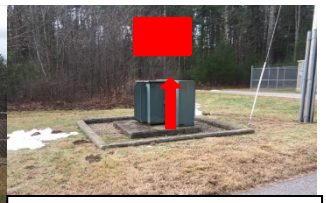
Resiliency improvements include raising the electrical equipment which provides power and control for the well, to a higher elevation in order to mitigate the potential for flooding impacts.

The Cranberry Wellfield

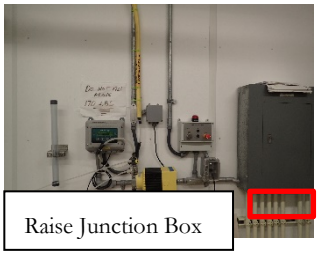
This is the other groundwater supply for the Town of Spencer. The wellfield is south and east of the existing wastewater treatment facility and is off of South Spencer Road. The wellfield includes 3 buildings; the building which houses the well and electrical equipment; the building used to store and inject chemicals including sodium hypochlorite for disinfection and sodium hydroxide for pH adjustment; and the building used for material and equipment storage.

Install Barrier



Raise Electrical Transformer

While the ground elevation in the area is seven (7) feet above the 100 year floodplain elevation for the Cranberry River, there are critical components within the wellfield that could be impacted during extreme weather. The Motor Control Center (MCC) in the well building should be protected by placing a barrier at the door to minimize water getting into the building. Further, the main transformer just outside the well building should be raised to also protect against flooding. Finally, the distribution box for power and control in the Chemical Feed and Storage Building should be raised.

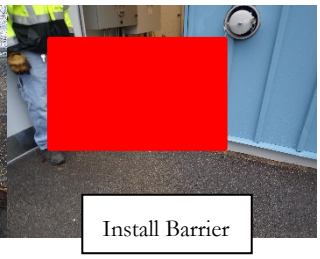


Raise Junction Box

Wastewater Pump Station on Meadow Road

This facility is along the edge of Meadow Road just south of Fourth Avenue and directly adjacent to the Seven Mile River and its 100 year flood zone and regulatory floodway. Given it conveys 10% of the flows to the wastewater treatment facility, this critical station, if flooded or disabled, could result in significant discharge of untreated wastewater to the river.

Raise Generator and Fuel Tank 3 ft.

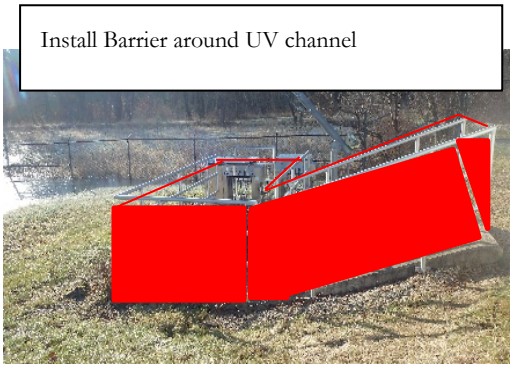


Install Barrier

Resiliency recommendations for this facility include protecting/raising the existing generator and propane tank outside the facility to a higher elevation to protect again potential flooding. They also include providing a barrier at the entrance of the facility to protect critical electrical components that are less than 3 feet above the floor.

UV disinfection system at the discharge end of the Wastewater Treatment Facility

This equipment is in a low-lying area just south of the existing lagoons and provides disinfection for the treated wastewater just prior to its discharge to the Cranberry River.



Resiliency recommendations, if this facility were to remain in place at this location, would include installing barriers around the UV channel and equipment. The barriers would raise wall elevations another 3 feet to protect the equipment in the channel and minimize runoff going through the equipment reducing the effectiveness of the UV Disinfection system.

Low lying area off Adams Street near Spencer Pond

This area around Spencer Pond has existing sewer and water main that could be affected by flooding due to significant runoff or overflow of the pond during extreme wet weather events. Further analysis of the outlet structure should be undertaken to determine if this is sized properly and if the gates currently in place are operational. Further, a level transducer should be installed to monitor water levels and alert system operators if water levels are getting high and could adversely affect the area.

8 Cost Summary Discussion

Based on recommendations summarized above, the following is a summary of the budgetary opinions of construction cost for resilience recommendations at each of the locations and vulnerabilities identified. They are summarized in **Table 2** and **Table 3** below for Charlton and Spencer, respectively. Costs include Contractor's general requirements including bonds, insurance, permits, and general conditions. Finally a 25% contingency is included. A range of total costs from minus 15% to plus 30% is shown in the table rounded to the nearest thousand dollars. Details of the costs for each facility are included in **Appendix A** (Charlton) and **Appendix B** (Spencer).

Table 2 - Summary of Recommended Resiliency Improvements at Identified Locations
Town of Charlton

Facility			Total Cost
Old Worcester Road PS			$34,000.00
North Main Street PS			$34,000.00
Muggett Hill Road PS			$31,750.00
South Sturbridge Road PS			$25,000.00
Stevens Park Road PS			$61,000.00
Route 20 (MTA 5E) PS			$30,000.00
J Hammond Road (MTA 6W) PS			$45,000.00
Route 20 PRV			$33,500.00
SUBTOTAL			$294,250.00
Contractor General Requirements			
Building Permits	%	0.40%	$1,177.00
Builders Risk Insurance	%	0.25%	$735.63
General Liability Insurance	%	1.5%	$4,413.75
Contractor Bonds	%	1%	$2,942.50
GC Field General Conditions	%	10%	$29,425.00
Contractor's Overhead and Profit	%	8%	$23,540.00
TOTAL OPINION OF CONSTRUCTION COST			$356,484.00
CONTINGENCY	%	25%	$89,121.00
ROUNDED TOTAL OPINION OF COST (-15% to + 30%)		**$379,000.00**	**$579,000.00**

Table 3 - Summary of Recommended Resiliency Improvements at Identified Locations
Town of Spencer

Facility			Total Cost
Seven Mile River Wellfield			$10,000.00
Cranberry River Wellfield			$45,000.00
Meadow Road PS			$40,000.00
UV System at WWTF			$20,000.00
Low Lying Area Adams Street/Spencer Pond			$32,500.00
SUBTOTAL			$147,500.00
Contractor General Requirements			
Building Permits	%	0.40%	$590.00
Builders Risk Insurance	%	0.25%	$368.75
General Liability Insurance	%	1.5%	$2,212.50
Contractor Bonds	%	1%	$1,475.00
GC Field General Conditions	%	10%	$14,750.00
Contractor's Overhead and Profit	%	8%	$11,800.00
TOTAL OPINION OF CONSTRUCTION COST			$178,697.00
CONTINGENCY	%	25%	$44,674.00
ROUNDED TOTAL OPINION OF COST (-15% to + 30%)		**$190,000.00**	**$290,000.00**

Figures

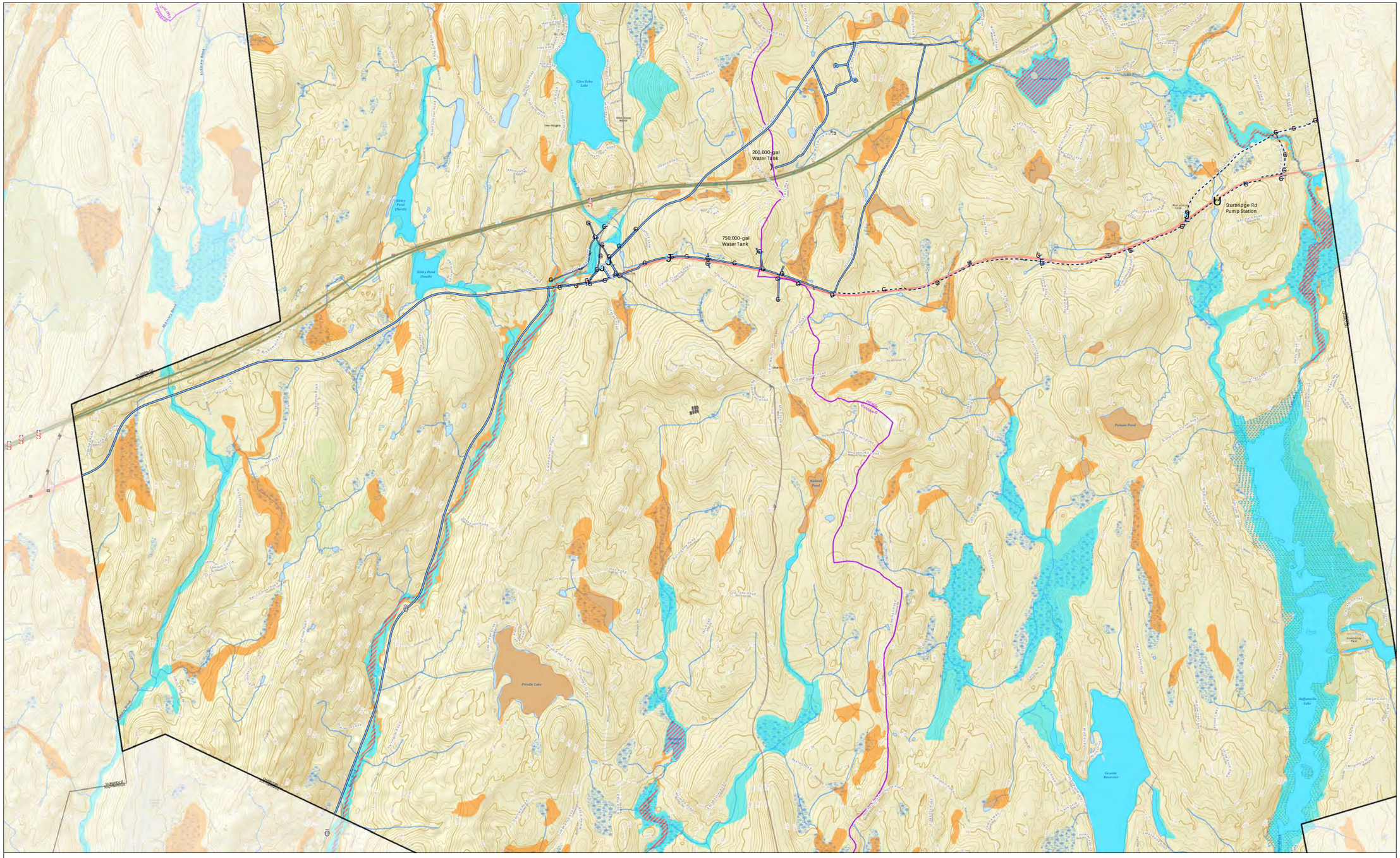


FIGURE 1
CHARLTON, MA
WATER DISTRIBUTION SYSTEM
VULNERABILITY ASSESSMENT

MUNICIPAL VULNERABILITY
PREPAREDNESS
PROGRAM

FUSS & O'NEILL

Water Infrastructure

- Hydrant
- PRV
- Pump Station
- Valve

Water Pipes

- Present Southbridge Water Line
- Existing 12in. Water Line
- Existing 8in. Water Line
- Inactive Line

Flood Zone Designations

- Regulatory Floodway
- 1% Annual Chance of Flooding
- 0.2% Annual Chance of Flooding

- Stream
- Intermittent Shoreline
- Manmade Shoreline

- Lake
- Wetland
- Inundated Area
- Watershed Boundary

0 0.5 1
Miles

Data sources:
MassGIS - Infrastructure, Hydrology, and Administrative Data
ESRI - World Topographic Map - Base Map

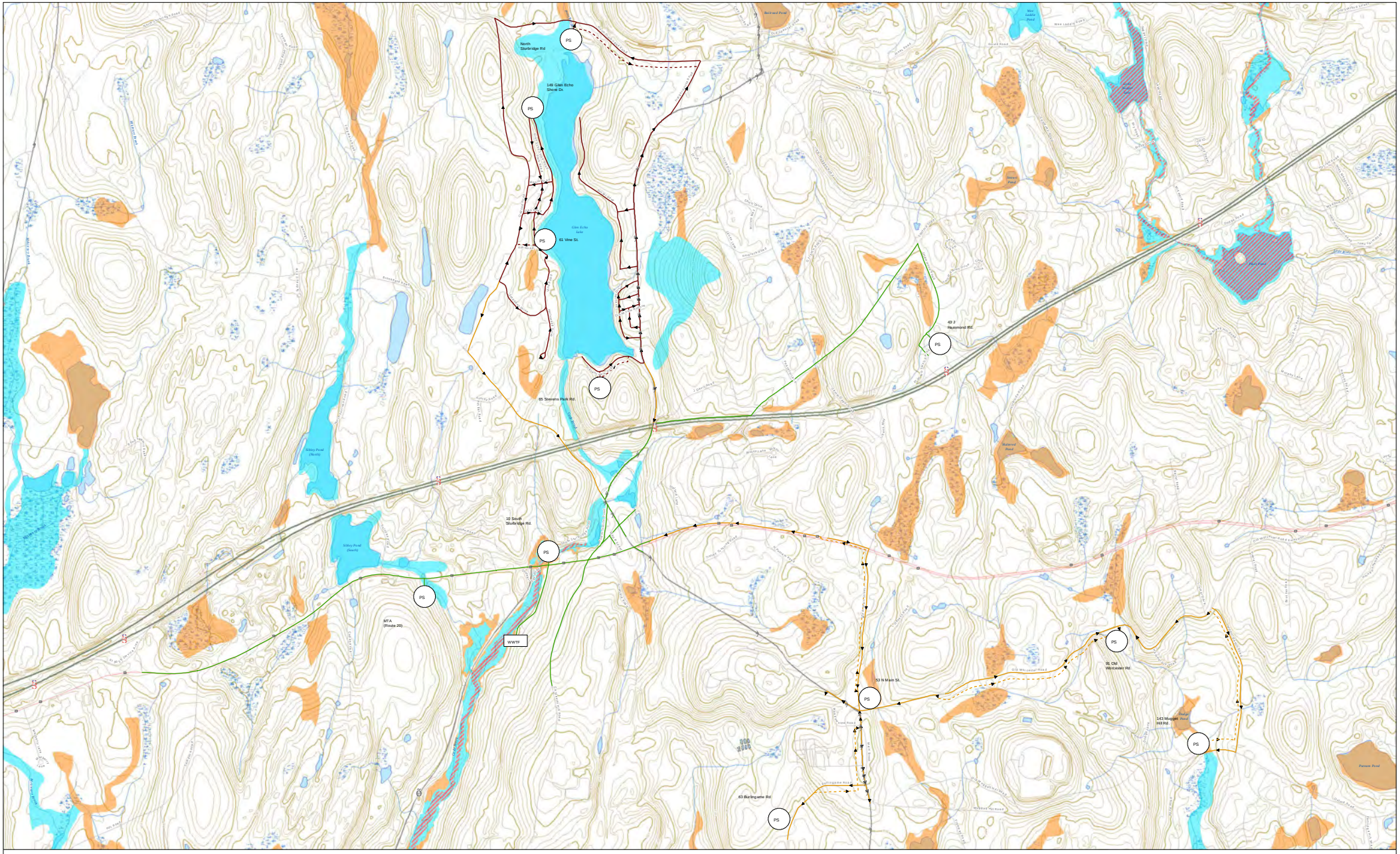


FIGURE 2
CHARLTON, MA
SANITARY SEWER SYSTEM
VULNERABILITY ASSESSMENT

MUNICIPAL VULNERABILITY
PREPAREDNESS
PROGRAM

FUSS & O'NEILL

- Sewer
- Sewer Force Main
- Glen Echo Lake Sewer
- Glen Echo Lake Sewer Force Main
- Old Charlton Sewer

Flood Zone Designations

- Regulatory Floodway
- 1% Annual Chance of Flooding
- 0.2% Annual Chance of Flooding

- Stream
- Manmade Shoreline

- Lake
- Wetland

N W E S

0 0.5 1
Miles

Data sources:
MassGIS - Infrastructure, Hydrology, and Administrative Data
ESRI - World Topographic Map - Base Map

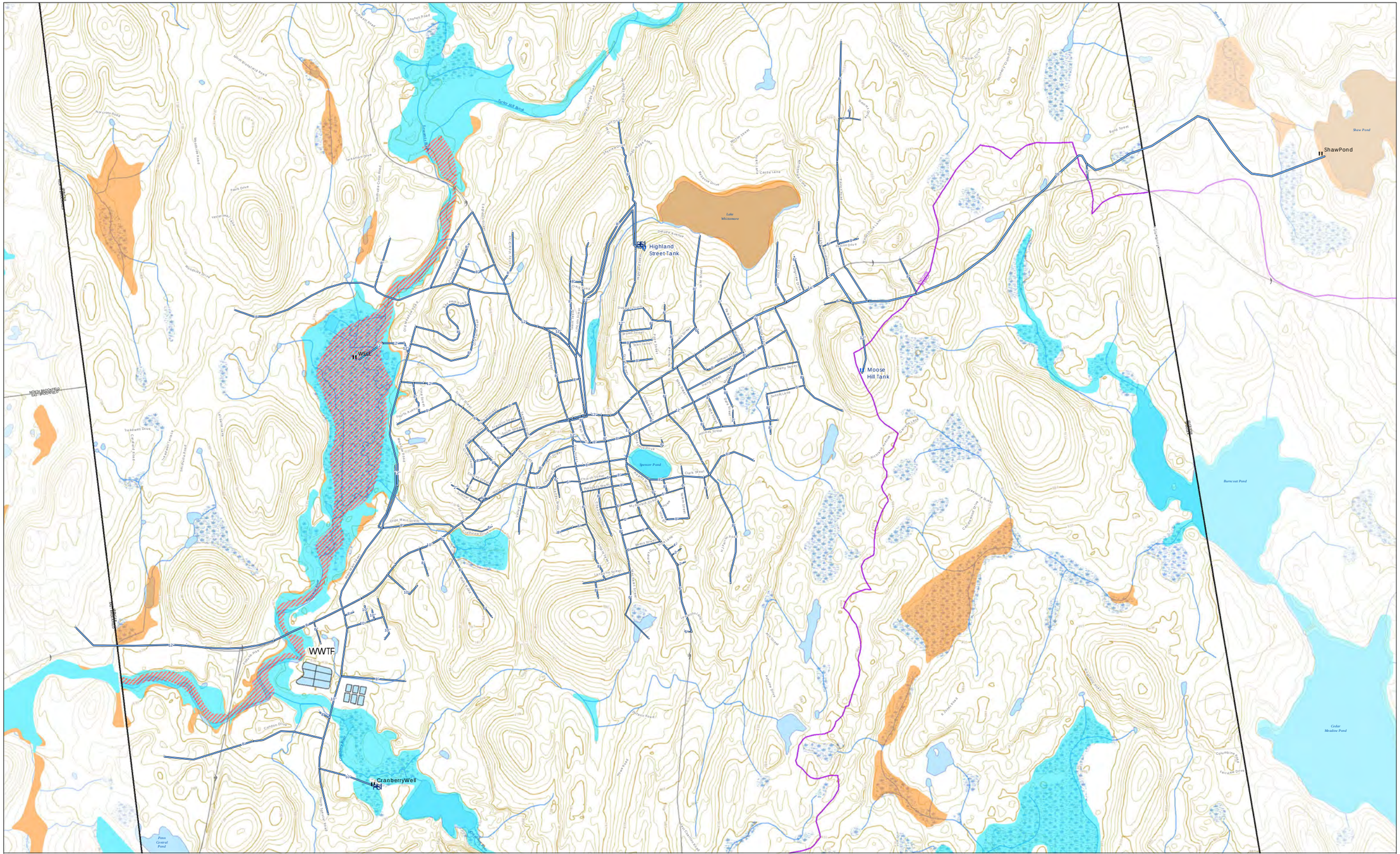


FIGURE 3
SPENCER, MA
WATER DISTRIBUTION SYSTEM
VULNERABILITY ASSESSMENT

MUNICIPAL VULNERABILITY
PREPAREDNESS
PROGRAM

FUSS & O'NEILL

- Pump Station
- Water Tank
- Water Supply

Water Main Diameter
- <8"
- 8-12"
- >12"

Flood Zone
- Regulatory Floodway
- 1% Annual Chance of Flooding
- 0.2% Annual Chance of Flooding

- Stream
- Manmade Shoreline
- Lake
- Wetland
- Watershed Boundary

N
W E
S

0 0.5 1
Miles

Data sources:
MassGIS - Infrastructure, Hydrology, and Administrative Data
ESRI - World Topographic Map - Base Map

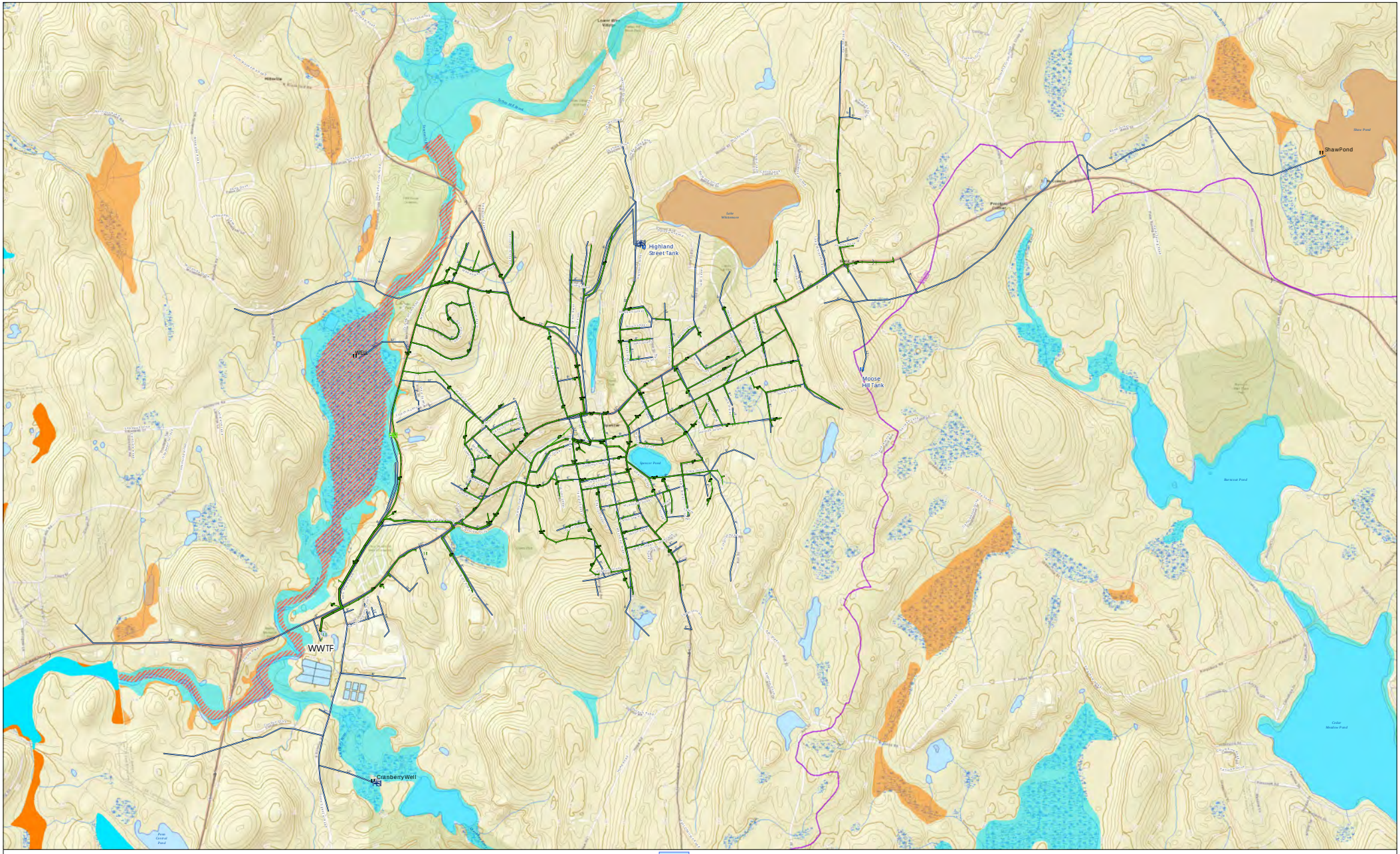


FIGURE 4
SPENCER, MA
SANITARY SEWER SYSTEM
VULNERABILITY ASSESSMENT

MUNICIPAL VULNERABILITY
PREPAREDNESS
PROGRAM

FUSS & O'NEILL

Sewer Pump Station
MH

DIAMETER
0 - 6
8 - 12
15 - 18
24

Pump Station
Water Tank
Water Supply
WaterMains_2017

Flood Zone Designations
Regulatory Floodway
1% Annual Chance of Flooding
0.2% Annual Chance of Flooding

Stream
Manmade Shoreline

Lake
Wetland
Watershed Boundary

0 0.5 1
Miles

Data sources:
MassGIS - Infrastructure, Hydrology, and Administrative Data
ESRI - World Topographic Map - Base Map

FUSS & O'NEILL

Appendix A

Summary and Detail of Costs for Resiliency Improvements
Town of Charlton, MA

FUSS & O'NEILL, INC.
1550 Main Street, Suite 400
Springfield, MA 01103

OPINION OF COST		DATE PREPARED : 03/21/19	SHEET 1 OF 1
PROJECT :	Charlton MVP Project	BASIS :	Vendor quotes; RS Means; previous projects
LOCATION :	Charlton, MA		
DESCRIPTION:	Budgetary Opinion of Cost		
DRAWING NO. :		ESTIMATOR : KMF	CHECKED BY : KAM

Since Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions, Fuss & O'Neill's opinion of probable Total Project Costs and Construction Cost are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.

ITEM NO.	ITEM DESCRIPTION	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST
	Old Worcester Road PS				$ 34,000.00
	North Main Street PS				$ 34,000.00
	Muggett Hill Road PS				$ 31,750.00
	South Sturbridge Road PS				$ 25,000.00
	Stevens Park Road PS				$ 61,000.00
	Route 20 (MTA 5E) PS				$ 30,000.00
	J Hammond Road (MTA 6W) PS				$ 45,000.00
	Route 20 PRV				$ 33,500.00
	SUBTOTAL OPINION OF CONSTRUCTION COST				**$ 294,250.00**
	Building Permits	%	0.40%	$1,177	$1,177.00
	Builders Risk Insurance	%	0.25%	$736	$735.63
	General Liability Insurance	%	1.5%	$4,414	$4,413.75
	Contractor Bonds	%	1%	$2,943	$2,942.50
	GC Field General Conditions	%	10%	$29,425	$29,425.00
	Contractor's Overhead and Profit	%	8%	$23,540	$23,540.00
	TOTAL OPINION OF CONSTRUCTION COST				**$ 356,483.88**
	CONTINGENCY	%	25%		**$ 89,120.97**
	TOTAL OPINION OF COST (-15% to + 30%)			**$379,000.00**	**$ 579,000.00**

FUSS & O'NEILL, INC.
1550 Main Street, Suite 400
Springfield, MA 01103

OPINION OF COST	DATE PREPARED : 03/21/19	SHEET 1	OF 1
PROJECT : Charlton MVP Project	BASIS : Vendor quotes; RS Means; previous projects		
LOCATION : Charlton, MA - Old Worcester Rd. PS			
DESCRIPTION: Budgetary Opinion of Cost			
DRAWING NO. :	ESTIMATOR : KMF	CHECKED BY : KAM	

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ITEM NO.	ITEM DESCRIPTION	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST
	Furnish and Install Barrier Wall Around Station	LF	100	$ 100.00	$ 10,000.00
	Foundation for Barrier Wall	LF	100	$ 200.00	$ 20,000.00
	Opening with Weir Boards	LS	1	$ 2,000.00	$ 2,000.00
	Weir Boards	EA	4	$ 500.00	$ 2,000.00
	SUBTOTAL OPINION OF CONSTRUCTION COST				**$ 34,000.00**
	Building Permits	%	0.40%	$136	$136.00
	Builders Risk Insurance	%	0.25%	$85	$85.00
	General Liability Insurance	%	1.5%	$510	$510.00
	Contractor Bonds	%	1%	$340	$340.00
	GC Field General Conditions	%	10%	$3,400	$3,400.00
	Contractor's Overhead and Profit	%	8%	$2,720	$2,720.00
	TOTAL OPINION OF CONSTRUCTION COST				**$ 41,191.00**
	CONTINGENCY	%	25%		**$ 10,297.75**
	TOTAL OPINION OF COST (-15% to + 30%)			**$44,000.00**	**$ 67,000.00**

FUSS & O'NEILL, INC.
1550 Main Street, Suite 400
Springfield, MA 01103

OPINION OF COST	DATE PREPARED : 03/21/19	SHEET 1	OF 1
PROJECT : Charlton MVP Project	BASIS : Vendor quotes; RS Means; previous projects		
LOCATION : Charlton, MA - N. Main St. PS			
DESCRIPTION: Budgetary Opinion of Cost			
DRAWING NO. :	ESTIMATOR : KMF	CHECKED BY : KAM	

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ITEM NO.	ITEM DESCRIPTION	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST
	Furnish and Install Barrier Wall Around Station	LF	100	$ 100.00	$ 10,000.00
	Foundation for Barrier Wall	LF	100	$ 200.00	$ 20,000.00
	Opening with Weir Boards	LS	1	$ 2,000.00	$ 2,000.00
	Weir Boards	EA	4	$ 500.00	$ 2,000.00
	SUBTOTAL OPINION OF CONSTRUCTION COST				**$ 34,000.00**
	Building Permits	%	0.40%	$136	$136.00
	Builders Risk Insurance	%	0.25%	$85	$85.00
	General Liability Insurance	%	1.5%	$510	$510.00
	Contractor Bonds	%	1%	$340	$340.00
	GC Field General Conditions	%	10%	$3,400	$3,400.00
	Contractor's Overhead and Profit	%	8%	$2,720	$2,720.00
	TOTAL OPINION OF CONSTRUCTION COST				**$ 41,191.00**
	CONTINGENCY	%	25%		**$ 10,297.75**
	TOTAL OPINION OF COST (-15% to + 30%)			**$44,000.00**	**$ 67,000.00**

FUSS & O'NEILL, INC.
1550 Main Street, Suite 400
Springfield, MA 01103

OPINION OF COST	DATE PREPARED : 03/21/19	SHEET 1 OF 1
PROJECT : Charlton MVP Project	BASIS : Vendor quotes; RS Means; previous projects	
LOCATION : Charlton, MA - Muggett Hill Rd PS		
DESCRIPTIO Budgetary Opinion of Cost		
DRAWING NO. :	ESTIMATOR : KMF	CHECKED BY : KAM

Since Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions, Fuss & O'Neill's opinion of probable Total Project Costs and Construction Cost are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.

