

Appendix G: Due Diligence Report and
DEP Approved Sediment Sampling Plan

DUE DILLIGENCE REVIEW & SEDIMENT SAMPLING PLAN

Ipswich Mills Dam Removal February 2024

1. INTRODUCTION

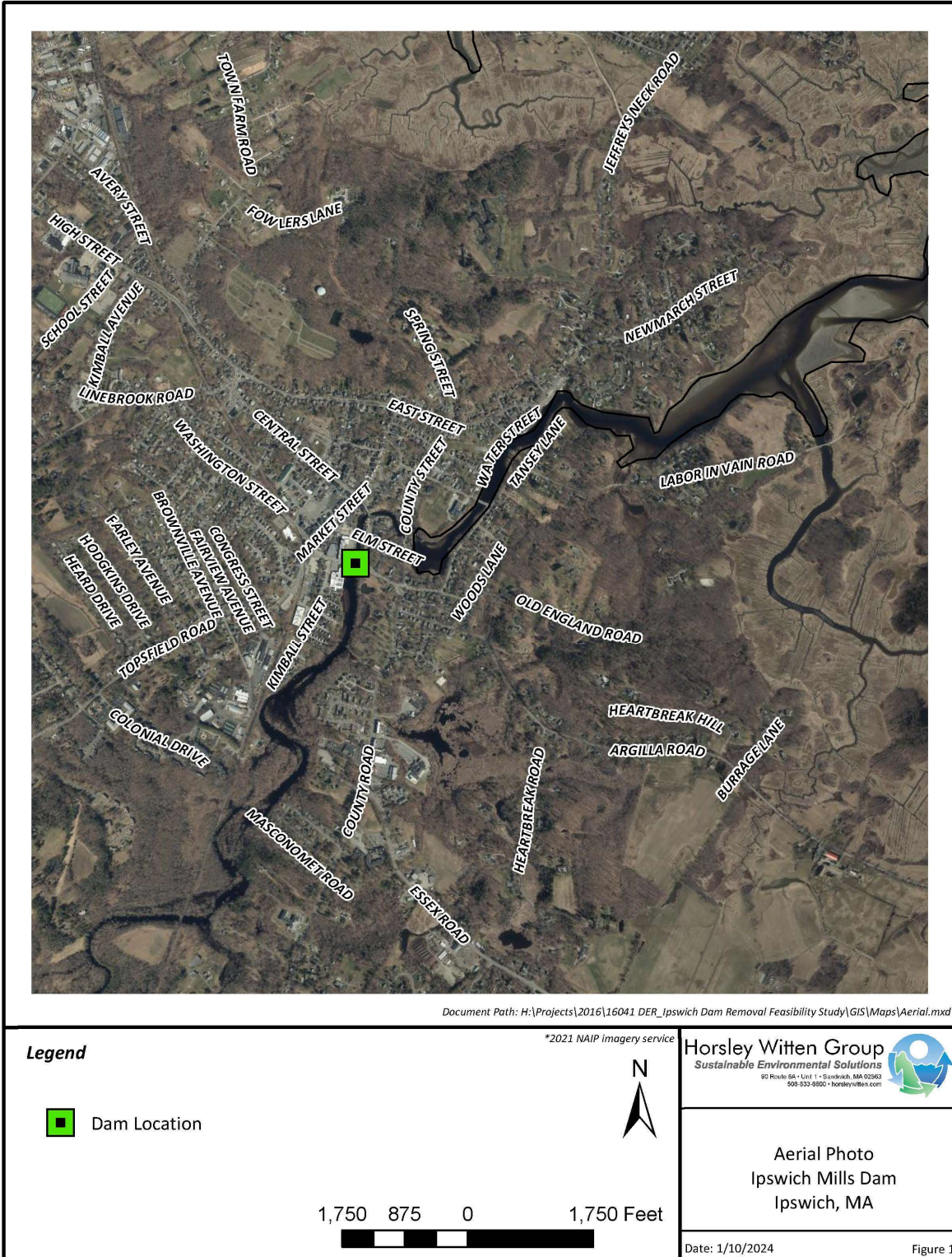
Horsley Witten Group, Inc. (HW) has completed a limited due diligence review to evaluate potential historical threats to sediment quality and to inform sediment sampling to be conducted as part of a proposed dam removal project for the Ipswich Mills Dam, located along the Ipswich River in downtown Ipswich, Massachusetts (the “Subject Property”).

The limited due diligence review consisted of the following:

- An evaluation of online records available from the Massachusetts Department of Environmental Protection (MassDEP) Waste Site and Reportable Releases Database (the “Database”);
- A review of historical topographical maps, Sanborn Fire Insurance maps, and historical aerial photographs available online from the EDR™ Report, published by Environmental Data Resources Inc. (“EDR”);
- A screening of regulatory records for environmental conditions at and abutting the Subject Property from the EDR Radius Map™ Report, published by EDR;
- A visual field assessment of the Subject Properties for evidence of a release of oil and/or hazardous materials (OHM).

The results of the due diligence review, combined with the requirements of the MassDEP Water Quality Certification (WQC) program informed the proposed sediment sampling plan discussed later in this document.

Refer to Figure 1 for regional location and general geographic setting of the Subject Property.



*Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services

Figure 1. Location of Subject Property with Aerial View

2. HISTORICAL BACKGROUND

The Ipswich Mills Dam is located at the head of tide on the Ipswich River, in downtown Ipswich, approximately 750-feet south (upstream) of the Route 133/South Main Street/Choate Bridge crossing (Figure 1). The dam is currently owned and operated by the Town of Ipswich Utilities Department (Haley & Aldrich, 2009). The river flows approximately south to north (left to right in Figure 1), ultimately discharging to the ocean waters of Plum Island Sound.

2.1. Ipswich Mills Dam Industrial History

The Town of Ipswich is the current owner of the Ipswich Mills dam while EBSCO Information Services is currently housed west of the Ipswich Mills Dam within the Old Mill Building (Ipswich Mill). Based on Ipswich historical records, the current EBSCO building was constructed soon after the turn of the 20th century as a mill that utilized the dam for power. Many other mill buildings and industries existed at the Subject Property from the 17th into the 20th century. The current EBSCO facility constitutes the last of the remaining mill buildings.

The Newburyport/Rockport Massachusetts Bay Transformation Association Line (formerly Boston & Maine Railroad) runs to the west of the Ipswich River. Ipswich Station is located proximal to the EBSCO building. The River itself is located in a previously industrial area of Ipswich that played a key role within the industrial revolution when small-scale production shifted toward industrial manufacturing.

According to the Cultural Resources Report prepared by the Public Archaeology Laboratory (PAL) in February of 2017 for the Ipswich Mills Dam Removal Feasibility Study, the Ipswich River was originally utilized as a hydro-power source beginning circa 1635-1637 to power a grist mill shortly upstream of the present location of the dam. A variety of hydro-powered mills and factories flourished in the vicinity of the dam over the following centuries, including fulling mills, sawmills, woolen mills, bark mills, dye houses, and tanneries. The vicinity of the Ipswich Mills Dam and Ipswich River was previously known as “Mill Garden,” according to PAL. A sawmill on the east bank of the river utilized the waterpower from earlier iterations of the dam from the late 1700s to circa 1858 when the sawmill was moved downstream.

In 1824, the mill was owned and operated by Boston & Ipswich Lace Company and produced lace until 1828 when it was taken over by the Ipswich Manufacturing Company to produce cotton cloth. The Ipswich Manufacturing Company was the first sizable manufacturing corporation in Ipswich. According to PAL, a new stone dam was constructed circa 1828-1829 just below the older dam and was noted as a “higher, more substantial stone dam” than what had previously existed.

The 1828-1829 stone dam was later owned and operated by the Dane Manufacturing Company in 1846 where production of cotton cloth continued. The Ipswich Mills Company took over the Ipswich Mills site in 1868 and began producing hosiery and became the “largest stocking mill in the country” (PAL).

The next iteration of a dam at the Subject Property was constructed circa 1880 consisting of cut granite blocks (PAL, 2017). As a part of the industrial expansion of the Ipswich Mills site, the 1880 dam was rebuilt in 1908 to its current structural design to improve the available waterpower. The 1829 stone mill was demolished during the reconstruction. During this time, a knitting mill took place of the stone mill. A new fishway was constructed in 1919 after being destroyed in 1916.

After a period of vacancy from circa 1928 to circa 1932, the Tanning Process Company, a subsidiary of the United Shoe Machinery Company (USMC), took over ownership of the mill and dam. Shoe mills are known for the use of mercury salts (i.e., mercuric chloride and mercuric nitrate) and lead during the manufacturing and bluing process as well as solvents, acids, bases and dyes and additional contaminants of concern including volatile organic compounds, cyanide, heavy metals (such as arsenic), pesticides, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons.

According to PAL and historical dam inspection reports, the mills were leased to Hygrade Sylvania Corporation (Sylvania) from 1940 to 1948 for the production of “proximity fuses, military and commercial transformers as well as tungsten coils”. The proximity fuses were a key contribution to World War II aerial bombing operations that allowed the bombs to detonate at specified altitudes above the ground surface. The proximity fuses were electronic in nature. No known explosives production occurred at the facility.

