AREA WIDE ASSESSMENT
BAY STREET AREA

FINAL REPORT

ST. JOHNSBURY, VERMONT
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EXECUTIVE SUMMARY

Stone Environmental, Inc. (Stone) was retained by the Vermont Department of Environmental Conservation (VT DEC) to perform an Area-Wide Assessment (AWA) of the Bay Street Project Area in St. Johnsbury, Vermont (Project Area or Site) utilizing funds provided through a Technical Assistance Grant from United States Environmental Protection Agency (US EPA). The overall objective of the AWA was to provide a preliminary evaluation of environmental conditions and potential environmental concerns within the assessment area. To complete this objective, Stone reviewed pertinent historical documents, published geologic literature, Town of St. Johnsbury records, archives from the St. Johnsbury Athenaeum and Fairbanks Museum, Federal and State environmental databases, and VT DEC files for known hazardous waste sites in the vicinity.

Past commercial and industrial enterprises within and adjacent to the Project Area have included bulk fuel storage, a rail yard with turn table, engine house, and ancillary support, a manufactured gas plant, gasoline retailers, automotive service stations, dry cleaners, wood preservation, two grain elevators, bulk coal storage, print shops, hat makers, dentists, photographers, machinists, an electrical utility power station, and several lumber yards. Manufacturing within the area has included door and window sash manufacturing, and granite manufacturing. Given these historical uses, the receipt, distribution, storage, production and/or use of petroleum fuels and solvents, coal tar, chlorinated solvents, wood preservatives (pentachlorophenol, creosote, and arsenic), pesticides, polycyclic aromatic hydrocarbons and heavy metals may have resulted in releases to the environment in the vicinity of the Project Area, and constitute recognized environmental conditions (RECs).

Prior investigations of environmental sites within the Project Area, including the former Northern Petroleum properties, former Lewis Oil, Lewis-Sangravco, the former Ralston Purina Mill, Central Vermont Public Service (CVPS), and the St. Johnsbury Rail Yard, have demonstrated widespread petroleum contamination in soil and groundwater within the middle third of the Project Area. To date, however, the full extent of this contamination and its impact on sensitive receptors has not been adequately defined. Furthermore, prior investigations have not focused on other potential contaminants of concern (COCs) identified during this AWA.

Further investigation is necessary to assess the RECs and data gaps identified within the Project Area.

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1. INTRODUCTION

Stone Environmental, Inc. (Stone) was retained by the Vermont Department of Environmental Conservation (VT DEC) to perform an Area-Wide Assessment (AWA) of the Bay Street Project Area in St. Johnsbury, Vermont (Project Area or Site) utilizing funds provided through a Technical Assistance Grant from United States Environmental Protection Agency (US EPA) (Figures 1 and 2, Appendix A). The AWA was completed in accordance with Stone's proposal dated October 14, 2011, which was approved verbally by the VT DEC on October 18, 2011.

This AWA has drawn upon existing Phase I Environmental Site Assessments (ESA) within the Project Area, available historical documentation resources, environmental site reports for managed sites within and adjacent to the Project Area, and local knowledge to develop a Conceptual Site Model (CSM) of recognized environmental conditions (RECs) in the vicinity of the Project Area.

1.1. Objective

The overall objective of the AWA was to provide a preliminary evaluation of environmental conditions and potential environmental concerns within the assessment area. The Town of St. Johnsbury currently does not have a specific redevelopment plan for the Project Area, but has identified it as an area of potential growth. Recent initiatives for the Project Area include a large-scale retailer or a professional baseball park.

The AWA is intended to be used as the basis for follow up work within the Project Area, including the possible completion of Phase I ESAs for redevelopers and Phase II ESAs across the Project Area. As a stand-alone document, the AWA does not satisfy required criteria under the US EPA's All Appropriate Inquiry rule nor adhere to ASTM E 1527-05, the so-called Phase I ESA standard.

The information provided herein relies heavily on work performed by others and historical resources that are open to interpretation. Where relevant, Stone has interjected opinion of findings presented by others.

1.2. Project Area Description

The Town of St. Johnsbury is a population and economic hub of Vermont's "Northeast Kingdom". As the largest town (population ~7,500) in this rural three-county region, St. Johnsbury has been the historical center of industry and manufacturing since the 1800s.

The Bay Street Project Area encompasses 41 industrially-zoned privately- and state-owned properties (including a rail yard) along Bay Street southeast of downtown St. Johnsbury, Vermont. The extent of the AWA was defined by the Passumpsic River to the east, Railroad Street to the west in the northern portion, South Main Street to the west in the southern portion, and Portland Avenue (US Route 2) to the north. The Project Area extends southward to Interstate 91, where South Main Street comprises the western boundary. The Project Area is bisected along the north-south axis by a rail and Bay Street. The largest user of the Project Area is the State of Vermont, which owns the rail yard (56 acres).

The Project Area includes several operating commercial enterprises including, from north to south: St. Johnsbury Paper Company; TJ Mold Tool Company; Allen Lumber Company; the Central Vermont Public Service (CVPS) Bay Street Substation; Dead River Company, G&H Lubricants; Myers Rubbish Removal; tenants within former Ralston Purina Mill, B&W Mechanical; the St. Johnsbury Wastewater Treatment Facility; South Main Auto; and the Irwin slaughterhouse on Mallory St. Figure 2 (Appendix A) presents the Project Area with parcel owners. Residential properties can be found along South Main Street, on Mallory Street, and on the western side of Railroad Street.

Surface finishes of the Project Area are generally asphalt paved surrounding buildings; however, large expanses of scrub and grass are found throughout the Project Area, particularly in the southern half of the Site and along the Passumpsic River. The rail yard property is surfaced with gravel.

Utilities traversing the Project Area include sanitary sewer, stormwater, buried and overhead electrical and communications. Water and sewer within the Project Area are supplied by municipal utilities. The nearest water supply well is a domestic water supply well located over 1,200 feet east of the Project Area on the east side of the Passumpsic River. A right-of-way for a sanitary sewer main traverses the eastern Project Area starting at the northern end and terminating at the wastewater treatment facility.

Topography within the Project Area is terraced and generally at greater elevation in the northern third (in the area of Allen Lumber and the E.T. & H.K. Ide properties). Federal Emergency Management Agency (FEMA) flood plain mapping indicates that nearly all of the terrain south of the CVPS substation has a one percent chance of inundation, exceptions being the former Ralston Mill complex and the rail yard.

1.3. Scope of Work Performed

To achieve the objectives of the AWA, Stone reviewed the following resources:

1. Historical documentation made available from:
    a. commercial vendors,
    b. the Vermont State Library,
    c. the Vermont Historical Society,
    d. the University of Vermont
    e. the Saint Johnsbury Athenaeum, and
    f. the Fairbanks Museum;
2. The State of Vermont VT DEC Environmental Interest Locator;
3. Federal, State and Local environmental databases, as provided by Environmental Data Resources (EDR);
4. Hazardous Site File reviews from the VT DEC Sites Management Section; and
5. Phase I and II ESAs of properties within the Project Area provided by Northeastern Vermont Development Association (NVDA).
6. Act 250 Applications from the VT DEC Wastewater Division

In addition, Stone completed a Site reconnaissance and interviewed select property representatives, and interviewed the VT DEC Site Managers of hazardous waste sites in the vicinity of the Project Area.

2. HISTORICAL RECORDS REVIEW

Stone performed a comprehensive search of relevant historical references, including:

- Sanborn Fire Insurance Maps;
- historical topographic maps,

- Mannings City Directories;
- printed resources;
- historic photographs provided by the Town of St. Johnsbury and the Land Use Change Program at the University of Vermont; and
- documents provided by the St. Johnsbury Historical Society, the Vermont Historical Society, the Vermont State Library, the St. Johnsbury Athenaeum, the Fairbanks Museum, and several publically available sources online.

Appendix B contains a bibliography of sources used for the AWA.

2.1. Limitations

Mannings City Directory listings and Sanborn Fire Insurance Maps were interpreted by Stone to establish past commercial and industrial uses of properties within and adjacent to the Project Area. Due to the nature of these historic resources, errors may have occurred when locating historically-referenced features on the present-day map of the Project Area. In regards to Mannings Directories, which list occupants of each building along a particular street according to its historical street number which predate E911 addresses, Stone extrapolated between known benchmarks – typically intersections with cross streets. Stone maintains that the relative position of each business is correct, although the exact position of the listing for a given year may be off. For instance, the listing at 250 Railroad in the Mannings City Directory for 1920 is likely slightly different than where 250 North Main Street resides today. As appropriate and possible, Stone cross-referenced listings within the Mannings Directory with findings from Sanborn Fire Insurance Maps and other historic resources.

With respect to Sanborn Fire Insurance Maps, which indicate both street number for the given building for a given year and the aerial view floor plan for each building with its use, Stone interpreted where the feature would occur today based on the shape of the building, the street number and its position relative to consistent benchmarks. For buildings that have existed for a long period of time and are shown on several Sanborn maps, the location of the feature is likely accurate; however, for those historical features that are not present today, the relative positioning of a feature may be slightly off. Figures 3a through 3d include E911 street numbers for reference.

