil composition and structure, topography, and proximity to water bodies and waterways of lower floodplains can provide the following important wildlife habitat functions:*

*1. Food, shelter, migratory and overwintering areas for wildlife;*
*2. Breeding areas for birds, mammals and reptiles.*

**As noted above, the wildlife value is limited due to the brook being culverted through Quincy Center. Bordering Land Subject to Flooding is located at the downstream connection point to the existing open channel section of Town Brook. Proposed grading alterations will result in the net increase of flood storage on an incremental basis, as the grade will be lowered at this location for the creation of approximately 5,500 square feet public open space. No temporary or permanent displacement of flood storage is proposed within the project area within BLSF. The hydrology regime is important to downstream areas of the proposed relocation of Town Brook to ensure no impacts will occur during storm events. Chapter 5 details the drainage and flood control aspects of the project, with technical data presented in Appendix B.**

*(e) Riverfront Area. The topography, soil structure, plant community composition and structure, and hydrologic regime can provide the following important wildlife habitat functions:*

*1. Food, shelter, overwintering and breeding areas for wildlife, including turtle nesting areas, nesting sites for birds which typically reuse specific nesting sites, cavity trees, and isolated depressions that function as vernal pools.*
*2. Migratory areas along the riparian corridor including the movement of wildlife unimpeded by barriers within the riverfront area.*

**As stated in Chapter 3, the Riverfront Area is previously degraded from the surrounding development and is almost completely impervious. Very little wildlife value is located on the project site within the Riverfront Area other than a small grass area and a few saplings near the Hong Kong Eatery restaurant on parcel DU65. The Riverfront Area along the existing open channel sections south of Revere Road are within developed areas consisting of**

**the American Legion and several residential homes, with limited green space. The banks of the channel contain some trees and minimal vegetation.**

The criteria for restoration/replication of altered wildlife habitat under 310 CMR 10.60(3) of the WPA follow (standard presented in italics, response in bold):

*Alterations of wildlife habitat characteristics beyond permissible thresholds may be restored onsite or replicated offsite in accordance with the following general conditions, and any additional conditions the issuing authority deems necessary to insure that the standard in 310 CMR 10.60(1)(a) is satisfied:*

**The implementation of wildlife habitat characteristics will be created in a new location within the proposed work areas.**

*(a) the surface of the replacement area to be created ("the replacement area") shall be equal to that of the area that will be lost ("the lost area");*

**Based upon the wildlife habitat evaluation, the "lost area" can be classified as non-existent as there is no value associated with the degraded and impervious areas of the project site. However, approximately 5,500 square feet of the area near the day-lighted sections of the relocated Town Brook will contain wildlife enhancements for the "replacement area". This will include the incorporation of a rain garden as a low impact development stormwater feature to collect and treat stormwater runoff from the open space area and discharge into the smelt resting pool and shade trees along the south side of the open channel sections to provide temperature mitigation to support smelt habitat.**

*(b) the elevation of groundwater relative to the surface of the replacement area shall be approximately equal to that of the lost area;*

**The Brook is culverted and therefore groundwater elevations will not be impacted.**

*(c) the replacement area shall be located within the same general area as the lost area. In the case of banks and land under water, the replacement area shall be located on the same water body or waterway if the latter has not been rechanneled or otherwise relocated. In the case of bordering land subject to flooding, the replacement area shall be located approximately the same distance from the water body or waterway as the lost area. In the case of vernal pool habitat, the replacement area shall be located in close proximity to the lost area;*

**The "replacement area" will be located on the same waterway, although it is being relocated from the existing location due to the constraints outlined in Chapter 2.**

*(d) interspersion and diversity of vegetation, water and other wildlife habitat characteristics of the replacement area, as well as its location relative to neighboring wildlife habitats, shall be similar to that of the lost areas, insofar as necessary to maintain the wildlife habitat functions of the lost area;*

**As the existing vegetation and wildlife habitat is practically non-existent, the "replacement area" has been created with measures to maintain new wildlife habitat functions and values which include landscaping, rain gardens, and riffling pools within the proposed open space parcels.**

*(e) the project shall not alter ten or more acres of Land Subject to Flooding or Land Under Water found to be significant to the protection of wildlife habitat, or 2,000 feet or more of Bank found to be significant to the protection of wildlife habitat (in the case of a bank of a stream or river, this shall be measured on each side of said stream or river).*

**The project will not alter BLSF, LUWW or Bank significant to the protection of wildlife habitat due to the disturbed and degraded nature of the project area. Although greater than 2,000 linear feet of Bank will be altered (approximately 3,640 linear feet), almost all of this area is located within an existing culvert and contains little to no wildlife value, including that to the fisheries.**

*(f) if the replacement area is located in an area subject to M.G.L. c. 131, § 40, there shall be no adverse effect on the existing important wildlife habitat functions of said area as measured by the standards of 310 CMR 10.60;*

**The "replacement area" is proposed primarily within upland locations not subject to the WPA under M.G.L. c. 131, § 40 and 310 CMR 10.00 or within densely developed Riverfront Area. The "replacement area" will be constructed adjacent to the proposed day-lit section of Town Brook south of Revere Road. The area proposed for replacement is the American Legion building parcel (D91) and is developed, therefore there are no impacts to existing important wildlife habitat functions and values.**

*(g) the "thresholds" established in 310 CMR 10.54(4)(a)5., 10.56(4)(a)4., 10.57(4)(a)3. And 10.58(4)(d)1.c. (below which alterations of resource areas are not deemed to impair capacity to provide important wildlife habitat functions) shall not apply to any replacement area; and*

**The project is in compliance with all applicable standards.**

*(h) the replacement area shall be provided in a manner which is consistent with all other General Performance Standards for each resource area in 310 CMR 10.51 through 10.60.*

**The "replacement area" has been designed in compliance with all other performance standards for each resource area.**

## Fisheries

### Banks of or Land Under the Ocean, Ponds, Streams, Rivers, Lakes, or Creeks that Underlie an Anadromous/Catadromous Fish Run ("Fish Run") – 310 CMR 10.35 WPA

Under the WPA, when Bank for LUWW *is determined to be significant to the protection of marine fisheries, 310 CMR 10.35(3) through (5) shall apply* (standard presented in italics, response in bold):

> *(3) Any project on such land or bank shall not have an adverse effect on the anadromous or catadromous fish run by:*
>
> *(a) impeding or obstructing the migration of the fish, unless DMF has determined that such impeding or obstructing is acceptable, pursuant to its authority under M.G.L. c. 130, § 19;*
>
> **The proposed relocation of Town Brook will not impede or obstruct the migration of the rainbow smelt and will in fact significantly improve conditions immediately upstream of Revere Road. Based on conversations with the Division of Marine Fisheries, most of the smelt population do not utilize Town Brook above the culverted sections near Revere Road. Smelt eggs were identified during one season at the Hong Kong Eatery open channel section prior to the construction of the Deep Rock Relief Tunnel.**
>
> *(b) changing the volume or rate of flow of water within the fish run; or*
>
> **The City is coordinating with the DMF and their flow restoration project at the Centre Street Junction Box and the Deep Rock Relief Tunnel intake area, which when implemented will increase base flow in the Brook and benefit the rainbow smelt population. The design of the culvert, substrate, and low flow channel is being coordinated with the DMF.**
>
> *(c) impairing the capacity of spawning or nursery habitats necessary to sustain the various life stages of the fish.*
>
> **The proposed project will improve and enhance the existing spawning habitat of the rainbow smelt populations within the project areas of Town Brook.**
>
> *(4) Unless otherwise allowed by DMF pursuant to M.G.L. c. 130, § 19, dredging, disposal of dredged material or filling in a fish run shall be prohibited between March 15th and June 15th in any year.*
>
> **The existing fish run will not be altered, dredged or filled. New and enhanced habitat will be created immediately upstream of the existing fish run. Construction and realignment of Town Brook will not occur between March 1st and June 15th.**

*(5) Notwithstanding the provisions of 310 CMR 10.35(3), no project may be permitted which will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species, as identified by procedures established under 310 CMR 10.37.*

**Not applicable – The site is not located in rare species habitat.**

---

## PROPOSED HABITAT ENHANCEMENTS

As part of the project a number of enhancements will be incorporated into the design which will benefit the habitat and spawning area of the rainbow smelt. The fisheries habitat will be improved along the proposed open channel sections of Town Brook and include the following enhancements:

- Low flow trapezoidal channel within the open channel sections of proposed culvert, with the channel design coordinated with the Massachusetts Division of Marine fisheries plans to increase low flow in the brook through proposed modifications to the Centre Street Junction Box and/or Deep Rock Relief Tunnel
- Spawning substrate within the low flow channel
- Spawning riffles and resting pools
- Temperature mitigation via shade trees along the banks (species and exact locations to be determined)

As part of the project the City of Quincy is proposing to implement the following water quality enhancements:

- Installation of rain gardens on the proposed public open space parcels to treat surface runoff
- Identification and removal of direct illicit sanitary sewer connections to the Brook within the project area.
- Develop a Town Brook Watershed Master Plan to address potential water quality improvements within the watershed through public works projects and development of water quality objectives for future projects

One resting pool is located west of Mechanic Street and south of the proposed channel and is hydraulically connected to the stream. A proposed rain garden will catch stormwater from the surrounding open space areas and filter it prior to discharge into the resting pool. A similar resting pool and rain garden system are proposed east of Mechanic Street and south of the proposed channel prior to the downstream connection point. The two resting pools consist of an area approximately 350 square feet in size.

The City of Quincy and the project team will continue to coordinate with the DMF/NMF and other appropriate agencies for the design of the resting pools, riffle pools, smelt spawning areas and substrate of the low flow channel.

## MASSACHUSETTS STREAM CROSSING GUIDELINES

The Massachusetts River and Stream Crossing Standards were developed by the River and Stream Continuity Partnership in conjunction with the University of Massachusetts – Amherst, the Nature Conservancy, the Massachusetts Division of Ecological Restoration – Riverways Program, and American Rivers. The document was originally published in August of 2004 and was revised in 2006 and again on March 1, 2011.

Although the Stream Crossing Standards are not regulations, they can be adopted through permitting and review of a project. The standards are specifically intended for new, permanent crossings such as highways, railways, roads, driveways, bike paths, etc., and for replacing existing permanent crossings when appropriate. The Town Brook Enhancement Project does not consist of a stream crossing, but the open channel sections and downstream connection point deserve a discussion in relation to the standards.

The Stream Crossing Standards have three primary goals, two of which are in unison with the goals of the Town Brook Enhancement Project. The three goals as stated in the Standards are identified in italics below, with a response in bold.

1. *Fish and other Aquatic Organism Passage: Facilitate movement for fish and other aquatic organisms, including relatively small, resident fish, semi-aquatic amphibians & reptiles, and large invertebrates (e.g. crayfish, mussels).*

   **One of the objectives of the enhancement of Town Brook is to facilitate movement of the rainbow smelt further upstream into the proposed day-lit sections. Resting pools and appropriate substrate will be created to allow the smelt to engage the area and hopefully spawn in the new sections of Town Brook. With approximately 185 linear feet proposed for day-lighting, there is the ample opportunity for other organisms to utilize the newly created substrate and open channel.**

2. *River/Stream Continuity: Maintain continuity of the aquatic and benthic elements of river and stream ecosystems, generally through maintenance of appropriate substrates and hydraulic characteristics (water depths, turbulence, velocities, and flow patterns). Maintenance of river and stream continuity is the most practical strategy for facilitating movement of small, benthic organisms as well as larger, but weak-swimming species such as salamanders and crayfish.*

   **The relocation of the brook has been analyzed with specific focus on the downstream connection point to ensure the new channel provides adequate smelt habitat. The goal is to prevent the smelt from entering the existing Town Brook culvert as it will function solely as a stormwater conveyance upon the**

**new culvert being brought on-line. The substrate will be designed for seamless transition to the new open channel sections.**

3. *Wildlife Passage: Facilitate movement of wildlife species including those primarily associated with river and stream ecosystems and others that may utilize riparian areas as movement corridors. Some species of wildlife such as muskrats and stream salamanders may benefit from river and stream continuity. Other species may require more open structures as well as dry passage along the banks or within the streambed at low flow.*

**Although the opportunity to provide wildlife habitat is limited due to the development of the neighborhood, two large open space areas are proposed immediately adjacent to the day-lit sections of the relocated brook on either side of Mechanic Street. These areas will provide bank shade trees and other landscaping features that will provide food and shelter for bird species and small mammals. The reduction of impervious surface is also a benefit to the area.**

A few points to consider in this section are that the Standards were not prepared to address certain issues and situations. They are not intended for constructed drainage systems designed primarily for the conveyance of stormwater. The existing culverted section of Town Brook serves as a stormwater conveyance structure for flood control and storm damage prevention.

One of the purposes of the standards is to prevent barrier effects of crossings on populations of fish and wildlife, which coincides with the goal of the Town Brook enhancements to day-light a section of the brook at the practical limit of the existing fish run. *Appropriate engineering is required to ensure that structures are sized and designed to provide adequate capacity (to pass various flood flows) and stability (bed, bed forms, footings and abutments).* The standards were developed with the goal of facilitating fish and wildlife movement and restoration of stream and river continuity. They are not necessarily sufficient to address drainage or flood control issues that need to be considered during design and permitting of a project, as has been documented in this ENF.

The standards suggested for new structures at sites where no previous crossing structure existed are addressed below for the general standards. The optimal standards are similar to the general requirements, but to a more strict design. As this project is not a traditional "stream crossing" the discussion related to the general standards is sufficient. The general standard is identified in italics, with a discussion following in bold.

*1. Spans that preserve the natural stream channel are strongly preferred.*

**This standard does not apply to this project, although day-lighting options have been examined to the extent feasible for the preferred alternative.**

*2. If a culvert, then it should be embedded:*
*- a minimum of 2 feet for all culverts,*
*- a minimum of 2 feet and at least 25 percent for round pipe culverts*

*- When embedment material includes elements > 15 inches in diameter, embedment depths should be at least twice the D84 (particle width larger than 84 % of particles) of the embedment material.*

**The relocated channel will flow through a culvert embedded below the surface a minimum of two feet. The day-lit section will contain the culvert embedded to a minimum depth of six feet.**

*3. Spans channel width (a minimum of 1.2 times the bankfull width).*

**Not applicable.**

*4. Natural bottom substrate within the structure.*

**A natural bottom substrate is not appropriate for the relocation of the Town Brook as its primary purpose is a flood and stormwater conveyance structure. A natural substrate could erode and cause issues in the future if used for this conveyance. However, as the project abuts the smelt fish run, the substrate at the downstream connection point at the American Legion will be designed to provide spawning habitat and be suitable for egg deposition within the low flow channel. This meets the intent of this standard and improves the substrate conditions.**

*5. Designed with appropriate bed forms and streambed characteristics so that water depths and velocities are comparable to those found in the natural channel at a variety of flows.*

**The project has been designed so the water depths and velocities are comparable to those found in the natural channel. The Massachusetts Division of Marine Fisheries is currently seeking to restore previous flows to Town Brook to ensure the success of rainbow smelt during the spawning season. The project team will continue to coordinate with the DMF.**

*6. Openness> 0.82 feet (0.25 meters).*

**This standard cannot be met with this project due to the length of culvert involved and the constraints of the downtown Quincy Center.**

*7. Banks should be present on each side of the stream matching the horizontal profile of the existing stream and banks.*

**This standard is difficult to address as the primary purpose of the culvert is flood conveyance and storm damage protection. There are limitations on the area to create a gradual slope and the day-lit sections will consist of an open culvert.**

Before replacing a culvert with another structure it is essential that the replacement be evaluated for its impacts to downstream flooding, upstream and downstream habitat, potential for erosion and head cutting, and stream stability. The flooding impacts, erosion potential, and stream stability have been examined and detailed in Chapter 5. The upstream and downstream habitat is limited due to the culverted (open or closed) nature of Town Brook.

Further compliance with the Stream Crossing Standards is discussed below, in regards to "applying the standards".

*1. Replacement culverts should meet the design guidelines for either general standards or optimal standards (see Standards for New Crossings above) unless:*

- *Doing so would result in significant stream instability that can't otherwise be mitigated.*

**The evaluation for the enhancement and relocation of Town Brook has been thoroughly vetted and will undergo significant review by the applicable local, state, and federal authorities. As such, the proposed design has been created to prevent stream instability with the habitat enhancements.**

- *Meeting the standards would create a flooding hazard that can't otherwise be mitigated.*

**See response above.**

- *Site constraints make it impossible to meet the standards.*

**There are numerous constraints to the relocation of Town Brook as outlined in Chapter 2, "Alternatives Analysis", including the preferred alternative. As such, complying with all the applicable general standards is difficult and the project has sought to meet the "intent" of the Stream Crossing Standards.**

*2. If it is not possible to meet all of the applicable standards, replacement crossings should be designed to avoid or mitigate the following problems.*

→ *Inlet drops*
→ *Outlet drops*
→ *Flow contraction that produces significant turbulence*
→ *Tailwater armoring*
→ *Tailwater scour pools*
→ *Physical barriers to fish and wildlife passage*

**Chapter 5 details the drainage and flood control for the project.**

*3. If it is not possible to meet all of the applicable standards avoid Smooth High Density Polyethylene Pipes (HDPP) or other pipes with a Mannings n equal or less than 0.010.*

**The relocated channel will be constructed with reinforced concrete with a Mannings roughness coefficient, "n" equal to 0.013.**

*4. As indicated by long profiles, scour analyses and other methods, design the structure and include appropriate grade controls to ensure that the replacement will not destabilize the river/stream.*

**Chapter 5, "Stormwater and Flood Control" and Appendix B, "Hydrology and Hydraulics" detail the appropriate grade controls ensuring that the relocation of Town Brook will not destabilize the stream.**

*5. To the extent practicable conduct stream restoration upstream and/or downstream of the structure as needed to restore river/stream continuity and eliminate barriers to aquatic organism movement.*

**There is limited space downstream of the site to improve conditions and the upstream location does not provide smelt fisheries habitat due to the length of the culvert. The fisheries enhancements are proposed at the downstream location near the practical upper limit of the fish run.**

---

## RELATED PROJECTS

The Massachusetts Division of Marine Fisheries is currently undertaking a study to review modifications to the Centre Street Junction Box and Deep Rock Relief Tunnel intake area in order to increase low base flow in Town Brook to improve the habitat and spawning areas of the rainbow smelt. The City has an ongoing dialogue with both the Massachusetts Division of Marine Fisheries and the National Marine Fisheries and will incorporate these agencies input and the findings of the report into the final design of this Project.

### Flow Restoration in Town Brook

The Massachusetts Division of Marine Fisheries is currently seeking to restore previous flows to Town Brook to ensure the success of rainbow smelt during the spawning season. At this time, the DMF has authorized a feasibility study to determine options to restore flow to Town Brook. Gomez & Sullivan has prepared the "Preliminary Design of Flow Restoration in Town Brook" report dated February 2011 to evaluate potential alternatives. A final report is anticipated shortly and will be reviewed when available.

At this time, four possible alternatives have been evaluated and include the following:

1. Alternative 1 – Deep Rock Relief Tunnel Intake Area Gravity Option
2. Alternative 2 – Deep Rock Relief Tunnel Intake Area Pump Option
3. Alternative 3 – Centre street Junction Structure Gravity Option
4. Alternative 4 – Centre street Junction Structure Pump Option

The Technical Report (TR-30) prepared by the DMF recommends several options to restore smelt populations and habitat. The recommendations are as follows:

1. **Remediation Work Plan.** *Following the 1998 egg mortality event, Secretary of the EOEA requested that the ACOE's Lt. Colonel for the New England District develop a work plan with other agencies to remediate the flood control project impacts on the Town Brook smelt run. This effort has not been completed. It is recommended that the remediation plan be developed.*

2. **Sedimentation Maintenance.** *The accumulation of debris and sediment at the Centre Street junction structure had a major role in the smelt egg mortality event in 1998. Responsibility for maintaining sediment basins has been passed from the ACOE to MDC to the city of Quincy and is documented in the O&M plan. It is essential that sediment and debris are removed from Centre Street junction structures, the Rt. 93 sediment basin and the tunnel inlet basin each year prior to the spring smelt spawning season. Consideration should also be given to an in-stream sump downstream of the Centre Street Junction Box to capture sediment loads and facilitate cleaning.*

3. **Chronic Low Discharge.** *The USGS gauge station has documented depressed Town Brook discharges during the smelt spawning season since the deep rock tunnel became operational in 1998. This chronic condition is having a negative impact on the quality of smelt spawning habitat and the survival of smelt eggs. Two identified sources of lower flows were the reconstruction of Quincy Reservoir and diversions at the Centre Street junction structure. With the completion of the Quincy Reservoir in 2002, there may be more stability to spring flows and augmentation is now possible. However, the long-term solution is to recapture flow losses that are diverted at the Centre Street junction and run through the Burgin Parkway conduit into the tunnel. Routine annual maintenance of this structure is part of the solution. It is also recommended that the ACOE evaluate and correct dry weather diversions by using their program authorities for project modifications.*

4. **Stream Discharge Data.** *The USGS stream discharge station has provided useful data that improved our understanding of hydrological dynamics between Town Brook and the flood control project. It is recommended that this valuable data series (1973 to present) be continued. It is also recommended that analyses are conducted relating the operation of the flood control project to Town Brook discharges with consideration for precipitation.*

5. **Minimum Flow Requirements.** *The original flood control project did not contain requirements for sustaining minimum stream flows during the smelt spawning season. The Bigelow Street channel modification component (permitted but not constructed) does include requirements for maintaining stream flows during the spawning period. Project permits (ACOE 1998; and MDEP 1998) requires a monthly mean flow of 8 cfs, and a daily minimum of 4 cfs during March-May. It is recommended that future efforts to remediate the present impacts in Town Brook revisit the issue of minimum flows and provide updated criteria. The evaluation of existing DEP requirements, USGS stream gauge data and discharge records for the Old Quincy Reservoir can assist this process.*

6. **Revere Road Brook Substrate Modification.** *It is recommended that a spawning habitat restoration project be conducted along the Revere Road streambed. The flow regime at this location is suitable for smelt attraction but the elevation rise and smooth cement channel floor are not optimal for egg survival. Better egg survival could be achieved by removing the cement floor and replacing it with large cracked stone and reducing the stream elevation to prevent egg crowding.*

The City of Quincy and the project team will continue to coordinate with the Division of Marine Fisheries and the National Marine Fisheries related to the flow restoration options for Town Brook and ensure the Town Brook Enhancement Project will designed to accommodate those options.

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 4.1 NHESP.dwg

NOTES:
AERIAL PHOTOS AND NATURAL HERITAGE ENDANGERED SPECIES MAPPING FROM THE OFFICE OF GEOGRAPHIC INFORMATION (MassGIS). COMMONWEALTH OF MASSACHUSETTS INFORMATION TECHNOLOGY DIVISION.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 4.1 March 15, 2011

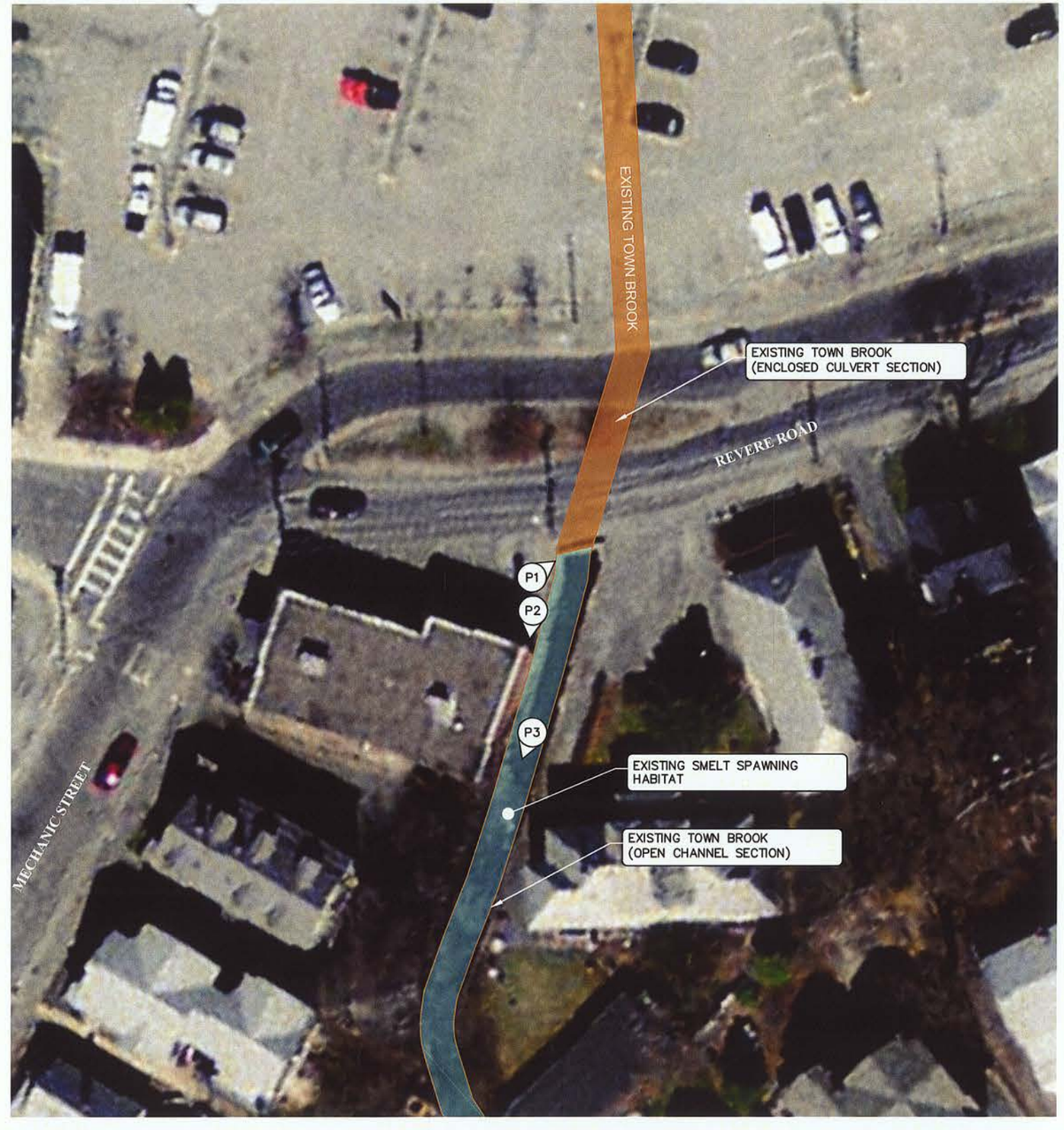
Natural Heritage and Endangered Species Map
Town Brook Enhancement Project
Quincy, Massachusetts

EXISTING SMELT SPAWNING HABITAT PICTURES

KEY EXISTING HABITAT FEATURES:

1 THE EXISTING SMELT SPAWNING HABITAT AREA CONSISTS OF A DEGRADED STREAM CHANNEL.

2. EXISTING STREAM SUBSTRATE IS NOT IDEAL FOR SMELT SPAWNING ACTIVITIES.




0 20 40 Feet

NOTES:

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 4.2 March 15, 2011

Existing Habitat Area

Town Brook Enhancement Project
Quincy, Massachusetts

# CHAPTER 5

# STORMWATER AND FLOOD CONTROL

## INTRODUCTION

This Chapter provides a detailed analysis of the stormwater and flood control as it relates to the Town Brook Enhancement Project (the Project). The Project proposes to re-align the existing Town Brook along the south side of the Concourse Roadway Improvement project, which is currently under construction. Figure 5.4.1 depicts the existing Town Brook culvert alignment. Figure 5.5 depicts the project location and proposed preferred alignment. Photographs of the existing Town Brook within the project area are shown in Figures 1.3.1 - 1.3.5

When completed, the Project will provide significant hydraulic and environmental benefits to Town Brook and represents one of the first steps in the City of Quincy's (the City) commitment to the revitalization of Quincy Center in an environmentally sensible and responsible manner.

## EXISTING TOWN BROOK ALIGNMENT

Town Brook (the Brook) is a perennial stream which originates in Braintree, approximately 2.2 miles upstream of the project area at the Old Quincy Reservoir and discharges into Town River Bay, approximately 0.7 miles downstream of the project area. A vast majority of the Brook in Quincy is conveyed in artificial channels that alternate between open channel and enclosed segments of culverts of varying materials and dimensions. Many flow control structures have been incorporated in the Brook to alleviate flooding impacts. Refer to Figure 5.1 for an overview of the Town Brook Watershed Drainage Features.

Beginning at the Old Quincy Reservoir, the Brook flows through a residential neighborhood in a north-easterly direction for approximately 0.7 miles prior to crossing Route 3 in Braintree. The Brook continues across Route 3 in a culvert and continues in a northerly direction in a combination of open channel and enclosed culverts, where it crosses into Quincy and enters the Centre Street Junction Structure at the intersection of Crown Colony Drive and Centre Street.

The Centre Street Junction Structure is a flow diversion structure designed to divert peak flows from the Town Brook channel to the Centre Street channel and thereby reduce downstream flooding within the Town Brook watershed. At the Centre Street Junction Structure, flow enters from two 48-inch diameter culverts and flows across a steel trough weir, where excess flows above the designed capacity overflow into the Centre Street Culvert below. The Centre Street Culvert continues to the north as the Burgin Parkway Culvert along the Burgin Parkway Alignment.

Design flows that are not diverted to the Centre Street culvert, continue in Town Brook in an enclosed culvert across Centre Street and day-light as an open channel for approximately 800

feet prior to entering an enclosed culvert and generally continuing along the Brook Road alignment for approximately 0.7 miles to the Deep Rock Tunnel (the Tunnel) intake.

The Deep Rock Tunnel project was designed by the Army Corps of Engineers with construction completed in 1997 to divert peak storm event flows from Town Brook, thereby reducing flooding to downstream properties historically prone to flooding. The Tunnel is a 12-foot diameter concrete lined tunnel in bedrock, approximately 140 to 180 feet below ground that spans approximately 4,060 feet from the Tunnel intake at School Street, approximately 700-feet upstream of the project area, to the Tunnel outlet at Town River Bay. Flows from Town Brook enter a diversion structure at the Deep Rock Tunnel Intake, which diverts excess storm event flows from Town Brook to the Deep Rock Tunnel, bypassing downstream areas of Quincy historically prone to flooding. Refer to Figure 5.8 for the Tunnel Intake Plans. The previously diverted flow in the Burgin Parkway Culvert enters the Tunnel Intake structure from the south and is conveyed in its entirety to the Deep Rock Tunnel. Flow in Town Brook not diverted to the Tunnel continues across Burgin Parkway and the MBTA railway tracks via an enclosed culvert system prior to entering the Project Area.

Town Brook within the project area consists of approximately 1,700 linear feet of culverted channel, which is completely enclosed with the exception of a 16 linear foot open channel segment at the rear of Parcel DU 65 (the Hong Kong Eatery) adjacent to the existing City of Quincy Hancock surface parking lot. The existing culvert within the project limits varies widely in size, shape, material and structural integrity, with 11 different segments of culvert identified within the project area. Table 5.1 below summarizes each segment of the existing Town Brook alignment within the project area. Refer to Figures 5.4.1 and 5.4.2 for a depiction of the existing culvert segments and alignment.

**Table 5.1**
**Existing Town Brook Segments**

| Segment | From Station (ft) | To Station (ft) | Height (ft) | Width (ft) | Slope | Capacity[1] Q (cfs) | Material & Shape |
|---|---|---|---|---|---|---|---|
| 1 | 10+00 | 11+84 | 6.5 | 7.9 | 1.10% | 785 | Granite & Concrete Sidewalls with Variable Material Channel Bottom |
| 2 | 11+84 | 12+39 | 4.25 | 12.5 | 0.20% | 318 | Twin 6'-3" W x 4'-3" H Concrete Box Culverts |
| 3 | 12+39 | 15+82 | 6.583 | 9.75 | 0.70% | 416 | Arched Corrugated Metal Pipe (CMP-ARMCO) 6'-7"H x 9'-9"W |
| 4 | 15+82 | 16+00 | 6.5 | 9.1 | 1.67% | 449 | Variable Material Channel |
| 5 | 16+00 | 19+38 | 6.5 | 9 | -0.20% | 686 | Concrete & Granite Channel with Variable Dimensions and Materials |
| 6 | 19+38 | 19+76 | 6.5 | 9 | 0.25% | 221 | Stone Culvert |
| 7 | 19+76 | 21+40 | 5.5 | 9 | 0.25% | 175[2] | Stone Culvert |
| 8 | 21+40 | 22+00 | 5.5 | 9 | 0.23% | 404 | Concrete Culvert |
| 9 | 22+00 | 23+58 | 5.5 | 9 | 0.23% | 404 | Concrete Culvert |
| 10 | 23+58 | 26+25 | 5.5 | 9 | 0.075% | 221 | Concrete Culvert |
| 11 | 26+25 | 28+16 | 5.5 | 9 | 0.29% | 435 | Concrete Culvert |

[1] Capacity of Culvert Segments determined by Manning's Equation for full flow conditions. (See Calculations in Appendix B)
[2] Limiting Hydraulic Segment

The area immediately downstream of the project area, south of Revere Road has been identified as a smelt spawning area. A key element of the spawning area is an approximately 3-foot deep pool caused by the failure of the artificial channel bottom, resulting in a channel segment with reverse slope ending in a depression.

Downstream of the project area, Town Brook continues generally in an easterly direction through a combination of open channel and enclosed culvert through residential and commercial areas for approximately 0.7 miles prior to discharging to Town River, and Town River Bay, which ultimately connects to the Boston Harbor.

**Materials**

The existing culvert within the project area varies widely in size, shape, age, material and structural integrity, with 11 different segments of culvert identified within the project limits. Refer to Table 5.1 and Figure 5.4.2 for a summary and description of the existing culvert segments. The existing culvert segments that constitute Town Brook in the Project Area were determined by research of available record drawings, various site investigations, and verified by inspection of the culvert segments including video documentation of the investigation. Refer to Appendix F for the Town Brook Video, prepared by Tunnel Vision in 2008.

**Low Base Flow**

Maintaining base flow in Town Brook has been identified as critical in order to sustain the existing smelt habitat. The base flow in Town Brook within the Project has been reduced since the Deep Rock Tunnel, and the Centre Street Junction Structure, were constructed. Both projects were designed to divert storm event flows from the upstream reaches of Town Brook and reduce downstream flooding, however the low base flow has also been reduced since the construction of the flood control structures.

The Massachusetts Division of Marine Fisheries (DMF) is currently undertaking a study to review modifications to the Centre Street Junction Structure and Deep Rock Tunnel intake area in order to increase low base flow in Town Brook to improve the habitat and spawning areas of the rainbow smelt. Existing low base flow as measured at the USGS Gauging Station (No. 1105585) since the installation of the Deep Rock Tunnel has been reported to be approximately 2.2 cfs, which is not sufficient to provide optimal flow depth for smelt spawning. The Town Brook Enhancement project will be coordinated and designed for low base flow conditions in accordance with discussions and guidance of the DMF. Refer to Chapter 4 for a more detailed discussion of this study.

The United States Army Corps of Engineers (USACOE) Operations and Maintenance Manual – Volume II (TB-017) details a low base flow protocol when drought conditions exist, due to the potential impact to the smelt spawning habitat as a result of insufficient base flow in Town Brook. Per the USACOE manual, drought conditions may be considered to occur when flows during the smelt spawning period at the Miller Stile Road USGS Gauge decrease to below 2 cfs, which is described as the minimum required at this location for successful smelt spawning.

When flows at the gauge are below 2 cfs and no significant rainfall is in the immediate forecast, low flow augmentation could be considered, and if there is agreement that the flow augmentation at Miller Stile Road is more important than maintaining the level of Old Quincy Reservoir, flow augmentation could be implemented.

## Peak Flow

In order to provide an adequately sized culvert that can convey peak storm event runoff, the appropriate design storm has been modeled to determine the peak flow. The Centre Street Junction Structure and Deep Rock Tunnel were constructed to divert peak flows from Town Brook, thereby reducing the flooding in downstream properties historically prone to flooding, and are described in more detail below.

Town Brook flows enter a diversion structure at the Deep Rock Tunnel intake, consisting of a 51-foot long weir, which diverts excess peak flows from Town Brook to the Deep Rock Tunnel. In conjunction with the weir, the entrance to the Town Brook culvert has a baffle that creates a reduced opening, limiting flows to downstream reaches. The baffle reduces the standard downstream section of a 10 x 5-foot concrete culvert to an effective 10 x 2-foot opening, which limits the flow to the downstream reaches of Town Brook. Flows passing through the baffle continue across Burgin Parkway and the MBTA railway tracks in an enclosed culvert system prior to entering the project area. See Figure 5.8 for the Deep Rock Tunnel intake Plans and Details.

According to USACOE Design Memorandum No.'s 1 and 5 (TB-006, TB-007), the diversion structure at the Deep Rock Tunnel intake is designed to pass up to 100 cfs to the downstream reaches of Town Brook. This will be treated as the storm event flow for the project area from upstream basins for the peak storm events. This calculation was verified by an orifice calculation for a 10 x 2-foot opening. See Appendix B for calculations. For smaller storm events and low flow conditions that produce less than 100-cfs in Town Brook at the Deep Rock Tunnel diversion, the entire amount of flow at the diversion is designed to continue downstream to the lower reaches of Town Brook and the project area.

The Peak Flow for the project area is a combination of the outlet controlled flow from the Deep Rock Tunnel diversion and the local surface runoff tributary from the watershed drainage basins downstream of the diversion structure. Refer to the Hydrology section herein for a detailed discussion of the hydrologic analysis of the project area.

## Hydraulic Capacity

The hydraulic capacity of the existing culvert within the project area varies widely due to variations in the size, shape and material. Refer to Table 5.1 and Figure 5.4.2 for a summary, description and hydraulic properties of the existing culvert segments.

The existing hydraulic capacity of Town Brook in the project area was calculated using Manning's equation assuming full flow, and varies greatly from a segment with limiting hydraulic section of 175-cfs near the midpoint of the channel, to over 900 cfs at the open channel segment at the downstream end of the Project Area.

## PREVIOUS STUDIES

City records document flooding associated with Town Brook dating back to 1885. These records include numerous requests, sketches and copies of permits to re-align and culvert segments of Town Brook through various parcels. These numerous projects were likely intended to mitigate flood impacts and optimize land use potential of the properties adjacent to Town Brook. The results of these multiple projects on individual parcels created the varying segments of the Brook within the project area.

Numerous studies have been performed by the City of Quincy, US Army Corps of Engineers (USACOE) and the Metropolitan District Commission (MDC), now the Department of Conservation and Recreation (DCR), identifying flooding problems associated with Town Brook and proposing potential feasible solutions to mitigate the flooding. Refer to the Table of Contents for a catalogue summary of record reports and studies developed for Town Brook that were reviewed in the development of this document.

The most significant and comprehensive studies were performed by the USACOE and the MDC. Our analysis of Town Brook in the Project Area mainly references and utilizes information from the following three (3) reports performed by the USACOE and the MDC:

- TB-019 Report to the Commonwealth of Massachusetts Metropolitan district Commission on Flood Control Systems for Town Brook, Quincy and Braintree. (1979)
- TB-006 Town Brook Local Protection Project, Quincy and Braintree, MA – Design Memorandum No. 1, General Design and Hydrology. (1985)
- TB-007 Town Brook Local Protection Project, Quincy and Braintree, MA – Design Memorandum No. 5, Hydraulics and Water Quality. (1985)

The USACOE and MDC reports analyzed a number of potential projects that were designed to reduce flooding impacts associated with Town Brook. Based on recommendations from feasibility studies, the USACOE and MDC moved forward with the design, permitting and construction of the following Town Brook flood control projects:

- Town Brook Tunnel and Appurtenance Structures (aka "Deep Rock Tunnel")
- Improvements to the Old Quincy Reservoir Dam for Flood Control
- Centre Street Junction Structure
- Burgin Parkway and Braintree Culverts

These flood improvement projects were authorized by the Water Resources Development Act of 1986, authorized by legislation enacted on November 17, 1986, through H. Doc. 39, 99th cong., 1st session.

Summaries of the MDC and USACOE reports along with relevant information pertinent to the current Town Brook Enhancement project are provided below.

**Report to the Commonwealth of Massachusetts Metropolitan District Commission on Flood Control Systems for Town Brook, Quincy and Braintree (Ref. TB-019)**
*Prepared for the Metropolitan District Commission (MDC) by Metcalf and Eddy, March, 1979*

This report analyzes several aspects of the Town Brook Watershed and the associated historical flooding that occurred prior to the construction of the suggested flood control improvements. The MDC report identifies several design parameters used in the Town Brook Enhancement analysis, and design.

The purpose of the MDC Study was to investigate the flood control and associated water resource problems in the watershed of Town Brook, and to develop the most suitable plan that would mitigate these problems. The report was intended to serve as a planning document, identifying various alternatives that could alleviate documented flooding problems and evaluating those alternatives based on economic, social and environmental effects. Since the report is primarily a planning document, additional technical evaluations and refinements were required prior to final design of the projects analyzed and recommended.