Sylvania was acquired by General Telephone and Electric (GTE) in 1959, and the facility was then used for equipment development and quartz glass manufacturing as part of GTE’s lighting and fluorescent manufacturing according to the Boston Globe. It is unknown if fluorescent light bulbs were produced at the facility but, if so, fluorescent lights can contain small amounts of mercury which could have possibility impacted sediment quality. Finally, in 1982, the Town of Ipswich purchased the dam from Sylvania, and the remaining buildings of the Ipswich Mills were sold to EBSCO Publishing in 1995.

Consequently, the historic mills and industrial land use surrounding the Subject Properties suggests the potential for asbestos, polychlorinated biphenyls (PCBs), metals, semi-volatile organic compounds (SVOCs), and volatile organic compounds (VOCs) to impact sediment quality. Additionally, railroad ties surrounding the property also suggest the potential for pesticides, herbicides, creosote, and metal contributions to sediments. While no known explosives production occurred at the facility, potential explosives-related metals and perchlorate contaminants to impact sediments were also included in the evaluation of sediment sampling parameters discussed in the Sediment Sampling Plan section of this document below.

2.2. Ipswich Mills Dam Structure

In 1908, the dam was modified to its current structural design to supply nearby mill buildings (at the time) with a more reliable source of power. The current dam is constructed out of cut granite blocks with concrete at some locations, with the spillway extending across most of the width of the river. The main spillway is 132 feet wide. A three-foot-wide low-level stop-log spillway is at the river-right end of the main spillway with an invert elevation approximately 0.4 feet lower than the spillway. Further to the right, the dam also has a 4.5-foot-wide by 3-foot-high low level gated outlet with an invert elevation approximately two feet lower than the main spillway. Further still to the right is a functional fish way that was installed in 1996 (IRWA). Furthest to the right is an abandoned fish ladder of older construction (Haley & Aldrich, 2009). According to the most recent dam inspection report (Tetra Tech, 2020), the dam is currently classified by the Office of Dam Safety (ODS) as an Intermediate dam with Significant Hazard Potential, meaning that failure would cause minimal property damage and loss of life if the failure occurred without warning with people present in the flow path.

A run of the river dam provides minimal storage above it and is operated such that the volume of water released below the dam is equal to the volume of water flowing in the stream or river above the dam on a normal, continuous basis. Put another way, water is not stored in the impoundment to be released later. Rather, the dam simply increases the head in the river, providing a potential power source that can be captured. It does not serve to prevent or mitigate flooding downstream of the dam since it allows water to flow over the dam during most typical flows. The dam receives river flow contributions from a 148 square-mile watershed upstream of the dam that is made up of primarily forested land, wetland areas, residential properties, agricultural land, and some commercial/industrial zones. The soils in the watershed primarily include somewhat excessively or excessively drained, loamy and sandy soils that were formed in outwash deposits and well drained, loamy soils formed in glacial till (Fuller and Francis, 1984). The river flows nearly 40 miles from its headwaters in Wilmington and North Andover to its mouth in Plum Island Sound, dropping approximately 115 feet in elevation along its course.

The Ipswich Mills Dam is located at the head of tide (upstream limit of tidal influence) roughly 3.7 miles from the Ipswich River's mouth. In addition to limiting many migratory fish species from moving upstream into the watershed to spawn or feed, the dam also presents a problem to freshwater resident species that pass over the dam for one reason or another, including many freshwater fish, turtles and other species that cannot survive long-term below the dam or simply die due to hitting rocks when they fall over the dam. With the exception of wildlife that are strong swimmers or good climbers many of these animals are likely to be permanently trapped below the dam.

Based on historical records and anecdotal observations reported during low flow conditions, it is generally believed that the dam was constructed on top of or at the toe of a rock ledge outcrop that created the Upper Falls. The extent of that ledge is yet to be determined. Normal or low water surface elevations under a dam removal scenario will be partially influenced by the extent and elevation of ledge present, as well as the prevailing profile of hard bottom substrate from upstream to downstream, and the prevailing hydrologic and tidal conditions at any given time.

2.3. Historical Records Research

Horsley Witten completed a review of historical topographical maps, Sanborn Fire Insurance maps, and historical aerial photographs available online from the EDR™ Report, published by Environmental Data Resources Inc. A copy of the EDR Report dated January 9-11, 2024, including aerials, topography, and Sanborn maps is attached herein as Appendix A. Additionally, a screening of regulatory records for environmental conditions at and abutting the Subject Property from online available MassDEP records and from the EDR Radius Map™ Report, published by EDR. Information obtained from these records is summarized below.

Aerial Photographs

Aerial Photographs dated 1938, 1952, 1960, 1965, 1978, 1986, 1995, 2006, 2010, 2014, and 2018 were reviewed. The aerial photographs show primarily industrial and residential land use with some wooded areas in the vicinity of the Subject Property. The area immediately adjacent to the dam is developed, and the 2006 through 2018 photographs illustrate the Riverwalk Pedestrian Bridge. Union Street, Estes Street, and South Main Street are depicted in all available aerials as well as the Ipswich River and the active railroad is shown west of the river. However, due to the scale and quality of the aerial photography, additional details regarding the Subject Property are not discernible.

USGS Topographic Maps

USGS Topographic maps dated 1888, 1893, 1915, 1919, 1943, 1945, 1950, 1966, 1985, 1997, 2012, 2015, 2018, and 2021 were reviewed. The available maps depict the properties surrounding the river as primarily developed; however, details of that development are not discernible. A railroad is depicted west of the dam and Ipswich River. The topographic maps illustrate Union Street, Estes Street, South Main Street, and the Ipswich River. The 1945 through 2021 maps depict the developed dam across the Ipswich River.

Sanborn Fire Insurance Maps

Sanborn Fire Insurance maps dated 1887, 1892, 1897, 1902, 1907, 1916, 1929, 1944, and 1961 were reviewed. Multiple Sanborn Fire Insurance Maps for the Ipswich River, Ipswich Mills Dam, and surrounding properties exist upstream and abutting the Dam property. Notable details of the various Sanborn maps reviewed include the following:

- The Boston & Maine Railroad is depicted west of the Ipswich River on various maps. The train platform is depicted southwest of the Ipswich dam. Contaminants of concern include herbicides, which were typically applied to railroad right of ways, and creosote and metals for wood preservative purposes, both which rail ties are known to contain.
- A Knitting Mill Steam Laundry included in the 1897 map located near First Street and Ipswich River.
- The 1916 through 1961 maps show South Cemetery on the eastern side of River.
- Hayward Hosiery Co Manufacturing Silt Stockings is depicted across the railroad near Hayward Street.
- Ipswich Mills Manufacturers Cotton Hosiery is illustrated on western bank of River from circa 1887 to circa 1929.
- In the 1961 map, a dry cleaner is shown just north of Ipswich Mill building on the western side of the river.
- Sylvania Manufacturers is depicted on the 1944 map.
- Within the 1916 map to circa 1944, a garage/autobody existed along the eastern bank of the river, upstream of the dam.
- Depicted on the 1961 map is a US Army reserve building on the eastern side of the river along with an autobody and sales building.

A copy of the EDR Report dated January 9-11, 2024, including aerials, topography, and Sanborn maps is included herein as Appendix A.

Historical Photographs

Historical photographs available online of the Ipswich Mills Dam and the former nearby factories were reviewed.

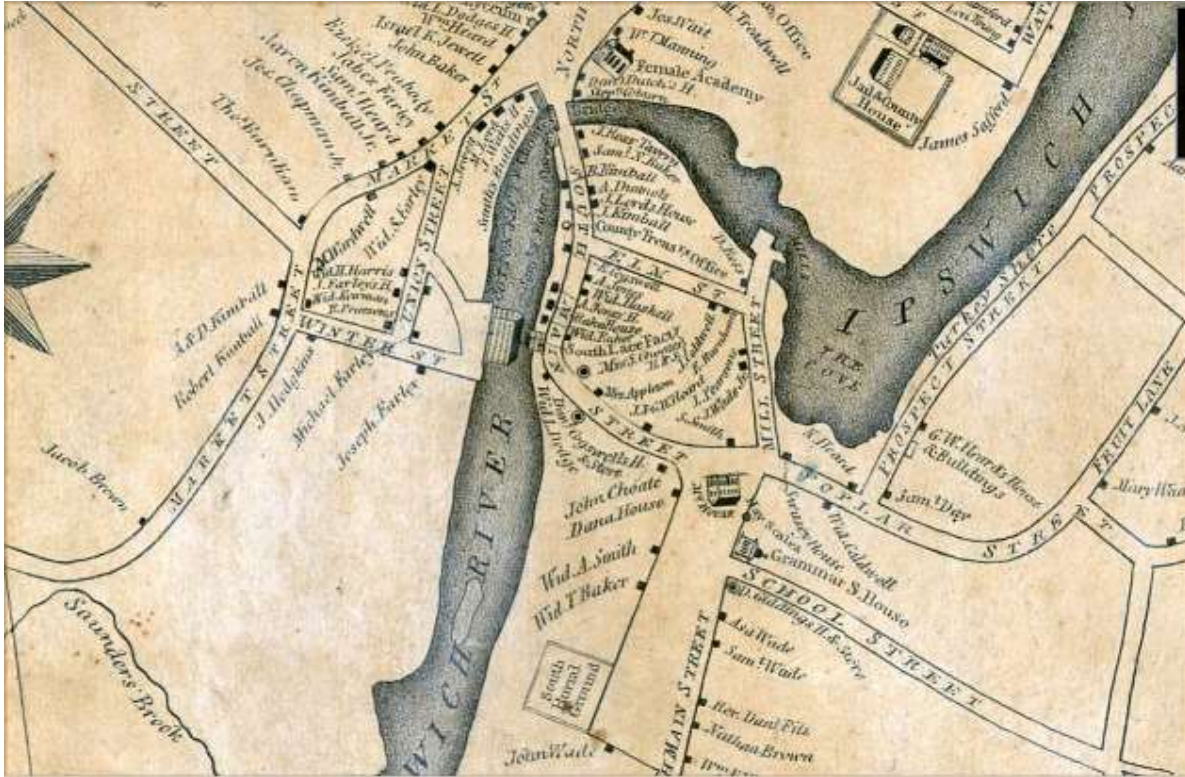


Photo 1: 1832 Ipswich Map – Map shows the stone cotton mill on the left of the lace factory on the right.