2.2. Sanborn and City Directories Review

Sanborn Fire Insurance Maps were available for 1884, 1889, 1900, 1905, 1912, 1927, 1943, 1958, and 1964. Properties considered for the historical Sanborn map review include those along Bay Street, the east and west sides of Railroad Street to Maple Street, Cross Street, Eastern Ave to Pearl Street, Pearl Street to street number 100, Depot Square, and Portland Street from Railroad Street to the Passumpsic River Bridge. Sanborn Maps are provided in Appendix C.

Stone performed a review of Mannings City Directories provided by the Vermont State Library for the years 1919, 1925, 1928, 1931, 1935, 1938, 1941, 1948, 1954, 1959, 1962, 1967, 1974, 1979, 1983, and of the Johnson City Directory for 1988, for the following streets:

- Railroad Street from the intersection with Pearl Street to the intersection with Maple Street;
- Bay Street;

- Cross Street from Railroad Street to Pearl Street;
- Eastern Ave from 70 to Railroad Street; and
- Portland Street from Railroad to the Passumpsic River.

Findings from the review of Sanborn Maps and City Directories are presented in tabular form in Table D1 of Appendix C. Table C1 also presents potential contaminants of concern (COCs) based on use and year of use based on professional knowledge of contaminant prominence for given industry types. For example, polychlorinated biphenyls (PCBs) are not considered contaminants of concern for painting facilities in the early 1900s, while they are in the 1970s when they were commonly added to paints.

Figures 3a through 3d of Appendix A present historical property uses that are considered to be RECs. For ease of presentation, historical uses are broken in to 25-year intervals. Each building footprint was given a unique GIS ID referencing the associated entry in the table at the bottom of each Figure. Historical structures that were found to not contain potential hazardous material based on use are not presented. When applicable, street numbers mentioned in the subsequent sections refer to the current-day numbering system. Descriptions of relevant map features for each year are provided below.

Sections 2.2.1 through 2.2.4, below, provide a narrative of historic property uses that are considered RECs based on review of the Sanborn Maps and City Directories. For ease of discussion, the Project Area was divided into six functional blocks as follows. These blocks are displayed on Figures 3a through 3d.

Table 1: Project Area Functional Blocks

Block	Description	Properties of Note
Mallory Street Block	Parcels within the Project Area south of the Sleeper River	South Main Auto Irwin Slaughterhouse
Ralston Block	Parcels within the Project Area north of the Sleeper River to rail yard.	Former Ralston Purina Mill Bay Street Properties Northern Petroleum Bulk and RPC Former Lewis Oil Lawrence Sangravco St. Johnsbury Wastewater Treatment Facility
Rail Yard Block	Includes Rail Yard, turn table and points east to River	Rail Yard CVPS
Ide Block	Parcels within the Project Area north of the Rail Yard	Allen Lumber E. T. and H.K. Ide St. Johnsbury Paper WSI KC Rentals
South Railroad St. Block	Parcels within the Project Area along eastern side of Railroad Street south of Depot Square. Parcels on western side of Railroad St also included.	Sanel Auto Parts Jiffy Mart Railroad Street Mobil Former St. Johnsbury Glovers
North Railroad Street Block	Parcels along Railroad Street north of and	Wards Block

	including Depot Square	Corner Service

2.3. Summary

In general terms, the Project Area has been in been in industrial use for every year available within the historic resources reviewed. Within the down town area and Railroad Street, past use has been predominantly commercial. The proximity of the commercial downtown and the industrial Bay Street area result in a strong link between the two functionally distinct zones.

Within the industrial Bay Street area, heavy reliance on the rail yard is obvious for every year reviewed. Keystone industries for the area – that have grown as a result of the rail - have included lumber, warehousing, grain milling and storage, stone manufacturing (both marble and granite), and petroleum storage and distribution. The current trend in industrial use of the area with less rail traffic and a struggling dairy industry, is more towards ancillary support services, such as automotive repair and waste transfer. …

Trends to commercial use within the downtown corridor are consistent with the introduction of new technologies and fashions. For instance, tinsmiths were common through the north Railroad Street area through the turn of the 20th century, however with the development of cheaper and more durable alternatives, such as plastics or aluminum, tinsmiths became less common and were no longer found after 1920.

Beginning in approximately 1920, with the introduction of affordable automobiles, service stations, garages, dealerships, and storage units for automobiles are widespread. Many of these facilities, rather than new businesses, formerly served as the support infrastructure for the horse-reliant populace; liveries become garages, blacksmiths become service stations.

The Northern Railroad Street Block area (from Depot Square to Portland Ave) has been a vibrant downtown community for all years reviewed with grocers, druggists, tailors, butchers, dry goods and launderers but also hardware stores selling hazardous materials (paints, kerosene, etc), print shops, photograph developers and portraitists, and millineries (hat makers and cleaners).

2.3.1. 1884 through 1909:

Refer to Figure 3a for the discussion of property use during this timeframe.

2.3.1.1. Mallory Block

Development within the Mallory Block was limited to what is now South Main Street (formerly Railroad Avenue) south of the Sleepers River. Beginning with the 1889 Sanborn, a manufacturing facility (J.W. Ransom Co Hardware Manufactury) can be found along the Sleepers River in the approximate area of 403 South Main Street. The facility consists of three main buildings and takes advantage of a dam on the Sleepers River. A penstock supplies water power to the facility with an outfall west of the northernmost building. The Sanborn Map shows that the property immediately to the north of the J.W. Ransom complex was formerly occupied by the Belknapp Knife Company. By 1900, the J.W. Ransom facility has closed, although the northern most building of the complex is noted to contain an out-of-service machine shop. Other buildings within the complex are shown to be dwellings.

By 1905, the former machine shop contains the L.F. Hull carriage repairing shop.

2.3.1.2. Ralston Block

Development within the Ralston Block began in 1895 with the construction of the Northern Lumber Company lumber mill. Based on the town index, the mill appears to be first located to the south of the current building on the Bay Street Holdings parcel (location of B&W Mechanicals). The mill first appears as being under construction with the 1895 Sanborn Map. Rail spurs are shown servicing the southern end of the mill building.

2.3.1.3. Rail Yard Block

The Portland and Ogdensburg Railroad Shops dominate the area. Buildings within the railroad shop complex include a paint shop, engine house, a machine shop, blacksmith and the turntable. A large freight warehouse is situated northwest of the turntable.

By 1900, coal sheds become prominent in the area of the turn table and roundhouse.

2.3.1.4. South Railroad Street Block

Area is predominantly residential. Coal sheds are found associated with 192 Railroad Street. This property later becomes the Wilder, Noyce and Co. Wholesale Hardware and Machine Shop. By 1905, the machine shop is gone and replaced by a creamery (Harry M. Scott Creamery).

2.3.1.5. North Railroad Street Block

Commercial properties and ancillary structures are found along this section of Railroad Street. Occupants of buildings include clothing retailers, grocers, druggists and banks. A paint shop is located to the rear (east) of 446 Railroad St.

By 1900, the St. Johnsbury Steam Laundry is located at the intersection of Eastern Ave and Pearl Street.

In 1905, a machine shop occurs at 17 Eastern Ave.

In 1900, other uses begin to appear in the downtown area including photographers, a livery, and a tin shop. On the western side of Railroad St, uses include a millinery, bicycle repairs, and launderers.

2.3.1.6. Ide Block

The area currently occupied by the Allen Lumber Company is home to the St. Johnsbury Granite Companies Works and later the Garrick Brothers granite works. This complex of buildings includes three machine shops, cutting and grinding buildings, and a polishing mill. Based on Stone's experience with granite manufacturing facilities in Barre, Vermont, granite works may also perform blasting of stones for making monuments through stencils that are glued to the stones. This process requires the use of heavy metal shot blast, glues, and solvents to remove the stencils.

Furniture manufacturing begins in this area circa 1889. The M.J. Caldbeck and Son window and door manufacturing facility appears west of the St. Johnsbury Granite Company. Painting and caulking of the window and door sashes in this building is likely.

By 1900, a portion of the Passumpsic River has been filled to the benefit of the E.T. & H.K. Ide grain elevator and coal sheds, the Wilson and Taft Wholesale Grocer (current cold storage wing of the Ide complex), the Potts Brothers Cold Storage (current KC Rentals property), and Farmers Mutual Creamery Co. (current Interstate Waste Services property located at 2-8 Bay St.).

By 1905, the Ide complex includes the former Wilson and Taft building for use as storage for farm machinery and maple sugar. The Farmers Mutual Creamery has expanded to include additional buildings to the north. A furniture finishing and painting factory is located south of the Cold Storage warehouse, which is now run by Harry H. Carr.

