



# Preliminary Feasibility Study *Daylighting and Revitalizing the Quequechan River*

Fall River, Massachusetts



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Project No. G230-000  
August 2017



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*Acknowledgements:* We would like to thank the following individuals for helpful discussions and adding their perspective to this study: **Green Futures** (Alfred Lima, Everett Castro, Joe Carvalho), **City of Fall River Sewer Division** (Terry Sullivan, Paul Ferland, John Lincourt), **Fall River Water Division** (John Friar, Mike Labossiere), **Fall River Planning Division** (William Kenney), **Fall River Engineering** (JR Frey), and **MA Division of Ecological Restoration** (Tim Purinton).



## 1.0 INTRODUCTION

The Quequechan River flows from the northwest corner of South Watuppa Pond, through the center of Fall River, Massachusetts, and ends at the Taunton River at the Mount Hope Bay tidal estuary (Figure 1). The 2.7-mile tributary of the Taunton River contains a flat, placid section of the river between South Watuppa Pond and the Plymouth Avenue intake structure, a steep enclosed section between Troy Street and a short tidal segment discharging to the Mount Hope Bay tidal estuary at Battleship Cove. The Taunton River is designated a Wild and Scenic River by U.S. Congress in 2009. The original legislation, which included 22 miles of the upper Taunton River from Bridgewater to Taunton, was expanded to include the lower Taunton River extending to the Braga Bridge in Fall River near Battleship Cove.

The Quequechan River once supported a series of eight falls along a dramatic drop of 130 vertical feet within a linear distance of 2,300 feet. The river and its waterfalls are the namesake of the City of Fall River; "Quequechan" means "Falling River" or "Leaping/Falling Waters" in Wampanoag. These falls, and large sections of the river, were buried and culverted during the 1800s as textile mills were built adjacent to and over the river. These mills led to the growth of Fall River as a major textile center. The river was further culverted and redirected during the construction of Interstate Route 195. The lower Quequechan flowed through downtown and in the area where Plymouth Avenue is now situated. Only one of the original falls remains behind the Metacomet Mill (MA DEP et al. 2005).

The non-profit educational and advocacy organization Green Futures has been advocating to restore and daylight sections of the Quequechan River to unite neighborhoods along the waterway and bring ecotourism to the city. The concept of restoring the Quequechan River was conceived over a decade ago. In 2001, Green Futures sponsored a forum on the Quequechan River, where the idea of daylighting the river was first raised. The forum became the catalyst for the Massachusetts Executive Office of Environmental Affairs Urban River Visions program. Fall River became one of the first seven communities in the program (Lima et al. 2013). A public workshop was held in 2002 to discuss ideas for future uses of the river corridor. Many residents were interested in making the Quequechan River's waterfall visible again (Miliote 2002). Other ideas include creating a public park around the falls with educational signage about the river and the city's history (Lima et al. 2013). Restoring the Quequechan River was also the subject of state Urban Rivers initiative conferences in 2002 and 2004 (Murphy 2009).

Historic and modern alterations to the Quequechan River have completely altered channel alignment, cross-section, and available floodplain, and changed hydrologic and hydraulic conditions. The goals of this report are to advance a restoration plan for the Quequechan River that will improve riparian function, identify viable restoration measures, and compile supporting information to guide planning. The report will identify relevant project history, current conditions, river restoration (daylighting) opportunities, and next steps.



**Preliminary Feasibility Study**  
**Daylighting and Revitalizing the Quequechan River**  
Fall River, Massachusetts

1 inch = 2,000 feet

0 465 930 1,860  
Feet

Source: 1) ESRI, World Topographic Map, 2017

**Project Locus**

**Figure 1**

## 2.0 PROJECT HISTORY

By 1703, Benjamin Church had established a saw mill, grist mill, and a fulling mill on the Quequechan River. Several mills and small dams followed in the years to come (Figure 2). In 1826, several mill owners established the Watuppa Reservoir Company and impounded a large area of water stretching all the way to the South Watuppa Pond (MA DEP et al. 2005). The impoundment, known as Mill Pond, flooded private property and created small islands within the pond. The water power potential of Fall River was maximized in the late 1840's.

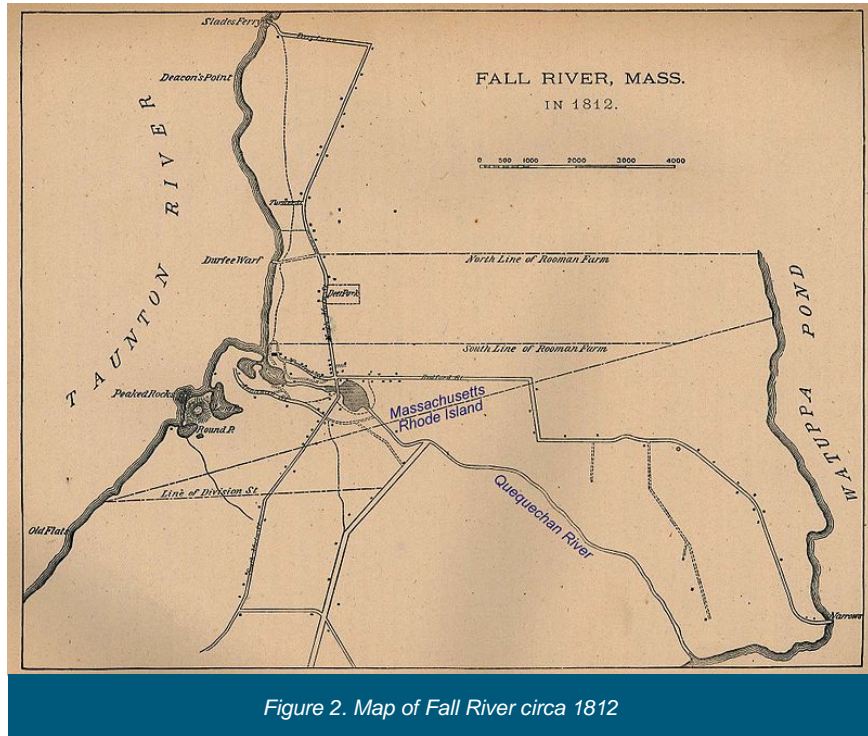


Figure 2. Map of Fall River circa 1812

In the mid to late 19<sup>th</sup> century, dozens of new mills were constructed due to the expansion of the textile industry and development of new corporations within the Quequechan River valley. The river's granite bed allowed for mills to be built firmly along the river bank with water wheels set in the stream bed. The water flow was also low enough to safeguard against flooding but strong enough to power machinery. The navigable waterways of the Taunton River and Mount Hope Bay also facilitated the direct delivery of coal to the mills from the mines, which reduced cost (Lima et al. 2013). The steam mills used cool river water to operate their steam engines and manufacture textiles while returning industrial used water directly to the river. New land for development was created by filling areas along the impounded upper river sections.

By the 1880's, water quality in the Quequechan River had deteriorated. Mills started to periodically shut down due to the lack of cool, clean water. During this time period, outbreaks of cholera resulting from contaminated drinking water frequently hit the city's immigrant population (Lima et al. 2013). Pollution continued until 1913 when the State Legislature established the Watuppa Ponds and Quequechan River Commission to find a solution to the river pollution. A report completed in 1915 recommended a three-tiered conduit to separate sewage, cool, clean water, and hot water (Fay, Spofford and Thorndike 1915). However, the designed conduit system was never implemented. Similarly, a study completed in 1954 proposed an open channel to carry clean processing water for industrial use from the beginning of the river to the Third Street dam, however; this plan was also not implemented (Lima et al. 2013).

In the 1950's, work began on the Fall River Expressway (Route 24) to link Boston and Fall River. Highway construction took place largely within the former Mill Pond area and resulted in the demolition of several mills and buildings along the river. The Quequechan River between Plymouth Avenue and the waterfront of the Taunton River was redirected into a series of underground culverts with the construction of Interstate Route 195 in the 1960's.

In recent years, construction of the Combined Sewer Overflow (CSO) Project has dramatically improved water quality in the Quequechan River, complementing current efforts to increase recreational opportunities around the river. In addition to planning efforts to daylight a portion of the falls, a river rail bike path and walking trail was built along the upper Quequechan River. The Alfred J. Lima Quequechan River Rail Trail officially opened in 2017 to city residents (Holtzman 2017). Current urban renewal initiatives are seeking to further expand recreational opportunities for the Quequechan River include building a green belt connecting downtown Fall River to the Taunton River waterfront along the Quequechan River corridor. Opportunities to daylight the Quequechan River and potentially recreate falls, would strengthen community ties to the river, enhance opportunities for historical interpretation and serve as a catalyst for urban renewal.