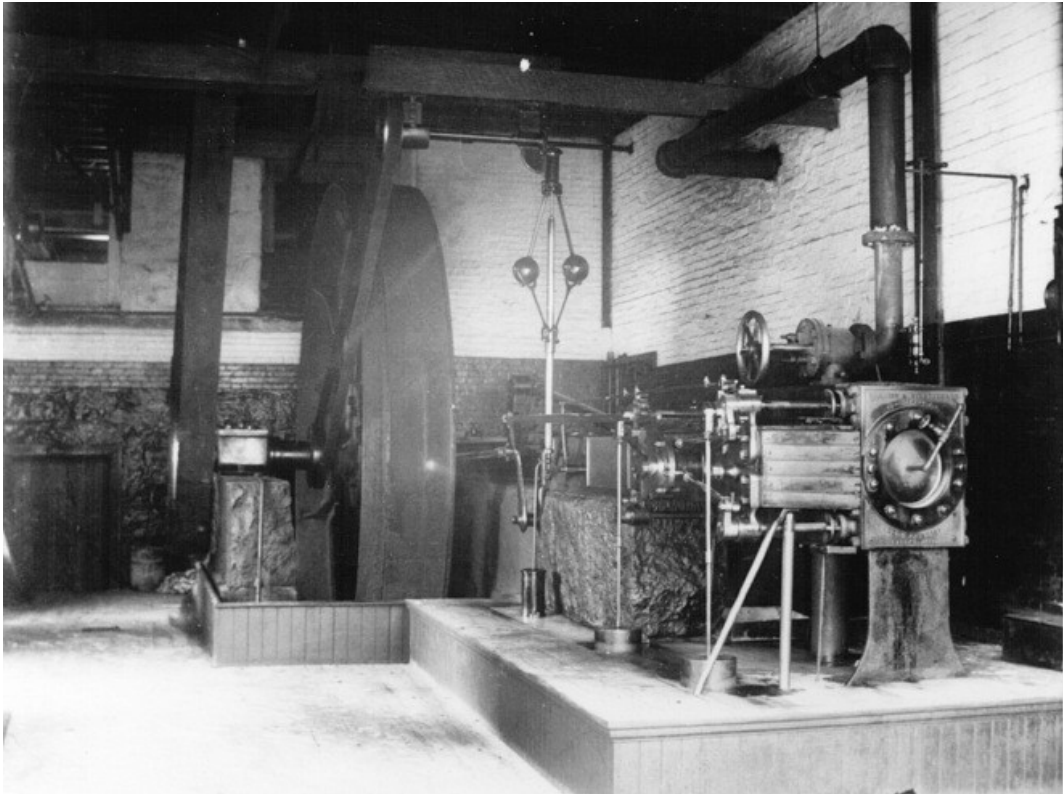


Photo 2: Water-powered machinery in the Ipswich mill. Undated photograph.



Photo 3: Ipswich Mills – View of the Mill just upstream of the dam and former pedestrian bridge circa early 20th century. The shorter building in foreground is the current EBSCO facility. The larger building no longer exists.

2.4. Ipswich Mills Dam Partial Feasibility Study, April 2014

In April 2014, Horsley Witten in collaboration with Clean Soils Environmental, Ltd, Inter-Fluve, Inc., Roux Associates, Inc. and the Ipswich River Watershed with assistance from Massachusetts Division of Ecological Restoration (DER) completed a Partial Feasibility Study of the Ipswich Mills Dam.

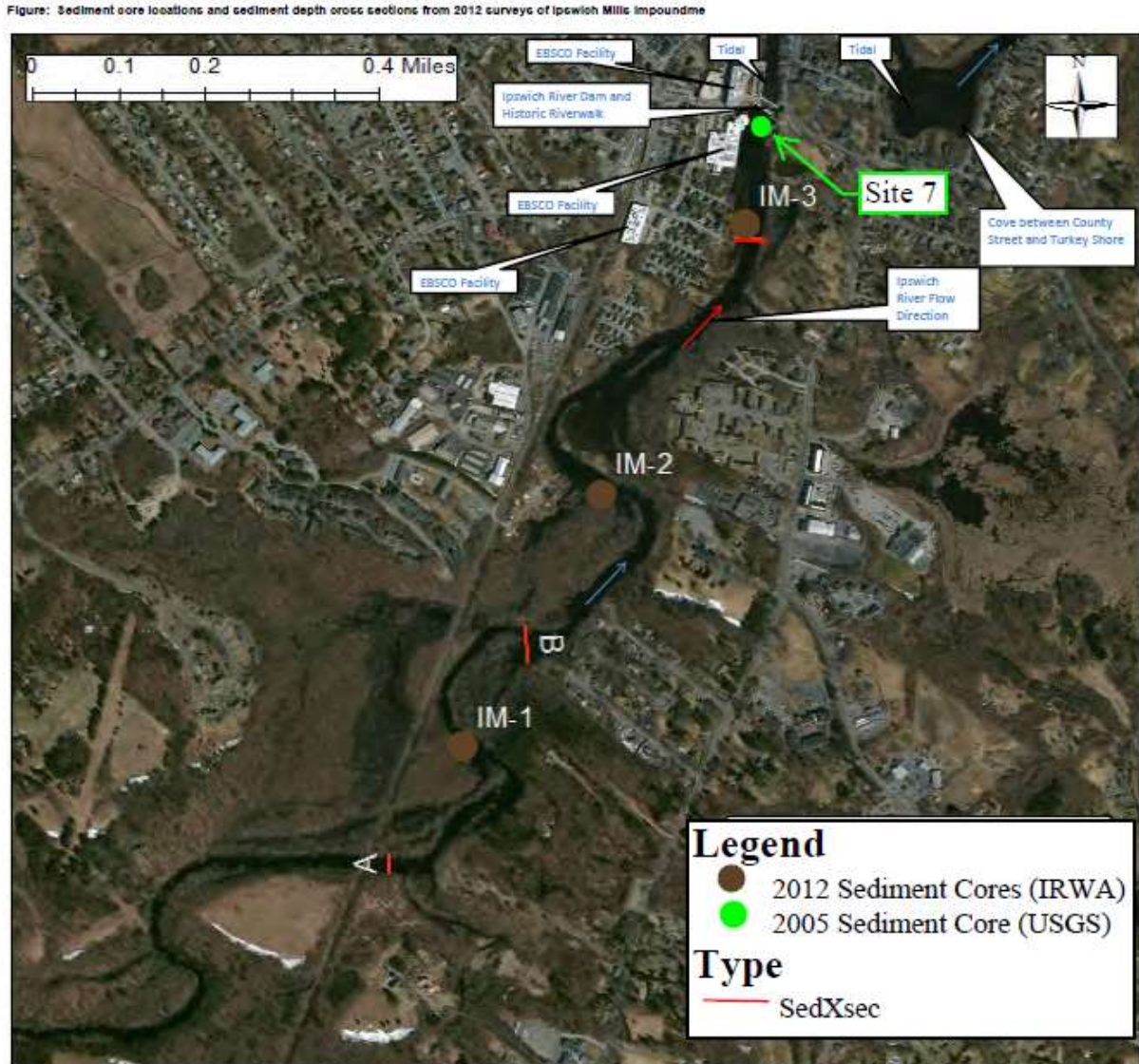
Included in the Partial Feasibility Study was a Sediment Management Preliminary Review completed by Clean Soils Environmental, Ltd. (CLE). CLE collected three (3) sediment cores along the Ipswich River in 2012. These samples were compared to USGS sediment cores collected in 2005 as part of a baseline study for selected dams in Massachusetts.

The USGS study included the collection of two sediment cores in close proximity to the Ipswich Mills impoundment. The sample was analyzed for Total Heavy Metals, Semi-Volatile Organic Compounds (SVOCs), Polycyclic Aromatic Hydrocarbons (PAHs), and Total Polychlorinated Biphenyls (PCBs). This study concluded that there was a 13% likelihood of toxicity of bottom sediments at the Ipswich Mills Dam, and the sediment results were considered to be below the applicable ecological impact benchmark limits. A condition of No Significant Risk within the impoundment had been met, according to the study.

In 2012, the IRWA collected three (3) sediment cores from the impoundment and along the Ipswich River. These samples (IM-1, IM-2, and IM-3) were analyzed for Total Heavy Metals, SVOCs, PAHs, VOCs, EPH, and Physical Characteristics. The results of IRWA and CLE's study included concentrations that were below applicable ecological benchmark limits in reference to the freshwater Sediment Probable Effects

Concentration Values (PEC) as well as below the MassDEP MCP Method 1 Cleanup Standards and Reportable Conditions (S1/GW-1) standards.

