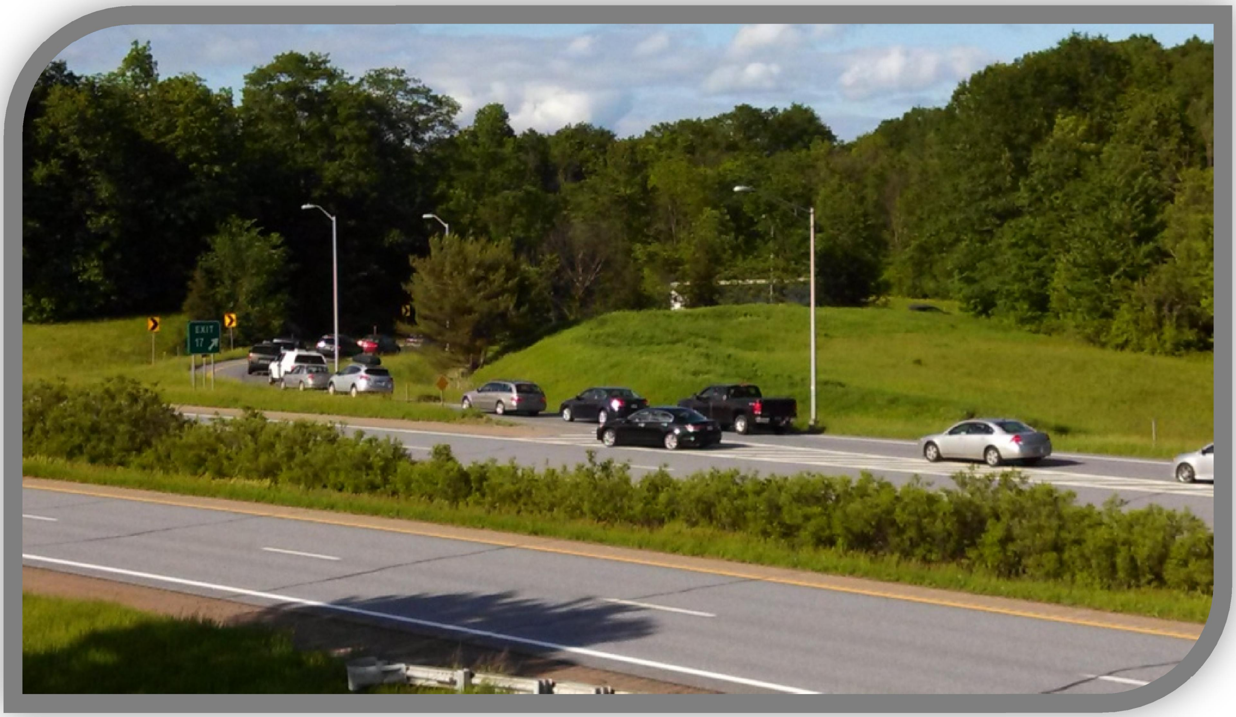
Exit 17 Scoping Study

Colchester, Vermont

Final Scoping Report

December 2014



Prepared for:

Colchester VERMONT

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Disclaimer:

The preparation of this report has been financed in part through grant[s] from the Federal Highway Administration and Federal Transit Administration, U.S. Department of Transportation, under the State Planning and Research Program, Section 505 [or Metropolitan Planning Program, Section 104(f)] of Title 23, U.S. Code. The contents of this report do not necessarily reflect the official views or policy of the U.S. Department of Transportation.

Table of Contents

List of Figures

List of Tables

1 Introduction

1.1 Background

The Exit 17 Scoping Study was initiated in the spring of 2013 through its inclusion in the Chittenden County Regional Planning Commission's (CCRPC) Unified Planning Work Program (UPWP). The focus of this scoping study was to develop and evaluate build alternatives for relieving congestion, increasing safety, and improving bicycle conditions at the I-89 Exit 17 interchange and adjacent intersection of US 2 and US 7—locally known as Chimney Corners—near the Colchester/Milton town line in Chittenden County, Vermont. The scoping process involves working with the Study Team, stakeholders, and the communities to select a municipally endorsed alternative.

Congestion in the study area—especially backups onto I-89 northbound from Exit 17—is well known by regular users of the interchange. An earlier study, the *Exit 17 Growth Center Transportation Study* (October 2006), identified the potential for greater traffic volumes and congestion caused by more intensive land use and population growth in the future. The previous study also pointed out that on-road bicycle facilities in the immediate vicinity of Chimney Corners were inadequate. This study focuses on long-term alternatives for improving travel in the study area. Two viable long-term options that were presented during alternatives presentations are discussed in detail. Cost estimates and associated impacts for each alternative are identified. Part of the long-term alternatives can be implemented in the short-term. This consists of infrastructure improvements east of the overpass that can be built without reconstructing the existing bridge and would experience minimal disturbances when the long-term alternative is eventually constructed. There are also near-term alternatives identified and are seen as those that can be conducted through minimal construction efforts and serve as minor improvements until the short and subsequent long-term alternative is completed.