ITEM NO.	ITEM DESCRIPTION	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST
	Construct Drainage Swales	LF	90	$ 75.00	$ 6,750.00
	Raise Electrical Components	LS	1	$ 15,000.00	$ 15,000.00
	Walkway for Raised Electrical Panels	LS	1	$ 10,000.00	$ 10,000.00
	SUBTOTAL OPINION OF CONSTRUCTION COST				**$ 31,750.00**
	Building Permits	%	0.40%	$127	$127.00
	Builders Risk Insurance	%	0.25%	$79	$79.38
	General Liability Insurance	%	1.5%	$476	$476.25
	Contractor Bonds	%	1%	$318	$317.50
	GC Field General Conditions	%	10%	$3,175	$3,175.00
	Contractor's Overhead and Profit	%	8%	$2,540	$2,540.00
	TOTAL OPINION OF CONSTRUCTION COST				**$ 38,465.13**
	CONTINGENCY	%	25%		**$ 9,616.28**
	TOTAL OPINION OF COST (-15% to + 30%)			**$41,000.00**	**$ 63,000.00**

FUSS & O'NEILL, INC.
1550 Main Street, Suite 400
Springfield, MA 01103

OPINION OF COST	DATE PREPARED : 03/21/19	SHEET 1 OF 1
PROJECT : Charlton MVP Project	BASIS : Vendor quotes; RS Means; previous projects	
LOCATION : Charlton, MA - South Sturbridge Rd PS		
DESCRIPTIO Budgetary Opinion of Cost		
DRAWING NO. :	ESTIMATOR : KMF	CHECKED BY : KAM

Since Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions, Fuss & O'Neill's opinion of probable Total Project Costs and Construction Cost are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.

ITEM NO.	ITEM DESCRIPTION	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST
	Construct Drainage Swales	LS	1	$ 10,000.00	$ 10,000.00
	Raise Electrical Cabinet on Concrete Pad	LS	1	$ 7,500.00	$ 7,500.00
	Raise Ventilation System on Concrete Pade	LS	1	$ 7,500.00	$ 7,500.00
	SUBTOTAL OPINION OF CONSTRUCTION COST				**$ 25,000.00**
	Building Permits	%	0.40%	$100	$100.00
	Builders Risk Insurance	%	0.25%	$63	$62.50
	General Liability Insurance	%	1.5%	$375	$375.00
	Contractor Bonds	%	1%	$250	$250.00
	GC Field General Conditions	%	10%	$2,500	$2,500.00
	Contractor's Overhead and Profit	%	8%	$2,000	$2,000.00
	TOTAL OPINION OF CONSTRUCTION COST				**$ 30,287.50**
	CONTINGENCY	%	25%		**$ 7,571.88**
	TOTAL OPINION OF COST (-15% to + 30%)			**$32,000.00**	**$ 49,000.00**

FUSS & O'NEILL, INC.
1550 Main Street, Suite 400
Springfield, MA 01103

OPINION OF COST	DATE PREPARED : 03/21/19	SHEET 1 OF 1
PROJECT : Charlton MVP Project	BASIS : Vendor quotes; RS Means; previous projects	
LOCATION : Charlton, MA - Stevens Park Rd PS		
DESCRIPTIO Budgetary Opinion of Cost		
DRAWING NO. :	ESTIMATOR : KMF	CHECKED BY : KAM

Since Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions, Fuss & O'Neill's opinion of probable Total Project Costs and Construction Cost are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.

ITEM NO.	ITEM DESCRIPTION	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST
	Construct Drainage Swales	LS	1	$ 20,000.00	$ 20,000.00
	Re-set Electrical Panel	LS	1	$ 10,000.00	$ 10,000.00
	Re-set Ventilation System	LS	1	$ 5,000.00	$ 5,000.00
	Concrete Pads for Electric And Ventilation	EA	2	$ 3,000.00	$ 6,000.00
	Re-set Fencing around the Station	LS	1	$ 20,000.00	$ 20,000.00
	SUBTOTAL OPINION OF CONSTRUCTION COST				**$ 61,000.00**
	Building Permits	%	0.40%	$244	$244.00
	Builders Risk Insurance	%	0.25%	$153	$152.50
	General Liability Insurance	%	1.5%	$915	$915.00
	Contractor Bonds	%	1%	$610	$610.00
	GC Field General Conditions	%	10%	$6,100	$6,100.00
	Contractor's Overhead and Profit	%	8%	$4,880	$4,880.00
	TOTAL OPINION OF CONSTRUCTION COST				**$ 73,901.50**
	CONTINGENCY	%	25%		**$ 18,475.38**
	TOTAL OPINION OF COST (-15% to + 30%)			**$79,000.00**	**$ 120,000.00**

FUSS & O'NEILL, INC.
1550 Main Street, Suite 400
Springfield, MA 01103

OPINION OF COST	DATE PREPARED : 03/21/19	SHEET 1 OF 1
PROJECT : Charlton MVP Project	BASIS : Vendor quotes; RS Means; previous projects	
LOCATION : Charlton, MA - Route 20 MTA 5E PS		
DESCRIPTIO Budgetary Opinion of Cost		
DRAWING NO. :	ESTIMATOR : KMF	CHECKED BY : KAM

Since Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions, Fuss & O'Neill's opinion of probable Total Project Costs and Construction Cost are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.

ITEM NO.	ITEM DESCRIPTION	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST
	Furnish and Install Protective Barrier	EA	1	$ 15,000.00	$ 15,000.00
	Furnish and Install Hatch between floors	LS	1	$ 10,000.00	$ 10,000.00
	Seal Penentrations between Main and Lower Level	LS	1	$ 5,000.00	$ 5,000.00
	SUBTOTAL OPINION OF CONSTRUCTION COST				**$ 30,000.00**
	Building Permits	%	0.40%	$120	$120.00
	Builders Risk Insurance	%	0.25%	$75	$75.00
	General Liability Insurance	%	1.5%	$450	$450.00
	Contractor Bonds	%	1%	$300	$300.00
	GC Field General Conditions	%	10%	$3,000	$3,000.00
	Contractor's Overhead and Profit	%	8%	$2,400	$2,400.00
	TOTAL OPINION OF CONSTRUCTION COST				**$ 36,345.00**
	CONTINGENCY	%	25%		**$ 9,086.25**
	TOTAL OPINION OF COST (-15% to + 30%)			**$39,000.00**	**$ 59,000.00**

FUSS & O'NEILL, INC.
1550 Main Street, Suite 400
Springfield, MA 01103

OPINION OF COST	DATE PREPARED : 03/21/19	SHEET 1 OF 1
PROJECT : Charlton MVP Project	BASIS : Vendor quotes; RS Means; previous projects	
LOCATION : Charlton, MA - J. Hammond Rd MTA 6W PS		
DESCRIPTIO Budgetary Opinion of Cost		
DRAWING NO. :	ESTIMATOR : KMF	CHECKED BY : KAM

Since Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions, Fuss & O'Neill's opinion of probable Total Project Costs and Construction Cost are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.

ITEM NO.	ITEM DESCRIPTION	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST
	Furnish and Install Protective Barrier	EA	1	$ 15,000.00	$ 15,000.00
	Furnish and Install Hatch between floors	EA	2	$ 10,000.00	$ 20,000.00
	Seal Penentrations between Main and Lower Level	LS	1	$ 10,000.00	$ 10,000.00
	SUBTOTAL OPINION OF CONSTRUCTION COST				**$ 45,000.00**
	Building Permits	%	0.40%	$180	$180.00
	Builders Risk Insurance	%	0.25%	$113	$112.50
	General Liability Insurance	%	1.5%	$675	$675.00
	Contractor Bonds	%	1%	$450	$450.00
	GC Field General Conditions	%	10%	$4,500	$4,500.00
	Contractor's Overhead and Profit	%	8%	$3,600	$3,600.00
	TOTAL OPINION OF CONSTRUCTION COST				**$ 54,517.50**
	CONTINGENCY	%	25%		**$ 13,629.38**
	TOTAL OPINION OF COST (-15% to + 30%)			**$58,000.00**	**$ 89,000.00**

FUSS & O'NEILL, INC.
1550 Main Street, Suite 400
Springfield, MA 01103

OPINION OF COST	DATE PREPARED : 03/21/19	SHEET 1 OF 1
PROJECT : Charlton MVP Project	BASIS : Vendor quotes; RS Means; previous projects	
LOCATION : Charlton, MA - Route 20 PRV		
DESCRIPTIO Budgetary Opinion of Cost		
DRAWING NO. :	ESTIMATOR : KMF	CHECKED BY : KAM

Since Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions, Fuss & O'Neill's opinion of probable Total Project Costs and Construction Cost are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.

ITEM NO.	ITEM DESCRIPTION	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST
	Furnish and Install Drainage Improvements	LS	1	$ 15,000.00	$ 15,000.00
	PRV Vault Modifications	LS	1	$ 15,000.00	$ 15,000.00
	Install New PR Valve	EA	1	$ 3,500.00	$ 3,500.00
	SUBTOTAL OPINION OF CONSTRUCTION COST				**$ 33,500.00**
	Building Permits	%	0.40%	$134	$134.00
	Builders Risk Insurance	%	0.25%	$84	$83.75
	General Liability Insurance	%	1.5%	$503	$502.50
	Contractor Bonds	%	1%	$335	$335.00
	GC Field General Conditions	%	10%	$3,350	$3,350.00
	Contractor's Overhead and Profit	%	8%	$2,680	$2,680.00
	TOTAL OPINION OF CONSTRUCTION COST				**$ 40,585.25**
	CONTINGENCY	%	25%		**$ 10,146.31**
	TOTAL OPINION OF COST (-15% to + 30%)			**$43,000.00**	**$ 66,000.00**

FUSS & O'NEILL

Appendix B

Summary and Detail of Costs for Resiliency Improvements
Town of Spencer, MA

FUSS & O'NEILL, INC.
1550 Main Street, Suite 400
Springfield, MA 01103

OPINION OF COST		DATE PREPARED : 03/21/19	SHEET 1 OF 1
PROJECT :	Charlton MVP Project	BASIS :	Vendor quotes; RS Means; previous projects
LOCATION :	Charlton, MA		
DESCRIPTION:	Budgetary Opinion of Cost		
DRAWING NO. :		ESTIMATOR : KMF	CHECKED BY : KAM

Since Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions, Fuss & O'Neill's opinion of probable Total Project Costs and Construction Cost are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.

ITEM NO.	ITEM DESCRIPTION	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST
	Seven Mile River Wellfield				$ 10,000.00
	Cranberry River Wellfield				$ 45,000.00
	Meadow Road PS				$ 40,000.00
	UV System at WWTF				$ 20,000.00
	Low Lying Area Adams Street/Spencer Pond				$ 32,500.00
	SUBTOTAL OPINION OF CONSTRUCTION COST				**$ 147,500.00**
	Building Permits	%	0.40%	$590	$590.00
	Builders Risk Insurance	%	0.25%	$369	$368.75
	General Liability Insurance	%	1.5%	$2,213	$2,212.50
	Contractor Bonds	%	1%	$1,475	$1,475.00
	GC Field General Conditions	%	10%	$14,750	$14,750.00
	Contractor's Overhead and Profit	%	8%	$11,800	$11,800.00
	TOTAL OPINION OF CONSTRUCTION COST				**$ 178,696.25**
	CONTINGENCY	%	25%		**$ 44,674.06**
	TOTAL OPINION OF COST (-15% to + 30%)			**$190,000.00**	**$ 290,000.00**

FUSS & O'NEILL, INC.
1550 Main Street, Suite 400
Springfield, MA 01103

OPINION OF COST	DATE PREPARED : 03/21/19	SHEET 1 OF 1
PROJECT : Spencer MVP Project	BASIS : Vendor quotes; RS Means; previous projects	
LOCATION : Spencer, MA - Seven Mile River Wellfield		
DESCRIPTION: Budgetary Opinion of Cost		
DRAWING NO. :	ESTIMATOR : KMF	CHECKED BY : KAM

Since Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions, Fuss & O'Neill's opinion of probable Total Project Costs and Construction Cost are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.

ITEM NO.	ITEM DESCRIPTION	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST
	Raise Electrical Equipment	LS	1	$ 10,000.00	$ 10,000.00
	SUBTOTAL OPINION OF CONSTRUCTION COST				**$ 10,000.00**
	Building Permits	%	0.40%	$40	$40.00
	Builders Risk Insurance	%	0.25%	$25	$25.00
	General Liability Insurance	%	1.5%	$150	$150.00
	Contractor Bonds	%	1%	$100	$100.00
	GC Field General Conditions	%	10%	$1,000	$1,000.00
	Contractor's Overhead and Profit	%	8%	$800	$800.00
	TOTAL OPINION OF CONSTRUCTION COST				**$ 12,115.00**
	CONTINGENCY	%	25%		**$ 3,028.75**
	TOTAL OPINION OF COST (-15% to + 30%)			**$13,000.00**	**$ 20,000.00**

FUSS & O'NEILL, INC.
1550 Main Street, Suite 400
Springfield, MA 01103

OPINION OF COST	DATE PREPARED : 03/21/19	SHEET 1	OF 1
PROJECT : Spencer MVP Project	BASIS : Vendor quotes; RS Means; previous projects		
LOCATION : Spencer, MA - Cranberry Wellfield			
DESCRIPTION: Budgetary Opinion of Cost			
DRAWING NO. :	ESTIMATOR : KMF	CHECKED BY : KAM	

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ITEM NO.	ITEM DESCRIPTION	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST
	Furnish and Install Barrier at Wellhouse Entrance	LS	1	$ 10,000.00	$ 10,000.00
	Raise Serivce Transformer	LS	1	$ 10,000.00	$ 10,000.00
	Power Company allowance	LS	1	$ 10,000.00	$ 10,000.00
	Concrete Pad	LS	1	$ 10,000.00	$ 10,000.00
	Raise Junction Box in Chemical Building	LS	1	$ 5,000.00	$ 5,000.00
	SUBTOTAL OPINION OF CONSTRUCTION COST				**$ 45,000.00**
	Building Permits	%	0.40%	$180	$180.00
	Builders Risk Insurance	%	0.25%	$113	$112.50
	General Liability Insurance	%	1.5%	$675	$675.00
	Contractor Bonds	%	1%	$450	$450.00
	GC Field General Conditions	%	10%	$4,500	$4,500.00
	Contractor's Overhead and Profit	%	8%	$3,600	$3,600.00
	TOTAL OPINION OF CONSTRUCTION COST				**$ 54,517.50**
	CONTINGENCY	%	25%		**$ 13,629.38**
	TOTAL OPINION OF COST (-15% to + 30%)			**$58,000.00**	**$ 89,000.00**

FUSS & O'NEILL, INC.
1550 Main Street, Suite 400
Springfield, MA 01103

OPINION OF COST	DATE PREPARED : 03/21/19	SHEET 1 OF 1
PROJECT : Spencer MVP Project	BASIS : Vendor quotes; RS Means; previous projects	
LOCATION : Spencer, MA - Meadow Road PS		
DESCRIPTIO Budgetary Opinion of Cost		
DRAWING NO. :	ESTIMATOR : KMF	CHECKED BY : KAM

Since Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions, Fuss & O'Neill's opinion of probable Total Project Costs and Construction Cost are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.

ITEM NO.	ITEM DESCRIPTION	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST
	Furnish and Install Barrier at PS Entrance	LS	1	$ 10,000.00	$ 10,000.00
	Raise Genereator	LS	1	$ 20,000.00	$ 20,000.00
	Raise Propane Tank	LS	1	$ 10,000.00	$ 10,000.00
	SUBTOTAL OPINION OF CONSTRUCTION COST				**$ 40,000.00**
	Building Permits	%	0.40%	$160	$160.00
	Builders Risk Insurance	%	0.25%	$100	$100.00
	General Liability Insurance	%	1.5%	$600	$600.00
	Contractor Bonds	%	1%	$400	$400.00
	GC Field General Conditions	%	10%	$4,000	$4,000.00
	Contractor's Overhead and Profit	%	8%	$3,200	$3,200.00
	TOTAL OPINION OF CONSTRUCTION COST				**$ 48,460.00**
	CONTINGENCY	%	25%		**$ 12,115.00**
	TOTAL OPINION OF COST (-15% to + 30%)			**$51,000.00**	**$ 79,000.00**

FUSS & O'NEILL, INC.

1550 Main Street, Suite 400
Springfield, MA 01103

OPINION OF COST	DATE PREPARED : 03/21/19	SHEET 1 OF 1
PROJECT : Spencer MVP Project	BASIS : Vendor quotes; RS Means; previous projects	
LOCATION : Spencer, MA - Meadow Rd. PS		
DESCRIPTIO Budgetary Opinion of Cost		
DRAWING NO. :	ESTIMATOR : KMF	CHECKED BY : KAM

Since Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions, Fuss & O'Neill's opinion of probable Total Project Costs and Construction Cost are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.

ITEM NO.	ITEM DESCRIPTION	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST
	Furnish and install Concrete Barrier wall around UV	LF	60	$ 250.00	$ 15,000.00
	Add entrance and weir boards	LS	1	$ 5,000.00	$ 5,000.00
	SUBTOTAL OPINION OF CONSTRUCTION COST				**$ 20,000.00**
	Building Permits	%	0.40%	$80	$80.00
	Builders Risk Insurance	%	0.25%	$50	$50.00
	General Liability Insurance	%	1.5%	$300	$300.00
	Contractor Bonds	%	1%	$200	$200.00
	GC Field General Conditions	%	10%	$2,000	$2,000.00
	Contractor's Overhead and Profit	%	8%	$1,600	$1,600.00
	TOTAL OPINION OF CONSTRUCTION COST				**$ 24,230.00**
	CONTINGENCY	%	25%		**$ 6,057.50**
	TOTAL OPINION OF COST (-15% to + 30%)			**$26,000.00**	**$ 39,000.00**

FUSS & O'NEILL, INC.
1550 Main Street, Suite 400
Springfield, MA 01103

OPINION OF COST	DATE PREPARED : 03/21/19	SHEET 1 OF 1
PROJECT : Spencer MVP Project	BASIS : Vendor quotes; RS Means; previous projects	
LOCATION : Spencer, MA - Low Lying Area Adams Street - Spencer Pond		
DESCRIPTIO Budgetary Opinion of Cost		
DRAWING NO. :	ESTIMATOR : KMF	CHECKED BY : KAM

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ITEM NO.	ITEM DESCRIPTION	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST
	Hydraulics Analysis -Pond, Storm Drainage and Outlet	LS	1	$ 25,000.00	$ 25,000.00
	Furnish and Install Level Transducer	LS	1	$ 2,500.00	$ 2,500.00
	Evaluate Gates at Outlet	LS	1	$ 5,000.00	$ 5,000.00
	SUBTOTAL OPINION OF CONSTRUCTION COST				**$ 32,500.00**
	Building Permits	%	0.40%	$130	$130.00
	Builders Risk Insurance	%	0.25%	$81	$81.25
	General Liability Insurance	%	1.5%	$488	$487.50
	Contractor Bonds	%	1%	$325	$325.00
	GC Field General Conditions	%	10%	$3,250	$3,250.00
	Contractor's Overhead and Profit	%	8%	$2,600	$2,600.00
	TOTAL OPINION OF CONSTRUCTION COST				**$ 39,373.75**
	CONTINGENCY	%	25%		**$ 9,843.44**
	TOTAL OPINION OF COST (-15% to + 30%)			**$42,000.00**	**$ 64,000.00**

Appendix E

Green Infrastructure Assessment Technical Memorandum

FUSS & O'NEILL

M E M O R A N D U M

TO: Project Steering Committee

FROM: Erik Mas, PE; Rachael Weiter, EIT
Fuss & O'Neill, Inc.
1550 Main Street, Suite 400
Springfield, MA 01103

DATE: June 20, 2019

RE: Green Infrastructure Assessment
Integrated Water Infrastructure Vulnerability Assessment and Climate Resiliency Plan
MVP Action Grant – Town of Charlton & Town of Spencer

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1. Introduction

Fuss and O'Neill performed a screening-level assessment of potential green infrastructure (GI) retrofit sites throughout the Towns of Charlton and Spencer (the Towns). The goal of this assessment is to identify opportunities and develop concepts for site-specific green infrastructure retrofits that achieve dual objectives: increase flood resiliency by reducing runoff volumes and peak flows and improve or protect water quality by reducing pollutant loads to receiving waters.

Green infrastructure refers to systems and practices that reduce surface water runoff through the use vegetation, soils, and natural processes to manage water and create healthier urban and suburban environments (EPA, 2014). Green infrastructure includes a variety of stormwater management practices such as bioretention, engineered wetland systems, permeable pavement, green roofs, green streets, infiltration planters, tree boxes, and rainwater harvesting. These practices capture, manage, and/or reuse rainfall close to where it falls, thereby reducing stormwater runoff and keeping it out of drainage systems and receiving waters.

In addition to reducing polluted runoff and improving water quality, green infrastructure can improve flow conditions in streams and rivers by infiltrating water into the ground, thereby reducing peak flows during wet weather and sustaining or increasing stream base flow during dry periods, which can be important for aquatic habitat and fisheries. When applied throughout a watershed, green infrastructure can help mitigate flood risk and increase flood resiliency. At a smaller scale, green infrastructure can also reduce erosive velocities and streambank erosion.

Finally, green infrastructure has been shown to provide other social and economic benefits relative to reduced energy consumption, improved air quality, carbon reduction and sequestration, improved property values, recreational opportunities, overall economic vitality, and adaptation to climate change. For these reasons, many communities are exploring the use of and are adopting green infrastructure within their municipal infrastructure programs.

2. Assessment Methods and Findings

The overall green infrastructure assessment consists of three major tasks:

1. Screening-level assessment to quickly identify areas within both communities with the greatest feasibility for and potential benefits from green infrastructure retrofits,
2. Field inventories of the most promising green infrastructure retrofit opportunities identified from the screening step,
3. Green infrastructure concept designs for selected retrofit sites.

This technical memorandum documents the methods and findings of the screening-level assessment, as well as field inventories and green infrastructure concept designs for selected retrofit sites.

2.1 Site Screening Evaluation

Sites were selected and analyzed using Geographic Information System (GIS) mapping and associated geospatial data. GIS allows for rapid evaluation of specific land-based attributes that are important for assessing the feasibility of green infrastructure practices. The assessment used the following site evaluation criteria[1] and data sources.

- Land Ownership – Publicly-owned (e.g., municipal) sites are most favorable because they avoid the cost of land acquisition and provide direct control over green infrastructure construction, maintenance, and monitoring by the municipality. Other publicly-owned sites such as schools, universities, state facilities, and federal facilities are also potential green infrastructure candidates.

  Publicly-owned properties in the watershed were identified and mapped using the "Tax Parcels for Query" dataset from MassGIS. Polygons with a "POLY_TYPE" value of "TAX" (properties that are tax-exempt) were selected, as these are typically municipally-owned properties or protected parcels. Parcels associated with fire stations, schools (public and private), libraries, and post offices were also included in the analysis.

- Impaired Waters – In order to locate green infrastructure where it will have the greatest benefit to water quality, sites were selected that are in close proximity to impaired waters, which are surface waters that do not meet current water quality standards for specific uses such as recreation and aquatic life. For this screening-level analysis, sites within 2 miles of a mapped water quality impairment were assumed to discharge to the impaired water body.

- Subsurface Conditions – Subsurface conditions are key considerations for infiltration-based green infrastructure retrofits. Soil infiltration capacity, depth to groundwater, depth to restrictive layers (bedrock, dense till), soil bulk density, and inundation of soils due to flooding are important soil-based characteristics that can affect the feasibility of infiltration-based green

[1] Other site-specific factors such as land area, impervious area, drainage area, subsurface utilities, subsurface contamination, and storm drainage system capacity are also important considerations for green infrastructure retrofits.

infrastructure retrofits. For the purposes of this screening evaluation, Natural Resources Conservation Services (NRCS) soil classifications and the Soil Survey Geographic (SSURGO) database were used to assess the feasibility of infiltration practices at a given site. The following describes the soils criteria used in the evaluation:

  - Hydrologic Soil Group – Hydrologic Soil Groups (HSGs) mapped by the NRCS provide an initial estimate of infiltration rate and storage capacity of soils on a site. Group A soils have the lowest runoff potential (highest infiltration rates) and Group D soils have the highest runoff potential (lowest infiltration rates) when thoroughly wet. Soils with higher infiltration capacities are generally better suited for green infrastructure. HSG mapping provides an initial estimate of infiltration potential; field investigations are necessary to verify soil conditions for final feasibility determinations and design purposes.

- 100-Year Floodplain – Practices installed within the 100-year floodplain are more likely to fail due to inundation during large floods. For this screening-level analysis, sites outside of the mapped 100-year floodplain were selected.

- Impervious Cover – Water quality impacts are known to occur in surface waters within drainage basins that have a high degree of impervious cover due to changes in watershed hydrology and pollutant sources that result from development of the landscape with hard surfaces. Sites with higher amounts of impervious cover generate more runoff and have greater potential for runoff reduction through the use of green infrastructure retrofits. Areas with a high degree of development and impervious surfaces are generally considered high priority for green infrastructure implementation. Selection criteria included site impervious coverage of over 30% or at least 1 acre of total impervious cover on a given site.

The site screening process described above was performed by applying each of the screening criteria in succession, thereby reducing the number of selected sites with each successive screening criterion.

2.2 Site Screening Results

A total of 15 sites were identified based on the GIS-based screening evaluation. This was not a sufficient number of sites, as the goal was to assess 30 sites. The subsurface conditions and impervious area criteria were relaxed and an additional 14 public sites were identified for field investigation. The list of the sites was provided to the Towns for review and comment before proceeding with the field investigation. Two additional sites were identified for field investigation by the Towns. Following the initial field investigations based on input from the Project Steering Committee. The sites were reviewed relative to the screening criteria and visited at a later date to confirm feasibility of potential green infrastructure

Table 1 lists the 33 sites selected for assessment, while Figures A and B depict the sites in each town. Aerial photographs of each site are provided in Attachment B.

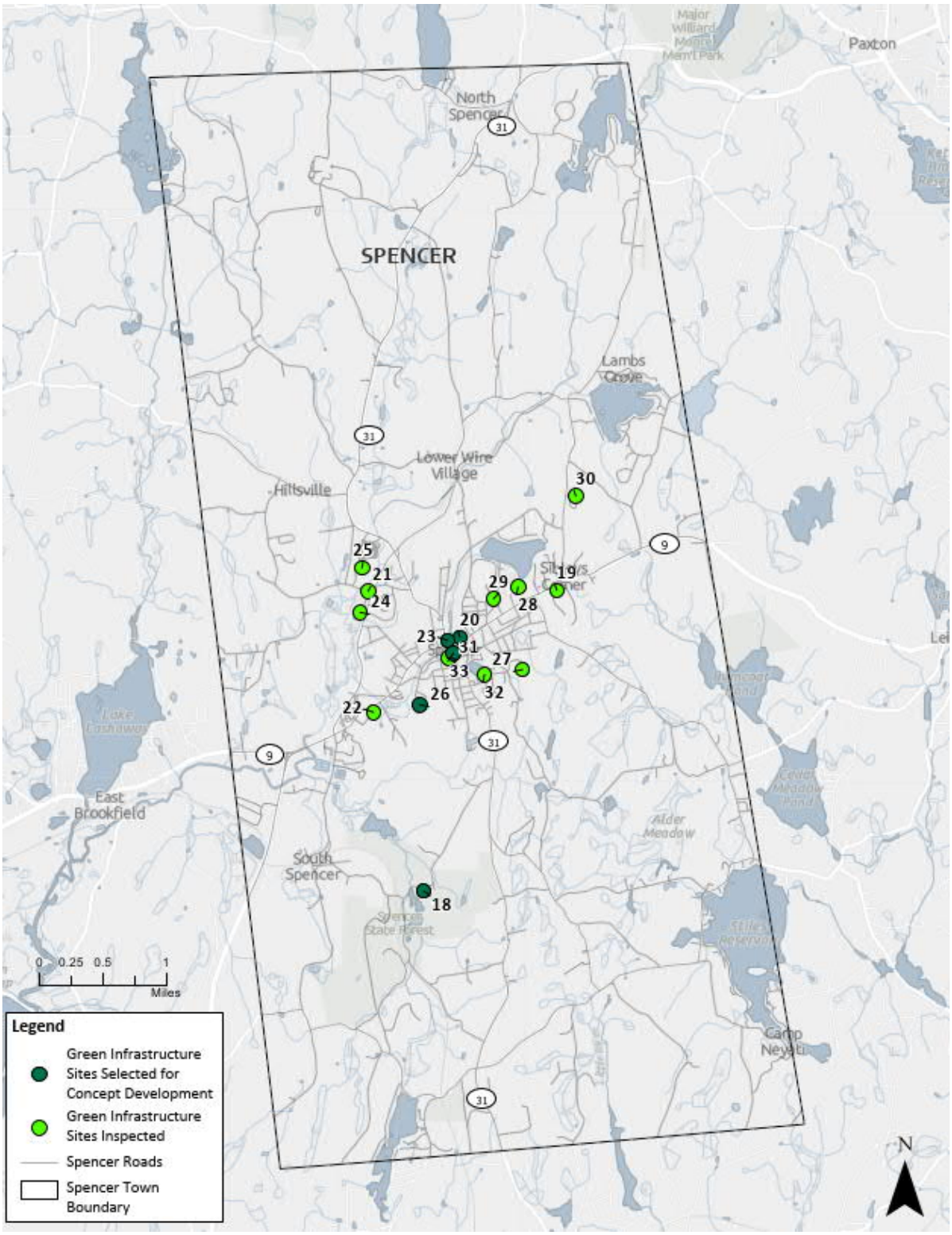

Figure 1: Map of potential green infrastructure sites selected for assessment in the Town of Spencer. See Table 1 for a key to the site numbers.