### **3.0 CURRENT CONDITIONS**

#### **3.1 Watershed**

The Quequechan River is a 2.7-mile tributary of the Taunton River in the Taunton River watershed. The Taunton River watershed is the second largest watershed in the state of Massachusetts; it encompasses 562 square miles and contains 221 lakes and ponds and 94 square miles of wetlands. The Taunton River starts in the Town of Bridgewater and passes through ten communities before ending in Rhode Island's Mount Hope Bay, which is part of Narragansett Bay. Tidal influences reach 18 miles inland and salt-water intrusion reaches 12.6 miles inland (MA EEA 2017).



*Figure 3. North and South Watuppa Ponds viewing South (photo courtesy of the City of Fall River)*

The Quequechan River watershed is a subwatershed of the Taunton River, totaling roughly 27 square miles. The upper freshwater watershed of the Quequechan River includes streams, uplands, wetlands, and ponds that all contribute to the flow of the river. Tributary ponds of the Quequechan River include the North Watuppa Pond, South Watuppa Pond, Stafford Pond, Sawdy Pond, and Devol Pond (Figure 3). North Watuppa Pond is the primary source of drinking water in Fall River. Pond Swamp is the main source of groundwater recharge to North Watuppa Pond. Water from Devol Pond and Sawdy Pond join South Watuppa from the south. Water from Stafford Pond flows into Sucker Brook, where it eventually joins South Watuppa Pond's water as well (Fall River 2004). The Quequechan River begins at the South Watuppa Pond outlet (Lima et al. 2013).

The Quequechan River watershed has had a history of pollution resulting from industrial use and poor wastewater and stormwater planning. For example, prior to 1948, combined sewer and stormwater discharge emptied directly into the Taunton River without treatment. Dry and wet-weather discharge of treated effluent from upstream wastewater treatment plants are an important contributor of nutrients into the watershed. Watershed pollution is currently being addressed through city infrastructure upgrades in wastewater and stormwater management (CDM Smith 2015). While the Quequechan is currently listed as an impaired waterway on the state's *Integrated List of Waters Final Listing of the Condition of Massachusetts' Waters Pursuant to Sections 305(b), 314 and 303(d) of the Clean Water Act Watershed Planning Program*, the impairment is listed as Category 4c related to habitat alterations (Massachusetts DEP 2015). Waterways effected by non-pollutant stressors included in the Integrated List are distinguished

from pollutants which would otherwise require the preparation of a Total Daily Maximum Load (TMDL) reporting for compliant with the Clean Water Act.

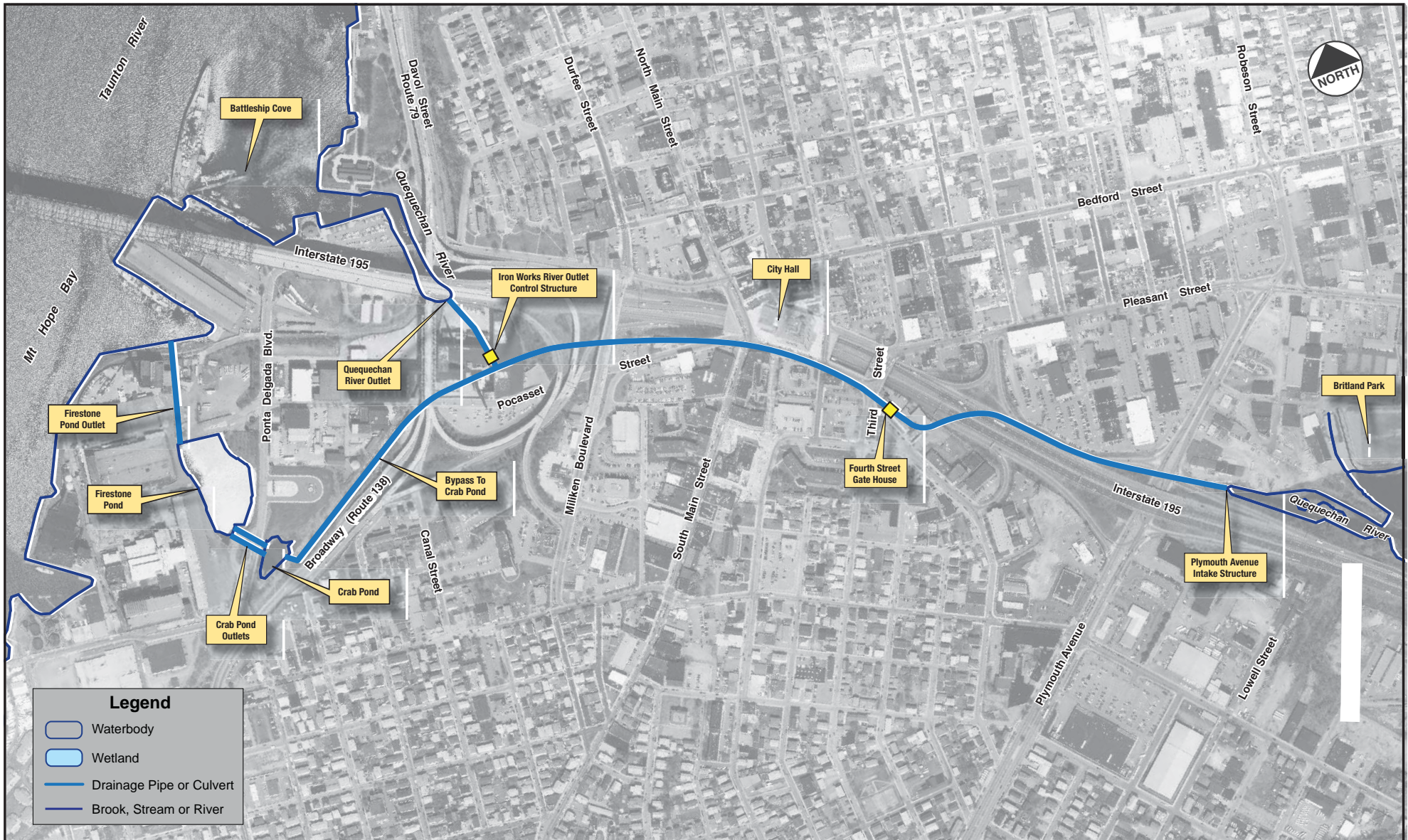
### 3.2 Quequechan River

The Quequechan River begins at the northwest corner of South Watuppa Pond and ends at one of two outfalls to the Taunton River; Battleship Cove or Crab Pond (Figure 4). South Watuppa Pond, an emergency water supply to Fall River, serves as the headwaters to the Quequechan River. Below South Watuppa Pond, the 2.7-mile long Quequechan River is comprised of three distinct segments; 1) a quiescent, low gradient aquatic environment between the outlet from South Watuppa Pond to the Plymouth Avenue intake structure, 2) a long, almost entirely closed culvert segment to the Iron Works Nos. 6 and 7 mill complex, and 3) a tidally-influenced channel which enters Mount Hope Bay. The corridor along the closed culvert section is entirely developed with a mix of land uses including industrial, commercial, institutional, multi-family residential and transportation (associated with Interstate Route 195 and other state and local roads).

Along the western shore of South Watuppa Pond a box culvert conveys flow beneath Interstate Route 195 and Route 24. This river segment between South Watuppa Pond and the Plymouth Avenue intake structure and has historically been impounded first by mill dams and now by a gatehouse further downstream within a closed conduit. The pond surface water elevation is controlled by the Fourth Street gatehouse and maintained at an elevation approximately 18 to 24 inches below the maximum full pond elevation, to the extent possible (CDM Smith 2015). The historic damming the river created a large area of placid, standing water, which is visually similar to a pond. The perimeter of the impoundment was historically filled to create additional land for development and areas which were once predominately open water habitats have now become well-established emergent marsh and shrub swamp as accumulated sediment and organic materials continue to reduce water depths (Figure 5). FEMA has mapped a 100-year flood plain for this area (Zone A) but has not determined a base flood elevation (NFIP Flood Insurance Rate Map Panel 0334G).



*Figure 5. Upper segment of the Quequechan River*



**Existing Conditions: Quequechan River below the Plymouth Avenue Intake Structure**

**Figure 4**

This upper segment of the river supports a wide range of habitats, wildlife and warm water fishery despite its altered, urban state. However, habitat conditions are adversely impacted by past industrial practices, non-point source runoff, and non-native wildlife and vegetation. Waterfowl known to inhabit this segment include Canada goose (*Branta canadensis*), green-winged teal (*Anas carolinensis*), ruddy duck (*Oxyura jamaicensis*), hooded merganser (*Lophodytes cucullatus*), and mallard duck (*Anas platyrhynchos*). The slow-moving waters also support native aquatic mammals such as muskrat (*Ondatra zibethicus*), otter (*Lontra canadensis*), and beaver (*Castor canadensis*) and terrestrial mammals such as racoon (*Procyon lotor*), mink (*Neovison vison*), red fox (*Vulpes Vulpes*), skunk (*Mephitis mephitis*), weasel (*Mustela frenata*), and white-tailed deer (*Odocoileus virginianus*) (Lima et al. 2013).