1.2 Study Area

The locus map and project study area shown are shown in Figure 1-1 and Figure 1-2, respectively. The study area is located in the northern portion of Colchester near the Milton town line. Contained within the study area are the Exit 17 interchange and junction of US 2 and US 7 (Chimney Corners). Exit 17 provides an important connection between I-89 and US 2, serving Grand Isle County and the Town of Milton via US 7. The study area is semi-rural and expected to experience moderate population and job growth over the next several decades.

1.3 Study Committee

A project Study Committee was formed for the Exit 17 Scoping Study to provide feedback throughout the study. The Study Committee consisted of the following members:

- Bryan Osborne, Director of Public Works, Town of Colchester
- Roger Hunt, Director of Public Works, Town of Milton
- Katherine Sonnick, Planning Director, Town of Milton
- Amy Bell, Planning Coordinator, VTrans
- Richard Hosking, District Project Manager, VTrans
- Michael LaCroix, Traffic Design & Safety Engineer, VTrans
- Chris Jolly, Planning & Programming Engineer, FHWA
- Matt McMahon, Government Affairs Specialist, LCRCC *(previous committee member)*
- Meredith Birkett, Director of Planning & Marketing, CCTA
- Joseph Barr, NE Planning/Environmental/Traffic Lead, Parsons Brinckerhoff
- Steve Rolle, Senior Transportation Engineer, Parsons Brinckerhoff
- Michele Boomhower, Assistant/MPO Director, CCRPC
- Eleni Churchill, Senior Transportation Planning Engineer, CCRPC
- Jason Charest, Senior Transportation Planning Engineer, CCRPC