The MDC report identifies downtown Quincy and the associated Town Brook as "*an area that has been subject to flooding problems for over a century. Some of the culverts, walled channels and covered channels are very old. Much of the stream has a fall of less than 2 ft per 1,000 ft, and it's limited capacity is further restricted by its meandering course through the densely developed lower third of the stream.*"

The report identifies the drainage areas and future development assumptions for the watershed basins tributary to Town Brook. The basins directly tributary to the project area of Town Brook are listed in Table 5.2. The watershed basins listed below are analyzed at an Index Point located in the vicinity of USGS Gauging Station number 1105585, located south of Miller Stile Road identified as MDC Index No. 2 on the MDC Watershed Delineation Map included as Figure 5.9.1. The Town Brook Enhancement watershed delineation is overlaid on the MDC Watershed Delineation Map for comparison.

**Table 5.2**
**MDC Study - Town Brook Tributary Areas**

| Drainage Basin | Acres | Impervious Surface | | | |
|---|---|---|---|---|---|
| | | 1974 | | Ultimate[1] | |
| | | Acres | Percent | Acres | Percent |
| TI[2,3] | 52 | 19 | 37 | 31 | 59 |
| TJ[3] | 123 | 49 | 40 | 66 | 54 |
| TK | 50 | 43 | 85 | 45 | 89 |
| TL | 217 | 76 | 35 | 87 | 40 |
| TM | 66 | 36 | 53 | 44 | 67 |

[1] Based on assumption that the ultimate development will have taken place by 1990.
[2] Sub catchment area TI modeled as being tributary to the Deep Rock Tunnel in "Improved Conditions" scenario.
[3] Limited by capacity of existing drainage system.

It should be noted that MDC Sub-catchment TI (a portion of the drainage area tributary to the MBTA railroad tracks near Quincy Center) is modeled as surface runoff tributary to MDC Index No. 2 (Bigelow Pool) for existing conditions, but is modeled as contributing to MDC Index No.

2A (Deep Rock Tunnel intake) for the improved system based on assumptions for future development. All plans reviewed in conjunction with this report in combination with the information available from the City of Quincy indicate that the area tributary to the MBTA Railroad track does not currently drain to the Deep Rock Tunnel Intake as modeled in the MDC report. MDC sub catchment TI (a portion of the Town Brook Enhancement Basin 4) is currently conveyed to Town Brook downstream of the Tunnel intake via a pump based system at the MBTA railway low-point just south of the Granite Street Bridge.

Subcatchment TJ, as identified on the MDC Watershed Delineation Map, collects surface runoff from the west side of the MBTA railway and conveys that runoff to a differential head based drainage structure with a subsurface sediment basin at a low point in Burgin Parkway. That structure facilitates the conveyance of the runoff from subcatchment TJ beneath the depressed MBTA railway to the east side of the MBTA railway tracks, where the flow joins with existing Town Brook in the project area.

The MDC report identifies sub catchment areas TI and TJ as limited to 80 and 40-cfs respectively, by the capacity of the local drainage system. Due to unknown design criteria and flow specifications for the MBTA pump, and the head based drainage structure, the Town Brook Enhancement hydrologic analysis conservatively assumes these drainage features do not limit the flow from the tributary areas.

To accurately create and calibrate the watershed Hydrology Model, the MDC report compared known historical rainfall data from various storm events and compared the rainfall data to the corresponding measured flow data at USGS Gauging Station 1105585. The storms used in the calibration as well as the analysis of the model were the August 1955 storm which resulted from the rain storm accompanying hurricane "Diane", the March 1968 storm which was a slow moving coastal storm, and the December 1969 storm which was a slow moving northeaster which started as snow over southern New England with an accumulation of about 5-inches of wet snow before changing to high intensity rainfall.

The basic hydrologic criteria adopted by the MDC for the planning and design of the structural flood control improvements on Town Brook was to design channels and culverts downstream of the Old Quincy Reservoir for the 25-year storm event with the exception of the proposed relief tunnels being sized for the 50-year storm. Other design criteria included taking into account the level of design recommended for other improvements in the general region, such as the 50-year flood specified by Mass DPW and MBTA for culverts and channels. Where applicable, the structures were designed to operate with a coincident tide level of El 6.0 MSL(1929 NGVD) in Town River Bay, the average spring tide level, which has been used as the basis of design for other drainage and flood control projects in the area. Refer to Table 5.3 for a summary of the peak rates of runoff calculated in the MDC study.

**Table 5.3**
**MDC Study - Town Brook Peak Rates of Runoff**

**25-Year (24 hour NRCS Type-III) Storm**

| Drainage Basin | Area (acres) | Present | | | | Future | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Tc (min) | i (in/hr) | C | $Q_{PEAK}$ (cfs) | Tc (min) | i (in/hr) | C | $Q_{PEAK}$ (cfs) |
| TI[2,3] | 52 | 21 | 4.13 | .312 | 66 | 21 | 4.13 | .441 | 94 (80[3]) |
| TJ[4] | 123 | - | - | - | 40[3] | - | - | - | 40[3] |
| TK | 51 | 26 | 3.67 | .598 | 111 | 26 | 3.67 | .628 | 116 |
| TL[4] | 218 | - | - | - | 370 | - | - | - | 400 |
| $TM_1$ | 66 | 24 | 3.84 | .359 | 45 | 24 | 3.84 | .436 | 55 |
| $TM_2$ | 66 | 20 | 4.23 | .555 | 40 | 20 | 4.23 | .579 | 42 |

[1] Based on assumption that the ultimate development will have taken place by 1990.
[2] Sub catchment area TI modeled as being tributary to the Deep Rock Tunnel in "Improved Conditions" scenario.
[3] Limited by capacity of existing drainage system.
[4] Peak Rates of Runoff for Basins TJ and TL are based on Unit Hydrograph Methodology. Peak rates of runoff for Basins TI, TK, TM1 and TM2 were calculated using the Rational Method.

Portions of the MDC study watershed hydrology analysis were performed using the Rational Method, which is recommended for watershed areas up to 200 acres maximum, typically is not used for large watershed modeling.

The formulation portion of the study involved the investigation of alternative solutions for resolving the problems and fulfilling the needs that have been defined in the study area. Several flood control features were included in the selected plan, and were designed to reduce the flooding in historically flood prone reaches of Town Brook.

The MDC study concluded that the best plan of improvements for flood control of the lower reaches of Town Brook would be to: construct a 12-foot diameter deep relief tunnel for diversion of upstream flood waters; enlarge culverts and channels above the tunnel intake to adequately convey runoff to the relief tunnel; and regulating works at the Old Quincy Reservoir outlet.

The flood control features were designed to reduce the peak stormwater runoff in Town Brook to a maximum of 525-cfs at the MDC Index No. 2 (Bigelow Pool) for the 25-year storm. This peak flow is a result of approximately 100 cfs conveyed from upstream reaches of Town Brook, joined with approximately 425 cfs from local surface runoff.

**Town Brook Local Protection Design Memorandum No.'s 1 & 5 (Ref. TB-006 & TB-007)**
Army Corps of Engineers, March, 1985

This report analyzes several aspects of the Town Brook watershed and includes detailed hydrologic analysis of the watershed and hydraulic analysis of the proposed flood control improvements. The hydrologic analysis and hydraulic calculations performed in the USACOE report serve as the basis for the analysis used in the Town Brook Enhancement project.

The Town Brook Local Protection project was recommended in a September 1980 feasibility report prepared by the New England Division of the United States Army Corps of Engineers (Ref. TB-003). The major features of the flood protection plan were:

- Construction of a 4,060 foot long relief tunnel under downtown Quincy.
- Improvements to the Town River Channel below the tunnel outlet consisting of new reinforced concrete box culverts constructed under the Southern Artery and an adjacent automobile dealer parking lot.
- Alterations to the left bank of the Town River below Southern Artery.
- Modifications to the Old Quincy Reservoir Dam.

For the purposes of Hydrologic Analysis and evaluation of the Town Brook watershed, the USACE report delineated the watershed into five (5) subareas as shown on Figure 5.9.2. The Basin Delineations for the current Town Brook Enhancement project are superimposed over the USACOE delineated basins for comparison. It should be noted that the USACOE report identifies the USACOE Basin D (Local to Upper Reach of Quincy Culvert) as tributary to the Deep Rock Tunnel inlet. However, all plans reviewed in conjunction with this report in combination with the information available from the City of Quincy indicate that the area identified as USACOE Drainage Basin D is conveyed across the MBTA railroad tracks partially via the differential head based drainage structure just north of the Concourse Roadway Bridge, and partially by the pump based system at the MBTA railway low-point just south of the Granite Street bridge described in more detail in the MDC report section.

The 12-foot diameter diversion tunnel extends 4,060 feet from its inlet just off School Street to its outlet to Town River just upstream of the Southern Artery Highway. The tunnel receives flood flow from the existing Town Brook drainage channel and from the Burgin Parkway relief culvert. All flows above approximately 100 cfs are diverted from Town Brook to the tunnel. Normal flows up to 100 cfs continue to pass down the existing Town Brook Channel.

The USACOE hydrologic analysis of floods in the Town Brook watershed was performed using the HEC-1 computer model. Stage-storage, stage-discharge and unit hydrograph data were developed for input in to the HEC-1 computer model, and were then calibrated by analyzing and reproducing selected rainfall-runoff events recorded during the period of stream flow records.

Unit hydrographs were developed for each subarea using "Snyder's Method" based on relative sub watershed characteristics. The coefficients were then refined in the process of calibrating the HEC-1 computer model. The data from the developed unit hydrographs is used in the

development of hydrographs used in the analysis for the Town Brook Enhancement project. Refer to Appendix B for supporting technical information.

The USACOE Project Design flood was the result of the 100-year storm, which is comparable to the recurring August 1955 flood of record. The selected 12-foot diameter tunnel will provide a project design discharge of 1,200 cfs with a differential head of about 13.5-feet. Thus, with a tailwater at the outlet of +8.0 feet NGVD (spring tide +1 foot), the energy gradient at the tunnel inlet with 1,200 cfs flow is approximately 21.5 feet NGVD, below the maximum wall elevation of the Intake Structure at 23.0 NGVD. Refer to Table 5.4 for a summary of the USACOE study peak rates of runoff at the Deep Rock Tunnel Intake and USGS Gauging Station 1105585.

**Table 5.4**
**USACOE Town Brook Peak Rates of Runoff**

| | 1955 Storm | | | 100-Year (6 hour) Storm | | |
|---|---|---|---|---|---|---|
| | Inflow (cfs) | Outflow (cfs) | Stage (ft) | Inflow (cfs) | Outflow (cfs) | Stage (ft) |
| Index #2A Deep Rock Tunnel Intake[3] | 1,310 | 1,240 | 24.8 | 1,320 | 1,190 | 24.5 |
| Index #2 USGS Gauging Station 1105585 | 450 | 450 | 14.2 | 500 | 500 | — |

The USACOE design flow at USGS Gauging Station 1105585 (USACOE Index No. 2) is modeled to convey 100 cfs from upstream segments of Town Brook in addition to 400 cfs of local surface runoff for a total peak flow of 500 cfs for the 100-year, 6-hour storm event.

## PROPOSED TOWN BROOK ALIGNMENT

The City of Quincy is proposing to enhance and re-align a portion of Town Brook within Quincy Center. The proposed re-alignment will remove perennial stream flow from approximately 1,700 linear feet of existing culverted segments of the Brook through Quincy Center, which are aged and segments of which are structurally compromised. The existing 1,700 linear feet of culvert will continue to convey collected surface runoff from Drainage Basin 4 (an approximately 170-acre watershed) and will eventually be decommissioned over time as stormwater improvements associated with the redevelopment of Quincy Center are implemented.

The re-alignment will be made by connecting a new culvert to the existing culvert alignment at a proposed connection point upstream of Quincy Center and conveying the existing flow, from west to east, along the south side of the Concourse Roadway improvement project, which is currently under construction. This will re-direct Town Brook flow through approximately 1,200 linear feet of 11-foot wide x 6-foot high closed and open channel/day-lit segments of culvert to the proposed connection point downstream of Quincy Center where the proposed culvert alignment will rejoin the existing Town Brook alignment. Refer to Figure 5.5 for the proposed alignment of Town Brook.

The Project is designed to provide a number of enhancements to Town Brook to include: enhanced hydraulic conveyance and flood control of Town Brook; additional open channel/day-lit segments with adjacent public open space; enhanced and expanded smelt habitat and spawning areas. The project will benefit from cost effective construction through coordination with on-going construction activities on land already controlled by the City of Quincy.

This project will improve a significant section of the Brook through Quincy Center and will establish a benchmark for future enhancements of the Brook within the City.

**Materials**

The proposed culvert section will be comprised of uniform 11-foot wide by 6-foot high enclosed and open channel segments of reinforced concrete. The enclosed culvert segments will be comprised of pre-cast reinforced concrete conforming to MassDOT specifications, and will be designed to withstand H-20 loading as well as deep fill conditions in the vicinity of the Hancock Street crossing. Refer to Table 5.5 for a summary of the proposed Town Brook segments.

**Table 5.5**
**Proposed Town Brook Segments**

| Segment | From Station (ft) | To Station (ft) | Height (ft) | Width (ft) | Slope | Capacity[1] Q (cfs) | Material & Shape |
|---|---|---|---|---|---|---|---|
| 1[2] | 10+00 | 11+84 | 6.5 | 7.9 | 1.10% | 785 | Granite & Concrete Sidewalls with Variable Material Channel Bottom |
| 2 | 21+11 | 22+05 | 6 | 11 | 0.33% | 875 | Rectangular Concrete Open Channel |
| 3 | 22+05 | 23+09 | 6 | 11 | 0.33% | 674 | Enclosed Concrete Box Culvert |
| 4 | 23+09 | 24+17 | 6 | 11 | 0.33% | 875 | Rectangular Concrete Open Channel |
| 5 | 24+17 | 33+29 | 6 | 11 | 0.33% | 674 | Enclosed Concrete Box Culvert |

[1] Capacity of Culvert Segments determined by Manning's Equation for full flow conditions. (See Calculations in Appendix B)
[2] Segment 1 is a portion of the Existing Town Brook

Portions of Town Brook will be constructed with spawning riffles and resting pools as well as a low flow trapezoidal channel with attached spawning substrate to enable smelt spawning. The design and implementation of these low flow features will be coordinated with the Massachusetts Division of Marine Fisheries

## Design Storm

To determine the design storm used in the analysis and design of the proposed Town Brook Enhancement Project, major past storms associated with historic flooding in the Town Brook watershed were evaluated. Historic flooding associated with Town Brook occurred in August, 1955, when many areas of New England experienced record rainfall amounts, March, 1968, and December 1969. Refer to Table 5.6 for the storm event characteristics.

**Table 5.6.**
**Precipitation Intensity/Duration[2]**

| Storm | Total Precipitation (in) for given Duration (hr) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 hour | 2 hours | 3 hours | 6 hours | 12 hours | 24 hours | Total |
| August 1955 | 1.74 | 2.88 | 4.07 | 5.27 | 6.34 | 9.93 | 13.76 |
| March 1968 | 0.50 | 0.99 | 1.38 | 2.54 | 4.30 | 6.62 | 7.53 |
| December 1969 | 0.58 | 1.08 | 1.48 | 2.50 | 3.53 | 5.56 | 6.07 |
| 25-Year Storm[1] | 2.1 | 2.7 | 3.1 | 3.9 | 4.8 | 5.6 | 5.6 |
| 100-Year Storm[1] | 2.7 | 3.4 | 3.8 | 4.8 | 5.9 | 6.8 | 6.8 |

[1] Based on US Weather Bureau, 1961 "Rainfall Frequency Atlas of the United States", Technical Paper 40.
[2] Precipitation Intensity/Duration values taken from "Report to the Commonwealth of Massachusetts Metropolitan District Commission on Flood Control Systems for Town Brook, Quincy and Braintree" (TB-019)

When selecting an appropriate design storm, it is important to consider not only the total rainfall, but also the appropriate rainfall distribution, and maximum intensity at any given time period. For example, the total rainfall for the August 1955 storm was 13.79 inches, and the peak rainfall intensity was 1.74-inches per hour during the peak hour. For comparison, the 25-year, 24 hour NRCS Type-III storm event creates only 5.6-inches over a 24-hour period, but the peak intensity is 2.1-inches per hour during the peak hour. Often times, specifically in urban watersheds similar to the project area, it is the concentrated peak of the storm event that results in the peak runoff, more so than the total rainfall over an extended period.

The 100 and 25-year, 24 hour NRCS Type-III storms as well as the previously mentioned historical storms, are modeled to arrive at the peak flow for use in the analysis of the proposed culvert. The 100-year, 24 hour NRCS Type-III storm event, with a rainfall depth of 6.8-inches, is used as the design storm. The proposed culvert is sized to convey the 100-year storm event. Refer to the Hydrology section of this chapter for a detailed discussion of the hydrologic analysis and Appendix B for supporting technical information.

## Hydrology

The purpose of the Watershed Hydrologic Analysis is to produce design flows to be used in the analysis of proposed improvements. The Town Brook watershed was delineated based on historical data as well as GIS topographic and storm drain information provided by the City of Quincy to determine design flows used in the analysis of the proposed improvements. The overall and individual watershed boundaries were also verified against the delineations in the previous reports for consistency. Refer to Figures 5.9.1 and 5.9.2 for a comparison of the Town Brook Enhancement project basin delineation overlaid on the watershed basin delineations used in the MDC and USACOE studies.

The area tributary to Town Brook was measured to be 4.46 mi2 above the USGS Gauging Station (No. 1105585) located downstream of Miller Stile Road. The overall drainage area in this study has been delineated into five (5) large basins similar to the basins delineated by the USACOE report (TB-006). Refer to Figure 5.9.2 for a graphical depiction of the current basin delineation overlaid on the previous USACOE delineation.

Basin 1 is the upper most basin with a watershed area of approximately 1.56 $mi^2$ with flow collected and regulated by the Old Quincy Reservoir. The basins downstream of the reservoir are delineated to facilitate analysis at key index locations.

Basin 2 is the first basin downstream of the Old Quincy Reservoir, with a watershed area of 1.38 $mi^2$ tributary to the Centre Street Junction Structure, where the surface runoff confluences with the flow discharged from the Old Quincy Reservoir and is conveyed via Town Brook and the Burgin Parkway Relief Culvert to the next index point.

Basin 3, with a watershed area of 0.84 $mi^2$, is comprised of the local drainage tributary to The Deep Rock Tunnel intake. At this location, the flow conveyed from the previous basin combines with the surface runoff tributary to the Deep Rock Tunnel intake, where the flow diversion is modeled with significant runoff diverted to the Deep Rock Tunnel allowing outlet controlled flow to continue downstream in Town Brook.

Basin 4, with a watershed area of 0.32 $mi^2$, includes portions of the MBTA railway drainage, Quincy Center in the vicinity of the project area and other urban areas west of the MBTA railway tributary to the project area reach of Town Brook. The area west of the MBTA railway, north of the Concourse Roadway Bridge and south of the MBTA railway stop is included in the Basin 4 tributary area, based on USGS contour information and available storm drain plans for the area. The western area of Basin 4 is conveyed across the MBTA railroad tracks via a differential head based drainage structure just north of the Concourse Roadway Bridge. Runoff tributary to the MBTA railway area is conveyed to the project area reach of Town Brook via a pump based system at the MBTA railway low-point just south of the Granite Street Bridge. For the proposed modeling of the watershed, it is assumed that these structures do not limit the conveyance of peak flood runoff to the downstream reaches of Town Brook. The index point for analysis of the proposed Town Brook improvements is located at the proposed downstream connection to existing Town Brook.

Basin 5, with a watershed area of 0.36 $mi^2$ includes urban Quincy areas tributary to Town Brook downstream of the proposed Town Brook Enhancement Project, at USGS Gauging Station 1105585 at Miller Stile Road.

Town Brook ultimately discharges into Town River, a tidal estuary connected to Town River Bay. Water levels in the estuary are influenced by tides in Town River Bay, however the limit of tidal influence in Town Brook as described in the FEMA Flood Insurance Study dated May 16, 2006, extends up to Elm Street, terminating approximately 0.5 miles downstream of the project area. Refer to Figure 5.3 for the limits of tidal influence.

The current basin delineations conform in composition and general basin geometry to the USACOE delineations. The Project Area is comprised of a significant amount of urban land, relatively unchanged from the previously modeled conditions. As such, the unit hydrographs previously developed in the USACOE report are used in the analysis of the current Town Brook Watershed hydrology, with adjustments to account for small changes in basin geometry, and general drainage patterns. The watershed is modeled using Generic unit Hydrograph methodology in the CivilStorm© computer program based on the Snyder's Coefficients developed in the USACOE report, listed in Table 5.7. Refer to Appendix B for supporting technical documentation.

**Table 5.7**
**Town Brook Watershed Basin Data**

| Description | "Snyder's"[1] | | USACOE Delineation Area ($mi^2$)[1] | $Q_{PEAK}$[1,2] (cfs) | Current Delineation Area ($mi^2$) | $Q_{PEAK}$[2] (cfs |
|---|---|---|---|---|---|---|
| | $T_P$ | $C_P$ | | | | |
| **Basin 1 (USACOE Basin A)** Old Quincy Reservoir | 2.5 | 0.50 | 1.56 | 677 | 1.56 | 669 |
| **Basin 2 (USACOE Basin B)** Local to Centre Street | 2.0 | 0.55 | 1.42 | 792 | 1.38 | 754 |
| **Basin 3 (USACOE Basin C)** Local to Deep Rock Tunnel intake | 1.5 | 0.55 | 0.79 | 541 | 0.84 | 564 |
| **Basin 4 (USACOE Basin D)**[3] Local to Town Brook at Project Area | 1.0 | 0.60 | 0.27 | 256 | 0.32 | 298 |
| **Basin 5 (USACOE Basin E)** Local to USGS Gauge at Miller Stile Road | 1.0 | 0.60 | 0.42 | 399 | 0.36 | 336 |

1 Snyder Unit Hydrograph variables, Basin Delineations and Peak Flows taken from USACOE Design Memorandum No. 1 – General Hydraulics and Hydrology. (TB-012)
2 Peak Flow based on 100-year (6 hour) storm event modeled by USACOE.
3 Per the USACOE study, USACOE Basin D is tributary to the Deep Rock Tunnel, and in the current Town Brook Enhancement analysis the runoff from a portion of USACOE identified as Basin 4 is tributary to Town Brook at the project area index point.

The runoff tributary to Town Brook in the project area is limited by upstream drainage facilities that divert excess peak flows to the Deep Rock Tunnel, which bypasses downtown Quincy and

outlets to Town Brook above the McGrath Highway culverts. Due to construction of the existing flood control improvements, the overall storm event runoff from the Town Brook watershed upstream of the Deep Rock Tunnel does not significantly impact the performance or design of the lower reaches of Town Brook for the 25 and 100-year storm events modeled. Thus, the project area is modeled with a level Tunnel Diversion outlet controlled flow from the contributing upstream watershed basins.

The design flow for the Town Brook Enhancement culvert is calculated in Town Brook at the downstream connection point of the proposed 11x6-foot culvert, just south of Revere Road, referred to as the Project Area Index Point 1. Refer to Figure 5.2 for a depiction of the Watershed Basin Delineation and Project Index Points. The outlet controlled flow of 100-cfs from the Deep Rock Tunnel diversion is conservatively modeled as a direct addition to the individual peak flow from the local surface runoff tributary to Town Brook at the Project Area Index Point.

The flow calculated at the Project Area Index Point is then added on a real-time basis with the local surface drainage from Basin 5 to determine the peak flow at USGS Gauging Station 1105585 (Index Point 2) based on the design storm. The time to peak flows for Basins 4 and 5 is similar, so the peak flows are conservatively compounded by direct addition as well. Refer to Table 5.8 for a summary of the various storm event modeled.

**Table 5.8.**
**Town Brook Enhancement Study Peak Flows**

| | Area (Current) | Aug, 1955 | | Mar, 1968 | | Dec, 1969 | | 25-year (24 hr NRCS Type-III) | | 100-year (24 hr NRCS Type-III) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ($mi^2$) | $Q_{Peak}$ ($ft^3$/sec) | $T_{Peak}$ (hours) | $Q_{Peak}$ ($ft^3$/sec) | $T_{Peak}$ (hours) | $Q_{Peak}$ ($ft^3$/sec) | $T_{Peak}$ (hours) | $Q_{Peak}$ ($ft^3$/sec) | $T_{Peak}$ (hours) | $Q_{Peak}$ ($ft^3$/sec) | $T_{Peak}$ (hours) |
| **Basin 1** Local to Old Quincy Reservoir | 1.56 | 739 | 14.75 | 309 | 16 | 296 | 24 | 580 | 15 | 724 | 15 |
| **Basin 2** Local to Centre Street | 1.38 | 782 | 14.25 | 297 | 15.5 | 303 | 24 | 660 | 14.5 | 821 | 14.5 |
| **Basin 3** Local to Deep Rock Tunnel Intake | 0.84 | 556 | 13.75 | 188 | 15 | 194 | 23.5 | 499 | 14 | 617 | 14 |
| Outlet Controlled Flow[1] | - | 100 | - | 100 | - | 100 | | 100 | - | 100 | - |
| **Basin 4** Local to Town Brook at Project Area | 0.32 | 270 | 13.25 | 79 | 14.5 | 85 | 23.1 | 272 | 13.5 | 335 | 13.5 |
| Total @ Project Area **Index Point 1** | - | **370** | - | **179** | - | **185** | | **372** | - | **435** | - |
| **Basin 5** Local to USGS Gauge at Miller Stile Road | 0.36 | 303 | 13.25 | 89 | 14.5 | 95 | 23 | 304 | 13.5 | 375 | 13.5 |
| Total @ USGS Gauge **Index Point 2** | - | **673** | 13.25 | **268** | 14.5 | **280** | | **676** | 13.5 | **810** | 13.5 |
| **TOTAL =** | 4.46 | | | | | | | | | | |

[1] *Outlet Controlled Flow to downstream segments of Town Brook from Tunnel Intake Structure diversion*

The Peak Flow at Project Area Index Point 1 is calculated to be 435-cfs as a result of the 100-year, 24 hour NRCS Type-III storm event, and is used as the design flow. The August 1955 storm event produces similar peak flows for the larger drainage basins with longer times of concentration, however the smaller urban watershed basins tributary to project area respond more to the concentrated peak hourly precipitation associated with the NRCS-Type III distribution.

## Design Flows

The proposed culvert has been designed to provide hydraulic capacity greater than the existing Town Brook culvert and to convey the 100-year storm event, which results in a peak flow of 435-cfs within the proposed Town Brook culvert. The storm event flow in Town Brook controlled by the Deep Rock Tunnel diversion from upstream of the project area is limited to 100-cfs based on the analysis and calculations contained in the USACOE report and confirmed with supporting calculations found in Appendix B.

In addition to the peak flow analysis, a low flow condition is analyzed. The DMF has developed a study to review alternatives to increase base flow in Town Brook. Design objectives are presented in the "Preliminary Design of Flow Restoration in Town Brook", dated February, 2011 by Gomez and Sullivan Engineers, PC. The design objectives outlined in the report to achieve base flows approaching 10 cfs, an increase of the existing approximate 2.2 cfs as measured as USGS Gauging Station 1105585 are analyzed. Refer to Appendix B for supporting technical calculations.

## Hydraulics

The capacity of the existing and proposed Town Brook segments was calculated using Manning's formula with an "n" value not to be less than 0.013 for full flow conditions. A profile of the proposed Town Brook Channel was created with hydraulic grade lines calculated using the CivilStorm© computer program for the design storm event. A tailwater condition for the proposed 11x6-foot culvert was calculated by modeling approximately 150-feet of the existing Town Brook channel downstream of the proposed downstream connection point in the CivilStorm© computer program. Normal depth flow conditions are assumed at the downstream end of the existing channel, based on the channel geometry and slope. Refer to Appendix B for supporting technical information.

CivilStorm uses the a dynamic routing model based on the continuity and momentum equations utilizing the Sain-Venant equations of one dimension unsteady flow in the analysis of open and closed channel flows.

The low base flow condition is analyzed, supporting design of a proposed low flow channel, based on the existing low base flow of 2.2 cfs and potential restored future low flows up to 10 cfs. Normal depth calculations were performed using Manning's equation for a trapezoidal low flow channel with attached substrate, with a "n" value of 0.030, demonstrating that a 2-foot

wide trapezoidal low flow channel with substrate attains the guideline attraction velocities and depth favored by smelt for spawning.

The 100 and 25-year Peak Flows at the Project Area Index Point 1 are calculated to be 435 and 372 cfs respectively, which can both be conveyed in the proposed 11-foot wide by 6-foot high reinforced concrete culvert, with a full flow capacity calculated to be 675 cfs. Refer to Appendix B for supporting technical documentation.

### Floodplain Information

According to the May 16, 2006 FEMA Flood Insurance Rate Map for the City of Quincy, Community Panel Numbers 255219-0057D, 255219-0019D, and 255219-0076D, Town Brook contains the 100-year (BLSF) and 500-year flood, with a small area of surface flood plain adjacent to the open channel segment of Town Brook on parcel D91 (currently occupied by the American Legion). The surface floodplain is identified as Zone AE, which is described as being subject to inundation by the 1% annual chance flood, with Base Flood Elevations determined. The base flood elevation determined in this location is 16-feet NAVD88, as depicted on FEMA FIRM map 255219, Panel 0057D.

No permanent or temporary alterations within the flood plain are proposed that would displace storage volume. The creation of open space and open channel on parcel D91 will result in providing additional flood storage

The proposed downstream connection point to Town Brook is upstream of the tidally influenced segment of Town Brook. The limit of tidal influence is just downstream of Elm Street, according to the FIS, which is approximately 0.5 miles downstream of the proposed connection point. Refer to Figure 5.3 for the flood plain information and limits of tidal influence.

## RELATED PROJECT – FLOW RESTORATION IN TOWN BROOK

The Massachusetts Division of Marine Fisheries is currently undertaking a study to review modifications to the Centre Street Junction Structure and Deep Rock Relief Tunnel intake area in order to increase low base flow in Town Brook to improve the habitat and spawning areas of the rainbow smelt. The City has an ongoing dialogue with both the Massachusetts Division of Marine Fisheries and the National Marine Fisheries and will incorporate these agencies' input and the findings of the final report into the final design of the Project.

## STORMWATER MANAGEMENT POLICY COMPLIANCE

The purpose of the Stormwater Management Policy is to provide long-term protection of natural resources in and around project Site development. This is achieved by implementing water quality and quantity control measures designed to decrease the amount of pollutants discharged from the Site, increase the quality of stormwater recharged on the Site, and control discharge rates.

As part of the Project, the creation of public open space adjacent to the open channel/day lit segments of the Brook at the downstream end of the project is proposed. Low impact development stormwater features will be provided on the public open space to handle surface runoff from the proposed landscaped and hardscaped areas. The City has reviewed the project for compliance with the standards. A summary of compliance with the ten stormwater standards is documented below.

The following sections describe the regulations pertinent to stormwater management and the specific components of the Plan to be implemented.

**Stormwater Management Standards and Guidelines**

The methods for compliance with the ten-stormwater performance standards developed by the MA DEP are summarized below.

1. *No new stormwater conveyances may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.*

The Project does not create any new stormwater collection or conveyance systems and proposes to alter the alignment of the existing Town Brook culverted conveyance, no new point discharges are proposed as part of this project.

2. *Stormwater management systems must be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.*

No stormwater management system is proposed and no permanent significant alteration of ground cover on adjacent properties is proposed. As part of the project enhancements, public open space amenities are proposed adjacent to the open channel segments, which will result in the conversion of the existing impervious surfaces to approximately 5,000 square feet of landscape area, with rain garden to capture surface runoff from the open space, resulting in a net reduction in impervious are within the watershed.

3. *Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, storm water best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This standard is met when the storm water management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater handbook. .*

No stormwater management system is proposed and no permanent significant alteration of ground cover on adjacent properties is proposed. As part of the project enhancements, public open space amenities are proposed adjacent to the open channel segments, which will result in the conversion of the existing impervious surfaces to approximately 5,000 square feet of landscape area, with rain garden to capture surface runoff from the open space, resulting in a

net reduction in impervious are within the watershed and potential for additional recharge to groundwater.

4. *Stormwater Management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This standard is met when:*

   - *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;*
   - *Structural storm water best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook.*
   - *Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*

No stormwater management system is proposed and no permanent significant alteration of ground cover on adjacent properties is proposed. As part of the project enhancements, public open space amenities are proposed adjacent to the open channel segments, which will result in the conversion of the existing impervious surfaces to approximately 5,000 square feet of landscape area, with rain garden to capture surface runoff from the open space, resulting in a net reduction in impervious are within the watershed and potential for additional recharge to groundwater.

5. *For land uses with higher potential pollutant loads (LUHPPL), source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If, through source control and/ or pollution prevention, all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt and storm water runoff, the proponent shall use the specific structural storm water BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act.*

The project is not classified as a LUHPPL.

6. *Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and storm water discharges near any other critical area require the use of the specific source control and pollution prevention measures and the specific structural storm water best management practices determined by the Department to be suitable for managing discharges to such areas as provided in the Massachusetts Stormwater Handbook.*

NA

7. *A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural storm water best management practice requirements of Standards 4, 5 and 6. Existing Stormwater discharges shall comply with Standard I only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater management Standards and improve existing conditions.*

NA

8. *A plan to control construction related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.*

Erosion and sedimentation control measures will be implemented during construction, the contractor will be required to obtain an NPDES General Permit for Stormwater Discharge from Construction Activities and a Stormwater Pollution Prevention Plan will be developed prior to construction.

9. *A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.*

No stormwater management system is being proposed as part of this project, however operation and maintenance guidelines have been summarized in this Chapter to address sediment and debris accumulation within the culvert as well as maintenance of the rain gardens within the open space areas adjacent to the proposed open channel segments of culvert. The culvert will be maintained by the City consistent with the City of Quincy NPDES PH II MS4 General Permit.

10. *All illicit discharges to the storm water management system are prohibited*

As part of the project mitigation, known direct illicit sanitary sewer connection to Town Brook within the Project Area will be eliminated.

**Operation and Maintenance**

The following maintenance program is proposed to ensure the continued effectiveness of the structural water quality controls previously described.

**Culvert and Low Flow Channel:**

The culvert and low flow channel are to be maintained in accordance with the following requirements:

- Inspect channel sections for accumulation of sediment and debris, remove when depths exceed 2" or annually, remove debris as encountered
- Inspect substrate within low flow channel annually, replace and secure substrate as necessary
- Sediment and debris to be removed by hand
- Routinely inspect for litter accumulation, remove as necessary
- Maintenance to be performed within the culvert and low flow channel is to be done outside of the Smelt spawning season (March 1st through June 15th)

A comprehensive Operations and Maintenance plan will be developed for inclusion into the Notice of Intent filing to address the maintenance of all final enhancement features.

In addition to the physical maintenance of the proposed improvements, the City of Quincy will continue to coordinate with the Massachusetts Division of Marine Fisheries to update the Town Brook low flow protocol to include updates associated with DMF projects to increase base flow within the Brook. The existing low flow protocol was put into effect by the City of Quincy and the MDC in 2004, to protect rainbow smelt in Town Brook.

**Rain Garden:**

Premature failure of biorention areas is a significant issue caused by lack of regular maintenance. Ensuring long term effectiveness involves careful attention while plants are being established and season landscaping maintenance thereafter. Proper selection of plant species and support during establishment of vegetation should minimize – if not eliminate - the need for fertilizers and pesticides.

The rain-garden is to be maintained in accordance with the following requirements:

- Add mulch/compost annually in spring – do not bury plantings
- Water plantings during drought period (and during initial planting season until vegetation is stabilized)
- Weed in spring until vegetation is stabilized
- Prune plantings annually
- Inspect and remove trash and debris quarterly
- Remove pet waste regularly
- Inspect soil and repair eroded areas monthly
- Re-mulch/compost void areas as needed
- Replace mulch/compost every two years, in the early spring.
- Replant vegetation as necessary

## CONCLUSION

The proposed Town Brook Enhancement Project improves flood control throughout the project area by increasing the capacity of Town Brook with a uniform section of enlarged culvert. Currently, the capacity of Town Brook is limited by various irregular sections with a limiting hydraulic section of 175-cfs, creating backwater effects in sections of the culvert during storm events. The proposed 11x6-foot culvert has a full flow capacity of 674-cfs, which is sufficient to convey the 100-year design storm event.

The project will provide a low flow channel to convey base flow through the downstream portions of the project area. The final design of the low flow channel will be coordinated with the Division of Marine Fisheries in order to create improved conditions for the smelt spawning habitat during low flow periods.

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Drainage\10 006 TB ENF 5.1 Features.dwg

LEGEND

- POINTS OF INTEREST
- EXISTING DIVERSION CHANNEL/TUNNEL
- EXISTING OPEN CHANNEL
- EXISTING CLOSED CONDUIT

1,000 500 1,500 Feet

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

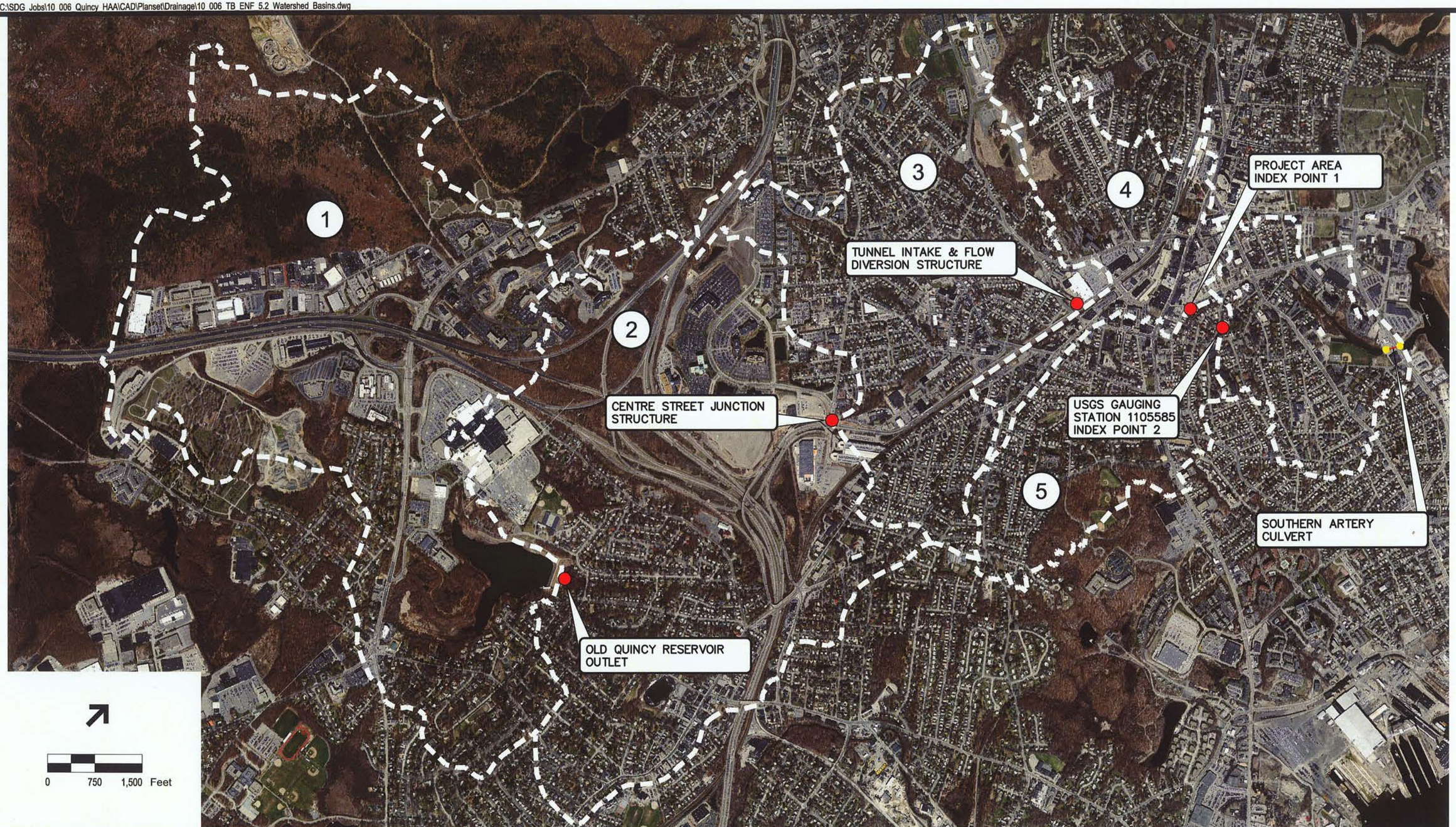
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 5.1 March 15, 2011

Existing Town Brook Watershed
Drainage Features
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Drainage\10 006 TB ENF 5.2 Watershed Basins.dwg




LEGEND

- INDEX POINTS
- DRAINAGE BASIN BOUNDARY
- (2) DRAINAGE BASIN NUMBER

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 5.2 March 15, 2011

Existing Town Brook Watershed

Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Drainage\10 006 TB ENF 5.3 WETRES.dwg

NOTES:

1 LIMITS OF TIDAL INFLUENCE AS DESCRIBED IN THE FEMA FLOOD INSURANCE STUDY FOR THE CITY OF QUINCY, MASSACHUSETTS, DATED MAY 16, 2006.