North of Portland Ave, at the intersection with Railroad Street development includes the John H. Ryan Carriage Manufactury. East of St. Mary's Street and north-bound railway is the St. Johnsbury Wood Yard, which also serves to store bulk coal.

2.3.2. 1909 through 1933

Refer to Figure 3b for the discussion of property use during this timeframe.

2.3.2.1. Mallory Block

With the 1912 Sanborn Map, development of South Main Street area continues. The former carriage repair shop has been replaced by the Hygienic Ice Co., which is comprised of three tightly packed buildings and utilizes a gasoline UST located east of the buildings. By 1919, evidence of the ice company complex is gone and has been replaced by dwellings.

Beginning in 1912, the St. Johnsbury Gas Company, a manufactured gas plant (coal gas), is present in the location of what is now South Main Street Auto Sales and Service, . The complex includes two iron gas holders, a building marked "oil storage" and the manufacturing facility. The property is served by a rail spur, located on the eastern side of the manufacturing facility.

With the 1919 Sanborn, the Caledonia Fair Grounds is constructed at the south end of Railroad Avenue in the approximate location of 16 through 118 South Main Street.

2.3.2.2. Ralston Block

Between 1905 and 1912, the Northern Lumber Company became the National Flooring Company Lumber Dressing Mill. With the 1912 map, the former mill buildings have been expanded to approximately twice their original size, expanding to the north. A power plant has been added to the southern portion of the mill complex. Ancillary buildings have been constructed and include an office building and lumber storage sheds. A second mill building, operated by the Pillsbury & Baldwin Company is located north of the lumber mill. The Pillsbury & Baldwin Company plant manufactures "closet combinations" with rail service extending to both the east and west sides of this building through loading sheds within the sawmill complex. Functional uses of this building include a dry kiln, wood working, wood finishing, coal storage, a coal furnace and engine house, and loading docks. Based on the layout of the Pillsbury and Baldwin building, it appears that this building is the same as what is now the Bay Street Holdings building (659 Bay Street). By 1927, the southern saw mill building is greatly reduced while the northern building is now labeled as the C.H. Goss Supply Co.

With the 1927map, we begin to see what will begin to be a prominent use in the Ralston Block: bulk petroleum fuel storage. A small building can be found on the southern end of the Sanborn-covered area marked "oil pump" with a note stating it is 15 feet to the tanks. This notation is consistent with the position of the Northern Petroleum RPC property.

2.3.2.3. Rail Yard Block

By 1912, the B&M Railroad Yard has expanded with additional sidings and spurs. Spurs now extend north to the Goss Supply Company (current CVPS property) and to the west of the Depot building.

Coal sheds can be found surrounding the turntable. A large coal shed is located southwest of the turntable.

Beginning with the 1912 Sanborn, along the Passumpsic River, we see the occurrence of the St. Johnsbury Electric Company Power Station. This facility is located northwest of the turntable, east of the existing substation yard on land built into the river. By 1919, this power station has become the Twin State Gas and Electric Company. A dam is present extending across the river.

2.3.2.4. South Railroad Street Block

Street numbers have switched such that they begin on the south side of Railroad Street (with the intersection with Pearl Street).

Area is predominantly residential. Large automotive service garages can be found between 166 and 192 Railroad and Railroad Street. Both of these garages have gasoline underground storage tanks associated with them.

The coal sheds associated with the former 512 to 513 Railroad Street properties have been replaced by storage for a wholesale grocer at this property.

2.3.2.5. North Railroad Street Block

Caldbeck-Cosrgrove now occupies a warehouse behind 59 Railroad Street (north of the underpass for Bay Street with the Railroad). The Caldbeck-Cosgrove Company, presumably the succession to M.J. Caldbeck and Sons, have carpentry shops and lumber yards south of the Ide grain elevator and in the current location of the KC Rentals building.

The former machine shop at 22 Eastern Ave is now listed as a grocer.

2.3.2.6. Ide Block

The St. Johnsbury Granite Companies Works is now the Goss Supply Company, suppliers of plumbing and hardware.

As of 1919, the St. Johnsbury Steam Laundry is located on the current WSI property. A gasoline UST is located within the Bay Street right-of-way at this location.

The former Farmers Mutual Creamery Co. is now listed as an automotive service facility.

North of Portland Ave, west of the rail is an automotive service station with two gasoline USTs: one located along the Railroad Street (west) side of the property; the second located on the Portland Ave (southern) side. Also on the northern side of Portland, but to the east of the railway is the Cary Maple Sugar plant and the Menut & Parks Co. Coal, Wood and Ice yard.

2.3.3. 1934 through 1958

Refer to Figure 3c for the discussion of property use during this timeframe.

2.3.3.1. Mallory

Dwellings comprise properties along the western side of South Main Street adjacent the Sleepers River during this period.

The St. Johnsbury Gas Company a manufactured gas plant remains unchanged for this period.

A gasoline UST is noted on the western side of South Main Street opposite the Caledonia Fair Grounds. This UST is in the approximate location of what is today 183 South Main Street.

2.3.3.2. Ralston Block

South of the turn table, on the current Bradford Oil property (parcel ID 4 on Figure 2) are four oil above ground storage tanks and a building marked as "oil storage"; ASTs are also present on both the property now known as Lewis Oil, the Bradford Oil properties (both the former Northern Petroleum Bulk plant and RPC properties) and CN Brown properties (parcel ID 5 on Figure 2).

Appearing for the first time on the 1943 Sanborn Map is the Ralston Purina Co. Mill and Warehouse. Note that the footprint is from plans and the building has not yet been constructed. The plan set includes a boiler house to the west of the 4-story portion of the Ralston Mill. The Site is serviced by three rail spurs; two to the east, one to the west. Of note is the notation that the covered sheds for the rail spurs and front office areas are finished with corrugated asbestos. Later historical resources, specifically accounts of the current landowner, have indicated that the site formerly utilized several ASTs. Most of these ASTs contained molasses for mixing with grain for livestock feed, however at least one tank contained heating fuel to supply the boiler house.

The Goss plant now is owned by Chas. Millar & Sons, who operated a wholesale plumbing and heating and building supplies. The southern building, formerly used as a sawmill, is now the Tempered Maple Corporation, manufactures of bowling pins. Ancillary buildings and functions of the property now include an electrical transformer yard, drying rooms, boiler rooms, a lacquer shed, a saw dust house, and storage sheds.

2.3.3.3. Rail Yard Block

With the 1943 map, most of the former coal sheds have been replaced by oil store houses. Oil storage can be found surrounding the turntable. A large coal shed is located southwest of the turntable.

With the 1943 map, the Twin State Gas and Electric Power Station remains in its former extent, however two transformer yards are located north and northwest of the station building and a gasoline UST is located off the southern end of the building. The current CVPS substation matches well with the northwestern transformer yard. Current evidence for the northern transformer yard was not observed during reconnaissance of the Project Area. The CVPS maintenance garage is shown north of the current transformer yard; a gasoline UST is located off the southwest corner of this building.

2.3.3.4. South Railroad Street Block

Commercial uses of Railroad Street are becoming more prominent beginning with the 1943 map. Five properties are shown on the eastern side of Railroad Street with two gasoline USTs each between 15 and 33 Railroad Street. In addition, at 27 Railroad Street is the St. Johnsbury Glovers manufacturing facility (current LaBonte property). On the western side of the street, residential properties are still predominant; however, a building noted as "Plumbing and Heating Garage" is found at 26-28 Railroad Street (formerly 12 to 14 Railroad St). This building coincides with what was formerly an automotive service station; a gasoline UST is noted to remain on the property along the roadway.

2.3.3.5. North Railroad Street Block

Two new gasoline filling stations occur in the North Railroad Street Block area during this time period. The first is located at 48 Railroad Street and has 3 gasoline USTs. The second has two gasoline USTs and is located at the intersection of Eastern and Railroad Streets, adjacent the Star Theater movie hall.

Other uses along the North Railroad Street Block remain largely unchanged from previous maps.

2.3.3.6. Ide Block

At 2-8 Bay Street, the former St. Johnsbury Steam Laundry is now marked as wood working and storage; however, the gasoline UST remains. The building is now connected with what was the former automotive service facility building to the north.

At 5 Bay Street, there is a large building containing wholesale automotive supplies.

The KNTT Investments Corp building (KC Rentals) at 20 to 24 Bay street is comprised of two distinct buildings and contains a bottling works and black smith.

North of Portland Ave, the automotive service station has been reconfigured, but functionally the same as the 1927 map. With the 1943 map, three gasoline USTs are indicated in the western portion of the property. The Cary Maple Sugar plant has been replaced by the Peck Company hardware store. The Menut & Parks Co. Coal, Wood and Ice yard remains; however, now a gasoline UST is noted on the property.

2.3.4. 1959 through 1988

Refer to Figure 3d for the discussion of property use during this timeframe.

2.3.4.1. Mallory

Dwellings comprise properties along the western side of South Main Street adjacent the Sleepers River during this period.