Historically, the Quequechan River supported pickerel (*Esox niger*), yellow perch (*Perca flavescens*), pumpkinseed (*Lepomis gibbosus*), white sucker (*Catostomus commersonii*), and brown bullhead (*Ameiurus nebulosus*). In addition, this reach supports both largemouth bass (*Micropterus salmoides*) and smallmouth bass (*M. dolomieu*), which were introduced into the river. Other species now found in the river include bluegill (*L. macrochirus*), black crappie (*Pomoxis nigromaculatus*), northern pike (*Esox Lucius*), and muskellunge (*Esox masquinongy*). Although the river's tributaries once supported brook trout (*Salvelinus fontinalis*), they are no longer present due to the degraded environment (Lima et al. 2013).

The aquatic flora inhabiting the upland section of the river has changed significantly due to invasive species and urbanization. For example, endemic stands of cattail (*Typha* sp.) and wild rice (*Zizania* sp.) have been replaced by invasive common reed (*Phragmites australis*) and purple loosestrife (*Lythrum salicaria*). The river has seen an overall decline in native aquatic species, which have been partly driven out by pollution and the presence of invasive milfoil (*Myriophyllum* sp.), fanwort (*Cabomba caroliniana*), and south American waterweed (*Egeria densa*). The presence of invasive, territorial mute swan (*Cygnus olor*) has also lead to the decline to native waterfowl (Lima et al. 2013).

The City of Fall River has developed an Integrated Wastewater and Stormwater Master Plan Draft for the community to keep the City in compliance with state and federal regulations (CDM Smith 2015). The draft Master Plan provides a detailed description of the closed conduit segment of the Quequechan River within the project area, which is summarized, in part, below. Prior to construction of Interstate 195 in 1964, some portions of the river remained open to the Iron Works Nos. 6 and 7 mill complex. As part of the highway construction, a culvert was installed to convey the river under the highway and City Hall area to the mill complex (Figure 6).

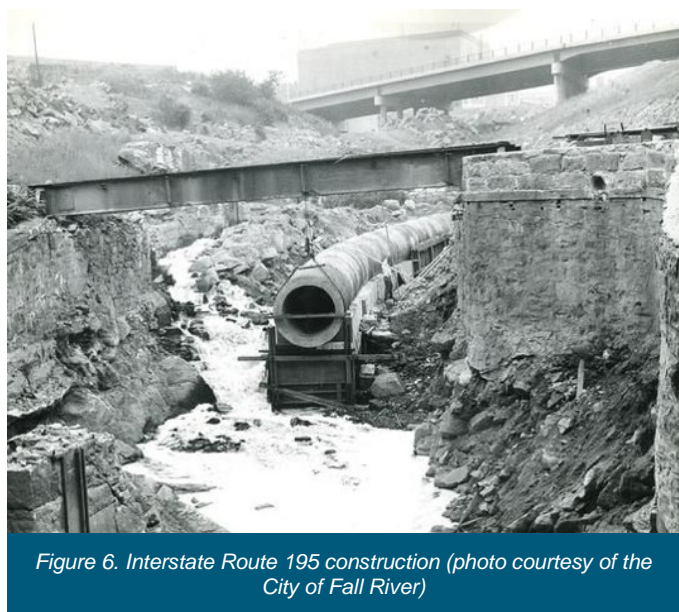


Figure 6. Interstate Route 195 construction (photo courtesy of the City of Fall River)

The river segment from the Plymouth Avenue intake structure to the Chamber of Commerce building (west of South Main Street) was reconstructed as part of the Interstate 195 construction in 1964. Improvements included a new intake structure, 96-inch diameter reinforced concrete culvert and the Fourth Street gatehouse. The Plymouth Avenue intake structure consists of a rip-rap sloped approach and a 12-foot wide concrete inlet structure with bar racks at the entrance to a 96-inch diameter concrete culvert (Figure 7). The intake structure and approach were recently rehabilitated as part of the Quequechan Control Structure Improvements project. The structure is regulated by the state as a high hazard dam.



Figure 7. Plymouth Avenue intake structure

The river continues from the intake structure in a northwestern direction, consisting of approximately 1,700 linear feet of 96-inch diameter concrete culvert to the Fourth Street gatehouse. The Fourth Street gatehouse, constructed in 1964, located at the southeasterly corner of the Interstate Route 195 Fourth Street overpass, serves as the control point for the surface water elevation within the South Watuppa Pond (Figure 8). The gatehouse consists of two 10-foot by 16-foot-5-inch crest gates and two 18-inch bypass lines. The total capacity of the gatehouse is approximately 500 cubic feet per second (cfs). The gatehouse was also recently rehabilitated as part of the Quequechan Control Structure Improvements project. From the gatehouse, the Quequechan River continues underground in a northwestern direction along Pocasset Street via approximately 850 linear feet of 96-inch reinforced concrete pipe, followed by approximately 950 linear feet of 66-inch reinforced concrete pipe, to an outlet structure located just upstream of the Iron Works Nos. 6 and 7 mill complex. Approximately 80 linear feet of the river is exposed in this location but is well-hidden from view between a tall retaining wall along the pavement edge (Figure 9). The Quequechan River flows underneath/through both mill buildings.



Figure 8. Fourth Street gatehouse

The mill buildings at the Iron Works Nos. 6 and 7 mill complex are listed on the National Register of Historic Places. The mill complex is comprised of four buildings—two mills and two storage buildings—constructed between 1847 and 1906. The Metacomet Mill (i.e., American Printing Co. Mill No. 6 and Iron Works Mill No. 6) was considered a model facility in its time. American Printing Co. Mill No. 7 (i.e., Iron Works Mill No. 7) was the last expansion on this site.

The Iron Works Nos. 6 and 7 mill complex includes a series of culverts and chambers conveying the river beneath the mill buildings and a gated control structure, located in the courtyard of the mill. A gated control structure, near the center of the mill complex below Mill No. 7, creates an impoundment that was designed to divert flow in two directions: in a northerly direction via the Quequechan River to Battleship Cove/Taunton River, and in a westerly direction via a bypass channel to Crab Pond, Firestone Pond and Mount Hope Bay.

The principal river flow path is toward Battleship Cove through a spillway with a 6-foot by 6-foot wood sluice gate (Figure 10). Another very short segment of the river is exposed within the courtyard between the spillway and the southern edge of Mill No. 6. The flow then passes under Mill No. 6 in a northerly direction through a 9-foot by 4.5-foot arched culvert to an approximate 15-foot by 20-foot chamber. From there, the river flows in a northerly direction through three 9-foot wide arch culverts for approximately 140 feet, where it then transitions to a new single 5-foot high by 9-foot wide concrete box culvert sized to convey 500 cfs. This recent improvement, as part of the Route 79/Braga Bridge Improvements Project, dramatically improved the flow dynamics of the Quequechan River. This portion of the river, below Mill No. 6 is tidally influenced by Mount Hope Bay.

The control structure in the mill complex courtyard was also designed to divert flow to Crab Pond during low flow periods. Large portions of the bypass channel to Crab Pond were reconstructed as part of the Route 79/Braga Bridge Improvements Project. The pond was divided and partially filled in 1986 with the construction of Ponta Delgada Boulevard and creation of Firestone Pond. The Crab Pond outlet consists of two 48-inch RC pipes under Ponta Delgada Boulevard which discharge to Firestone Pond. Firestone Pond discharges to the Taunton River via a 24-inch drainage pipe. The outlet from Firestone Pond is regulated by the state as a significant hazard dam.



Figure 9. Short daylighted river segment above Mill No. 7



Figure 10. Spillway above Mill No. 6

The final segment of the river is the tidally influenced open channel below the recently constructed single 5-foot high by 9-foot wide concrete box culvert which begins at a point just north of the state's railroad tracks and extends approximately 350 feet to Battleship Cove (Figure 11). This brackish segment of the river below the Braga Bridge continues under the stone arch of Central Street and into the Mount Hope Bay estuary at Battleship Cove (Figures 12 and 13). The segment upstream of the Central Street Bridge is highly disturbed by both past and more recent construction activities. The banks are generally protected from erosion by cut stone blocks or riprap. The channel substrate is primarily cobble-sized stone due to somewhat higher velocities during ebb tide conditions. Channel banks below Central Street consist of low cut stone seawalls protecting portions of the Battleship Cove parking area and Heritage Park. FEMA has established a 100-year base flood elevation (VE Zone) of elevation 17 feet (NAVD 88) for this section of the Taunton River (Mount Hope Bay) shoreline (NFIP Flood Insurance Rate Map Panel 0333G). This elevation would significantly inundate larger sections of the developed shoreline including Mill No. 6.