2 100 AND 500 YEAR FLOOD PLAIN LIMITS AS DEPICTED ON THE FEMA FLOOD INSURANCE RATE MAPS 2552190019D, 2552190057D, 2552190038D, 2552190076D, DATED MAY 16, 2006, NAVD 1988.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

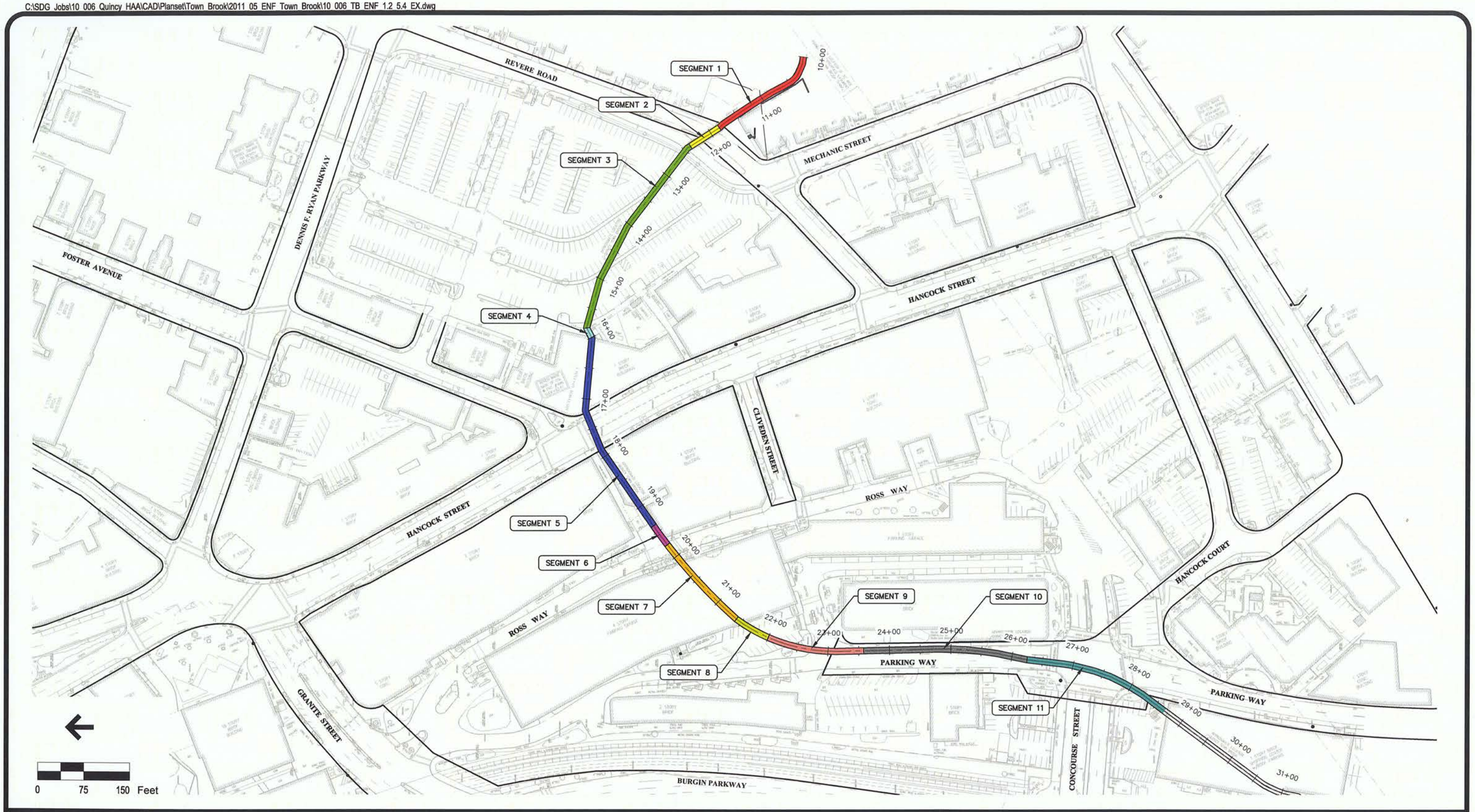
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 5.3 March 15, 2011

Flood Plain and Limit of Tidal Influence
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 1.2 5.4 EX.dwg




NOTES:
REFER TO FIGURE NO. 5.4.2 FOR EXISTING TOWN BROOK SEGMENT SUMMARY

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 5.4.1 March 15, 2011

Existing Town Brook
Culvert Alignment
Town Brook Enhancement Project
Quincy, Massachusetts

APPROXIMATE EXISTING TOWN BROOK CULVERT ALIGNMENT:

SEGMENT 1 - STA 10+00 (EL.=8.2±) TO 11+84 (EL=10.2±)- OPEN CHANNEL
AVERAGE SLOPE THROUGH SEGMENT 1 = 1.10%
GRANITE/CONCRETE SIDEWALLS, CHANNEL BOTTOM VARIABLE MATERIAL
CHANNEL WIDTH VARIES 7.3' TO 8.5' WIDTH.
$Q_{full}$=785± cfs

SEGMENT 2 - STA 11+84 (EL=10.2±) TO STA 12+39 (EL=10.3±)- CULVERTED SECTION
AVERAGE SLOPE THROUGH SEGMENT 2 = 0.20%
TWIN 6'-3" WIDE BY 4'-3" HIGH - CONCRETE BOX CULVERTS
$Q_{full}$=318± cfs

SEGMENT 3 - STA 12+39 (EL=10.3±) TO STA 15+82 (EL=12.7±) - PIPED SECTION
AVERAGE SLOPE THROUGH SEGMENT 3 = 0.70%
ARCHED CORRUGATED METAIL PIPE (CMP-ARMCO) 6'-7" HIGH X 9'-9" WIDE
$Q_{full}$=416± cfs

SEGMENT 4 - STA 15+82 (EL=12.7±) TO STA 16+00 (EL=13.0±) - OPEN CHANNEL
AVERAGE SLOPE THROUGH SEGMENT 4 = 1.67%
CONCRETE SIDEWALLS, CHANNEL BOTTOM VARIABLE MATERIAL
CHANNEL WITH VARIES 8.2' TO 10' WIDE
$Q_{full}$=449± cfs

SEGMENT 5 - STA 16+00 (EL=13.0±) TO STA 19+38 (EL=12.3±) CULVERTED SECTION
AVERAGE SLOPE THROUGH SEGMENT 5 = -0.20%
CONCRETE/ GRANITE CHANNEL WITH VARIABLE DIMENSIONS/ MATERIALS
$Q_{full}$=686± cfs

SEGMENT 6 - STA 19+38 (EL=12.3±) TO STA 19+76 (EL=12.39±) CULVERTED SECTION
AVERAGE SLOPE THROUGH SEGMENT 6 = 0.25%
STONE CULVERT 6'-6" HIGH X 9' WIDE
$Q_{full}$=221± cfs

SEGMENT 7 - STA 19+76 (EL=12.30±) TO STA 21+40 (EL=12.8±) CULVERTED SECTION
AVERAGE SLOPE THROUGH SEGMENT 7 = 0.25%
STONE CULVERT 5'-6" HIGH X 9' WIDE
$Q_{full}$=175± cfs

SEGMENT 8 - STA 21+40 (EL=12.8±) TO STA 22+00 (EL=12.94±) CULVERTED SECTION
AVERAGE SLOPE THROUGH SEGMENT 8 = 0.23%
CONCRETE CULVERT 5'-6" HIGH X 9' WIDE
$Q_{full}$=404± cfs

SEGMENT 9 - STA 22+00 (EL=12.94±) TO STA 23+58 (EL=13.3±) CULVERTED SECTION
AVERAGE SLOPE THROUGH SEGMENT 9 = 0.23%
CONCRETE CULVERT 5'-6" HIGH X 9' WIDE
$Q_{full}$=404± cfs

SEGMENT 10 - STA 23+58 (EL=13.3±) TO STA 26+25 (EL=13.5±) CULVERTED SECTION
AVERAGE SLOPE THROUGH SEGMENT 10 = 0.075%
CONCRETE CULVERT 5'-6" HIGH X 9' WIDE
$Q_{full}$=221± cfs

SEGMENT 11 - STA 26+25 (EL=13.5±) TO STA 28+67 (EL=14.2±) CULVERTED SECTION
AVERAGE SLOPE THROUGH SEGMENT 11 = 0.29%
CONCRETED CULVERT 5'-6" HIGH X 9' WIDE
$Q_{full}$=435± cfs

NOTES:
REFER TO FIGURE NO. 5.4.1 FOR THE SEGMENTED EXISTING TOWN BROOK CULVERT ALIGNMENT

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 5.4.2 March 15, 2011

Existing Town Brook
Segment Summary
Town Brook Enhancement Project
Quincy, Massachusetts

PROPOSED TOWN BROOK CULVERT ALIGNMENT:

SEGMENT 1 - STA 20+00 (EL.=8.2±) TO 20+93 (EL=10.3±)- OPEN CHANNEL
AVERAGE SLOPE THROUGH SEGMENT 1 = 1.14%
GRANITE/CONCRETE SIDEWALLS, CHANNEL BOTTOM VARIABLE MATERIAL
CHANNEL WIDTH VARIES 7.3' TO 8.5' WIDTH, CHANNEL DEPTH
$Q_{(full)}$=922± cfs

SEGMENT 2 - STA 20+93 (EL=10.3±) TO STA 22+05 (EL=10.6±)- VARIES (SEE OPTIONS)
AVERAGE SLOPE THROUGH SEGMENT 2 = 0.33%
11' WIDE BY 6' HIGH - CONCRETE BOX CULVERT - OPEN TOP
$Q_{(full)}$=674± cfs

OPTION 1
OPEN CHANNEL SECTION AND OPEN CHANNEL LOW FLOW STREAM SECTION WITH HIGH FLOW ENCLOSED BYPASS CULVERT (11' WIDE BY 6' HIGH)

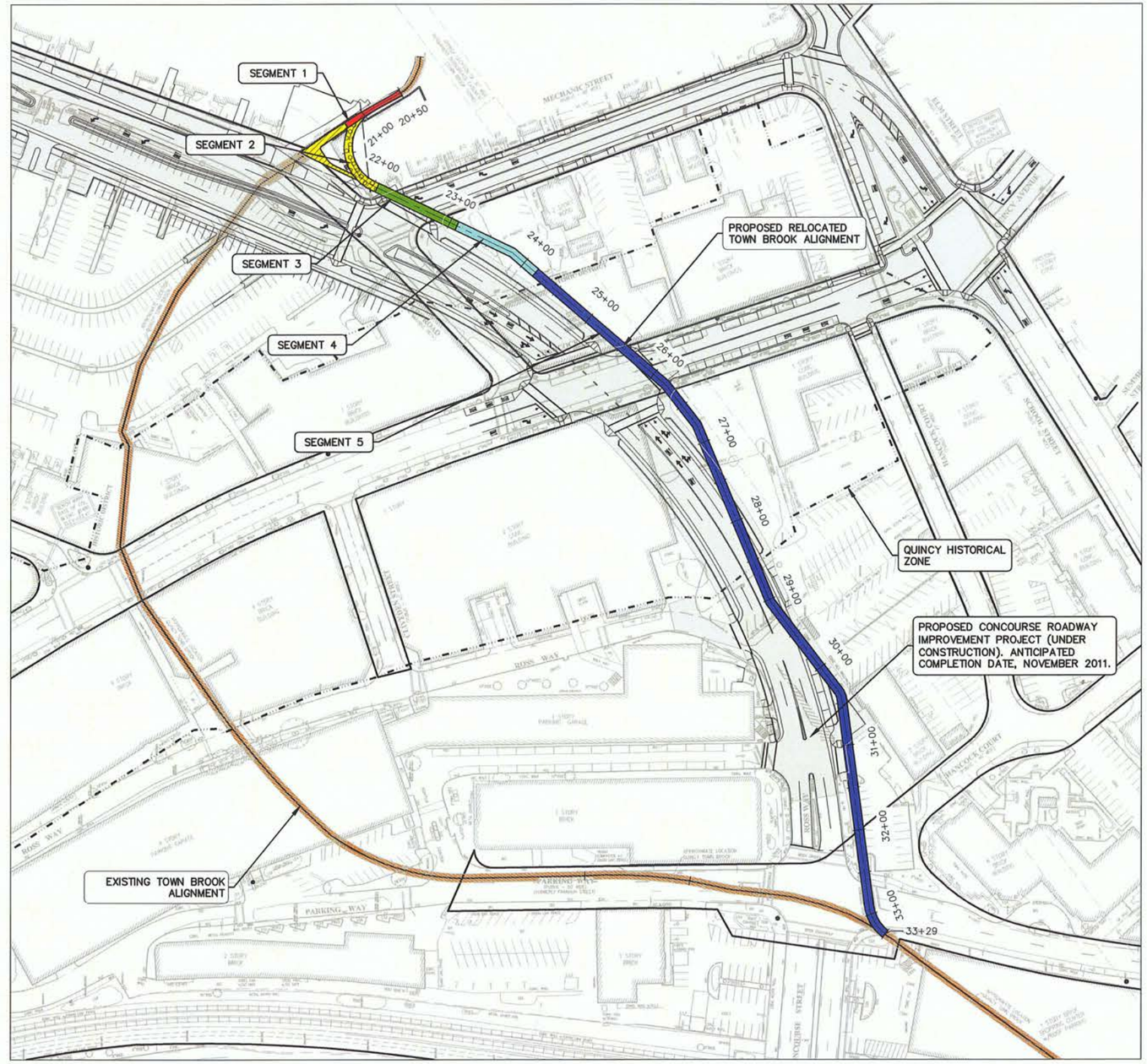
OPTION 2
OPEN CHANNEL SECTION - 11' WIDE BY 6' HIGH - CONCRETE BOX CULVERT - OPEN TOP

SEGMENT 3 - STA 22+05 (EL=10.6±) TO STA 23+09 (EL=11.0±) - BOX CULVERT
AVERAGE SLOPE THROUGH SEGMENT 3 = 0.33%
11' WIDE BY 6' HIGH - CONCRETE BOX CULVERT
$Q_{(full)}$=674± cfs

SEGMENT 4 - STA 23+09 (EL=11.0±) TO STA 24+17 (EL=11.3±) - OPEN CHANNEL
AVERAGE SLOPE THROUGH SEGMENT 4 = 0.33%
11' WIDE BY 6' HIGH - CONCRETE BOX CULVERT - OPEN TOP
$Q_{(full)}$=674± cfs

SEGMENT 5 - STA 24+17 (EL=11.3±) TO STA 33+29 (EL=14.2±) CULVERTED SECTION
AVERAGE SLOPE THROUGH SEGMENT 5 = 0.33%
11' WIDE BY 6' HIGH - CONCRETE BOX CULVERT
$Q_{(full)}$=674± cfs

0 75 150 Feet




NOTES:

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

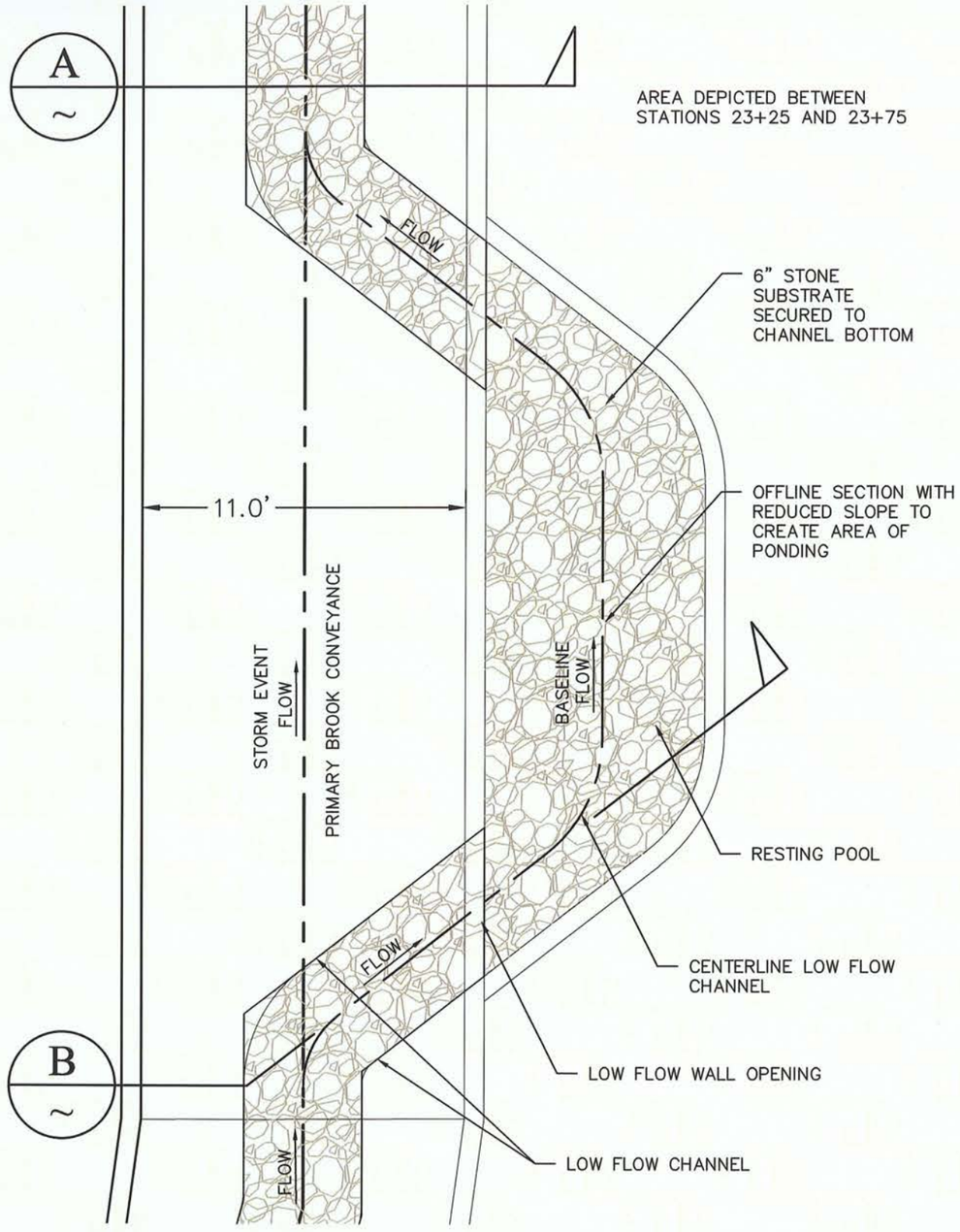
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

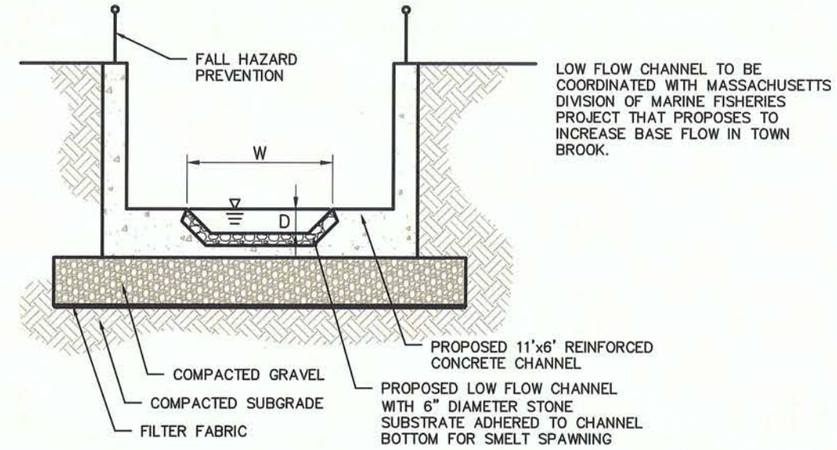
STEPHENSON DESIGN GROUP

Figure 5.5 March 15, 2011

Proposed Town Brook
Culvert Alignment
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Drainage\10 006 TB ENF 5.6 Sections.dwg

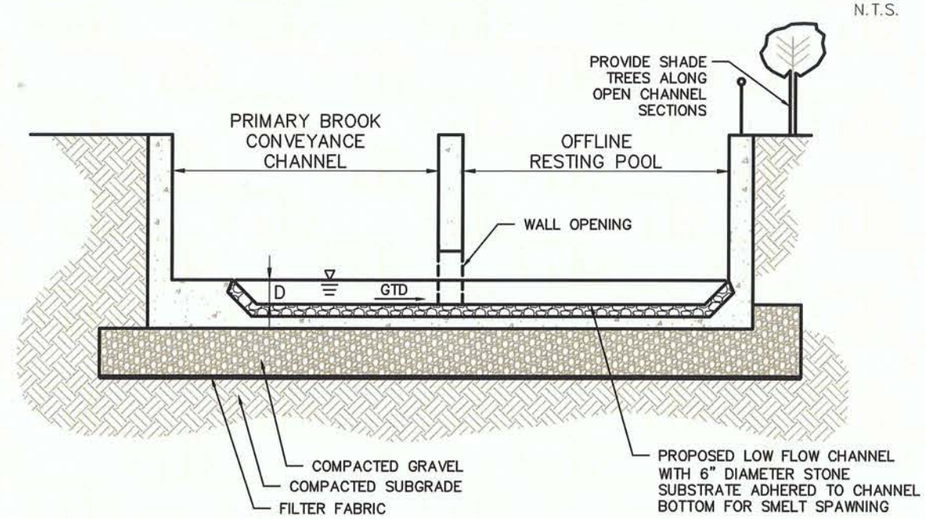



A

TYPICAL LOW FLOW CHANNEL SECTION 3/11

N.T.S.




B

RESTING POOL SECTION – OFFLINE OPTION 3/11

N.T.S.

DESIGN OBJECTIVES:

1 – MAINTAIN DESIGN VELOCITY OF 1.6–3.2 FT/SEC ("ATTRACTION VELOCITY" WITHIN SPAWNING RIFFLE SECTIONS
2– DAY LIT CULVERT SECTIONS AND RESTING POOLS SHALL HAVE 6" DIAMETER STONE SUBSTRATE SECURED TO CULVERT BOTTOM
3 – PROVIDE SHADE TREES ALONG DAY LIT SECTIONS OF CULVERT.
4 – MAINTAIN FLOW DEPTH OF 6"–12" IN SPAWNING RIFFLES DURING LOW/ BASE FLOW

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

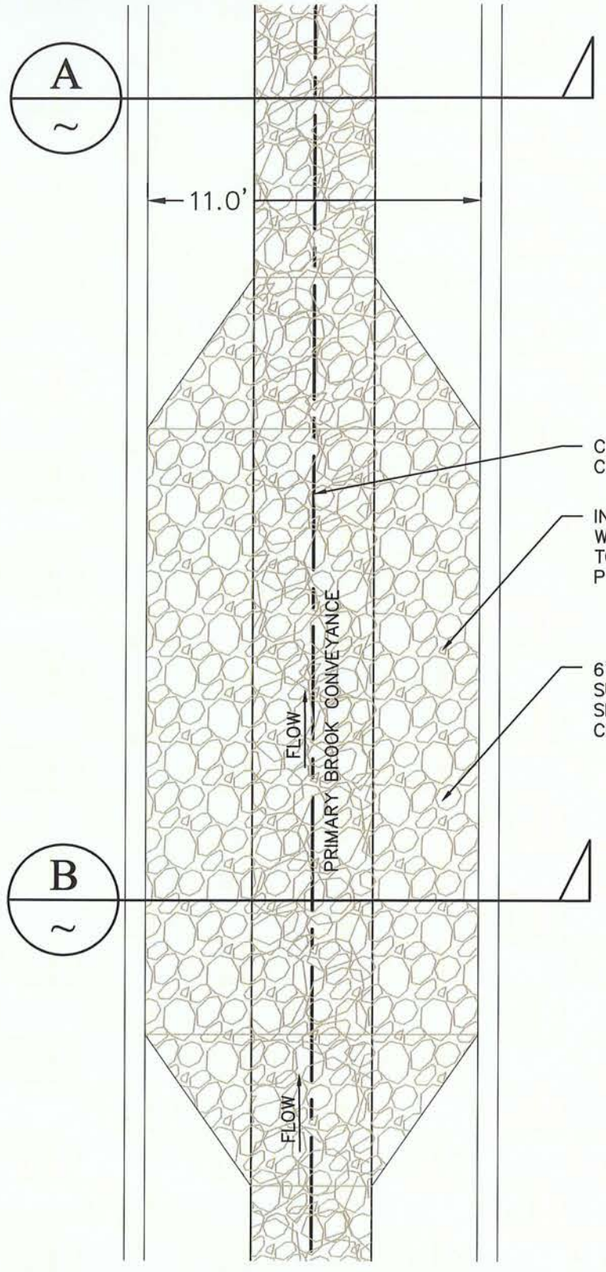
LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 5.6.1 March 15, 2011

Proposed Town Brook Cross Sections
Offline Smelt Resting Pool Option
Town Brook Enhancement Project
Quincy, Massachusetts

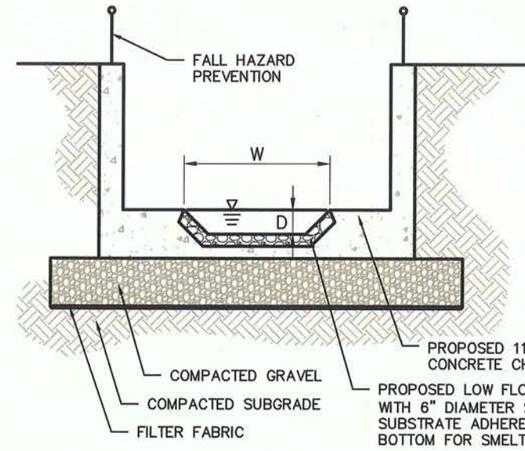



AREA DEPICTED BETWEEN STATIONS 23+25 AND 23+75

CENTERLINE LOW FLOW CHANNEL

INLINE RESTING POOL WITH REDUCED SLOPE TO CREATE AREA OF PONDING

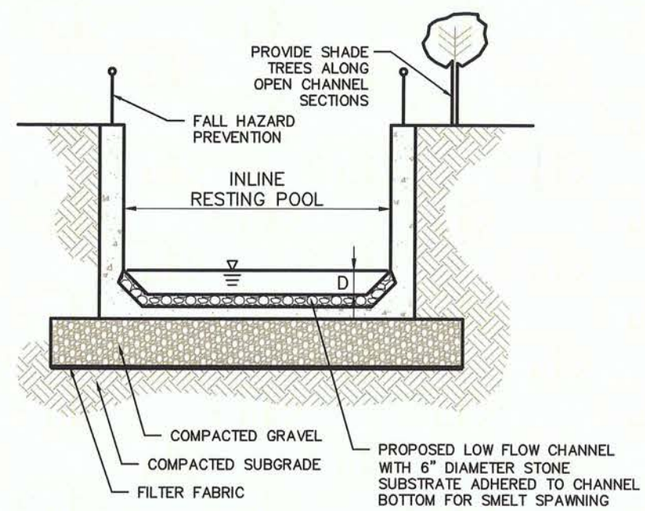
6" STONE SUBSTRATE SECURED TO CHANNEL BOTTOM




LOW FLOW CHANNEL TO BE COORDINATED WITH MASSACHUSETTS DIVISION OF MARINE FISHERIES PROJECT THAT PROPOSES TO INCREASE BASE FLOW IN TOWN BROOK.

A ~ TYPICAL LOW FLOW CHANNEL SECTION 3/11

N.T.S.




B ~ RESTING POOL SECTION – INLINE OPTION 3/11

N.T.S.

DESIGN OBJECTIVES:

1 – MAINTAIN DESIGN VELOCITY OF 1.6–3.2 FT/SEC ("ATTRACTION VELOCITY" WITHIN SPAWNING RIFFLE SECTIONS
2– DAY LIT CULVERT SECTIONS AND RESTING POOLS SHALL HAVE 6" DIAMETER STONE SUBSTRATE SECURED TO CULVERT BOTTOM
3 – PROVIDE SHADE TREES ALONG DAY LIT SECTIONS OF CULVERT.
4 – MAINTAIN FLOW DEPTH OF 6"–12" IN SPAWNING RIFFLES DURING LOW/ BASE FLOW

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 5.6.2 March 15, 2011

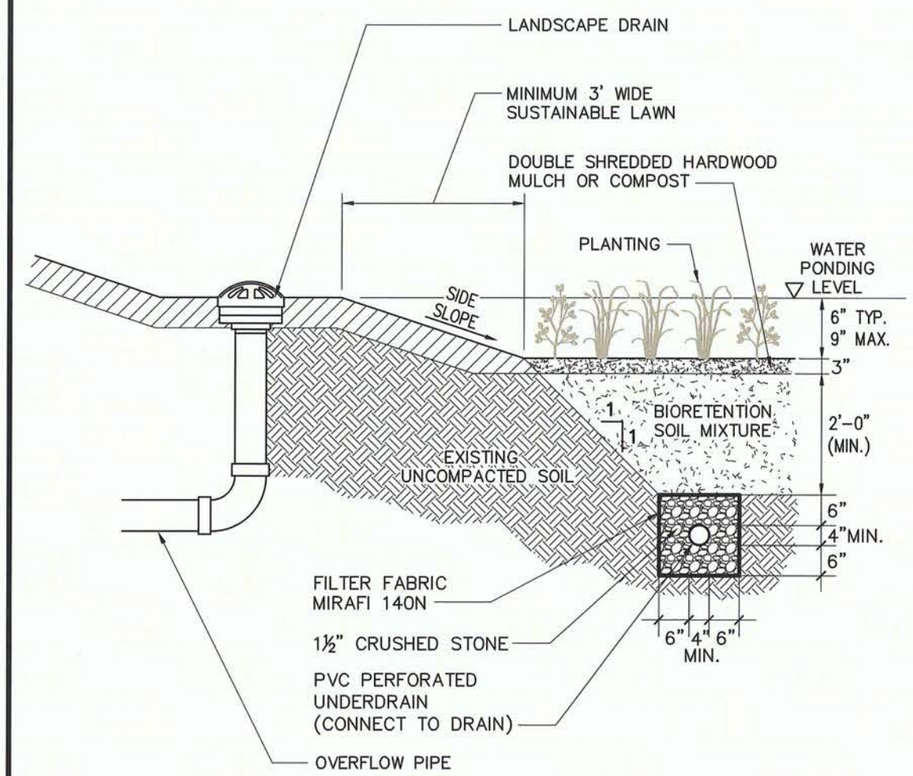
Proposed Town Brook Cross Sections
Inline Smelt Resting Pool Option
Town Brook Enhancement Project
Quincy, Massachusetts

## Rain Garden with Subdrain - Implemented in Open Space Areas

N.T.S.

**Notes:**

1. INSTALL UNDERDRAINS AT 10 FEET ON CENTER. CONNECT TO DRAINS PER PLAN.
2. SIDE SLOPES SHALL BE 3:1 MAX. 2% MIN




This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

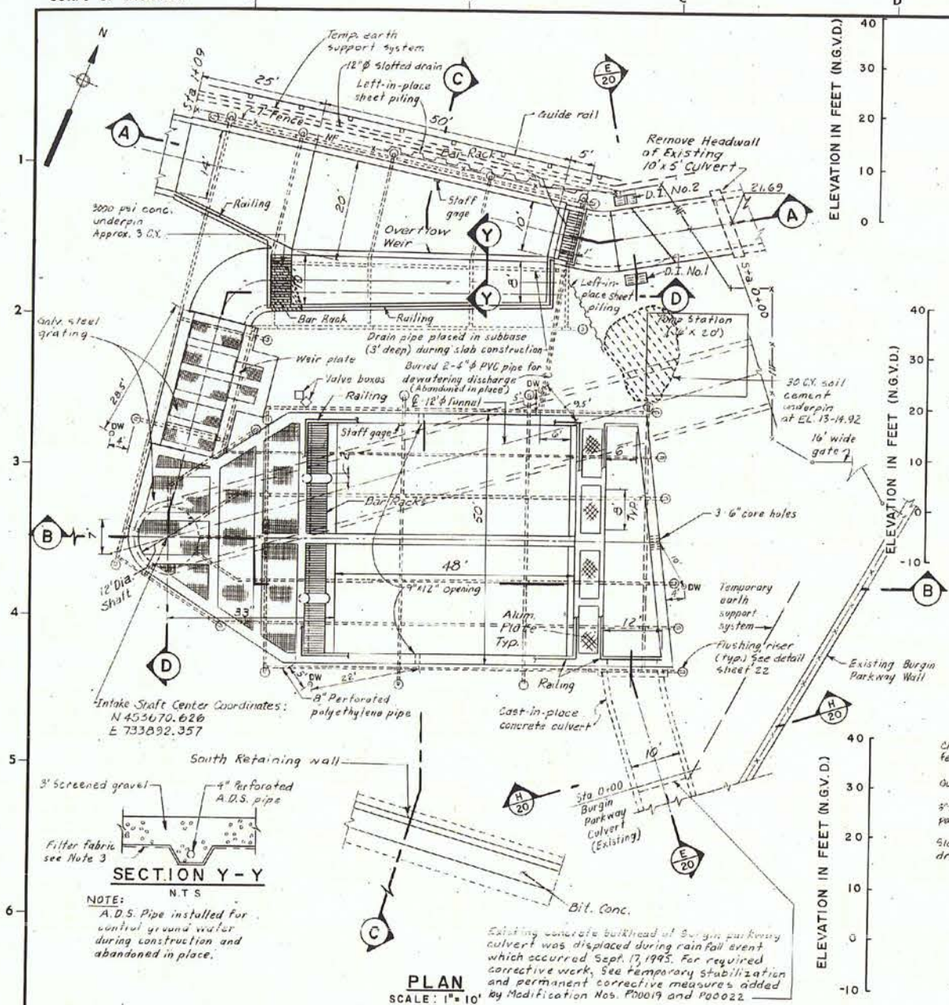
Figure 5.7 March 15, 2011

Mitigation Measures Details

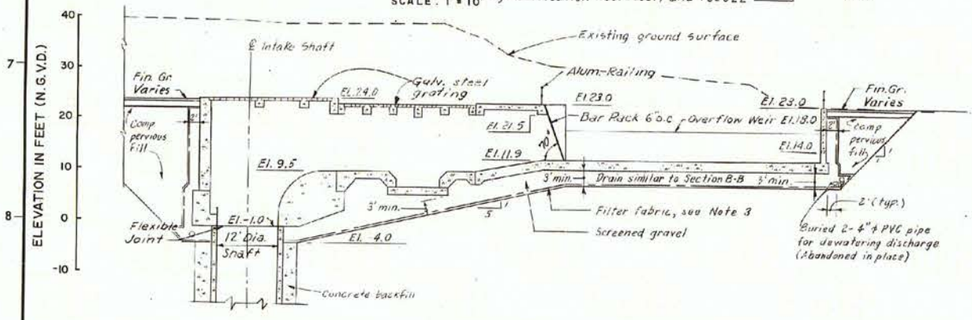
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Drainage\10 006 TB ENF 5.8 Tunnel Intake.dwg

CORPS OF ENGINEERS — U. S. ARMY

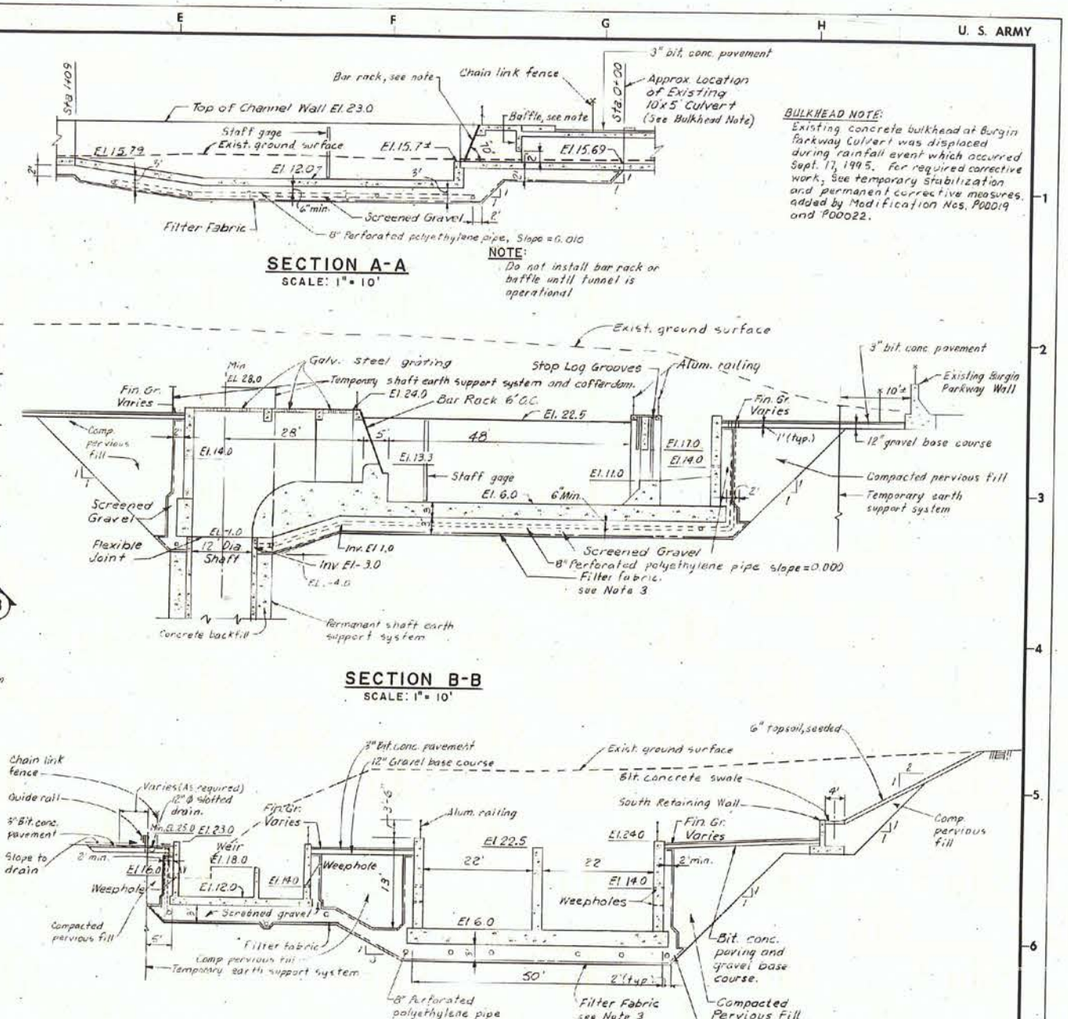



PLAN
SCALE: 1" = 10'




SECTION Y-Y
N.T.S.

NOTE:
A.D.S. Pipe installed for control ground water during construction and abandoned in place.




BULKHEAD NOTE:
Existing concrete bulkhead at Burgin Parkway Culvert was displaced during rainfall event which occurred Sept. 17, 1995. For required corrective work, See temporary stabilization and permanent corrective measures, added by Modification Nos. P00019 and P00022.

NOTE:
Do not install bar rack or baffle until tunnel is operational

SECTION A-A
SCALE: 1" = 10'

SECTION B-B
SCALE: 1" = 10'




SECTION C-C
SCALE: 1" = 10'




SECTION D-D
SCALE: 1" = 10'

NOTES:

1. See structural sheets for dimensions of concrete structures and location of aluminum railings
2. See Mechanical sheets for piping locations and details
3. Filter fabric shall be installed between the pervious fill and screened gravel layers next to the grit basin, intake channel and overflow structures. Filter fabric shall extend vertically to the road subbase then horizontally between the subbase and screened gravel. See applicable sections: B-B, C-C, D-D, E-20, and H-20.