The St. Johnsbury Gas Company a manufactured gas plant remains now includes two additional iron gas storage tanks.

A gasoline UST is noted on the western side of South Main Street opposite the Caledonia Fair Grounds. This UST is in the approximate location of what is today 183 South Main Street.

2.3.4.2. Ralston Block

Fuel storage areas within the Ralston Block (i.e. Northern Petroleum (two properties), Lewis Oil, and CN Brown) remain unchanged from the previous map.

With the 1958 map, the Ralston Mill property shows having access from a total of five rail spurs: two on the east, and three on the west of the main building. The boiler house includes an electrical transformer yard and three above ground fuel storage tanks (ASTs). By 1964, two additional ASTs are present adjacent the boiler house, although the Sanborn Map includes a strike through of the words “fuel oil” with the 1964 map; it is uncertain whether this is an intentional edit, although if it were, it would be consistent with accounts that at least some portion of these tanks were used for storing molasses.

The Chas. Millar & Sons, facility remains, now noting manufacturing of solder, along with paints and hardware. The Tempered Maple Corporation complex remains largely the same.

2.3.4.3. Rail Yard Block

With the 1943 map, most of the former coal sheds have been replaced by oil store houses. Oil storage can be found surrounding the turntable. A large coal shed is located southwest of the turntable.

With the 1958 map, the Twin State Gas and Electric Power Station and transformer yards remain in the same extent as previously. A scrap metal storage area is noted within the middle of what is now an open space north of the current substation. A rail spur extends between the service garage and western transformer yard. The current CVPS maintenance garage is shown north of the current transformer yard; a gasoline UST is still located off the southwest corner of this building.

2.3.4.4. South Railroad Street Block

With the 1958 map, St. Johnsbury Glovers has relocated across the street to 131 Railroad Street. Properties with gasoline USTs include 142, 166, 169, 192, and Railroad Street and are associated with automotive service stations. A building is located north of 220 Railroad Street that also has an associated gasoline UST; this building, however is no longer present.

By 1964, the gasoline retailer at 169 had become a grocer. The former plumbing supply retailer at 189 Railroad is now listed as an automotive supply and parts retailer and warehouse.

2.3.4.5. North Railroad Street Block

With the 1964 map, dry cleaners are noted at 69 and 94 Eastern Avenue.

In 1958, Sear Roebuck operates a warehouse to the east of 378 Railroad Street. By 1965, a large paint retailer has moved in to the Drouin Block of North Railroad Street (approximately at 378 and 394 Railroad Street).

Other uses along the North Railroad Street Block remain largely unchanged from previous maps.

2.3.4.6. Ide Block

With the 1958 map, the 2-8 Bay Street property is marked as Private Autos. The northernmost building on this property is now noted as containing woodworking and furniture storage. No UST is shown associated with this property on the 1964 map.

In 1964, the automotive supplies retailer is now noted for having a machine shop.

The KNTT Investments Corp building (KC Rentals) now houses plumbing and heating supplies.

With the 1958 map, properties north of Portland Ave are unchanged. By 1964, however, the automotive service station located at the intersection of Portland and Railroad Streets has been replaced by a much smaller building marked “filling station”. The locations of the USTs associated with this property are not noted on the 1964 map.

The E.T. & H.K. Ide facility appears unchanged.

3. FEDERAL AND STATE ENVIRONMENTAL DATABASE REVIEW

In the development of the AWA, Stone reviewed appropriate State and Federal databases to discern potential sources of contamination within and nearby the Project Area. Specific databases reviewed for the AWA include:

- Federal CERCLIS (Comprehensive Environmental Response, Compensation and Liability Information System)
- Federal NPL (National Priority List)
- Federal RCRA (Resource Conservation and Recovery Act) Generators List
- Federal RCRA TSD (Transport, Storage and Disposal) Facility List
- Federal ERNS List (Emergency Response Notification System)
- State Hazardous Sites List
- State Landfill or Solid Waste Disposal Site List
- State RCRA Generators List
- State Leaking, Registered and Pulled Underground Storage Tank List
- State Brownfield Sites List

Results of the database reviews are presented on Figure 4; further details can be found within the Environmental Data Resources (EDR) report provided in Appendix F.

3.1. Vermont Hazardous Waste Sites

Based on Stone's review of the VT DEC database, several sites were identified for more comprehensive review. With the assistance of VT DEC and NVDA, Stone obtained available SMS files for the sites presented in Table 2, below, and Phase I ESAs performed within the Project Area. Files were reviewed to glean physical (geology and hydrology), process, and chemical distribution information to assist with the development of the CSM for the Project Area, and to identify data gaps. Documents included in the review are presented in Appendix B. Table 2 provides a brief summary of the sites reviewed during the AWA. Detailed summary tables for each site reviewed, which include site information, type of contaminant release, assessed and impacted media, notes, and remaining data gaps, are presented in Appendix D.

Table 2: Hazardous Waste Sites Within or Adjacent to Project Area

Site	SMS[1] #	Address	Status	Data Gaps (y/n)
Sites within the Project Area				
The St. Johnsbury Rail Yard	982356	Rt. 5 and Bay St.	Medium	Y, Limited assessment and target analytes
Northern Petroleum RCT	880179; 911169	492 Bay Street	NFAP, Med	Y, extent of downgradient contamination not well understood. No other COCs assessed.
Northern Petroleum Bulk Plant	20053397	603 Bay St.	Medium Medium	Y, current extent of >VGES unknown
CVPS – St. Johnsbury	921202	299 Bay Street	SMAC	Y, further delineation of PAHs in surface soil; assessment of other past use.
Lawrence Sangravco	921244	483 Bay Street	SMAC	N, Extent of free product and groundwater contamination not well understood. Has been assigned to SMS

				# 911169
13 Portland Street (St. Johnsbury Paper)	941711	13 Portland St.	SMAC	Y, impact from past use not assessed. SI performed on USTs only.
Former Ralston Purina Plant	951844	40 Bay St	Medium	Y, impact from other past uses not assessed (rail spurs, grain, boiler house).
Carlet Gilson and Hurley	972187	50 Bay St	SMAC	Y, impact from past use not assessed (saw mill, wood treatment, wood finishing, rail spurs).
Lewis Oil Company	982484	Bay St,	Medium	Y, extent of free product not well defined. No analyte specific analyses for surface soils.
2-8 Bay Street	20104049	2-8 Bay St.	SMAC	Y, Several unassessed RECs including floor drains, stains on concrete, former building slabs and USTs.
Sites Upgradient of the Project Area				
Depot Square Apartments *In Downtown Area on Western side of Railroad Street*	931524	Railroad St.	Medium	N
Party Tyme *On Western side of Railroad Street from Project Area*	972277	157 Railroad St.	SMAC	Y, past use (including rail spur and adjacent gasoline stations) not assessed.
Irving Oil Mainway *Immediately west of Project Area*	20093901	142 Railroad St.	Medium	Y, Investigation needed.
Former Sears Building *Approximately ¼ west of Project Area*	20012925	Pearl St.	SMAC	N
Rent Way *In Downtown Area on Western side of Railroad Street*	20012929	429 Railroad St.	SMAC	N
Northern Auto *On Western side of Railroad Street from Project Area*	20012904	125 Railroad St.	Medium	Y, Former Bond Auto. ISI not performed. Sanborn maps show several gasoline USTs that may remain on site.
Windshield World *On Western side of Railroad Street from Project Area*	931549	Railroad St	Low	Y, Current use is as an automotive service station.
Railroad Street Texaco *Northwest of Project Area*	8900433	490 Railroad St.	Low	Y, Other past uses, including a carriage mfg have not been assessed. Has been an automotive service station for over 70 years.
Menut and Parks *Immediately north of Project Area*	20073751	50 St. Mary's St.	SMAC	Y, former coal storage and carriage mfg have not been assessed. SI dealt with UST only.

[1]SMS: Sites Management Section

3.2. Hazardous Waste Generators

Five State of Vermont registered hazardous waste generators were identified within or adjacent to the Project Area, as presented in Table 3, below.

Table 3: VT Hazardous Waste Generators within or adjacent to the Project Area.

Site	EPA ID	Listed Address	Status	Distance to Project Area
Central Vermont Public Service	VT5000001115	South Main Street	SQG[1]	665 feet West
Central Vermont Public Service	VTD988367348	Route 5	CEG[2]	665 feet West
Railroad Street Mobile	VTR000004861	24 Railroad Street	CEG	Immediately adjacent (west) of Project Area
Palmer Brothers Dry Cleaners Inc.	VTD019130731	72 Eastern Ave	SQG	930 feet Northwest
South Main Body Shop	VTD988366100	South Main Street	CEG	Within Project Area

[1]SQG: Small Quantity Generator; [2]CEG: Conditionally Exempt Generator

Reports of shipping manifests for the sites presented in Table 3 are presented in Appendix G. Federal hazardous waste generators within the Project Area are presented on Page 5 of the EDR report included in Appendix F and include the following:

- TJ Mold and Tool Company: water miscible cutting and grinding fluids
- Railroad Street Mobile: Benzene, Methyl Ethyl Ketone (MEK), PCE, Petroleum Distillates, and ethylene glycol.
- South Main Body Shop: Flammable Liquids
- Bradford Oil Bay Street Bulk Plant: unreported
- First Student Inc. LOC 2543: Non-halogenated hydrocarbons, petroleum distillates, and ignitable hazardous wastes
- GH Berlin Lubricants: oil contaminated solids, oil-water mixtures, and waste gasoline

3.3. VT DEC Listed USTs

There are 57 State of Vermont UST Program listed (including registered, permitted, pulled and/or leaking) USTs that were identified within or adjacent to the Project Area. Table 4, below, presents registered USTs along with their proximity to the Project Area.