The included Figure 2 below illustrates the USGS Sediment sample collected in 2005 as well as the three sediment samples collected by IRWA in 2012.



Prepared by the Ipswich River Watershed Association (IRWA) including notes from Clean Soils Environmental, Ltd. (CSE)

Figure 2. IRWA 2012 and USGS 2005 Sediment Sampling Locations

HW developed Table 1A summarizing previous sediment sampling results and included herein as Appendix B. Reference the above Figure 2 for sample locations from Table 1A.

2.5. Ipswich Mills Dam Full Feasibility Study, 2019

In 2019, HW completed a full Feasibility Study for the proposed dam removal that primarily focused on potential hydrologic and hydraulic impacts to infrastructure, fish passage, and recreation, as well as historic and cultural considerations. No new sediment sampling was conducted during this project phase. However, a partial drawdown of the impoundment was conducted in August and September for 2016 as part of that project phase that revealed the presence of an abandoned, underwater, natural gas line running across the river. According to IRWA and the Town of Ipswich, the gas company was contacted, and the gas line removed while the water levels were still low during the drawdown. Photos 4 and 5 show the gas line present, and then removed from that summer/fall 2016 time period.



Photo 4: August 2016 Drawdown – The Ipswich River was drawn down behind the dam to better assess conditions in the impoundment, and an old gas line for the mill was exposed.



Photo 5: August/ September 2016 drawdown showing gas line removed.

2.6. Identified Release Sites

To evaluate environmental conditions at and abutting the Subject Property, standard federal, and state environmental databases were reviewed. HW obtained these records from an Environmental Database Report (“EDR Report”). A copy of the EDR Report, dated January 9, 2024, is included as Appendix A. A summary of the standard federal and state databases reviewed in the EDR Report and located within a 1.0-mile radius of the Subject Property are indicated in Table 2.

Table 2 – Standard Environmental Records

Federal/State Records Database	Subject Property	Distance from Subject Property				
		<1/8 Mile	1/8 Mile	¼-1/2 Mile	½- 1 Mile	Total Sites
National Priority List Sites	No	0	0	0	0	0
Delisted National Priority List	No	0	0	0	0	0
Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLA-SEMS)	No	0	0	0	0	0
CERCLIS No Further Remedial Action Planed (SEMS-ARCHIVE)	No	0	0	0	0	0
Resource Conservation and Recovery Act (RCRA) Corrective Action Sites	No	0	0	0	0	0
RCRA Treatment, Storage and Disposal Sites	No	0	0	0	0	0
RCRA Generators	No	6	7	NR	NR	13
Institutional Control/Activity and Use Limitation Sites	No	0	0	0	0	0
State Hazardous Waste Sites	No	24	2	4	6	36
Landfills	No	0	0	0	0	0
Leaking Underground Storage Tank Sites	No	14	1	3	NR	18
Leaking Aboveground Storage Tank Sites	No	8	3	0	NR	11
Registered Underground Storage Tank Sites	No	11	0	NR	NR	11
Registered Aboveground Storage Tank Sites	No	5	0	NR	NR	5
Brownfield Sites	No	0	0	0	0	0

Figure 3 below illustrates the standard federal and state databases reviewed in the EDR Report within a 1-mile radius of the Ipswich Mills Dam. Per the EDR legend, red triangles indicate sites at elevations higher than or equal to the target property and black diamonds indicate sites at elevations lower than the target property. However, since the target property dam is likely the lowest elevation from that part of the river upstream, the accuracy of the elevation designations of Figure 3 is uncertain.

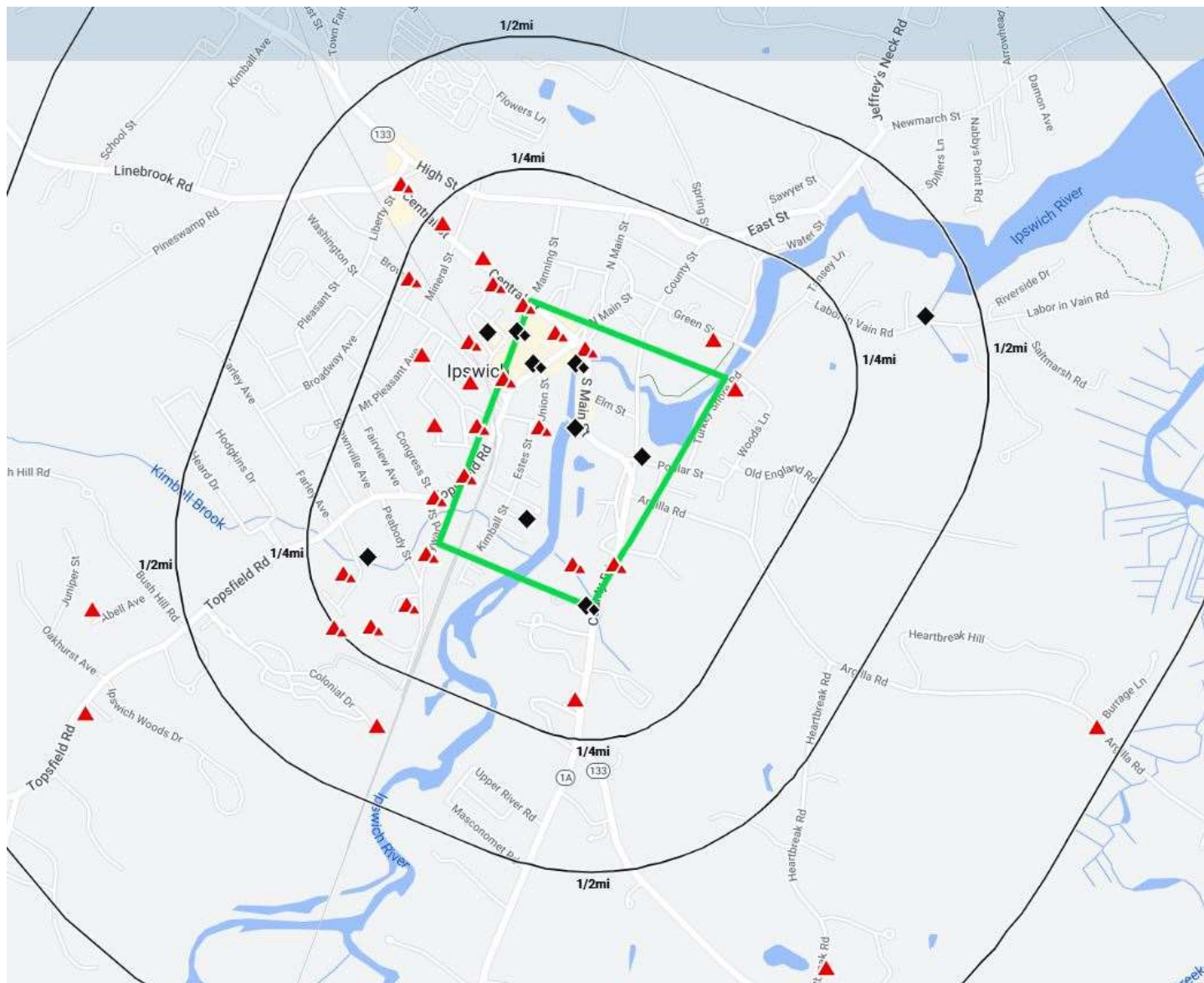


Figure 3. EDR Radius Map

HW utilized the historical information along with a review of regulatory records for environmental conditions at and abutting the Subject Property from the EDR Radius Map™ Report, published by Environmental Data Resources Inc. (“EDR”) as well as online records available from the Massachusetts Department of Environmental Protection (MassDEP) Waste Site and Reportable Releases Database to determine and research known “Release Sites” at and abutting the Subject Properties. According to the EDR Report, 36 release sites with documented releases of OHM were identified within a 1.0-mile radius of the Subject Property. Details regarding select release sites, mainly release sites that may impact the Ipswich River, are set forth below.

**Ipswich Mills Cofferd Dam
61 South Main Street**

**Release Tracking Number (RTN) 3-14628
approximately 26 feet upstream of Ipswich Mills Dam**

According to the Release Notification Form and Response Action Outcome (RAO) Statement prepared by Vertex Engineering Services, Inc. and dated January 17, 1997, a release of approximately 10 gallons of fuel oil occurred to the Ipswich River as a result of a failing fuel tank during de-watering for the construction of a cofferdam connected to the Ipswich Mills Dam. Response actions included the deployment of containment booms and absorbent pads as well as emptying the leaking tank. Impacted sandbags from the cofferdam were removed and additional absorbent materials were applied. Spent materials were removed off site for disposal in one 55-gallon drum. The Ipswich Fire Department reported that “most of the spill was contained in the cofferdam”. According to the RAO, a minimal amount of fuel had dripped from the cofferdam to the river, but the amount had been reduced to background levels as a result of the “turbulent flow of the river”. A condition of No Significant Risk had been established on site. Considering the release occurred immediately downstream of the dam and the extent of the release associated with RTN 3-14628, it is unlikely that this release will significantly impact the property.