SAFETY PAYS

GRAPHIC SCALES
1" = 10'

**Record Drawing**
Contract no. DACW33-93-C-0064

| REVISION | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | Final field corrections | |

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DESIGNED M.A.D. DRAWN H.F.E. CHECKED
CHIEF, DESIGN BRANCH
CHIEF, DESIGN DIVISION
REVIEWED
DIV. MANAGER
APPROVAL RECOMMENDED
CHIEF, ENG. INVEST. DIVISION

WATER RESOURCES DEVELOPMENT PROJECT
QUINCY, MASSACHUSETTS
TOWN BROOK LOCAL PROTECTION
TUNNEL AND APPURTENANT STRUCTURES
INTAKE AREA-PART PLAN AND SECTIONS

APPROVED
DIRECTOR OF ENGINEERING
DATE MAR. 1993
SCALE 1" = 10' SPEC. NO. DACW33-93-B-0041
DRAWING NUMBER
TOW - 1
SHEET 19

STEPHENSON DESIGN GROUP
Figure 5.8 — March 15, 2011
Deep Rock Tunnel Intake Plans
Town Brook Enhancement Project
Quincy, Massachusetts

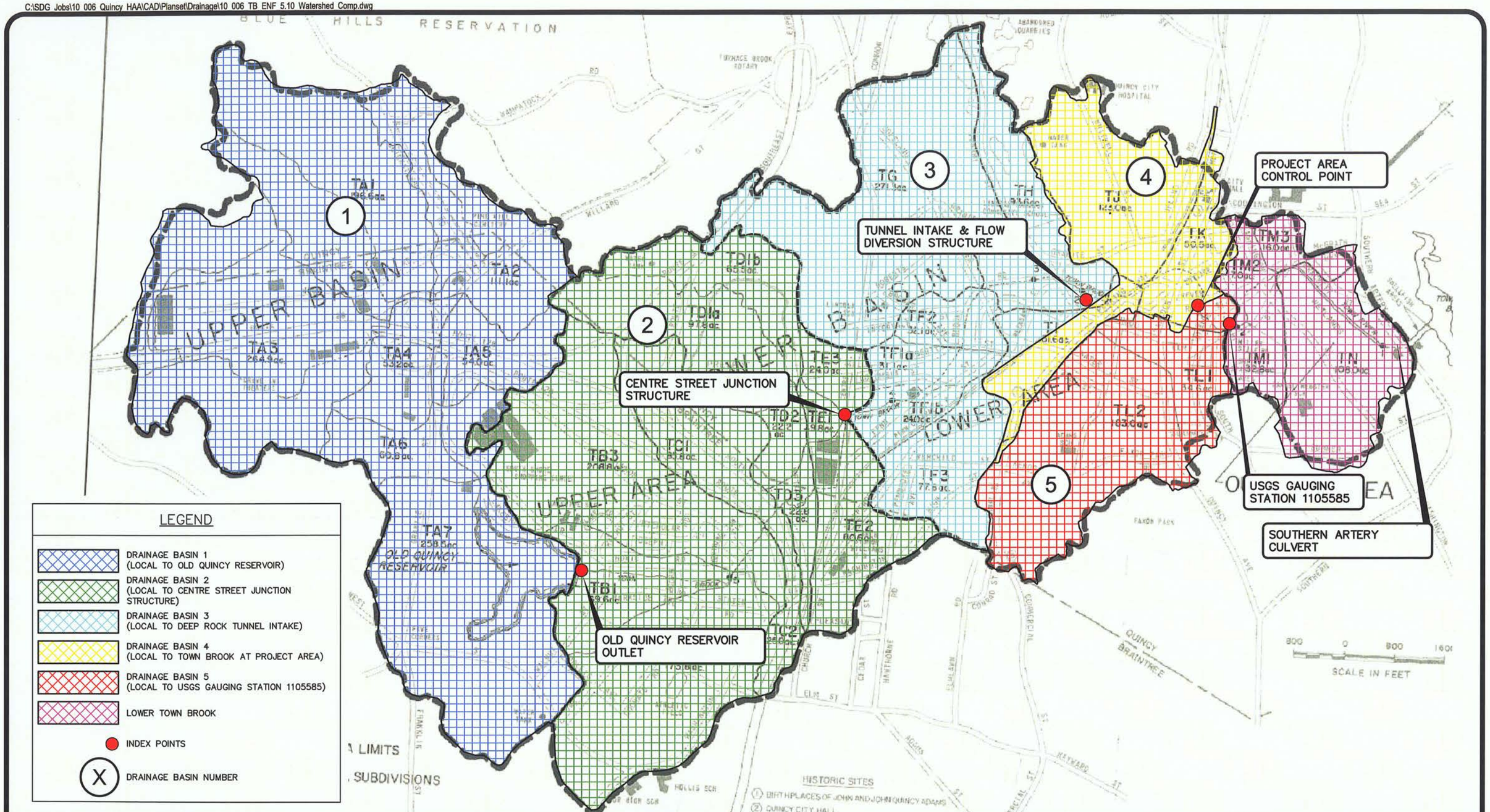
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

This Figure Prepared in Coordination With:
CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Drainage\10 006 TB ENF 5.10 Watershed Comp.dwg




NOTES:
REFERENCED WATERSHED DELINEATION TAKEN FROM:

**REPORT TO THE COMMONWEALTH OF MASSACHUSETTS METROLPOLITAN DISTRICT COMMISSION ON FLOOD CONTROL SYSTEMS FOR TOWN BROOK, QUINCY AND BRAINTREE (TB-019)**, PREPARED FOR THE MDC BY METCALF AND EDDY, MARCH 1979.

0 750 1,500 Feet

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

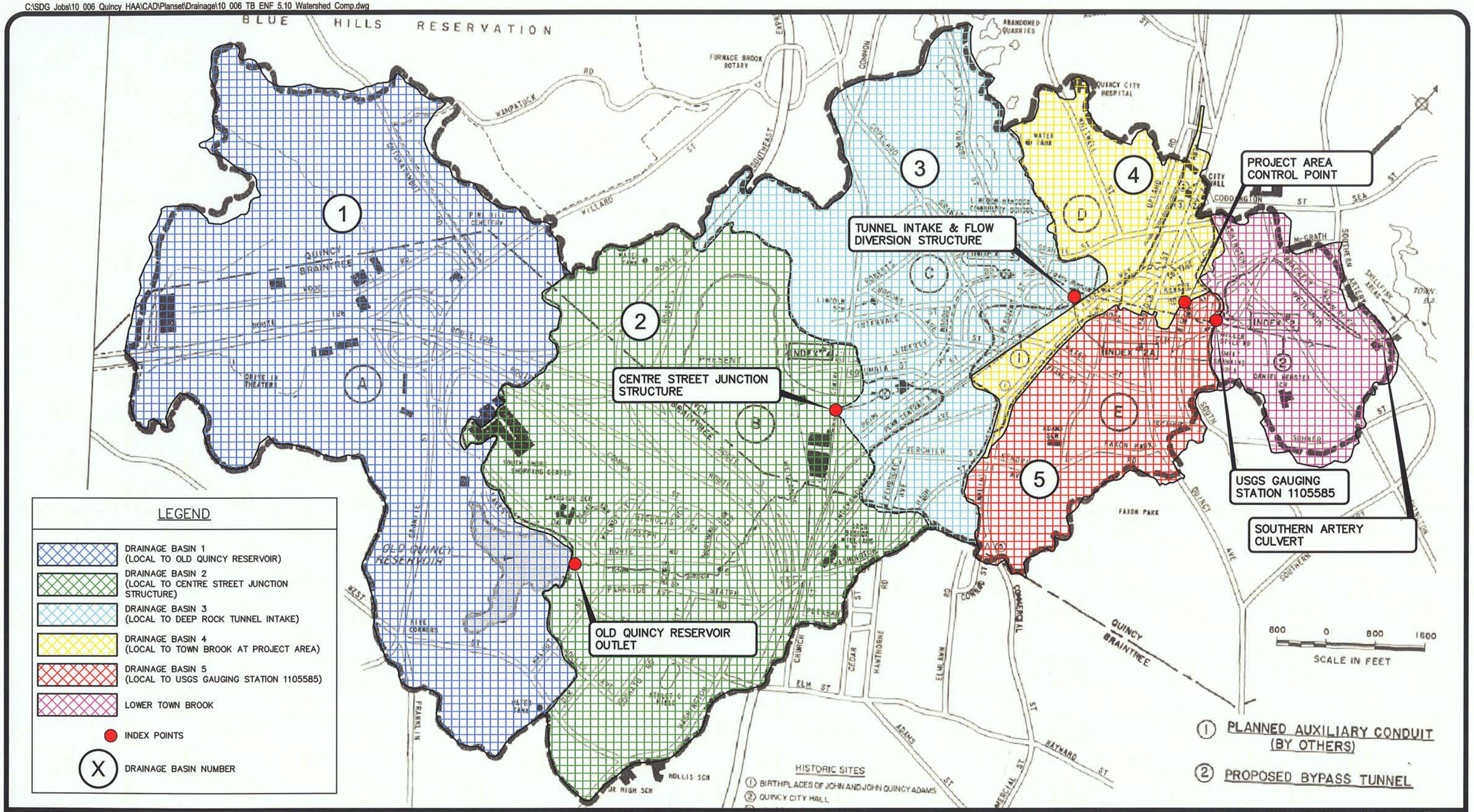
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 5.9.1 March 15, 2011

Town Brook Drainage Basin Comparison
MDC Basin Delineation
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Drainage\10 006 TB ENF 5.10 Watershed Comp.dwg




0 750 1,500 Feet

NOTES:
REFERENCED WATERSHED DELINEATION TAKEN FROM:

**TOWN BROOK LOCAL PROTECTION DESIGN MEMORANDUM NO. 1 GENERAL DESIGN AND HYDROLOGY (TB-006)**
PREPARED BY THE UNITED STATES ARMY CORPS OF ENGINEERS, FEBRUARY, 1985

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 5.9.2 March 15, 2011

Town Brook Drainage Basin Comparison
ACOE Basin Delineation
Town Brook Enhancement Project
Quincy, Massachusetts

# CHAPTER 6

# SOIL AND GROUNDWATER CONDITIONS

## INTRODUCTION

The enhancement and realignment of Town Brook will involve diversion of the perennial stream from a connection point upstream of Quincy Center through approximately 1,200 linear feet of closed and open channel sections of culvert to the proposed connection point downstream of Quincy Center where the culvert will rejoin the existing Town Brook alignment. Generally, the relocated alignment will be configured along the south side of the Concourse Roadway Improvement project, which is currently under construction.

This Chapter describes surface and subsurface conditions along the alignment, anticipated construction methods, and actions to mitigate potential adverse impacts of the work.

## OVERVIEW OF SITE CONDITIONS

The proposed Town Brook alignment traverses generally west to east through developed areas of the City just south of Quincy Center. From its connection to Town Brook just west of Parking Way (Sta. 33+29), current conditions along the alignment include a paved section along the south side of Converse Street, an unpaved lot between Ross Way and Hancock Street, a crossing at Hancock Street, a vacant block between Hancock and Mechanic Streets, a crossing at Mechanic Street, and reconnection to Town Brook just south of Revere Road (Sta. 20+91).

The alignment passes within about six feet of the northeast corner of a retail building on Converse Street at approximately Station 30+25. Just east of Hancock Street, the alignment passes through the footprint of a former single-story retail building at approximately 1630 Hancock Street, which has recently been demolished. At the eastern limits of the alignment, the culvert will travel beneath the footprint of the current American Legion building at 2 Mechanic Street (parcel D91), which will be demolished. Along its remaining length, the alignment is relatively distant from existing structures.

## TOPOGRAPHY

Surface topography varies significantly along the proposed alignment, as follows:

| Table 6-1<br>Surface Topography Summary | | | |
|---|---|---|---|
| **Location** | **Station** | **Existing Surface Grades** | **Depth to Culvert Invert (ft.)** |
| Connection at Parking Way | 33+29 | El. 26 | 13 |
| Along Concourse Street | 33+29 to 29+00 | El. 26 to El. 23 | 11 to 13 |
| Concourse Street to Hancock Street | 29+00 to 26+85 | El. 23 to El. 36 | 11 to 24 |
| Hancock Street Crossing | 26+85 to 24+00 | El. 36 to El. 30 | 24 to 20 |
| Mechanic Street Crossing | 24+00 to 22+00 | El. 30 to El. 18 | 20 to 8 |
| Reconnection Near Revere Road | 21+91 | El. 14 | 4 |

## GEOLOGY, HYDROGEOLOGY, AND SUBSURFACE CONDITIONS

Soil conditions in Quincy Center and specifically in the vicinity of the relocated Town Brook alignment were derived primarily from the most recent glacial advance and retreat, which deposited a broad range of soil types. Naturally-deposited soils in the area of the alignment typically consist of sands and gravels which may overlie fine-grained glacial lake bed sands, silts and possibly clays at depth. Following glaciation, compressible organic deposits accumulated locally along stream valleys and within low-lying depressions. Historical construction and industrial activities modified the landscape with the placement of fill soils and the construction of various building foundations and other civil infrastructure.

Nine test borings (designated B-TB1 through B-TB8 including B-TB3A) were conducted along the proposed alignment in December 2010, ranging in depths from 15 to 30 feet. Typically, the test borings were terminated near or below the proposed culvert invert.

The test borings disclosed the following general sequence of subsurface strata, proceeding from ground surface downward. The encountered conditions were consistent with the area geology.

| Table 6-2<br>Subsurface Strata Summary | |
|---|---|
| **Stratum** | **Range in Encountered Thickness, Feet** |
| Pavement, Loam and MISCELLANEOUS FILL | 4 to 15.5 |
| PEAT | 0 to 3.5 |
| SAND with varying amounts of gravel, cobbles | 6.5 to 20 |

Peat was encountered in B-TB6 and B-TB7 at approximately Sta. 30+11 and Sta. 31+16, respectively, at locations of relatively low topography along Converse Street in the general vicinity of the historic abandoned Town Brook alignment. The SAND stratum, typically dense to very dense, was not fully penetrated in any of the test borings.

Based on the test borings, conditions at the proposed culvert inverts are anticipated to typically consist of the following:

**Table 6-3**
**Soil Conditions at Proposed Inverts**

| Approximate Station | Soil Conditions at Invert |
|---|---|
| Sta. 33+29 to Sta. 30+50 | FILL or PEAT |
| Sta. 30+50 to Sta. 29+50 | FILL or SAND |
| Sta. 29+50 to Sta. 21+91 | SAND |

Water was reported in the seven of the nine test borings (not encountered in B-TB1 and B-TB2) at depths ranging from 11.5 to 25 feet. The recorded water levels were typically below the planned culvert invert elevations. Accordingly, significant dewatering is not anticipated to be required for culvert installation.

## LIMITS & EXTENTS OF KNOWN CONTAMINATION

A Phase I Environmental Site Assessment was performed by Vanasse Hangen Brustlin, Inc. in November 2008 for the property located at 1515 Hancock Street, approximately 300 feet north of the relocated culvert alignment. Limited information on environmental conditions in the area is contained in that report.

No specific releases have been identified along the alignment. However, due to the urban setting of the proposed alignment, subsurface contamination may be present. Typical sources of soil and/or groundwater contamination for such an urban area could include former commercial or industrial uses of properties along the alignment, underground oil storage tanks, urban fill, and releases associated with vehicular traffic.

## CONTAMINATED SOIL & GROUNDWATER PROTOCOL

Installation of the relocated culvert will generate excess and unsuitable soils that may require off-site disposition. Soils to be disposed off-site will be characterized in accordance with the requirements of the Massachusetts Contingency Plan, 310 CMR 40.0000 ("MCP") and disposal facility acceptance criteria. If oil or hazardous materials as defined by the MCP are encountered, regulatory actions including assessment and mitigation will be performed as required in accordance with the MCP. Discharge of dewatering effluent will be performed in accordance with all applicable regulations including NPDES.

## FOUNDATION/BASE RECOMMENDATIONS

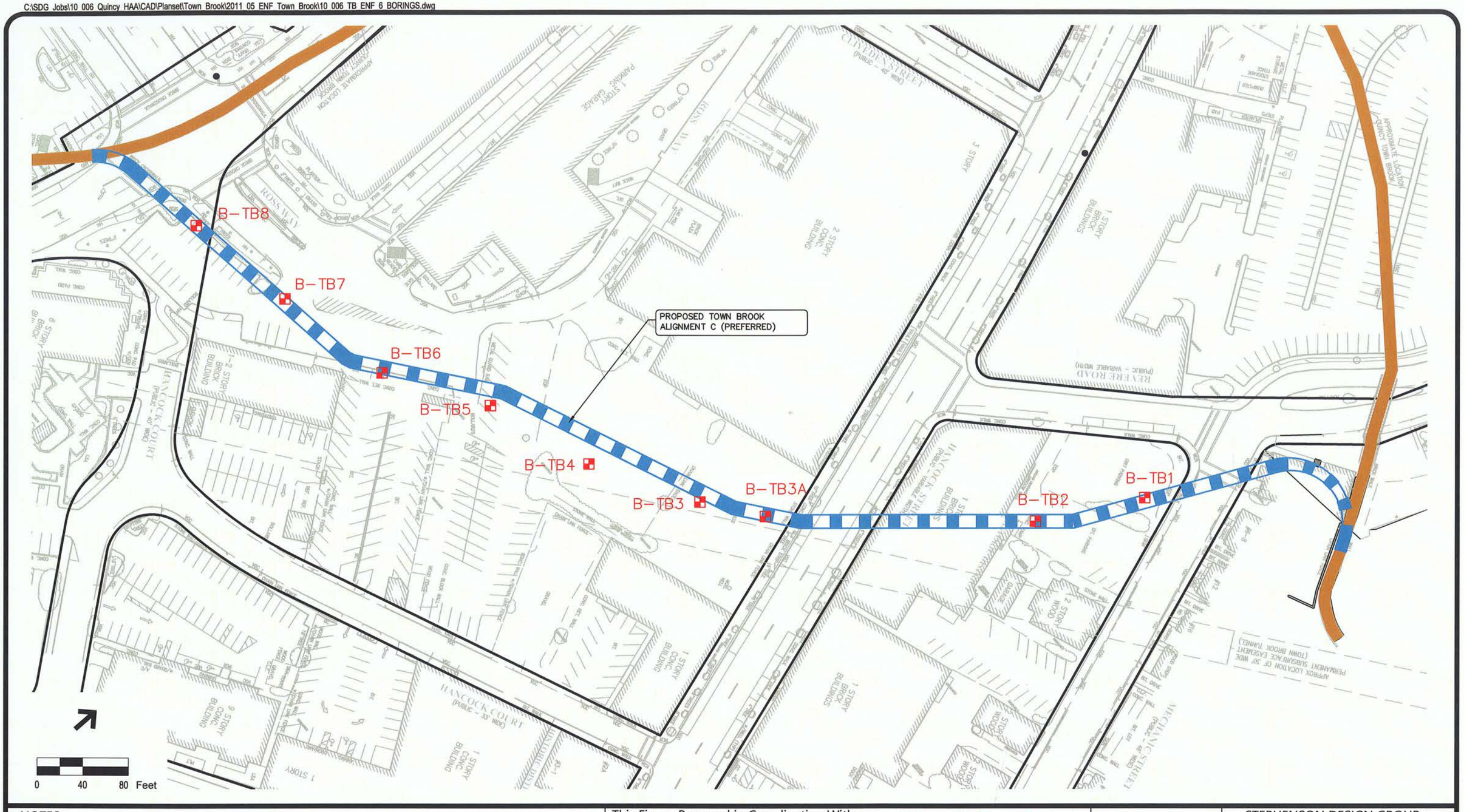
Piles or other deep or special foundations are not anticipated to be required for support of the culvert. It is expected that direct soil support for the culvert will be feasible after excavation and subgrade preparation.

As noted above, the test borings indicated soil conditions at the proposed culvert inverts for most of the alignment that consisted of sandy FILL or naturally-deposited SAND soils. In those areas, the exposed soils are anticipated to be suitable for support of the proposed culvert after subgrade preparation and placement of bedding materials. For a short section of the alignment, in the vicinity of test borings B-TB6 and B-TB7 estimated to be from approximately Sta. 31+50 to Sta. 30+50, the subgrade could consist of PEAT or thin FILL overlying PEAT, which would represent potentially unsuitable bearing conditions. Where such conditions are exposed, the unsuitable materials will be excavated and replaced with suitable bedding materials or crushed stone prior to culvert installation.

## EXCAVATION AND EXCAVATION SUPPORT

The proposed concrete culvert will be installed using conventional utility trenching methods except for the crossing at Hancock Street which will be performed using trenchless methods such as pipe jacking or directional drilling due to the significant depth of the structure below grade in that area. Trenching will typically be performed using trench boxes for lateral support. Locally, internally-braced timber sheeting may be used if needed to accommodate the proximity of existing utilities or other substructures. Soldier piles and lagging may be used in the vicinity of the existing building at approximately Sta. 30+25, to protect the building foundations. Further evaluations are planned to assess the need for underpinning the corner of the building foundation in this area.

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 6 BORINGS.dwg




NOTES:

1. BORINGS PERFORMED BY CARR-DEE CORP., MEDFORD, MASSACHUSETTS ON DECEMBER 15, 2010.
2. REFER TO FIGURE 6.2 FOR BORING LOGS

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

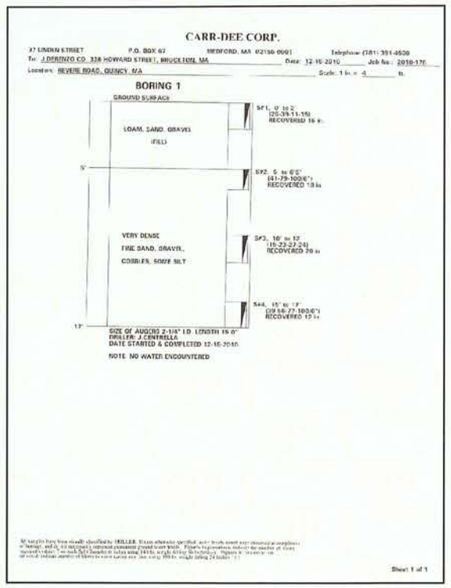
STEPHENSON DESIGN GROUP

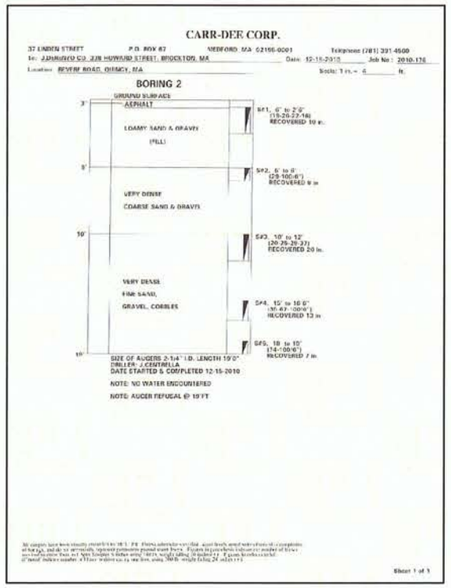
Figure 6.1 March 15, 2011

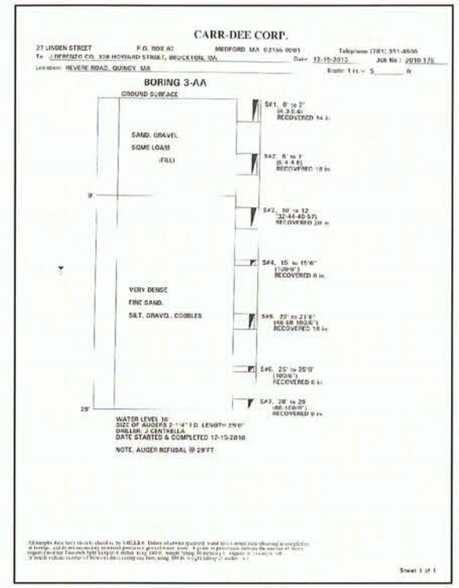
Boring Location Plan

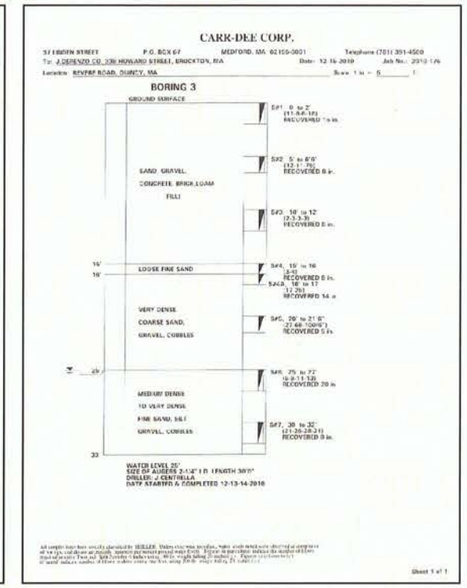
Town Brook Enhancement Project
Quincy, Massachusetts

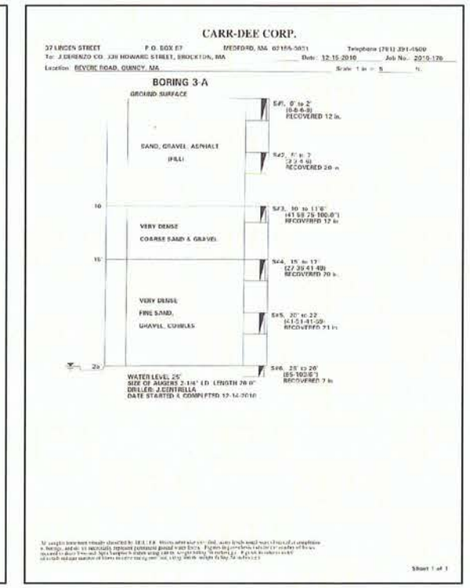
C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 6 BORINGS.dwg

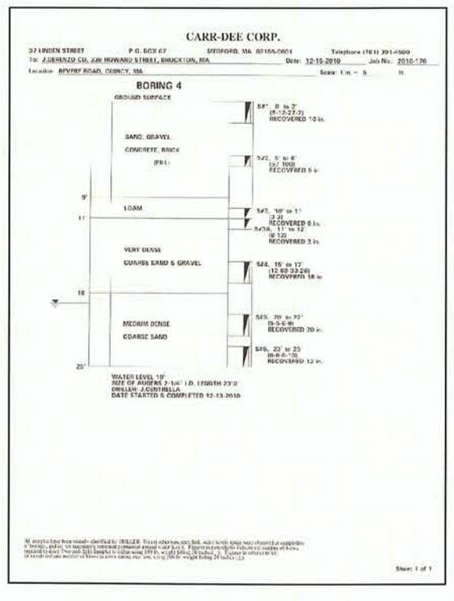


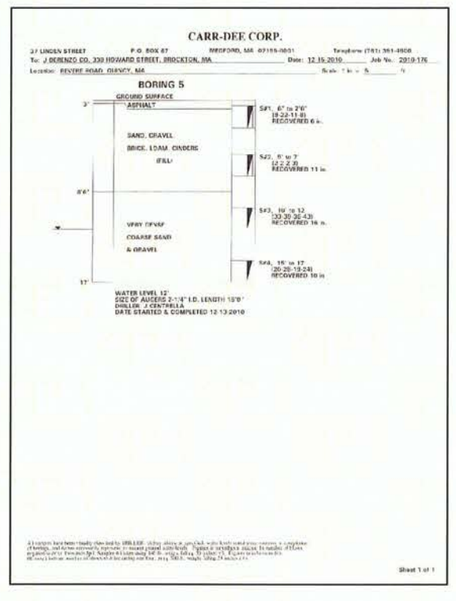



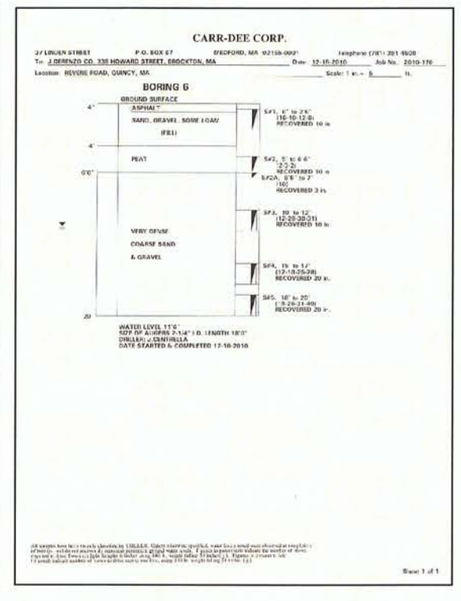



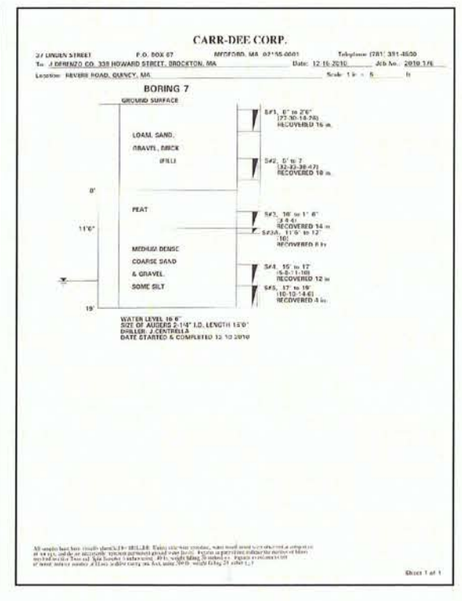



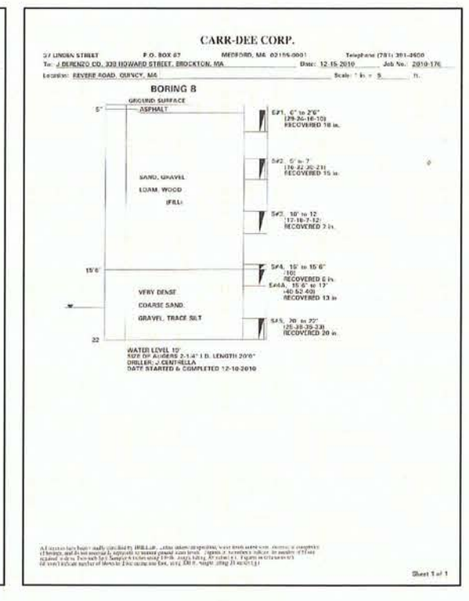




NOTES:

1. BORINGS PERFORMED BY CARR-DEE CORP., MEDFORD, MASSACHUSETTS ON DECEMBER 15, 2010.
2. REFER TO FIGURE 6.1 FOR BORING LOCATIONS.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 6.2 March 15, 2011

Boring Logs

Town Brook Enhancement Project
Quincy, Massachusetts

# CHAPTER 7
# CONSTRUCTION PERIOD IMPACTS

## INTRODUCTION

Construction of the Town Brook Enhancement Project will generally consist of connecting a new culvert to the existing culvert alignment upstream of Quincy Center and conveying the existing flow, from west to east, along the south side of the Concourse Roadway Improvement project, which is currently under construction. This will divert Town Brook flow through approximately 1,200 linear feet of 11' wide x 6' high closed and open channel/day-lit sections of culvert to the proposed connection point downstream of Quincy Center where it will rejoin the existing Town Brook alignment.

## CONSTRUCTION PHASING

Construction of the Project will occur in two primary phases to minimize impacts to the stream and to take advantage of the existing construction activities associated with the Concourse Roadway Improvement Project.

Phase I of the Project will include the installation of 'dry' culvert outside the limits of the resource areas located within the project area. Phase I construction activities shall be concurrent with the construction of the Concourse Roadway Improvement Project. There will be no connection to the existing Brook or alteration of regulated resource areas during this phase.

Phase II of the Project will include the remainder of the culvert construction, including both connection points at the upstream and downstream ends of the culvert. Phase II construction will include work within regulated resource areas as previously stated in Chapter 3. Phase II construction cannot proceed until all necessary local, state and federal permits are obtained.

No construction activities shall occur during the active fish run season, March 1 through June 15. Construction activities within the Brook shall occur only during low-flow conditions outside the specified date range.

## NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM

Under the NPDES provisions of the Clean Water Act, the U.S. Environmental Protection Agency regulates water quality, sediment, and pollutant discharge of stormwater runoff from construction sites. Construction projects that propose the alteration of one or more acres of land must obtain coverage under the NPDES Stormwater Construction General Permit. The project proponent must submit a one page registration form known as a Notice of Intent to the EPA and must develop and implement a Stormwater Pollution Prevention Plan. The SWPPP details construction activities, erosion control measures, and inspection schedules to be

implemented during construction to ensure that the construction activities do not have an adverse impact on wetlands and waterways. A Construction General Permit will be obtained prior to the start of construction for related impacts.

**Spill Prevention Control & Countermeasures**

Spill prevention, control and countermeasures have been prepared as an overall objective to develop a functional contingency plan that meets all federal, state, and local emergency response programs. This plan is designed to minimize hazards to human health and/or the environment from any unplanned sudden or non-sudden releases of oils, toxic, hazardous, or other polluting materials to the air, soil, surface water or groundwater.

This plan identifies the type and quantity of material handled for this project and measures taken for spill preparedness and prevention. Emergency response procedures describe the actions that will be taken in response to leaks, spills, or discharges of oil and hazardous wastes and hazardous substances. Spill incident reporting procedures and arrangements with the local police and fire departments, hospitals, and state and local emergency response teams will be developed prior to construction.

**Material and Waste Inventory**

A list of the locations, sources and quantities of chemicals used or stored within the project atea that have the potential of causing environmental degradation or endangerment of public health and safety through accidental releases will be prepared prior to construction. This list will include nutrients, such as fertilizers and sanitary wastes; solid waste, such as scrap metals, masonry products and other construction raw materials and debris; construction chemicals, such as paints, soil additives and acids for cleaning; petroleum products, such as fuels and lubricants; and other materials including concrete wash from mixers, explosives, etc.

**Good Housekeeping Program**

The construction area will be maintained in a neat and orderly manner. Solid wastes, such as food, wrappings, cigarette butts and packets, styrofoam cups and plates, and similar wastes will be disposed of off-site, not in construction holes. Any spills or leaks will be cleaned up as expeditiously as possible. Trash will be routinely collected for off-site disposal. Container storage areas will be maintained in a neat and orderly manner. The Contractors representatives will:

- Inspect work areas daily for proper use, storage and clean-up of material on site
- Store only enough material onsite to satisfy current construction job requirements needs – use entire contents of open container before opening new container
- Follow manufacturer's instructions and/or federal, state and local regulations for handling, storage, and disposal of materials
- Store hazardous materials in original, labeled, tightly lidded containers separate from each other
- Keep Material Safety Data Sheets (MSDS) on site and available for inspection

### NPDES Inspection and Record Keeping Requirements

Visual inspections of all BMPs on the construction site will be performed weekly and within 24 hours of the end of a storm with rainfall amounts greater than 0.5 inches. Inspection personnel will be designated prior to construction.

The inspections are intended to verify that the BMPs of the SWPPP are in working condition and are minimizing erosion. The inspection will also note whether corrective actions to established BMPs are required or whether additional BMPs are necessary to prevent stormwater contamination based on field conditions. Completed forms will be provided to the on-site supervisor and maintained at the Owner's office during the entire construction project.

If construction activities or design modifications are made to the site plan that could impact stormwater, the SWPPP will be amended appropriately. The amended SWPPP will have a description of the new activities that contribute to the increased pollutant loading and the planned source control activities. Amendments will be added as an attachment if necessary.

## BEST MANAGEMENT PRACTICES

The site design includes BMPs to control pollutants, sediment transport, and maintain potentially unstable soils during construction. Descriptions of the BMPs that were incorporated into the design are included below. The BMPs used in this design were chosen for their effectiveness balanced against required maintenance.

### STORMWATER MANAGEMENT CONTROLS

During construction, there is the potential for stormwater impact. However, through the implementation to BMP's and the SWPPP, impacts to stormwater will be minimized if not completely avoided. The SWPPP will include potential impacts to stormwater and ways to avoid and minimize potential impacts and contamination of stormwater.

### Potential Impacts for Stormwater Contamination

Construction typically requires the following general operations that have the potential for erosion and sedimentation due to stormwater flows.

- Culvert Construction: excavating for the culverts create soil stockpiles with the potential for erosion
- Construction Vehicles: refueling of vehicles may spill or drip gasoline and diesel fuel onto the ground. On-site maintenance of excavating equipment may drip hydraulic oil, lubricants and antifreeze onto the ground.

### Avoidance and Minimization of Stormwater Impacts

Best management erosion control practices have been incorporated to ensure the control of erosion from the temporary work areas. Erosion controls will be installed prior to construction activities and maintained until road surfaces have been repaved and road shoulders re-vegetated and stabilized. Dewatering structures will be constructed prior to excavation in areas where groundwater may be and located outside of the 100-Foot Buffer Zone.

## PROTECTION OF SMELT HABITAT

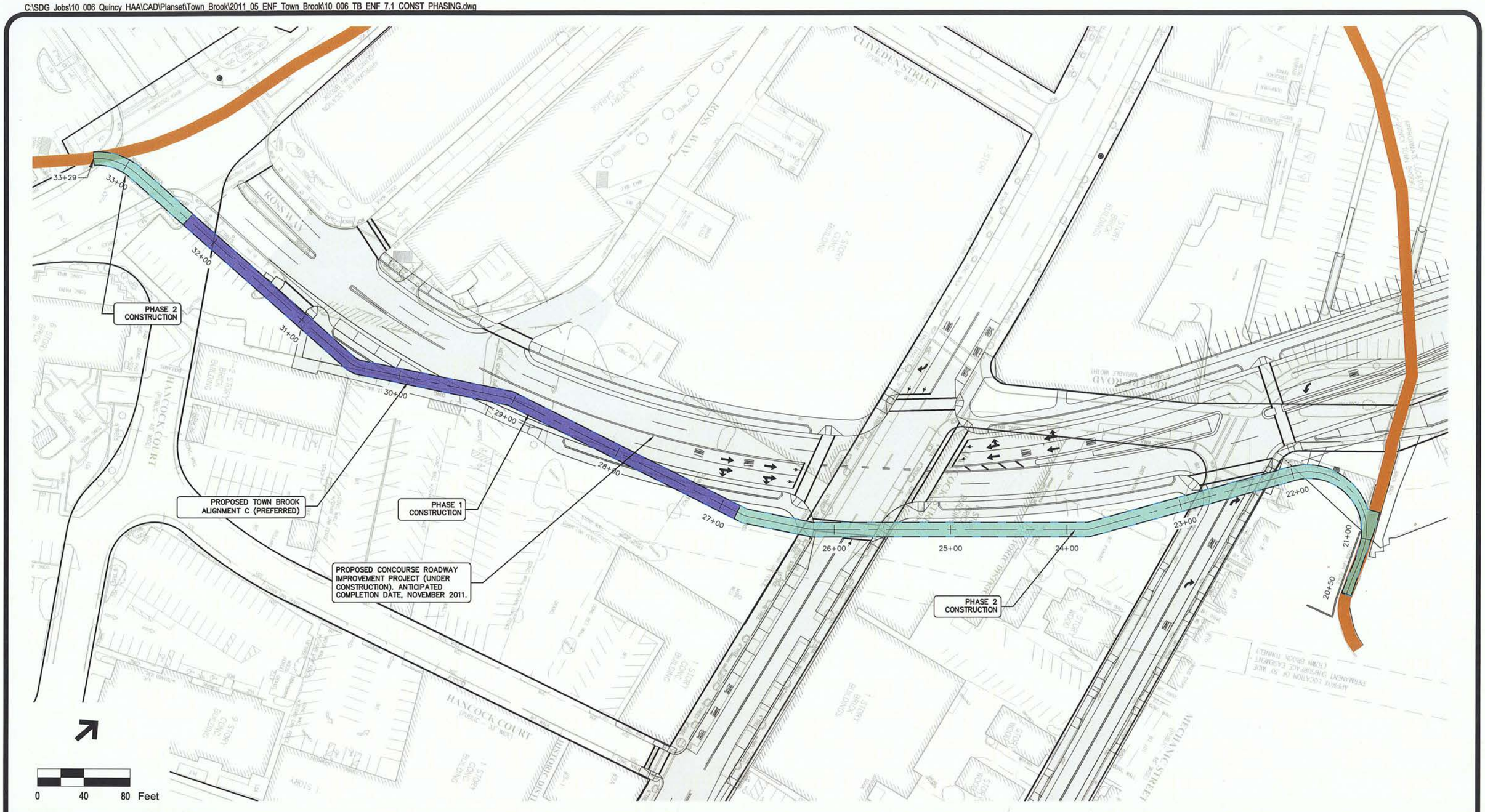
A key element to the Project is the enhancement of the rainbow smelt habitat and spawning areas. Construction will include work to expand this habitat and spawning area. No construction activities shall occur during the active fish run season, March 1 through June 15. Construction activities within the Brook shall occur only during low-flow conditions.