The state has mapped the tidal section of the river below Central Street as suitable habitat for American oyster (*Crassostrea virginica*) and soft-shelled clam (*Mya arenaria*). The Quequechan River is not included in the Massachusetts Division of Marine Fisheries' *Recommended Time of Year Restrictions (TOYs) for Coastal Alteration Projects to Protect Marine Fisheries Resources in Massachusetts Technical Report TR-47*. The height of the original falls prior to any alterations would have prohibited the ability for anadromous species to mitigate upstream to spawn within North and South Watuppa Ponds (B. Chase, Massachusetts DMF Biologist, pers. comm.). Nonetheless, river herring (*Alosa* spp.) are



Figure 11. Lower Quequechan River at Railroad Crossings



Figure 12. Lower Quequechan River at Central Street



Figure 13. Lower Quequechan River at Battleship Cove

attracted to the base of the falls at Mill No. 6, which in turn attracts striped bass (*Morone saxatilis*), creating a seasonal angling opportunity for fishermen within the lower Quequechan.

Another anadromous species, rainbow smelt (*Osmerus mordax*) may also be attracted to river in late-winter. Smelt are a pelagic, schooling species that spends most of its time in nearshore waters. During winter months, they are found between estuary mouths and the brackish water areas of coastal streams with spawning beginning in late-February within fresh or slightly brackish stream reaches. Most spawning occurs in fast flowing, turbulent water in stream sections dominated by rocks, boulders and aquatic vegetation (MA DMF Species Profiles accessed at <http://www.mass.gov/eea/agencies/dfg/dmf/recreational-fishing/species-profiles-rainbow-smelt.html>.) While no data is available on the species presence in the lower Quequechan, the possibility of enhancing spawning habitat substrate should be explored further by recording velocity and salinity data during the spawning period.

### **3.3 Combined Sewer Overflows**

The Integrated Wastewater and Stormwater Master Plan Draft also provided a detailed description of the Combined Sewer Overflow Project which is summarized, in part, below. Historically, wet-weather events caused frequent discharges from five combined sewer overflows (CSOs) to enter the river system. As a result of a federal court order, the City has constructed \$180 million in CSO controls which, in part, included the CSO tunnel system and the Quequechan Surface Interceptor (QSI). The QSI was constructed in 2008, and was designed to eliminate the need to extend the CSO tunnel under the Quequechan River and Interstate 195. The new surface interceptor replaced an old and undersized interceptor to the North Plymouth Avenue Drop Shaft with a new and larger pipe.

The CSO tunnel system is made up of a 3-mile long, 20-foot diameter unlined deep rock tunnel, drop shafts and associated structures, the plant conduit and tunnel ventilation system (Figure 14). The upstream end of the CSO tunnel starts at the end of Lowell Street. The downstream end of the CSO tunnel terminates at Swift Street, across Bay Street from the waste water treatment plant (WWTP). The CSO tunnel provides storage capacity of 38-million gallon to reduce CSOs. The CSO tunnel was designed to handle the 3-month storm volume for its tributary area. For larger storms, the tunnel is closed off from the sewer system when full, and the sewers and CSO outfalls perform as they would have, but with



Figure 14. CSO tunnel (photo courtesy of the City of Fall River)

significantly reduced overflows. Flows to the CSO tunnel are stored and conveyed to the WWTP for treatment as treatment capacity becomes available. The wastewater storage provided by the CSO tunnel reduces the frequency and volume of CSOs during wet-weather. However, it can also act as a dry-weather interceptor. Construction of the CSO Project has largely eliminated wet-weather discharges to the Quequechan River dramatically improved water quality. The river current meets Class B Surface Water Standards (314 CMR 4.06, T. Sullivan, Director City of Fall River Sewer Division, pers. comm.).



### **3.4 Geomorphology and Hydrology**

The geomorphology of the original river system was heavily influenced by the bedrock geology of the region. The upper reaches of the river contain a flat, placid section of between South Watuppa Pond and the currently steeply enclosed section. This enclosed section originally supported a series of eight falls along a dramatic drop of 130 vertical feet within a linear distance of 2,300 feet along exposed granite bedrock outcrops. The currently exposed calm, low gradient aquatic environment within the upper Quequechan does not provide a suitable reference reach for the design of a daylighted reach further downstream. A reference reach is a river section that represents a stable channel within a river's particular morphology. The reference reach is used to develop natural channel design criteria.

Typically, reference reach data such as longitudinal profile, cross-sections, channel bed, and bank materials characteristics would be used to aid in initial design envelope for channel morphology to provide the required flood protection and channel stability, as well as to integrate sustainable natural channel forms, in-stream habitat improvements (i.e. riffle, run, pool segments) and riparian buffer re-establishment, where possible. Without reference reach data, the channel design envelope will largely be determined by anticipated flow volumes and the desire to recreate historic falls. Current hydrology data is limited to the peak discharge design capacity of the closed conduit system of 500 cfs. Hydrographs of discharge volumes in the watershed under more frequent, channel forming events will be developed during subsequent design phases.

## **4.0 RESTORATION (DAYLIGHTING) OPPORTUNITIES**

### **4.1 Overview**

Daylighting the Quequechan River provides an opportunity to bring the community of Fall River together and enhance the City's economic state through ecotourism. Restoring the river could also provide enhanced recreational opportunities for residents and link residential neighborhoods to downtown community areas through pedestrian walkways. The creation of new public spaces will also provide additional public spaces for art and entertainment, add native green space within a densely developed area, and help revitalize downtown urban areas. Restoration of the Quequechan River will enhance the community's connection to and relationship with the river and help preserve and celebrate of heritage and local history. Daylighting a segment of the river also provides the opportunity to realize limited ecological benefits by restoring aquatic habitat, improve dissolved oxygen levels and enhance riparian functions. However, in an urban environment, communities' positive attitudes may be driven by landscape aesthetics and cultural and recreational value, rather than improvements to natural riverine services.

In a developed setting, daylighting a segment of the river presents a number of challenges. The historic and current alterations have completely altered channel alignment and cross-section, available floodplain, and changed hydrologic and hydraulic conditions. One of the largest challenges involves the identification and acquisition of parcels of sufficient size to accommodate both a daylighted river segment as well as the space for critically important recreational and cultural features. The topographic setting and proximity to the existing conduit also dictate the suitability of possible restoration sites.

The primary objective of this Preliminary Feasibility Study was the identification of potential sites which, among other goals, could daylight a substantial segment of the closed river system and serve as a cultural attraction to link downtown and the working waterfront. The investigation initially included a number of potential sites generally located along the closed river system, as well as the tidally-influenced reach. Three locations which offer limited opportunities are briefly discussed below. Revitalization actions within these

locations could enhance the public's user experience along the river corridor, including a more comprehensive interpretive trail extending from downtown (City Hall area) to the waterfront, but are not considered to sufficiently meet the primary objective of this study.

Two such opportunities are associated with the Iron Works Nos. 6 and 7 mill complex. This lot is identified as Parcel ID N-12-0007 owned by Old Iron Works Realty Inc. Just upstream of the Mill No. 7 approximately 80 linear feet of the river is exposed but is hidden from view behind a tall retaining wall along the pavement edge (Figure 9). The upper limits of the short daylighted reach represents the terminus of the Interstate Route 195 improvements and contains the headwall of the 66-inch reinforced concrete pipe and outlet structure. The outlet structure includes a concrete baffle wall to, presumably, reduce water velocities entering the mill structure. The reach also includes an inoperable gate structure with a catwalk spanning the river. Further hydraulics investigations are necessary to establish the functionality of the outlet structure and determine whether it would be possible to reconstruct the structure without the baffle and (ideally) reposition it further upstream within the state right-of-way associated with the Interstate Route 195 off-ramp. Should this be feasible, the potential exists to expose a short but dramatic falling section of the river; however, close coordination with MassDOT would be required. The ability to make this reach visual to the public introduces additional challenges. Currently the high retaining wall obscuring views supports a paved apron to access docking docks along Mill No. 7 (Figure 15). It would be possible to create an appealing, small pocket park by lowering the retaining wall and potentially accessing the catwalk. Existing trees north of river, along the roadway embankment, provides a visual screen from the adjacent transportation infrastructure and enhances a sense of place. Acquisition of this private property would be necessary and, likely, would eliminate the ability for trucks to access the loading docks to the mill building, complicating acquisition potential.