**GTE Products
Este Street**

**Release Tracking Number (RTN) 3-2120
Subject Property (located northwest of Dam)**

According to the report titled *Phase 2 Remedial Environmental Site Assessment* prepared by Briggs Associates, Inc. and dated June 17, 1988, and the letter report prepared by GEI Consultants, Inc. and dated July 18, 1994, a release of fuel oil occurred from a leaking fuel oil tank. Response actions included excavation of contaminated soils for disposal and the installation of a recovery well. The excavation grave was backfilled with shells to allow drainage of remaining oil to recovery wells. No groundwater was encountered during excavation. A total of 429 cubic yards of petroleum-contaminated soil and approximately 47,950 gallons of petroleum-contaminated water was removed and disposed of off-site. Groundwater monitoring wells were advanced and monitored at the property as well. While total petroleum hydrocarbons (TPH) and Volatile Organic Compounds (VOCs) were detected in two of the monitoring wells, the concentrations detected were below their applicable reportable concentrations. Additionally, according to the letter report and License Site Professional Evaluation Opinion prepared by GZA and dated May 31, 1995, a Method 1 Risk Characterization concluded that the release posed no significant risk of harm to human health, public safety, and welfare or the environment. Considering the release is located downstream/northwest of the Ipswich Dam and considering groundwater flow, it is unlikely that the release associated with RTN 3-2120 will significantly impact the property.

**Osram Sylvania
2 Estes Street**

This property is listed under EDR’s RCRA NonGen/NLR Listing with a waste description regarding halogenated solvents used in decreasing including Tetrachloroethylene, Trichlorethylene, Methylene Chloride, 1,1,1-Trichloroethane, Carbon Tetrachloride, and Chlorinated Fluorocarbons.

This property is also listed in EDR’s FINDS (Facility Index System) which is a central and common inventory of facilities monitored or regulated by the EPA. Osram Sylvania is currently listed in the following EPA inventory:

- **The Air Facility System (AFS)** – “contains compliance and permit data for stationary sources of air pollution regulated by the EPA, state, and local air pollution agencies.” **This listing is in compliance and has been permanent closure.**

- **ICIS-Air (AIR) AIR** – “the modernization of the Air Facility System (AFS) into the Integrated Compliance Information System (ICIS). AIR contains enforcement, compliance, and permit data for stationary sources of air pollution regulated by the EPA, State, and Local air pollution agencies.” **This listing has been Permanently Closed.**
- The **Toxic Release Inventory System (TRIS)** – “a publicly available EPA database reported annually by certain covered industry groups, as well as federal facilities. It contains information about more than 650 toxic chemicals that are being used, manufactured, treated, transported, or released into the environment, and includes information about waste management and pollution prevention activities.” **This listing was last reported for 1994.**
- The **Massachusetts - Environmental Protection Integrated Computer System (MA-EPICS)** – “the central repository for all environmental protection data for the State of Massachusetts.”
- The **Resource Conservation and Recovery Act Information System (RCRAInfo)** – “EPA’s comprehensive information system in support of the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. It tracks many types of information about generators, transporters, treaters, storers, and disposers of hazardous waste.” **This listing is currently Inactive.**

These databases primarily are in regard to the property’s former industrial use and manufacturing of lighting glassware including descriptions of electric lamp bulb and part manufacturing as well as other pressed and blown glass and glassware manufacturing.

No Location Aid
10 Estes Street

Release Tracking Number (RTN) 3-34967
approximately 218 feet west of the Ipswich River
approximately 427 feet southwest (upstream) of the Dam

According to the report titled *Permanent Solution Statement with No Conditions* prepared by Clean Soils Environmental Ltd and dated July 16, 2018, a release of approximately 30 gallons of hydraulic fluid from a trash truck hydraulic line occurred to pavement, storm drain catch basins, and pervious soils nearby. Response actions included the deployment of absorbent materials, cleanout of two affected catch basins via a vacuum truck, and the installation of absorbent booms into the catch basins. One catch basin, CB-2, has an outlet to the Ipswich River. However, there were no visual observations of the release affecting the river. Additional response actions including soil excavation and sampling from the excavation grave. Eleven 55-gallon drums of spent material and 365 gallons of oily solids were managed and disposed of offsite. Groundwater was not encountered during excavation. Based on a Method 1 Risk Characterization and laboratory results, the post excavation soil samples were below applicable standards and a condition of No Significant Risk existed at the property. Considering the extent of release and groundwater was not encountered, it is unlikely that the release associated with RTN 3-34967 will significantly impact the property.

No Location Aid
12 First Street

Release Tracking Number (RTN) 3-25387
approximately 226 feet west of the Ipswich River
approximately 1,066 feet southwest (upstream) of the Dam

According to the report titled *Class A-1 Response Action Outcome Statement* prepared by CEA, Inc. and dated January 2006, a release of approximately 10-20 gallons of hydraulic oil was released from a hydraulic line of a truck to the paved roadway and pervious shoulder. Response actions included the application of absorbent material and excavation of impacted soils. Six 55-gallon drums of spent material and soil were transported off site for disposal. Groundwater did not appear to be impacted during this

release. Soil samples were collected from the final excavation grave areas, and based on a Method 1 Risk Characterization and exposure point concentration calculation, a condition of No Significant Risk had been achieved. Considering the extent of release and groundwater was not encountered, it is unlikely that the release associated with RTN 3-25387 will significantly impact the property.

**Ipswich Shellfish Co. Inc.
8 Hayward Street**

**Release Tracking Number (RTN) 3-12119
approximately adjacent to Kimball Brook
approximately 1,734 feet southwest (upstream) of Dam**

According to the letter report in response to an Immediate Response Action (IRA) Completion Statement for Hayward Street prepared by Ransom Environmental Consultants, Inc. and dated May 30, 1995, a release of approximately 50 gallons of diesel fuel from a truck occurred to a parking area. Response actions included the application of speedi-dry, absorbent materials, and soil. The spill had been contained to the concrete area, and while soil and pervious surfaces existed nearby, it was determined that the spill had been contained. A total of 14.21 tons of spent material and impacted soil that was used to contain the spill was hauled off site for disposal. Groundwater was not impacted. The response Action Outcome and IRA concluded that a condition of No Significant Risk had been achieved. Considering the extent of the release and that groundwater was not impacted, the release associated with RTN 3-12119 is unlikely to significantly impact the Subject Property.

**Arvos Mobil
18 Topsfield Road**

**Release Tracking Number (RTN) 3-10291
approximately 100 feet north of Kimball Brook
approximately 1,511 feet southwest (upstream) of Dam**

According to the report titled *Class A-2 Response Action Outcome Statement* prepared by Corporate Environmental Advisors, Inc. and dated February 2009, a release of organic vapors was discovered in a residence and in sewer drain manhole at an adjacent property. Additionally, water was encountered in a gasoline USTs and a sheen was observed in the Kimball Brook. Response actions included the removal and replacement of two 6,000-gallon gasoline USTs, the removal of a 500-gallon UST and a 200-gallon waste oil UST, excavation of approximately 170 cubic yards of petroleum-impacted soil, and excavation of a groundwater interceptor trench that was equipped with a passive free-phase product recovery system to capture product before entering Kimball Brook. Groundwater flow was inferred to move in a southerly direction toward Kimball Brook. Additionally, soil samples, groundwater samples, surface water samples, and air quality readings were collected as part of the Phase I and Phase II investigations. Sediment samples were collected within Kimball Brook for the presence of lead and Total Organic Carbon (TOC). These sediment samples were collected to determine if the impact of the release extended greater than halfway across Kimball Brook. Two sediment samples collected adjacent to the site had detections of lead greater than the Sediment Probable Effects Concentration Values (PEC) values. However, it was determined that these exceedances are isolated and have not migrated more than halfway across the brook. As a result of the release, the selected remedial action was Monitored Natural Attenuation (MNA) to allow the natural processes in degradation and dissipation. Based on a Method 3 Risk Characterization, groundwater was not deemed a direct concern for exposure and a condition of No Significant Risk had been achieved. Considering the extent of release, that groundwater was determined to not be a direct concern, and sediment contamination had been contained and unlikely to move further downstream, the release associated with RTN 3-10291 is unlikely to significantly impact the Subject Property.

**Okeefe Chevrolet Oldsmobile
96 County Road**

**Release Tracking Number (RTN) 3-862
approximately 265 feet north of Saltonstall Brook
approximately 1,648 feet southeast (upstream) of Dam**

According to the report, low level petroleum hydrocarbon contamination was released on site as a result of the nature of the property as an autobody and mobile business. Additionally, several underground storage tanks had been removed at the property. Response actions included surface soil samples, exploratory trenches, soil borings, and monitoring wells. Elevated levels of VOCs and PAHs were detected in soils. Groundwater samples were collected and analyzed for the presence of Benzene, Toluene, Ethylbenzene, and Xylene (BTEX). Contaminants of concern were not detected in groundwater nor were detected at concentrations below applicable standards. Groundwater was determined to flow in an easterly direction. Analytical testing of surface water deemed undetectable levels as well. Based on the Risk Characterization, it was determined that the site does not pose a risk to public safety, public welfare, and the environment. Considering the inferred groundwater flow direction, the release associated with RTN 3-862 is unlikely to significantly impact the Subject Property.