## CONSTRUCTION PERIOD IMPACTS AND MITIGATION MEASURES

Construction period impacts will be identified during the local approvals process. Mitigation measures shall be in conformance with the NPDES permit and order of conditions issued by the Quincy Conservation Commission and will include:

- Erosion and sedimentation control program
- Inspection and maintenance program
- Proper waste disposal
- Street sweeping
- Proper sanitary facilities
- Dust and air quality control
- MassDEP Clean Construction Equipment Initiative
- Noise control
- Conformance with blasting, earth and ledge removal regulations
- Construction vehicle traffic management plan
- Proper management of soil and groundwater

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 7.1 CONST PHASING.dwg




EXISTING TOWN BROOK ALIGNMENT
PHASE 1 CONSTRUCTION
PHASE 2 CONSTRUCTION

NOTES:
REFER TO CHAPTER 7 OF THE ENF REPORT FOR A SUMMARY OF THE CONSTRUCTION PHASING.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 7.1 March 15, 2011

Construction Phasing Diagram

Town Brook Enhancement Project
Quincy, Massachusetts

# CHAPTER 8
# MITIGATION

## INTRODUCTION

As outlined in 301 CMR 11.07(6)(j) of the MEPA regulations, this chapter presents a consolidated overview of the program of comprehensive mitigation measures for the Project as they relate to the environmental impacts associated with the Project.

The project is in the design process and as the project advances, the City will continue agency and public outreach to incorporate appropriate input into the final design while addressing the environmental and sustainable planning objectives of the City of Quincy, which are outlined in Chapter 1.

## WETLANDS

Resource areas regulated by the Wetlands Protection Act within the project area include: Land Under Water Bodies and Waterways, Bordering Land Subject to Flooding, Bank, Fish Run, and Riverfront Area. The current condition of the resource areas within the Project area are degraded, with a majority of Quincy Center consisting of impervious surfaces. The wetland resource areas within and surrounding the existing culverted brook are limited due to the developed nature of Quincy Center and the poor quality of the channel. Refer to Figures 1.3.1 through 1.3.5 for photos of the project area.

The proposed re-aligned culvert will provide environmental and hydraulic enhancements, improving the existing environmental conditions within the project area. Direct mitigation is proposed at the downstream end of the project area to extend and enhance the existing smelt habitat and fish passage, refer to Figures 8.1.1 and 8.1.2. The figures depict two options associated with the preferred alternative (Alternative C) for the implementation of fisheries enhancements and open space associated with the proposed open channel/day-lit sections of culvert. Additional water quality benefits to Town Brook will be derived through the removal of illicit sanitary sewer connections within the project area and the removal of direct untreated stormwater surface runoff from Quincy Center to the existing culvert. Additionally the City is coordinating with the Massachusetts Division of Marine Fisheries and their efforts to increase base flows in Town Brook upstream of the project area. As the design advances the City will continue to coordinate with DMF to incorporate their implemented design to increase base flows and accommodate for it in the proposed low flow channel. To clarify, the DMF project is separate from the Project presented in this report but the two projects will be coordinated.

**Bank**

Bank linear dimensions will be reduced in total due the reduction in the length of the Town Brook culvert through the project area. The existing primarily enclosed culvert through the project area is approximately 1,700 linear feet, while the proposed preferred alignment is 1,200 linear feet. The implementation of the Project will divert flow from the 1,700 linear feet of existing culvert and the 16 linear feet of open channel section, which is surrounded by pavement and buildings, and convey the diverted flow through 1,200 linear feet of culvert, providing an additional 185 linear feet of open channel section with adjacent public open space. This additional open channel/day-lit section of Brook will support the fisheries enhancements and provide public open space that will support urban habitat.

**Bordering Land Subject to Flooding**

The existing Town Brook is a flood conveyance structure that contains the 0.2% annual chance flood or 500-year storm event, according to the FIS. The relocated Town Brook has been designed to provide more hydraulic capacity than the existing Town Brook culvert for the conveyance of storm events. At the downstream connection point, adjacent to the existing open channel section of the existing culvert south of Revere Road, BLSF extends beyond the banks of the existing culvert. The project does not propose any temporary or permanent displacement of flood storage at this location and will provide additional flood storage volume on an incremental basis as part of the construction of the open space adjacent to the proposed day-lit section of Town Brook. The final design of the open space will result from a public design process and will be presented in the local, state, and federal permitting applications for this project, along with details of the incremental increase in BLSF storage.

**Land Under Waterbodies and Waterways**

This existing degraded resource area will be reduced in area due to the shorter proposed culvert alignment. The proposed culvert will contain enhancements to promote anadromous fisheries, specifically rainbow smelt, known to be present in the Brook immediately downstream of the project area.

**Riverfront Area**

Approximately 13,315 square feet of the previously developed degraded Riverfront Area will be altered within the project area during the construction of the culvert and environmental enhancements south of Revere Road. In addition, existing Riverfront Area associated with the 16 linear feet of day-lit section will be removed when the Brook is diverted to its new alignment. A summary of these impacts can be found in Chapter 1 and Chapter 3. The creation of new Riverfront Area associated with the proposed 185 linear feet of open channel/day-lit sections south of Revere Road section will result in approximately 88,230 square feet of proposed net

new Riverfront Area. Within the proposed Riverfront Area, approximately 5,500 square feet of public open space will be created and designed to support urban habitat.

### Habitat – Wildlife & Fisheries

In coordination with the Massachusetts Division of Marine Fisheries , the City has developed plans for the environmental enhancement of Town Brook that will extend and improve the anadromous fisheries spawning area. The proposed improvements include:

- Design of culvert with low flow trapezoidal channel (coordinated with DMF Flow Restoration project to increase low base flow) to achieve a flow depth of 6 inches to 12 inches)
- Spawning substrate in low flow trapezoidal channel, proposed 6" diameter rounded stone substrate for smelt eggs to adhere to
- Spawning riffles achieved by designing the culvert to achieve attraction velocities of between 1.6 and 3.2 feet per second during low base flow conditions
- Smelt resting pools off-line (or in-line option) and adjacent to spawning riffle sections
- Temperature mitigation - proposing shade trees adjacent to day-lit channel sections

## STORMWATER MANAGEMENT

The Project will provide stormwater management benefits and improvements to water quality, flood control, and hydraulic conveyance as outlined in the next two sections.

### Water Quality

The Project proposes the removal of illicit sanitary sewer connections within the project area and will allow for the removal of direct untreated stormwater surface runoff from Quincy Center to the existing culvert. In addition, rain gardens will be incorporated into the development of the open space to treat surface runoff from the landscape and hardscape associated with the open space project.

During the final design and local permitting efforts the City will evaluate the use of Low Impact Development (LID) measures and Sustainable Design measures where it is practical and feasible to implement these features through the project area in an effort to improve water quality.

### Flood Control and Hydraulic Conveyance

The proposed Town Brook Enhancement Project will improve hydraulic conveyance through the project area by increasing the capacity of Town Brook by installing a uniform section of enlarged culvert. Currently, within the existing alignment of Town Brook there are limiting hydraulic sections with full capacities of approximately 175-cfs. Refer to Figures 1.2.1 and 1.2.2.

The capacity of the proposed 11′ wide by 6′ deep culvert is 674 cfs, which has been designed to convey the flood water associated with the appropriate design storm. A summary of the design flows can be found in Chapter 5.

## SOIL AND GROUNDWATER CONDITIONS

The Project is not anticipated to significantly impact, short or long term, soil or groundwater conditions in the project area. Based on preliminary boring information the groundwater elevations within the project area are lower than the proposed invert of the preferred culvert alignment. Refer to Chapter 6 of this report for a summary of soil and groundwater conditions.

## CONSTRUCTION PERIOD IMPACTS

In this document methods of soil and erosion control have been identified. The selected contractor will be required to obtain an NPDES General Permit for Stormwater Discharge from Construction Activities and a project specific Stormwater Pollution Prevention Plan will be developed prior to construction. Refer to Chapter 7 for additional information on construction period impacts.

## MITIGATION SUMMARY

While the project will result in many benefits to Town Brook, the project will require construction activities within resource areas regulated by the Wetlands Protection Act and the City of Quincy Wetlands Protection Regulations & Ordinance to include: Land Under Water Bodies and Waterways, Bordering Land Subject to Flooding, Bank, Fish Run, and Riverfront Area. The Project area is outside of tidally influenced sections of Town Brook and outside of any Areas of Critical Environmental Concern. The Proponent has committed to a series of mitigation measures as part of the project which include the following:

- Riverfront Area enhancements – active public open space adjacent to open channel sections of the Brook on City owned land
- Increase the extent of open channel sections in Town Brook, proposing 185 linear feet of day-lit channel
- Fish Run – rainbow smelt habitat enhancements
    - Design of culvert with low flow trapezoidal channel (coordinated Mass DMF Flow Restoration project to increase low base flow) to achieve a flow depth of at least 6 inches to 12 inches
    - Spawning substrate in low flow trapezoidal channel, proposed 6" diameter rounded stone substrate for smelt eggs to adhere to
    - Spawning riffles achieved by designing the culvert to achieve attraction velocities of between 1.6 and 3.2 feet per second during low base flow conditions

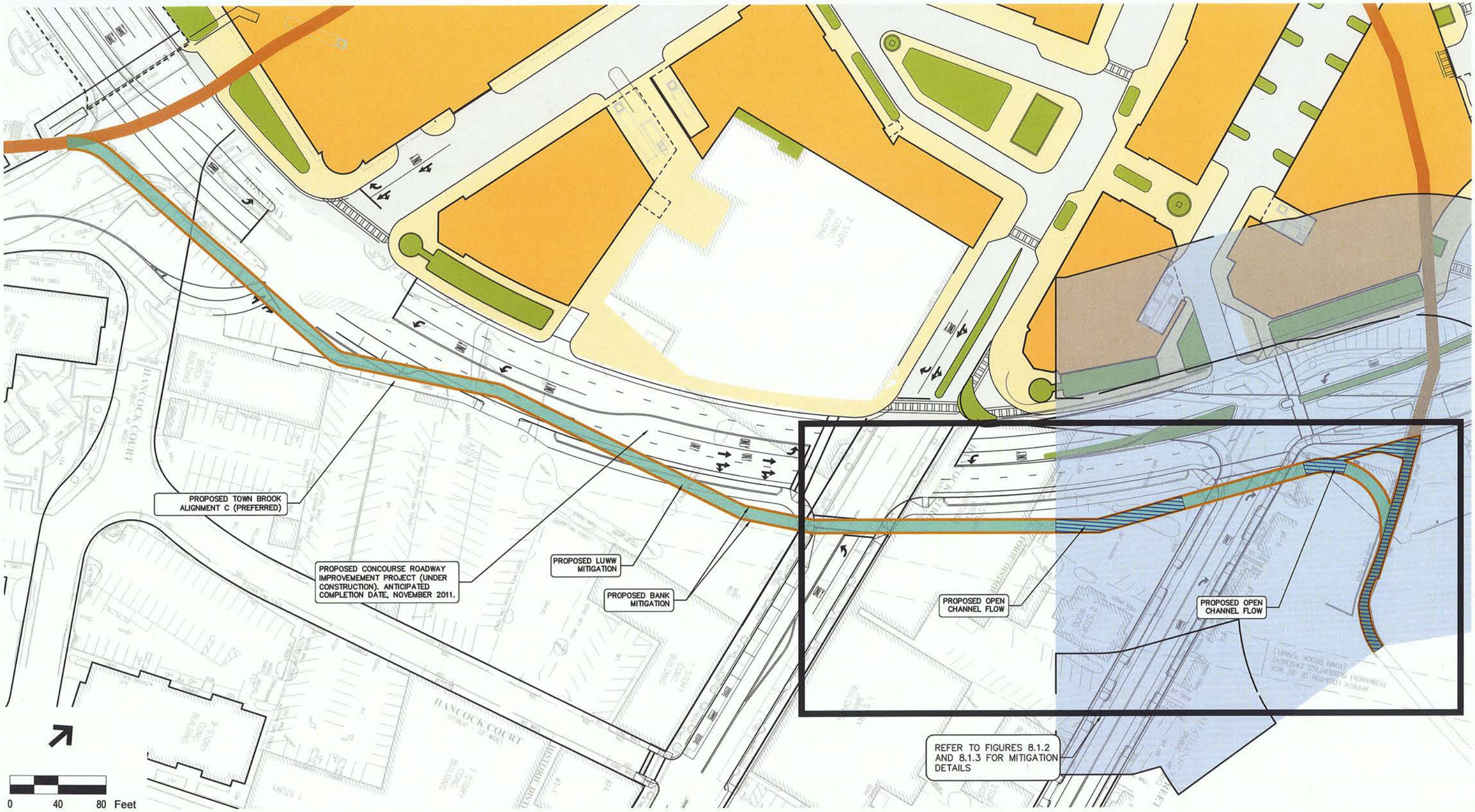
  - Smelt resting pools off-line (or in-line option) and adjacent to spawning riffle sections
  - Temperature mitigation - proposing shade trees adjacent to day-lit channel sections
- Flood Control – A larger uniform culvert section (11'wide x 6' deep) is proposed to convey the design storm event through the project area, replacing the limiting hydraulic section of the existing Town Brook culvert
- Water Quality improvements – proposed rain gardens in open space parcels on east and west sides of Mechanic Street to treat surface runoff
- Removal of illicit sanitary sewer connections within the project area
- Allows for the removal of direct untreated stormwater surface runoff from the Quincy Center Area
- Town Brook Watershed Master Plan – development of plan to be coordinated with selected developer of URDP

These proposed mitigation items will reduce the environmental impacts associated with the project and will improve the regulated wetland resource areas associated with Town Brook.

Additionally, in order to mitigate the temporary construction related impacts the City is proposing these additional mitigation measures:

- Measures to reduce construction period impacts include controlling erosion and sedimentation, dust, and machinery traffic on local roadways
- Compliance with the EPA's National Pollution Discharge Elimination System General Permit Program for Stormwater Discharges from Construction Sites

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 3.3 WET MIT PR.dwg




NOTES:

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

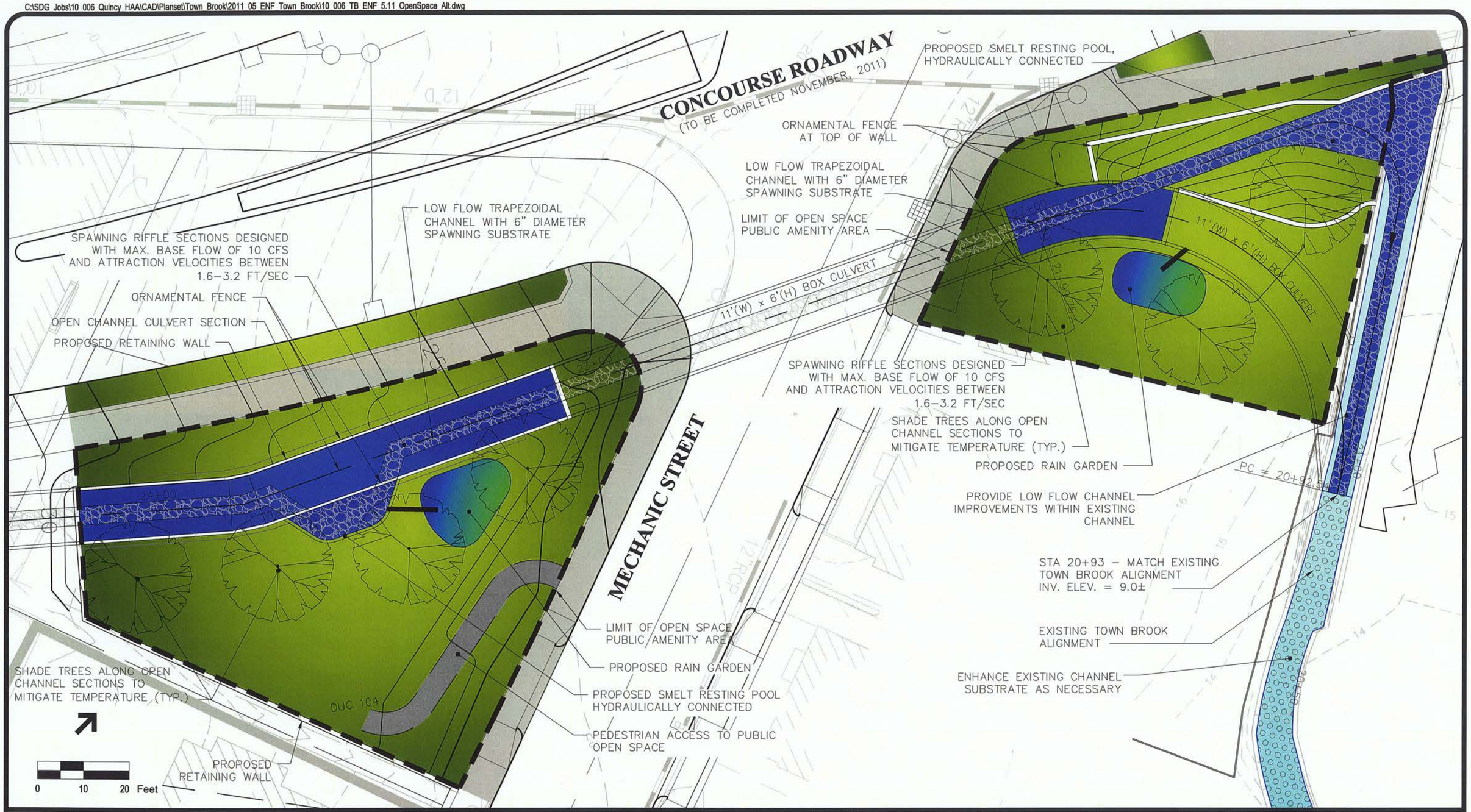
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 8.1.1 March 15, 2011

Proposed Mitigation
Overview Plan
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 5.11 OpenSpace Alt.dwg




NOTES:

1. MAINTAIN DESIGN VELOCITY OF 1.6-3.2 FT/SEC ("ATTRACTION VELOCITY" WITHIN SPAWNING RIFFLE SECTIONS
2. DAY LIT CULVERT SECTIONS AND RESTING POOLS SHALL HAVE 6" DIAMETER STONE SUBSTRATE SECURED TO CULVERT BOTTOM
3. PROVIDE SHADE TREES ALONG DAY LIT SECTIONS OF CULVERT.
4. MAINTAIN FLOW DEPTH OF 6"-12" IN SPAWNING RIFFLES DURING LOW/ BASE FLOW

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

Hancock Adams Associates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

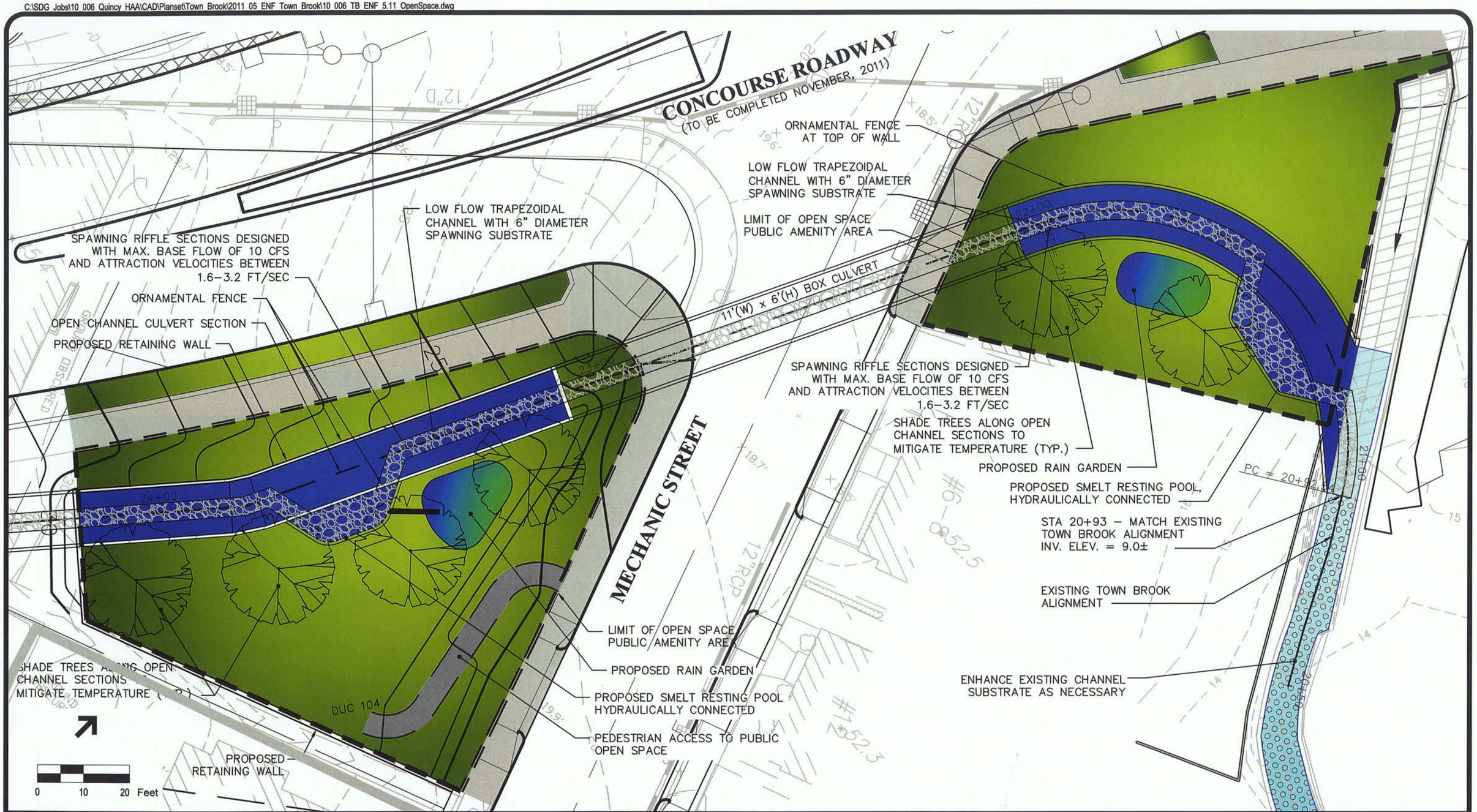
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 8.1.2 March 15, 2011

Proposed Mitigation Details
Option 1
Town Brook Enhancement Project
Quincy, Massachusetts

C:\SDG Jobs\10 006 Quincy HAA\CAD\Planset\Town Brook\2011 05 ENF Town Brook\10 006 TB ENF 5.11 OpenSpace.dwg




NOTES:

1. MAINTAIN DESIGN VELOCITY OF 1.6-3.2 FT/SEC ("ATTRACTION VELOCITY" WITHIN SPAWNING RIFFLE SECTIONS
2. DAY LIT CULVERT SECTIONS AND RESTING POOLS SHALL HAVE 6" DIAMETER STONE SUBSTRATE SECURED TO CULVERT BOTTOM
3. PROVIDE SHADE TREES ALONG DAY LIT SECTIONS OF CULVERT.
4. MAINTAIN FLOW DEPTH OF 6"-12" IN SPAWNING RIFFLES DURING LOW/ BASE FLOW

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

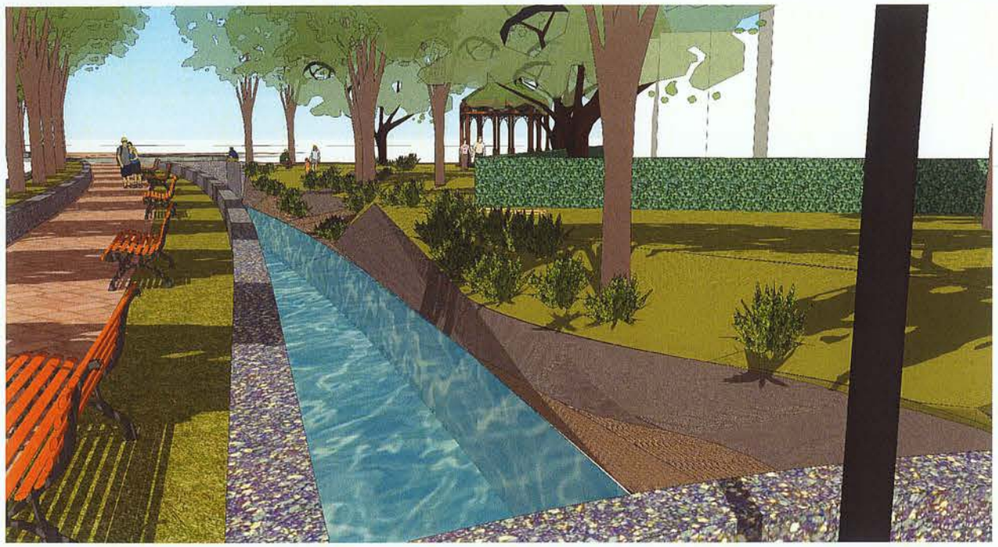
LUCAS ENVIRONMENTAL, LLC
LAND DEVELOPMENT & PERMITTING
129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

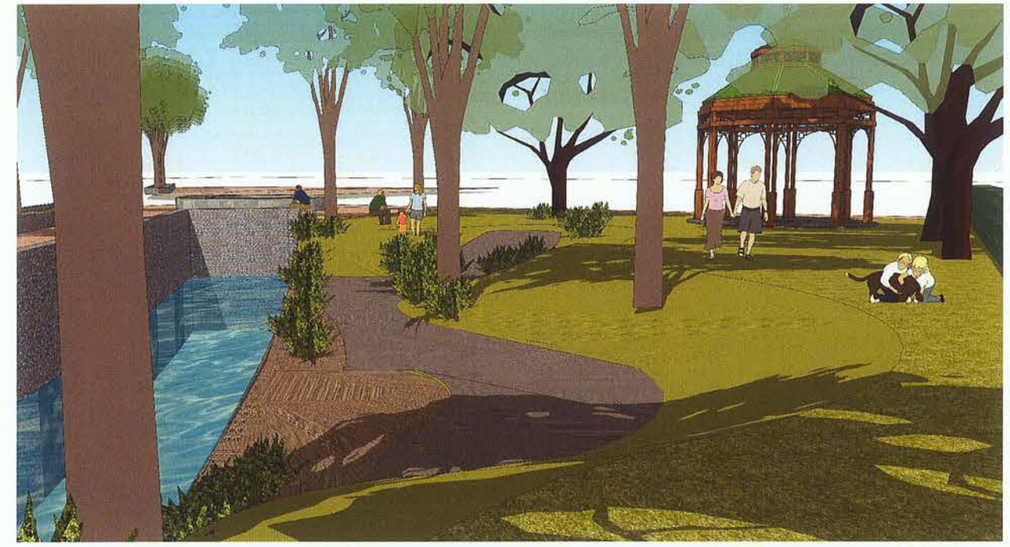
SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

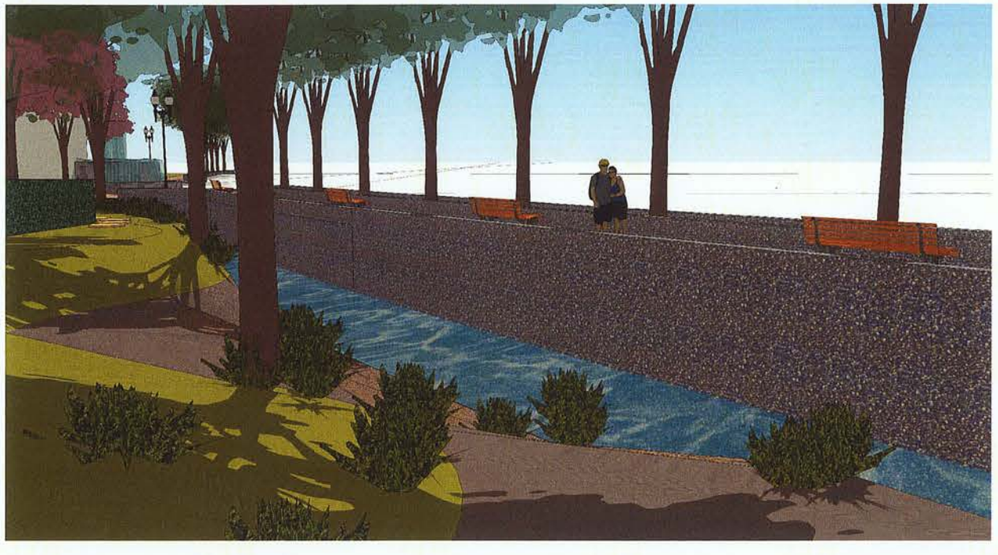
STEPHENSON DESIGN GROUP

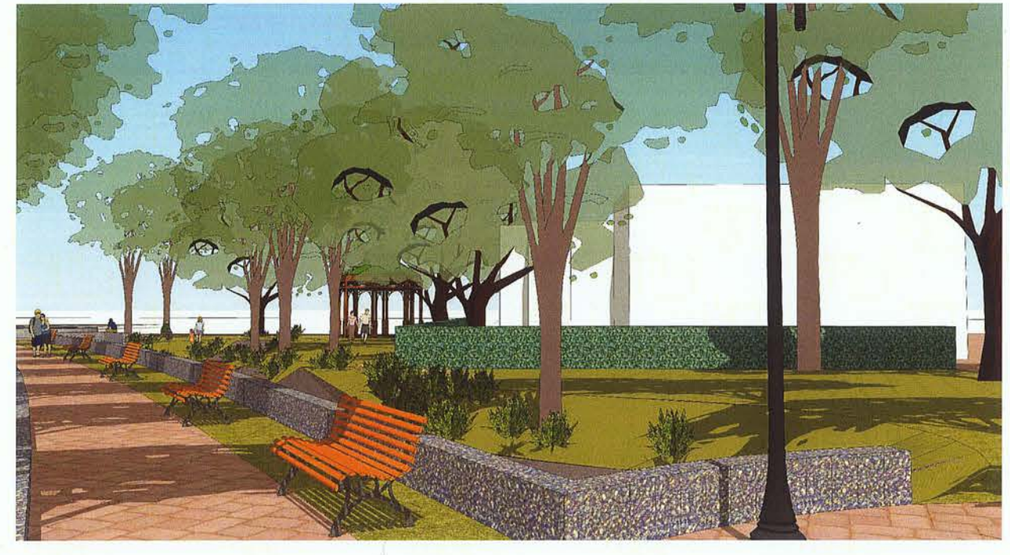
Figure 8.1.3 March 15, 2011

Proposed Mitigation Details
Option 2
Town Brook Enhancement Project
Quincy, Massachusetts









NOTES:

PLAN REPRESENTS A CONCEPTUAL VIEW OF POTENTIAL FUTURE CONDITIONS. ACTUAL SITE FEATURES AND MATERIALS TO BE DETERMINED THROUGH A PUBLIC DESIGN PROCESS AND REQUIRE PERMITTING THROUGH THE QUINCY CONSERVATION COMMISSION.

This Figure Prepared in Coordination With:

CITY OF QUINCY
CITY HALL
1305 HANCOCK STREET
QUINCY, MASSACHUSETTS

HancockAdamsAssociates
1400 HANCOCK STREET
QUINCY, MASSACHUSETTS

129 BEALE STREET, #3
QUINCY, MASSACHUSETTS

SDG
51 Sleeper Street
Suite 600
Boston MA 02210
617-512-7095

STEPHENSON DESIGN GROUP

Figure 8.2 March 15, 2011

Conceptual Public Open Space
Amenity Plan - Rendering
Town Brook Enhancement Project
Quincy, Massachusetts

# APPENDIX A
## DISTRIBUTION LIST

In accordance with Section 11.16 of the Massachusetts Environmental Policy Act, a copy of the Environmental Notification Form has been submitted to the following list of local, state, and federal agencies, as well as other interested parties.

### Local Agencies

City of Quincy
City Council
1305 Hancock Street, City Hall
Quincy, Massachusetts 02169

City of Quincy, Conservation Commission
Attn: Rob Conlon
55 Sea Street
Quincy, MA 02169

City of Quincy
Planning and Community Development
Attn: Dennis Harrington
1305 Hancock Street
Quincy, MA 02169

City of Quincy
Inspectional Services
Attn: Jay Duca
55 Sea Street
Quincy, MA 02169

City of Quincy
Department of Public Works
55 Sea Street
Quincy, MA 02169

City of Quincy
City Engineer
Attn: Shawn Hardy
55 Sea Street
Quincy, MA 02169

City of Quincy
Department of Sewer & Water
Attn: Peter Hoyt
55 Sea Street
Quincy, MA 02169

City of Quincy
City Clerk
Attn: Joseph Shea
1305 Hancock Street
Quincy, MA 02169

City of Quincy
Health Department
Attn: Andrew Scheele
440 East Squantum Street
Quincy, MA 02171

## State Agencies

Secretary Richard K. Sullivan, Jr.
Executive Office of Energy and
Environmental Affairs (EEA)
Attn: MEPA Office
100 Cambridge Street, Suite 900
Boston, MA 02114
(2 copies to MEPA Office)

Department of Environmental Protection
Commissioner's Office
One Winter Street
Boston, MA 02108

DEP/Northeast Regional Office
Wetlands and Waterways
Attn: Heidi Davis
205B Lowell Street
Wilmington, MA 01887

DEP/Northeast Regional Office
Wetlands and Waterways
Attn: Ken Chin
205B Lowell Street
Wilmington, MA 01887

Massachusetts Department of
Transportation
Public/Private Development Unit
10 Park Plaza
Boston, MA 02116

Massachusetts Department of
Transportation
District #6
Attn: MEPA Coordinator
185 Kneeland Street
Boston, MA 02111

Massachusetts Historical Commission
The MA Archives Building
220 Morrissey Boulevard
Boston, MA 02125

Metropolitan Area Planning Council
60 Temple Place/6th floor
Boston, MA 02111

Massachusetts Office of Coastal Zone
Management
Attn: Project Review Coordinator
251 Causeway Street, Suite 800
Boston, MA 02114

Massachusetts Division of Marine Fisheries
(North Shore)
Attn: Environmental Reviewer
30 Emerson Avenue
Gloucester, MA 01930

Massachusetts Division of Marine Fisheries
(North Shore)
Attn: Tay Evans
30 Emerson Avenue
Gloucester, MA 01930

Massachusetts Division of Marine Fisheries
(Quest Campus)
Attn: Bradford Chase
1213 Purchase St. - 3rd Floor
New Bedford, MA 02740

Department of Conservation & Recreation
Attn: MEPA Coordinator
251 Causeway St. Suite 600
Boston MA 02114

Department of Conservation & Recreation
Attn: Paul DiPietro
251 Causeway St. Suite 600
Boston MA 02114

Massachusetts Water Resource Authority
Attn: MEPA Coordinator
100 First Avenue
Charlestown Navy Yard
Boston, MA 02129

## State Agencies (continued)

Massachusetts Bay Transit Authority
Attn: MEPA Coordinator
10 Park Plaza, 6th Fl.
Boston, MA 02216-3966

## Federal Agencies

U.S. Army Corps of Engineers
New England District
Attn: Kevin R. Kotelly
696 Virginia Road
Concord, Massachusetts 01742

U.S. Environmental Protection Agency
Attn: Edward Reiner
One Congress Street, Suite 1100 (CMA)
Boston, MA 02114-2023

NOAA National Marine Fisheries Service
Northeast Fisheries Science Center
Attn: Michael Johnson
166 Water Street
Woods Hole, MA 02543-1026

## Other Interested Parties

The Delahunt Group LLC
Attn: Mark Forest – Executive Director
1147 Hancock Street, Suite 212
Quincy, MA 02169

Quincy Environmental Network
P.O. Box 690184
Quincy, MA 02269

Thomas Crane Public Library
40 Washington Street
Quincy, MA 02169

# APPENDIX B

## HYDROLOGY AND HYDRAULICS

### TABLE OF CONTENTS


- NORMAL DEPTH CALCULATIONS
  - EXISTING CHANNEL SEGMENT CAPACITY
  - EXISTING CHANNEL SEGMENT (STA 20+00) TAILWATER CALCULATION
  - PROPOSED CHANNEL SEGEMENT CAPACITY
  - EXISTING LOW FLOW CONDITION
  - PROPOSED LOW FLOW CONDITION
- DEEP ROCK TUNNEL DIVERSION CALCULATIONS
  - WEIR OVERFLOW CALCULATIONS
  - OUTLET CONTROL CALCULATIONS
- UNIT HYDROGRAPH CALCULATIONS
  - UNIT HYDROGRAPHS FOR CURRENT TOWN BROOK ENHANCEMENT PROJECT
- CIVILSTORM© RESULTS
  - SUMMARY OF RESULTS
  - ELEMENT TABLES
  - DEVELOPED HYDROGRAPHS FOR 100-YEAR (24 HOUR NRCS TYPE-III) STORM EVENT
    - TOWN BROOK WATERSHED
    - BASIN 4 (AREA TRIBUTARY TO PROJECT AREA INDEX POINT) WATERSHED

# NORMAL DEPTH CALCULATIONS

# Hydraulic Calculations

Project Name: **Town Brook Enhancement** Proj. No.: **10-006**

Project Location: **Quincy , MA** Date: **3/15/2011**

Calculated by: **KPS**

## EXISTING SECTION 1 - 7.9 X 6.5 FOOT CONCRETE CHANNEL

### *CHANNEL DATA*

| | | | |
|---|---|---|---|
| d = | 6.50 | ft | |
| n = | 0.015 | | |
| s = | 0.011 | ft/ft | |
| $z_1$ = | 0 | ft/ft | |
| $z_2$ = | 0 | ft/ft | |
| w = | 7.9 | ft | |
| h = | 0.00 | ft | (enclosed conduit only) |

A = 51.35 sf

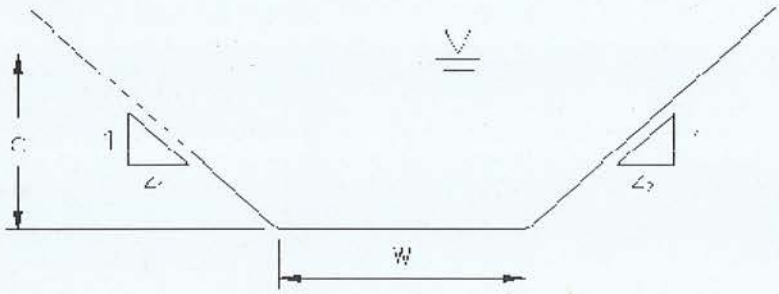
**Q = 785 $ft^3$/sec**

**V (ft/sec) 15.28 ft/sec**

$$Q = \frac{1.486}{n} A R^{2/3} s^{1/2}$$

**V = Q / A**

**OPEN CHANNEL FLOW**



# Hydraulic Calculations

Project Name: **Town Brook Enhancement** Proj. No.: **10-006**

Project Location: **Quincy , MA** Date: **3/15/2011**

Calculated by: **KPS**

## EXISTING SECTION 2 - TWIN 6'-3" X 4'-3" BOX CULVERTS

### *CHANNEL DATA*

d = 4.25 ft

n = 0.013

s = 0.002 ft/ft

$z_1$ = 0 ft/ft

$z_2$ = 0 ft/ft

w = 6.25 ft

h = 4.25 ft (enclosed conduit only)

A = 26.56 sf

**Q =** **159 $ft^3$/sec** (single culvert)

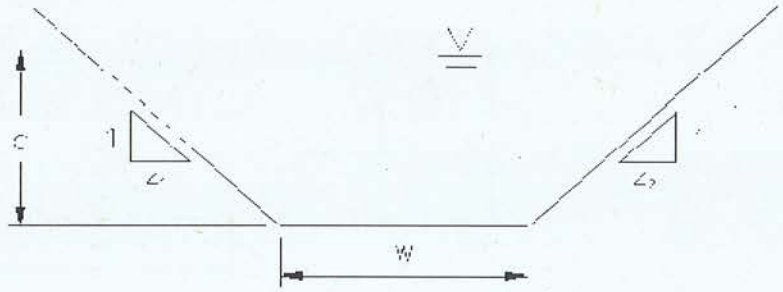
**Qtotal =** **318 $ft^3$/sec** (twin culverts)

**V (ft/sec)** **5.98 ft/sec**

$$Q = \frac{1.486}{n} A R^{2/3} s^{1/2}$$

**V = Q / A**

**FULL FLOW**



# Hydraulic Calculations

Project Name: **Town Brook Enhancement** Proj. No.: **10-006**

Project Location: **Quincy , MA** Date: **3/15/2011**

Calculated by: **KPS**

## EXISTING SECTION 3 - ARCHED CMP 9'-9"W X 7'-7"H

### *CHANNEL DATA*

d = 7.58

n = 0.024

s = 0.007 ft/ft

w = 9.75 ft

h = 7.58 ft (enclosed conduit only)

$$Q = \frac{1.486}{n} A R^{2/3} s^{1/2}$$

$$V = Q / A$$

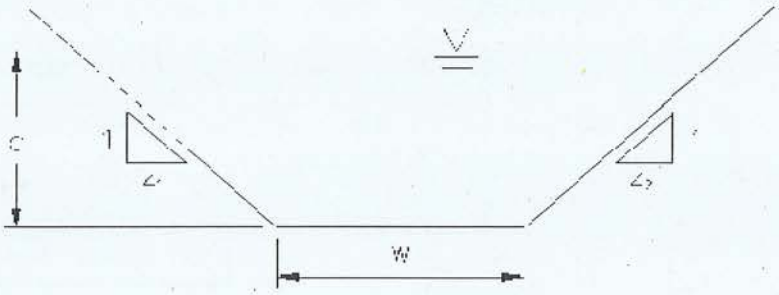
P = **25.19** $ft^2$ **Direct Entry**

A = **50.54** $ft^2$ **Direct Entry**

**Q = 416 $ft^3$/sec**

**FULL FLOW**

**V (ft/sec) 8.24 ft/sec**



# Hydraulic Calculations

Project Name: **Town Brook Enhancement**
Project Location: **Quincy , MA**

Proj. No.: **10-006**
Date: **3/15/2011**
Calculated by: **KPS**

## EXISTING SECTION 4 - VARIABLE MATERIAL

### *CHANNEL DATA*

d = 6.50 ft
n = 0.025
s = 0.0167 ft/ft
$z_1$ = 0 ft/ft
$z_2$ = 0 ft/ft
w = 6.5 ft
h = _____ ft (enclosed conduit only)