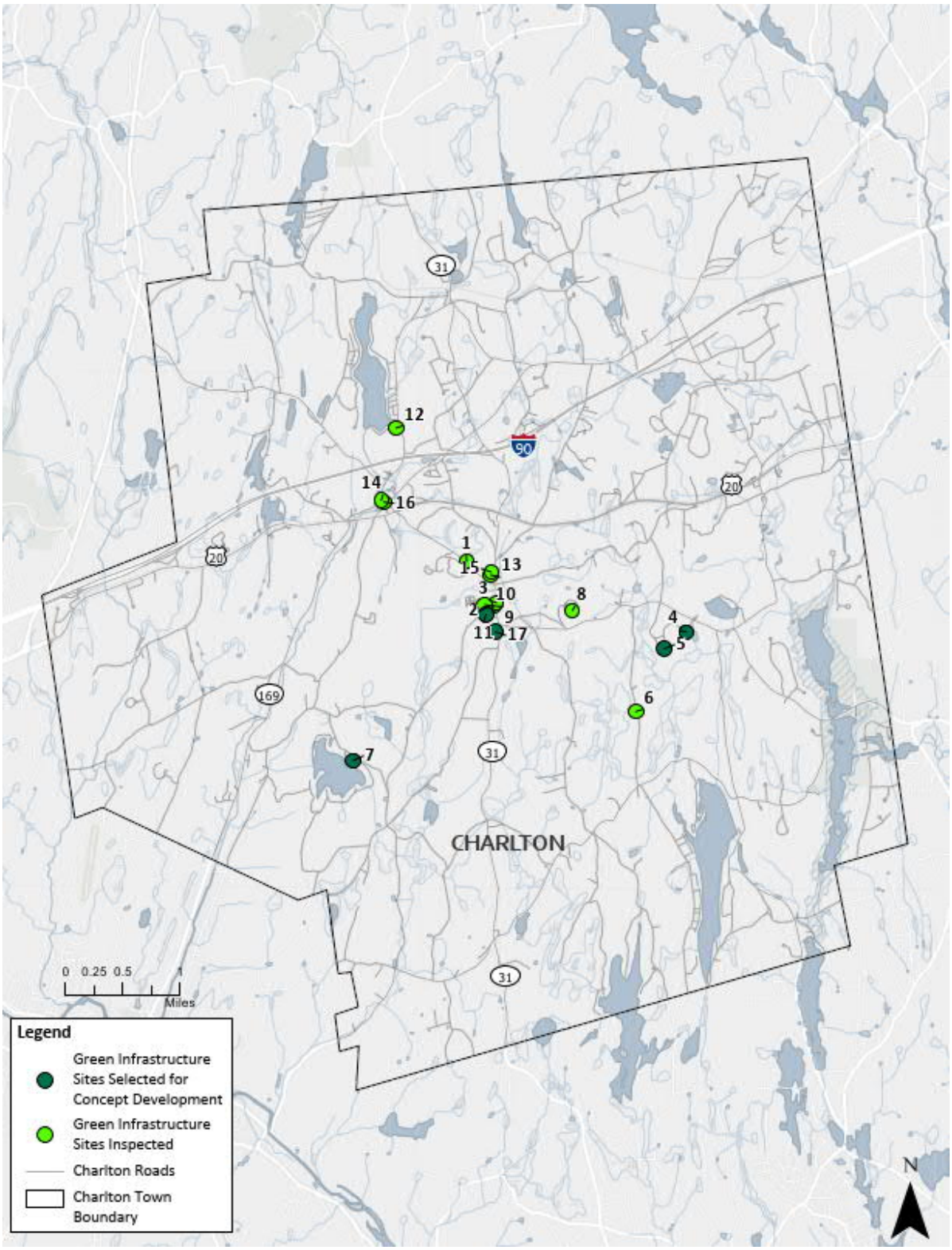

Figure 2: Map of potential green infrastructure sites selected for assessment in the Town of Charlton. See Table 1 for a key to the site numbers.

Table 1. Potential green infrastructure retrofit sites selected for field investigation.

Site Number	Site Name/Description	Address	Owner
Town of Charlton			
1	Charlton Police Department	85 Masonic Home Road	Town of Charlton
2	Charlton Municipal Offices (Charlton Town Hall)	37 Main Street	Town of Charlton
3	Open Space in Front of Charlton Town Hall	Route 31 Right-of-Way	Town of Charlton
4	Heritage School	34 Oxford Road	Dudley-Charlton Regional School District
5	Charlton Middle School	2 Oxford Road	Dudley-Charlton Regional School District
6	Charlton Little League	50 Bond Road and 106 Bond Road	Charlton Little League, Charlton Youth Soccer Inc.
7	Prindle Lake Park	0 Prindle Hill Road	Town of Charlton
8	Bay Path Vocational School	15 Old Muggett Hill Road	Southern Worcester County
9	Charlton Public Library	40 Main Street	Town of Charlton
10	Fields Behind Charlton Public Library	0 Main Streetr	Town of Charlton
11	Charlton Elementary School	9 Burlingame Road	Dudley-Charlton Regional School District
12	Glen Echo Lake Access	0 City Depot Road	Commonwealth of Massachusetts
13	United States Post Office	56 North Main Street	David Peters
14	United States Post Office	9 Power Station Road	R&D Alliance LLC (leased to USPS)
15	Charlton Garage	54 North Main Street	Town of Charlton
16	Charlton Fire Department Headquarters	10 Power Station Road	Town of Charlton
17*	Maynard Farms Recreation Area	12 Dresser Hill Road and 0 Burlingame Road	Town of Charlton
	Town of Spencer		
18	Howe State Park	51 Howe Road	Commonwealth of Massachusetts
19	David Prouty High School and Spencer-East Brookfield Regional HS Athletic Fields	302 Main Street	Town of Spencer
20	Spencer Town Hall	157 Main Street	Town of Spencer
21	Powder Mill Park	Meadow Road	Town of Spencer
22	Spencer Police Department Spencer Fire Department Headquarters Spencer Rescue & Emergency Squad	9 West Main Street 11 West Main Street 6 Bixby Road	Town of Spencer Town of Spencer Spencer Rescue & Emergency Squad
23	Richard Sugden Library	117 Main Street	Town of Spencer
24	Spencer Water & Sewer Department	3 Meadow Hill Road	Town of Spencer
25	Spencer Fairgrounds	46 Smithville Road	Town of Spencer
26	O'Gara Park	Valley Street	Town of Spencer
27	Knox Trail Junior High School	73 Ash Street	Town of Spencer

Table 1. Potential green infrastructure retrofit sites selected for field investigation.

Site Number	Site Name/Description	Address	Owner
28	Luther Hill Park Laurel Hill Park	19 Park Street 269 Main Street	David P. Durgan Town of Spencer
29	Lake Street School (public amenity portion)	17 Lake Street and 42 Highland Avenue	Town of Spencer
30	Wire Village School	60 Paxton Road	Town of Spencer
31	Intersection of Lloyd Dyer and Wall Streets	Wall Street and Lloyd Dyer Street	Town of Spencer
32	Clark Street Outfall to Muzzy Meadow Pond	Clark Street	Town of Spencer
33*	Mechanic Street Parking Lot	14, 18, and 20 Mechanic Street	Town of Spencer

*Sites requested for assessment after field assessments were complete. Aerial photographs and field forms are not available for these sites.

3. Field Inventories, Site Selection, and Conceptual Designs

3.1 Field Inventories

Site visits were conducted at the selected sites in December 2018. The sites and adjacent street areas were walked and visually inspected for potential green infrastructure retrofit opportunities (i.e., impervious surfaces connected to the on-site drainage system, available green space to accommodate new green infrastructure practices, and drainage features that could be enhanced or improved) and physical site characteristics such as site configuration, drainage patterns, current use, slope, landscaping, subsurface utilities, design complexity, and maintenance access considerations. Field notes on potential green infrastructure retrofit sites were recorded using inventory forms developed by the Center for Watershed Protection (Attachment C) and photographs were taken at each location.

The types of green infrastructure retrofits with potential applicability in both communities include:

- Bioretention/bioswales, including roadside bioswales or linear bioretention.
- Belowground infiltration systems, including infiltrating catch basins (with appropriate pretreatment), dry wells, or linear infiltration systems.
- Permeable pavement (sidewalks, on-street and parking lot parking spaces, and low-traffic areas).
- Tree boxes and tree planting (primarily streetscape applications).
- Water harvesting and reuse.

3.2 Sites Selected for Concept Designs

Based on the findings of the field inventories, green infrastructure retrofit opportunities were identified at most of the sites visited (see Attachment D for potential retrofit suggestions). Ten of these sites were chosen for development of concept designs consistent with the project scope and available budget for this task. These sites were selected because they: (1) have the greatest feasibility for green infrastructure retrofits and (2) provide the best opportunities to infiltrate (i.e., reduce) or filter runoff.

Many of the sites are also in highly visible, public locations and therefore provide good demonstration value. The ten sites are listed in Table 2.

Table 2. Sites selected for development of green infrastructure design concepts.

Concept Site Number	Site Name	Green Infrastructure BMP Type	Project Cost Estimate
Town of Charlton			
1	Heritage School	Bioretention Roof Runoff Capture and Reuse Regrade and consider elevating access road	$513,000*
2	Charlton Middle School	Green Roof Bioretention Roof Runoff Capture and Reuse	$426,000*
3	Charlton Elementary School	Infiltration Bioretention Native Plantings	$49,000
4	Prindle Lake Park	Bioretention	$28,000
5	Maynard Farm Recreation Area	Bioretention	$44,000
Town of Spencer			
6	Howe State Park	Pavement Removal Bioretention	$51,000
7	Mechanic Street Parking Lot	Bioretention Underground Infiltration Permeable Pavers	$495,000
8	Spencer Town Hall	Bioretention (with Improved Pedestrian Access) Pavement Removal	$441,000
9	Richard Sugden Library	Bioretention Permeable Pavers	$20,000
10	O'Gara Park	Riparian Buffer Restoration Native Plantings	$11,000

*Cost estimate does not include costs for roof runoff capture and reuse for irrigation.

3.3 Design Concepts

Green infrastructure retrofit design concepts were prepared for the selected sites. The design concepts reflect opportunities for infiltration and/or water quality treatment at each site. BMPs were sited to capture and infiltrate/treat the 1-inch Water Quality Volume (WQv), where possible. Opportunities were also evaluated to manage additional runoff from on-site and off-site drainage areas.

The retrofit design concepts, including planning-level costs and estimated pollutant removals, are presented on the concept sheets in Attachment D. Each concept sheet includes a general site description, the proposed retrofit concept, field images with renderings of retrofit opportunities (where available), typical details of recommended BMPs, and estimates of pollutant removal, runoff reduction, and cost. Sizing calculations for the recommended bioretention practices are provided in Attachment E.

Preliminary, planning-level costs were estimated for the site-specific concepts based upon unit costs derived from published sources, engineering experience, and the proposed design concepts. A 30% contingency is used to account for the costs of design and permitting. A more detailed breakdown of

estimated costs, including operation and maintenance costs and total annualized costs based on the anticipated design life of each practice, is provided in Attachment F.

The green infrastructure retrofit concepts presented in this technical memorandum provide potential on-the-ground projects for future implementation. They also serve as examples of the types of projects that could be implemented at similar sites throughout the watershed. It is important to emphasize that these design concepts are not detailed designs. Individual project proponents (e.g., municipalities, school districts, Commonwealth of Massachusetts) are responsible for evaluating the ultimate feasibility of, as well as design and permitting for, these and similar site-specific concepts.

Attachments:
Attachment A: Aerial Photographs of Potential Green Infrastructure Retrofit Sites
Attachment B: Field Sheets
Attachment C: Spreadsheet of Potential Green Infrastructure Retrofit Sites
Attachment D: Retrofit Design Concepts
Attachment E: Bioretention Practice Sizing Calculations
Attachment F: Planning Level Cost Estimates