Table 4: Registered UST Sites Within or Adjacent to Project Area

Site	Facility ID	Listed Address	Status	Type Tank ID; Size (gallons); Substance; Condition (if removed)	Distance from Project Area
St. Johnsbury Service Center (CVPS) SMS # 921292	698	Bay St.	Pulled 1974	1974-1; 4,000 g; Gasoline; Condition Unknown	700 feet west
St. Johnsbury Rent Way	5555222	429 Railroad St.	Pulled 2001	1945-1-R; 1,000 g, #2[1]; Poor	75 feet west
Rapid Rubbish Removal Inc.	7482313	2-8 Bay St.	Pulled 1993 Pulled 1993	1982-1; 2,000 g; Gasoline: Condition Unknown 1983-2; 2,000 g; #2; Condition Unknown	Within Project Area
13 Portland St. (St. Johnsbury Paper)	9999841	13 Portland St.	Pulled 1996	1981-1; 8,000 g; #2; Condition Unknown	Within Project Area
St. Johnsbury Shell SMS # 890433	1098	490 Railroad St.	Active Active Active Pulled 1989 Pulled 1989 Pulled 1989 Pulled 1989	1989-1: 10,000 g Gasoline 1989-2: 10,000 g Gasoline 1989-3: 4,000 Diesel 1960-3-R 3,000 g Gasoline LUST[2] 1964-2-R 4,000 g Gasoline, LUST 1976-4-R; 10,000 g Gasoline; LUST 1979-1-R; 4,000 g; Gasoline, LUST	85 feet northwest
Rear Parking Lot – Hoveys Main Store	1454	446-453 Railroad St.	Pulled 1980	1980-1-R: 10,000 g; #2[2]; Condition Unknown	30 feet west
Apartment Bldg Depot Square	2457	Railroad St/Eastern Ave	Active Pulled 1993 Pulled 1993 Pulled 1993	1993-1: 5,000 g; #2 -1-1-R: 1,000 g; #2; Good -1-2-R; 3,000 g; #2; LUST -1-3-R; 6,000 g; #2; Good	305 feet west
Northern Petroleum Bulk Plant SMS # 911169	70	492 Bay St.	Pulled 1991 Pulled 1991 Pulled 2010	1976-1; 2,000 g; Diesel; Condition Unknown 1976-2; 2,000 g; Gasoline; Condition Unknown -1-1-R; 500 g; Used Oil; Poor	Within Project Area

Site	Facility ID	Listed Address	Status	Type Tank ID; Size (gallons); Substance; Condition (if removed)	Distance from Project Area
Lawrence Sangravco SMS # 921244	323	Bay St.	Pulled 1996 Pulled 1996 Pulled 1992	1975-1; 1,000 g; #2; Condition Unknown 1975-2; 1,000 g; Kerosene; Condition Unknown 1975-3; 12,000 g; #2; Condition Unknown	Within Project Area
Windshield World SMS # 931549	954	1 Railroad St.	Pulled 1993 Pulled 1993 Pulled 1993 Pulled 1988 Pulled 1988	-1-1; 3,000 g; Unknown; Condition Unknown -1-2; 3,000 g; Unknown; Condition Unknown -1-3; 3,000 g; Unknown; Condition Unknown -1-4; 5,000 g; Unknown; Condition Unknown -1-5; 2,000 g; Unknown; Condition Unknown	75 ft west
St. Johnsbury Rail Yard SMS # 982356	5558144	Bay St.	Pulled 1998 Pulled 1998	-1-1-R; 200 g; Kerosene; Good -1-2-R; 200 g; Kerosene; Good	Within Project Area
Jiffy Mart Railroad St.	67	189 Railroad St.	Active Active Active Pulled 1993 Pulled 1988 Pulled 1988 Pulled 1991 Pulled 1988 Pulled 2002 Pulled 2002 Pulled 2002	2002-1-2; 10,000 g; Gasoline 2002-1-2; 5,000 g; Gasoline 2002-2; 15,000 g; Gasoline -1-1-R; 1,000 g; Gasoline, Good 1956-3-R; 5,000 g; Gasoline; LUST 1956-5-R; 3,000 g; Gasoline; Poor 1967-2-R; 1,000 g; Diesel; Good 1976-4-R; 6,000 g; Gasoline; Poor 1988-1-R; 6,000 g; Gasoline; Good 1988-2-R; 6,000 g; Gasoline; Good 1988-3-R; 6,000 g; Gasoline; Good	75 ft west
St. Johnsbury Irving Mainway SMS # 20093901	344	142 Railroad St.	Pulled 1993 Pulled 1993 Pulled 1986 Pulled 1986 Pulled 1986	-1-6-R; 634 g; #2; Good -1-7-R; 1,000 g; Gasoline; Good 1976-3-R; 3,000 g; Gasoline; Poor 1976-4-R; 3,000 g; Gasoline; Poor 1976-5-R; 2,000 g; Diesel; Poor	Within Project Area

Site	Facility ID	Listed Address	Status	Type Tank ID; Size (gallons); Substance; Condition (if removed)	Distance from Project Area
			Pulled 1986	1978-1-R; 4,000 g; Gasoline; Poor	
			Pulled 1986	1978-2-R; 4,000 g; Gasoline; Poor	
			Pulled 2008	1986-1-M-r; 4,000 g; Gasoline; Fair	
			Pulled 2008	1986-2-M-r; 4,000 g; Gasoline; Fair	
			Pulled 2005	1986-3-R; 4,000 g; Gasoline; Filled in Place	
			Pulled 2008	1986-4-r; 4,000 g; Gasoline; Fair	
			Pulled 2008	1986-5-r; 4,000 g; Gasoline; Fair	
Wastewater Treatment Facility; SMS # 900536	1942	799 Bay St.	Active	1990-1; 4,000 g; #2	Within Project Area
			Pulled 1990	1963-1-R; 3,000' #2; LUST	

[1]#2: #2 Fuel Oil; [2]LUST: Leaky Underground Storage Tank;

4. SITE INSPECTIONS AND INTERVIEWS

To assess current conditions and inspect for visual indications of a contaminant release, Stone inspected the parcels within the Project Area over the course of four days in November 2011. For parcels where access was granted, full site inspections were performed in accordance with ASTM E-1527-05. Site access was granted on the following properties:

- 2-8 Bay Street (Parcel ID 19 on Figure 5) – Interstate Waste, former maintenance garage and waste transfer station that is currently vacant.
- 136 Bay Street (a.k.a. 13 Portland St.; Parcel ID 21 on Figure 5) – St. Johnsbury Paper, office products distribution warehouse on ground floor, pharmaceutical bottling and packaging on second floor.
- 202 Bay Street – E.T. and H.K. Ide (Parcel ID 9 on Figure 5), primarily storage; one building, the former retail office, is leased to TJ Mold and Tool Co.
- 249 Bay Street – Allen Lumber (Parcel ID 2 on Figure 5), lumber sales and storage
- 220 Railroad Street – Hudson Property (Parcel ID 8 on Figure 5), leased for private storage
- 515 Bay Street – Former Ralston Purina Mill (Parcel ID 14 on Figure 5), commercial and light industrial use.
- 659 Bay Street – Bay Street Holdings (Parcel ID 3 on Figure 5), LLC, B&W Mechanicals, automotive service.

With the exception of the 659 Bay Street property, site inspections consisted of interior and exterior observations, photographs and interviews with tenants and/or the property owner. For the 659 Bay Street property, the inspection was limited to exterior observations due to the land owner's request.

For the balance of the parcels within the Project Area where access was not available during the project timeline, Stone performed a "windshield survey", consisting of visual inspection of target parcels from common areas such as roads and the river corridor.

Based on observations made by Stone during site inspections and windshield survey, several RECs were identified for each target property. Current use within the Project Area is presented on Figure 5 and detailed in the Site Inspection Forms provided in Appendix E. Using the "Indentify" function on the accompanying GIS for this AWA allows the user to actively review findings from the Site inspections, including Site Inspection Forms and other associated photographs.