A = 42.25 sf

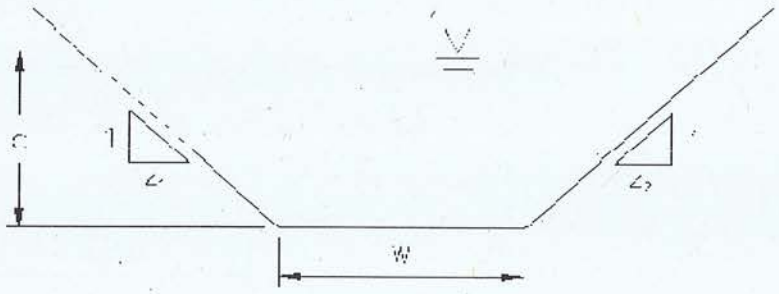
**Q = 449 $ft^3$/sec**

**V (ft/sec) 10.62 ft/sec**

$$Q = \frac{1.486}{n} A R^{2/3} s^{1/2}$$

$$V = Q / A$$

**OPEN CHANNEL FLOW**



# Hydraulic Calculations

Project Name: **Town Brook Enhancement** Proj. No.: **10-006**

Project Location: **Quincy , MA** Date: **3/15/2011**

Calculated by: **KPS**

## EXISTING SECTION 5 - CONCRETE & GRANITE CHANNEL

### *CHANNEL DATA*

d = 6.50 ft

n = 0.025

s = 0.0167 ft/ft

$z_1$ = 0 ft/ft

$z_2$ = 0 ft/ft

w = 9 ft

h = 0.00 ft (enclosed conduit only)

A = 58.50 sf

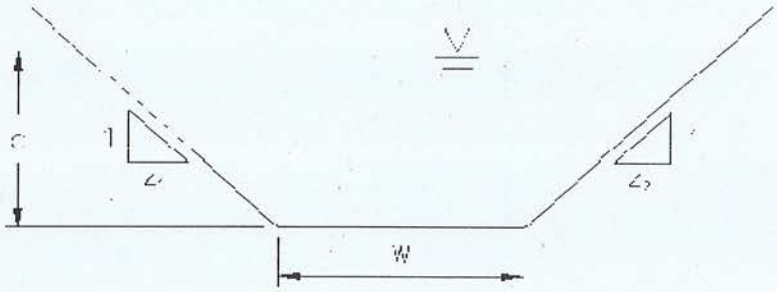
**Q = 686 $ft^3$/sec**

**V (ft/sec) 11.73 ft/sec**

$$Q = \frac{1.486}{n} A R^{2/3} s^{1/2}$$

**V = Q / A**

**OPEN CHANNEL FLOW**



# Hydraulic Calculations

Project Name: **Town Brook Enhancement**
Project Location: **Quincy , MA**

Proj. No.: **10-006**
Date: **3/15/2011**
Calculated by: **KPS**

## EXISTING SECTION 6 - STONE CULVERT

### *CHANNEL DATA*

d = 6.50 ft
n = 0.03
s = 0.0025 ft/ft
$z_1$ = 0 ft/ft
$z_2$ = 0 ft/ft
w = 9 ft
h = 6.50 ft (enclosed conduit only)

A = 58.50 sf

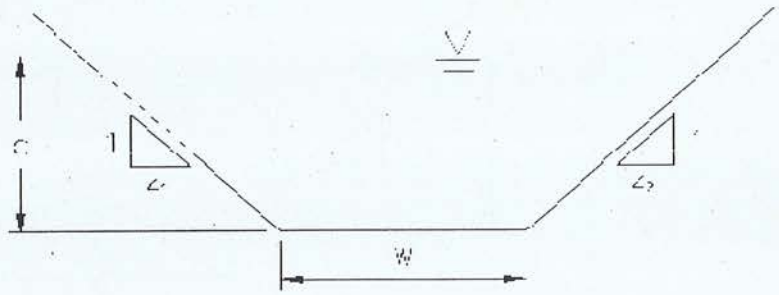
**Q = 221 $ft^3$/sec**

**V (ft/sec) 3.78 ft/sec**

$$Q = \frac{1.486}{n} A R^{2/3} s^{1/2}$$

$$V = Q / A$$

**FULL FLOW**



# Hydraulic Calculations

Project Name: **Town Brook Enhancement** Proj. No.: **10-006**

Project Location: **Quincy , MA** Date: **3/15/2011**

Calculated by: **KPS**

## EXISTING SECTION 7 - STONE CULVERT

### *CHANNEL DATA*

d = 5.50 ft

n = 0.03

s = 0.0025 ft/ft

$z_1$ = 0 ft/ft

$z_2$ = 0 ft/ft

w = 9 ft

h = 5.50 ft (enclosed conduit only)

A = 49.50 sf

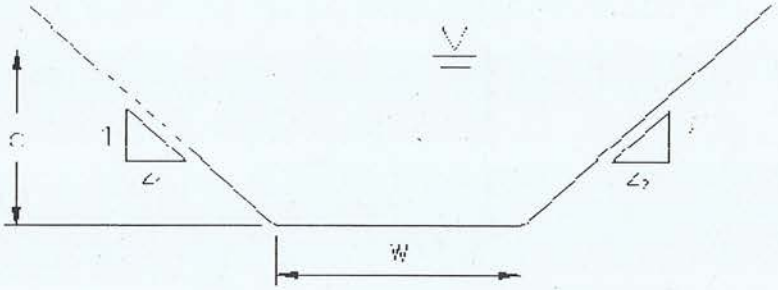
**Q = 175 $ft^3$/sec**

**V (ft/sec) 3.54 ft/sec**

$$Q = \frac{1.486}{n} A R^{2/3} s^{1/2}$$

**V = Q / A**

**FULL FLOW**



# Hydraulic Calculations

Project Name: **Town Brook Enhancement**
Project Location: **Quincy , MA**

Proj. No.: **10-006**
Date: **3/15/2011**
Calculated by: **KPS**

## EXISTING SECTION 8 - CONCRETE CULVERT

### *CHANNEL DATA*

| | | |
|---|---|---|
| d = | 5.50 | ft |
| n = | 0.013 | |
| s = | 0.0025 | ft/ft |
| $z_1$ = | 0 | ft/ft |
| $z_2$ = | 0 | ft/ft |
| w = | 9 | ft |
| h = | 5.50 | ft (enclosed conduit only) |

A = 49.50 sf

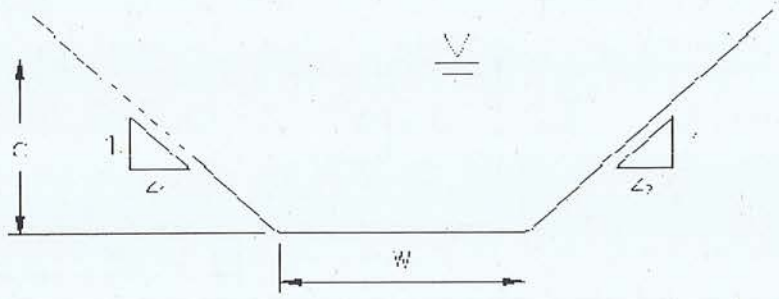
**Q = 404 $ft^3$/sec**

**V (ft/sec) 8.16 ft/sec**

$$Q = \frac{1.486}{n} A R^{2/3} s^{1/2}$$

$$V = Q / A$$

**FULL FLOW**



# Hydraulic Calculations

Project Name: **Town Brook Enhancement**
Project Location: **Quincy , MA**

Proj. No.: **10-006**
Date: **3/15/2011**
Calculated by: **KPS**

## EXISTING SECTION 9 - CONCRETE CULVERT

### *CHANNEL DATA*

d = 5.50 ft
n = 0.013
s = 0.0025 ft/ft
$z_1$ = 0 ft/ft
$z_2$ = 0 ft/ft
w = 9 ft
h = 5.50 ft (enclosed conduit only)

A = 49.50 sf

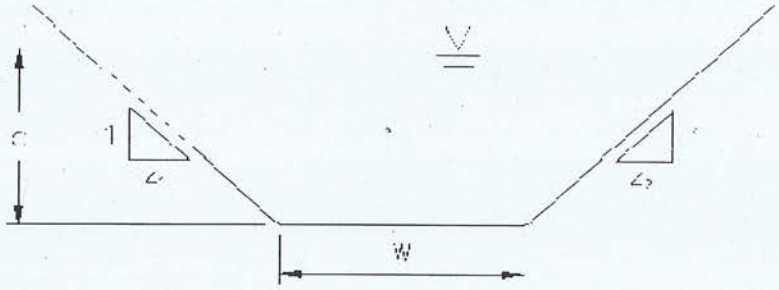
**Q = 404 $ft^3$/sec**

**V (ft/sec) 8.16 ft/sec**

$$Q = \frac{1.486}{n} A R^{2/3} s^{1/2}$$

**V = Q / A**

**FULL FLOW**



# Hydraulic Calculations

Project Name: **Town Brook Enhancement**
Project Location: **Quincy , MA**

Proj. No.: **10-006**
Date: **3/15/2011**
Calculated by: **KPS**

## EXISTING SECTION 10 - CONCRETE CULVERT

### *CHANNEL DATA*

d = 5.50 ft
n = 0.013
s = 0.00075 ft/ft
$z_1$ = 0 ft/ft
$z_2$ = 0 ft/ft
w = 9 ft
h = 5.50 ft (enclosed conduit only)

A = 49.50 sf

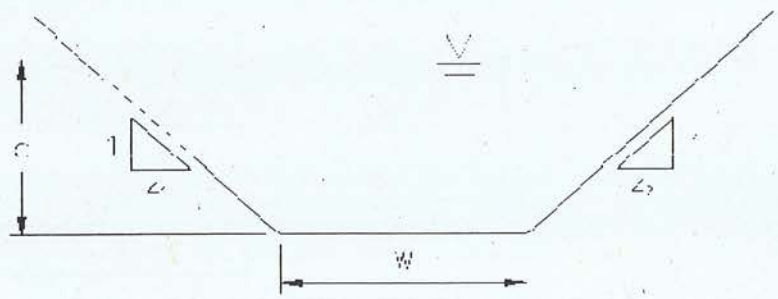
**Q = 221 $ft^3$/sec**

**V (ft/sec) 4.47 ft/sec**

$$Q = \frac{1.486}{n} A R^{2/3} s^{1/2}$$

**V = Q / A**

**FULL FLOW**



# Hydraulic Calculations

Project Name: **Town Brook Enhancement**
Project Location: **Quincy , MA**

Proj. No.: **10-006**
Date: **3/15/2011**
Calculated by: **KPS**

## EXISTING SECTION 11 - CONCRETE CULVERT

### *CHANNEL DATA*

d = 5.50 ft
n = 0.013
s = 0.0029 ft/ft
$z_1$ = 0 ft/ft
$z_2$ = 0 ft/ft
w = 9 ft
h = 5.50 ft (enclosed conduit only)

A = 49.50 sf

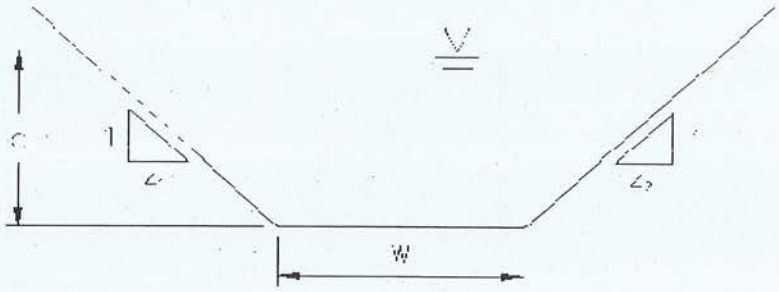
**Q = 435 $ft^3$/sec**

**V (ft/sec) 8.79 ft/sec**

$$Q = \frac{1.486}{n} A R^{2/3} s^{1/2}$$

**V = Q / A**

**FULL FLOW**



# Hydraulic Calculations

Project Name: **Town Brook Enhancement**

Project Location: **Quincy , MA**

Proj. No.: **10-006**

Date: **3/15/2011**

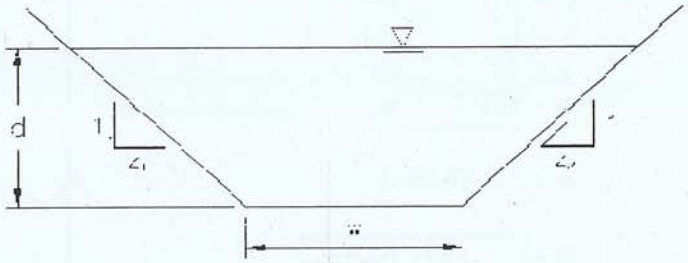
Calculated by: **KPS**

## NORMAL DEPTH OF TOWN BROOK - STA 20+00 - EXISTING (100 YR STORM)

### *CHANNEL DATA*

| | | |
|---|---|---|
| Q = | 435.00 | $ft^3/sec$ |
| n = | 0.015 | |
| s = | 0.011 | ft/ft |
| $z_1$ = | 0 | ft/ft |
| $z_2$ = | 0 | ft/ft |
| w = | 8.47 | ft |

$$Q = \frac{1.486}{n} A R^{2/3} s^{1/2}$$




A = 27.78 sf

**d = 3.28 ft**

**V (ft/sec) 15.66 ft/sec**

**V = Q / A**

# Hydraulic Calculations

Project Name: **Town Brook Enhancement** Proj. No.: **10-006**

Project Location: **Quincy , MA** Date: **3/15/2011**

Calculated by: **KPS**

## PROPOSED 11 X 6 FOOT BOX CULVERT - OPEN CHANNEL

### *CHANNEL DATA*

d = 6.00 ft

n = 0.013

s = 0.0033 ft/ft

$z_1$ = 0 ft/ft

$z_2$ = 0 ft/ft

w = 11 ft

h = 6.00 ft (enclosed conduit only)

A = 66.00 sf

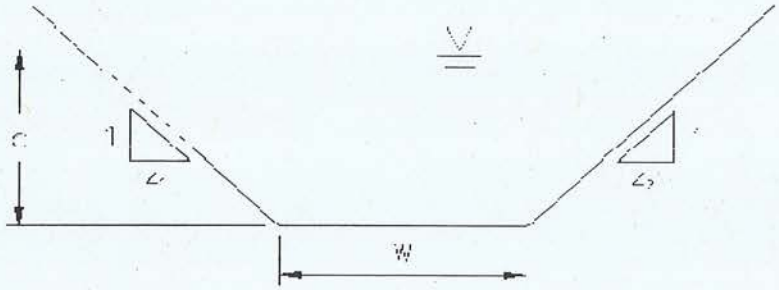
**Q = 875 $ft^3$/sec**

**V (ft/sec) 13.26 ft/sec**

$$Q = \frac{1.486}{n} A R^{2/3} s^{1/2}$$

**V = Q / A**

**PARTIAL FLOW**



# Hydraulic Calculations

Project Name: **Town Brook Enhancement** Proj. No.: **10-006**

Project Location: **Quincy , MA** Date: **3/15/2011**

Calculated by: **KPS**

## PROPOSED 11 X 6 FOOT BOX CULVERT

### *CHANNEL DATA*

| | | |
|---|---|---|
| d = | 6.00 | ft |
| n = | 0.013 | |
| s = | 0.0033 | ft/ft |
| $z_1$ = | 0 | ft/ft |
| $z_2$ = | 0 | ft/ft |
| w = | 11 | ft |
| h = | 6.00 | ft (enclosed conduit only) |

A = 66.00 sf

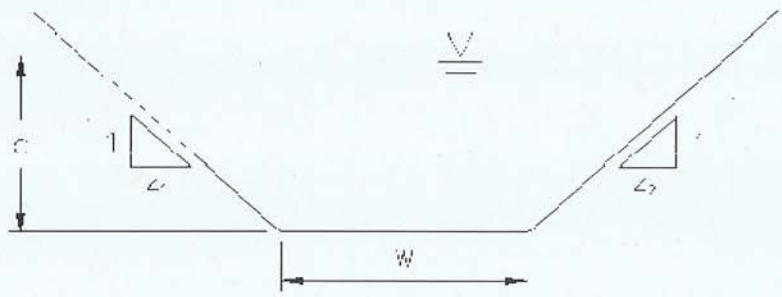
**Q = 674 $ft^3$/sec**

**V (ft/sec) 10.22 ft/sec**

$$Q = \frac{1.486}{n} A R^{2/3} s^{1/2}$$

**V = Q / A**

**FULL FLOW**



# Hydraulic Calculations

Project Name: **Town Brook Enhancement** Proj. No.: **10-006**

Project Location: **Quincy , MA** Date: **3/15/2011**

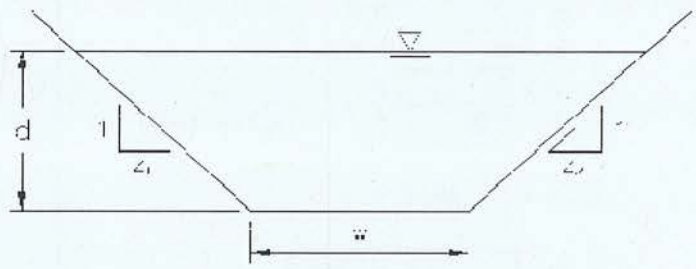
Calculated by: **KPS**

## NORMAL LOW-FLOW DEPTH OF TOWN BROOK - EXISTING

### *CHANNEL DATA*

| | | |
|---|---|---|
| Q = | 2.20 | $ft^3/sec$ |
| n = | 0.015 | |
| s = | 0.011 | ft/ft |
| $z_1$ = | 0 | ft/ft |
| $z_2$ = | 0 | ft/ft |
| w = | 7.9 | ft |

$$Q = \frac{1.486}{n} A R^{2/3} s^{1/2}$$




A = 0.87 sf

**d = 0.11 ft**

**V (ft/sec) 2.53 ft/sec**

**V = Q / A**

# Hydraulic Calculations

Project Name: **Town Brook Enhancement** Proj. No.: **10-006**

Project Location: **Quincy , MA** Date: **3/15/2011**

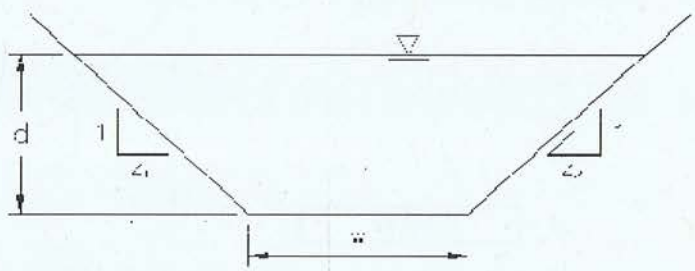
Calculated by: **KPS**

## NORMAL LOW-FLOW DEPTH OF TOWN BROOK - PROPOSED

### *CHANNEL DATA*

| | | |
|---|---|---|
| Q = | 2.20 | $ft^3/sec$ |
| n = | 0.030 | |
| s = | 0.0033 | ft/ft |
| $z_1$ = | 1 | ft/ft |
| $z_2$ = | 1 | ft/ft |
| w = | 2 | ft |

$$Q = \frac{1.486}{n} A R^{2/3} s^{1/2}$$




A = 1.40 sf

**d = 0.55 ft**

**V (ft/sec) 1.57 ft/sec**

**V = Q / A**

# Hydraulic Calculations

Project Name: **Town Brook Enhancement** Proj. No.: **10-006**

Project Location: **Quincy , MA** Date: **3/15/2011**

Calculated by: **KPS**

## NORMAL LOW-FLOW DEPTH OF TOWN BROOK - PROPOSED

### *CHANNEL DATA*

$Q = 5.00$ $ft^3/sec$

$n = 0.030$

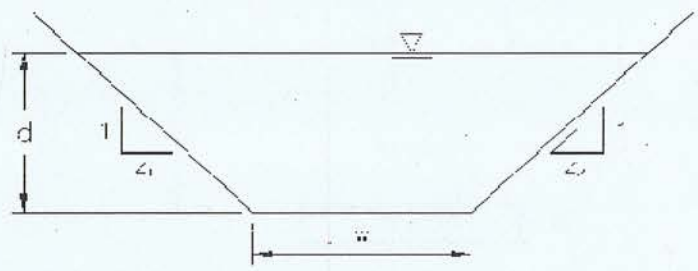
$s = 0.0033$ ft/ft

$z_1 = 1$ ft/ft

$z_2 = 1$ ft/ft

$w = 2$ ft

$$Q = \frac{1.486}{n} A R^{2/3} s^{1/2}$$




A = 2.53 sf

**d = 0.88 ft**

**V (ft/sec) 1.97 ft/sec**

**V = Q / A**

# Hydraulic Calculations

Project Name: **Town Brook Enhancement** Proj. No.: **10-006**

Project Location: **Quincy , MA** Date: **3/15/2011**

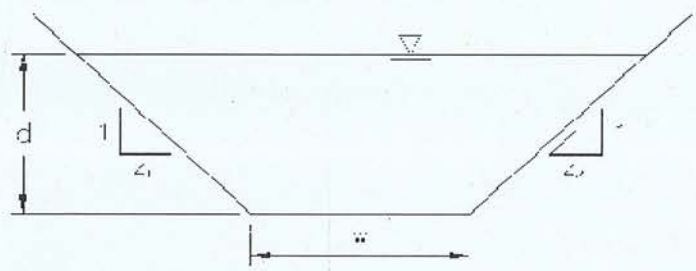
Calculated by: **KPS**

## NORMAL LOW-FLOW DEPTH OF TOWN BROOK - PROPOSED

### *CHANNEL DATA*

| | | |
|---|---|---|
| Q = | 10.00 | $ft^3/sec$ |
| n = | 0.030 | |
| s = | 0.0033 | ft/ft |
| $z_1$ = | 1 | ft/ft |
| $z_2$ = | 1 | ft/ft |
| w = | 2 | ft |

$$Q = \frac{1.486}{n} A R^{2/3} s^{1/2}$$




A = 4.24 sf

**d = 1.29 ft**

**V (ft/sec) 2.36 ft/sec**

**V = Q / A**

# DEEP ROCK TUNNEL DIVERSION CALCULATIONS

# Hydraulic Calculations

Project Name: **Town Brook Enhancement** Proj. No.: **10-006**

Project Location: **Quincy , MA** Date: **3/15/2011**

Calculated by: **KPS**

## DEEP ROCK TUNNEL DIVERSION - WEIR OVERFLOW

| | | |
|---|---|---|
| L = | 51.00 | ft |
| C = | 3.40 | |
| hup = | 22.30 | |
| hweir = | 18.00 | |
| Delta h= | 4.30 | |
| Htailwater = | 21.00 | |

$Q = CLH^{3/2}$

$Q_{MAX}$ = **1,546.2 $ft^3$/sec**

**WEIR IS SUBMERGED - ADJUST QMAX FOR SUBMERGENCE FACTOR**

$Q_{TOTAL}$ = **601.6 $ft^3$/sec**

$$Q_{TOTAL} = Q_{MAX} \left(1 - (H_T / H_{WEIR})^{1.5}\right)^{0.385}$$

# Hydraulic Calculations

Project Name: **Town Brook Enhancement** Proj. No.: **10-006**

Project Location: **Quincy , MA** Date: **3/15/2011**

Calculated by: **KPS**

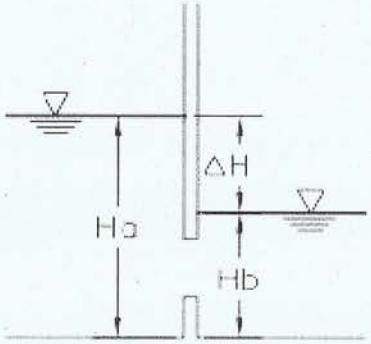
## DEEP ROCK TUNNEL DIVERSION - OUTLET CAPACITY

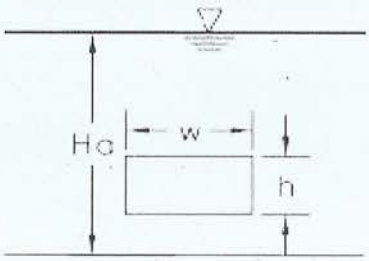
### *ORIFICE CALCULATIONS*

**Q= (Cd)(A)√(2gh)**

| | | | | | |
|---|---|---|---|---|---|
| g = | 32.20 | ft/sec$^2$ | $El._A$ = | 18.00 | WEIR ELEVATION |
| w = | 10.00 | ft | $El._B$ = | 15.72 | |
| h = | 2.00 | ft | $El._{ORIFICE}$ = | 15.72 | **FREE OUTFALL** |
| Cd = | 0.61 | | Delta h= | 1.28 | |
| | | | f = | 0% | CLOGGING FACTOR |

**Q = 110.8 ft$^3$/sec**



# UNIT HYDROGRAPH CALCULATIONS

# Unit Hydrograph Calculations

Project Name: **Town Brook Enhancement** Proj. No.: **10-006**

Project Location: **Quincy, MA** Date: **3/15/2011**

Calculated by: **KPS**

## LOCAL TO USGS GAUGE 1105585 (CURRENT DELINEATION)

### *BASIN DATA*

$T_{LAG}$ = 1.00 hours (Lag Time)

$C_P$ = 0.60 (Peaking Coefficient)

A = 0.36 $mi^2$ (Basin Area)

$T_D$ = 1.00 hours (Duration of Unit Rainfall)

$Q_P$ = **138.24** $ft^3/sec$ (Peak Flow)

$$Q_P = \frac{640 \times A \times C_P}{T_{LAG}}$$

$T_P$ = **1.50** hours (Time to Peak)

$$T_P = \frac{T_D}{2} + T_{LAG}$$

$W_{50}$ = 1.22 hours

$W_{75}$ = 0.72 hours

$Q_{50}$ = 69.12 $ft^3/sec$

$Q_{75}$ = 103.68 $ft^3/sec$

$T_{BASE}$ = 4.5

Variables Used for Creating Snyder Unit Hydrograph

$$W_{50} = 756 \times Q_A^{-1.081}$$

$$W_{75} = 450 \times Q_A^{-1.081}$$

($Q_A$ is the discharge per square mile)

$$T_{BASE} = 3 \times T_P$$

*minimum - adjust $T_{BASE}$ as needed to shape hydrograph for volume

### *UNIT HYDROGRAPH DATA*

| | Time | Q ($ft^3/sec$) |
|---|---|---|
| **Start** | 0.00 | 0.00 |
| **$T_{50}$** | 1.09 | 69.12 |
| **$T_{75}$** | 1.26 | 103.68 |
| **$T_P$** | 1.50 | 138.24 |
| **$T_{75}$** | 1.98 | 103.68 |
| **$T_{50}$** | 2.31 | 69.12 |
| **$T_{BASE}$** | 4.50 | 0.00 |

# Unit Hydrograph Calculations

Project Name: **Town Brook Enhancement** Proj. No.: **10-006**

Project Location: **Quincy, MA** Date: **3/15/2011**

Calculated by: **KPS**

## LOCAL TO PROJECT AREA (CURRENT DELINEATION)

### *BASIN DATA*

$T_{LAG}$ = 1.00 hours (Lag Time)

$C_P$ = 0.60 (Peaking Coefficient)

A = 0.32 $mi^2$ (Basin Area)

$T_D$ = 1.00 hours (Duration of Unit Rainfall)

$Q_P$ = **122.88** $ft^3/sec$ (Peak Flow)

$$Q_P = \frac{640 \times A \times C_P}{T_{LAG}}$$

$T_P$ = **1.50** hours (Time to Peak)

$$T_P = \frac{T_D}{2} + T_{LAG}$$

$W_{50}$ = 1.22 hours

$W_{75}$ = 0.72 hours

$Q_{50}$ = 61.44 $ft^3/sec$

$Q_{75}$ = 92.16 $ft^3/sec$

$T_{BASE}$ = 4.5

Variables Used for Creating Snyder Unit Hydrograph

$$W_{50} = 756 \times Q_A^{-1.081}$$

$$W_{75} = 450 \times Q_A^{-1.081}$$

($Q_A$ is the discharge per square mile)

$$T_{BASE} = 3 \times T_P$$

*minimum - adjust $T_{BASE}$ as needed to shape hydrograph for volume

### *UNIT HYDROGRAPH DATA*

| | Time | Q ($ft^3/sec$) |
|---|---|---|
| **Start** | 0.00 | 0.00 |
| **$T_{50}$** | 1.09 | 61.44 |
| **$T_{75}$** | 1.26 | 92.16 |
| **$T_P$** | 1.50 | 122.88 |
| **$T_{75}$** | 1.98 | 92.16 |
| **$T_{50}$** | 2.31 | 61.44 |
| **$T_{BASE}$** | 4.50 | 0.00 |

# Unit Hydrograph Calculations

Project Name: **Town Brook Enhancement** Proj. No.: **10-006**

Project Location: **Quincy, MA** Date: **3/15/2011**

Calculated by: **KPS**

## LOCAL TO DEEP ROCK TUNNEL (CURRENT DELINEATION)

### *BASIN DATA*

$T_{LAG}$ = 1.50 hours (Lag Time)

$C_P$ = 0.55 (Peaking Coefficient)

A = 0.84 $mi^2$ (Basin Area)

$T_D$ = 1.00 hours (Duration of Unit Rainfall)

$Q_P$ = **197.12** $ft^3/sec$ (Peak Flow)

$$Q_P = \frac{640 \times A \times C_P}{T_{LAG}}$$

$T_P$ = **2.00** hours (Time to Peak)

$$T_P = \frac{T_D}{2} + T_{LAG}$$

$W_{50}$ = 2.07 hours

$W_{75}$ = 1.23 hours

$Q_{50}$ = 98.56 $ft^3/sec$

$Q_{75}$ = 147.84 $ft^3/sec$

$T_{BASE}$ = 6.65

Variables Used for Creating Snyder Unit Hydrograph

$$W_{50} = 756 \times Q_A^{-1.081}$$

$$W_{75} = 450 \times Q_A^{-1.081}$$

($Q_A$ is the discharge per square mile)

$$T_{BASE} = 3 \times T_P$$

*minimum - adjust $T_{BASE}$ as needed to shape hydrograph for volume

### *UNIT HYDROGRAPH DATA*

| | Time | Q ($ft^3/sec$) |
|---|---|---|
| **Start** | 0.00 | 0.00 |
| $T_{50}$ | 1.31 | 98.56 |
| $T_{75}$ | 1.59 | 147.84 |
| $T_P$ | 2.00 | 197.12 |
| $T_{75}$ | 2.82 | 147.84 |
| $T_{50}$ | 3.38 | 98.56 |
| $T_{BASE}$ | 6.65 | 0.00 |

# Unit Hydrograph Calculations

Project Name: **Town Brook Enhancement**
Project Location: **Quincy, MA**

Proj. No.: **10-006**
Date: **3/15/2011**
Calculated by: **KPS**

## LOCAL TO CENTRE STREET JUNCTION STRUCTURE (CURRENT DELINEATION)

### *BASIN DATA*

| | | | |
|---|---|---|---|
| $T_{LAG}$ = | 2.00 | hours | (Lag Time) |
| $C_P$ = | 0.55 | | (Peaking Coefficient) |
| A = | 1.38 | $mi^2$ | (Basin Area) |
| $T_D$ = | 1.00 | hours | (Duration of Unit Rainfall) |

**$Q_P$ =** **242.88** $ft^3/sec$ (Peak Flow)

$$Q_P = \frac{640 \times A \times C_P}{T_{LAG}}$$

**$T_P$ =** **2.50** hours (Time to Peak)

$$T_P = \frac{T_D}{2} + T_{LAG}$$

| | | |
|---|---|---|
| $W_{50}$ = | 2.83 | hours |
| $W_{75}$ = | 1.68 | hours |
| $Q_{50}$ = | 121.44 | $ft^3/sec$ |
| $Q_{75}$ = | 182.16 | $ft^3/sec$ |
| $T_{BASE}$ = | 8.75 | |

Variables Used for Creating Snyder Unit Hydrograph

$$W_{50} = 756 \times Q_A^{-1.081}$$

$$W_{75} = 450 \times Q_A^{-1.081}$$

($Q_A$ is the discharge per square mile)

$$T_{BASE} = 3 \times T_P$$

*minimum - adjust $T_{BASE}$ as needed to shape hydrograph for volume

### *UNIT HYDROGRAPH DATA*

| | Time | Q ($ft^3/sec$) |
|---|---|---|
| **Start** | 0.00 | 0.00 |
| **$T_{50}$** | 1.56 | 121.44 |
| **$T_{75}$** | 1.94 | 182.16 |
| **$T_P$** | 2.50 | 242.88 |
| **$T_{75}$** | 3.62 | 182.16 |
| **$T_{50}$** | 4.38 | 121.44 |
| **$T_{BASE}$** | 8.75 | 0.00 |

# Unit Hydrograph Calculations

Project Name: **Town Brook Enhancement** Proj. No.: **10-006**

Project Location: **Quincy, MA** Date: **3/15/2011**

Calculated by: **KPS**

## OLD QUINCY RESERVOIR (CURRENT DELINEATION)

### *BASIN DATA*

$T_{LAG}$ = 2.50 hours (Lag Time)

$C_P$ = 0.50 (Peaking Coefficient)

A = 1.56 $mi^2$ (Basin Area)

$T_D$ = 1.00 hours (Duration of Unit Rainfall)

$Q_P$ = **199.68** $ft^3/sec$ (Peak Flow)

$$Q_P = \frac{640 \times A \times C_P}{T_{LAG}}$$

$T_P$ = **3.00** hours (Time to Peak)

$$T_P = \frac{T_D}{2} + T_{LAG}$$

$W_{50}$ = 3.99 hours

$W_{75}$ = 2.37 hours

$Q_{50}$ = 99.84 $ft^3/sec$

$Q_{75}$ = 149.76 $ft^3/sec$

$T_{BASE}$ = 11.8

Variables Used for Creating Snyder Unit Hydrograph

$$W_{50} = 756 \times Q_A^{-1.081}$$

$$W_{75} = 450 \times Q_A^{-1.081}$$

($Q_A$ is the discharge per square mile)

$$T_{BASE} = 3 \times T_P$$

*minimum - adjust $T_{BASE}$ as needed to shape hydrograph for volume

### *UNIT HYDROGRAPH DATA*

| | Time | Q ($ft^3/sec$) |
|---|---|---|
| **Start** | 0.00 | 0.00 |
| $T_{50}$ | 1.67 | 99.84 |
| $T_{75}$ | 2.21 | 149.76 |
| $T_P$ | 3.00 | 199.68 |
| $T_{75}$ | 4.58 | 149.76 |
| $T_{50}$ | 5.66 | 99.84 |
| $T_{BASE}$ | 11.80 | 0.00 |

# CIVILSTORM© RESULTS

# Calculation Detailed Summary

| <General> | | | |
|---|---|---|---|
| Label | Base Calculation Options | | |

| Inlets | | | |
|---|---|---|---|
| Neglect Side Flow? | False | Active Components for Combination Inlets In Sag | Grate and Curb |
| Neglect Gutter Cross Slope For Side Flow? | False | Active Components for Combination Inlets on Grade | Grate and Curb |

| Options (Advanced) | | | |
|---|---|---|---|
| Virtual Flow Depth | 0.040 ft | NR Weighting Coefficient | 0.700 |
| Y Iteration Tolerance | 0.03 ft | Relaxation Weighting Coefficient | 0.600 |
| LPI Coefficient | 1.000 | Computation Distance | 50.00 ft |

| Calculation Options | | | |
|---|---|---|---|
| Calculation Time Step | 0.025 hours | Hydrologic Time Step | 0.025 hours |
| Output Increment | 0.050 hours | Total Simulation Time | 24.000 hours |

## Catchment Calculation Summary

| Label | Runoff Method | Loss Method | Total Rainfall Depth (in) | Area (User Defined) (mile²) | Volume (Total Runoff) (ac-ft) | Flow (Peak) (ft³/s) | Time To Peak (hours) |
|---|---|---|---|---|---|---|---|
| Old Quincy Res | Unit Hydrograph | fLoss | 6.800 | 1.560 | 381.91 | 724.08 | 15.000 |
| Centre Street Jct | Unit Hydrograph | fLoss | 6.800 | 1.380 | 340.23 | 820.97 | 14.500 |
| Deep Rock Tunnel | Unit Hydrograph | fLoss | 6.800 | 0.840 | 207.06 | 617.61 | 14.000 |
| Project Area | Unit Hydrograph | fLoss | 6.800 | 0.320 | 82.84 | 334.92 | 13.500 |
| USGS Gauge | Unit Hydrograph | fLoss | 6.800 | 0.360 | 93.19 | 375.48 | 13.500 |

## General Calculation Summary

## General Calculation Summary

| Label | Element Type | Branch | Time to Maximum Flow (hours) | Flow (Maximum) (ft³/s) | Velocity (Maximum) (ft/s) | Hydraulic Grade (Maximum) (ft) |
|---|---|---|---|---|---|---|
| Culvert End | Manhole | 1 | --- | --- | --- | 13.50 |
| Culvert Start | Catch Basin | 1 | --- | --- | --- | 17.88 |
| Proposed 11x6 RBC | Conduit | 1 | 13.500 | 434.38 | 10.74 | 15.93 |
| Exist TB1 | Channel | 1 | 13.550 | 435.23 | 18.51 | 13.04 |
| Exist TB2 | Channel | 1 | 13.550 | 435.27 | 13.24 | 12.71 |
| Exist TB3 | Channel | 1 | 13.550 | 435.32 | 11.54 | 12.57 |
| Exist TB4 | Channel | 1 | 13.550 | 435.39 | 11.64 | 12.47 |
| Sta. 20+75 | Cross Section | 1 | --- | --- | --- | 12.81 |
| Sta. 20+50 | Cross Section | 1 | --- | --- | --- | 12.63 |
| Sta. 20+25 | Cross Section | 1 | --- | --- | --- | 12.51 |

## Node Calculation Summary

| Label | Element Type | Branch | Time to Maximum Inflow (hours) | Flow (Total In Maximum) (ft³/s) | Time To Maximum Inlet Flow (hours) | Flow (Surface Maximum) (ft³/s) | Time To Maximum Captured Flow (hours) | Flow (Captured Maximum) (ft³/s) | Time to Maximum Overflow (hours) | Flow (Overflow Maximum) (ft³/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| Culvert End | Manhole | 1 | 13.550 | 435.05 | --- | --- | --- | --- | 0.000 | 0.00 |
| Culvert Start | Catch Basin | 1 | 13.500 | 434.45 | 13.500 | 434.45 | 13.500 | 434.45 | 0.000 | 0.00 |
| Tunnel Inlet | Outfall | 0 | (N/A) | (N/A) | --- | --- | --- | --- | (N/A) | (N/A) |
| Resevoir Outlet | Outfall | 0 | (N/A) | (N/A) | --- | --- | --- | --- | (N/A) | (N/A) |
| Center St Jct | Outfall | 0 | (N/A) | (N/A) | --- | --- | --- | --- | (N/A) | (N/A) |
| Sta. 20+00 | Outfall | 1 | 13.550 | 435.42 | --- | --- | --- | --- | 0.000 | 0.00 |
| USGS Gauge | Outfall | 0 | (N/A) | (N/A) | --- | --- | --- | --- | (N/A) | (N/A) |

## Gutter Calculation Summary

| Label | Open Cross Section | Flow (Maximum) (ft³/s) | Time to Maximum Flow (hours) | Velocity (Maximum) (ft/s) |
|---|---|---|---|---|

# FlexTable: Catchment Table (10006_EX-Unit_Hydro_TB.csd)

## Current Time: 0.000 hours

| Id | Label | Outflow Node | Area (mile²) | Flow (Peak) (ft³/s) | Time To Peak (hours) | Volume (Total Runoff) (ac-ft) | Loss Method | fLoss (in/h) | Unit Hydrograph Method |
|---|---|---|---|---|---|---|---|---|---|
| 143 | Old Quincy Res | Resevoir Outlet | 1.560 | 724.08 | 15.000 | 381.91 | fLoss | 0.100 | Generic Unit Hydrograph |
| 157 | Centre Street Jct | Center St Jct | 1.380 | 820.97 | 14.500 | 340.23 | fLoss | 0.100 | Generic Unit Hydrograph |
| 159 | Deep Rock Tunnel | Tunnel Inlet | 0.840 | 617.61 | 14.000 | 207.06 | fLoss | 0.100 | Generic Unit Hydrograph |
| 160 | Project Area | Culvert Start | 0.320 | 334.92 | 13.500 | 82.84 | fLoss | 0.100 | Generic Unit Hydrograph |
| 161 | USGS Gauge | USGS Gauge | 0.360 | 375.48 | 13.500 | 93.19 | fLoss | 0.100 | Generic Unit Hydrograph |