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Attachment A

Aerial Photographs of Potential Green Infrastructure Retrofit Sites

Site Name: Heritage School
Site Number: 1

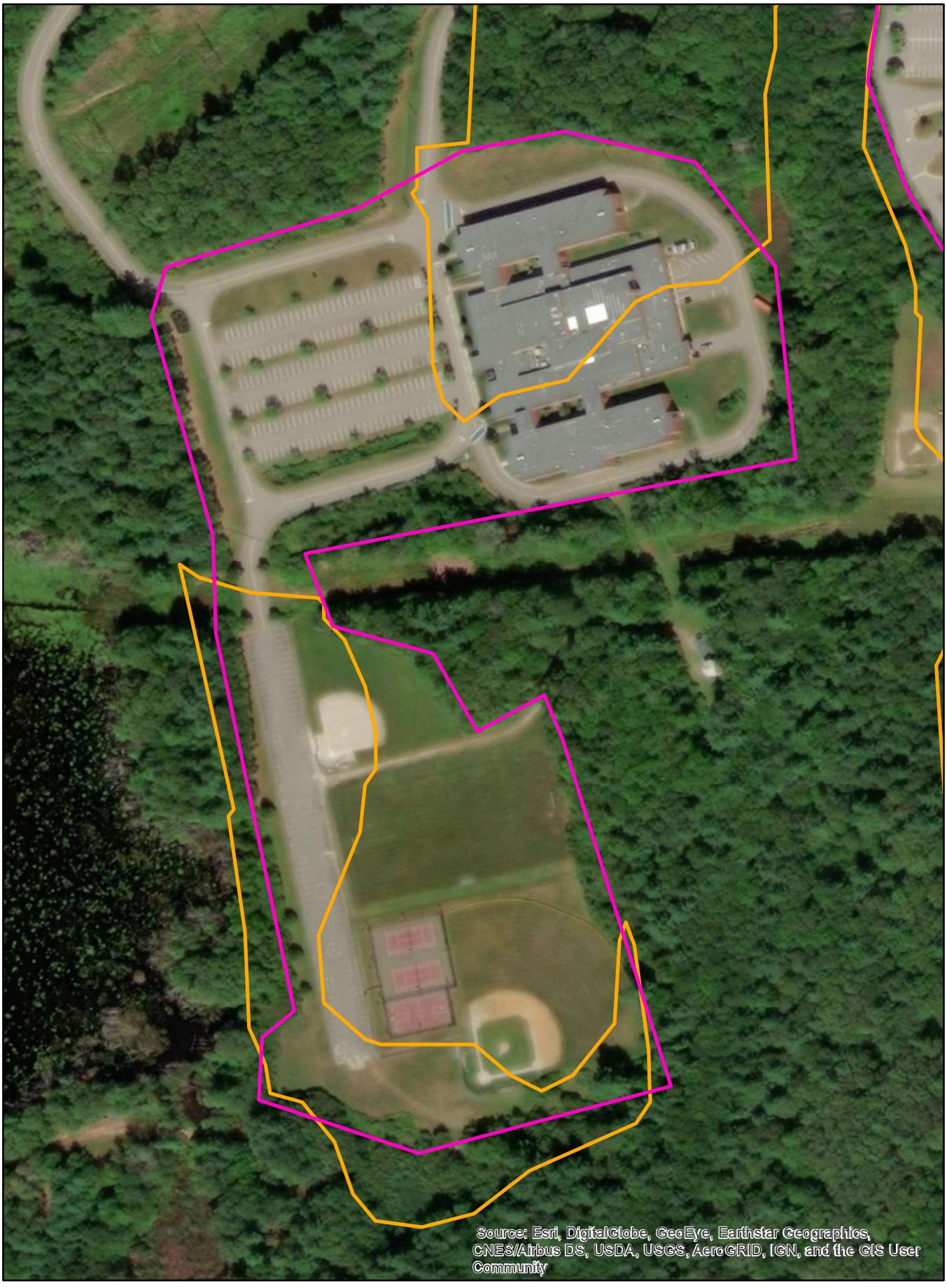
0 55 110 220 Feet

N

Site Name: Charlton Middle School
Site Number: 2

0 105 210 420 Feet

N



Site Name: Charlton Police Department
Site Number: 3

0 35 70 140
Feet

N

Site Name: Charlton Sewer Office, etc.l
Site Number: 4

0 20 40 80 Feet

N

Site Name: Charlton Library
Site Number: 5

0 15 30 60 Feet

N

Site Name: Charlton Town Hall
Site Number: 6

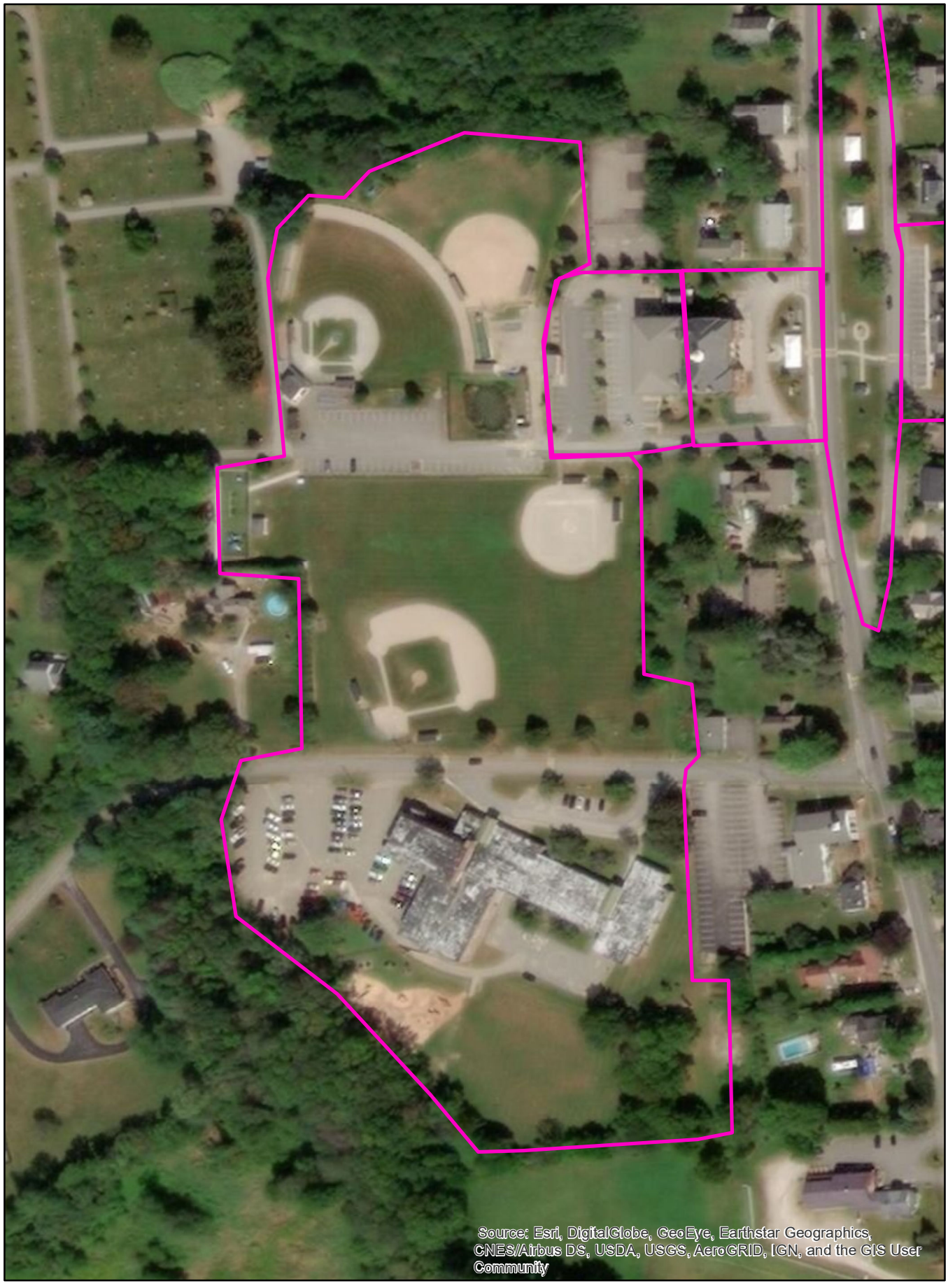
0 15 30 60 Feet

N

Site Name: Charlton Elementary School
Site Number: 7

0 85 170 340 Feet

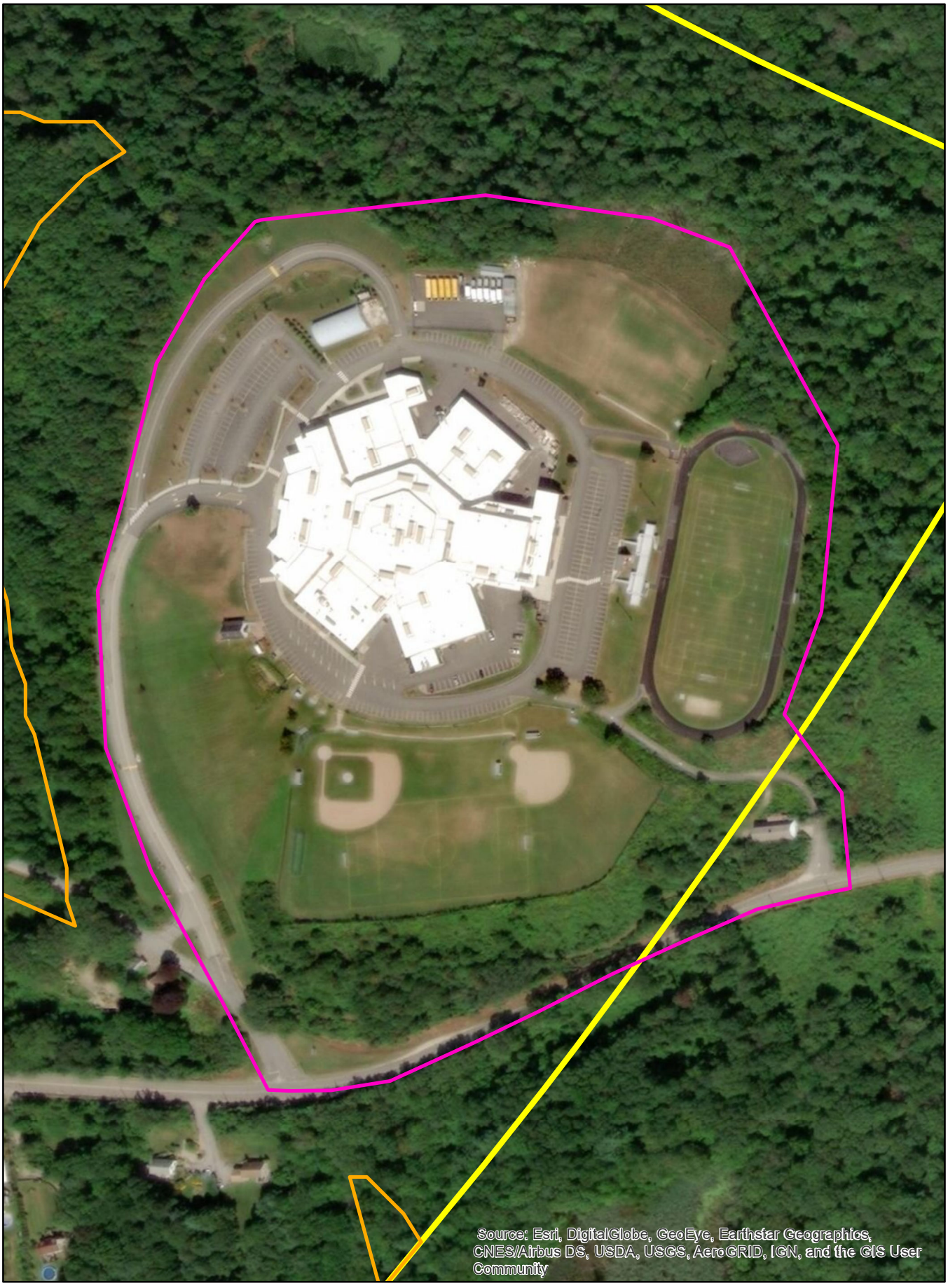
N



Site Name: Bay Path Vocational School
Site Number: 8

0 120 240 480
Feet

N



Site Name: Charlton Fire Station
Site Number: 9

0 10 20 40 Feet

N

Site Name: Charlton Fire Station #2
Site Number: 10

0 15 30 60 Feet

N

Site Name: Charlton Post Office Powerstation Road
Site Number: 11

0 10 20 40 Feet

N

Site Name: Charlton Post Office Main Street
Site Number: 12

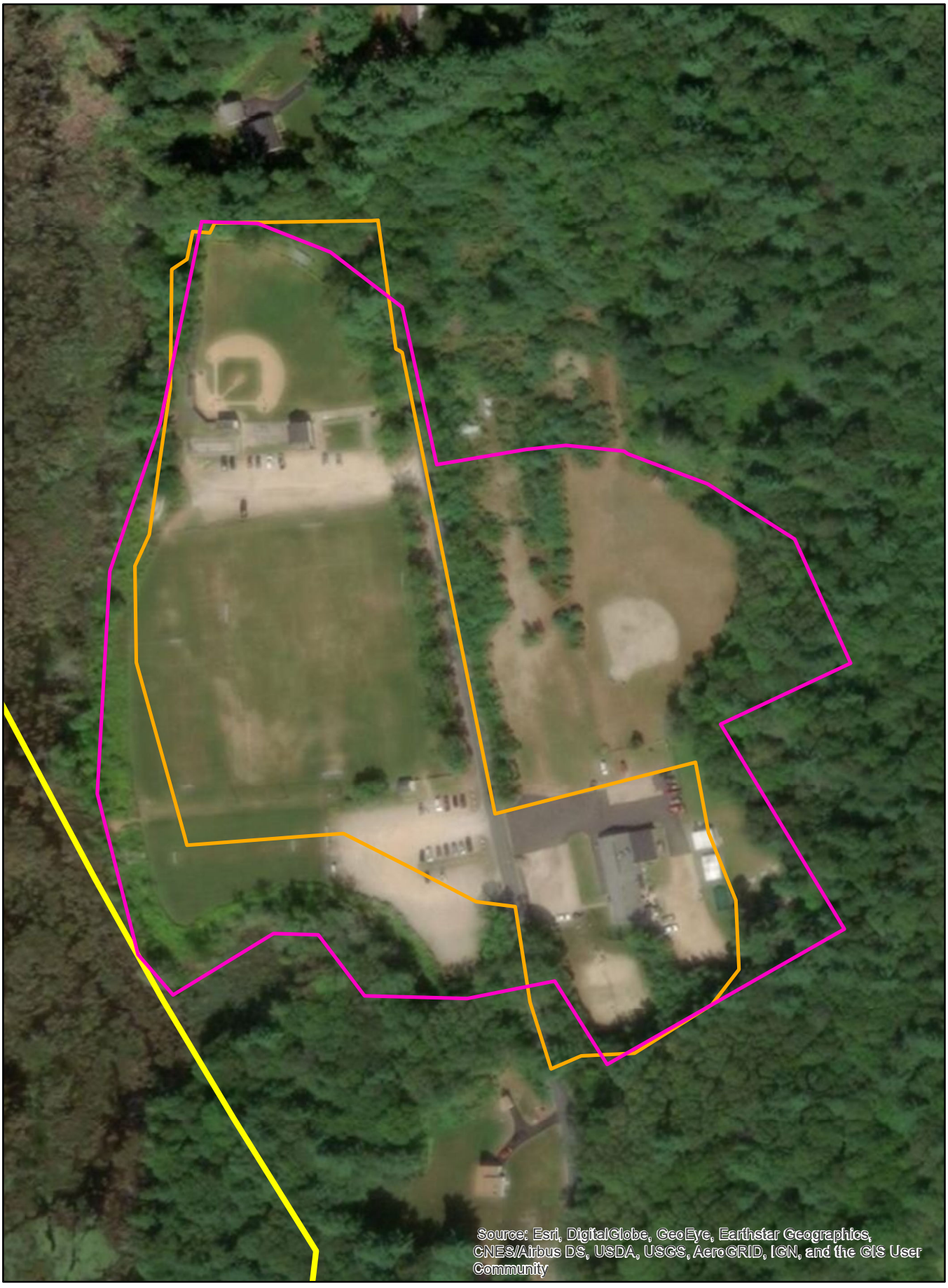
0 20 40 80 Feet

N

Site Name: Charlton Little League
Site Number: 13

0 80 160 320 Feet

N



Site Name: Glen Echo Lake Public Access
Site Number: 14

0 30 60 120 Feet

N

Site Name: Prindle Lake Park
Site Number: 15

0 40 80 160
Feet

N

Site Name: Howe State Park
Site Number: 16

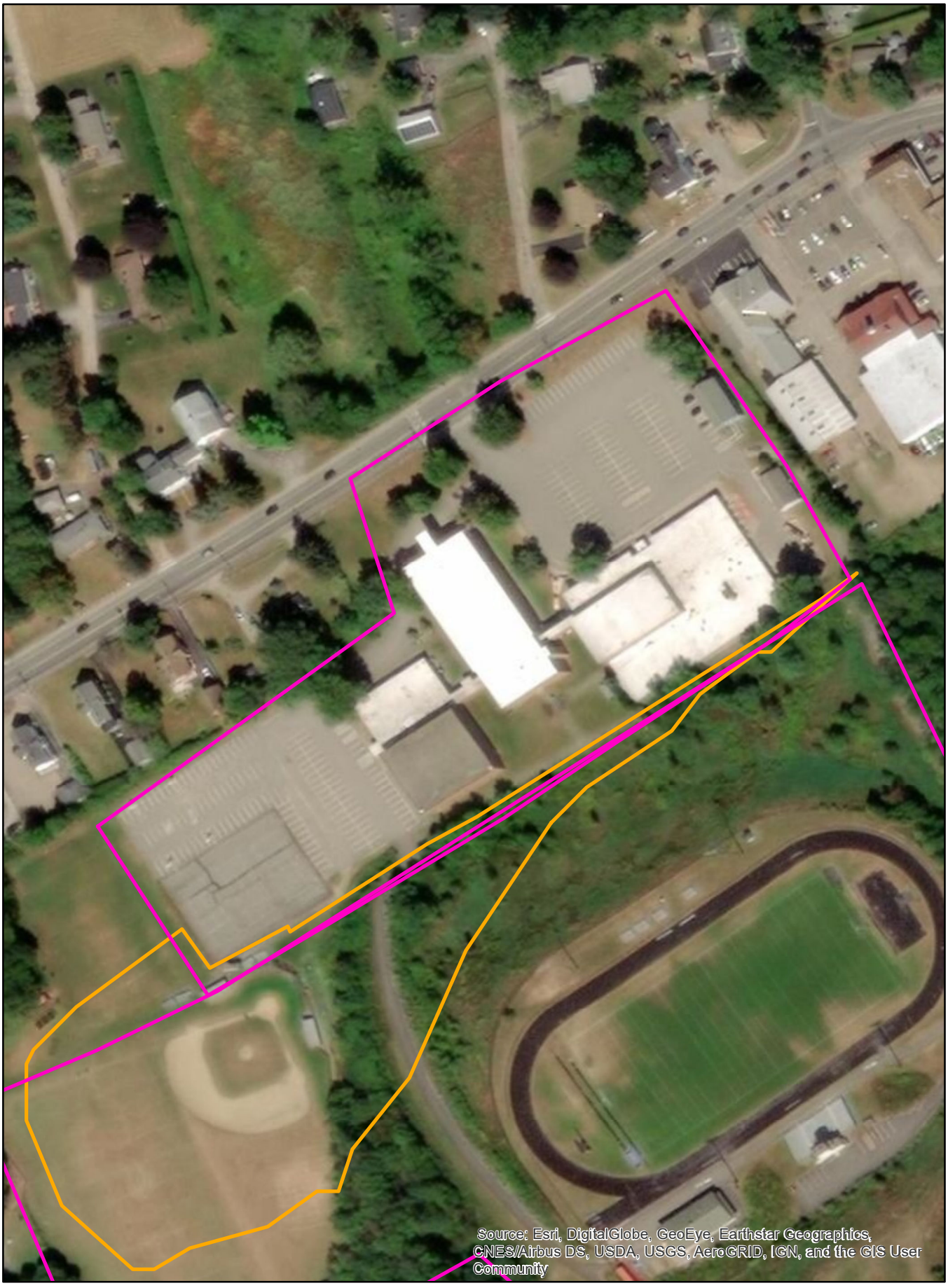
0 25 50 100 Feet

N

Site Name: David Prouty High School
Site Number: 17

0 80 160 320 Feet

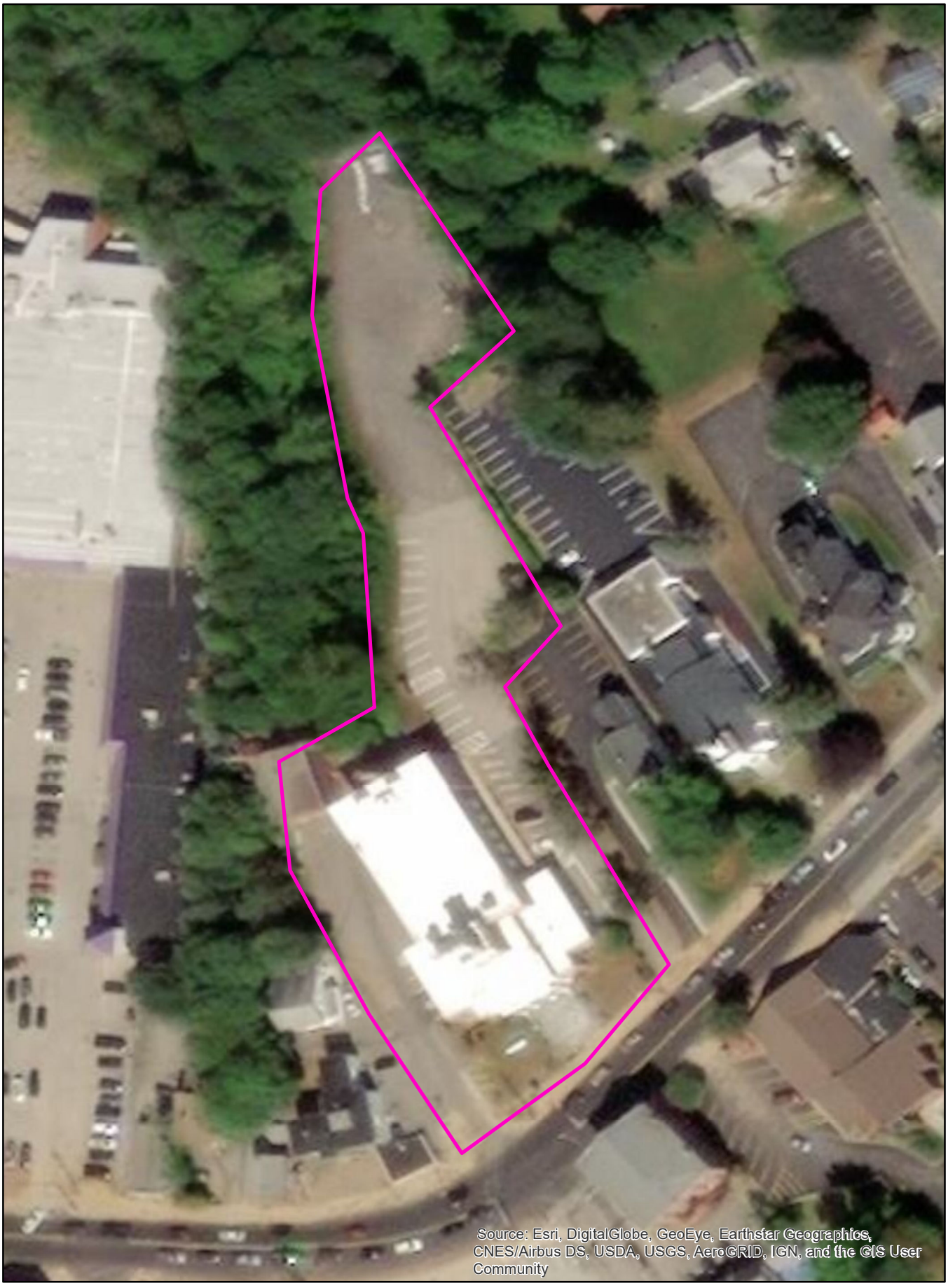
N



Site Name: Spencer Town Hall
Site Number: 18

0 40 80 160 Feet

N



Site Name: Spencer Police Fire and Rescue
Site Number: 19

0 40 80 160
Feet

N

Site Name: Richard Sugden Library
Site Number: 20

0 15 30 60 Feet

N

Site Name: Spencer Water Department
Site Number: 21

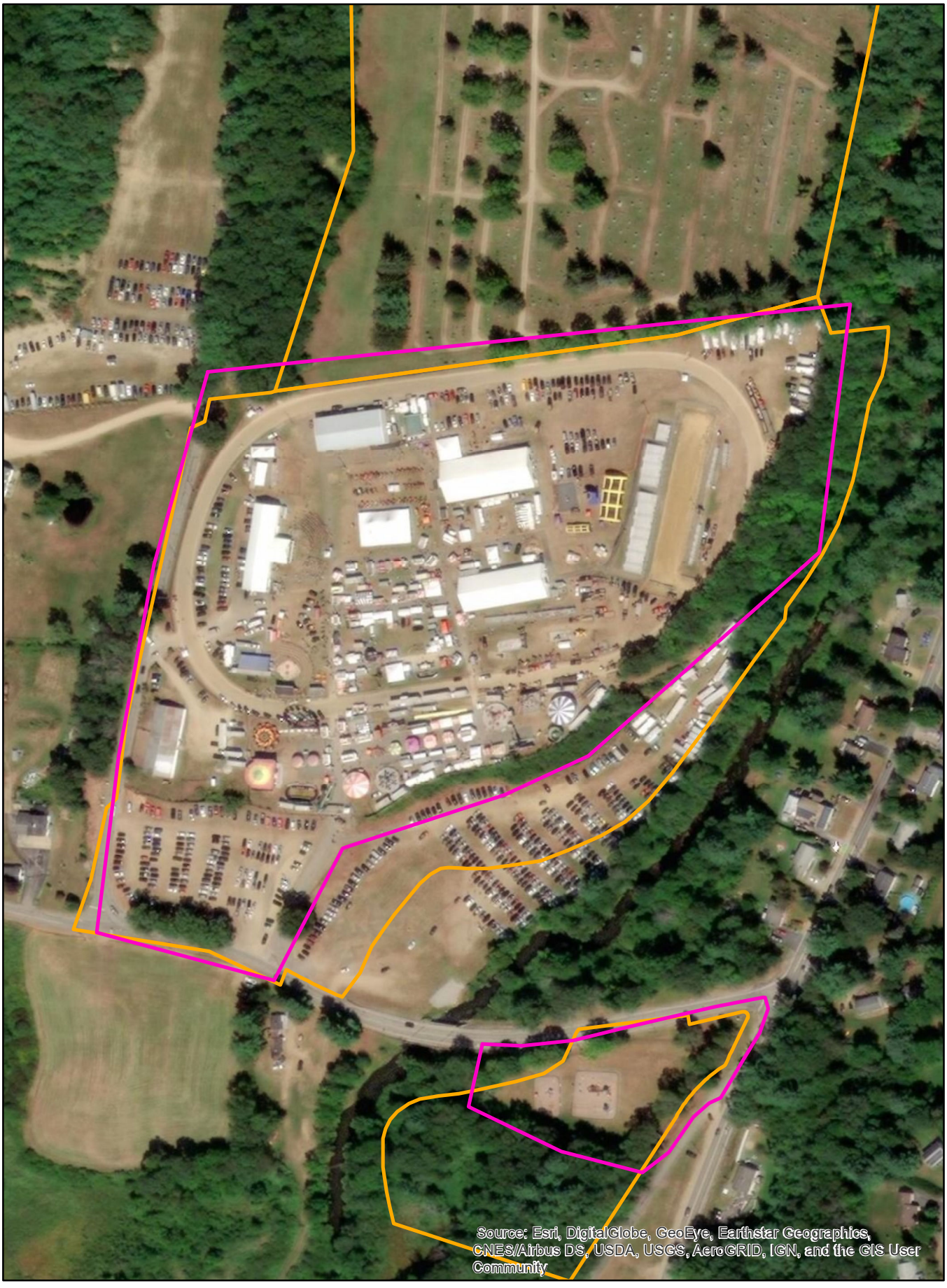
0 20 40 80 Feet

N

Site Name: Spencer Fairgrounds
Site Number: 22

0 120 240 480
Feet

N



Site Name: Knox Trail Junior High School
Site Number: 23

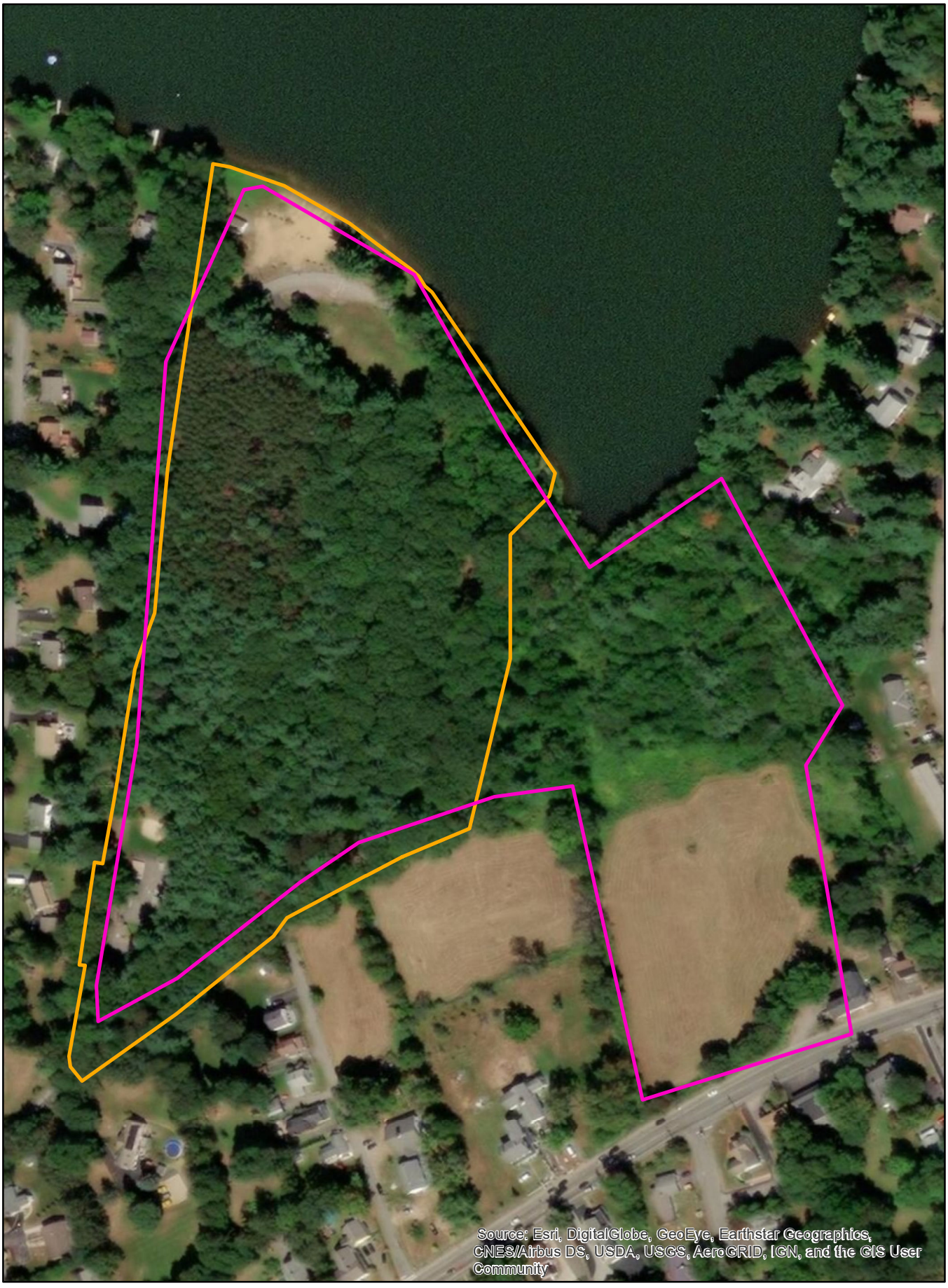
0 80 160 320 Feet

N

Site Name: Luther Hill and Laurel Hill Park
Site Number: 24

0 105 210 420 Feet

N



Site Name: Lake Street School
Site Number: 25

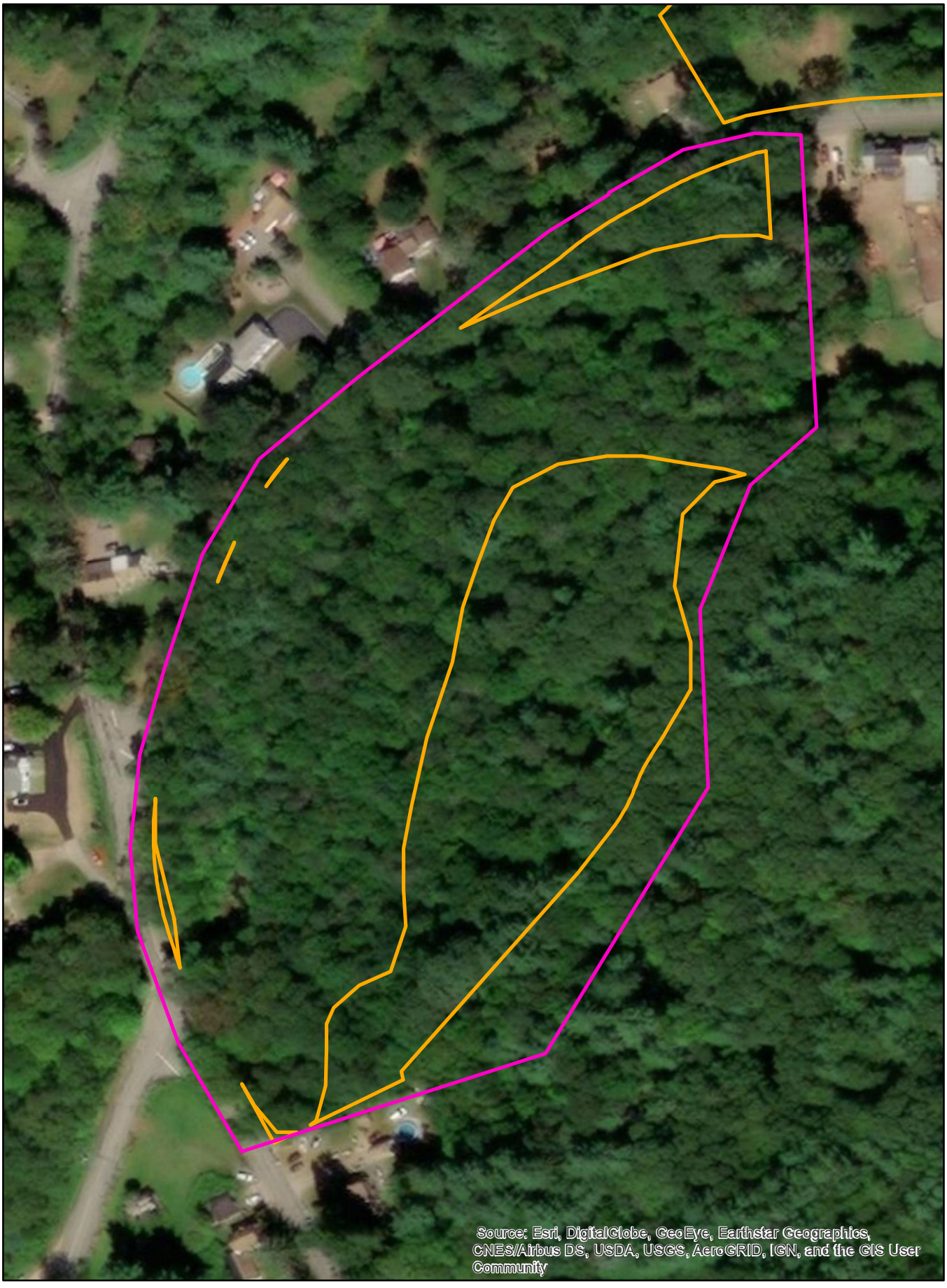
0 70 140 280
Feet

N

Site Name: Turkey Hill Brook Park
Site Number: 26

0 70 140 280 Feet

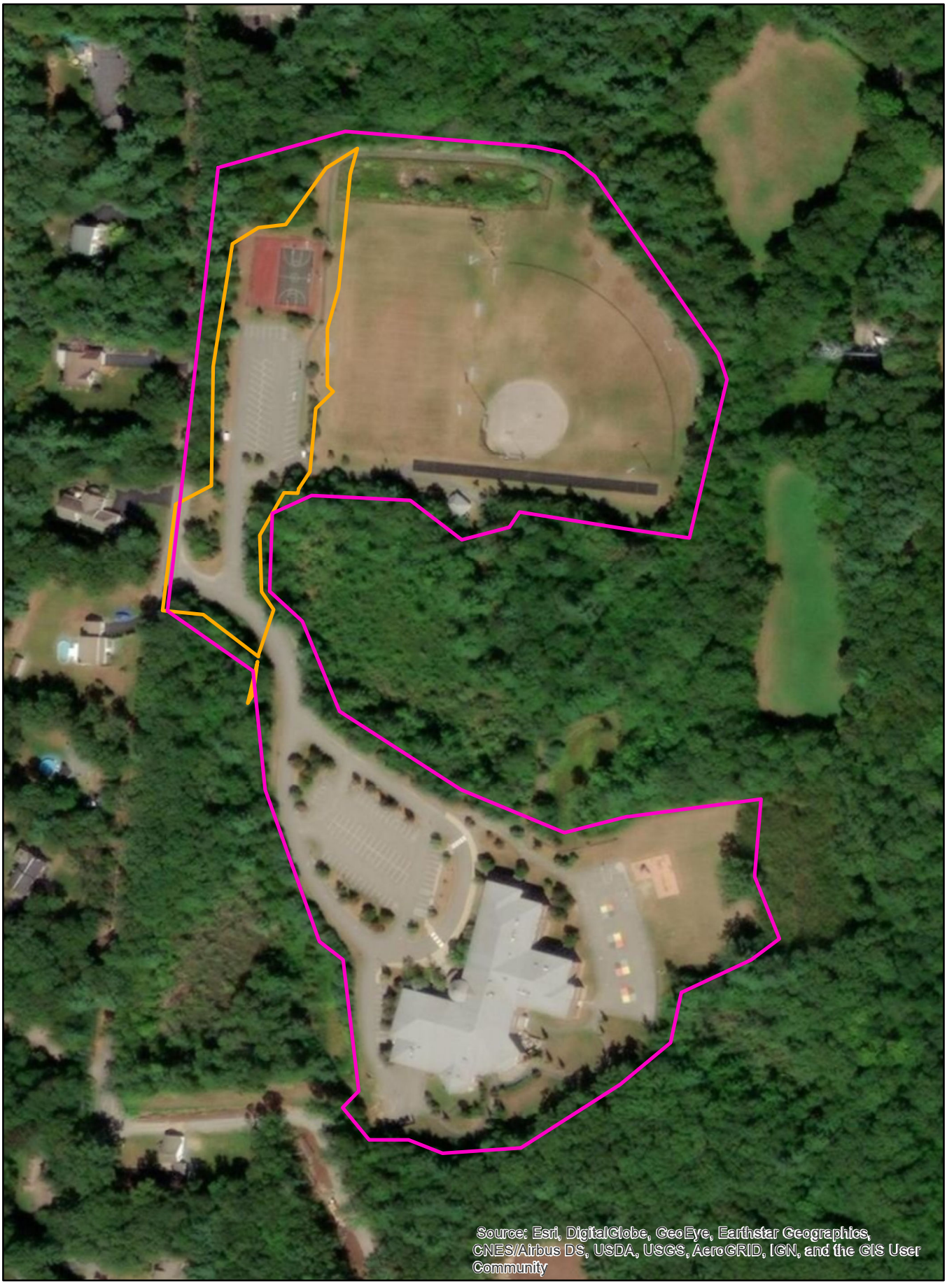
N



Site Name: Wire Village School
Site Number: 27

0 95 190 380 Feet

N



Site Name: Powder Mill Park
Site Number: 28

0 45 90 180 Feet

N

Site Name: O'Gara Park
Site Number: 29

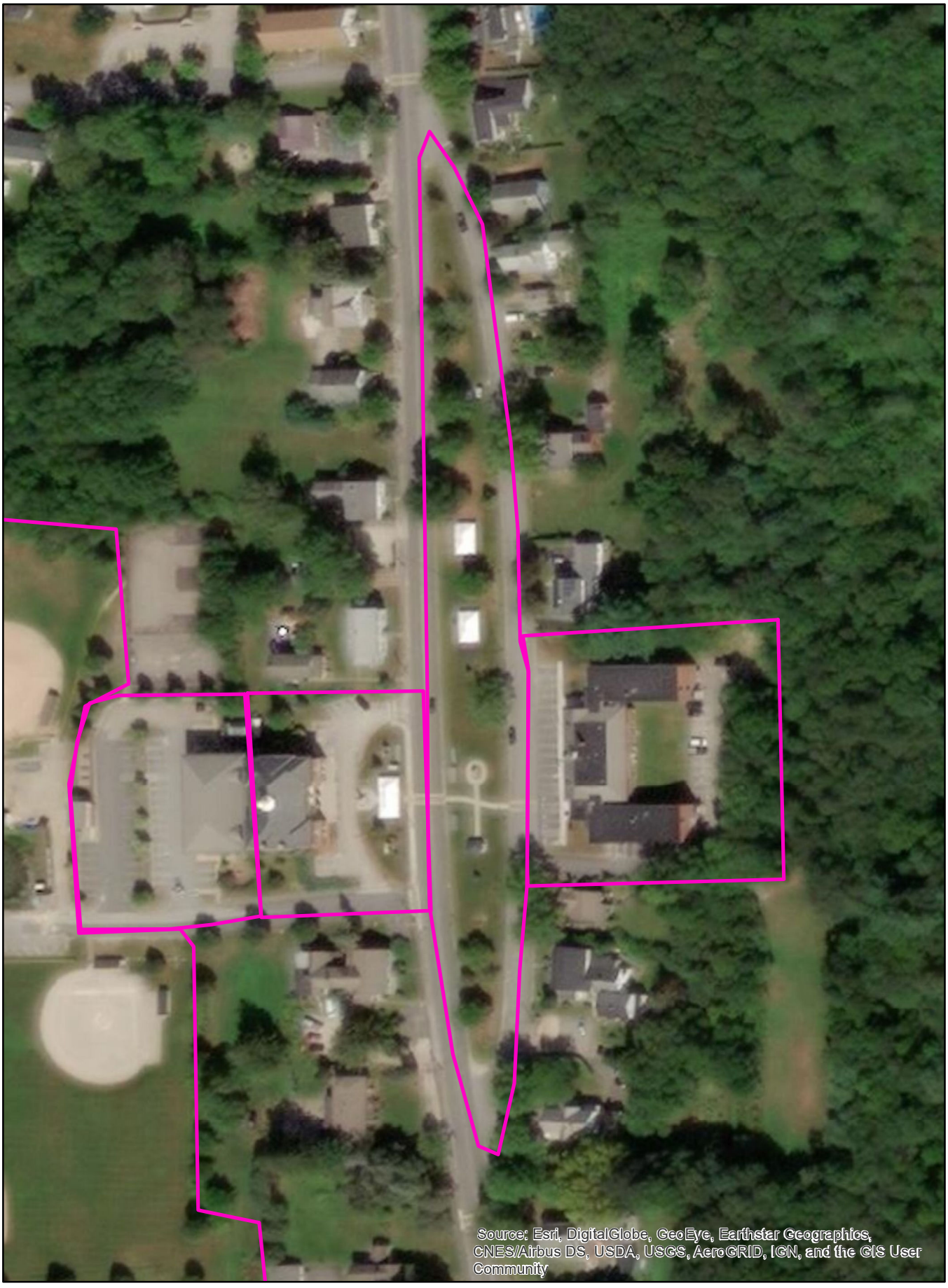
0 55 110 220 Feet

N

Site Name: Park in Front of Charlton Town Hall
Site Number: 30

0 65 130 260
Feet

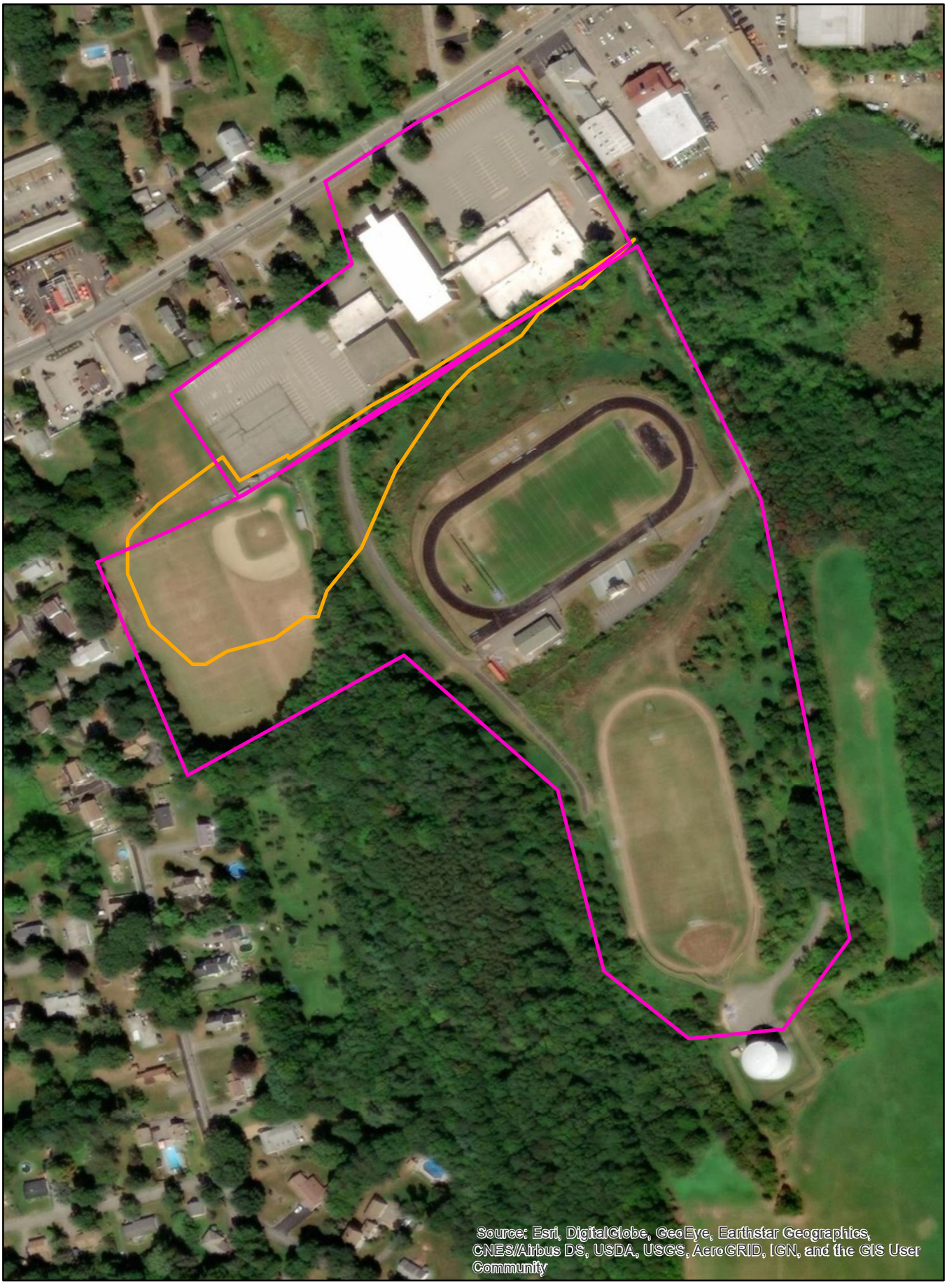
N



Site Name: Regional High School Athletic Fields
Site Number: 31

0 130 260 520 Feet

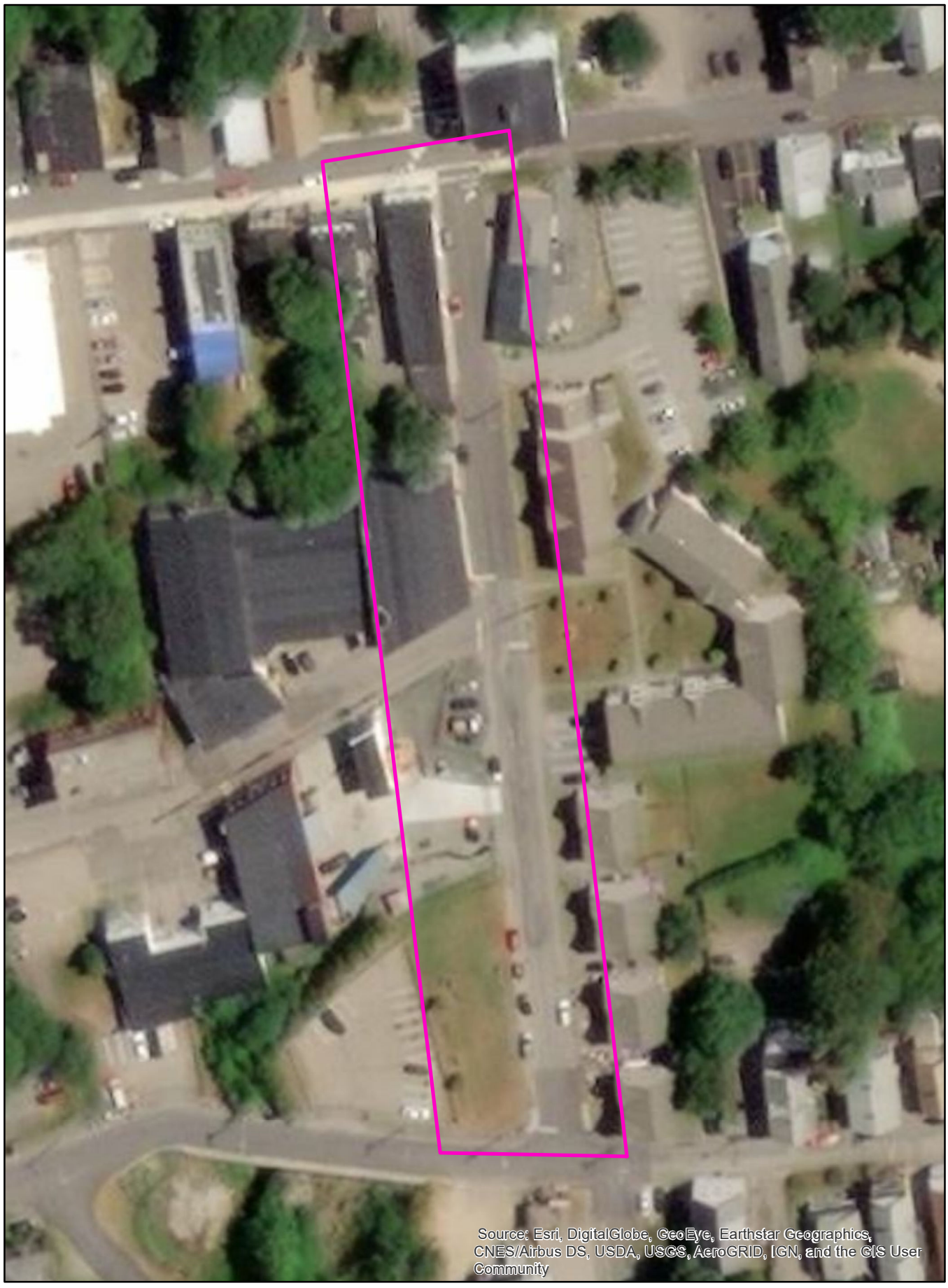
N



Site Name: Intersection of Wall & Lloyd Dyer Streets
Site Number: 33

0 40 80 160
Feet

N



Site Name: Clark Street Outfall to Muzzy Meadow Pond
Site Number: 34

0 37.5 75 150
Feet

N

FUSS & O'NEILL

Attachment B

Field Sheets

Retrofit Reconnaissance Investigation **RRI**

WATERSHED: ~~Spe~~ Charlton	SUBWATERSHED:		UNIQUE SITE ID: 1
DATE: 12/13/18	ASSESSED BY: RW HF	CAMERA ID: 2	PICTURES:
GPS ID:	LMK ID:	LAT:	LONG:

SITE DESCRIPTION

Name: HERITAGE SCHOOL
Address:

Ownership: ☑ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☑ Local ☐ State ☐ DOT ☐ Other:

Corresponding USSR/USA Field Sheet? ☐ Yes ☐ No If yes, Unique Site ID:

Proposed Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Road ROW
- ☐ Other:
- ☐ Above Roadway Culvert
- ☐ In Conveyance System
- ☑ Near Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☐ Underground
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☑ Landscape / Hardscape
- ☐ Other:

DRAINAGE AREA TO PROPOSED RETROFIT

Drainage Area ≈ _____
Imperviousness ≈ _____ %
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ☐ Residential
  - ☐ SFH (< 1 ac lots)
  - ☐ SFH (> 1 ac lots)
  - ☐ Townhouses
  - ☐ Multi-Family
- ☐ Commercial
- ☑ Institutional
- ☐ Industrial
- ☐ Transport-Related
- ☐ Park
- ☑ Undeveloped
- ☐ Other:

EXISTING STORMWATER MANAGEMENT

Existing Stormwater Practice: ☐ Yes ☑ No ☐ Possible
If Yes, Describe:

new water like coming in. road improvement 50% funded by EXXON MOBIL compensation for oil contam. of local wells.