**Railroad Tracks
Topsfield Road**

**Release Tracking Number (RTN) 3-2316
approximately 145 west of Ipswich River
approximately 2,609 feet southwest (upstream) of Dam**

According to the report titled *Phase II Comprehensive Site Assessment and Response Action Outcome Statement* prepared by Weston and Sampson and dated December 2000, an investigation occurred to assess the nature and extent of OHM in subsurface soil and groundwater and impacts to the Ipswich River. The property had experienced various spills and releases over the years as a result of its industrial use for railroad activities, service, maintenance, and re-fueling activities. Known releases included the following:

- 1984 – a diesel spill onto railroad ballasts and materials beneath the rail ties. No further actions were included in DEP files.
- 1989 – an oil release between the wall and floor of a metal storage shed. Response actions included soil sampling, test pit advancement, and monitoring well installation. In-situ bioremediation was also deployed in 1991 as soil excavation and removal was not feasibility due to the close proximity to the active rail line. The in-situ remediation had resulted in a percent reduction in TPH concentrations from 24.2% to 99.9%.
- 1995 – a sheen was discovered in “Foley Brook,” the surface water body located nearby. Response actions included the collection of sediment samples and surface water samples. There was low concentrations of metals and petroleum detected in the sediment samples, and surface water sample concentrations were all below their respective detection limits. There was no evidence of a release to significantly impact the surface water.

The Phase II determined that the primary contaminant in soil on site was total petroleum hydrocarbons (TPH) as a result of these former releases. Response actions included soil sampling, monitoring well installation, piezometer installation, and sediment and surface water sampling. Groundwater was inferred to flow in an easterly direction toward the Ipswich River. Polycyclic Aromatic Hydrocarbons (PAHs) were detected near a storm water outfall pipe into the surface water body. Sediment samples were collected in the Ipswich River and had detections of VOCs (likely attributed to laboratory contaminants) and PAHs adjacent to the outfall.

Based on a combined Method 1 and Method 3 Risk Characterization as well as the calculation of exposure point concentrations (EPCs) which were below the applicable Method 1 standards for soil and groundwater, a condition of No Significant Risk was determined to have been achieved. While the PAHs are generally immobile, there is the possibility this release associated with RTN 3-2316 may impact the sediments along the Ipswich River and Ipswich River Dam.

**Town of Ipswich
100 Country Road**

**Release Tracking Number (RTN) 3-17720
approximately 100 feet south of Saltonstall Brook
approximately 1,885 feet southeast (upstream) of Dam**

According to the report titled *Class A-3 Response Action Outcome and Immediate Response Action Completion Statement* prepared by Clean Soils Environmental, Ltd. and dated July 30, 1999, a release of unleaded gasoline was discovered during an underground storage tank (UST) removal. During removal, the tank grave was observed to be half full of groundwater with a petroleum sheen. The release was attributed to tank overfills over the years. Response actions included soil and groundwater samples from the tank grave. Contaminated soils were excavated and a total of 56.77 tons of soil was removed for disposal off site. Additional responses include the installation of soil borings and groundwater monitoring wells. Groundwater was inferred to flow in a southerly and easterly direction, seasonally dependent. Groundwater concentrations remained below the applicable reportable conditions. A Method 1 Risk Characterization determined a condition of No Significant Risk had been achieved; however, an Activity and Use Limitation (AUL) was required on site as exposure point concentrations exceeded the S1 Method 1 standards for unrestricted use. Considering the extent of release, the release associated with RTN 3-17720 is unlikely to significantly impact the Subject Property.

**No Location Aid
45-47 South Main Street**

**Release Tracking Number (RTN) 3-25904
approximately 316 feet north (upstream) of Dam**

According to the letter report in response to a Release Action Outcome (RAO) Statement for the property of 45-47 South Main Street and prepared by Ransom Environmental Consultants, Inc. a release of No. 2 fuel oil occurred as a result of the Ipswich River flooding consequently flooding a basement and submerged and released the contents of four 275-gallon ASTs. An estimated 400 gallons of No. 2 fuel oil was released. Response actions included skimming the recoverable oil off the surface water of the basement and deploying oil absorbent pads. A total of approximately 1,960-gallons of oily water were removed. In a small crawl space of the basement, an earthen floor was discovered, and soil samples were collected in this area. Contaminants of concerns for petroleum products were either not detected above their respective laboratory reporting limit or were detected in concentrations below applicable soil standards. As a majority of the release was contained the basement, Random concluded that groundwater had not been impacted. A Method 1 Risk Characterization determined that a condition of No Significant Risk had been achieved. Considering groundwater was not adversely impacted and the inferred groundwater flow, the release associated with RTN 3-25904 is unlikely to significantly impact the Subject Property.

3. SEDIMENT SAMPLING PLAN

Our proposed Sediment Sampling Plan relies on the Chapter 401 Water Quality Certification (401 WQC) regulations and the due diligence assessment of historic land uses surrounding and upstream of the dam to inform its selection of parameters. The number and location of samples to be collected is similarly informed by the 401 WQC regulations and the due diligence-identified land uses and oil and hazardous materials (OHM) spills. Proposed sampling locations are, however, also informed by the need to assess how existing sediment quality compares for the areas of the impoundment modeled to be potentially mobilized following dam removal as compared to upstream conditions and downstream conditions, where mobilized sediment may likely accumulate. Fundamentally, this Sampling Plan seeks to assess the quality of the potentially mobile sediment behind the dam as compared to upstream areas that will be unaffected by dam removal and downstream areas where the mobile sediment is likely to accumulate. There is up to 6,900 cubic yards of potentially mobile sediment within the impoundment.

3.1 Parameters to be Analyzed

Based on the above-discussed due diligence assessment, the Ipswich River project area, including the mainstream river and tributaries further upstream, has a long history of industrial land use for manufacturing. Former factories and sites include the Ipswich Manufacturing Company, Ipswich Hosiery Mills, Tanning Process Company – a subsidiary of the United Show Machinery Company, and Sylvania.

A railroad line also traverses near the left bank or westerly side of the river across the project area. The known contaminant source at the Ipswich Mills Building and the other historic mills and industrial land use more closely surrounding the Subject Properties suggests the potential for polychlorinated biphenyls (PCBs), metals, semi-volatile organic compounds (SVOCs), and volatile organic compounds (VOCs) to impact sediment quality. While there is no indication that Sylvania's use of the mill facility during World War II included munitions production, perchlorate is included as an analyte in this proposed sediment sampling in case explosives were produced there. Additionally, the former railroad line along the river left bank also suggests the potential for pesticides, herbicides, creosote, and metal contributions to sediments.

As such, HW suggests completing additional laboratory analysis beyond the typical 401 Water Quality Certification (WQC) Requirements (314 CMR 9.00). We suggest sampling for metals (the eight included on the 401 WQC list), VOCs, SVOCs (to take the place of PAHs from the 401 list and are included with the broader SVOC scan), perchlorate, and herbicides (in addition to the pesticides included on the 401 list). We also suggest to field screen the sediment for the presence of Total Organic Volatiles (TOV) using a calibrated Photoionization Detector (PID) in order to select those sample locations that most warrant VOC analysis (unlike other parameters, VOCs are not allowed to be composited for WQC from multiple locations).

Based upon the above-discussed due diligence review, and in consideration of the 401 Water Quality Certification requirements (314 CMR 9.00), the proposed sediment sampling plan for the Ipswich Mills Dam includes all of the standard 401 WQC parameters, plus adding the additional parameters for SVOCs, perchlorate, and herbicides, as follows:

- Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc);
- Volatile Organic Compounds (VOCs);
- Semi-Volatile Organic Compounds (SVOCs);

- Organochlorine Pesticides and Herbicides;
- Polychlorinated Biphenyls (PCBs) with congeners;
- Extractable Petroleum Hydrocarbons (EPH);
- Total Petroleum Hydrocarbons (TPH);
- Total Organic Carbon;
- Percent water; and
- Grain Size Distribution – wet sieve (ASTM D422).

In addition, Toxicity Characteristics Leaching Procedure (TCLP) analyses will be run for those parameters that are detected above the TCLP 20X rule relative to the standards from 40 CFR 261.24. It is anticipated, based on past sampling results from 2005 and 2012, that TCLP testing requirements will not be tripped. MassDEP will use the TCLP data as one tool to help evaluate whether or not sediment from the sites qualifies as hazardous waste and, therefore, how it could potentially be managed as part of a dam removal project.

3.2 Sampling Locations

Hydrologic and Hydraulic (H&H) Modeling completed during the dam removal project's assessment and design phase identified the areas in the impoundment upstream of the dam where sediment is likely to mobilize and downstream where mobilized sediment is likely to settle. Figure 4 (also depicted as Figure 20 from the figure's original location within the Project's Basis of Design report) below depicts existing and post-dam removal flow velocity conditions for the 2-year storm event. The 2-year event is the channel forming flow condition where the highest velocities tend to occur in the most spatially focused locations, encouraging erosion. Higher flow events tend to overtop channel banks and spread out over wider areas such that erosive velocities are lesser. On Figure 4, the yellow indicates areas where silt and finer sand size particles are likely to mobilize, and the red indicates areas where larger sand and gravel particles are likely to mobilize. As evident in Figure 4, sediment mobilization is anticipated over a broader area immediately upstream of the dam and is mostly confined to a narrower channel within the confines of the current impoundment further upstream.

Based on H&H modeling and understanding of tidal conditions downstream of the limits of the H&H model, Figure 5 below depicts areas where sediment mobilized from the impoundment post dam removal would be likely to accumulate. Shown in yellow is the stretch of river for approximately the first 1,000 feet below the dam characterized by dominantly riverine morphology and flow characteristics. It receives tidal influence but only at the higher end of the tidal range. This area has received a limited sediment supply due to the influence of the upstream dam and has a generally rocky substrate where mobile sand and gravel size particles could settle and accumulate between the larger rocks. The velocity conditions here are modeled to be high enough that finer sediment sizes would be unlikely to accumulate.