# FlexTable: Conduit Table (10006_EX-Unit_Hydro_TB.csd)

## Current Time: 0.000 hours

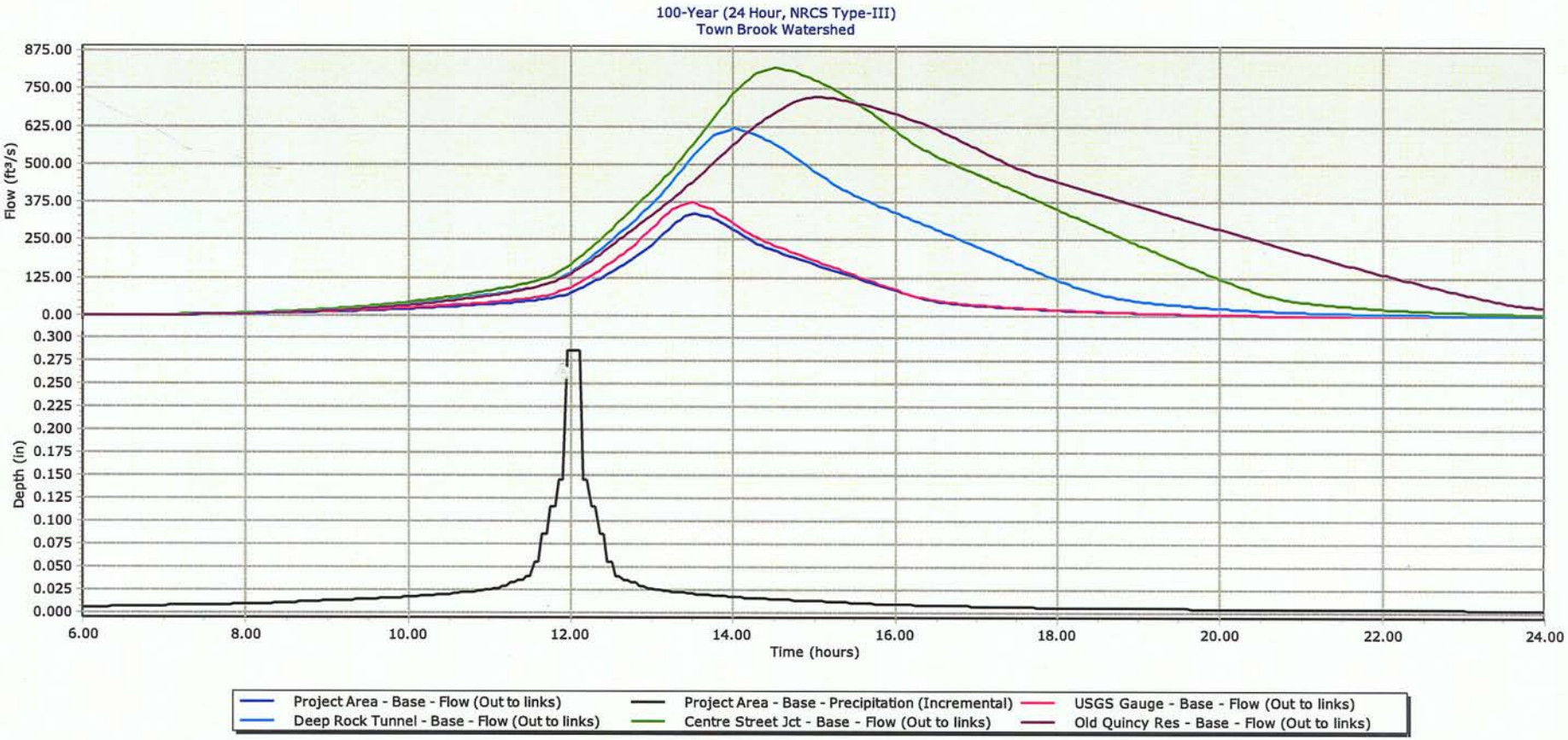
| Id | Label | Rise (ft) | Span (ft) | Start-node Id | Invert (Start) (ft) | Hydraulic Grade (Start) (ft) | Stop-node Id | Invert (Stop) (ft) | Hydraulic Grade (Stop) (ft) | Length (ft) | Constructed Slope (ft/ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 176 | Proposed 11x6 RBC | 6.00 | 11.00 | Culvert Start | 14.20 | 14.84 | Culvert End | 10.30 | 12.51 | 1236.00 | 0.003 |

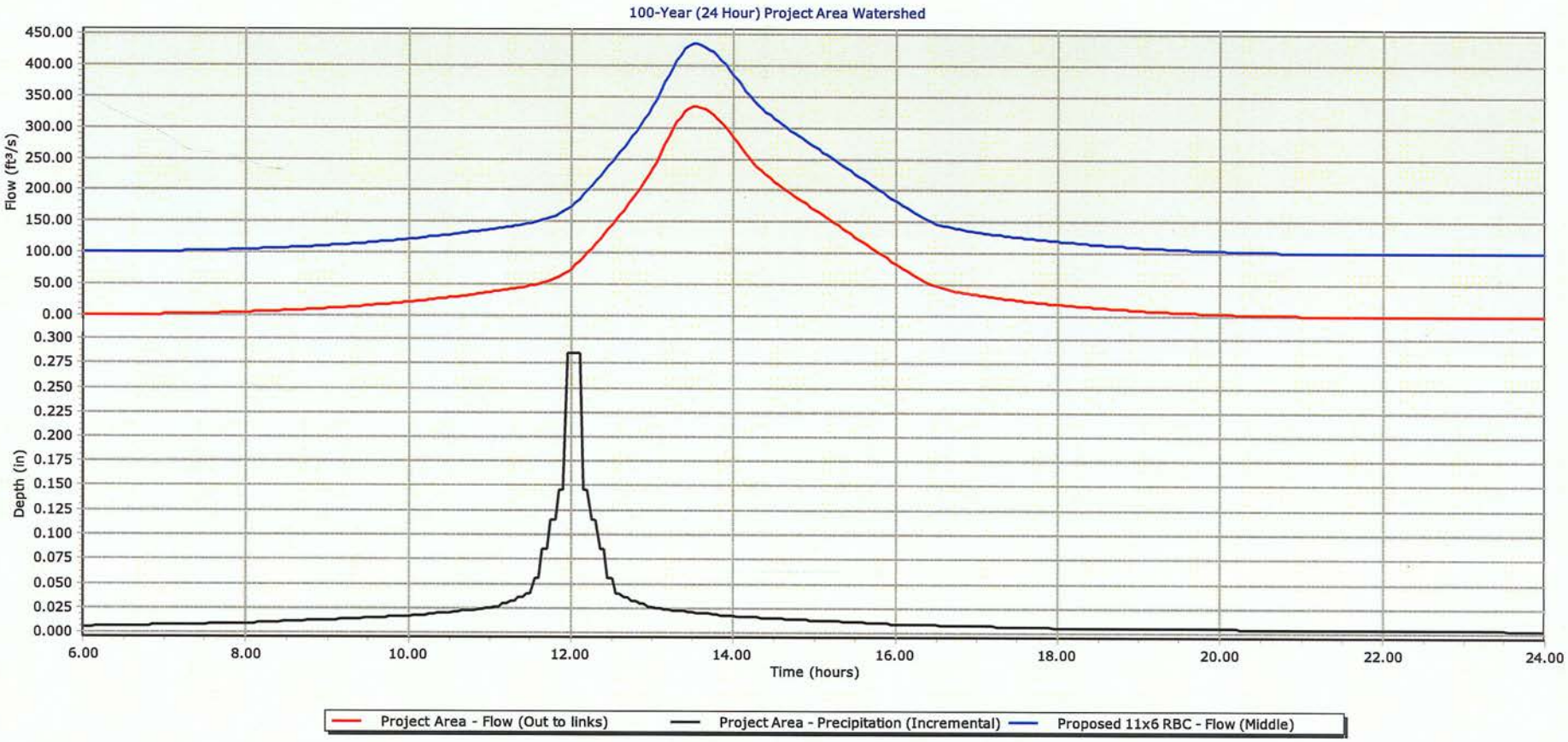
| Flow (Maximum) ($ft^3/s$) | Velocity (Maximum) (ft/s) | Section Type | Capacity (Full) ($ft^3/s$) | Manning's n |
|---|---|---|---|---|
| 434.38 | 10.74 | Box | 659.39 | 0.013 |

# FlexTable: Cross Section Table (10006_EX-Unit_Hydro_TB.csd)

## Current Time: 0.000 hours

| Id | Label | Section Type | Invert Elevation (ft) | Bottom Width (ft) | Height (ft) | Manning's n | Hydraulic Grade (ft) |
|---|---|---|---|---|---|---|---|
| 183 | Sta. 20+75 | Trapezoidal Cross Section | 7.93 | 6.03 | 5.04 | 0.015 | 12.49 |
| 185 | Sta. 20+50 | Trapezoidal Cross Section | 7.33 | 7.01 | 5.70 | 0.015 | 12.48 |
| 188 | Sta. 20+25 | Trapezoidal Cross Section | 7.98 | 8.47 | 5.00 | 0.015 | 12.48 |


100-Year (24 Hour, NRCS Type-III)
Town Brook Watershed
Flow (ft³/s)
875.00
750.00
625.00
500.00
375.00
250.00
125.00
0.00
Depth (in)
0.300
0.275
0.250
0.225
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
22.00
24.00
Time (hours)
Project Area - Base - Flow (Out to links)
Deep Rock Tunnel - Base - Flow (Out to links)
Project Area - Base - Precipitation (Incremental)
Centre Street Jct - Base - Flow (Out to links)
USGS Gauge - Base - Flow (Out to links)
Old Quincy Res - Base - Flow (Out to links)


100-Year (24 Hour) Project Area Watershed
Flow (ft³/s)
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Depth (in)
0.300
0.275
0.250
0.225
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
22.00
24.00
Time (hours)
Project Area - Flow (Out to links)
Project Area - Precipitation (Incremental)
Proposed 11x6 RBC - Flow (Middle)

# APPENDIX C

## TOWN BROOK FLOOD CONTROL PROJECT HISTORY

### TABLE OF CONTENTS

- TOWN BROOK HISTORY
- TOWN BROOK LOCAL PROTECTION PROJECT
  - Deep Rock Relief Tunnel Project Description
  - Deep Rock Relief Tunnel Permitting History
    - Channel Improvements
    - Relief Tunnel
    - Intake Area
    - Outlet Area
    - Tunnel Aeration Systems
  - Old Quincy Reservoir
    - Dam Embankment and Dike
    - Spillway and Permanent Pool Structure
    - Outlet Works and Howie Road Diversion Conduit
- ADDITIONAL FLOOD CONTROL PROJECTS
  - Bigelow Street (Conduit) Project
  - Brook Road Diversion Project
- SALT MARSH RESTORATION HISTORY

## TOWN BROOK HISTORY

Town Brook has a long documented history of flooding dating back to the 1880's. Repeated flooding in Quincy throughout the 1950's and 1960's (specifically the flood events of 1955, 1968, and 1969), led to the request for federal flood control aid in 1969. The major flooding occurred in the lower basin east of the Southeast Expressway in Quincy, eventually leading to the New England Division of the U.S. Army Corps of Engineers (USACOE) to undertake a study to determine the feasibility of providing flood protection in flood-prone areas of the City. An initial assessment completed in November of 1970 found that local flood protection projects were warranted and further investigation was justified (Ref. TB-003).

Several studies were completed throughout the 1970's. In March of 1978, Metcalf & Eddy, Inc. prepared the "Report to the Commonwealth of Massachusetts Metropolitan District Commission on Flood Control Systems for Town Brook – Quincy and Braintree". The report was prepared to investigate the flood control problems and the water resource issues within the Town Brook watershed. In September of 1980, the USACOE New England Division released a "Feasibility Report for Water Resources Development for the Town Brook Local Protection – Massachusetts Coastal Streams". This was released as an interim report to present the findings on flood issues and other possible water resource problems in the Town Brook watershed. [The Hayward Creek and Furnace Brook watersheds were also examined, but under separate studies.]

Both studies incorporated several other studies that were conducted for the same area including but not limited to the following:

- New England-New York Inter-Agency Committee (NENYIAC) Report – 1956
- North Atlantic Regional Water Resources (NAR) Study – 1982
- Boston Harbor-Eastern Massachusetts Metropolitan Area Wastewater Management (EMMA) Study
- Southeastern New England (SENE) Study – 1975
- Northeastern United States Water Supply (NEWS) Study – 1977
- USACOE Flood Insurance Studies for the City of Quincy – 1972
- Unpublished ACOE Reconnaissance Report – 1970
- USACOE Water Resource Investigation & Plan of Survey – 1973
- Hayward Creek Reports – 1974
- Furnace Brook Feasibility Report – 1976

According to the 1980 Feasibility Report, the two most damaging floods along Town Brook were during August 1955 and March 1968. The 1955 flood was caused by a rainfall event of approximately 5.3 inches within a six hour period during Hurricane Diane. The 1968 flood was due to an approximate 2.5 inch rain event over a six hour period, with a total of 5.7 inches over an 18 hour period. This flood was exacerbated by frozen ground conditions (Ref. TB-003).

Town Brook did not have the capacity to carry runoff from the development throughout the City, via a system of culverts, underground conduits, and enclosed culvert sections dating back to the 1880's, or earlier. The two studies identified six " flood pools" along Town Brook that temporarily store flood water and include the following:

- Braintree Pool – due to the high invert elevations of the culverts under Route 3 and from the restriction imposed by the conduit from Worthington Circle to Common Street.
- Centre Street Pool – due to the inadequately sized 72-inch concrete pipe conduit west of Columbia Street. The pool covers a large area west of Centre Street.
- Brook Road Pool – caused by the restriction from a flat section of an 8.5-foot by 5-foot concrete box. The flooding extends along Brook Road and west along Water Street and south and northeast of Water Street.
- Shopping Center Pool – due to the restriction of the 10-foot by 5-foot box culvert under the railroad tracks and Quincy business district.
- Bigelow Pool – caused by the inadequate 10-foot by 4.8-foot culvert at the lower crossing of Bigelow Street.
- Town River Pool – due to the constriction caused by fill and two 72-inch culvert pipes under the parking lot west of the Southern Artery. The pool extends along Town River below Elm Street.

The Braintree, Centre Street, Brook Road, and Shopping Center Pools were located upstream of the project area. The Bigelow Pool is located downstream of Revere Road and the limit of the downstream portion of work. The Town River Pool was located further downstream of the project area along Town River.

Many federal, state, and local agencies were involved and provided input into these studies. The Commonwealth of Massachusetts took an active role in the preparation and coordination for the reports through the Metropolitan District Commission (MDC) with input and coordination from the ACOE to assure the adequacy of the studies.

The M&E study provided the initial recommendation for the Deep Rock Tunnel work stating that the *best plan of improvements for protecting the flood-prone lower reaches of Town Brook provides a 12-foot diameter deep relief tunnel in rock for diversion of upstream flood waters near Liberty Street. It discharges these flood flows into Town River east of Elm Street, which in turn discharges into Town River Bay* (Ref. TB-024). The report also set the tone for reducing flooding through the Quincy Center business district and allowing adequate control of the existing culverts and conduits between the Deep Rock Relief Tunnel intake and outlet. The report also states that additional work upstream of the intake area will be needed including work to the Old Quincy Reservoir for flood attenuation.

Additional studies and documents were prepared throughout the 1980's to address the flooding within Quincy. In March of 1984, the USACOE prepared the "Reevaluation Report" for the Town Brook Local Protection in Quincy and Braintree. The purpose of this study was to evaluate two layouts for the relief tunnel and determine the most feasible option to avoid environmental impacts in a cost effective manner. Several Technical Memorandums for the flood control project were also prepared. The details of the existing Deep Rock Tunnel and the permitting follow in the next sections. The following table identifies the pertinent documents that were reviewed relative to the Town Brook Local Protection Project.

## Table C.1
## Existing Document Summary

| Document | Date | Agency | Notes |
|---|---|---|---|
| City of Quincy Town Brook Improvements | November 1955 | City of Quincy | Proposed TB Culvert improvements from the American Legion Hall downstream to just past garage (Connection point of proposed culvert) |
| Flood Control Systems for Town Brook – Quincy and Braintree, by Metcalf & Eddy, Inc. | March 1978 | MDC (DCR) | Investigations, studies and recommendations for efficient flood control systems for Town Brook |
| Town Brook – Hydrologic Analysis of Floods | December 1979 | USACOE | Town Brook watershed analysis |
| Town Brook Local Project – Feasibility Report for Water Resources Development | September 1980 | USACOE | Feasibility study from dam modifications to outfall at Town River Bay |
| Town Brook Local Project – Feasibility Report for Water Resources Development | September 1980 | USACOE | Technical Appendices for TB-003 |
| Town Brook Local Project – Reevaluation Report | March 1984 | USACOE | Evaluation of two Deep Rock tunnel alignments 3,520 LF vs. 4,060 LF, shorter has more impact on Salt marsh (longer route was constructed) |
| Town Brook Local Protection Project – Design Memorandum No. 1 General Design and Hydrology | February 1985 | USACOE | Hydro design from Quincy reservoir to outfall |
| Town Brook Local Protection Project, Design Memorandum No. 4, Tunnel, Conduits and Shafts, Site Geology | October 1986 | USACOE | Geotechnical and Groundwater data associated with each component of the project |
| Town Brook Local Protection Project – Design Memorandum No. 5 Hydraulics and Water Quality | July 1985 | USACOE | Hydraulic calculations to support the Deep Rock Tunnel with design tail water elevations |
| Town Brook Local Protection Project – Operation and Maintenance Manual Volume I | September 2001 | USACOE | Operations and maintenance guidelines and Forms, to include the Low Flow Augmentation Protocol to increase base flow for Smelt |
| Town Brook Local Protection Project – Operation and Maintenance Manual Volume II | April 2003 | USACOE | Operation and Maintenance guidelines primarily for Quincy Reservoir Dam |
| Town Brook Flood Control Project – Centre Street Culvert | June 1980 | MDC (DCR) | Centre Street junction box drawings and Burgin Pkwy. Culvert – 8 sheet set |
| Town Brook Flood Control Project – Burgin Pkwy Culvert | March 12, 1984 | MDC (DCR) | Burgin Pkwy Culvert drawings updated to show as-built conditions – 18 sheet set |
| Town Brook Flood Control Project – Bigelow Street Relief Conduit | June 30, 1993 | MDC (DCR) | Bigelow Relief Conduit construction drawings– 12 sheet set |
| Centre St./ Crown Colony Drive Street Reconstruction – Drainage Control Structure Modification-Sections and details | March 27, 1989 | City of Quincy | Centre St. Junction Box |
| Plan of easements and fee acquisitions – City of Quincy | February 1993 | MDC (DCR) | Easement Drawings for the Deep Rock Tunnel – 4 sheet set |
| Town Brook Drainage Assessment Bigelow Street Relief Conduit | May 30, 2006 | City of Quincy | Evaluation of Bigelow Relief Conduit |

## TOWN BROOK LOCAL PROTECTION PROJECT

The Town Brook Local (or Flood Control) Protection project by the MDC in cooperation with the USACOE, has a long history with permitting started in the 1980's. The primary purpose of the project was flood protection, with importance placed on maintaining flow within Town Brook and ensuring adequate dissolved oxygen levels in the relief tunnel. The next two sections summarize the permitting involved in the project and the work completed through the 1990's.

### Deep Rock Relief Tunnel Permitting History

This section contains a summary and history of the Deep Rock Relief Tunnel permitting information. The project team has contacted various agencies and conducted an exhaustive search of records to determine the history of the permitting and approval for the Deep Rock Relief Tunnel. The permits and approvals for the project were obtained from the appropriate agencies, however, due to the time period since the work was completed, most of the agencies do not have the record plans submitted for approval. The following agencies were contacted to obtain the records on file:

- USACOE
- City of Quincy
  - Department of Public Works
  - Conservation Commission
  - Inspectional Services
  - Engineering Department
- MassDEP (formerly the DEQE)
  - Waterways Regulation Program
  - Division of Water Pollution Control (Water Quality Certification Program)
  - Bureau of Resource Protection
  - Boston Office
- DCR (formerly the MDC)

The following permits were obtained and reviewed:

**Table C.2**
**Deep Rock Relief Tunnel Permitting Summary**

| Permit/Approval | Issue Date | Permitting Agency | Notes |
|---|---|---|---|
| Environmental Notification Form (EEA #: 4033) | May 5, 1981 | MEPA | Deep Rock Relief Tunnel Permitting EIR required for the project |
| Project Change (EEA #: 4033) | March 10, 1982 | MEPA | No EIR required |
| Order of Conditions (DEQE File No. 59-196) | March 17, 1989 | DEQE (MassDEP) | Deep Rock Relief Tunnel Permitting |
| Decision on Request for Variance (DEQE File No. 59-196) | March 17, 1989 | DEQE (MassDEP) | Deep Rock Relief Tunnel Permitting |
| Water Quality Certification | March 24, 1989 | DEQE (MassDEP) | Deep Rock Relief Tunnel Permitting |
| Chapter 91 Waterways License (No. 1978) | July 13, 1989 | DEQE (MassDEP) | Deep Rock Relief Tunnel Permitting |
| Extension Permit for the Order of Conditions and Variance (DEP File No. 59-196) | March 27, 1992 | MassDEP | Extension Permit issued with expiration on March 17, 1995 |
| Extension Permit for the Order of Conditions and Variance (DEP File No. 59-196) | February 2, 1995 | MassDEP | Extension Permit issued with expiration on March 17, 1998 |

The Deep Rock Relief Tunnel Permitting involved significant agency coordination and approvals led by the MDC in cooperation with the USACOE. The final approvals and permits were issued in 1989 after years of review.

The MDC initially filed the Environmental Notification Form (EEA #: 4033) with MEPA for two alternatives for the proposed project. The preferred alternative was less costly, however proposed more environmental impacts. On May 5, 1981, the Secretary of Environmental Affairs issued a Certificate on the ENF and directed the MDC to prepare an EIR. The MDC filed a Project Change with a commitment to proceed with the second alternative which was the lesser of the two related to environmental impacts. The Secretary rescinded the decision for the requirement of an EIR in the Certificate issued on March 10, 1982 and no further MEPA review was required.

The Order of Conditions (DEQE File No. 59-196) was issued on March 17, 1989 by the Department of Environmental Engineering, with Special Conditions attached. The Decision on the Request for a Variance (DEQE File No. 59-196) was also issued on March 17, 1989 by the DEQE. The Department initially denied the work because it involved the destruction of approximately 0.9 acres of salt marsh. The project would be permitted to allow the alteration of approximately 0.5 acres of vegetated wetlands classified as Isolated Land Subject to Flooding. The MDC requested an adjudicatory hearing and variance to proceed with the project. The Coastal Zone Management Office denied Federal Consistency Review and intervened in the review process.

In summary, the project review consisted of the construction of the flood relief tunnel with an inlet structure on Town Brook and the outlet structure with associated channel improvements on the Town River. The intake structure was proposed as a 200-foot long by 14-foot wide concrete channel to divert flood stage water into the relief tunnel. The tunnel itself was proposed as a 12-foot minimum diameter tunnel, approximately 4,100 linear feet underneath the City. The tunnel also includes the 180 to 200-foot deep vertical intake shaft and 170-foot deep vertical outlet shaft. An outlet channel was also proposed as a 300-foot long by 60-foot wide constructed channel.

Also included in the permitting of this project were Town River channel improvements, including deepening by two feet, widening by 52 feet, and erosion and scour prevention for 860 linear feet. The flows would continue through a 280-foot long by 52-foot wide box culvert under the Southern Artery and parking lot, then through a 350-foot long section where stone filled gabions were proposed along the west bank with river widening up to 15 feet.

Some of the work mentioned above was subject to the WPA, however portions were not subject to regulation or a variance. The inlet structure to the relief tunnel is regulated, but does not require a variance. The inlet/outlet shafts and the relief tunnel itself are not subject to regulation except for the direct and indirect effects they may have on the river or other environmental resource areas such as diverting flood waters from Town Brook and discharging water into the Town River. The entire project was originally denied under the Superceding Order of Conditions by the DEQE because the Department denied the Town River portion of the proposed work, but was eventually approved.

The DEQE issued an Extension Permit for the Order of Conditions and Variance on March 27, 1992, extending the approval through March 17, 1995. The DEQE also issued a second Extension Permit for the Order of Conditions and Variance on February 2, 1995, extending the permit through March 17, 1998.

The Order of Conditions and Decision on the Request for a Variance provide further detail on the project and the conditions issued. A discussion of the mitigation authorized under this review is included in a later section.

Within a week of the issuance of the OOC and the Decision on the Request for a Variance, the DEQE issued the Water Quality Certification on March, 24, 1989. The approval authorized the work described above for the relief tunnel and associated Town River widening and channelizing. The Water Quality Certification also addresses the aeration system for the relief tunnel to ensure proper circulation to prevent anaerobic conditions. A monitoring protocol was also established. Additional work for the overall flood relief project includes the following:

1. changes to the spillway a the Old Quincy Reservoir in Braintree
2. reconstruction of the dam embankment
3. dredging of the bottom of the Reservoir adjacent to the spill way
4. construction of a dike and drainage way to project areas immediately downstream of the dam

The Water Quality Certification provides further detail on the project and the conditions issued. A discussion of the mitigation authorized under this review is included in a later section.

The DEQE issued a Chapter 91 Waterways License (No. 1978) on July 13, 1989 for the approval of the above mentioned work. The Department has the record for the attached plans that were approved for the project, identifying proposed work, details, and mitigation.

---

**Deep Rock Relief Tunnel Project Description**

The work to complete the Deep Rock Relief Tunnel and the Town River widening/channel improvements was completed in 1997. Based upon discussions with the DCR, the salt marsh restoration work authorized under this project would have been included with construction of the Bigelow Street Relief Conduit. Another phase of the flood control work is related to the Brook Road Diversion project.

The federally authorized portion of the Town Brook Local Flood Protection Project consists of the following:

- construction of the Deep Rock Relief Tunnel and associated structures
- improvement to the Town River channel below the tunnel outlet
- modifications to the Old Quincy Dam for flood control, and construction of the Centre Street, Burgin Parkway, and Braintree culverts.

The project area associated with the work described above consists of the following (Ref. TB-008):

> *The overall project is located in the town of Braintree and the city of Quincy. It begins at its upstream end in Braintree at Old Quincy Reservoir dam which was reconstructed by the Corps. The majority of the flow continues through the Howie Road diversion, also constructed by the Corps, until it rejoins Town Brook at the Worthington Circle conduit (Braintree culvert) built by the MDC. Some flow is also maintained in the portion of the brook parallel to the Howie Road diversion and that portion flows through two small culverts built by the MDC. Combined flow continues through the culvert under Route 3 which was built by MA DPW; then it crosses into Quincy and enters the Centre Street culvert built by the MDC. From the Centre Street junction structure, flow continues in Town Brook with overflows directed to the Burgin Parkway culvert built by the MDC. The brook and culvert flows rejoin at the intake to the Town Brook tunnel built by the Corps and located on the north side of School Street just east of Fort Square. Brook flows continue through a short culvert under Burgin Parkway, while flows from the Burgin Parkway culvert and overflow from the brook enter the tunnel. The tunnel outlet is*

*located between Washington Street and the Southern Artery where it rejoins Town Brook and flows into Town River Bay. Improvements to the portion of Town River between the tunnel outlet and the bay were made by the Corps.*

An Operations & Maintenance Manual was prepared for the project components. Volume I details the tunnel and associated structures, in addition to the Town River improvements and was prepared in 2001. Volume II covers the Old Quincy Reservoir work and Volume III describes the culverts. The notice to proceed on the Town River improvements was given on November 4, 1992 and construction was essentially completed by June 1994. The notice to proceed on the tunnel and associated structures was given on October 28, 1993 and construction was functionally complete by September 1997.

The project, as constructed, consists of a 4,060 foot long relief tunnel located approximately 190 feet below the City of Quincy. The intake shaft and associated structures are located near School Street and the outlet shaft and associated structures are located near the Southern Artery. The channel improvements begin at a point near the outlet structure to the Town River Bay.

The following sections contain excerpts taken from Volume I of the O&M Plan to describe the channel improvements, relief tunnel, and associated aeration systems.

**Channel Improvements**

*Channel improvements were made to widen channels and increase flow capacity. The portion of the Town River between a point approximately 300 feet upstream of the tunnel outlet structure and the Southern Artery was widened and lined on the bottom and sides with PVC coated gabion mattresses. Three 280 foot long reinforced concrete box conduits were installed to carry river and tunnel flows beneath the Southern Artery and adjacent parking lot. Downstream of the Southern Artery to the point where Town River enters Town River Bay, the channel was widened and provided with a layer of stone protection on the left bank.*

**Relief Tunnel**

*A 12 foot diameter concrete lined tunnel was provided to convey excess flows beneath the city of Quincy during flood events. Water flows into the vertical intake shaft from Town Brook and from the Burgin Parkway culvert. Intake structures consist of a reinforced concrete overflow weir connecting the Town Brook channel to the tunnel intake shaft via a 30 foot long 8 x 10 foot box conduit. Water from the Burgin Parkway culvert flows to the tunnel intake shaft through a 48 x 50 foot reinforced concrete grit retention chamber. The vertical tunnel outlet shaft transitions to a horizontal concrete apron which widens into five 10 foot wide bays to convey tunnel discharge flows to the Town River.*

**Intake Area**

*The intake to the tunnel...consists of two pre-cast reinforced concrete weirs discharging to a 12 foot diameter concrete lined vertical intake shaft. Two systems provide flows to the tunnel intake; one from the Town Brook channel and one from the Burgin Parkway culvert. In addition, cast-in-place retaining walls, and drainage and groundwater*

*monitoring systems are provided. Water level sensing and recording equipment, presently operated under contract with the USGS, monitors water level in the brook channel and in the grit basin.*

**Outlet Area**

*The tunnel's vertical outlet shaft transitions into a horizontal concrete apron with invert elevation of 2.0 feet NGVD. The transition occurs between elevations -20.0 and 2.0 feet NGVD and horizontally over a 40 foot distance measured from the tunnel centerline. Five 10 foot wide exit bays are provided at the downstream end of the concrete apron. Each bay is provided with stop log slots, and an aluminum bar trash rack to keep large debris and people out of the tunnel. The exit bays empty into a 60 foot wide outlet channel with battered gabion walls and lined on the bottom with PVC coated gabion mattresses. The outlet channel extends approximately 300 feet downstream to its intersection with Town River.*

**Tunnel Aeration Systems**

*An automatic aeration system consisting of a pumped water circulation system and a compressed air and diffuser system was provided to maintain the dissolved oxygen levels in the tunnel at 6.0 mg/L or above. The pumps, compressor and monitoring and control equipment are housed in two masonry structures; one located at the tunnel intake and one at the tunnel outlet.*

The MDC (DCR) was the local sponsor for the project and was primarily responsible for the operation and maintenance of the project upon completion. The MDC has an agreement with the City of Quincy and the Town of Braintree, delegating the operation and maintenance responsibilities to the municipalities.

**Old Quincy Reservoir**

The Old Quincy Reservoir, located near Lakeside and Walnut Streets in Braintree, was reconstructed as part of the overall project. The dam was reconstructed in order to provide flood control and insure the structural integrity of the dam. Volume II of the O&M Plan provides significant detail into the history and construction of the dam and associated maintenance requirements. The O&M Plan was prepared by the USACOE in 2003 for use by the City of Quincy and the Town of Braintree to meet the special conditions of the approved permits.

A summary taken from Volume II follows to provide brief synopsis of the project, specifically the dam embankment and dike, the spillway and permanent pool structure, and the outlet works and Howie Road Diversion Conduit. Further information is detailed in the O&M Plan that is not relevant to this project.

### Dam Embankment and Dike

*The reconstructed dam embankment has a crest elevation of 88 feet NGVD* [1929 National Geodetic Vertical Datum], *a crest width of 25-feet, a 1V:3H upstream slope and a 1V:2.5H downstream slope. The dam crest elevation is maintained on the left side of the reservoir (looking downstream) by a dike running from the left dam abutment to a point approximately 1600-feet upstream. The crest elevation of the last 200-feet of the dike is at elevation 84.5 feet NGVD to allow shallow bank overflow during a maximum probable flood. Design storage volumes for the reservoir are: 300-acre-feet at normal pool elevation and 550-acre-feet at spillway crest elevation.*

### Spillway and Permanent Pool Structure

*The new spillway is located at the right abutment of the dam and consists of an ungated box type overflow weir with crest elevation of 80.9 feed NGVD leading to a 25-foot wide, 315-foot long U shaped concrete chute with a stilling basin at its downstream end. The spillway chute discharges into a stone lined open channel leading to Town Brook approximately 120-feet below the toe of the dam.*

*An inlet channel at the upstream toe of the dam directs flow over an inlet weir at elevation 73.4 feet NGVD. The weir forms one end of a 22x24-foot concrete box-shaped permanent pool structure adjacent to the spillway. Sluice gates are provided in the permanent pool structure to control flows leaving the structure, and to allow lowering of the reservoir pool below the inlet weir.*

### Outlet Works and Howie Road Diversion Conduit

*A 3x5-foot box conduit conveys normal reservoir outlet flows from the bottom of the permanent pool to a brook diversion structure at the toe of the dam. The main portion of the discharge flow passes through this structure into another 3x5-foot box conduit (the Howie Road Diversion) which conveys it to the Worthington Circle culvert in Town Brook, approximately 2500-feet downstream of the dam. A 12-inch diameter pipe and plug valve are provided in the brook diversion structure to allow a regulated amount of reservoir outflow into the section of Town Brook between the dam and the Worthington Circle culvert.*

---

## ADDITIONAL FLOOD CONTROL PROJECTS

### Bigelow Street (Conduit) Project

The Bigelow Street Project was the next planned phase of the Town Brook Flood Control project to alleviate flooding issues within Quincy Center. The work was permitted in the late 1990's due to flooding that occurred in the mid '90's. Through the search for information on the Deep Rock Relief Tunnel, information was obtained regarding the Bigelow Street Project and verified with the DCR.

The Water Quality Certification (MassDEP File No. 059-0590) was issued on August 31, 1998 by MassDEP. An Order of Conditions (MassDEP File No. 059-0590) was issued on or about January 24, 1997 by the Quincy Conservation Commission. The Bigelow Street Project proposed the widening and channelizing of a portion of the Town Brook channel near Bigelow Street, downstream of Washington Street. These approvals for the Bigelow phase of the Town Brook Flood Control project were obtained within a year of the end of construction of the Deep Rock Relief Tunnel.

The Bigelow Street Project also included a relief conduit composed of a culvert running along Revere Road and McGrath Highway and rejoining Town Brook at Elm Street (Ref. TB-008). The project also proposes to widen and channelize approximately 850 linear feet of the lower portions of Town Brook commonly referred to as Town River between the tunnel outlet and Washington Street. The relief conduit consists of approximately 1,300 feet of the 66-inch culvert between the diversion structure near Revere Road and the upper part of the Town River channel. The Water Quality Certification states the following:

> *Four different alternatives were investigated for the original flood control project prior to the selection of this alternative in 1978. Subsequently, environmental impacts for the Bigelow Street project (this project) were further reduced by avoiding some known smelt spawning areas near Bigelow Street. Mitigation, originally proposed in the nearby Neponset Marsh, has been deleted. As described in the February 18, 1998 letter [we have not been able to obtain this letter] from C. Costello of Metcalf & Eddy, Inc. (M&E, project consultants), the 7,500 square feet (sf) of Phragmites lost will be restored as open water. Overall the project will add some 8,160 sf of Waters of the United States.*

The DEP had concerns over this project and its potential impacts to the anadromous smelt fisheries. The Department issued its opinion that the project could be permitted with clarifications and additional protection to avoid issues with stream flow that would affect the fish eggs within the brook. The MDC was advised that fisheries are an important aspect of the project, the contractor was to be advised of such, and no in-stream work would occur during smelt migration or spawning. All agencies involved would also be regularly updated as to the project status and issues during construction.

Due to a number of issues including funding sources, the Bigelow Street project was never started. As such, the proposed work was not completed, including any mitigation associated with the project.

---

**Brook Road Diversion Project**

The Brook Road Diversion project was also permitted and approved but never started. The proposals for this project were submitted under separate cover to the appropriate agencies in the late 1990's concurrently with the Bigelow Street Project. The Brook Road Diversion proposal consists of a conduit running from the intersection of Roberts and Water Streets and re-connects to Town Brook near the Fort Square Area (Ref. TB-008).

The Brook Road Diversion Conduit was designed to carry excess stormwater from Water Street under Booth Street and Fort Square, and connect with the existing Town Brook culvert near the western end of the Deep Rock Relief Tunnel. Approximately 1,680 linear feet of box conduit were proposed from the Water Street junction structure to the Town Brook channel east of Fort Square. Most of the conduit was proposed within upland areas with a portion proposed within the wetland northeast of Booth Street (Ref. TB-001).
Due to a number of issues including funding sources, the Brook Road Diversion project was never started. As such, the proposed work was not completed.

---

## SALT MARSH RESTORATION HISTORY

This section contains a summary of the permitting information specifically related to the salt marsh mitigation associated with the Town Brook Flood Control Project.

In short summation, the Order of Conditions, Decision on the Request for a Variance, Water Quality Certification ('89), Chapter 91 Waterways License and Metcalf & Eddy (M&E) correspondence make reference to the salt marsh restoration work. Most of the language in the documents refers to the construction of salt marsh as identified on the approved plans which the agencies have no records. Fortunately, the Chapter 91 License and M&E information identify the approved location of this work. The salt marsh was to be created within the area between the Town River and the channel at the outlet structure of the Deep Rock Relief Tunnel. With the construction of the relief tunnel and Town River improvements completed in 1997, the permitting for the next phase of the project continued. This phase included the Bigelow Street Conduit and separate proposals for the Brook Road Diversion project. In conversations with the DCR, the mitigation work was to be performed as part of the Bigelow Street project which was never funded, therefore the salt marsh work was not completed as approved in 1998.

Permitting for the Bigelow Street work was approved in 1998 for the Water Quality Certification for the widening and channelizing of the Town Brook (actually Town River) near Bigelow Street, downstream of Washington Street. The attached Certification states the following:

> *Four different alternatives were investigated for the original flood control project prior to the selection of this alternative in 1978. Subsequently, environmental impacts for the Bigelow Street project (this project) were further reduced by avoiding some known smelt spawning areas near Bigelow Street. Mitigation, originally proposed in the nearby Neponset Marsh, has been deleted. As described in the February 18, 1998 letter* [we have not been able to obtain this letter] *from C. Costello of Metcalf & Eddy, Inc. (M&E, project consultants), the 7,500 square feet (sf) of Phragmites lost will be restored as open water. Overall the project will add some 8,160 sf of Waters of the United States.*
>
> *Via its September 8, 1998 letter, the U.S. EPA announced its intention of seeking redress to its concerns through the "404" federal permitting process. Those concerns chiefly center on EPA's use of Phragmites in saltmarsh identification and whether or not adequate wetland mitigation is proposed, and the appropriateness of using gabion mattresses in the project.*

The Certification goes on to state that the mitigation will still be performed but not as part of this permit as originally planned. The proponent for both the Deep Rock Relief Tunnel and the Town Brook widening project is the Metropolitan District Commission (currently DCR). Based upon our discussions with the DCR and the documents and correspondence reviewed, the original salt marsh restoration was not completed, but was linked to the permitting and construction of a future phase of the Town Brook Flood Control Project.

# APPENDIX D

## WILDLIFE HABITAT EVALUATION UNDER WPA

### TABLE OF CONTENTS

- Wildlife Habitat Evaluation Summary
- Wildlife Habitat Protection Guidance Forms
  - Appendix A: Simple Wildlife Habitat Evaluation
  - Appendix B: Detailed Wildlife Habitat Evaluation

## WILDLIFE HABITAT EVALUATION SUMMARY

Section 310 CMR 10.60 of the WPA outlines the standards for wildlife habitat and the requirements for a wildlife habitat evaluation.