Describe Existing Site Conditions, Including Existing Site Drainage and Conveyance:

Primary access entrance road through wetland areas chronically affected by ~~fra~~ heaving. light posts tilted potholes. Storm drains to wetlands from road & parking lot in front (N) of building. Deep recessed area in front (NE) side of building w/ downspouts connected draining to wetland. Downspouts around rest of building drain to surface. mostly positive drainage and minimal problems except for arsenic filter discharge which floods sidewalk on W side @ unknown times. Leach field out back is dry, dusty. Large open green space below steep slope, surrounded by woods and wetland. Small greenhouse on S side and open green space. both used by students.

Unique Site ID: 1

PROPOSED RETROFIT

Purpose of Retrofit:

- [x] Water Quality
- [x] Demonstration / Education
- [x] Recharge
- [ ] Repair
- [ ] Channel Protection
- [ ] Other:
- [x] Flood Control

① Raise road to reduce drainage problems; construct swale on U/S side. Avoid swale/infilt. in hotspot areas further up street.
② Capture roof runoff for soccer field, greenhouse, + garden irrigation
③ Convert grass islands + verges in main parking lot to bioretention to capture runoff currently draining straight to wetlands...

Proposed Treatment Option:

- [ ] Extended Detention
- [x] Filtering Practice
- [ ] Wet Pond
- [x] Infiltration
- [ ] Created Wetland
- [x] Swale
- [x] Bioretention
- [ ] Other:

Describe Elements of Proposed Retrofit, Including Surface Area, Maximum Depth of Treatment, and Conveyance:

see photo

③ ...(plant w/ salt tolerant plants due to winter salt use)

SITE CONSTRAINTS

Adjacent Land Use:

- [ ] Residential
- [ ] Commercial
- [ ] Institutional
- [ ] Industrial
- [ ] Transport-Related
- [ ] Park
- [ ] Undeveloped
- [ ] Other:

Possible Conflicts Due to Adjacent Land Use? [ ] Yes [ ] No

If Yes, Describe:

Access:

- [ ] No Constraints

Constrained due to

- [ ] Slope
- [ ] Space
- [ ] Utilities
- [ ] Tree Impacts
- [ ] Structures
- [ ] Property Ownership
- [ ] Other:

Conflicts with Existing Utilities:

- [ ] None
- [x] Unknown

Yes	Possible	
[ ]	[x]	Sewer
[ ]	[ ]	Water
[ ]	[x]	Gas
[ ]	[ ]	Cable
[ ]	[x]	Electric
[ ]	[x]	Electric to Streetlights
[ ]	[ ]	Overhead Wires
[ ]	[ ]	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	[ ] Probable	[x] Not Probable
Impacts to Wetlands	[x] Probable	[ ] Not Probable
Impacts to a Stream	[ ] Probable	[x] Not Probable
Floodplain Fill	[ ] Probable	[x] Not Probable
Impacts to Forests	[ ] Probable	[x] Not Probable
Impacts to Specimen Trees	[x] Probable	[ ] Not Probable

How many?

Approx. DBH

Other factors:

Soils:

Soil auger test holes:	[ ] Yes	[ ] No
Evidence of poor infiltration (clays, fines):	[ ] Yes	[ ] No
Evidence of shallow bedrock:	[ ] Yes	[ ] No
Evidence of high water table (gleying, saturation):	[ ] Yes	[ ] No

A/B soils

Unique Site ID: 1

SKETCH

On-Site Salting

- on-site school uses calcium chloride
- roads + plots - sand + salt mix

Water usage. 3300 gal/day
5000 gpd @ max usage

Requires treatment for arsenic in gw supply

Soon converting to town water (1-6 mos)

Unique Site ID: 1

DESIGN OR DELIVERY NOTES

- no envtal curriculum @ school
- 4th grade teachers use greenhouse
- gardens built by boy scouts no longer used
- Chris thought school might be open to using roof water for irrigation of field, greenhouse, gardens

~~- only~~

Maint (grounds): Chris + one more full-time person

Account for plowing

~~Focus~~ far end of street affected by oil leak + to be restored by Nat. Grid; hotspot area

FOLLOW-UP NEEDED TO COMPLETE FIELD CONCEPT

- ☐ Confirm property ownership
- ☐ Confirm drainage area
- ☐ Confirm drainage area impervious cover
- ☐ Confirm volume computations
- ☐ Complete concept sketch
- ☐ Obtain existing stormwater practice as-builts
- ☐ Obtain site as-builts
- ☐ Obtain detailed topography
- ☐ Obtain utility mapping
- ☐ Confirm storm drain invert elevations
- ☒ Confirm soil types
- ☐ Other: _____

INITIAL FEASIBILITY AND CONSTRUCTION CONSIDERATIONS

Road - get rec in before waterline comes through (this winter: 1 month out? 6 months out?)

Road/plots not to be repaved for decades

SITE CANDIDATE FOR FURTHER INVESTIGATION:	☒ YES	☐ NO	☐ MAYBE
IS SITE CANDIDATE FOR EARLY ACTION PROJECT(S):	☒ YES	☐ NO	☐ MAYBE
IF NO, SITE CANDIDATE FOR OTHER RESTORATION PROJECT(S):	☐ YES	☐ NO	☐ MAYBE

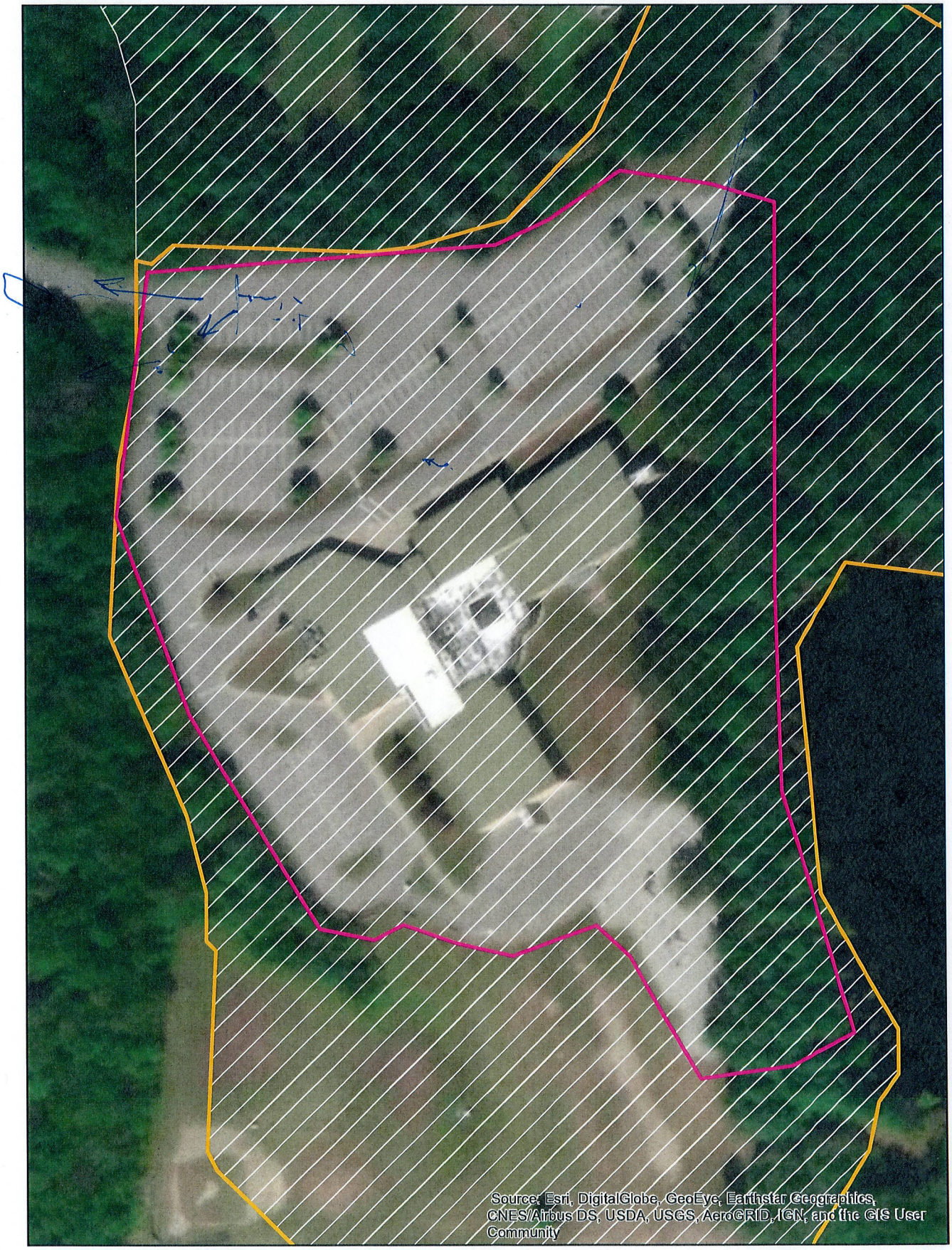
IF YES, TYPE(S): _____

Unique Site ID: 1

Site Name: Heritage School
Site Number: 1

0 55 110 220 Feet

N



Site Name: Heritage School
Site Number: 1

0 55 110 220 Feet

N

Retrofit Reconnaissance Investigation **RRI**

WATERSHED: Charlton	SUBWATERSHED:	UNIQUE SITE ID: 2	
DATE: 12·13·18	ASSESSED BY: RW NF	CAMERA ID: 2	PICTURES:
GPS ID:	LMK ID:	LAT:	LONG:

SITE DESCRIPTION

Name: CHARLTON MIDDLE SCHOOL
Address: _____

Ownership: ☑ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☑ Local ☐ State ☐ DOT ☐ Other: _____

Corresponding USSR/USA Field Sheet? ☐ Yes ☐ No If yes, Unique Site ID: _____

Proposed Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Road ROW
- ☐ Other: _____
- ☐ Above Roadway Culvert
- ☐ In Conveyance System
- ☑ Near Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☐ Underground
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Other: _____

DRAINAGE AREA TO PROPOSED RETROFIT

Drainage Area ≈ _____
Imperviousness ≈ _____ %
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ☐ Residential
  - ☐ SFH (< 1 ac lots)
  - ☐ SFH (> 1 ac lots)
  - ☐ Townhouses
  - ☐ Multi-Family
- ☐ Commercial
- ☐ Institutional
- ☐ Industrial
- ☐ Transport-Related
- ☐ Park
- ☐ Undeveloped
- ☐ Other: _____

EXISTING STORMWATER MANAGEMENT

Existing Stormwater Practice: ☒ Yes ☐ No ☐ Possible
If Yes, Describe:

Multiple large detention/BR basins treat most water runoff from site
(Site redeveloped ~2000) - Basins are either out of the way or fenced off - for safety?

Describe Existing Site Conditions, Including Existing Site Drainage and Conveyance:

90k sq. ft. rooftop flat. Needs new roof asap. Kinder Morgan Gas line through site. Water pump station. Multiple large retention basins around school property. some chained off, some open. 1 Main parking lot in front and 2 driveway entrances. Softball, baseball, tennis & basketball fields in contiguous large area w/ own large parking lot to South of school parking lot.

Unique Site ID: 2

PROPOSED RETROFIT

Purpose of Retrofit:
☑ Water Quality ☑ Recharge ☐ Channel Protection ☐ Flood Control
☑ Demonstration / Education ☐ Repair ☐ Other:_____

1b cont'd) ... school, greenhouse, + gardens

Proposed Treatment Option:
☐ Extended Detention ☐ Wet Pond ☐ Created Wetland ☑ Bioretention
☑ Filtering Practice ☑ Infiltration ☐ Swale ☒ Other: Green roof

Describe Elements of Proposed Retrofit, Including Surface Area, Maximum Depth of Treatment, and Conveyance:
(1) Possible green roof integrated w/ roof upgrade
(1b) potential ~~to~~ to use roof water to irrigate soccer field, front of K.
(2) BRB installation on west side of athletic fields parking lot w/ interp signs

SITE CONSTRAINTS

Adjacent Land Use:
☐ Residential ☐ Commercial ☒ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☒ Undeveloped ☐ Other:_____
Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☐ No
If Yes, Describe:

Access:
☐ No Constraints
Constrained due to
☑ Slope ☑ Space
☑ Utilities ☑ Tree Impacts
☑ Structures ☐ Property Ownership
☐ Other:_____

Conflicts with Existing Utilities:
☐ None
☑ Unknown

Yes	Possible	
☐	☑	Sewer
☐	☑	Water
☐	☑	Gas
☐	☐	Cable
☐	☑	Electric
☐	☐	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:_____

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☒ Not Probable
Impacts to Wetlands	☒ Probable	~~☒ Not Probable~~
Impacts to a Stream	☒ Probable	☐ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☐ Probable	☒ Not Probable
Impacts to Specimen Trees	☐ Probable	☒ Not Probable

How many?_____
Approx. DBH_____

Other factors:_____

Soils:

Soil auger test holes:	☐ Yes ☐ No	B/C & some A/B
Evidence of poor infiltration (clays, fines):	☐ Yes ☐ No	
Evidence of shallow bedrock:	☐ Yes ☐ No	
Evidence of high water table (gleying, saturation):	☐ Yes ☐ No	

SKETCH

DESIGN OR DELIVERY NOTES

Roof drains deteriorating - leaking into school
Roof also leaking ~~today~~ many patches (dry-rotted) 90,000 s.ft.

- opp for grant funding - green roof
- opp to use water for greenhouse + gardens?
  Jim said there may be interest in that

Water usage
2000 gpd normal
3000 gpd w/irrigation
No arsenic treatment needed
Soon converting to town water

FOLLOW-UP NEEDED TO COMPLETE FIELD CONCEPT

- ☐ Confirm property ownership
- ☐ Confirm drainage area
- ☐ Confirm drainage area impervious cover
- ☐ Confirm volume computations
- ☐ Complete concept sketch
- ☐ Obtain existing stormwater practice as-builts
- ☐ Obtain site as-builts
- ☐ Obtain detailed topography
- ☐ Obtain utility mapping
- ☐ Confirm storm drain invert elevations
- ☒ Confirm soil types soil ty
- ☐ Other:_____

INITIAL FEASIBILITY AND CONSTRUCTION CONSIDERATIONS

- No arsenic in well water

SITE CANDIDATE FOR FURTHER INVESTIGATION:	☒ YES	☐ NO	☐ MAYBE
IS SITE CANDIDATE FOR EARLY ACTION PROJECT(S):	☒ YES	☐ NO	☐ MAYBE
IF NO, SITE CANDIDATE FOR OTHER RESTORATION PROJECT(S):	☐ YES	☐ NO	☐ MAYBE

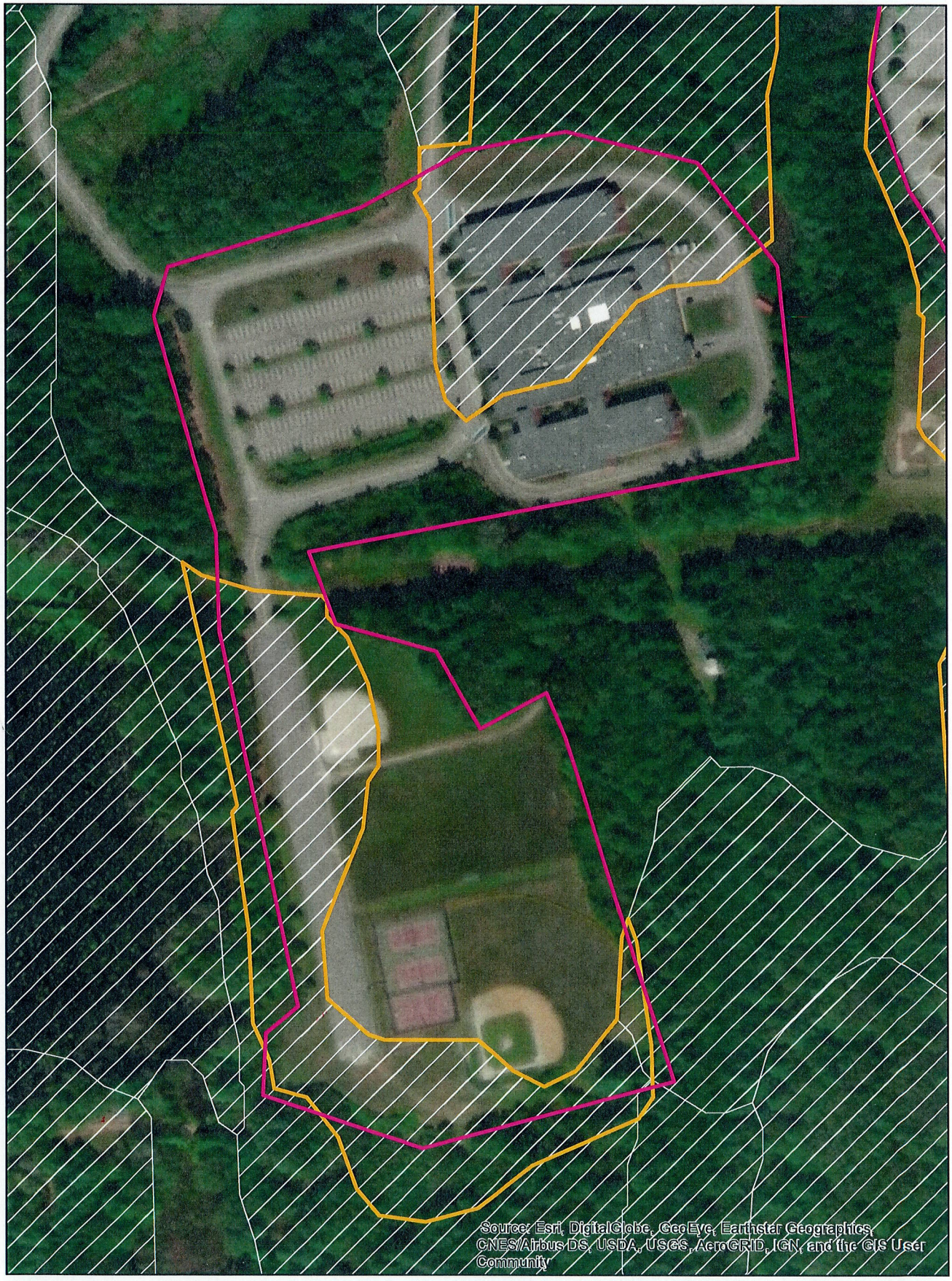
IF YES, TYPE(S):_____

Unique Site ID: 2

Site Name: Charlton Middle School
Site Number: 2

0 105 210 420 Feet

N



Site Name: Charlton Middle School
Site Number: 2

0 105 210 420 Feet

N

creek backed up by beavers

flows south

beaver dam

- has been there for years

Retrofit Reconnaissance Investigation **RRI**

WATERSHED: Charlton	SUBWATERSHED:	UNIQUE SITE ID: 3	
DATE: 12/13/18	ASSESSED BY: RLW, NF	CAMERA ID: 2	PICTURES: 11:10AM
GPS ID:	LMK ID:	LAT:	LONG:

SITE DESCRIPTION

Name: Charlton Police Dept
Address: 83 Masonic Home Road

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☒ Local ☐ State ☐ DOT ☐ Other:_____

Corresponding USSR/USA Field Sheet? ☐ Yes ☐ No If yes, Unique Site ID:_____

Proposed Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Road ROW
- ☐ Other:_____
- ☐ Above Roadway Culvert
- ☐ In Conveyance System
- ☐ Near Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☐ Underground
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Other:_____

DRAINAGE AREA TO PROPOSED RETROFIT

Drainage Area ≈ _____
Imperviousness ≈ _____%
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ☐ Residential
  - ☐ SFH (< 1 ac lots)
  - ☐ SFH (> 1 ac lots)
  - ☐ Townhouses
  - ☐ Multi-Family
- ☐ Commercial
- ☒ Institutional
- ☐ Industrial
- ☐ Transport-Related
- ☐ Park
- ☐ Undeveloped
- ☐ Other:_____

EXISTING STORMWATER MANAGEMENT

Existing Stormwater Practice: ☐ Yes ☐ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Site Drainage and Conveyance:

PROPOSED RETROFIT

Purpose of Retrofit:

- [x] Water Quality
- [ ] Recharge
- [ ] Channel Protection
- [ ] Flood Control
- [ ] Demonstration / Education
- [ ] Repair
- [ ] Other:_____

Proposed Treatment Option:

- [ ] Extended Detention
- [ ] Wet Pond
- [ ] Created Wetland
- [ ] Bioretention
- [x] Filtering Practice
- [ ] Infiltration
- [ ] Swale
- [ ] Other: Rain barrels?

Describe Elements of Proposed Retrofit, Including Surface Area, Maximum Depth of Treatment, and Conveyance:

No infiltration
Best site for filtering practice is above d
Poss. pretreatment along side of road? swale?
Aquaswirl treatmt or sand filter attached to the catch basin for pretreatment of water before entering wetland

SITE CONSTRAINTS

Adjacent Land Use:

- [ ] Residential
- [ ] Commercial
- [x] Institutional
- [ ] Industrial
- [x] Transport-Related
- [ ] Park
- [ ] Undeveloped
- [ ] Other:_____

Possible Conflicts Due to Adjacent Land Use? [ ] Yes [ ] No

If Yes, Describe:

Access:

- [ ] No Constraints

Constrained due to

- [x] Slope
- [x] Space
- [ ] Utilities
- [ ] Tree Impacts
- [ ] Structures
- [ ] Property Ownership
- [ ] Other:_____

Conflicts with Existing Utilities:

- [ ] None
- [ ] Unknown

Yes	Possible	
[ ]	[x]	Sewer (Septic?)
[ ]	[ ]	Water
[ ]	[ ]	Gas
[ ]	[ ]	Cable
[ ]	[x]	Electric
[ ]	[ ]	Electric to Streetlights
[ ]		Overhead Wires
[ ]	[ ]	Other:_____

Potential Permitting Factors:

Dam Safety Permits Necessary	[ ] Probable	[x] Not Probable
Impacts to Wetlands	[x] Probable	[ ] Not Probable
Impacts to a Stream	[ ] Probable	[x] Not Probable
Floodplain Fill	[ ] Probable	[x] Not Probable
Impacts to Forests	[ ] Probable	[x] Not Probable
Impacts to Specimen Trees	[ ] Probable	[x] Not Probable

How many?_____
Approx. DBH_____

Other factors:_____

Soils:

Soil auger test holes:	[ ] Yes	[ ] No
Evidence of poor infiltration (clays, fines):	[ ] Yes	[ ] No
Evidence of shallow bedrock:	[ ] Yes	[ ] No
Evidence of high water table (gleying, saturation):	[ ] Yes	[ ] No

C/D soils

Unique Site ID: 3

SKETCH

see aerial

DESIGN OR DELIVERY NOTES

FOLLOW-UP NEEDED TO COMPLETE FIELD CONCEPT

- ☐ Confirm property ownership
- ☐ Confirm drainage area
- ☐ Confirm drainage area impervious cover
- ☐ Confirm volume computations
- ☐ Complete concept sketch
- ☐ Obtain existing stormwater practice as-builts
- ☐ Obtain site as-builts
- ☐ Obtain detailed topography
- ☐ Obtain utility mapping
- ☐ Confirm storm drain invert elevations
- ☐ Confirm soil types
- ☐ Other:_____

INITIAL FEASIBILITY AND CONSTRUCTION CONSIDERATIONS

wetland proximity
existing pretreatment @ CB?

SITE CANDIDATE FOR FURTHER INVESTIGATION:	☐ YES	☒ NO	☒ MAYBE
IS SITE CANDIDATE FOR EARLY ACTION PROJECT(S):	☐ YES	☒ NO	☐ MAYBE
IF NO, SITE CANDIDATE FOR OTHER RESTORATION PROJECT(S):	☐ YES	☐ NO	☐ MAYBE

IF YES, TYPE(S): Native plantings

Site Name: Charlton Police Department

Site Number: 3

0 35 70 140 Feet

N

Site Name: Charlton Police Department
Site Number: 3

0 35 70 140
Feet

N

83 Masonic Home Road

Retrofit Reconnaissance Investigation **RRI**

WATERSHED: Charlton	SUBWATERSHED:	UNIQUE SITE ID: 4	
DATE: 12/4/18	ASSESSED BY: RW, HF	CAMERA ID: 2	PICTURES: 8:53 -
GPS ID:	LMK ID:	LAT:	LONG:

SITE DESCRIPTION

Name: Charlton Town Hall
Address:

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☒ Local ☐ State ☐ DOT ☐ Other:

Corresponding USSR/USA Field Sheet? ☐ Yes ☐ No If yes, Unique Site ID:

Proposed Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Road ROW
- ☒ Other:
- ☐ Above Roadway Culvert
- ☐ In Conveyance System
- ☐ Near Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☒ Small Parking Lot
- ☐ Individual Street
- ☐ Underground
- ☒ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Other:

DRAINAGE AREA TO PROPOSED RETROFIT

Drainage Area ≈ _____
Imperviousness ≈ _____ %
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ☐ Residential
  - ☐ SFH (< 1 ac lots)
  - ☐ SFH (> 1 ac lots)
  - ☐ Townhouses
  - ☐ Multi-Family
- ☐ Commercial
- ☒ Institutional
- ☐ Industrial
- ☐ Transport-Related
- ☐ Park
- ☐ Undeveloped
- ☐ Other:

EXISTING STORMWATER MANAGEMENT

Existing Stormwater Practice: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Site Drainage and Conveyance:

Roof drainage mainly directed to storm system
Single catch basin in parking lot

Unique Site ID: 4

PROPOSED RETROFIT

Purpose of Retrofit:

- [x] Water Quality
- [x] Demonstration / Education
- [ ] Recharge
- [ ] Repair
- [ ] Channel Protection
- [ ] Other:
- [ ] Flood Control

Proposed Treatment Option:

- [ ] Extended Detention
- [ ] Filtering Practice
- [ ] Wet Pond
- [ ] Infiltration
- [ ] Created Wetland
- [ ] Swale
- [ ] Bioretention
- [ ] Other: Rain barrels

Describe Elements of Proposed Retrofit, Including Surface Area, Maximum Depth of Treatment, and Conveyance:

Route rain barrels to raised garden beds behind town hall (Food Pantry + Senior center onsite

Possible bioretention/stormwater park in adjacent field (ownership?)