Figure 15. East side of Mill No. 7

The Iron Works Nos. 6 and 7 mill complex courtyard also provides limited opportunities to meet the primary goal of the study (Figure 16). The courtyard contains several gated control structures designed to divert flow. Covered sections of the river provide critical transportation access interior to the courtyard as well as parking and loading docks within the northern portion of the complex. Therefore, it is likely that much of the existing pavement would need to remain and limit additional daylighting opportunities. While daylighting opportunities are limited, the courtyard provides views of attractive mill facades and offers an excellent



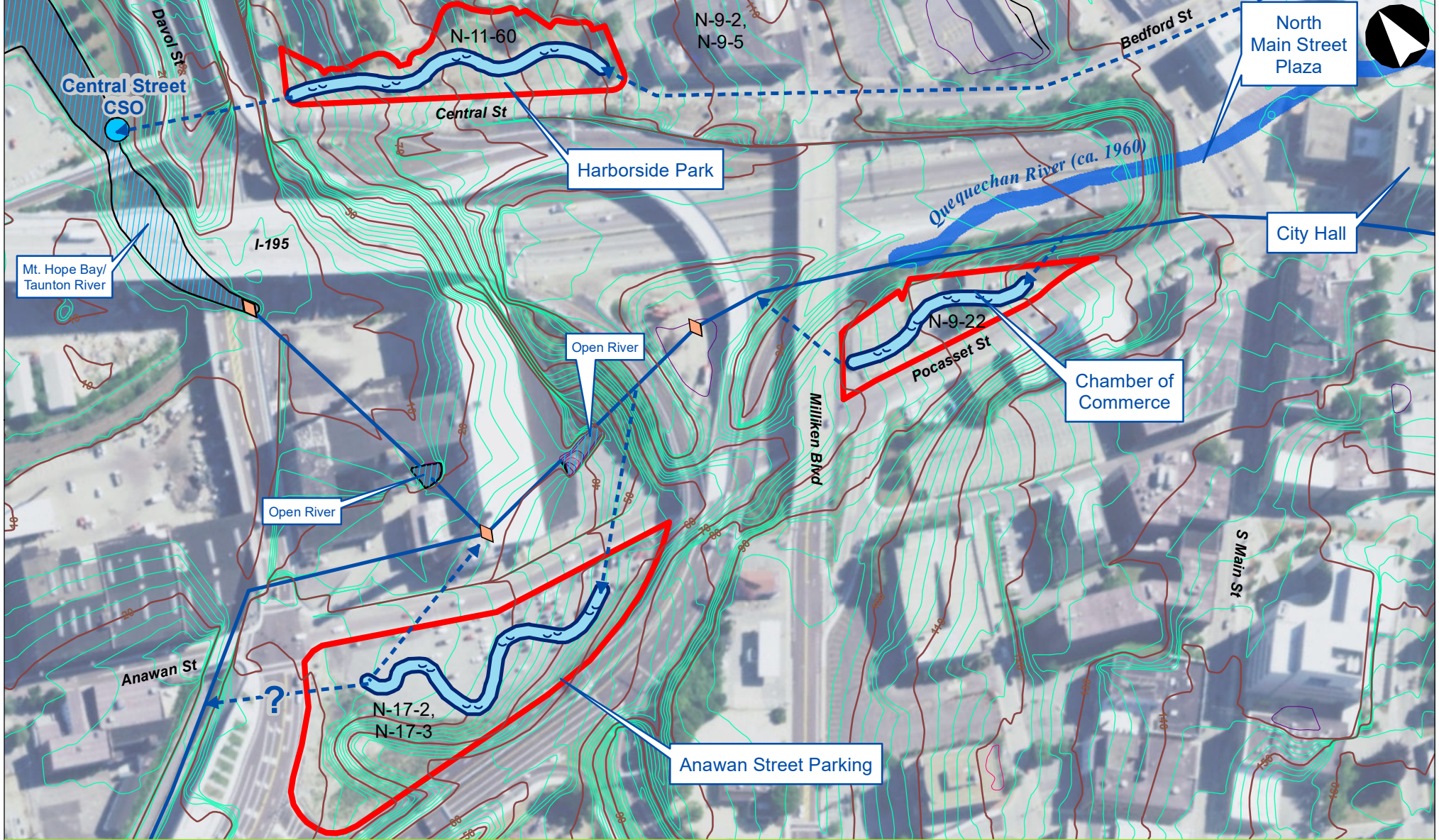
Figure 16. Iron Works Nos. 6 and 7 mill complex courtyard



sense of place to the industrial past. As the Metacomet Mill was considered a model facility in its time, many opportunities for historical interpretation are possible. Any work within the courtyard area would require extensive coordination with cultural resource agencies, as well as the property owner. Investments in the aging water control mechanisms would also be welcomed.

Below Mill No. 6, the river daylights at the end of a recently constructed 5-foot high by 9-foot wide concrete box at a point just north of the state's railroad tracks and extends approximately 350 feet to Central Street and Battleship Cove. The segment of the river between the railroad tracks and the Central Street stone arch is highly disturbed by both past and more recent construction activities. It would be possible to expose a longer section of this tidal reach within the existing parking area north of Mill No. 6. This action would impact parking and access to loading docks within the northern portion of the mill complex. One's sense of place is heavily influenced by traffic noise and shadows from the Braga Bridge. Shading from the bridge would limit opportunities to use bio-engineering techniques to improve streambank conditions. The MassDOT 195 Infra-space planning project is considering improvements to this general state-owned area which is intended to make better use of this space and establish a pedestrian-friendly connection to the working waterfront. These planning efforts should include efforts to improve the attractiveness and safety of the river corridor. The channel banks below Central Street consist of low, cut stone seawalls protecting portions of the Battleship Cove parking area and Heritage Park. It would be possible to introduce a fringing salt marsh along this state-owned property as part of a green infrastructure coastal resiliency initiative. This action could also be included as part of the MassDOT 195 Infra-space planning effort. Providing nursery and foraging marsh habitat for smaller prey species could attract larger fish such as striped bass, increasing angling opportunities.

Three other locations have been identified which appear to meet the primary objective of this study by daylighting a substantial segment of the closed river system and serve as an important cultural attraction. These locations are shown on Figure 17 and discussed below, individually. The sites are not necessarily mutually exclusive. However, further investigation regarding available hydrology to support multiple locations would be required. The daylighting of river segments along both Pocasset and Central Streets would create the potential for a looping interpretive trail extending from downtown to the waterfront and back. The opportunities and challenges associated with the potential restoration (daylighting) sites are summarized in Table 1.



**Preliminary Feasibility Study**  
**Daylighting and Revitalizing the Quequechan River**  
 Fall River, Massachusetts

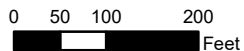
**Potential Daylighting Opportunities**



Source: 1) City of Fall River, Utility Data, 2017  
 2) ESRI, World Imagery, 2017  
 3) Hayden, Harding & Buchanan Inc. "Proposed Bridge Under Interstate Route 195", 1964

**Legend**

- Stormwater Structures
- Potential Daylighted Reach
- Historic Quequechan River (1964)
- Potential Flow Diversion
- 10-foot Topo Contours
- Storm Water Pipe
- Shoreline



**Figure 17**

**Table 1. Opportunities and Challenges Associated with Potential Restoration (Daylighting) Sites**

Opportunities and Challenges			Alternatives		
			Fair 	Good 	Better 
			Harbor-side Park	Chamber of Commerce	Anawan Street Parking
Opportunities	Ecological 	Restore Aquatic Habitat			
		Improve Dissolved Oxygen Levels			
		Enhance Riparian Functions			
	Recreational 	User Group Accessibility			
		Space for Play			
		Trail Network Potential			
	Cultural 	Historical Interpretation			
		Sense of Place			
		Urban Green Space			
		Space for Public Arts & Events			
	Economic 	Catalyst for Urban Renewal			
		Maintenance Costs			
Linkage Between Downtown and Harbor					
Challenges	Available Space				
	Topographic Setting				
	Acquisition/Relocation				
	Flow Diversion				

## 4.2 Harborside Park

The Harborside Park site consists of a 1.1 acre open space parcel (Parcel ID: N-11-0060) owned by the City of Fall River (Figure 18). The parcel formerly contained public housing units which were demolished. The site borders Central Street to the south, the Heritage Heights housing development to the north, Harbor Street to the west and Green Street to the east. The narrow parcel is approximately 500 feet in length and varies in width from approximately 50 to 140 feet. The parcel slopes dramatically to the west from Green Street to Harbor Street from approximately elevation 90 feet to elevation 50 feet.

The existing slope is well-suited to establish a cascading stream channel approximately 425 feet in length with a profile falling approximately 30 feet over an average gradient of roughly 7%. This gradient could accommodate several segments of short falls. The channel cross section would depend on anticipated flow volumes to be determined from a combination of flow volumes diverted from the main conduit and capacity limitations to convey flows back to the river within existing sewer infrastructure. However, sufficient space is available to establish naturalized high velocity channel segment with a bedrock and boulder streambed and potentially a narrow vegetated riparian edge.