4.1. Interviews

Stone performed interviews with Site owners, managers and/or occupants as part of the Site reconnaissance. Results from these interviews are incorporated within the Site Inspection Forms included in Appendix G. Owners and/or tenants interviewed include the following:

- Bruce Ralston, owner of Yankee Builders and the former Ralston Purina Mill
- Spencer Hudson, owner of 220 Railroad Street
- Thomas Allen, owner of Allen Lumber Company, Four Parcels
- Guy Herman, Power of Attorney for 659 Bay Street
- Timothy Ide, owner of 202 Bay Street (E.T. & H.K. Ide)

- William Tremblay, owner of 136 Bay Street (St. Johnsbury Paper)
- Assistant Chief Marc LaRose of the St. Johnsbury Fire Department.

Response reports for incidents within the Project Area were provided to Stone by the St. Johnsbury Fire Department. These reports, which cover the period of 1996 through present, are provided in Appendix H. Of particular note within these reports was a small release of kerosene on October 6 2006, in Bay Street adjacent to Allen Lumber and a sheen of oil observed within the Passumpsic River emanating from the bank adjacent to the WSI property on Bay Street. Both of these incidents were managed by the property owners.

Stone also conducted interviews with SMS site managers Tami Wuestenberg, Sarah Bartlett, John Schmeltzer, and Ashley Desmond for sites under their management within or adjacent the Project Area for their impression of the environmental condition of each parcel and its potential for impacting the Project Area.

5. CONCEPTUAL SITE MODEL

The following is a CSM for the Project Area based on review of historic documentation of prior uses within the downtown area, existing data sets of identified hazardous sites within or nearby the Project Area, and various other sources for the physical description of the area.

5.1. Project Area Geology and Hydrogeology

According to the Surficial Geologic Map of Vermont (Doll, 1970), native unconsolidated soils in the Project Area consist of recent alluvium along the river margin, that is, fluvial sands and gravels deposited by the Passumpsic River, lacustrine silt or silty clay in the area of the confluence of the Sleepers and Passumpsic Rivers, and subaqueous glacial outwash in other site areas. Due to the large size, actual geologic conditions and the nature of this artificial fill change from one portion of the Project Area to another. Non-native fill is mapped to occur along the railroad. Based on historic and field observations, substantive infilling of the Passumpsic River channel has also occurred from the Ide property eastward and east of the existing CVPS substation. The nature of this fill is unknown. Filling has also occurred on the Ralston and Bay Street Holdings properties, as indicated by soil stockpiles throughout these areas.

Based on soil boring and test pit logs from hazardous sites within the Project Area, non-native fill, consisting demolition debris can be expected in nearly all portions of the Project Area to as deep as six feet below ground surface (bgs) save perhaps the extreme southern portion within the immediate flood plain. Native materials range from sand and gravels in western and northern areas to silty clay in the southern Project Area, particularly in the area of the wastewater treatment facility.

Bedrock in the vicinity of the Project Area has been mapped (Hall, 1959; Doll, 1961) as the Waits River formation, that is, a quartzose and micaceous limestone. Structural geology mapping of the area observes folding of the bedrock with axial planes dipping moderately to the north.

Surface water bodies in proximity to the Project Area include the Passumpsic River and Sleepers River. The Passumpsic River forms the eastern boundary of the Project Area, while the Sleepers River traverses the southern portion of the Site.

Surface water within paved areas at the Site is captured within the municipal stormwater system, which include Combine Sewer Overflows situated along the river margin of the Project Area.

As suggested by Sanborn Maps and other historic resources, the Project Area has undergone significant man-made alterations including river channel filling and subsurface utilities that may result in preferential pathways for migration of contaminated soil gas and groundwater. Between 1884 and 1900, a large bend of the Passumpsic adjacent Portland Street was in-filled to make room adjacent the rail yard for the E.T. & H.K. Ide grain elevator and surrounding businesses. The nature of fill in this area is unknown, although regional industries include foundries, granite and marble cutting, and saw mills; it is not unreasonable to assume that wastes from these industries were used for fill in this area.

Demolition debris fill, potentially including lead-based paint, asbestos, and other process-specific contaminants, is found throughout the project area.

Asbestos mine tailings, reportedly from mines within southern Canada, has been documented within fill material within rail yard as fill material beneath rail lines.

5.2. Historical Concerns

Long-running historical industrial and commercial enterprises that have known and presumed uses of hazardous materials were identified within or adjacent to the Project Area using numerous historical sources and are presented on Figures 3a through 3d. Historical uses within Project Area include saw mills, woodworking facilities – including wood treatment and preservation, grain milling and storage, a coal gasification plant, electrical power generation, granite and marble manufacturing, automotive maintenance, print shops, bulk petroleum fuel storage, and an extensive rail yard with associated ancillary support (such as machine shops, painting sheds, and blacksmiths), a turn table, warehousing, coal and petroleum fuel storage. Speaking to the rail yard, it is not an exaggeration to suspect that during the past 150 years any produced or needed goods for the northern portions of Vermont and New Hampshire or Southern Canada passed through the St. Johnsbury Rail Yard.

Commercial/industrial enterprises on adjacent properties have included automotive service stations, retail gasoline dealers, blacksmiths, carriage manufacturers, railroad traffic, railroad warehouses, dry cleaners, machinists, dentists, hat makers, photograph developers, and print shops. Given these historical uses, the receipt, distribution, production and/or use of petroleum fuels and solvents, chlorinated solvents, wood preservatives (pentachlorophenol, creosote, and arsenic), herbicides, insecticides/fumigants, polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs) and heavy metals may have resulted in releases to the environment in the vicinity of the Project Area.

5.3. Contaminant Distribution

Based on the historical uses within and adjacent to the Project Area, contaminants of concern (COC) are numerous. Table 5 below describes physical properties of contaminants of concern, their potential impacted media, and area of concern.

Table 5: Contaminants of Concern, Bay Street Redevelopment Project

Contaminant of Concern	Physical Properties	Media	Source	Potential Location
Petroleum VOCs	SG: 0.876	Soil	Gasoline USTs	Railroad St.
e.g. Benzene	SOL: 1,790,000 µg/L	Groundwater	Fuel-oil USTs	North Bay St.

Contaminant of Concern	Physical Properties	Media	Source	Potential Location
	VP: 95 Torr M: high	Soil Gas	Releases at automotive service stations Storage and Transport of bulk fuels	Bulk Petroleum Storage Yards
Chlorinated Solvents e.g. PCE	SG[1]: 1.62 SOL[2]:206,000 µg/L VP[3]: 19 Torr M[4]: moderate	Groundwater Soil Soil gas	Dry cleaners Machinists Auto Service Stations	Roundhouse Eastern Ave Railroad St., North Bay St.
Coal Tar	Contains components that are both LNAPL and DNAPL	Soil Groundwater	Manufactured Coal Gas Plant	South Main Street
PAHs e.g. Benzo(a)pyrene	SG: Solid at STP SOL: 1.62 µg/L VP: 0.000000005 Torr M: immobile	Surface soil	Fossil fuel combustion (coal, fuel oil) Creosote treated lumber	Rail yard and former Spurs. Blacksmiths Coal Storage areas Bulk Petroleum Storage Yards
Pentachlorophenol (PCP)	SG: 1.26 SOL: 14,000 µg/L VP: 0.00011 Torr M: low	Surface soil	Treated lumber	Rail yard CVPS Property Former Rail Spurs Former turntable Saw Mill
PCBs e.g. Aroclor 1260	SG: 1.5 SOL: 700 µg/L VP: 0.0000771 Torr M: immobile	Soil	Printing Inks Hydraulic Fluids Electrical components	Turntable Automotive Service Stations. Print shops (Eastern Ave, 629 Bay St)
Mercury	SG: 13.56 SOL: 60 µg/L VP: 0.0012	Soil	Dental Amalgam Hat making Radio and Television	Railroad Street Eastern Ave.
Arsenic	SG: Solid at STP SOL: NA µg/L VP: NA	Soil	Naturally occurring element Treated lumber Pesticides	Site-wide former railroad beds/spurs Turntable
Herbicides e.g. 4,4-DDT	SG: 1.56 SOL: 5.5 µg/L VP: 0.00000015 Torr M: immobile	Soil	Application to Railroad ROW Transfer along railroad	Railroad right of way Railroad warehouses Turntable

[1]SG: Specific Gravity (various references). [2]SOL: Solubility (Massachusetts Contingency Plan Toxicity Tables, 2007). [3]VP: Vapor Pressure (MCP Toxicity Tables, 2007). M: Relative mobility (Fetter, 2001).

5.3.1. Known Contaminants of Concern

The following contaminants were identified during a review of available site investigation reports and are known COCs for the project area. Each section presents a summary of the current extent of contamination; further details and historical context and extents are presented in reports referenced in Appendix B.