SITE CONSTRAINTS

Adjacent Land Use:

- [x] Residential
- [ ] Commercial
- [ ] Institutional
- [ ] Industrial
- [ ] Transport-Related
- [?] Park
- [x] Undeveloped
- [ ] Other:

Possible Conflicts Due to Adjacent Land Use? [ ] Yes [ ] No

If Yes, Describe:

Access:

- [ ] No Constraints

Constrained due to

- [x] Slope
- [x] Space
- [x] Utilities
- [ ] Tree Impacts
- [ ] Structures
- [?] Property Ownership
- [ ] Other:

Conflicts with Existing Utilities:

- [ ] None
- [ ] Unknown

Yes	Possible	
[ ]	[x]	Sewer
[x]	[x]	Water
[ ]	[x]	Gas
[ ]	[x]	Cable
[ ]	[x]	Electric
[ ]	[ ]	Electric to Streetlights
[ ]		Overhead Wires
[ ]	[ ]	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	[ ] Probable	[x] Not Probable
Impacts to Wetlands	[ ] Probable	[x] Not Probable
Impacts to a Stream	[ ] Probable	[x] Not Probable
Floodplain Fill	[ ] Probable	[x] Not Probable
Impacts to Forests	[ ] Probable	[ ] Not Probable
Impacts to Specimen Trees	[ ] Probable	[x] Not Probable

How many?

Approx. DBH

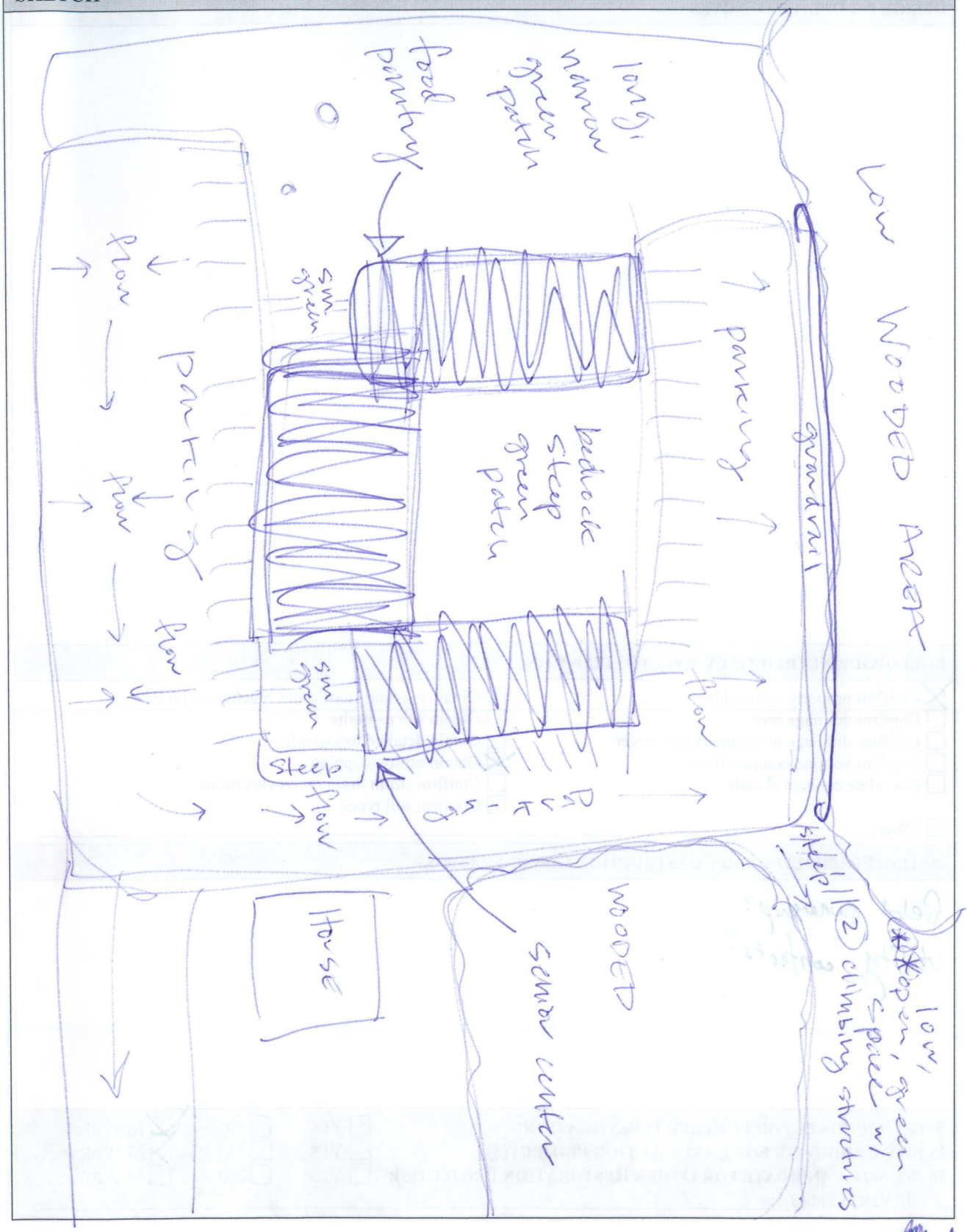
Other factors:

Soils:

Soil auger test holes:	[ ] Yes	[ ] No	CID soils
Evidence of poor infiltration (clays, fines):	[ ] Yes	[x] No	
Evidence of shallow bedrock:	[x] Yes	[ ] No	Behind building near parking lot
Evidence of high water table (gleying, saturation):	[ ] Yes	[x] No	

Unique Site ID: 64

SKETCH



Unique Site ID: 4

DESIGN OR DELIVERY NOTES

FOLLOW-UP NEEDED TO COMPLETE FIELD CONCEPT

- [x] Confirm property ownership
- [ ] Confirm drainage area
- [ ] Confirm drainage area impervious cover
- [ ] Confirm volume computations
- [ ] Complete concept sketch
- [ ] Obtain existing stormwater practice as-builts
- [ ] Obtain site as-builts
- [ ] Obtain detailed topography
- [x] Obtain utility mapping
- [ ] Confirm storm drain invert elevations
- [ ] Confirm soil types
- [ ] Other:_____

INITIAL FEASIBILITY AND CONSTRUCTION CONSIDERATIONS

field ownership?
utility conflicts?

SITE CANDIDATE FOR FURTHER INVESTIGATION:	☐ YES	☐ NO	☑ MAYBE
IS SITE CANDIDATE FOR EARLY ACTION PROJECT(S):	☐ YES	☐ NO	☑ MAYBE
IF NO, SITE CANDIDATE FOR OTHER RESTORATION PROJECT(S):	☐ YES	☐ NO	☐ MAYBE

IF YES, TYPE(S):_____

Unique Site ID: 6

Site Name: ~~Charlton Sewer Office, etc.~~ Town Hall

Site Number: 4

0 20 40 80 Feet

N

Site Name: ~~Charlton Sewer Office, etc.~~ Town Hall

Site Number: 4

0 20 40 80 Feet

N

Retrofit Reconnaissance Investigation **RRI**

WATERSHED: Charlton	SUBWATERSHED:	UNIQUE SITE ID: 5	
DATE: 12/4/18	ASSESSED BY: RW, NF	CAMERA ID: 2	PICTURES:
GPS ID:	LMK ID:	LAT:	LONG:

SITE DESCRIPTION

Name: Charlton Library
Address:

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☒ Local ☐ State ☐ DOT ☐ Other:

Corresponding USSR/USA Field Sheet? ☐ Yes ☐ No If yes, Unique Site ID:

Proposed Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Road ROW
- ☐ Other:
- ☐ Above Roadway Culvert
- ☐ In Conveyance System
- ☒ Near Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☒ Small Parking Lot
- ☐ Individual Street
- ☐ Underground
- ☒ Individual Rooftop
- ☐ Small Impervious Area
- ☒ Landscape / Hardscape
- ☐ Other:

DRAINAGE AREA TO PROPOSED RETROFIT

Drainage Area ≈ _____
Imperviousness ≈ _____ %
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ☐ Residential
  - ☐ SFH (< 1 ac lots)
  - ☐ SFH (> 1 ac lots)
  - ☐ Townhouses
  - ☐ Multi-Family
- ☐ Commercial
- ☒ Institutional
- ☐ Industrial
- ☒ Transport-Related
- ☐ Park
- ☐ Undeveloped
- ☐ Other:

EXISTING STORMWATER MANAGEMENT

Existing Stormwater Practice: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Lower parking lot - ~~sto~~ catch basins

Describe Existing Site Conditions, Including Existing Site Drainage and Conveyance:

Constrained, built-out site w/ minimal green space steep slopes front to back crossed by paths into building on south side. significant landscape plants (shrubs & trees) on all sides. seating area on south side in front of "Reading Room" entrance.

War memorial monument within symmetrical, formal layout in front. Green space is elevated above surrounding parking & drive. Downspouts on all corners of building connect directly into storm sewer

PROPOSED RETROFIT

Purpose of Retrofit:

☐ Water Quality ☐ Recharge ☐ Channel Protection ☐ Flood Control
☒ Demonstration / Education ☐ Repair ☐ Other:_____

Disconnect downspouts and store rainwater in attractive above ground tanks integrated w/ educational garden. on south side of building next to outdoor seating area in front of "Reading Room". Something on spectrum from raised planting beds / learning garden to full-on outdoor classroom w/ specimens & water features using roof runoff

Proposed Treatment Option:

☐ Extended Detention ☐ Wet Pond ☐ Created Wetland ☒ Bioretention Rain garden
☐ Filtering Practice ☐ Infiltration ☐ Swale ☐ Other:_____

Describe Elements of Proposed Retrofit, Including Surface Area, Maximum Depth of Treatment, and Conveyance:

Small rain garden near outdoor reading/classroom area

SITE CONSTRAINTS

Adjacent Land Use:

☑ Residential ☐ Commercial ☑ Institutional
☐ Industrial ☐ Transport-Related ☑ Park
☐ Undeveloped ☐ Other:_____

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☐ No

If Yes, Describe:

Access:

☐ No Constraints

Constrained due to

☑ Slope ☑ Space
☑ Utilities ☑ Tree Impacts
☑ Structures ☐ Property Ownership
☐ Other:_____

Conflicts with Existing Utilities:

☐ None
☑ Unknown

Yes	Possible	
☐	☑	Sewer
☐	☑	Water
☐	☑	Gas
☐	☑	Cable
☐	☑	Electric
☐	☐	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:_____

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☑ Not Probable
Impacts to Wetlands	☐ Probable	☑ Not Probable
Impacts to a Stream	☐ Probable	☑ Not Probable
Floodplain Fill	☐ Probable	☑ Not Probable
Impacts to Forests	☐ Probable	☑ Not Probable
Impacts to Specimen Trees	☑ Probable	☐ Not Probable

How many?_____

Approx. DBH_____

Other factors:_____

Soils: C/D soils

Soil auger test holes:	☐ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☑ No
Evidence of shallow bedrock:	☐ Yes	☑ No
Evidence of high water table (gleying, saturation):	☐ Yes	☑ No

Unique Site ID: 5

SKETCH

see aerial

Unique Site ID: 5

DESIGN OR DELIVERY NOTES

FOLLOW-UP NEEDED TO COMPLETE FIELD CONCEPT

- ☐ Confirm property ownership
- ☐ Confirm drainage area
- ☐ Confirm drainage area impervious cover
- ☐ Confirm volume computations
- ☐ Complete concept sketch
- ☐ Obtain existing stormwater practice as-builts
- ☐ Obtain site as-builts
- ☐ Obtain detailed topography
- ☐ Obtain utility mapping
- ☐ Confirm storm drain invert elevations
- ☐ Confirm soil types
- ☐ Other:_____

INITIAL FEASIBILITY AND CONSTRUCTION CONSIDERATIONS

may not have enough space to treat drainage from each downspout

SITE CANDIDATE FOR FURTHER INVESTIGATION:	☐ YES	☐ NO	☑ MAYBE
IS SITE CANDIDATE FOR EARLY ACTION PROJECT(S):	☐ YES	☑ NO	☐ MAYBE
IF NO, SITE CANDIDATE FOR OTHER RESTORATION PROJECT(S):	☐ YES	☐ NO	☑ MAYBE

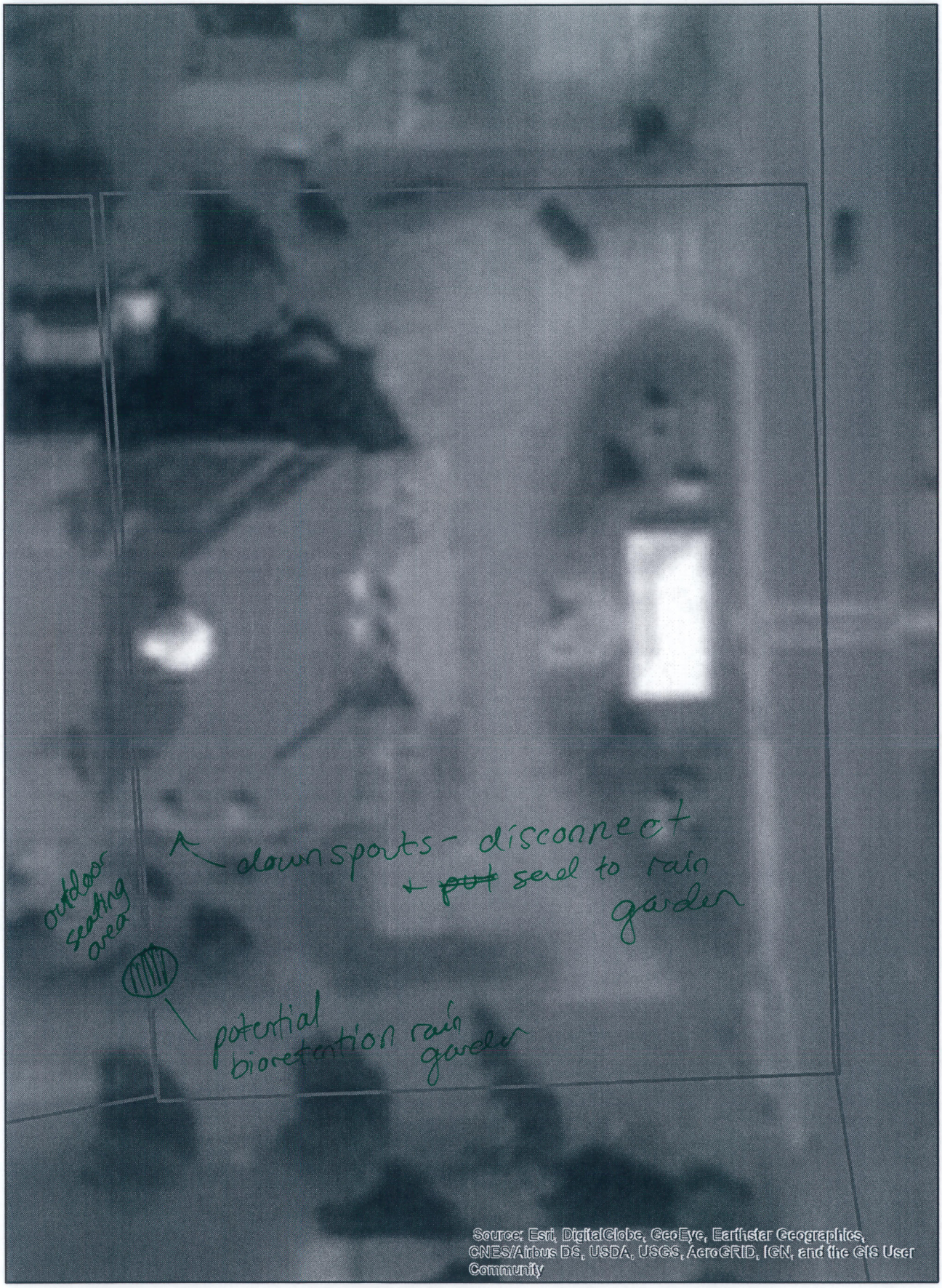
IF YES, TYPE(S): Native plantings

Unique Site ID: 5

Site Name: Charlton Library
Site Number: 5

0 15 30 60 Feet

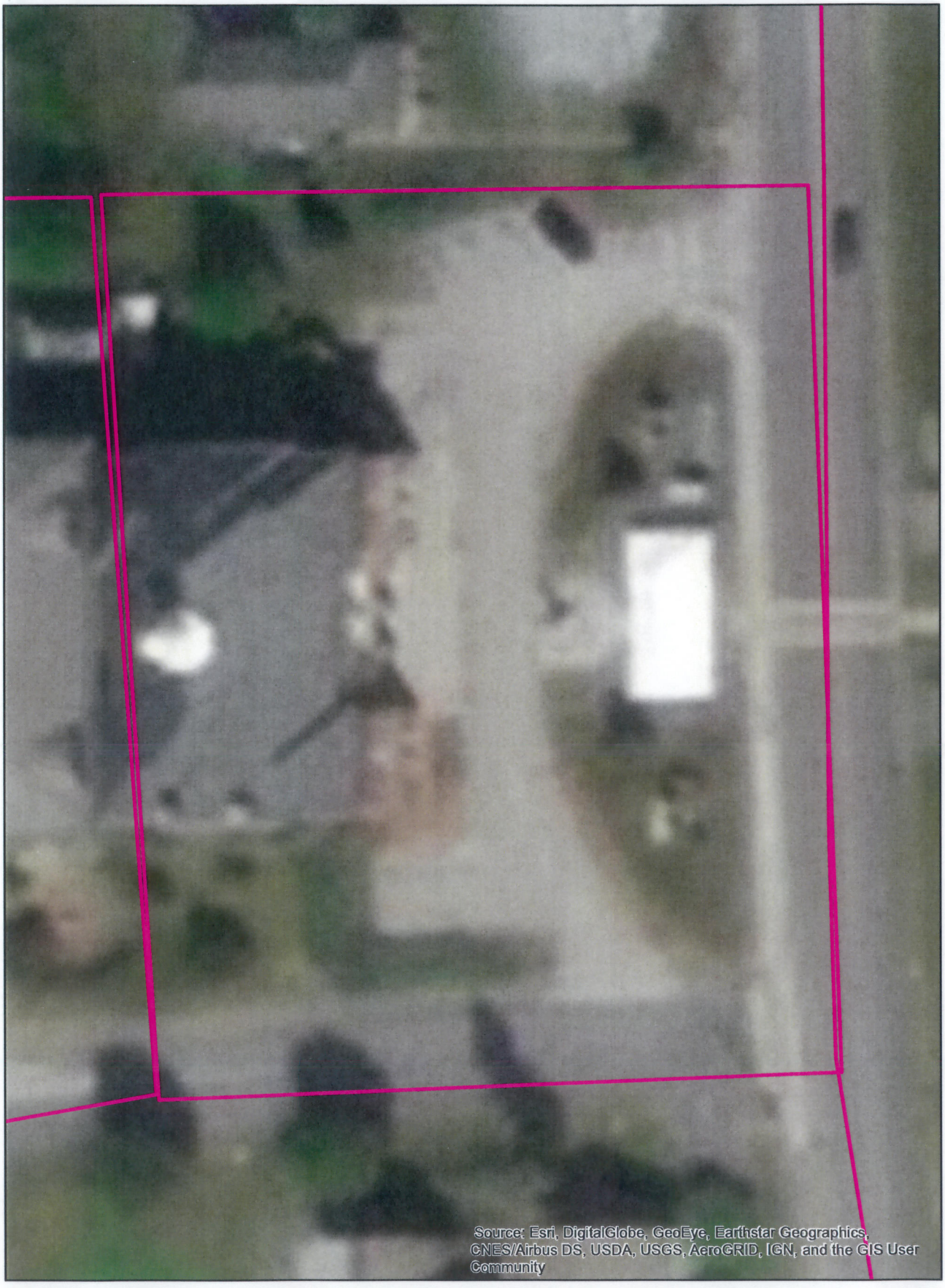
N



Site Name: Charlton Library
Site Number: 5

0 15 30 60
Feet

N

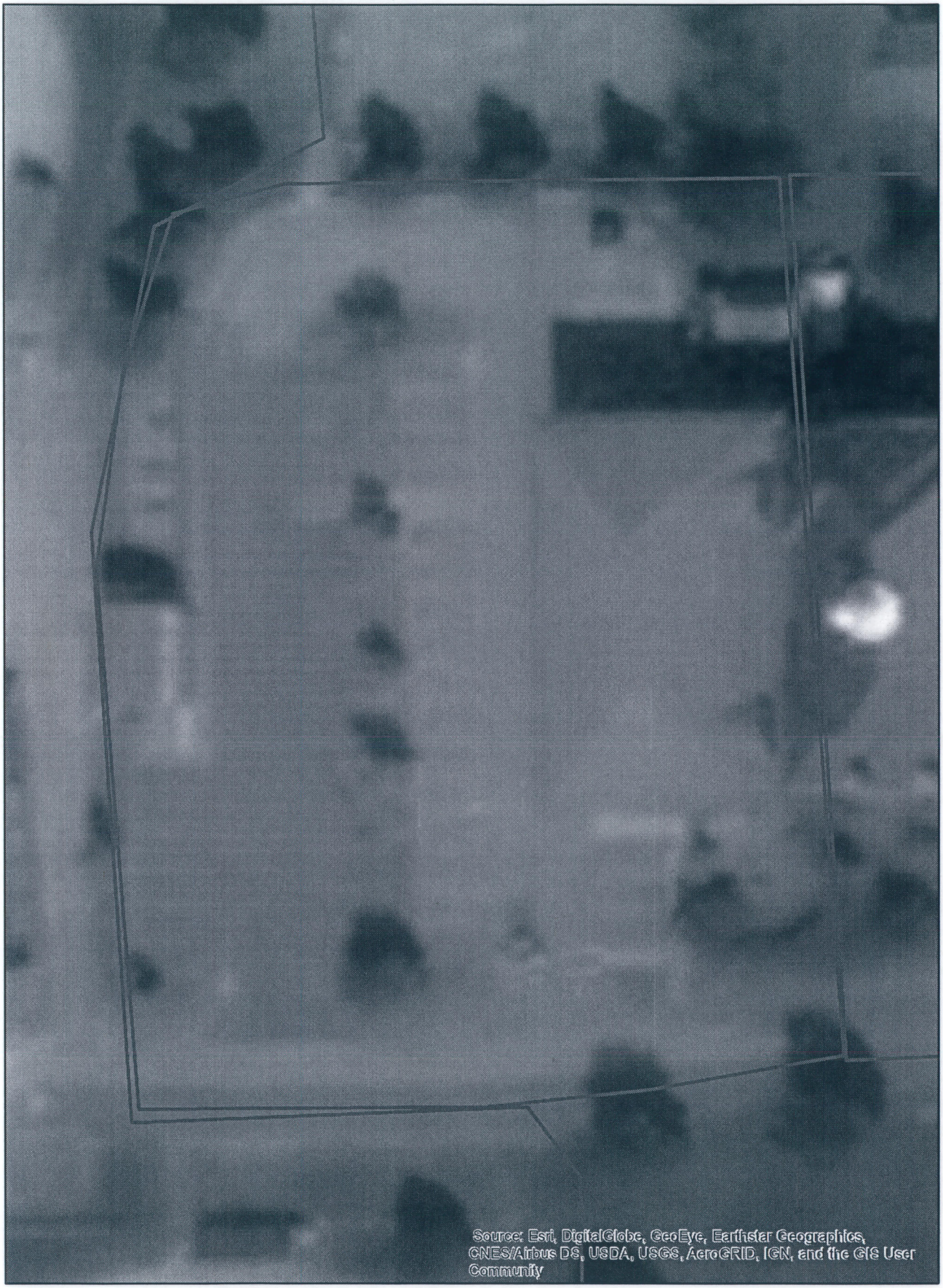


Site Name: ~~Charlton Town Hall~~ ? Library

Site Number: 6

0 15 30 60 Feet

N



Retrofit Reconnaissance Investigation **RRI**

WATERSHED: ~~Spruce~~ Charlton	SUBWATERSHED:	UNIQUE SITE ID: 7	
DATE: 12/13/18	ASSESSED BY: RW HS	CAMERA ID: 2	PICTURES:
GPS ID:	LMK ID:	LAT:	LONG:

SITE DESCRIPTION

Name: Charlton Elementary School
Address: _____

Ownership: ☑ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☒ Local ☐ State ☐ DOT ☐ Other: _____

Corresponding USSR/USA Field Sheet? ☐ Yes ☐ No If yes, Unique Site ID: _____

Proposed Retrofit Location:

Storage
- ☐ Existing Pond
- ☑ Below Outfall
- ☑ In Road ROW
- ☐ Other: _____
- ☐ Above Roadway Culvert
- ☐ In Conveyance System
- ☑ Near Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☑ Small Parking Lot
- ☐ Individual Street
- ☐ Underground
- ☐ Individual Rooftop
- ☑ Small Impervious Area
- ☑ Landscape / Hardscape
- ☐ Other: _____

DRAINAGE AREA TO PROPOSED RETROFIT

Drainage Area ≈ _____
Imperviousness ≈ _____ %
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ☐ Residential
  - ☐ SFH (< 1 ac lots)
  - ☐ SFH (> 1 ac lots)
  - ☐ Townhouses
  - ☐ Multi-Family
- ☐ Commercial
- ☐ Institutional
- ☐ Industrial
- ☐ Transport-Related
- ☐ Park
- ☐ Undeveloped
- ☐ Other: _____

EXISTING STORMWATER MANAGEMENT

Existing Stormwater Practice: ☐ Yes ☑ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Site Drainage and Conveyance:

Several small drainage basins in front of building on NE corner. Steep slope on NW corner of building surface drains to utility/access area against exterior walls. Asphalt bricking. Large parking area on NW side. Access road around back of building causing runoff onto playground. Building roof runoff daylights in green patch to W of playground. Lg. paved open space behind building runs off Lg. green space (old leach field). Former, crushed septic tank

Unique Site ID: 7

PROPOSED RETROFIT

Purpose of Retrofit:

☑ Water Quality ☐ Recharge ☐ Channel Protection ☒ Flood Control
☑ Demonstration / Education ☑ Repair ☐ Other:_____

(3) cont'd... best site is main location in front of school

Proposed Treatment Option:

☐ Extended Detention ☐ Wet Pond ☐ Created Wetland ☒ Bioretention
☐ Filtering Practice ☐ Infiltration ☑ Swale ☒ Other: dry injection well

Describe Elements of Proposed Retrofit, Including Surface Area, Maximum Depth of Treatment, and Conveyance:

(1) • capture water from playground + drain to dry injection well in former leach field ↑ using grated gutter/perforated pipe w/ slots in curb

(2) Vegetate steep eroding slopes w/ veg that won't interfere w/ oil tank or access
Repave access road for positive drainage across parking lot (instead of puddling at toe of slope

(3) 2 potential sites for demo. bioretention basins @ front storm drains, . .