Shown in teal is the cove area below the lower falls and the County Street bridge which is expected to be the primary depositional area for mobile sediment as it is the first area below the dam where the river morphology widens and deepens resulting in lower velocities. With its low elevation beneath the lower falls it is also the first river location downstream of the dam receiving nearly full tidal fluctuation. Tidal influence will tend to redistribute sediment that initially settles here over a larger area over time.

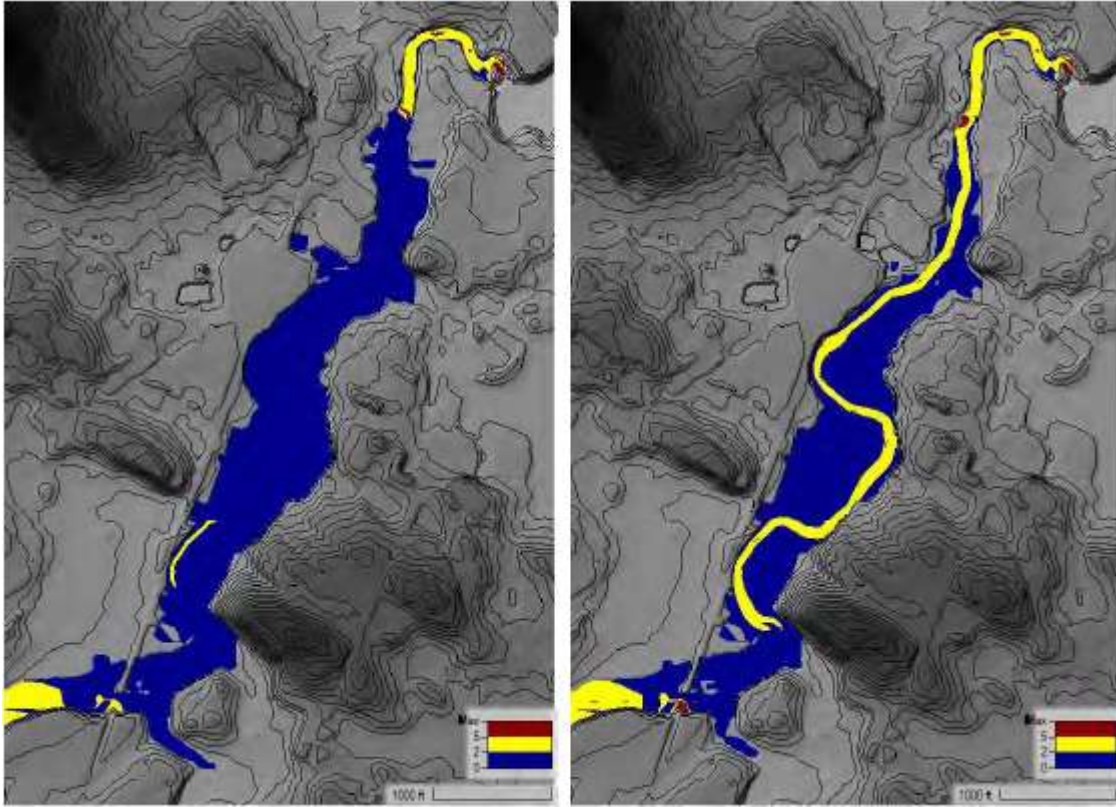


Figure 4. Anticipated Sediment Transport Areas from H&H Modeling

Blue: no sediment transport expected (0-2fps)

Yellow: transport of silt is feasible (2-5 fps)

Maroon: transport of silt, sand, and gravel is feasible (5 fps or greater)

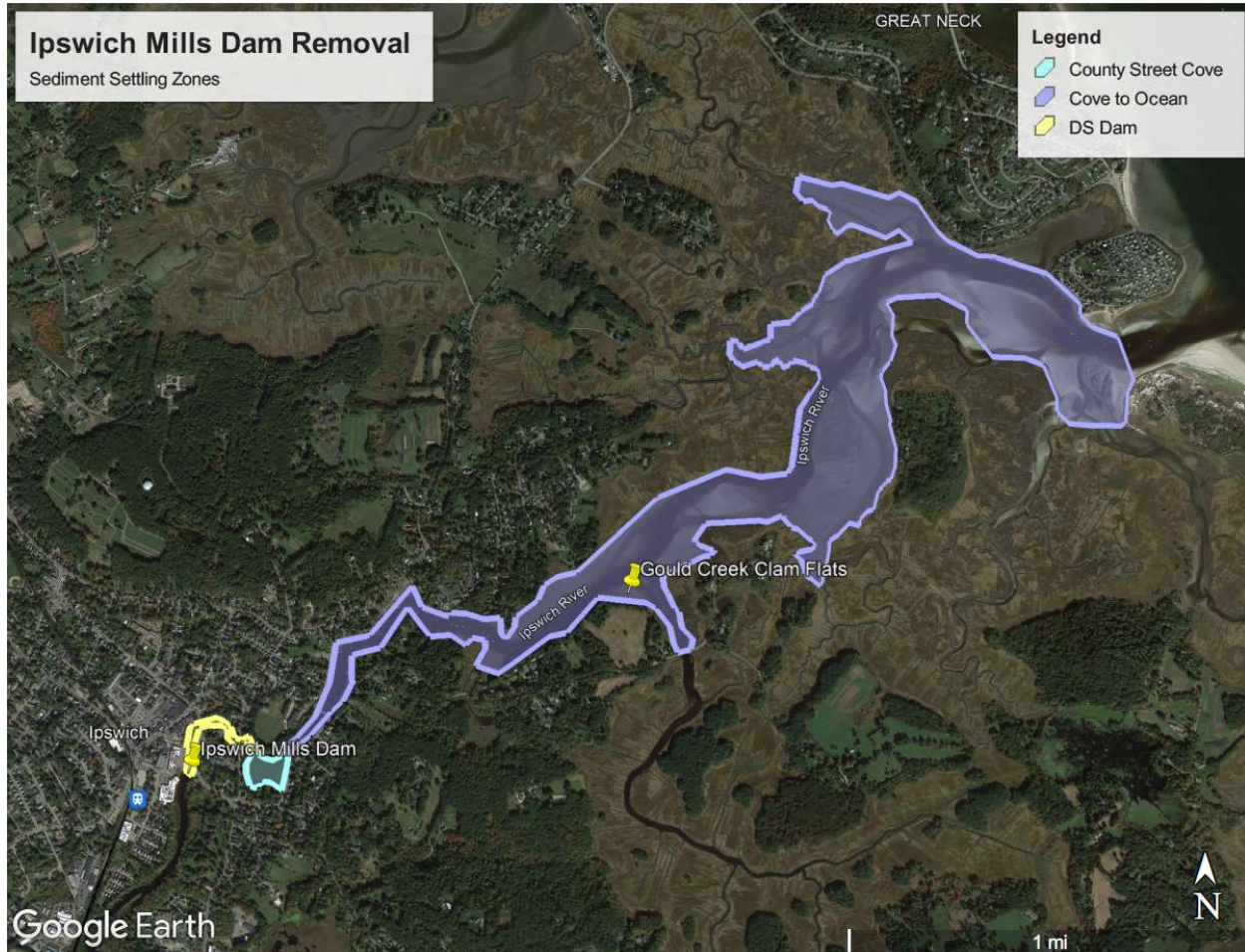


Figure 5. Anticipated Sediment Settling Areas

Shown in purple is the large estuarine salt marsh area at the mouth of the river before it enters Plum Island Sound. This purple-colored area is approximately 300 acres within the estuary’s banks. During higher astronomical tides, when the water floods over the salt marsh plain, the receiving area is likely an order of magnitude larger. Ocean influence on this area for both water and sediment dynamics greatly exceed freshwater riverine influences. Any sediment mobilized to this area as a result of dam removal will be redistributed over the large area relatively quickly under the dominant influence of oceanic dynamics.

Another concept utilized in our selection of upstream sampling locations, given the very long length of the impoundment, is to use the confluences of tributary streams to break the impounded stretch of mainstream river into “reaches” each to be characterized by three discrete sample locations combined into a single composite laboratory sample submittal. Paying attention to these tributary confluences also helps to identify any potential sediment quality concerns in the mobile sediment portions of the mainstem river that may have originated from contaminant sources on the tributaries, as the due diligence assessment indicated.

Based on the above discussion outlining the philosophy behind sampling location selection, the sampling plan includes submitting 11 composite (VOCs will not be composited) sediment samples for laboratory analysis. Each composite will consist of three discrete grab samples. Therefore, a total of 33 individual grab samples are recommended for collection.