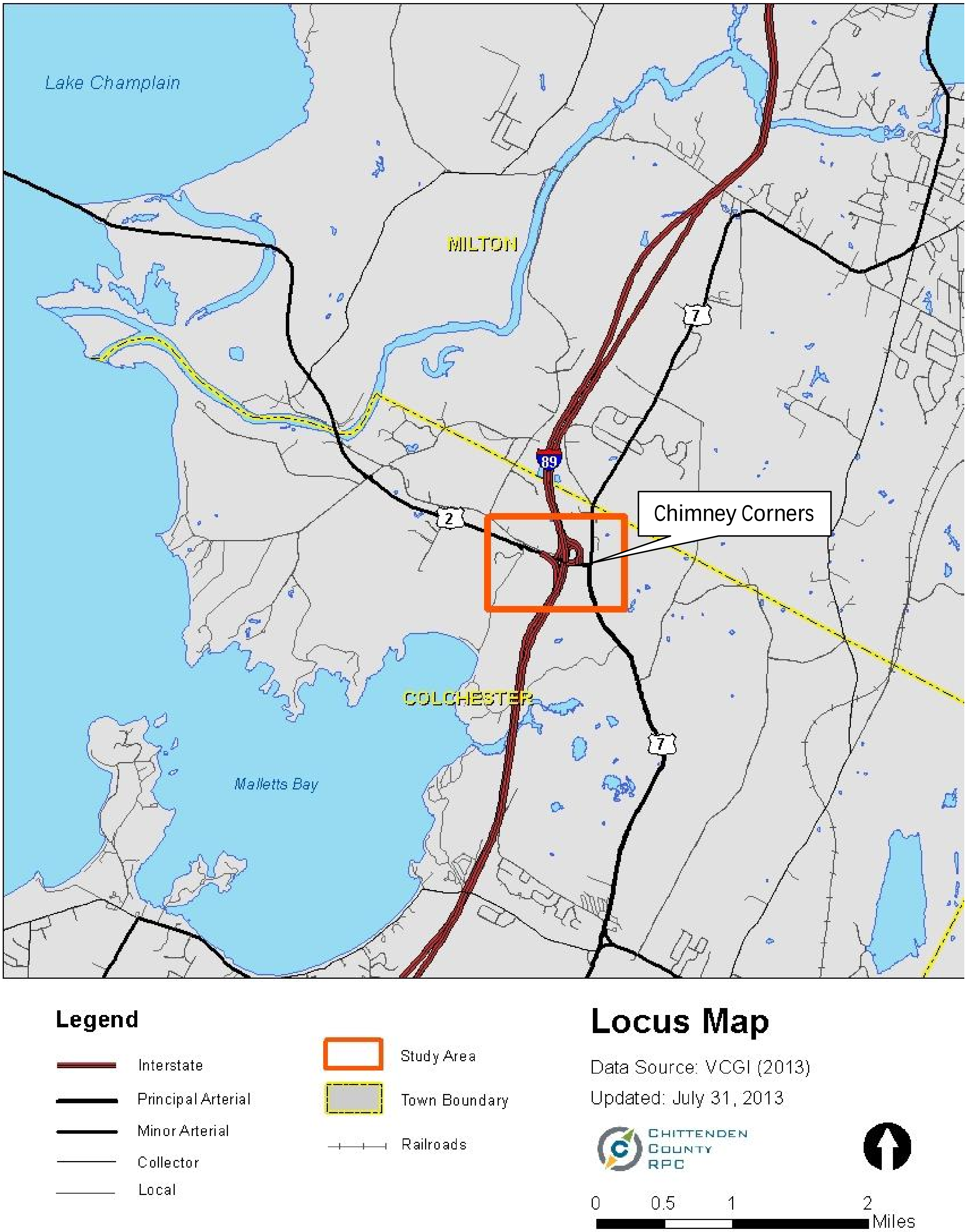


Figure 1-1: Project Locus Map

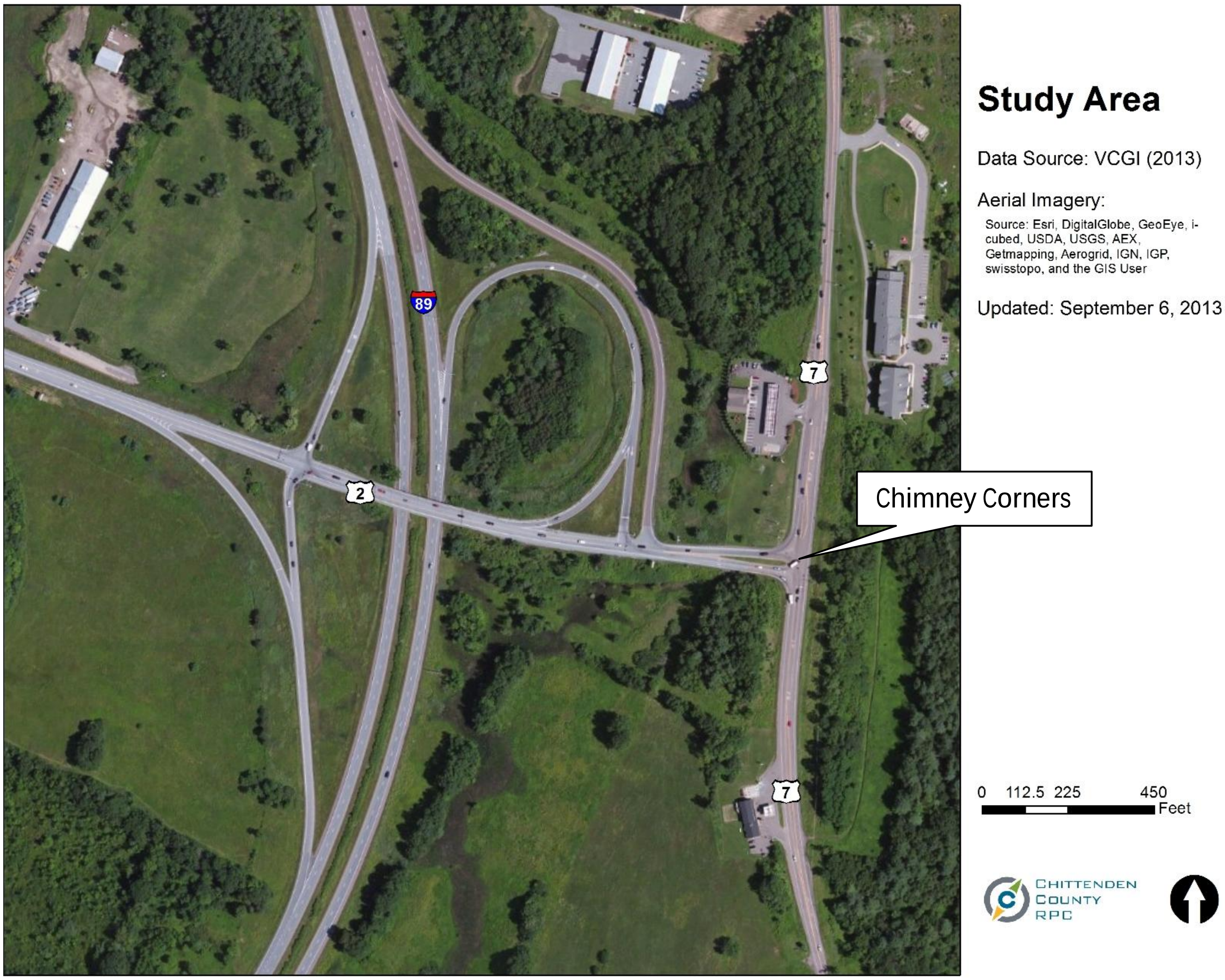


Figure 1-2: Project Study Area

2 Study Purpose and Needs

2.1 Purpose

The purpose of the Exit 17 Scoping Study is to develop transportation alternatives that enhance the operation of the Exit 17 interchange by reducing traffic congestion at the ramps and the adjacent US 2/US 7 intersection; provide infrastructure for safe and efficient travel by all users; and improve connectivity and access between the Interstate and nearby communities in Chittenden, Franklin and Grand Isle Counties under current and projected future conditions.

2.2 Needs

Improve safety for all users

- Queuing on the northbound I-89 off-ramp extends onto the Interstate forcing vehicles to queue on the I-89 shoulder.
- The intersections of US 2 at the northbound and southbound I-89 ramps are High Crash Locations (HCL's).
- US 2 is designated as part of the Lake Champlain Bikeways Corridor but is not well suited for use by bicyclists through the interchange area due to lack of dedicated space, high vehicular travel speeds, and conflicts with turning vehicles.
- No accommodations are provided for pedestrians anywhere in the study area.

Reduce traffic congestion and enhance mobility for all users

- Current peak period travel demand causes traffic congestion (LOS E and F conditions for specific movements) in the study area, and there will be insufficient capacity to accommodate future local and regional growth.
- The two signalized intersections east of the US 2 bridge over I-89 are closely spaced and have inadequate stacking space for vehicles to queue.

Provide access from the Interstate

- Exit 17 provides an important connection between the Interstate and the Towns of Colchester, Milton, and Franklin and Grand Isle Counties via US 2 and US 7.
- The current bridge dates from 1964 and is rated as "Structurally Deficient" due to the poor condition of its substructure.

3 Existing Conditions

3.1 Roadway Function, Alignment, and Topography

3.1.1 Roadway Function and Alignment

The study area is served by three arterial roadways—I-89, US 2, and US 7—all owned by the State of Vermont and maintained and operated by the Vermont Agency of Transportation (VTrans). I-89, a limited access Interstate freeway running in a general north-south direction, provides crucial mobility within Chittenden County, as well as access to south to New Hampshire and north to Quebec, CA. I-89 in the study area has two lanes in each direction separated by a grassed median. US 2, an undivided principal/minor arterial running in a general east-west direction through the study area, connects with I-89 at Exit 17, a complete interchange consisting of diamond direct ramp and cloverleaf elements.