Figure 18. Harborside Park site, viewing west

The required infrastructure to divert river flows to this parcel would be a major challenge. It is anticipated a diversion structure would be constructed within the infield of Interstate Route 195 ramps located near the point where the main conduit conveying the river crosses under Route 195 (Figure 19). New conduit would be constructed within the existing right-of way of local roads including Pleasant Street, Third Street, Bedford Street and Central Street for a total linear distance of approximately 2,900 linear feet. River flows at the lower end of the linear park would be directed into existing sewer infrastructure in Harbor Street and discharged through the Central Street CSO near Harborside Park (Figure 17). Further study is necessary to determine the capacity of this existing drainage infrastructure.



Figure 19. Location of proposed diversion structure to divert flow to Harborside Park

Major advantages of the site, in addition to the favorable vertical gradient, include the current land use and City ownership. The narrow configuration of the parcel would limit opportunities to replace existing recreational use and limit space available for parking or public events. The majority of the existing pedestrian trails could be maintained with footbridges over a new daylighted segment. The two properties

immediately uphill of the site include Parcel ID: N-09-0002 which borders Green Street and Parcel ID: N-09-0005 which borders Durfee Street (Figure 20). These properties were considered to supplement restoration potential along Central Street. Following a recent fire in the building on Parcel N-09-0002, the structure was demolished and the land is being marketed for sale. Parcel N-09-0005 is owned by Mart Inc. Midtown Motor and operates as mixed-use commercial building. Tenants on the ground level include leased space to the USPS vehicle maintenance facility and H&R Block. Due to the extensive length of the required diversion infrastructure, it does not appear to be possible to daylight river flows within these lots. However, the properties would be useful to support ancillary facilities and parking for a linear streamside park below Green Street.



Figure 20. Corner Lot near Harborside Park

While a linear park along Central Street would provide an attraction to link downtown to the waterfront, it does not provide a compelling sense of place given the fragmentation caused by the Route 195 transportation corridor from remaining mill buildings. As with all the restoration sites, the safety of visitors will be critical due to a combination of steep channel gradients and downstream drainage infrastructure. Safety measures are likely to consist primarily of aesthetically pleasing railings tied to the landscape architectural theme.

### 4.3 Chamber of Commerce

The Chamber of Commerce site consists of a 0.7 acre property identified as Parcel ID: N-09-0022. This property abuts Pocasset Street, Milliken Boulevard and Interstate Route 195. The property is owned by the Bristol County Chamber of Commerce and is operated as such (Figure 21). The parcel contains a single small office building and a tiered surface parking lot. The overall length of the parcel is approximately 375 feet but the property narrows significantly approaching Main Street. The parcel slopes substantially toward the Milliken Boulevard overpass from approximately elevation 104 feet to elevation 80 feet. The existing slope is well-suited to establish a cascading stream channel approximately 300 feet in length with a profile falling approximately 15-20 feet over an average gradient of roughly 6%. This gradient could accommodate a couple segments of short falls.



Figure 21. Chamber of Commerce Building

The channel cross section would depend on flow volumes diverted from the main conduit. At this site, a diversion structure could be constructed within the Interstate Route 195 right-of-way to divert a portion of



the flow in the main conduit conveying the river. Alternatively, the entire conduit could be intercepted and daylighted within the Chamber of Commerce parcel and redirected back to the main conduit under the Milliken Boulevard overpass. The higher flow volumes associated with the entire conduit would likely create a more dramatic river segment. However, flow volume control afforded by a diversion structure would permit a level of adaptive management to address maintenance and uncertainties. For example, a turbulent river reach so close to Interstate Route 195 may create unsafe microclimatic conditions (fog, rim ice) during winter months. This issue could be addressed with a wall segment. A wall would have the added benefit of reducing traffic noise from the highway. Work on this site would require close coordination with MassDOT officials. While the proposed channel cross section will need additional investigation, the fact that the lower reach of the river is conveyed by a single 5-foot high by 9-foot wide concrete box culvert sized to convey peak discharge events of 500 cfs, provides some insight into required channel dimensions.

The major advantages of this site are related to the physical setting. The site includes a favorable vertical gradient. The site is also close to the existing conduit, historic river corridor and falls, as well as downtown. This setting allows flexibility with flow diversion, enhances a sense of place, and improves historic interpretation potential in comparison to Central Street. As the site is within viewing distance of North Main Street Plaza, this underutilized space could become part of a broader interpretive trail. The site could become a catalyst to repurpose underutilized space in commercial buildings directly across Pocasset Street. It is assumed the Chamber of Commerce could be relocated to other vacant office space in downtown.

The relatively small size of this parcel would limit public areas available for recreation, urban green spaces and public events. No on-site parking is likely. Sufficient space is available to establish naturalized high velocity channel segment with a bedrock and boulder streambed and a narrow vegetated riparian edge. However, the need to accommodate a channel of sufficient width to convey the entire flow of the river would further limit land area available for public spaces. Additional area for either public spaces or river revitalization could be gained by narrowing the width of Pocasset Street by eliminating existing parking on the south side of the road or by introducing traffic calming measures.

The ability to redevelop the Chamber of Commerce site in combination with a limited daylighting approach just upstream of Mill No. 7 offers an interesting opportunity to expose a meaningful segment of the main river system in close proximity to the mill complex and historic river corridor. This combination warrants further exploration in future phases of design.

#### **4.4 Anawan Street Parking**

The Anawan Street Parking site includes two parcels; Parcel N-17-0002 which abuts Pocasset Street and is across from the mill complex and Parcel N-17-0003 which abuts Broadway Extension (Figure 22). Parcel N-17-0002 is owned by Old Ironworks Realty LLC and is operated as a surface parking lot. Parcel N-17-0003 is currently shown as being owned by the City of Fall River Housing Authority; however, it now contains a recently upgraded stormwater basin associated with the Route 79/Braga Bridge Improvements Project. Both parcels, as currently configured, total approximately 2.5 acres. The overall length of the combined parcel is approximately 550 feet with an average width of the approximately 160 feet. The parcel slopes substantially toward Broadway Extension from approximately elevation 60 feet to elevation 30 feet. The existing slope is well-suited to establish a cascading stream channel approximately 400 feet in length with a profile falling approximately 15-20 feet over an average gradient of roughly 4%. A steeper gradient channel would be introduced within the eastern end of the parcel to create a cascading section and a lower gradient, more sinuous section introduced with the western end of the parcel. This steeper gradient segment could accommodate a couple short falls. A riffle-pool segment with a gradient in the range of 1.5% would be targeted further downstream.



*Figure 22. Anawan parking lot, viewing east*

As with the other daylighting opportunities, the channel cross section would depend on flow volumes diverted from the main conduit. At this site, a diversion structure could be constructed below the Interstate Route 195 on-ramp, as shown on Figure 17, to divert a portion of the flow in the main conduit conveying the river. Alternatively, a diversion structure could be constructed further upstream near Milliken Boulevard and carried down Pocasset Street. More detailed survey of the affected utilities would be necessary to determine whether there are benefits in the form of a higher in water surface elevation (allowing a steeper channel gradient) that would outweigh the additional costs of a longer diversion route. More detailed survey is also required to determine the best route to redirect flow back to the mill complex. As part of the necessary improvements to daylight the river within this parcel, it may be advantageous to reconfigure the existing infrastructure which diverts flow to Crab Pond during low flow periods.

The major advantages of this site are related to the overall size, especially if the recently upgraded stormwater basin associated with the Route 79/Braga Bridge Improvements Project can be effectively relocated or accommodated into the restoration design with a smaller footprint. The width of the site could more easily accommodate public space for both play and events. This could include opportunities for visitors to have more direct access to lower gradient river banks or incorporate other water features such as a spray pond. Similarity, space would be available to accommodate a more natural cross section with riparian habitats as well as urban green spaces.

A major challenge of this site is the replacement of 162 lost parking spaces. It is assuming that both the lost spaces, as well as parking for visitors to the revitalized river segment would be provided in a new



parking facility constructed within the northern portion of the mill complex. This construction would require close coordination with cultural resource agencies and the owner of the lot and mill complex.

While the site is not as close the historic river corridor as the Chamber of Chamber parcel, its proximity to the mill complex enhances a sense of place, and improves historic interpretation potential in comparison to Central Street. The site could become a catalyst to repurpose underutilized space within the adjacent mill complex.

#### **4.5 Due Diligence**

Six subject sites were evaluated by a limited environmental due diligence review (Appendix B). These parcels are within or adjacent to the three locations identified as potential daylighting opportunities. All six sites are all located in an area that was extensively developed during the last two centuries. Each of the six sites are likely all to be underlain by varying amounts of urban fill that are known to contain concentrations of petroleum aromatic hydrocarbons (PAHs) that may exceed the applicable Massachusetts Contingency Plan S-1 standards. Impacts from on-site fuel oil tanks, gasoline tanks, and overhead deposition of lead paint chips have been shown to be additional sources of lead and total petroleum hydrocarbon (TPH) at some sites. See Appendix B for a more complete listing and additional information about each site.