Figures 6 and 7 depict the recommended upstream and downstream sampling locations, respectively, with color coding to show the approximate locations of discrete grabs to be composited into each laboratory-submitted sample. The recommended sediment sampling locations, listed from upstream to downstream are as follows:

- One composite sample (white dots on Figure 6) from approximately 1.5 miles upstream of the dam (above the railroad bridge). This sample will represent upstream background conditions beyond the extent of hydraulic or sediment impacts anticipated to occur as a result of dam removal.
- One composite sample (purple dots on Figure 6) from approximately 1.20 – 1.30 miles upstream of the dam representing the river reach at the Miles River confluence and below the MBTA Railroad bridge influence upstream.
- One composite sample (dark blue dots on Figure 6) from approximately 0.95 – 1.05 miles upstream of the dam representing the river reach adjacent to the next MBTA Railroad influence.
- One composite sample (light blue dots on Figure 6) from approximately 0.70 – 0.80 miles upstream of the dam representing the river reach between Kimball Brook and the MBTA Railroad.
- One composite sample (light green dots on Figure 6) from approximately 0.45 – 0.55 miles upstream of the dam representing the river reach between Saltonstall Brook and Kimball Brook.
- One composite sample (yellow dots on Figure 6) from approximately 0.25 miles upstream of the dam representing the river reach between the broader section of the dam impoundment and Kimball Brook.
- One composite sample (orange dots on Figure 6) from approximately 200-1,000 feet upstream of the dam representing the wider impounded river reach relatively close to the dam where significant mobilization is anticipated.
- One composite sample (red dots on Figure 6) from immediately upstream of the dam where significant mobilization is anticipated.
- One composite sample (pink dots on Figure 7) from the first 1,000 feet downstream of the dam representing the yellow depositional area from Figure 5.
- One composite sample (light green dots on Figure 7) approximately 1,500-2,000 feet downstream of the dam representing the teal depositional area in the cove below the lower falls from Figure 5.
- One composite sample (orange dots on Figure 7) from approximately 1-3 miles downstream of the dam representing the purple salt marsh depositional area from Figure 5.

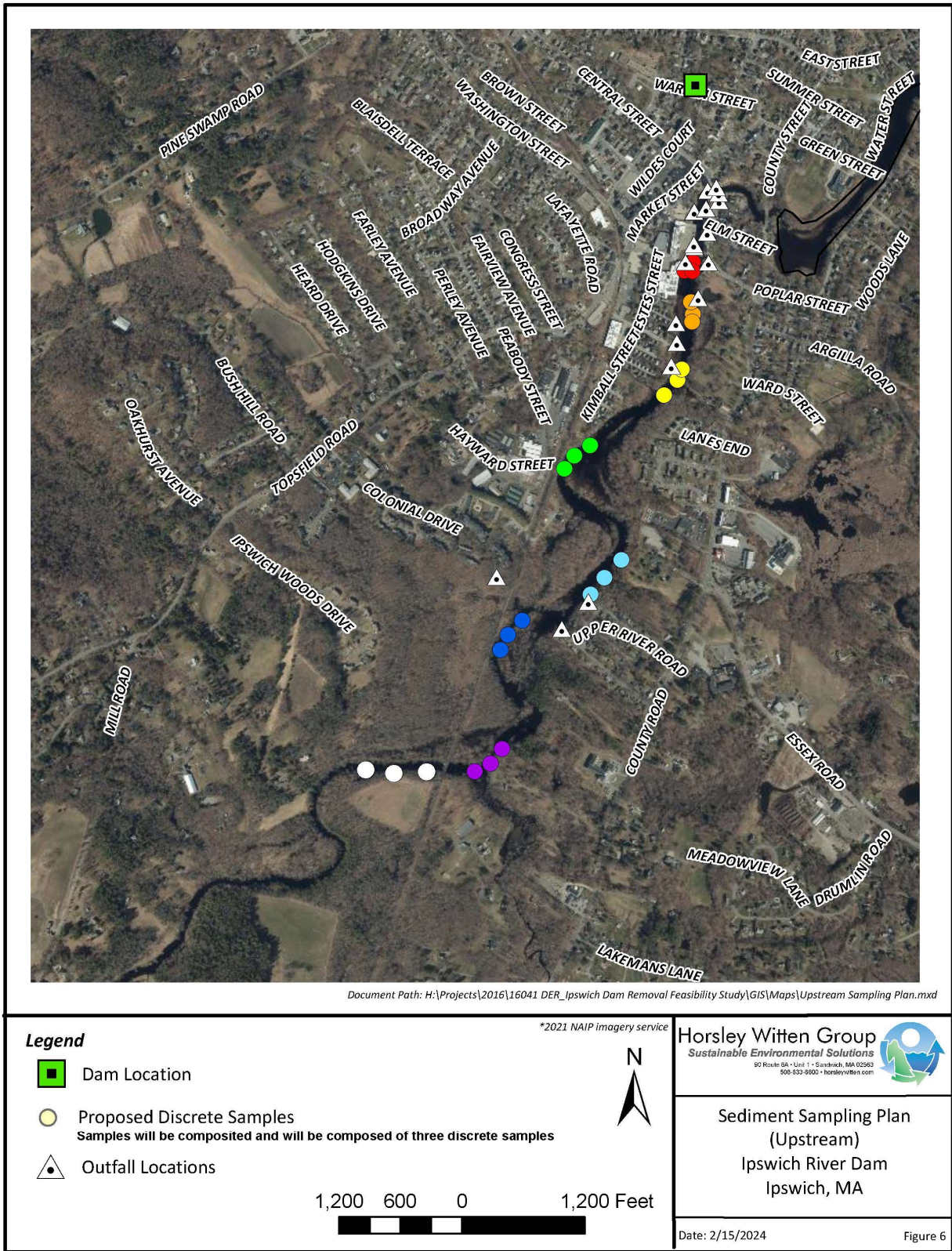


Figure 6. Upstream Sampling Locations

Due Diligence Review
Ipswich Mills Dam
Ipswich River, Ipswich, MA

Horsley Witten Group, Inc.
February 2024

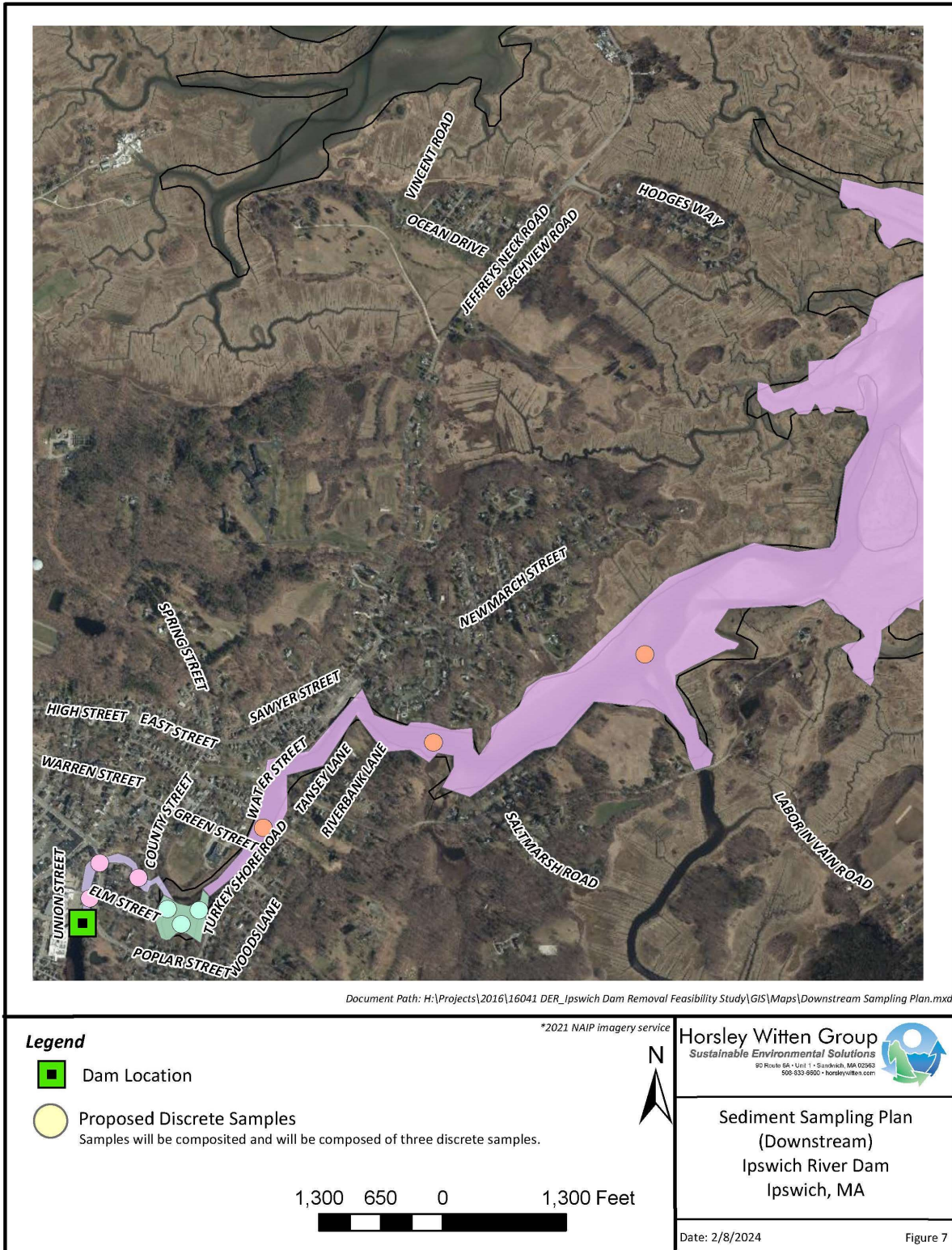


Figure 7. Downstream Sampling Locations

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