Section 310 CMR 10.60(1)(a) states that *to the extent that a proposed project on inland Banks, Land Under Water, Riverfront Area, or Land Subject to Flooding will alter vernal pool habitat or will alter other wildlife habitat beyond the thresholds permitted under 310 CMR 10.54(4)(a)5., 10.56(4)(a)4., 10.57(4)(a)3. and 10.58(4)(d)1., such alterations may be permitted only if they will have no adverse effects on wildlife habitat. Adverse effects on wildlife habitat mean the alteration of any habitat characteristic listed in 310 CMR 10.60(2), insofar as such alteration will, following two growing seasons of project completion and thereafter (or, if a project would eliminate trees, upon the maturity of replanted saplings) substantially reduce its capacity to provide the important wildlife habitat functions listed in 310 CMR 10.60(2).*

Wildlife habitat of the Bank, Land Under Water Bodies and Waterways, Bordering Land Subject to Flooding, Riverfront Area, and the 100-Foot Buffer Zone was examined to determine the quality and value of such areas. Due to the developed nature of the site, there is little wildlife habitat present within the Riverfront Area, BLSF, Bank, LUWW and Buffer Zone to said resources. The detailed Wildlife Habitat Evaluation forms per MassDEP guidelines follow.

The forms were prepared by Lucas Environmental, LLC and meets the requirements of Section 310 CMR 10.60(1)(b) *an evaluation by the applicant of whether a proposed project will have an adverse effect on wildlife habitat beyond permissable thresholds shall be performed by an individual with at least a masters degree in wildlife biology or ecological science from an accredited college or university, or other competent professional with at least two years experience in wildlife habitat evaluation.*

The forms attached within this Appendix were prepared during the winter season as a preliminary evaluation of wildlife habitat. This evaluation is presumed accurate due to the highly developed urban center surrounding the impacted resource areas of Town Brook. However, to adequately document the limited vegetation surrounding the culverted channel, a fully detailed Wildlife Habitat Evaluation will be filed with the Notice of Intent application to the Quincy Conservation Commission. This WHE will include the completed forms, a detailed narrative, photographic documentation and any other material deemed appropriate for review.

**Massachusetts Department of Environmental Protection**
Bureau of Resource Protection – Wetlands program

# Wildlife Habitat Protection Guidance

## Appendix A: Simplified Wildlife Habitat Evaluation

## Project Information

**Important:** When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

Town Brook - Quincy Center
Project Location (from NOI)

Christopher M. Lucas
Name of Person Completing Form

March 13, 2011
Date

## Important Habitat Features

Direct alterations to the following important habitat features in resource areas may be permitted only if they will have no adverse effect (refer to Section V).

- ☐ Habitat for state-listed animal species (receipt of a positive opinion or permit from MNHESP shall be presumed to be correct. Do not refer to Section V).
- ☐ Sphagnum hummocks and pools suitable to serve as nesting habitat for four-toed salamanders
- ☐ Trees with large cavities (≥18" tree diameter at cavity entrance)
- ☐ Existing beaver, mink or otter dens
- ☐ Areas within 100 feet of existing beaver, mink or otter dens (if significant disturbance)
- ☐ Existing nest trees for birds that traditionally reuse nests (bald eagle, osprey, great blue heron)
- ☐ Land containing freshwater mussel beds
- ☐ Wetlands and waterbodies known to contain open water in winter with the capacity to serve as waterfowl winter habitat
- ☐ Turtle nesting areas
- ☐ Vertical sandy banks (bank swallows, rough-winged swallows or kingfishers)

The following habitat characteristics when not commonly encountered in the surrounding area:

- ☐ Stream bed riffle zones (e.g. in eastern MA)
- ☐ Springs
- ☐ Gravel stream bottoms (trout and salmon nesting substrate)
- ☐ Plunge pools (deep holes) in rivers or streams
- ☐ Medium to large, flat rock substrates in streams

# Wildlife Habitat Protection Guidance

## Appendix A: Simplified Wildlife Habitat Evaluation

## Activities

When any one of the following activities is proposed within resource areas, applicants should complete a Detailed Wildlife Habitat Evaluation (refer to Appendix B).

☐ Activities located in mapped "Habitat of Potential Regional or Statewide Importance"

☐ Activities affecting certified or documented vernal pool habitat, including habitat within 100' of a certified or documented vernal pool when within a resource area

☒ Activities in bank, land under water, bordering land subject to flooding (presumed significant) where alterations are more than twice the size of thresholds

☐ Activities affecting vegetated wetlands >5000 sq. ft. occurring in resource areas other than Bordering Vegetated Wetland

☒ Activities affecting the sole connector between habitats >50 acres in size.*

☐ Installation of structures that prevent animal movement

☐ Activities for the purpose of bank stabilization using hard structure solutions that significantly affect ability of stream channel to shift and meander, or disrupt continuity in cover that would inhibit animal passage

☐ Dredging (greater than 5,000 sf)

***Although Town Brook is the sole connector between habitats, it is not functioning as a wildlife corridor as large sections of the channel are culverted through densely developed areas of Quincy.**

**Massachusetts Department of Environmental Protection**
Bureau of Resource Protection - Wetlands Program

# Wildlife Habitat Protection Guidance

## Appendix B: Detailed Wildlife Habitat Evaluation

## Part 1. Summary Sheet

**Important:** When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

Town Brook Enhancment Project
Project Name

Town Brook - Quincy Center
Location

31,155 square feet of area associated with Town Brook & surrounding land — March 13, 2011
Size of Area Being Impacted — Date

Impact Areas (linear feet, square feet, or acres for each of the impact areas within the site)

| Name | Bank | LUWW | RA | BLSF |
|---|---|---|---|---|
| 1. Parcel DU65 Hong Kong Eatery | 32 l.f. | 161 s.f. | 6,680 s.f. | 0 s.f. |
| 2. Parcel D91 Revere Road Area | 3,608 l.f. | 17,679 s.f. | 84,990 s.f. | 4,850 s.f. |
| 3. | | | | |
| 4. Total | 3,640 l.f. | 17,840 s.f. | 91,670 s.f. | 4,850 s.f. |
| 5. | | | | |
| 6. | | | | |
| 7. | | | | |

*Riverfront Area/BLSF

Attach Sketch map and/or photos of the Impact Areas

Narrative Description of Site (attach separate page if necessary)

Chapter 1 of the ENF provides detailed information on the project site. Chapters 3 and 4 of the ENF document the compliance with the Wetlands Protection Act and detail the resource areas and habitat on the site.

## Certification

I hereby certify that this project has been designed to avoid, minimize, and mitigate adverse effects on wildlife habitat, and that it will not, following two growing seasons of project completion and thereafter, substantially reduce its capacity to provide important wildlife habitat functions.

Christopher M. Lucas — Christopher M. Lucas, PWS
Signature of Wildlife Specialist (per 310 CMR 10.60 (1) (b)) — Typed or Printed Name

**Massachusetts Department of Environmental Protection**
Bureau of Resource Protection - Wetlands Program

# Wildlife Habitat Protection Guidance

## Appendix B: Detailed Wildlife Habitat Evaluation

## Part 2. Field Data Form (for each wetland or non-wetland resource area)

### I. General Information

Town Brook - Quincy Center
Project Location (from NOI page 1)

Parcel DU65 Hong Kong Eatery Area - Bank, LUWW, RA & BLSF
Impact Area (number/name)

December 22, 2010 & March 13, 2011
Date(s) of Site Visit(s) and Data Collection

Overcast, 30 degrees & Overcast, 45 degrees
Weather Conditions During Site Visit (if snow cover, include depth)

Christopher M. Lucas — March 13, 2011
Person completing form per 310 CMR 10.60(1)(b) — Date this form was completed

The information on this data sheet is based on my observations unless otherwise indicated

Christopher M. Lucas
Signature

### II. Site Description (complete A or B under Classification - see instructions for full description)

A. Classification

1. For Wetland Resource Areas, complete the following:

System: Riverine — Subsystem: Upper Perennial

Class: N/A - Culvert — Subclass: N/A - Culvert

Hydrology/Water Regime

- ☒ Permanently flooded
- ☒ Intermittently exposed
- ☐ Semi-permanently flooded
- ☐ Seasonally flooded
- ☐ Saturated
- ☐ Temporarily flooded
- ☐ Intermittently flooded
- ☐ Artificially flooded

2. For Riverfront or Bordering Land Subject to Flooding Resource Areas, complete the following. Use a terrestrial classification system such as one of the two listed below:
   a. "Classification of the Natural Communities of Massachusetts (Draft)" by Patricia C. Swain and Jennifer B. Kearsley, MA DFW NHESP, Westborough, MA. July 2000. (Department of Fish & Game Website)
   b. "New England Wildlife: Habitat, Natural History, and Distribution" by Richard M. DeGraaf and Deborah D. Rudis, USDA Forest Service, Northeastern Forest Experiment Station. General Technical Report NE-108. August 1992. 491 pages.

N/A - Developed Urban Center
Community Name

N/A - Minimal vegetation along culvert Bank edge
Vegetation Description

Developed Urban Center
Physical Description

# Wildlife Habitat Protection Guidance

## Appendix B: Detailed Wildlife Habitat Evaluation

## Part 2. Field Data Form (continued)

B. Inventory (Plant community)

| % Cover: | TBD | TBD | TBD | TBD | TBD |
|---|---|---|---|---|---|
| | Trees (> 20') | Shrubs (< 20') | Woody vines | Mosses | Herbaceous |

Plant Lists (species that comprise 10% or more of the vegetative cover in each strata; "*" designates a dominant plant species for the strata):

| Strata | Plant Species | Strata | Plant Species |
|---|---|---|---|
| TBD in the Spring | TBD in the Spring | TBD in the Spring | TBD in the Spring |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

C. Inventory (Soils)

Urban Land
Soil Survey Unit

Field Determination
Drainage Class

Varies - Urban Fill
Texture (upper part)

Varies - Urban Fill
Depth

8 to 10 feet
Depth to Water Table

**III. Important Habitat Features (complete for all resource areas)**

If the following habitat characteristics are present, describe & quantify them on a separate sheet & attach.

Wildlife Food

Important Wetland/Aquatic Food Plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

☐ Abundant ☐ Present ☒ Absent

Important Upland/Wetland Food Plants (hard mast and fruit/berry producers)

☐ Abundant ☐ Present ☒ Absent

Shrub thickets or streambeds with abundant earthworms (American woodcock)

☐ Present ☒ Absent

Shrub and/or herbaceous vegetation suitable for veery nesting

☐ Present ☒ Absent

# Wildlife Habitat Protection Guidance

## Appendix B: Detailed Wildlife Habitat Evaluation

## Part 2. Field Data Form (continued)

Number of trees (live or dead) > 30" DBH: 0

Number (or density) of Standing Dead Trees (potential for cavities and perches):

| 6-12" dbh | 12-18" dbh | 18-24" dbh | > 24" dbh |
|---|---|---|---|
| 0 | 0 | 0 | 0 |

Number of Tree Cavities in trunks or limbs of:

0
6-12" diameter (e.g., tree swallow, saw whet owl, screech owl, bluebird, other songbirds)

0
12-18" diameter (e.g., hooded merganser, wood duck, common goldeneye, mink)

0
>18" diameter (e.g., hooded merganser, wood duck, common goldeneye, common merganser, barred owl, mink, raccoon, fisher)

Small mammal burrows

☐ Abundant ☐ Present ☒ Absent

Cover/Perches/Basking/Denning/Nesting Habitat

☐ Dense herbaceous cover (voles, small mammals, amphibians & reptiles)

☐ Large woody debris on the ground (small mammals, mink, amphibians & reptiles)

☐ Rocks, crevices, logs, tree roots or hummocks under water's surface (turtles, snakes, frogs)

☐ Rocks, crevices, fallen logs, overhanging branches or hummocks at, or within 1m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

☐ Rock piles, crevices, or hollow logs suitable for:

☐ otter ☐ mink ☐ porcupine ☐ bear ☐ bobcat ☐ turkey vulture

☐ Live or dead standing vegetation overhanging water or offering good visibility of open water (e.g., osprey, kingfisher, flycatchers, cedar waxwings)

Depressions that may serve as seasonal (vernal/autumnal) pools

☐ Present ☒ Absent

Standing water present at least part of the growing season, suitable for use by

☐ Breeding amphibians ☐ Non-breeding amphibians (foraging, re-hydration)

☐ Turtles ☐ Foraging waterfowl

Sphagnum hummucks or mats, moss-covered logs or saturated logs, overhanging or directly adjacent to pools of standing water in spring (four-toed salamander)

☐ Present ☒ Absent

# Wildlife Habitat Protection Guidance

## Appendix B: Detailed Wildlife Habitat Evaluation

## Part 2. Field Data Form (continued)

Important habitat characteristics (if present, describe and quantify them on a separate sheet)

Medium to large (> 6"), flat rocks within a stream (cover for stream salamanders and nesting habitat for spring & two-lined salamanders)

☐ Present ☒ Absent

Flat rocks and logs on banks or within exposed portions of streambeds (cover for stream salamanders and nesting habitat for dusky salamanders)

☐ Present ☒ Absent

Underwater banks of fine silt and/or clay (beaver, muskrat, otter)

☐ Present ☒ Absent

Undercut or overhanging banks (small mammals, mink, weasels)

☐ Present ☒ Absent

Vertical sandy banks (bank swallow, kingfisher)

☐ Present ☒ Absent

Areas of ice-free open water in winter

☐ Present ☒ Absent

Mud flats

☐ Present ☒ Absent

Exposed areas of well-drained, sandy soil suitable for turtle nesting

☐ Present ☒ Absent

Wildlife dens/nests (if present, describe & quantify them on the back of this sheet)

Turtle nesting sites

☐ Present ☒ Absent

Bank swallow colony

☐ Present ☒ Absent

| | | | |
|---|---|---|---|
| Nest(s) present of | ☐ Bald Eagle | ☐ Osprey | ☐ Great Blue Heron |
| Den(s) present of | ☐ Otter | ☐ Mink | ☐ Beaver |

# Wildlife Habitat Protection Guidance

## Appendix B: Detailed Wildlife Habitat Evaluation

## Part 2. Field Data Form (continued)

Project area is within:

☐ 100' of beaver, mink or otter den, bank swallow colony or turtle nesting area

☐ 200' of Great Blue Heron or osprey nest(s)

☐ 1400' of a Bald Eagle nest[1]

Emergent Wetlands (if present, describe & quantify them on a separate sheet)

Emergent wetland vegetation at least seasonally flooded during the growing season (wood duck, green heron, black-crowned night heron, king rail, Virginia rail, coot, etc.)

| | | |
|---|---|---|
| Flooded > 5 cm | ☐ Present | ☒ Absent |
| Flooded > 25 cm (pied-billed grebe) | ☐ Present | ☒ Absent |

Persistent emergent wetland vegetation at least seasonally flooded during the growing season (mallard, American bittern, sora, common snipe, red-winged blackbird, swamp sparrow, marsh wren)

| | | |
|---|---|---|
| Flooded > 5 cm | ☐ Present | ☒ Absent |
| Flooded > 25 cm (least bittern, common moorhen) | ☐ Present | ☒ Absent |

Cattail emergent wetland vegetation at least seasonally flooded during the growing season

| | | |
|---|---|---|
| Flooded > 5 cm (marsh wren) | ☐ Present | ☒ Absent |
| Flooded > 25 cm (least bittern, common moorhen) | ☐ Present | ☒ Absent |

Fine-leafed emergent vegetation (grasses and sedges) at least seasonally flooded during the growing season (common snipe, spotted sandpiper, sedge wren)

| | | |
|---|---|---|
| Flooded > 5 cm | ☐ Present | ☒ Absent |
| Flooded > 25 cm (least bittern, common moorhen) | ☐ Present | ☒ Absent |

### IV. Landscape Context

A. **Habitat Continuity** (if present, describe the landscape context on a separate sheet and its importance for area-sensitive species)

| | | | |
|---|---|---|---|
| Is the impact area part of an emergent marsh at least | 1.0 acre in size? | ☐ Yes | ☒ No |
| (marsh and waterbirds) | 2.0 acres in size? | ☐ Yes | ☒ No |
| | 5.0 acres in size? | ☐ Yes | ☒ No |
| | 10.0 acres in size? | ☐ Yes | ☒ No |

[1] 1400 feet is the distance used by NHESP for evaluating potential disturbance impacts on eagle nests under MESA. Keep in mind, however, that this doesn't give jurisdiction within 1400' of an eagle's nest; it only identifies it on the checklist so that adverse effects can be avoided if work in a resource area is within 1400 feet.

# Wildlife Habitat Protection Guidance

## Appendix B: Detailed Wildlife Habitat Evaluation

## Part 2. Field Data Form (continued)

| | | | |
|---|---|---|---|
| Is the impact area part of a wetland complex at least | 2.5 acres in size? | ☐ Yes | ☐ No |
| (turtles, frogs, waterfowl, mammals) | 5.0 acres in size? | ☐ Yes | ☐ No |
| | 10.0 acres in size? | ☐ Yes | ☐ No |
| | 25.0 acres in size? | ☒ Yes | ☐ No |

For upland resource areas is the impact area part of contiguous forested habitat at least

| | | | |
|---|---|---|---|
| (forest interior nesting birds) | 50 acres in size? | ☐ Yes | ☒ No |
| | 100 acres in size? | ☐ Yes | ☒ No |
| | 250 acres in size? | ☐ Yes | ☒ No |
| | 500 acres in size? | ☐ Yes | ☒ No |
| (grassland nesting birds) | > 1.0 acre in size? | ☐ Yes | ☒ No |
| (special habitat such as gallery floodplain forest, alder thicket, etc.) | > 1.0 acre in size? | ☐ Yes | ☒ No |

B. **Connectivity with adjoining natural habitats**

- ☒ No direct connections to adjacent areas of wildlife habitat (little connectivity function)
- ☐ Connectors numerous or impact area is embedded in a large area of natural habitat (limited connectivity function)
- ☐ Impact area contributes to a limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)
- ☐ Impact area serves as *part of* a sole connector to adjacent areas of habitat (important for connectivity function)
- ☐ Impact area serves as *only* connector to adjacent areas of habitat (very important for connectivity function)

V. **Habitat Degradation** (describe degradation and wildlife impacts on the back of the sheet)

- ☐ Evidence of significant chemical contamination
- ☐ Evidence of significant levels of dumping
- ☐ Evidence of significant erosion or sedimentation problems
- ☐ Significant invasion of exotic plants (e.g., purple loosestrife, *Phragmites*, glossy buckthorn)
- ☒ Disturbance from roads or highways
- ☒ Other human disturbance
- ☒ Is the site the only resource area in the vicinity of an otherwise developed area

Note: These are not the only important habitat features that may be observed on a site. If the wildlife specialist identifies other features they should be noted in the application.

# Wildlife Habitat Protection Guidance

## Appendix B: Detailed Wildlife Habitat Evaluation

## Part 2. Field Data Form (continued)

### VI. Quantification Table for Important Habitat Characteristics

| Habitat Characteristic | Amount Impacted in Impact Area | Current (entire site) | Post-Construction (entire site) |
|---|---|---|---|
| Example: standing dead trees 6-12" dbh | 4 | 12 | 8 |
| 0 | 0 | 0 | 0 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**Massachusetts Department of Environmental Protection**
Bureau of Resource Protection - Wetlands Program

# Wildlife Habitat Protection Guidance

## Appendix B: Detailed Wildlife Habitat Evaluation

## Part 2. Field Data Form (for each wetland or non-wetland resource area)

### I. General Information

Town Brook - Quincy Center
Project Location (from NOI page 1)

Parcel D91 Revere Road Area - Bank, LUWW, RA & BLSF
Impact Area (number/name)

December 22, 2010 & March 13, 2011
Date(s) of Site Visit(s) and Data Collection

Overcast, 30 degrees & Overcast, 45 degrees
Weather Conditions During Site Visit (if snow cover, include depth)

Christopher M. Lucas — March 13, 2011
Person completing form per 310 CMR 10.60(1)(b) — Date this form was completed

The information on this data sheet is based on my observations unless otherwise indicated

Christopher M. Lucas
Signature

### II. Site Description (complete A or B under Classification - see instructions for full description)

A. Classification

1. For Wetland Resource Areas, complete the following:

System: Riverine — Subsystem: Upper Perennial

Class: N/A - Culvert — Subclass: N/A - Culvert

Hydrology/Water Regime

- ☒ Permanently flooded
- ☒ Intermittently exposed
- ☐ Semi-permanently flooded
- ☐ Seasonally flooded
- ☐ Saturated
- ☐ Temporarily flooded
- ☐ Intermittently flooded
- ☐ Artificially flooded

2. For Riverfront or Bordering Land Subject to Flooding Resource Areas, complete the following. Use a terrestrial classification system such as one of the two listed below:

   a. "Classification of the Natural Communities of Massachusetts (Draft)" by Patricia C. Swain and Jennifer B. Kearsley, MA DFW NHESP, Westborough, MA. July 2000. (Department of Fish & Game Website)

   b. "New England Wildlife: Habitat, Natural History, and Distribution" by Richard M. DeGraaf and Deborah D. Rudis, USDA Forest Service, Northeastern Forest Experiment Station. General Technical Report NE-108. August 1992. 491 pages.

N/A - Developed Urban Center
Community Name

N/A - Minimal vegetation along culvert Bank edge
Vegetation Description

Developed Urban Center
Physical Description

# Wildlife Habitat Protection Guidance

## Appendix B: Detailed Wildlife Habitat Evaluation

## Part 2. Field Data Form (continued)

B. Inventory (Plant community)

| % Cover: | TBD | TBD | TBD | TBD | TBD |
|---|---|---|---|---|---|
| | Trees (> 20') | Shrubs (< 20') | Woody vines | Mosses | Herbaceous |

Plant Lists (species that comprise 10% or more of the vegetative cover in each strata; "*" designates a dominant plant species for the strata):

| Strata | Plant Species | Strata | Plant Species |
|---|---|---|---|
| TBD in the Spring | TBD in the Spring | TBD in the Spring | TBD in the Spring |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

C. Inventory (Soils)

Urban Land
Soil Survey Unit

Field Determination
Drainage Class

Varies - Urban Fill
Texture (upper part)

Varies - Urban Fill
Depth

8 to 10 feet
Depth to Water Table

**III. Important Habitat Features (complete for all resource areas)**

If the following habitat characteristics are present, describe & quantify them on a separate sheet & attach.

Wildlife Food

Important Wetland/Aquatic Food Plants (smartweeds, pondweeds, wild rice, bulrush, wild celery)

☐ Abundant ☐ Present ☒ Absent

Important Upland/Wetland Food Plants (hard mast and fruit/berry producers)

☐ Abundant ☐ Present ☒ Absent

Shrub thickets or streambeds with abundant earthworms (American woodcock)

☐ Present ☒ Absent

Shrub and/or herbaceous vegetation suitable for veery nesting

☐ Present ☒ Absent

# Wildlife Habitat Protection Guidance

## Appendix B: Detailed Wildlife Habitat Evaluation

## Part 2. Field Data Form (continued)

Number of trees (live or dead) > 30" DBH: 5

Number (or density) of Standing Dead Trees (potential for cavities and perches):

| 0 | 0 | 0 | 0 |
|---|---|---|---|
| 6-12" dbh | 12-18" dbh | 18-24" dbh | > 24" dbh |

Number of Tree Cavities in trunks or limbs of:

0
6-12" diameter (e.g., tree swallow, saw whet owl, screech owl, bluebird, other songbirds)

0
12-18" diameter (e.g., hooded merganser, wood duck, common goldeneye, mink)

0
>18" diameter (e.g., hooded merganser, wood duck, common goldeneye, common merganser, barred owl, mink, raccoon, fisher)

Small mammal burrows

☐ Abundant ☐ Present ☒ Absent

Cover/Perches/Basking/Denning/Nesting Habitat

☐ Dense herbaceous cover (voles, small mammals, amphibians & reptiles)

☐ Large woody debris on the ground (small mammals, mink, amphibians & reptiles)

☐ Rocks, crevices, logs, tree roots or hummocks under water's surface (turtles, snakes, frogs)

☐ Rocks, crevices, fallen logs, overhanging branches or hummocks at, or within 1m above the water's surface (turtles, snakes, frogs, wading birds, wood duck, mink, raccoon)

☐ Rock piles, crevices, or hollow logs suitable for:

☐ otter ☐ mink ☐ porcupine ☐ bear ☐ bobcat ☐ turkey vulture

☐ Live or dead standing vegetation overhanging water or offering good visibility of open water (e.g., osprey, kingfisher, flycatchers, cedar waxwings)

Depressions that may serve as seasonal (vernal/autumnal) pools

☐ Present ☒ Absent

Standing water present at least part of the growing season, suitable for use by

☐ Breeding amphibians ☐ Non-breeding amphibians (foraging, re-hydration)

☐ Turtles ☐ Foraging waterfowl

Sphagnum hummucks or mats, moss-covered logs or saturated logs, overhanging or directly adjacent to pools of standing water in spring (four-toed salamander)

☐ Present ☒ Absent

# Wildlife Habitat Protection Guidance

## Appendix B: Detailed Wildlife Habitat Evaluation

## Part 2. Field Data Form (continued)

Important habitat characteristics (if present, describe and quantify them on a separate sheet)

Medium to large (> 6"), flat rocks within a stream (cover for stream salamanders and nesting habitat for spring & two-lined salamanders)

☐ Present ☒ Absent

Flat rocks and logs on banks or within exposed portions of streambeds (cover for stream salamanders and nesting habitat for dusky salamanders)

☐ Present ☒ Absent

Underwater banks of fine silt and/or clay (beaver, muskrat, otter)

☐ Present ☒ Absent

Undercut or overhanging banks (small mammals, mink, weasels)

☐ Present ☒ Absent

Vertical sandy banks (bank swallow, kingfisher)

☐ Present ☒ Absent

Areas of ice-free open water in winter

☐ Present ☒ Absent

Mud flats

☐ Present ☒ Absent

Exposed areas of well-drained, sandy soil suitable for turtle nesting

☐ Present ☒ Absent

Wildlife dens/nests (if present, describe & quantify them on the back of this sheet)

Turtle nesting sites

☐ Present ☒ Absent

Bank swallow colony

☐ Present ☒ Absent

Nest(s) present of ☐ Bald Eagle ☐ Osprey ☐ Great Blue Heron

Den(s) present of ☐ Otter ☐ Mink ☐ Beaver

# Wildlife Habitat Protection Guidance

## Appendix B: Detailed Wildlife Habitat Evaluation

## Part 2. Field Data Form (continued)

Project area is within:

☐ 100' of beaver, mink or otter den, bank swallow colony or turtle nesting area

☐ 200' of Great Blue Heron or osprey nest(s)

☐ 1400' of a Bald Eagle nest[1]

Emergent Wetlands (if present, describe & quantify them on a separate sheet)

Emergent wetland vegetation at least seasonally flooded during the growing season (wood duck, green heron, black-crowned night heron, king rail, Virginia rail, coot, etc.)

| | | |
|---|---|---|
| Flooded > 5 cm | ☐ Present | ☒ Absent |
| Flooded > 25 cm (pied-billed grebe) | ☐ Present | ☒ Absent |

Persistent emergent wetland vegetation at least seasonally flooded during the growing season (mallard, American bittern, sora, common snipe, red-winged blackbird, swamp sparrow, marsh wren)

| | | |
|---|---|---|
| Flooded > 5 cm | ☐ Present | ☒ Absent |
| Flooded > 25 cm (least bittern, common moorhen) | ☐ Present | ☒ Absent |

Cattail emergent wetland vegetation at least seasonally flooded during the growing season

| | | |
|---|---|---|
| Flooded > 5 cm (marsh wren) | ☐ Present | ☒ Absent |
| Flooded > 25 cm (least bittern, common moorhen) | ☐ Present | ☒ Absent |

Fine-leafed emergent vegetation (grasses and sedges) at least seasonally flooded during the growing season (common snipe, spotted sandpiper, sedge wren)

| | | |
|---|---|---|
| Flooded > 5 cm | ☐ Present | ☒ Absent |
| Flooded > 25 cm (least bittern, common moorhen) | ☐ Present | ☒ Absent |

### IV. Landscape Context

A. **Habitat Continuity** (if present, describe the landscape context on a separate sheet and its importance for area-sensitive species)

| | | | |
|---|---|---|---|
| Is the impact area part of an emergent marsh at least | 1.0 acre in size? | ☐ Yes | ☒ No |
| (marsh and waterbirds) | 2.0 acres in size? | ☐ Yes | ☒ No |
| | 5.0 acres in size? | ☐ Yes | ☒ No |
| | 10.0 acres in size? | ☐ Yes | ☒ No |

[1] 1400 feet is the distance used by NHESP for evaluating potential disturbance impacts on eagle nests under MESA. Keep in mind, however, that this doesn't give jurisdiction within 1400' of an eagle's nest; it only identifies it on the checklist so that adverse effects can be avoided if work in a resource area is within 1400 feet.

# Wildlife Habitat Protection Guidance

## Appendix B: Detailed Wildlife Habitat Evaluation

## Part 2. Field Data Form (continued)

| | | | |
|---|---|---|---|
| Is the impact area part of a wetland complex at least | 2.5 acres in size? | ☐ Yes | ☐ No |
| (turtles, frogs, waterfowl, mammals) | 5.0 acres in size? | ☐ Yes | ☐ No |
| | 10.0 acres in size? | ☐ Yes | ☐ No |
| | 25.0 acres in size? | ☒ Yes | ☐ No |

For upland resource areas is the impact area part of contiguous forested habitat at least

| | | | |
|---|---|---|---|
| (forest interior nesting birds) | 50 acres in size? | ☐ Yes | ☒ No |
| | 100 acres in size? | ☐ Yes | ☒ No |
| | 250 acres in size? | ☐ Yes | ☒ No |
| | 500 acres in size? | ☐ Yes | ☒ No |
| (grassland nesting birds) | > 1.0 acre in size? | ☐ Yes | ☒ No |
| (special habitat such as gallery floodplain forest, alder thicket, etc.) | > 1.0 acre in size? | ☐ Yes | ☒ No |

B. **Connectivity with adjoining natural habitats**

- ☒ No direct connections to adjacent areas of wildlife habitat (little connectivity function)
- ☐ Connectors numerous or impact area is embedded in a large area of natural habitat (limited connectivity function)
- ☐ Impact area contributes to a limited number of connectors to adjacent areas of habitat (somewhat important for connectivity function)
- ☐ Impact area serves as *part of* a sole connector to adjacent areas of habitat (important for connectivity function)
- ☐ Impact area serves as *only* connector to adjacent areas of habitat (very important for connectivity function)

V. **Habitat Degradation** (describe degradation and wildlife impacts on the back of the sheet)

- ☐ Evidence of significant chemical contamination
- ☐ Evidence of significant levels of dumping
- ☐ Evidence of significant erosion or sedimentation problems
- ☐ Significant invasion of exotic plants (e.g., purple loosestrife, *Phragmites*, glossy buckthorn)
- ☒ Disturbance from roads or highways ☒ Other human disturbance
- ☒ Is the site the only resource area in the vicinity of an otherwise developed area

Note: These are not the only important habitat features that may be observed on a site. If the wildlife specialist identifies other features they should be noted in the application.

# Wildlife Habitat Protection Guidance

## Appendix B: Detailed Wildlife Habitat Evaluation

## Part 2. Field Data Form (continued)

### VI. Quantification Table for Important Habitat Characteristics

| Habitat Characteristic | Amount Impacted in Impact Area | Current (entire site) | Post-Construction (entire site) |
|---|---|---|---|
| Example: standing dead trees 6-12" dbh | 4 | 12 | 8 |
| 0 | 0 | 0 | 0 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

# APPENDIX E

## MEPA/Permitting Correspondence

### TABLE OF CONTENTS

- Advisory Opinion Letter, dated March 4, 2011, from the Assistant Secretary of Environmental Affairs, dated March 4, 2011
- Request for Advisory Opinion Letter, dated February 24, 2011, from the City of Quincy to the Secretary of Environmental Affairs
- Certificate of Non-Applicability, dated March 7, 2011, from the Quincy Historical Commission

# The Commonwealth of Massachusetts
*Executive Office of Energy and Environmental Affairs*
*100 Cambridge Street, Suite 900*
*Boston, MA 02114*

Deval L. Patrick
GOVERNOR

Timothy P. Murray
LIEUTENANT GOVERNOR

Richard K. Sullivan, Jr.
SECRETARY

Tel: (617) 626-1000
Fax: (617) 626-1181
http://www.mass.gov/envir


FILE COPY

March 4, 2011

Dennis Harrington
City of Quincy Department of Planning and Economic Development
1305 Hancock Street
Quincy, MA 02169

Re: Request for Advisory Opinion
City of Quincy Redevelopment Projects – Quincy

Dear Mr. Harrington:

I am writing in response to your letter of February 24, 2011, in which you requested a determination regarding the applicability of the Massachusetts Environmental Policy Act (MEPA) to the projects referenced above.

According to your letter, the City of Quincy is engaged in three distinct components of its comprehensive plans to revive and redevelop the downtown area – the Town Brook Enhancement Project, the Adams Green Transportation Improvement Project, and the New Quincy Center Redevelopment Project. It is the City's position that, although the projects related in that they are geographically coterminous, and efforts to advance each component are proceeding concurrently, they are in fact separate undertakings with distinct purposes, and should be viewed as independent of one another for the purpose of determining whether they are subject to MEPA jurisdiction. The MEPA regulations at 301 CMR 11.01(2)(c) regarding segmentation state that:

> In determining whether a Project is subject to MEPA jurisdiction or meets or exceeds any review thresholds, and during MEPA review, the Proponent, any Participating Agency, and the Secretary shall consider the entirety of the Project, including any likely future Expansion, and not separate phases or segments thereof. The Proponent may not phase or segment a Project to evade, defer or curtail MEPA review. The Proponent, any Participating Agency, and the

> Secretary shall consider all circumstances as to whether various work or activities constitute one Project, including but not limited to: whether the work or activities, taken together, comprise a common plan or independent undertakings, regardless of whether there is more than one Proponent; any time interval between the work or activities; and whether the environmental impacts caused by the work or activities are separable or cumulative.

In this case, it is expected that two of the projects – the Town Brook Enhancement Project and the New Quincy Center Redevelopment Project – will undergo MEPA review. In addition, each of the projects have been fully described to the MEPA Office, and I therefore find that there is no effort to evade, defer or curtail MEPA review. In addition, while the Town Brook Enhancement Project is necessary in order for the New Quincy Center Redevelopment Project, it was made apparent that the three projects have independent utility in a recent meeting between this office and the City. Specifically, the Town Brook culvert is over 100 years old, in poor condition, and needs to be relocated regardless of whether the Redevelopment Project moves forward. Likewise, the Adams Green Transportation Improvement Project is an independent initiative to enhance the area surrounding the Church of Presidents which is being independently funded through a federal earmark to enhance the City's historic amenities.

Based on the foregoing, I hereby determine that these projects do not comprise a common plan, but rather, three separate independent undertakings. Therefore, they may proceed separately for purposes of MEPA review.

Please contact Rick Bourré, Assistant Director of the MEPA Office, at (617) 626-1130 if you have any questions concerning this matter.

Sincerely,

Alicia McDevitt
Assistant Secretary

**Department of Planning and Community Development**
**1305 Hancock Street, Quincy, Massachusetts 02169**
**Tel. (617) 376-1362 FAX (617) 376-1097**
**TTY /TDD (617) 376-1375**

**DENNIS E. HARRINGTON**
**Planning Director**

**THOMAS P. KOCH**
**Mayor**

February 24, 2011

Secretary Richard K. Sullivan, Jr.
c/o Assistant Secretary Alicia McDevitt
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

**Re: City of Quincy Redevelopment Projects**
**Request for Advisory Opinion**

Dear Secretary Sullivan:

This is a request on behalf of the City of Quincy for an advisory opinion under 301 CMR 11.01(6) (A) and M.G.L. c. 30, §8.

As part of its ongoing efforts to revive and redevelop our downtown, the City of Quincy is planning directly to undertake two projects and, with its designated developer, initiate a third. The two projects which the City is undertaking directly are the Town Brook Enhancement Project and the Adams Green Transportation Improvement Project. Through the Quincy Center Urban Revitalization District Plan, 2007 (URDP), the City has designated Hancock Adams Associates LLC ("Street-Works") as the redeveloper that shares the City's *Vision* for a revitalized downtown. The New Quincy Center Redevelopment Project proposed by Hancock Adams Associates, LLC and adopted by the City of Quincy on January 25, 2011 is the third of these projects.

The Town Brook Enhancement Project relates specifically to the portion of Town Brook that is substantially enclosed in a culvert and crosses Hancock Street. The culvert was constructed in segments, some of which are more than a 100 years old, and it is in poor physical condition. There are illegal connections to it and, in some cases, its upper portion consists of the floorboards of existing buildings. Separate from any redevelopment in Quincy, this infrastructure component needs to be replaced. Because of its meandering configuration under multiple properties, it is proposed to relocate this portion adjacent to portions of the new Concourse Roadway which is currently under construction.

While its relocation will facilitate redevelopment of the downtown and the New Quincy Center Redevelopment Project, it is not exclusively for these purposes that its relocation needs to be

accomplished at this time and its replacement is required regardless of whether the Redevelopment Project moves forward.

The City is proud of its heritage as being the location of the Church of Presidents, a landmark that draws many visitors to Quincy. The City recognizes that the enhancement of this area through modification of the road network is essential to preserve and improve this important feature of the City's heritage. In addition, with the near completion of the new Concourse Roadway, it is an opportunity to redirect traffic currently just traveling through the City (as opposed to traffic which has its destination in the City) onto Washington Street and along the Concourse for travel to the south and north shores. The City has obtained a grant for the design of the Adams Green Transportation Improvement Project and there is a federal earmark available to underwrite the road and signalization improvements that are a significant component of the project. Again, while the construction of Adams Green Transportation Improvement Project will enhance the New Quincy Center Redevelopment Project, it is not being undertaken to serve the Redevelopment Project.

The New Quincy Center Redevelopment Project is a mixed-use project containing office, retail, hotel and residential components. The Redevelopment Project will be undertaken in accordance with the Quincy Center Urban Revitalization and Development Plan approved by DHCD. The City and Street-Works have executed a Land Disposition Agreement (the "LDA") which establishes design parameters for the Redevelopment Project and the scope of certain infrastructure assessments which must be undertaken as part of the Redevelopment Project. The City expects that the scope issued for the New Quincy Center Redevelopment Project under MEPA will require such assessments.

For these reasons, we believe that it would be appropriate for you to conclude that each of the Town Brook Enhancement Project, the Adams Green Transportation Improvement Project and the New Quincy Center Redevelopment Project may be treated as separate projects under MEPA and each may be processed separately.

Thank you for your consideration.

Very truly yours,

Dennis E. Harrington

Dennis E. Harrington
Planning Director

cc: Honorable Thomas P. Koch, Mayor
Steven Chruscial, Street-Works, LLC
Robert C. Davis Esq., Golston & Storrs
Jon Stephenson PE, Stephenson Design Group

# QUINCY HISTORICAL COMMISSION

Quincy City Hall, 1305 Hancock Street, Quincy, MA 02169
(617) 376-1363 FAX (617) 376-1097
TTY/TDD (617) 376-1375


The Quincy Historical Commission at its open public meeting on Monday February 28, 2011 voted the following:

## Town Brook Enhancement Project

The proposed culvert alignment crosses through the Quincy Center Historic District, which generally overlays the parcels along the east and west sides of Hancock Street.

The culvert as it passes through the Historic District is well below grade and no permanent grade alteration or impact to structures within the district is proposed as part of the project.

Pursuant to Chapter 40C of the General Laws of the Commonwealth of Massachusetts and the Historic Districts Ordinance of the City of Quincy, the Quincy Historical Commission hereby issues a Certificate of Non-Applicability with respect to the Town Brook Enhancement Project.

Respectfully,

*Quincy Historical Commission*

Anthony Ricci, Chair

Ronald Affsa

Edward Fitzgerald

Maralin Manning

Erin Hunt

David Jacobs

Mary Smith

# CITY OF QUINCY HISTORICAL COMMISSION

*Certificate No.**022811-01***

Pursuant to Chapter 40C of the General Laws of the Commonwealth of Massachusetts and the Historic Districts Ordinance of the City of Quincy, the Quincy Historical Commission hereby issues a

## *Certificate of Nonapplicability*

For the work described in the accompanying application and listed exhibits. If any conditions are imposed, they shall be enforced in the same manner as in the Building Code. The applicant may proceed with the proposed work provided a copy of this **CERTIFICATE** is filed with the Inspector of Buildings and he issues a permit when required. A building permit is not required for exterior painting and some other work, but a **CERTIFICATE** is necessary and should be delivered to the contractor. This **CERTIFICATE** is valid for six months from the date hereof.

LOCATION of work: **Hancock St. / Hannon Parkway** Historic District: **YES**
APPLICANT/Lessee: **Director, Planning Dep't.** Telephone: **617-376-1362**
mailing address: **1305 Hancock St., Quincy, MA 02169**
PROPERTY OWNER: **City of Quincy** Telephone: **same**
Mailing address: **same as above**

DESCRIPTION OF APPROVED WORK:

Acceptance of the petitioner's application was approved

Application received: **02/09/11** Hearing Date: **02/28/11** Certificate issued: **03/07/11**

Copies to: File
Inspector of Buildings
Owner and/or Applicant
City Clerk

Administrator

# APPENDIX F

## DVD OF TOWN BROOK VIDEO