SITE CONSTRAINTS

Adjacent Land Use:

☑ Residential ☐ Commercial ☑ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☑ Undeveloped ☐ Other:_____

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☐ No
If Yes, Describe:

Access:

☐ No Constraints
Constrained due to
☑ Slope ☑ Space
☑ Utilities ☑ Tree Impacts
☑ Structures ☐ Property Ownership
☐ Other:_____

Conflicts with Existing Utilities:

☐ None
☑ Unknown

Yes	Possible	
☐	☐	Sewer
☐	☑	Water
☐	☑	Gas
☐	☐	Cable
☐	☑	Electric
☐	☐	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:_____

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☑ Not Probable
Impacts to Wetlands	☑ Probable	☐ Not Probable
Impacts to a Stream	☐ Probable	☑ Not Probable
Floodplain Fill	☐ Probable	☑ Not Probable
Impacts to Forests	☑ Probable	☐ Not Probable
Impacts to Specimen Trees	☐ Probable	☑ Not Probable

How many?_____
Approx. DBH_____

Other factors:_____

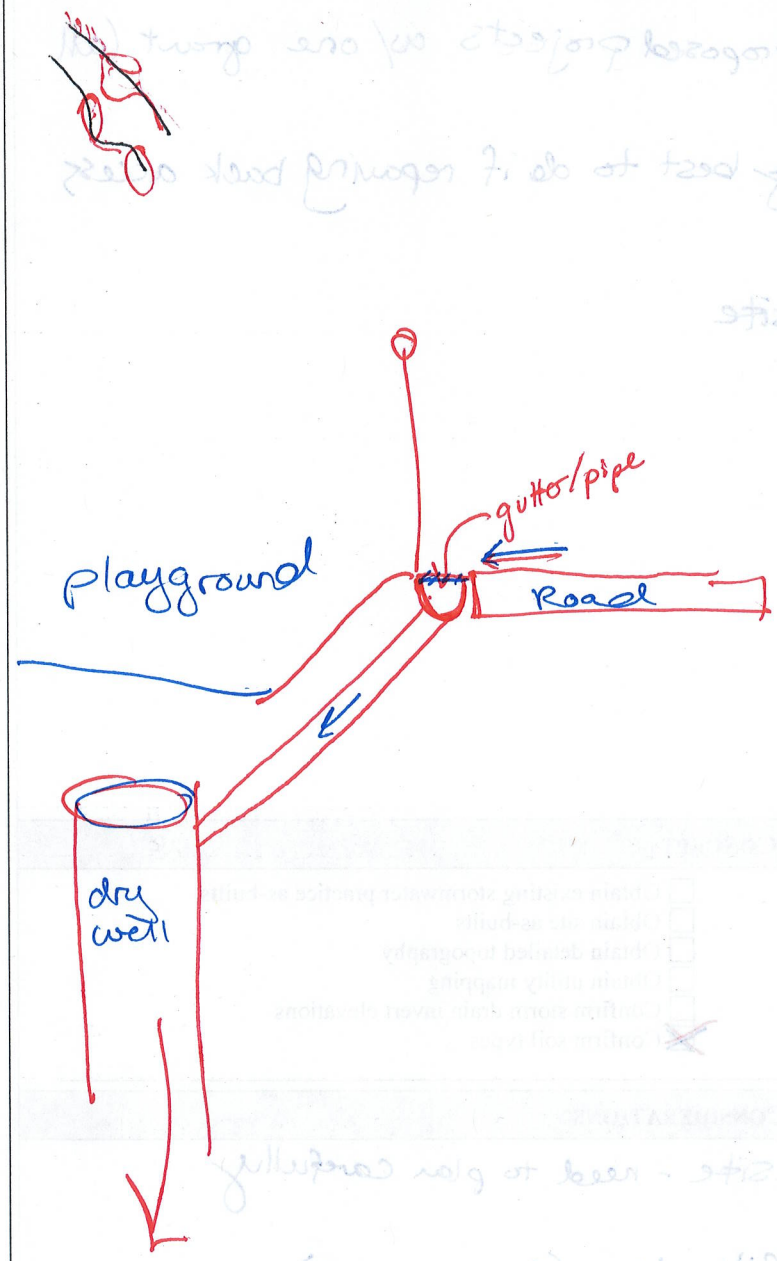
Soils:

Soil auger test holes:	☐ Yes	☒ No
Evidence of poor infiltration (clays, fines):	☒ Yes	☐ No
Evidence of shallow bedrock: exposed ledge	☒ Yes	☐ No
Evidence of high water table (gleying, saturation):	☐ Yes	☒ No

C/D soils

Unique Site ID: 7

SKETCH

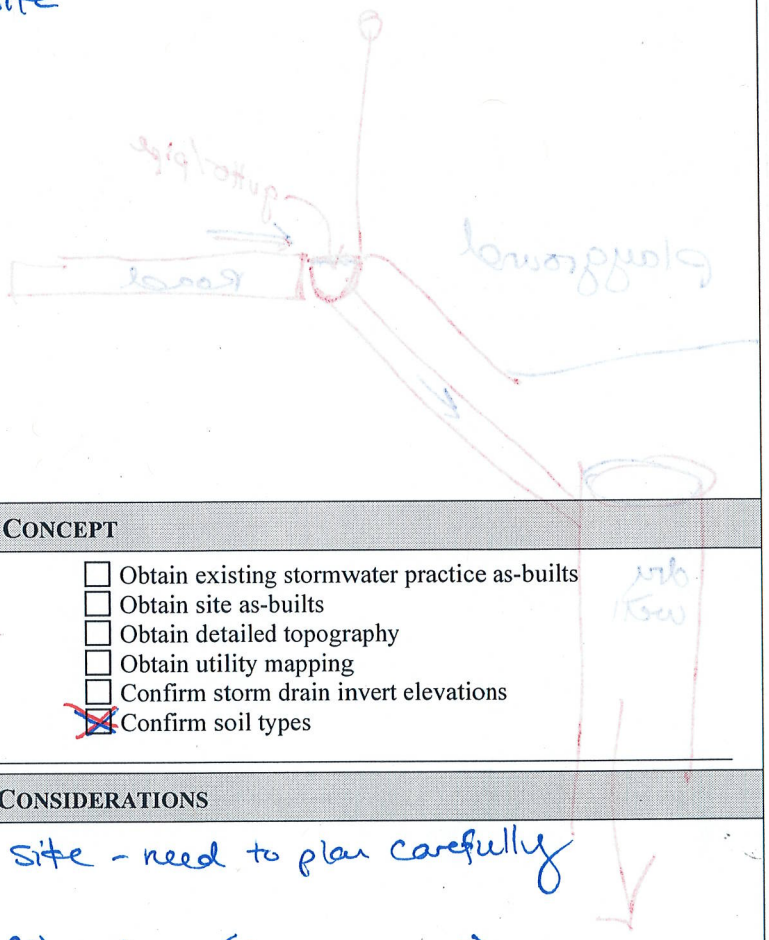


Unique Site ID: 7

DESIGN OR DELIVERY NOTES

site in good shape
may be able to fund all proposed projects as/ one grant (all small)
Playground proposal - ~~may~~ best to do if repaving back access road

No irrigation used on site



FOLLOW-UP NEEDED TO COMPLETE FIELD CONCEPT

- ☐ Confirm property ownership
- ☐ Confirm drainage area
- ☐ Confirm drainage area impervious cover
- ☐ Confirm volume computations
- ☐ Complete concept sketch
- ☐ Obtain existing stormwater practice as-builts
- ☐ Obtain site as-builts
- ☐ Obtain detailed topography
- ☐ Obtain utility mapping
- ☐ Confirm storm drain invert elevations
- ☒ Confirm soil types
- ☐ Other:_____

INITIAL FEASIBILITY AND CONSTRUCTION CONSIDERATIONS

~~lots of~~ facilities buried on site - need to plan carefully
Site in good condition
test leach field for infiltration (for dry well)

SITE CANDIDATE FOR FURTHER INVESTIGATION:	☒ YES	☐ NO	☐ MAYBE
IS SITE CANDIDATE FOR EARLY ACTION PROJECT(S):	☐ YES	☒ NO	☐ MAYBE
IF NO, SITE CANDIDATE FOR OTHER RESTORATION PROJECT(S):	☐ YES	☐ NO	☐ MAYBE

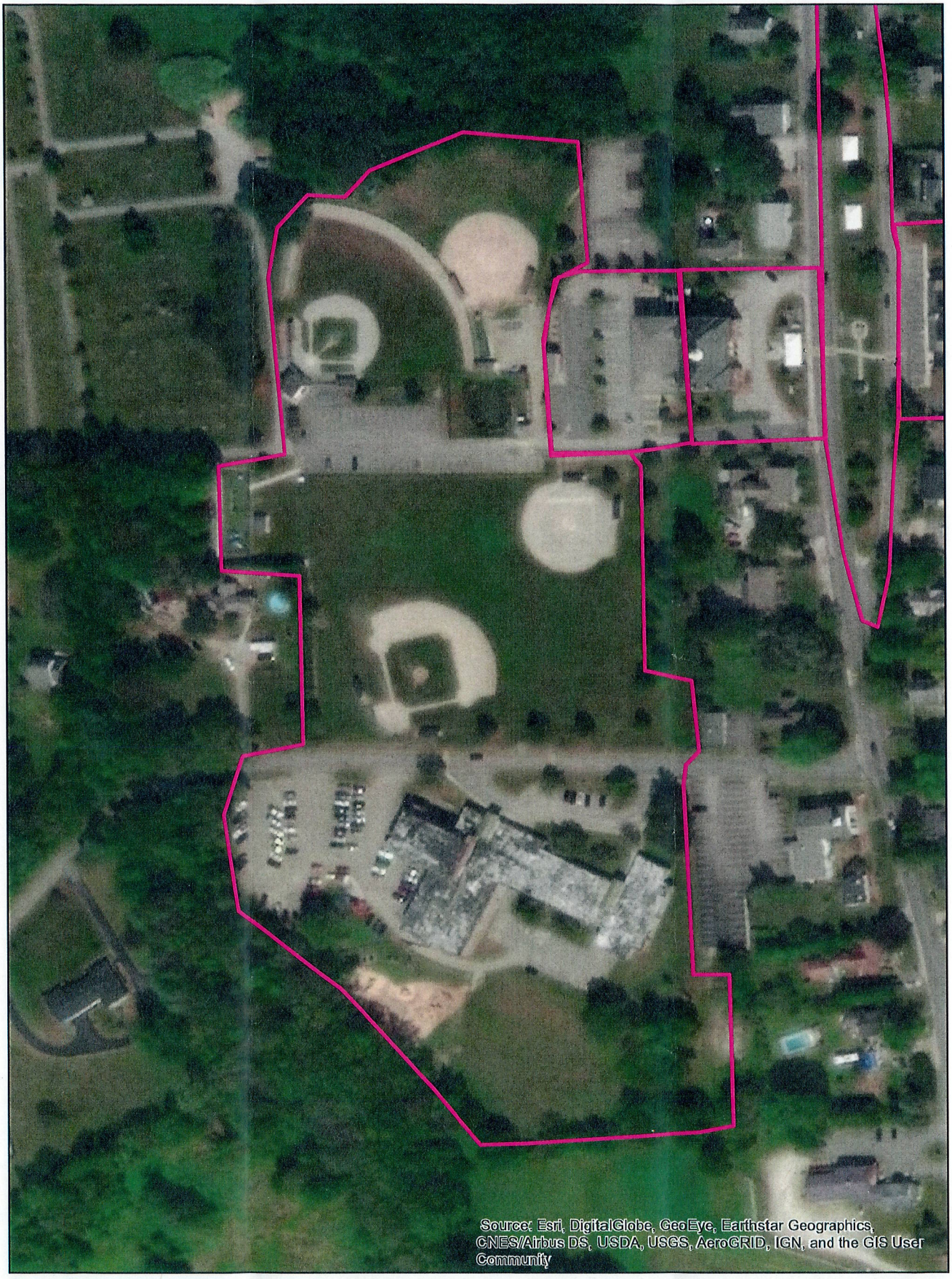
IF YES, TYPE(S):_____

Unique Site ID: 7

Site Name: Charlton Elementary School
Site Number: 7

0 85 170 340 Feet

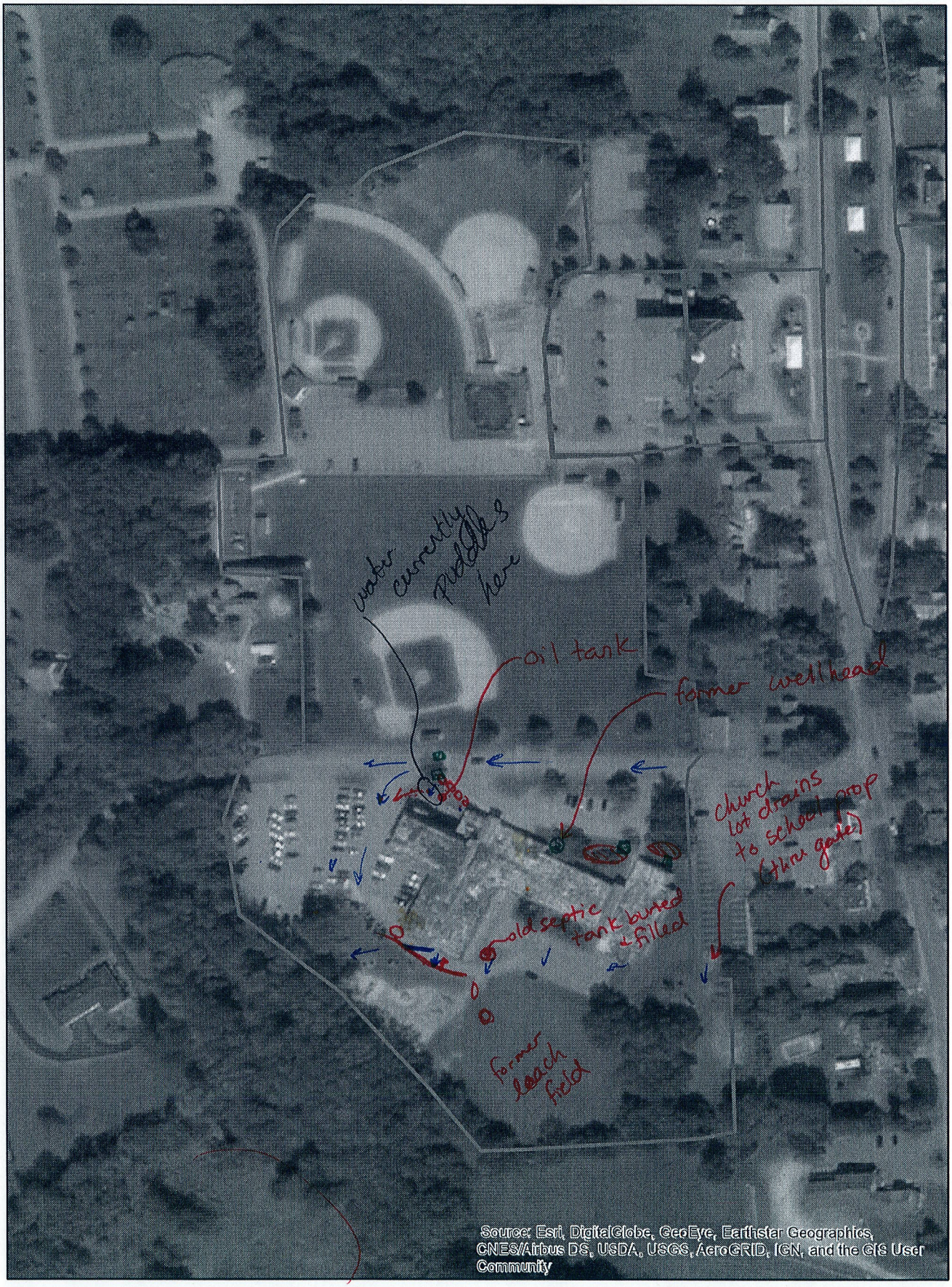
N



Site Name: Charlton Elementary School
Site Number: 7

0 85 170 340 Feet

N



Retrofit Reconnaissance Investigation **RRI**

WATERSHED: ~~Spencer~~ Charlton	SUBWATERSHED:	UNIQUE SITE ID: 8	
DATE: 12-13-18	ASSESSED BY: RW MS	CAMERA ID: 2	PICTURES:
GPS ID:	LMK ID:	LAT:	LONG:

SITE DESCRIPTION

Name: BAY PATH VOC HIGH
Address:

Ownership: ? ☐ Public ☐ Private ☒ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Corresponding USSR/USA Field Sheet? ☐ Yes ☐ No If yes, Unique Site ID:

Proposed Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Road ROW
- ☐ Other:
- ☐ Above Roadway Culvert
- ☐ In Conveyance System
- ☐ Near Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☐ Underground
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Other:

DRAINAGE AREA TO PROPOSED RETROFIT

Drainage Area ≈ _____
Imperviousness ≈ _____ %
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ☐ Residential
  - ☐ SFH (< 1 ac lots)
  - ☐ SFH (> 1 ac lots)
  - ☐ Townhouses
  - ☐ Multi-Family
- ☐ Commercial
- ☐ Institutional
- ☐ Industrial
- ☐ Transport-Related
- ☐ Park
- ☐ Undeveloped
- ☐ Other:

EXISTING STORMWATER MANAGEMENT

Existing Stormwater Practice: ☑ Yes ☐ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Site Drainage and Conveyance:

MASSIVE stormwater basins for holding parking lot run off & possibly roof runoff also. Building is round shape w/ impervious surfaces surrounding all sides. Most/all runoff already captured and held on site. Recreation (football & baseball) on lower tiers to the E and S of building. Access roads circumvent the site, which is a mountain top

Unique Site ID: 8

PROPOSED RETROFIT

Purpose of Retrofit:

- [x] Water Quality
- [x] Demonstration / Education
- [ ] Recharge
- [ ] Repair
- [ ] Channel Protection
- [ ] Other:
- [ ] Flood Control

Proposed Treatment Option:

- [ ] Extended Detention
- [ ] Filtering Practice
- [ ] Wet Pond
- [ ] Infiltration
- [ ] Created Wetland
- [x] ~~Swale~~
- [x] Bioretention linear
- [ ] Other:

Describe Elements of Proposed Retrofit, Including Surface Area, Maximum Depth of Treatment, and Conveyance:

Bioretention swale along back parking lot, ~~between park~~ along side, to capture + treat some water

SITE CONSTRAINTS

Adjacent Land Use:

- [ ] Residential
- [ ] Commercial
- [ ] Institutional
- [ ] Industrial
- [ ] Transport-Related
- [ ] Park
- [x] Undeveloped
- [ ] Other:

Possible Conflicts Due to Adjacent Land Use? [ ] Yes [ ] No

If Yes, Describe:

Access:

- [ ] No Constraints

Constrained due to

- [ ] Slope
- [ ] Space
- [ ] Utilities
- [ ] Tree Impacts
- [ ] Structures
- [ ] Property Ownership
- [ ] Other:

Conflicts with Existing Utilities:

- [ ] None
- [x] Unknown

Yes	Possible	
[ ]	[x]	Sewer
[ ]	[x]	Water
[ ]	[x]	Gas
[ ]	[x]	Cable
[ ]	[x]	Electric
[ ]	[ ]	Electric to Streetlights
[ ]		Overhead Wires
[ ]	[ ]	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	[ ] Probable	[x] Not Probable
Impacts to Wetlands	[ ] Probable	[x] Not Probable
Impacts to a Stream	[ ] Probable	[x] Not Probable
Floodplain Fill	[ ] Probable	[x] Not Probable
Impacts to Forests	[ ] Probable	[x] Not Probable
Impacts to Specimen Trees	[ ] Probable	[x] Not Probable

How many?

Approx. DBH

Other factors:

Soils:

Soil auger test holes:	[ ] Yes	[ ] No
Evidence of poor infiltration (clays, fines):	[x] Yes	~~[ ] No~~ Possible C/D soils or urban (per soils map)
Evidence of shallow bedrock:	[ ] Yes	[x] No
Evidence of high water table (gleying, saturation):	[ ] Yes	[x] No

SKETCH

- site used to be highest hill in Charlton
  - height reduced w/ renovation / construction of building

DESIGN OR DELIVERY NOTES

- Site renovated + upgraded w/in last year/2
- treatment already well underway
  - 2 large basins - probably treat roof runoff as well as parking lots
  - School certified LEED silver
  - unlikely to change buildings or new parking lots soon

FOLLOW-UP NEEDED TO COMPLETE FIELD CONCEPT

- ☐ Confirm property ownership
- ☐ Confirm drainage area
- ☐ Confirm drainage area impervious cover
- ☐ Confirm volume computations
- ☐ Complete concept sketch
- ☐ Obtain existing stormwater practice as-builts
- ☐ Obtain site as-builts
- ☐ Obtain detailed topography
- ☐ Obtain utility mapping
- ☐ Confirm storm drain invert elevations
- ☒ Confirm soil types
- ☐ Other:_____

INITIAL FEASIBILITY AND CONSTRUCTION CONSIDERATIONS

SITE CANDIDATE FOR FURTHER INVESTIGATION:	☐ YES	☐ NO	☒ MAYBE
IS SITE CANDIDATE FOR EARLY ACTION PROJECT(S):	☐ YES	☒ NO	☐ MAYBE
IF NO, SITE CANDIDATE FOR OTHER RESTORATION PROJECT(S):	☐ YES	☐ NO	☐ MAYBE

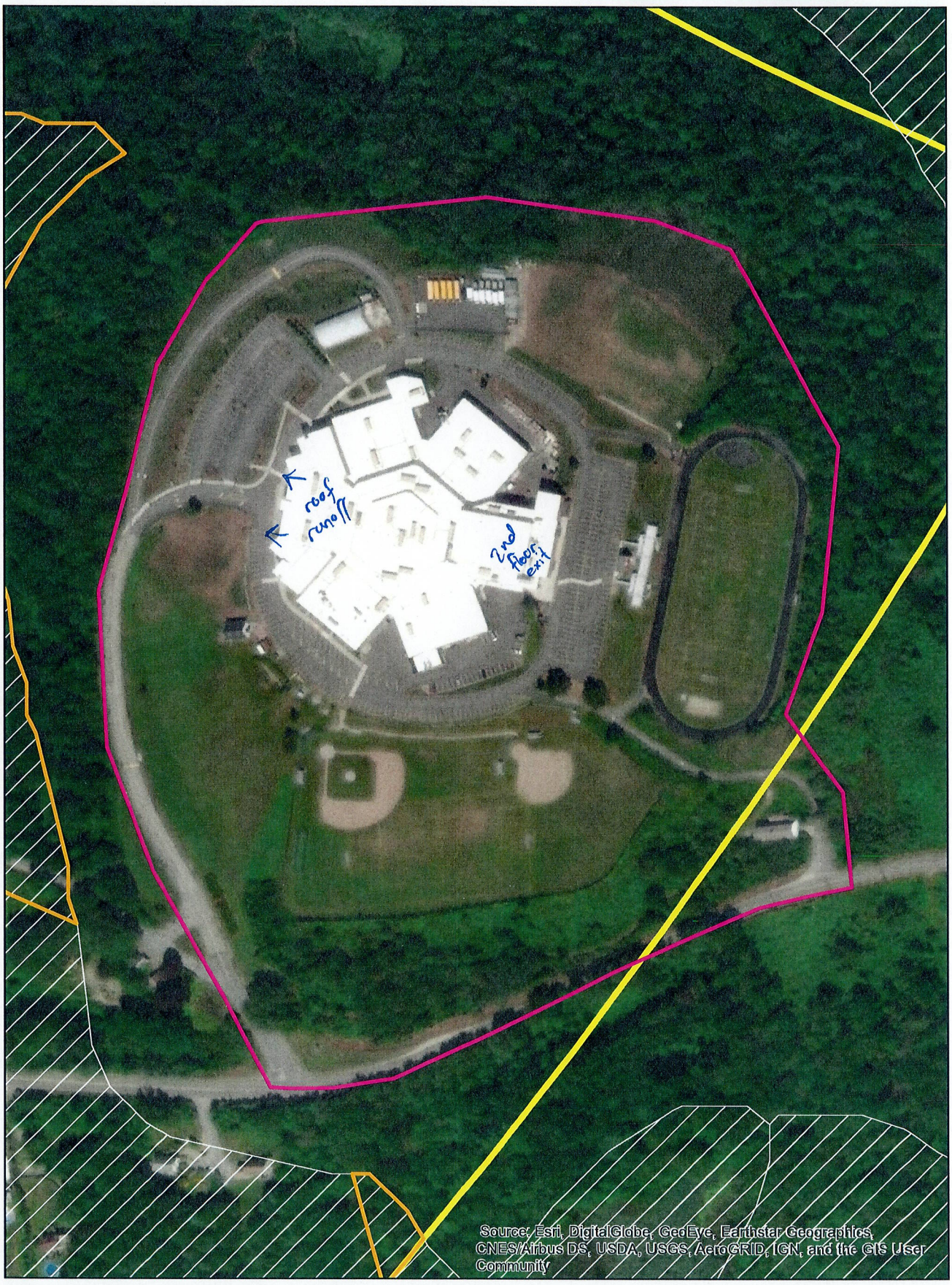
IF YES, TYPE(S):_____

Unique Site ID: 8

Site Name: Bay Path Vocational School
Site Number: 8

0 120 240 480 Feet

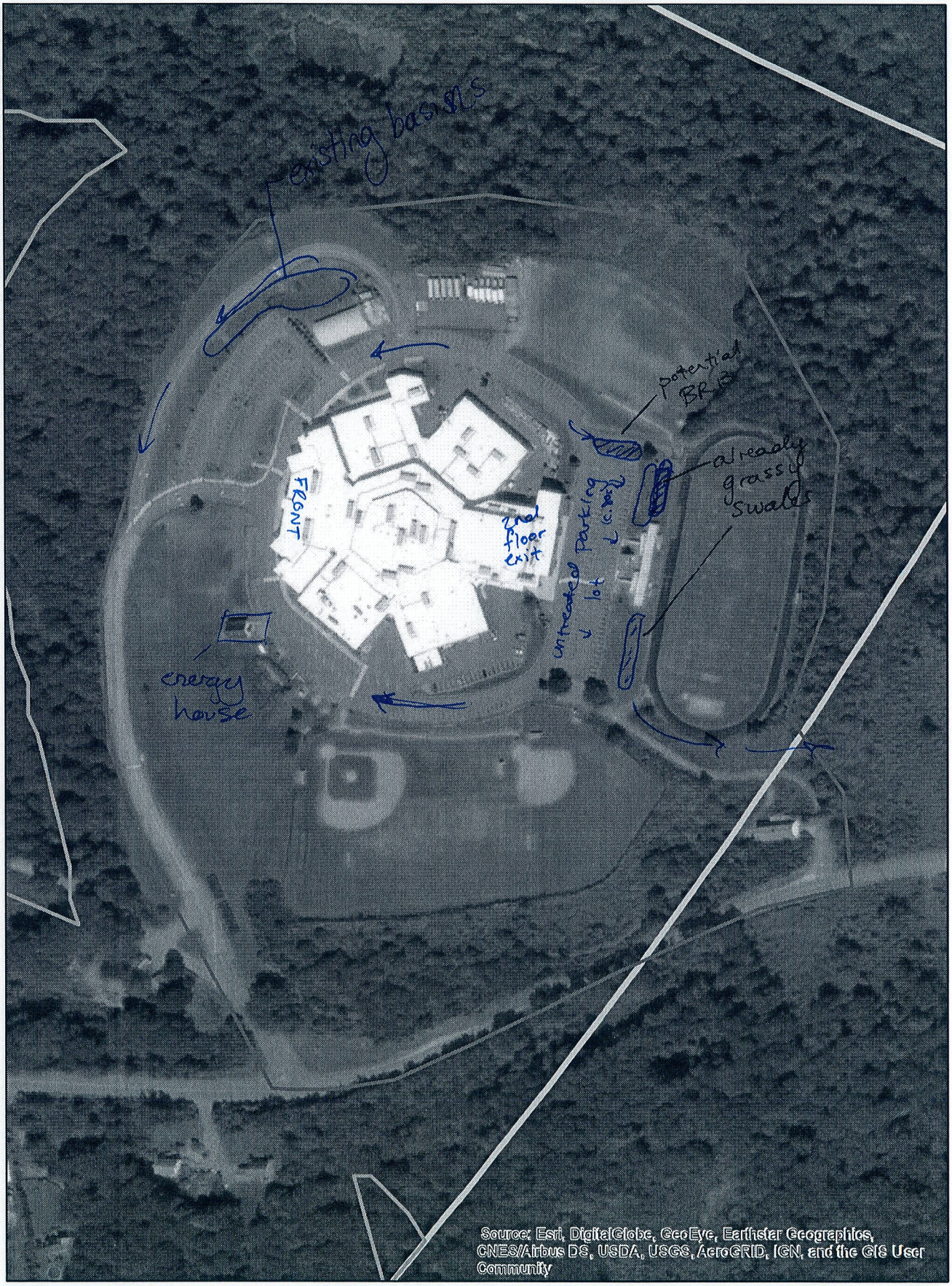
N



Site Name: Bay Path Vocational School
Site Number: 8

0 120 240 480 Feet

N



Retrofit Reconnaissance Investigation **RRI**

WATERSHED: Charlton	SUBWATERSHED:	UNIQUE SITE ID: 9	
DATE: 12/4/18	ASSESSED BY: RW HF	CAMERA ID: 2	PICTURES:
GPS ID:	LMK ID:	LAT:	LONG:

SITE DESCRIPTION

Name: Charlton Fire Station
Address: Power Station Road

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☒ Local ☐ State ☐ DOT ☐ Other:_____

Corresponding USSR/USA Field Sheet? ☐ Yes ☐ No If yes, Unique Site ID:_____

Proposed Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Road ROW
- ☐ Other:_____
- ☐ Above Roadway Culvert
- ☐ In Conveyance System
- ☐ Near Large Parking Lot

On-Site
- ☒ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☐ Underground
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Other:_____

DRAINAGE AREA TO PROPOSED RETROFIT

Drainage Area ≈ _____
Imperviousness ≈ _____%
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ☐ Residential
  - ☐ SFH (< 1 ac lots)
  - ☐ SFH (> 1 ac lots)
  - ☐ Townhouses
  - ☐ Multi-Family
- ☐ Commercial
- ☐ Institutional
- ☐ Industrial
- ☐ Transport-Related
- ☐ Park
- ☐ Undeveloped
- ☐ Other:_____

EXISTING STORMWATER MANAGEMENT

Existing Stormwater Practice: ☐ Yes ☐ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Site Drainage and Conveyance:

Firehouse occupies almost entire site, & paved entry/exit along front takes up rest

Unique Site ID: 9

PROPOSED RETROFIT

Purpose of Retrofit:

☐ Water Quality ☐ Recharge ☐ Channel Protection ☐ Flood Control
☐ Demonstration / Education ☐ Repair ☐ Other:_____

Proposed Treatment Option:

☐ Extended Detention ☐ Wet Pond ☐ Created Wetland ☐ Bioretention
☐ Filtering Practice ☐ Infiltration ☐ Swale ☐ Other: aquaswirl in nearby storm drain

Describe Elements of Proposed Retrofit, Including Surface Area, Maximum Depth of Treatment, and Conveyance:

SITE CONSTRAINTS

Adjacent Land Use:

☒ Residential ☒ Commercial ☒ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other:_____

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☐ No

If Yes, Describe:

Access:

☐ No Constraints

Constrained due to

☐ Slope ☒ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:_____

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☐	Sewer
☐	☐	Water
☐	☐	Gas
☐	☐	Cable
☐	☐	Electric
☐	☐	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:_____

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☐ Not Probable
Impacts to Wetlands	☐ Probable	☐ Not Probable
Impacts to a Stream	☐ Probable	☐ Not Probable
Floodplain Fill	☐ Probable	☐ Not Probable
Impacts to Forests	☐ Probable	☐ Not Probable
Impacts to Specimen Trees	☐ Probable	☐ Not Probable

How many?_____

Approx. DBH_____

Other factors:_____

Soils:

Soil auger test holes:	☐ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Evidence of high water table (gleying, saturation):	☐ Yes	☐ No

C/D soils

Unique Site ID: 9

SKETCH

see aerial

DESIGN OR DELIVERY NOTES

FOLLOW-UP NEEDED TO COMPLETE FIELD CONCEPT

- ☐ Confirm property ownership
- ☐ Confirm drainage area
- ☐ Confirm drainage area impervious cover
- ☐ Confirm volume computations
- ☐ Complete concept sketch
- ☐ Obtain existing stormwater practice as-builts
- ☐ Obtain site as-builts
- ☐ Obtain detailed topography
- ☐ Obtain utility mapping
- ☐ Confirm storm drain invert elevations
- ☐ Confirm soil types
- ☐ Other:_____

INITIAL FEASIBILITY AND CONSTRUCTION CONSIDERATIONS

SITE CANDIDATE FOR FURTHER INVESTIGATION:	☐ YES	☒ NO	☐ MAYBE
IS SITE CANDIDATE FOR EARLY ACTION PROJECT(S):	☐ YES	☒ NO	☐ MAYBE
IF NO, SITE CANDIDATE FOR OTHER RESTORATION PROJECT(S):	☐ YES	☒ NO	☐ MAYBE