5.3.1.1. Petroleum

Petroleum contamination (Figure 6a), specifically fuel oil and gasoline, has been documented at over 20 sites located within the Project Area or immediately upgradient. Of these sites, most are the result of releases from heating oil USTs; however, several are related to bulk fuel storage including Northern Petroleum Bulk Plant and RCT properties, former Lewis Oil, Lawrence Sangravco, and Irving Oil Mainway. An additional fuel oil storage facility was operated by CN Brown, Inc., however no release has been documented from this facility. Smaller gasoline USTs were associated with the former Ralston Mill, Former Windshield World, 2-8 Bay Street, the former Carlet, Gilson and Hurley property (Bay Street Holdings, LLC property), the St. Johnsbury Paper Company property, CVPS, and the Menut and Parks site.

Contaminants at and near gasoline USTs would be enriched in benzene, toluene, ethylbenzene and xylenes (BTEX) relative to the #2 fuel oil tanks and would also potentially contain methyl-tert-butyl-ether (MTBE), depending on the age of the release. These compounds are more soluble and volatile than the components of fuel oil and would partition to groundwater and soil gas more rapidly. However, the rate of aerobic degradation of these compounds is also rapid relative to the heavier hydrocarbons present in fuel oil. The heavier hydrocarbons have a higher affinity for organic matter in the soil and would therefore be retarded in transport relative to BTEX. Volatilization would be more prominent in the area of the gasoline releases and present the greater risk to indoor air via vapor intrusion.

Fuel oil contamination, released from USTs or from various mechanisms within the bulk storage facilities, would dissipate less through volatilization and migration in groundwater. Heavier compounds within the fuel oil, specifically PAHs and long-chain hydrocarbons, will dissipate more slowly.

Vehicular traffic and parking areas within the Project Area may have resulted in releases of automotive-related fluids to the asphalt surface. These contaminants, once released, may enter the subsurface through semi-pervious asphalt, gravel surfaces, cracks in the asphalt, or stormwater runoff.

5.3.1.2. PAHs

PAHs, presented in Figure 6b, are a group of chemical compounds that consist of fused aromatic rings. Some PAH compounds have been identified as carcinogenic, teratogenic and mutagenic. PAHs are byproducts resulting from the combustion of fossil fuels and are present in fuel oil, coal and tar. PAHs are persistent and widespread in the environment, and do not readily partition to water without help from a co solvent.

PAH contamination has been detected in surface soil within the rail yard and former CVPS utility pole stockyard, related to past creosote wood preservation occurring there. PAH contamination has also been documented within the Rail Yard.

Within the Project Area, Stone would also expect to find PAH contaminated soils associated with the known fuel oil contamination associated with the bulk petroleum facilities. Past environmental investigations of these sites have not included analyte-specific analysis for semi-volatile fraction of the petroleum but have instead focused on analysis of volatile organic compounds (VOCs) and total petroleum hydrocarbon (TPH). Other potential sources of PAHs include the former blacksmith shops where coal may have served as the primary

fuel source, coal sheds found throughout the Project Area, and current or former railroad beds and the turntable. PAHs could potentially be present within fill material on the CVPS property and Ide Block.

5.3.1.3. Asbestos

Investigation of the rail yard has identified asbestos tailings within the rail bed. Quantitative Risk Assessment (QRA) performed by the Vermont Department of Health of the rail yard has indicated that the risk of exposure to asbestos by site users or the general public to be low assuming a transient or low-occupancy exposure scenario. If the use of the rail yard were to change such that higher exposure scenarios would be experienced, such as increased maintenance needs or redevelopment, further assessment and recalculation of the QRA would be needed.

Based on the age of buildings within the Project Area, asbestos containing building materials (ACM) can be expected. Prior environmental investigation has identified ACM on the former Ralston Purina Mill, Lawrence Sangravco and Bay Street Holdings properties.

5.3.1.4. Chlorinated Solvents

Known releases of chlorinated solvents appear to be limited to groundwater contamination migrating onto the rail yard property from an unknown upgradient source. Potential sources of chlorinated solvents, presented on Figure 6c, including tetrachloroethene (PCE), trichloroethene (TCE), and carbon tetrachloride, within the Project Area may be linked with automotive service stations, machinists, dry cleaning, and as a fumigant – specifically for carbon tetrachloride.

PCE is a volatile chlorinated solvent that has been historically used as cleaning solvent in the dry cleaning industry and as a degreaser by the machining and automotive service industries. Use of PCE began to be prevalent in the 1940s.

When released in sufficient quantities as a free-phase liquid, most chlorinated solvents (e.g. PCE and TCE) will act as a dense non-aqueous phase liquid (DNAPL) and will move downward under the influence of gravity through the layer of fill present in many areas of the Project Area. The PCE will move laterally as well as it encounters areas with high entry pressures (i.e., small pore throats with high capillary pressures). When encountering silt and clay deposits or other more subtle variations in soil characteristics, even within what might be termed a reasonably homogeneous sand unit, the variations in the distribution of capillary pressure will re-direct and/or “hang up” DNAPL. In this manner, DNAPLs can migrate in directions that are dictated by subsurface geology rather than hydraulic head distribution.

Where sufficient concentrations of chlorinated solvents exist, dissolved-phase contamination will drive from transmissive zones into low permeability zones via diffusion. In these low permeability zones, contaminants are “stored” as dissolved phase in water and sorbed phase in soils. Once the original mass within the high transmissive zones has “flushed” from the system, the sorbed phase will serve as an ongoing source of groundwater and/or soil gas contamination through back diffusion (Sale, et al., 2007).

Due to the transport mechanisms mentioned above, investigation of the presence, degree or extent of chlorinated solvents requires the use of vertical groundwater profiling. As most of the investigation within the Project Area has been performed to assess petroleum constituents, which are classified as Light Non-Aqueous Phase Liquids (LNAPLs), and these investigations assessed shallow groundwater, deeper chlorinated solvent groundwater plumes may exist that have gone undetected.

5.3.2. Potential Contaminants of Concern

Past environmental investigation within the Project Area has typically focused on petroleum-related releases with token assessment of other potential contaminants of concern. Table 6, below, presents a summary of potential and known contaminants of concern that may originate in each specified parcel; potential migration of contaminants from other parcels is not included to avoid confusion. Parcel IDs, referenced within Table 6, can be found on Figure 2.

Table 6: Potential Contaminants of Concern by Parcel.

Parcel ID	Site Name	Source Type	Contaminant of Concern
1	Achilles Property	Illegal Bumping	VOCs, PAHs
2	Allen Lumber	Paints (past and current)	Ketones, Petroleum Solvents, PCBs
		Caulk (former sash mfg)	PCBs
		Diesel AST	Petroleum VOCs, PAHs
		Granite Manufacturing	Chlorinated and Petroleum Solvents, Metals (shot blast), PAHs, PCBs
3	Bay Street LLC	Automotive Service	Gasoline, Metals, Chlorinated and Petroleum Solvents, PCBs
		Paints	Ketones, Petroleum Solvents, PCBs
		Wood Preservation	PCP, Creosote (PAHs and VOCs), Arsenic
		Electrical Transformers	PCBs
		Gasoline UST (historic)	Petroleum VOCs
4	Bradford Oil (former Northern Petroleum)	Former Fuel Oil ASTs	Petroleum VOCs, PAHs
		Former Gasoline ASTs	Petroleum VOCs
		Lubricants	Petroleum VOCs, PCBs
5	CN Brown Co.	Former Fuel Oil Storage Area	Petroleum VOCs, PAHs
6	Central Vermont Public Service	Transformers	PCBs
		Wood Preservation	PCP, Creosote (PAHs and VOCs), Arsenic
		Former Gasoline UST	Petroleum VOCs
		Former Granite and Marble Manufacturing	Chlorinated and Petroleum Solvents, Metals (shot blast), PAHs, PCBs
7	Gray (Furniture Dealer)	Former Gasoline UST	Petroleum VOCs
		Coal Sheds	PAHs
8	Hudson	Former Automotive Service Station	Gasoline, Metals, Chlorinated and Petroleum Solvents, PCBs
9	E.T. & H.K. Ide	Grain Elevator	Fumigants, Carbon Tetrachloride
		Freight Elevator	Hydraulic Oil, PCBs
		Coal Storage	PAHs
		Petroleum Fuel Storage	Petroleum VOCs, PAHs
10	Irving Oil	Former Gasoline Retailer	Petroleum VOCs
		Former Automotive Service	Gasoline, Metals, Chlorinated and Petroleum Solvents, PCBs
11	Irwin	Abandoned Homestead	PAHs, Petroleum VOCs