#### **5.0 NEXT STEPS**

The primarily objective of this Preliminary Feasibility Study was the identification of potential sites which, among other goals, could daylight a substantial segment of the closed river system and serve as a cultural attraction to link downtown and the harbor. Three potential sites which generally meet this primary objective have been identified and evaluated based on available data sources. The next phase of the project would involve the selection of a preferred alternative based on the information provided in this document and input from city and state officials, the public and other stakeholders including Green Futures membership. With a preferred alternative selected, a number of data gaps will need to be addressed in order to advance to conceptual engineering design. Typically, a preliminary engineering design would be necessary to develop a detailed engineer's estimate of probable construction costs. However, it is possible to prepare a less detailed but useful initial cost estimate from a conceptual design. It should be recognized that even if daylighting a river segment is technically feasible, the conversion of use within the affected parcels may prove to be an even greater challenge and play a significant role in the site selection process. Public outreach and active stakeholder engagement will also be critical to the success of the project.



Additional data collection and studies as well as other efforts anticipated to be necessary to advance the restoration design through both conceptual and preliminary design are identified below along with an estimate of costs.

Task	Description	Estimated Cost
Environmental Due Diligence	On-site investigation of potential water, sediment or soil contamination	\$15,000
Hydrology & Hydraulics Study	Develop hydrograph for watershed/evaluate diversion strategies	\$15,000
Cultural Resources Evaluation	Investigate potential impacts to archeological or historical resources	\$12,500
Channel Geomorphology	Investigate channel properties during range of discharge events	\$10,000
Field Survey	Ground, property and affected utilities	\$10,000
Regulatory Compliance	Identify permits/approvals required	\$5,000
Geotechnical Study	Investigate soils and bedrock conditions	\$10,000
Land Use Planning	Integrate recreational and cultural goals	\$15,000
Landscape Architecture	Integrate urban green space design and riparian function	\$15,000
Stormwater Management	Integration of Low Impact Development strategies	\$7,500
Massachusetts DOT Coordination	Pro-active engagement with both transportation and planning officials	\$7,500
Public Outreach	Engagement of user groups, neighborhoods, other stakeholders and possible funding sources	\$12,500
Real Estate Services	Evaluation of private property acquisition/relocation	\$12,500
Traffic Engineering	Parking design & traffic management during construction	\$12,500
Civil Engineering Design	Conceptual and Preliminary	\$45,000
Cost Estimating	Itemized estimate of probable construction costs	\$7,500



## **6.0 REFERENCES**

- CDM Smith. 2015. City of Fall River Integrated Wastewater and Stormwater Master Plan Draft. <https://drive.google.com/drive/folders/0B7q94OoZgK9XRVAYRUZCcTJoSnM>
- Holtzman, M. 2017. Full length of Quequechan River Rail Trail to open. The Herald News. Published May 24, 2017. <http://www.heraldnews.com/news/20170524/full-length-of-quequechan-river-rail-trail-to-open>
- Fall River. 2004. Open Space and Recreation Plan for the City of Fall River, 2004. <http://www.greenfutures.org/projects/osp/>
- Lima, A.J., Champlin, K.M., and E.J. Castro. 2013. River and its City: The influence of the Quequechan River on the development of Fall River, Massachusetts. PearTree Press.
- [MA EEA] Massachusetts Office of Energy and Environmental Affairs. 2017. Taunton River Watershed. <http://www.mass.gov/eea/waste-mgmt-recycling/water-resources/preserving-water-resources/mass-watersheds/taunton-river-watershed.html>
- [MA DEP] Massachusetts Department of Environmental Protection. 2015. Massachusetts Year 2014 Integrated List of Waters Final Listing of the Condition of Massachusetts' Waters Pursuant to Sections 305(b), 314 and 303(d) of the Clean Water Act Watershed Planning Program. CN: 450.1. Division of Watershed Management, Watershed Planning Program. Worcester, MA.
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- Miliote, G. M. 2002. River Options Considered. The Herald News. Published November 24, 2002.
- Murphy, L. 2009. Restoring the Quequechan to its former glory. The Herald News. Published February 13, 2009.
- Fay, Spofford and Thorndike. 1915. Report of the Watuppa Ponds and Quequechan River Commission to the City Council, City of Fall River: Together with the Report of Fay, Spofford and Thorndike, Consulting Engineers. <https://books.google.com/books?id=kYUsAAAAYAAJ&pg=PP1#v=onepage&q&f=false>

## Appendix A

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### Review of Existing Material



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## MEMORANDUM

TO: Alfred Lima, Green Futures  
FROM: Scott DeHainaut, Craig Wood, Jason Gold  
SUBJECT: Data Sources Inventory  
COPY TO: Files

DATE: July 5, 2017  
ESS PROJECT NO.: G238-000

The following is a list of geospatial and supporting data acquired by ESS Group and associated with the City of Fall River's preliminary feasibility study for daylighting and revitalizing the Quequechan River. The list includes a variety of formats including GIS and CAD data, photos, and historic and related report PDF documents. Several sources contributed to this collection including the City of Fall River's Sewer and Planning offices.

- General Assets from June 2016 - "GEN\_ASSETS\_JUNE2016.shp" GIS shapefile provided by the City of Fall River sewer and planning offices
- Outlets from June 2016 - "OUTLETS\_JUNE2016.shp" GIS shapefile provided by the City of Fall River sewer and planning offices
- Storm Sewer Catch Basins from June 2016 - "SS\_CB\_JUNE2016.shp" GIS shapefile provided by the City of Fall River sewer and planning offices
- Storm Sewer Manholes from June 2016 - "SS\_MH\_JUNE2016.shp" GIS shapefile provided by the City of Fall River sewer and planning offices
- Storm Sewer Pipes from June 2016 - "SS\_PIPES\_JUNE2016.shp" GIS shapefile provided by the City of Fall River sewer and planning offices
- Surface Water Catch Basins from June 2016 - "SW\_CB\_JUNE2016.shp" GIS shapefile provided by the City of Fall River sewer and planning offices
- Surface Water Manholes from June 2016 - "SW\_ME\_JUNE2016.shp" GIS shapefile provided by the City of Fall River sewer and planning offices
- Surface Water Pipes from June 2016 - "SW\_PIPES\_JUNE2016.shp" GIS shapefile provided by the City of Fall River sewer and planning offices
- Surface Water Ponds from June 2016 - "SW\_PONDS\_JUNE2016.shp" GIS shapefile provided by the City of Fall River sewer and planning offices
- Surface Water Structures from June 2016 - "SW\_SSTRUCTURES\_JUNE2016.shp" GIS shapefile provided by the City of Fall River sewer and planning offices
- City of Fall River Parcel Information - "Parcels.dwg" shows cadastral information for Fall River including parcel boundaries, dimensions, ID numbers, and road names
- City of Fall River topography information - "TOPO.dwg" shows CAD data for terrain contours at 2-foot interval for the central business district of Fall River. Each line is attributed with the appropriate elevation and the file also contains specific spot elevation points with associated label



- Historic Strip Map for Bedford Street Sewer – “Bedford St HL17.pdf” scan of the original paper sheet showing Bedford Street sewer at horizontal scale of 1” = 50’ and vertical scale of 1” = 20’ (scales relative to the original hard-copy sheet). Unable to determine historic date
- Historic Strip Map for Bedford Street Layout – “Bedford St HR33.pdf” scan of the original paper sheet, circa 1925, showing Bedford Street including curb and frontage dimensions as well as ownership
- Historic Strip Map for Central Street Sewer – “Central St EI21.pdf” scan of the original paper sheet showing Central Street sewer at horizontal scale of 1” = 50’ and vertical scale of 1” = 20’ (scales relative to the original hard-copy sheet). Unable to determine historic date
- Historic Strip Map for Central Street Layout – “Central St MR5A.pdf” scan of the original paper sheet, circa 1924, showing Central Street including curb and frontage dimensions as well as ownership
- Historic Strip Map for Pleasant Street Sewer – “Pleasant St LL10.pdf” poor quality scan of the original paper sheet showing Pleasant Street sewer at horizontal scale of 1” = 50’ and vertical scale of 1” = 10’ (scales relative to the original hard-copy sheet). Unable to determine historic date
- Historic Strip Map for Pleasant Street Layout – “Pleasant St LR34.pdf” scan of the original paper sheet, circa 1920, showing Pleasant Street including curb and frontage dimensions as well as ownership
- Quequechan Control Structure, Phase I Inspection/Evaluation Report – “Quequechan Control Structure\_2007.pdf” scan of the 2007 report prepared by Pare Corporation, which includes maps and photographs of the control infrastructure
  - The Phase I Inspection/Evaluation report of the Quequechan Control Structure in Fall River, Massachusetts details the inspection and evaluation of the dam conducted on January 30, 2007 by Pare Corporation. The dam was classified as a large structure with a high hazard potential due to potential flooding upstream of the dam and at the mill complex at the outlet of the culvert. The Quequechan Control Structure was found to be in Satisfactory condition. The report also includes recommended actions to address deficiencies found at the dam.
- Investigation and Report on Quequechan River – “Quequechan River Investigations and Report\_1954.pdf” scan of a 1954 report prepared by Hayden, Harding & Buchanan, Consulting Engineers
  - The 1954 study on the Quequechan River by the engineering firm Hayden, Harding and Buchanan aimed to reduce pollution in the waterway. The firm proposed to develop an open channel to carry clean processing water for industrial use from the beginning of the river to the Third Street dam. The report includes schematic plans of recommended construction, improvements, and remedial work on the river.
- Quequechan River System Study Update & Improvement Projects – “Quequechan River System - Study Update & Improvement Projects\_2009.pdf” scan of a 2009 report prepared by Woodard & Curran