IF YES, TYPE(S):_____

Unique Site ID: 9

Site Name: Charlton Fire Station
Site Number: 9

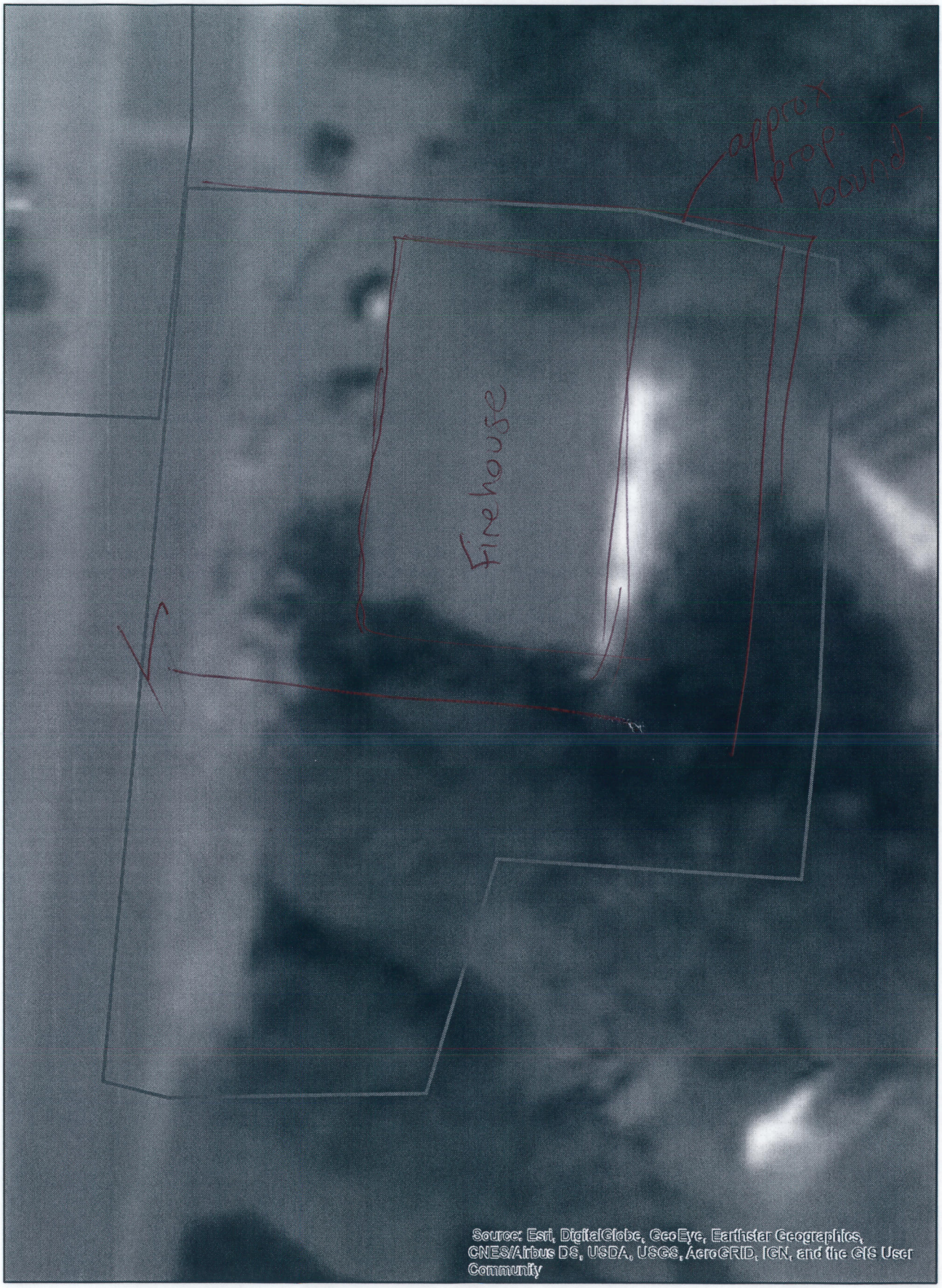
0 10 20 40
Feet

N

Site Name: Charlton Fire Station
Site Number: 9

0 10 20 40
Feet

N



Retrofit Reconnaissance Investigation **RRI**

WATERSHED: Charlton	SUBWATERSHED:	UNIQUE SITE ID: 10	
DATE: 12/4/18	ASSESSED BY: RLW, AG	CAMERA ID: 2	PICTURES:
GPS ID:	LMK ID:	LAT:	LONG:

SITE DESCRIPTION

Name: Charlton Fire Station #2
Address: North Main St

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☒ Local ☐ State ☐ DOT ☐ Other:_____

Corresponding USSR/USA Field Sheet? ☐ Yes ☐ No If yes, Unique Site ID:_____

Proposed Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Road ROW
- ☐ Other:_____
- ☐ Above Roadway Culvert
- ☐ In Conveyance System
- ☐ Near Large Parking Lot

On-Site
- ? ☒ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☐ Underground
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Other:_____

DRAINAGE AREA TO PROPOSED RETROFIT

Drainage Area ≈ _____
Imperviousness ≈ _____ %
Impervious Area ≈ _____

Notes: Steep wooded hillside drains to site

Drainage Area Land Use:
- ☐ Residential
  - ☐ SFH (< 1 ac lots)
  - ☐ SFH (> 1 ac lots)
  - ☐ Townhouses
  - ☐ Multi-Family
- ☐ Commercial
- ☒ Institutional
- ☐ Industrial
- ☒ Transport-Related
- ☐ Park
- ☒ Undeveloped
- ☐ Other:_____

EXISTING STORMWATER MANAGEMENT

Existing Stormwater Practice: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Site Drainage and Conveyance:

Site appears blighted & rundown; building in poor shape. Seepage draining from hillside @ back of site to CB on site. Monitoring well near back of site. Site drains to main road. paved & gravel parking areas. Site no longer an active fire station.

Unique Site ID: 10

PROPOSED RETROFIT

Purpose of Retrofit:
☒ Water Quality ☐ Recharge ☐ Channel Protection ☐ Flood Control
☒ Demonstration / Education ☐ Repair ☒ Other: Beautification

aquaswirl (1) @ storm drain
Plant area of seepage to stormdrain

Proposed Treatment Option:
☐ Extended Detention ☐ Wet Pond ☐ Created Wetland ☐ Bioretention
☐ Filtering Practice ☐ Infiltration ☐ Swale ☒ Other: Pavement Removal, aquaswirl

Describe Elements of Proposed Retrofit, Including Surface Area, Maximum Depth of Treatment, and Conveyance:

Remove pavement + building; Cap if necessary
Install stormwater + nature park??
Plant trees, etc to transpire water, reduce urban heat island
~~Playground? Dog Park?~~ Reversal of blight

SITE CONSTRAINTS

Adjacent Land Use:
☐ Residential ☒ Commercial ☐ Institutional
☐ Industrial ☒ Transport-Related ☐ Park
☐ Undeveloped ☐ Other:
Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☐ No
If Yes, Describe:

Access:
☐ No Constraints
Constrained due to
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☒ Other: use

Conflicts with Existing Utilities:
☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☐	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other: Monitoring wells

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☒ Not Probable
Impacts to Wetlands	☐ Probable	☒ Not Probable
Impacts to a Stream	☐ Probable	☒ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☐ Probable	☒ Not Probable
Impacts to Specimen Trees	☐ Probable	☒ Not Probable

How many?
Approx. DBH

Other factors:

Soils:

Soil auger test holes:	☐ Yes	☒ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Evidence of high water table (gleying, saturation):	☒ Yes	☐ No

C/D soils

2 seepage flowing to storm drain

Unique Site ID: 10

SKETCH

See aerial for site 12

Unique Site ID: 10

DESIGN OR DELIVERY NOTES

FD appears to use site for storage of trailers (e.g. hazmat, emergency etc) + vehicles

Building used for equipment storage? Need access to front garage doors?

Could town improve logistics + give up this site for some treatment?

Also design in native landscaping

FOLLOW-UP NEEDED TO COMPLETE FIELD CONCEPT

- ☐ Confirm property ownership
- ☐ Confirm drainage area
- ☐ Confirm drainage area impervious cover
- ☐ Confirm volume computations
- ☐ Complete concept sketch
- ☐ Obtain existing stormwater practice as-builts
- ☐ Obtain site as-builts
- ☐ Obtain detailed topography
- ☐ Obtain utility mapping
- ☐ Confirm storm drain invert elevations
- ☐ Confirm soil types
- ☐ Other: Confirm current site usage + poss. alternatives

INITIAL FEASIBILITY AND CONSTRUCTION CONSIDERATIONS

Site no longer active fire station but may have other use to town

SITE CANDIDATE FOR FURTHER INVESTIGATION:	☒ YES	☐ NO	☐ MAYBE
IS SITE CANDIDATE FOR EARLY ACTION PROJECT(S):	☒ YES	☐ NO	☐ MAYBE
IF NO, SITE CANDIDATE FOR OTHER RESTORATION PROJECT(S):	☐ YES	☐ NO	☐ MAYBE

IF YES, TYPE(S): _____

Unique Site ID: 10

Site Name: Charlton Fire Station #2
Site Number: 10

0 15 30 60
Feet

N

Site Name: Charlton Fire Station #2
Site Number: 10

0 15 30 60 Feet

N

Retrofit Reconnaissance Investigation **RRI**

WATERSHED: Charlton	SUBWATERSHED:	UNIQUE SITE ID:	
DATE: 12/4/18	ASSESSED BY: RW HF	CAMERA ID: 2	PICTURES: 11
GPS ID:	LMK ID:	LAT:	LONG:

SITE DESCRIPTION

Name: Charlton Post office
Address: Power station Road

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☒ Other: Federal?

Corresponding USSR/USA Field Sheet? ☐ Yes ☐ No If yes, Unique Site ID:

Proposed Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Road ROW
- ☐ Other:
- ☐ Above Roadway Culvert
- ☐ In Conveyance System
- ☐ Near Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☒ Small Parking Lot
- ☐ Individual Street
- ☐ Underground
- ☒ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Other:

DRAINAGE AREA TO PROPOSED RETROFIT

Drainage Area ≈ _____
Imperviousness ≈ _____ %
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ☒ Residential
  - ☐ SFH (< 1 ac lots)
  - ☐ SFH (> 1 ac lots)
  - ☐ Townhouses
  - ☐ Multi-Family
- ☒ Commercial
- ☒ Institutional
- ☐ Industrial
- ☒ Transport-Related
- ☐ Park
- ☐ Undeveloped
- ☐ Other:

EXISTING STORMWATER MANAGEMENT

Existing Stormwater Practice: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Site Drainage and Conveyance:

Unique Site ID: 11

PROPOSED RETROFIT

Purpose of Retrofit:
☒ Water Quality ☐ Recharge ☒ Channel Protection ☐ Flood Control
☐ Demonstration / Education ☐ Repair ☐ Other:_____

Proposed Treatment Option:
☐ Extended Detention ☐ Wet Pond ☐ Created Wetland ☐ Bioretention
☐ Filtering Practice ☐ Infiltration ☐ Swale ☐ Other: Riparian Buffer

Describe Elements of Proposed Retrofit, Including Surface Area, Maximum Depth of Treatment, and Conveyance:
extend riparian buffer behind post office w/ native shrubs & plantings

SITE CONSTRAINTS

Adjacent Land Use:
☒ Residential ☒ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other:_____
Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☐ No
If Yes, Describe:

Access:
☐ No Constraints
Constrained due to
☐ Slope ☒ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:_____

Conflicts with Existing Utilities:
☐ None
☒ Unknown

Yes	Possible		
☐	☒	Sewer	Septic
☐	☐	Water	
☐	☐	Gas	
☐	☐	Cable	
☐	☐	Electric	
☐	☐	Electric to Streetlights	
☐		Overhead Wires	
☐	☐	Other:_____	

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☐ Not Probable	see back
Impacts to Wetlands	☐ Probable	☒ Not Probable	
Impacts to a Stream	☒ Probable	☐ Not Probable	
Floodplain Fill	☐ Probable	☒ Not Probable	
Impacts to Forests	☐ Probable	☒ Not Probable	
Impacts to Specimen Trees	☐ Probable	☒ Not Probable	

How many?_____
Approx. DBH_____

Other factors:_____

Soils:

Soil auger test holes:	☐ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Evidence of high water table (gleying, saturation):	☒ Yes	☐ No

c/b soils

Unique Site ID: 11

SKETCH

See aerial

Unique Site ID: 11

DESIGN OR DELIVERY NOTES

Dam over Cady Brook
- Deadbeat
- Privately-owned
- Candidate for removal + FP restoration?

FOLLOW-UP NEEDED TO COMPLETE FIELD CONCEPT

- ☐ Confirm property ownership
- ☐ Confirm drainage area
- ☐ Confirm drainage area impervious cover
- ☐ Confirm volume computations
- ☐ Complete concept sketch
- ☐ Obtain existing stormwater practice as-builts
- ☐ Obtain site as-builts
- ☐ Obtain detailed topography
- ☐ Obtain utility mapping
- ☐ Confirm storm drain invert elevations
- ☐ Confirm soil types
- ☐ Other:_____

INITIAL FEASIBILITY AND CONSTRUCTION CONSIDERATIONS

Space
Federal cooperation

SITE CANDIDATE FOR FURTHER INVESTIGATION:	☒ YES	☐ NO	☐ MAYBE
IS SITE CANDIDATE FOR EARLY ACTION PROJECT(S):	☐ YES	☐ NO	☒ MAYBE
IF NO, SITE CANDIDATE FOR OTHER RESTORATION PROJECT(S):	☐ YES	☐ NO	☐ MAYBE

IF YES, TYPE(S):_____

Unique Site ID: 11

Site Name: Charlton Post Office Powerstation Road
Site Number: 11

0 10 20 40 Feet

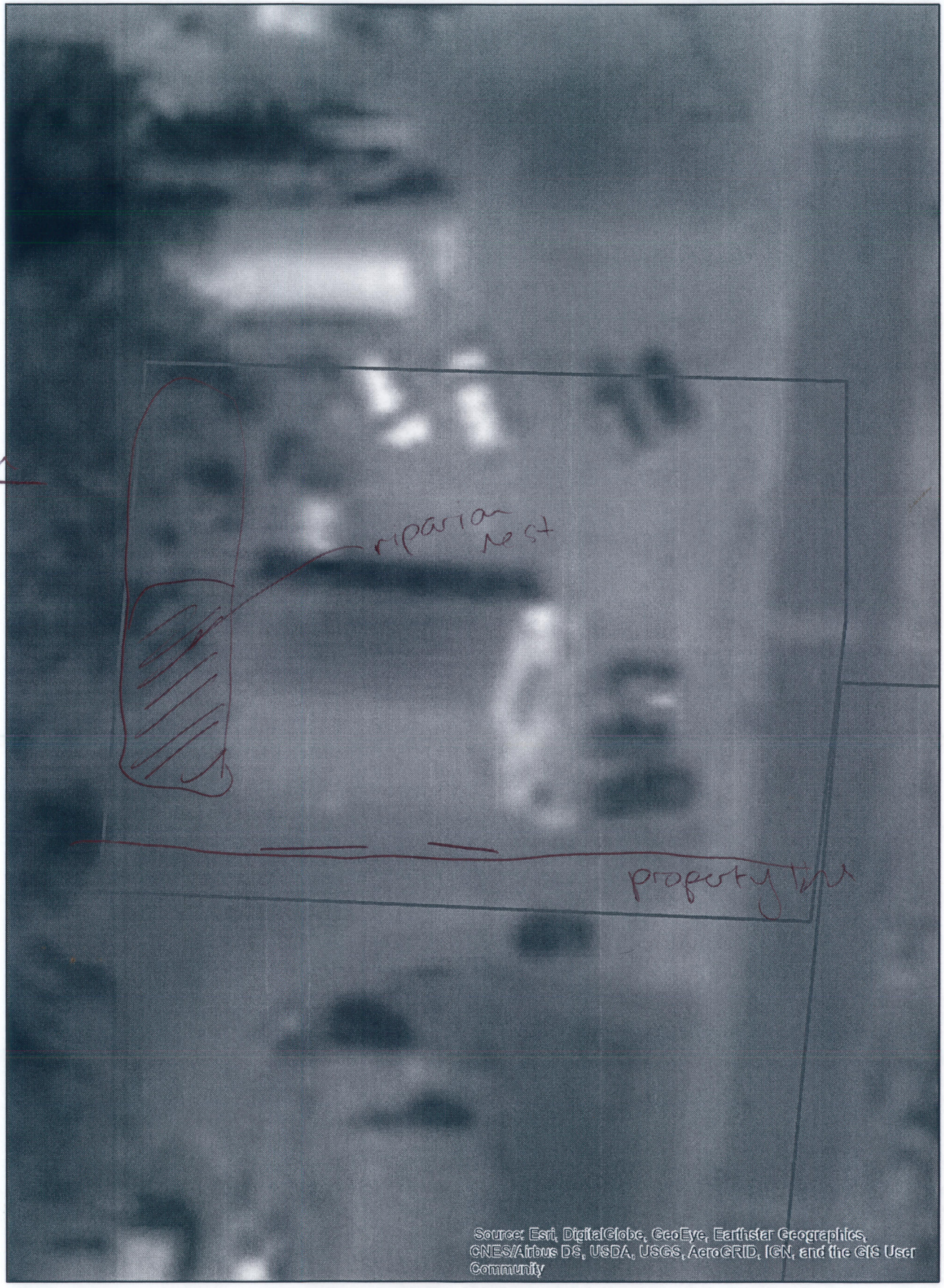
N

Site Name: Charlton Post Office Powerstation Road

Site Number: 11

0 10 20 40 Feet

N



Retrofit Reconnaissance Investigation **RRI**

WATERSHED: Chaster	SUBWATERSHED:	UNIQUE SITE ID: 12	
DATE: 12/4/18	ASSESSED BY: RW HF	CAMERA ID: 2	PICTURES:
GPS ID:	LMK ID:	LAT:	LONG:

SITE DESCRIPTION

Name: US Post office
Address: N. Main St.

Ownership: Federal? ☑ Public ☑ Private ☑ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☑ Other:

Corresponding USSR/USA Field Sheet? ☐ Yes ☐ No If yes, Unique Site ID:

Proposed Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Road ROW
- ☐ Other:
- ☐ Above Roadway Culvert
- ☐ In Conveyance System
- ☑ Near Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☑ Small Parking Lot
- ☐ Individual Street
- ☐ Underground
- ☑ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Other:

DRAINAGE AREA TO PROPOSED RETROFIT

Drainage Area ≈ _____
Imperviousness ≈ _____ %
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ☐ Residential
  - ☐ SFH (< 1 ac lots)
  - ☐ SFH (> 1 ac lots)
  - ☐ Townhouses
  - ☐ Multi-Family
- ☐ Commercial
- ☐ Institutional
- ☐ Industrial
- ☐ Transport-Related
- ☐ Park
- ☐ Undeveloped
- ☐ Other:

EXISTING STORMWATER MANAGEMENT

Existing Stormwater Practice: ☐ Yes ☑ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Site Drainage and Conveyance:

Completly developed site w/ large building & parking area. Narrow grass strip on N. side widens @ front of lot around driveway entrance. Large parking area in front of building drains directly into Main St. Post office shares building w/ real estate agency. Largest green spaces on site flank driveway entrance on both sides. Could be graded to receive runoff from surrounding imperv. Main parking area terminates @ back of lot into toe of steep wooded slope. Whole lot drains into Main St. Catch basin in intersecting parking lot behind buildings wooded slope seeps into lot.

PROPOSED RETROFIT

Purpose of Retrofit:

☑ Water Quality ☐ Recharge ☐ Channel Protection ☐ Flood Control
☑ Demonstration / Education ☐ Repair ☐ Other:_____

Aqvaswirl on stormdrain behind buidding. Medium pre-treatment basin in green patch btwn P.O. & fire station lot which detains runoff from main large parking area before overflowing back to street. Gutter roof runoff ~~into~~ from front of building into detention basin L side of entrance to slow and infiltrate before overflow to street

Proposed Treatment Option:

☐ Extended Detention ☐ Wet Pond ☐ Created Wetland ☑ Bioretention
☐ Filtering Practice ☐ Infiltration ☑ Swale ☐ Other:_____

Describe Elements of Proposed Retrofit, Including Surface Area, Maximum Depth of Treatment, and Conveyance:

Explore ownership of flat, open area ½ way up steep slope behind building for revegetation if possible

SITE CONSTRAINTS

Adjacent Land Use:

☐ Residential ☑ Commercial ☑ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other:_____

Possible Conflicts Due to Adjacent Land Use? ☑ Yes ☐ No

If Yes, Describe:

Access:

☐ No Constraints

Constrained due to

☑ Slope ☑ Space
☑ Utilities ☐ Tree Impacts
☑ Structures ☐ Property Ownership
☐ Other:_____

Conflicts with Existing Utilities:

☐ None
☑ Unknown

Yes	Possible	
☐	☑	Sewer
☐	☑	Water
☐	☑	Gas
☐	☑	Cable
☐	☑	Electric
☐	☑	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:_____

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☐ Not Probable
Impacts to Wetlands	☐ Probable	☐ Not Probable
Impacts to a Stream	☐ Probable	☐ Not Probable
Floodplain Fill	☐ Probable	☐ Not Probable
Impacts to Forests	☐ Probable	☐ Not Probable
Impacts to Specimen Trees	☐ Probable	☐ Not Probable

How many?_____
Approx. DBH_____

Other factors:_____

Soils:

Soil auger test holes:	☐ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☐ No
Evidence of shallow bedrock:	☐ Yes	☐ No
Evidence of high water table (gleying, saturation):	☐ Yes	☐ No

C/D soils

SKETCH

Unique Site ID:_____

DESIGN OR DELIVERY NOTES

FOLLOW-UP NEEDED TO COMPLETE FIELD CONCEPT

- [x] Confirm property ownership
- [ ] Confirm drainage area
- [ ] Confirm drainage area impervious cover
- [ ] Confirm volume computations
- [ ] Complete concept sketch
- [ ] Obtain existing stormwater practice as-builts
- [ ] Obtain site as-builts
- [ ] Obtain detailed topography
- [x] Obtain utility mapping
- [ ] Confirm storm drain invert elevations
- [x] Confirm soil types
- [ ] Other:_____

INITIAL FEASIBILITY AND CONSTRUCTION CONSIDERATIONS

SITE CANDIDATE FOR FURTHER INVESTIGATION:	[x] YES	[ ] NO	[ ] MAYBE
IS SITE CANDIDATE FOR EARLY ACTION PROJECT(S):	[ ] YES	[ ] NO	[x] MAYBE
IF NO, SITE CANDIDATE FOR OTHER RESTORATION PROJECT(S):	[ ] YES	[ ] NO	[ ] MAYBE

IF YES, TYPE(S):_____

Unique Site ID:_____

Site Name: Charlton Post Office Main Street
Site Number: 12

0 20 40 80
Feet

N

Site Name: Charlton Post Office Main Street

Site Number: 12

0 20 40 80

Feet

N

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Retrofit Reconnaissance Investigation **RRI**

WATERSHED: Charlton	SUBWATERSHED:	UNIQUE SITE ID:	
DATE: 12/31/18	ASSESSED BY: RW, HF	CAMERA ID: 2	PICTURES:
GPS ID:	LMK ID:	LAT:	LONG:

SITE DESCRIPTION

Name: Charlton Little League Fields
Address: Bond Road

Ownership: ☐ Public ☐ Private ☒ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Corresponding USSR/USA Field Sheet? ☐ Yes ☐ No If yes, Unique Site ID:

Proposed Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Road ROW
- ☐ Other:
- ☐ Above Roadway Culvert
- ☐ In Conveyance System
- ☐ Near Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☐ Underground
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Other:

DRAINAGE AREA TO PROPOSED RETROFIT

Drainage Area ≈ _____
Imperviousness ≈ _____ %
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ☐ Residential
  - ☐ SFH (< 1 ac lots)
  - ☐ SFH (> 1 ac lots)
  - ☐ Townhouses
  - ☐ Multi-Family
- ☐ Commercial
- ☐ Institutional
- ☐ Industrial
- ☐ Transport-Related
- ☒ Park
- ☒ Undeveloped
- ☐ Other:

EXISTING STORMWATER MANAGEMENT

Existing Stormwater Practice: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

No stormwater drainage

Describe Existing Site Conditions, Including Existing Site Drainage and Conveyance:

The site is flanked by 4-7' tall embankment along Bond Rd supporting mature canopy trees & thick stone wall in disrepair. Swale btwn embankmt & soccer field appears clogged: holding water. Possibly clogged w/ sediment eroding off embankmt. Soccer field extremely soggy still after several days w/o rain. Large parking area btwn baseball & soccer fields has valley in middle which drains to wetland. Constrained on all sides by rec. uses. Large parking area to south of soccer field accepting road drainage. large grass patch in center w/ large boulders. Also grass patch & boulder @ edge w/ road where swale from soccer field drains out into gravel strip. well-defined edge btwn rec. area uses and wetland buffer

Unique Site ID: 13

PROPOSED RETROFIT

Purpose of Retrofit:
☒ Water Quality ☒ Recharge ☐ Channel Protection ☐ Flood Control
☒ Demonstration / Education ☐ Repair ☐ Other:_____

Proposed Treatment Option:
☐ Extended Detention ☐ Wet Pond ☐ Created Wetland ☒ Bioretention Linear parking lot
☐ Filtering Practice ☐ Infiltration ☐ Swale ☐ Other:_____

Describe Elements of Proposed Retrofit, Including Surface Area, Maximum Depth of Treatment, and Conveyance:

6"-1ft deep Bioretention basins down middles & edges of parking lots
INFILTRATION
-include trees for shade

Could consider infiltration units under paved lot but too expensive

SITE CONSTRAINTS

Adjacent Land Use:
☐ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☒ Park
☒ Undeveloped ☒ Other: ~~Masar~~ Lions Club
Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☒ No
If Yes, Describe:

Access:
☒ No Constraints
Constrained due to
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:_____

Conflicts with Existing Utilities:
☐ None
☒ Unknown

Yes	Possible	
☐	☐	Sewer
☐	☐	Water
☐	☐	Gas
☐	☒	Cable
☐	☒	Electric
☐	☐	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:_____

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☒ Not Probable
Impacts to Wetlands	☐ Probable	☒ Not Probable Possible
Impacts to a Stream	☐ Probable	☒ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☐ Probable	☒ Not Probable
Impacts to Specimen Trees	☐ Probable	☒ Not Probable

How many?_____
Approx. DBH_____

Other factors:_____

Soils:

Soil auger test holes:	☐ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Evidence of high water table (gleying, saturation):	☒ Yes	☐ No

AB soils
Saturated soils in fields
- b/c fields are compacted?
+ recent rain

Unique Site ID: 13

SKETCH

see aerial

Unique Site ID: 23

DESIGN OR DELIVERY NOTES

Caretakers dumping grass @ edge of field above wetland

FOLLOW-UP NEEDED TO COMPLETE FIELD CONCEPT

- ☐ Confirm property ownership
- ☐ Confirm drainage area
- ☐ Confirm drainage area impervious cover
- ☐ Confirm volume computations
- ☐ Complete concept sketch
- ☐ Obtain existing stormwater practice as-builts
- ☐ Obtain site as-builts
- ☐ Obtain detailed topography
- ☐ Obtain utility mapping
- ☐ Confirm storm drain invert elevations
- ☐ Confirm soil types
- ☒ Other: Parking lot usage (# vs cap); buses?

INITIAL FEASIBILITY AND CONSTRUCTION CONSIDERATIONS

Would require paving both parking lots
Large potholes in current lots

SITE CANDIDATE FOR FURTHER INVESTIGATION:	☒ YES	☐ NO	☐ MAYBE
IS SITE CANDIDATE FOR EARLY ACTION PROJECT(S):	☒ YES	☐ NO	☐ MAYBE
IF NO, SITE CANDIDATE FOR OTHER RESTORATION PROJECT(S):	☐ YES	☐ NO	☐ MAYBE

IF YES, TYPE(S): _____

Unique Site ID: 13

Site Name: Charlton Little League
Site Number: 13

0 80 160 320
Feet

N

Site Name: Charlton Little League

Site Number: 13

0 80 160 320 Feet

N

Retrofit Reconnaissance Investigation **RRI**

WATERSHED: Charlton	SUBWATERSHED:	UNIQUE SITE ID: 14	
DATE: 12/4/18	ASSESSED BY: RW HF	CAMERA ID: 2	PICTURES: 13:20
GPS ID:	LMK ID:	LAT:	LONG:

SITE DESCRIPTION

Name:_____
Address:_____

Ownership: ☐ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:_____

Corresponding USSR/USA Field Sheet? ☐ Yes ☐ No If yes, Unique Site ID:_____

Proposed Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Road ROW
- ☐ Other:_____
- ☐ Above Roadway Culvert
- ☐ In Conveyance System
- ☐ Near Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☐ Underground
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Other:_____

DRAINAGE AREA TO PROPOSED RETROFIT

Drainage Area ≈ _____
Imperviousness ≈ _____%
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ☐ Residential
  - ☐ SFH (< 1 ac lots)
  - ☐ SFH (> 1 ac lots)
  - ☐ Townhouses
  - ☐ Multi-Family
- ☐ Commercial
- ☐ Institutional
- ☐ Industrial
- ☐ Transport-Related
- ☐ Park
- ☐ Undeveloped
- ☐ Other:_____

EXISTING STORMWATER MANAGEMENT

Existing Stormwater Practice: ☐ Yes ☐ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Site Drainage and Conveyance:

Wooded, privately owned, mowed adjacent to lake & low-lying

Unique Site ID: 14

PROPOSED RETROFIT

Purpose of Retrofit:

☐ Water Quality ☐ Recharge ☐ Channel Protection ☐ Flood Control
☐ Demonstration / Education ☐ Repair ☐ Other:_____

Proposed Treatment Option:

☐ Extended Detention ☐ Wet Pond ☐ Created Wetland ☐ Bioretention
☐ Filtering Practice ☐ Infiltration ☐ Swale ☐ Other:_____

Describe Elements of Proposed Retrofit, Including Surface Area, Maximum Depth of Treatment, and Conveyance:

None

SITE CONSTRAINTS

Adjacent Land Use:

☐ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other:_____

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☐ No

If Yes, Describe:

Access:

☐ No Constraints

Constrained due to

☐ Slope ☒ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☒ Property Ownership
☒ Other: low-lying @ lake edge

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☐	Sewer
☐	☐	Water
☐	☐	Gas
☐	☐	Cable
☐	☐	Electric
☐	☐	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:_____

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☐ Not Probable
Impacts to Wetlands	☐ Probable	☐ Not Probable
Impacts to a Stream	☐ Probable	☐ Not Probable
Floodplain Fill	☐ Probable	☐ Not Probable
Impacts to Forests	☐ Probable	☐ Not Probable
Impacts to Specimen Trees	☐ Probable	☐ Not Probable

How many?_____
Approx. DBH_____

Other factors:_____

Soils:

Soil auger test holes:	☐ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☐ No
Evidence of shallow bedrock:	☐ Yes	☐ No
Evidence of high water table (gleying, saturation):	☐ Yes	☐ No

Unique Site ID:_____

SKETCH

Unique Site ID:_____