		Slaughterhouse	
12	Kendall	Undeveloped	None, background and de minimis contaminants
13	KNTT Investments	Former Bottling Works	Process chemicals, sanitizers
		Former Blacksmith	PAHs, Metals
14	L&R Inc. (former Ralston Mill)	Grain Storage and Grist Mille	Carbon Tetrachloride, fumigants
		Fuel Oil ASTs and UST	Petroleum VOCs, PAHs
		Gasoline UST	Petroleum VOCs
15	Labonte	Former Automotive Service Station	Gasoline, Metals, Chlorinated and Petroleum Solvents, PCBs
		Coal Storage	PAHs
16	Lawrence-Sangravco Inc.	Fuel Storage	Petroleum VOCs, PAHs
		Automotive Service	Gasoline, Metals, Chlorinated and Petroleum Solvents, PCBs
		Gasoline UST	Petroleum VOCs
17	Northern Lights, Inc.	Rail Yard	ALL (VOCs, SVOCs, PCBs, Metals, Herbicides)
18	Roy	Undeveloped	None, background and de minimis contaminants
19	WSI St. Johnsbury	Former Drycleaner	Chlorinated and Petroleum Solvents
		Former Automotive Service Station	Gasoline, Metals, Chlorinated and Petroleum Solvents, PCBs
		Unknown Gasoline USTs	Petroleum VOCs
		Former Creamery	None
20	Town of St. Johnsbury WWTF and undeveloped lot	Current and former USTs	Petroleum VOCs, PAHs
		Downgradient of former manufactured gas plant	Petroleum VOCs, SVOCs, Coal Tar
21	Tremblay (St. Johnsbury Paper)	Former Machinist	Petroleum and Chlorinated Solvents, Metals, PCBs
		Former Auto Dealership	Gasoline, Metals, Chlorinated and Petroleum Solvents, PCBs
		Former Retail Automotive Parts	Gasoline, Metals, Chlorinated and Petroleum Solvents, PCBs
22	State of Vermont	Rail Yard	ALL
		Former Machinist	Petroleum and Chlorinated Solvents, Metals, PCBs
		Former Blacksmith	PAHs, Metals
		Former Coal Sheds	PAHs
23	Vinton (South Main Auto)	Automotive Service	Gasoline, Metals, Chlorinated and Petroleum Solvents, PCBs
		Former Manufactured Gas Plant	Petroleum VOCs, SVOCs, coal tar
24	In Contention	Adjacent Rail, Illegal Dumping	ALL
19	Sanel Realty Co. Inc.	Former Railroad Freight Warehouse	ALL
		Automotive Service	Gasoline, Metals, Chlorinated and Petroleum Solvents, PCBs

5.3.2.1. Wood Preservatives

Existing and historic railroad lines within the Project Area use wooden rail ties for the foundation of the rail. These wooden railroad ties were treated to prevent rotting or insect infestation. Commonly, creosote is used for wood treatment; however, pentachlorophenol (PCP) may also have been used. In addition, treatment operations allegedly existed on the CVPS property for utility poles. The former saw mill and bowling pin manufacturing facility on the Bay St. Holdings property may also have included wood preservation.

Creosote is obtained from high temperature distillation of coal tar (itself a mixture of hundreds of organic substances), and over 100 components in creosote have been identified ranging from BTEX with lighter molecular weight to PAHs, phenols and furans on the heavier end of the molecular-weight spectrum. It is used as a fungicide, insecticide, miticide, and sporicide to protect wood and is applied by pressure methods to wood products, primarily utility poles and railroad ties. Because creosote has a specific gravity of 1.01 to 1.2, it is a DNAPL and will sink below the water table if present in sufficient quantities. Creosote is characterized by a relatively high viscosity (10 to 70 centipoise) which when coupled with its relatively low specific gravity results in a low mobility DNAPL. This means it will not readily move through the subsurface unless present in significant quantities.

While creosote is not miscible, it does contain organic compounds that have solubilities in water that are well above Federal Maximum Contaminant Levels (MCLs) or VGESs. The physical and chemical properties of the individual components of creosote vary widely; some, for example benzene, are relatively highly soluble in water. Larger multi-ring compounds (such as PAHs) are not likely to migrate significantly while the low-molecular-weight aromatics (e.g., BTEX) will both readily volatilize into the air from the shallow soil and dissolve into water. The VOCs are typified by higher solubility, lower sorption potential, and faster rates of biodegradation in the subsurface relative to the SVOCs. They also comprise a small fraction of the creosote. Thus, they are likely to become depleted in the creosote through volatilization and dissolution followed by degradation. The SVOCs comprise a large fraction of the creosote but are only slightly soluble, sorb strongly to organic matter and degrade very slowly. Sorption to organic matter, though it is a reversible process, serves to slow the movement of the contaminants through the subsurface. The fraction of organic carbon (f_{OC}) is likely to be relatively high in the surficial soil near the former and current rail lines and former turn table due to over 150 years of fossil fuel burning, transport, and storage in these areas.

Commonly, fortifying agents were added to creosote to assist in degradation from insects. One such fortifying agent is arsenic.

PCP use for wood preservation began in the 1930s, post dating most of the railroad installations within the Project Area. It was, however, commonly used for wood preservation as well as an herbicide, defoliant, mossicide and disinfectant until its use in non-wood treatment was discontinued in 1987. Historically, as one of the most widely used biocides in the United States, it is conceivable that PCP was transported to/from the Rail Yard.

5.3.2.2. Polychlorinated Biphenyls (PCBs)

Polychlorinated Biphenyls (PCBs), presented in Figure 6d, are a class of organic compounds with 1 to 10 chlorine atoms attached to a biphenyl (molecule composed of 2 benzene rings). PCBs were widely used as coolants and insulating fluids within electrical appliances such as electrical transformers, capacitors and transistors due to their high thermal conductivity. They historically have been used in fluorescent light ballasts and as stabilizing additives in cutting fluids, sealants, adhesives, printing inks, paints, hydraulic fluids,

lubricating oils and within various other uses. PCBs have a low water solubility and low vapor pressure, but have a high solubility in most organic solvents, oils and fats. PCBs are very persistent in the environment. Within the Project Area, the occurrence of PCBs may be related to transfer of goods containing these compounds along the railroad or within hydraulic equipment associated with the former turntable. Other sources would include the former print shop within the Bay Street Holdings property, and former print and paint shops within the down town area.

5.3.2.3. Metals

Several metals may be found within the Project Area that, if present, may pose a risk of exposure to future Site users (Figure 6e). Lead, as a result of lead paint contamination, plumbing solder or automotive batteries among other sources, would be expected in the area of the blacksmith shops, associated with former automotive service stations, or along the railroad. Lead shot may also have been used within the granite manufacturing areas during stenciling of monuments. Mercury contamination, originating from fluorescent light bulbs, mercury light switches, batteries, hat making, dental amalgam and various other sources, may be present in surface soils behind the commercial buildings of northern Railroad St. or in those nearby the railroad and turntable. Arsenic is a naturally occurring metal in Vermont and has a low regional screening level (0.39 milligrams per kilogram (mg/Kg) for residential soils); background arsenic concentrations likely exceed the appropriate regulatory criteria for this compound, as typical arsenic concentrations in Vermont native soils range between 2 and 10 mg/Kg. Arseno-based pesticides may have either been shipped to/from the railroad or used during maintenance activities of the rail bed itself. Silver contamination may be found in association with the improper disposal of dental amalgam.

Waste oil can contain elevated levels of various heavy metals and would be associated with automotive service facilities.

Scrap metals salvage operations formerly operated to the west of the Northern Petroleum RCT property. Various metals, including lead, chromium, zinc, iron, and nickel.

5.3.2.4. Herbicides

Organo-chlorine herbicides, such as DDT, may, if present, pose a risk of exposure to future Site users. Herbicides generally are relatively insoluble, recalcitrant (depending on the specific herbicide) and have a low vapor pressure. Stone would expect to find these compounds in surface soils associated with the current or former rail bed, the railroad turntable or in warehouses storing these products.

As the mobility of these chemicals through natural processes (e.g. groundwater migration or within the vapor phase) is very low, Stone expects that their occurrence would be limited to where they may have been applied, stored or transferred.

6. CONCLUSIONS

Past commercial and industrial enterprises within and adjacent to the Bay Street Redevelopment Project Area have included grain storage facilities, coal storage lumber yards, saw mills, wood preservation facilities, a manufactured gas plant, electrical utilities, granite and marble manufacturers, automotive service stations, retail gasoline dealers, bulk petroleum storage areas, blacksmiths, railroad traffic, railroad warehouses, a railroad turntable, dry cleaners, machinists, hat makers, photograph developers, print shops, carriage shops, a glove maker and scrap yard. Given these historical uses, the receipt, distribution, production and/or use of petroleum fuels and solvents, chlorinated solvents, wood preservatives (PCP, creosote, and arsenic), coal tar, herbicides/insecticides, PAHs and heavy metals may have resulted in releases to the environment in the vicinity of the Project Area, and constitute RECs.

Prior investigations of known environmental sites within the Project Area, including the Northern Petroleum properties, Lawrence-Sangravco, CVPS, and Lewis Oil, Inc. have demonstrated widespread petroleum contamination within the middle third of the Project Area. To date, however, the full extent of this contamination and its impact on sensitive receptors has not been adequately defined. In addition, past investigations have not focused on other potential COCs identified during this AWA.

Further investigation is necessary to assess the RECs and data gaps identified within the Project Area.