- The 2009 Woodard & Curran report describes Quequechan river segments and recommends improvement projects to address concerns associated with the river. Each improvement project is accompanied by a cost estimate and the project's relative priority.
- Link to the City of Fall River Integrated Wastewater and Stormwater Master Plan Draft, which was developed by the engineering firm CDM Smith in 2015. The draft report is available here: [http://www.fallriverma.org/index.php?option=com\\_content&view=article&id=895:city-of-fall-river-integrated-wastewater-and-stormwater-master-plan-draft&catid=63:news-flash&Itemid=934](http://www.fallriverma.org/index.php?option=com_content&view=article&id=895:city-of-fall-river-integrated-wastewater-and-stormwater-master-plan-draft&catid=63:news-flash&Itemid=934)
  - The Fall River Integrated Wastewater and Stormwater Master Plan provides a plan for the upgrade and maintenance of city stormwater & wastewater infrastructure in order to keep Fall River in compliance with state and federal regulations. The report includes photographs, schematics, and descriptions of existing conditions and recommended improvements to the Fall River wastewater and stormwater system.
- Various Photos and Video in JPG and MP4 taken 31 May 2017 format showing potential development areas identified in the feasibility study

## Appendix B

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### Limited Environmental Due Diligence Review



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**MEMORANDUM**

TO: Craig Wood, PWS  
FROM: Jonathan D. Alvarez, CPG  
SUBJECT: Limited Environmental Due Diligence Review

DATE: July 11, 2017  
ESS PROJECT NO.: G238-000

**CONFIDENTIAL  
CLIENT  
PRIVILEGED  
INFORMATION**

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This letter serves to summarize the findings of a limited environmental due diligence review of the project areas included in the Quequechan River daylighting project.

**Site Summaries**

ESS reviewed the City of Fall River Tax Assessor's Geographic Information System (GIS) data portal to gather information on the six subject sites. The following information was accessed on July 11, 2017.

Chamber of Commerce - 200 Pocasset Street – Parcel ID: N-09-0022

This property abuts Pocasset Street and Milliken Boulevard. The property is owned by the Bristol County Chamber of Commerce and is operated as such.

Anawan Street Parking Pocasset Street – Parcel ID: N-17-0002

This property abuts Pocasset Street and the Old Iron Works Complex. The property is owned by Old Ironworks Realty LLC and is operated as a surface parking lot.

Canal Street Retention Basin – Parcel ID: N-17-0003

This property abuts Broadway Extension. The property is owned by the City of Fall River Housing Authority and is operated as a recently upgraded stormwater basin.

Harborside Park - Central Street – Parcel ID: N-11-0060

This property abuts the Heritage Heights housing development and Central Street. The property is owned by the City of Fall River and is used as an open space for the adjacent housing development.

Undeveloped Lot - 238 Central Street – Parcel ID: N-09-0002

This property abuts Central, Bank, and Green Streets. The property was formerly owned by Paul Chodkowski and was an abandoned property. As of June, 2017, the property was demolished and is being marketed for sale.

Auto Loft - 10 Durfee Street – Parcel ID: N-09-0005

This property abuts Central, Bank, and Durfee Streets. The property is owned by Mart Inc. Midtown Motor and operates as mixed-use commercial building. Tenants on the ground level include leased space to the USPS vehicle maintenance facility and H&R Block. A former auto storage loft occupied the 3<sup>rd</sup> floor space.





## **Environmental Database Listings**

ESS reviewed Massachusetts Department of Environmental Protection (MassDEP) online databases to identify sites that may have the potential to impact the subject Site. The narratives presented below are based on review of documents submitted to the MassDEP. Referenced documents are available for review via the MassDEP's Bureau of Waste Site Cleanup website and can be found using the associated MassDEP Release Tracking Numbers (RTNs).

### **Subject Sites**

- 200 Pocasset Street – Parcel ID: N-09-0022  
This property is not listed in the MassDEP searchable sites database. No other information is available for the property.
- Pocasset Street – Parcel ID: N-17-0002  
This property is not listed in the MassDEP searchable sites database. No other information is available for the property.
- Canal Street – Parcel ID: N-17-0003  
This property is not listed in the MassDEP searchable sites database. No other information is available for the property.
- Central Street – Parcel ID: N-11-0060 – RTN-4-0000075  
This property is listed as being associated with the initial development of the Harbor Terrace Project, a housing development constructed in 1941. During 1949, the facility was converted from coal to oil heat and two 10,000-gallon steel tanks were installed. Following an oil leak in 1983, and a subsequent adjacent downgradient seep from a railroad retaining wall, the tanks were decommissioned. The property was partially underlain by granular materials including clay, gravel and boulders. The property was redeveloped in 1987, and the USTs were removed. There is the potential for residual contamination, based on MassDEP reports, for oil and or hazardous materials to exist in the subsurface and bedrock at the Site.
- 238 Central Street – Parcel ID: N-09-0002  
This property is not listed in the MassDEP searchable sites database. No other information is available for the property.
- 10 Durfee Street – Parcel ID: N-09-0005 – RTN-4-0012854  
This property has been operating as a vehicle maintenance facility for USPS vehicles since as early as 1990. Four USTs (two 2,000-gallon, and two 1,000-gallon) were removed between 1994-1995. Petroleum impacts (gasoline) were found to exist beneath the tanks, pooling on the underlying bedrock. The site achieved a Class A-2 Response Action Outcome (RAO). There is the potential for residual petroleum contamination to exist, based on MassDEP reports, in the subsurface and bedrock at the Site.



## Off-Site Listings

The following database listings may have the potential to impact the subject sites through either soil and/or groundwater contamination. In addition, the presence of historic fill, known to have been used in developing the adjacent federal interstate, may be impacted with petroleum and/or hazardous materials.

- Central Street Pumpstation – Facility #138 – Braga Bridge RTN-4-11946

The property is owned and maintained by MassDOT as a highway maintenance facility and has historically stored deicing materials (salt and sand). The presence of elevated lead, total petroleum hydrocarbons (TPHs) and petroleum aromatic hydrocarbons (PAHs) in soil, and lead in groundwater in exceedance of the applicable standards required MassDOT to complete a release notification to MassDEP in February and August 1996. According to the RAO Plan, the source of lead was found to include paint chips from the overhead Braga Bridge. Visible chips were found in the soil samples and excavations. The source of the TPH exceedances was found to be likely associated with on-Site fueling operations. The source of PAH exceedances was found to likely be associated with the underlying fill that contained coal-ash. The source of lead contamination from the overhead Braga Bridge may extend to additional portions of the site and/or neighboring parcels.

- 174 Milliken Boulevard – RTN-4-0012729

The property is operated currently as a gasoline and diesel fueling station. During a piping upgrade in December 1996, gasoline impacted soils were encountered. While no soil has been found to exceed the S-1 standards for the contaminants of concern (COCs), soil has been found to exceed the applicable S-1 standards for PAHs in six borings. The presence of PAH exceedances were found to be likely associated with historic urban fill found beneath the site.

- 64 Durfee Street – Bristol Community College – Downtown Campus – RTN-4-13521

The property is the former Bradford Durfee Textile School, and operated between 1904 and 1969. According to the December 2005 Class A-2 RAO Statement, numerous investigations has shown the Site to be impacted with PAHs in exceedance of MCP S-1 standards. These are likely associated with historic urban fill which was found beneath the site.

## Summary

The six subject parcels evaluated by this Limited Environmental Due Diligence Review are all located in an area that was largely developed during the last two centuries. Each of the six sites are likely all to be underlain by varying amounts of urban fill that are known to contain concentrations of PAHs that may exceed the applicable MCP S-1 standards. Impacts from on-site fuel oil tanks, gasoline tanks, and overhead deposition of lead paint chips have been shown to be additional sources of lead and TPH at some sites.