[1] The current interchange has a single cloverleaf (or loop ramp) connecting I-89 northbound with US 2, a heavy traffic movement during the PM peak period. Direct ramps facilitate the other movements.

US 2 is one of the most important east-west links in northern Vermont, providing one of two roadway connections in Vermont across Lake Champlain into Grand Isle County (the other roadway connection to Grand Isle County is VT Route 78 approximately 26 miles north of the study area). US 2 enters the study area from the south sharing a route designation with US 7. It diverges from US 7 at Chimney Corners and proceeds west over the Interstate. US 2 passes over I-89 on a three lane bridge with two lanes in the westbound direction and a single lane in the eastbound direction. Westbound and eastbound lanes exhibit 2-foot and 4-foot shoulders respectively. The existing bridge dates from 1964 and is approaching the end of its useful life (official inspections for VTrans have determined the substructure to be in poor condition). West of the interchange, US 2 narrows to two lanes in each direction. The horizontal alignment of US 2 is relatively straight in the study area, with some slight curving near the I-89 overpass.

The intersections of US 2 with I-89 northbound and southbound are both signalized. The I-89 southbound intersection has a left turn lane and protected left turn movement for traffic from US 2 westbound. There is a right turn ramp for eastbound traffic heading south on I-89. The I-89 northbound intersection consists of one lane on each approach with a right turn ramp for those heading west on US 2.

US 2 in the study area carries the Lake Champlain Bikeway, a popular long-distance bicycle route that runs in a 381-mile loop from Whitehall, New York to Fort Chambly, Quebec via Burlington and Grand Isle County. Currently, the bridge carrying US 2 over I-89 lacks adequate shoulder widths for bicycles (less than the recommended minimum of 5 feet). In addition, the high-speed right turn ramps connecting I-89 with Route US 2 create a conflict between vehicles and cyclists.

Not far from the interchange—approximately 1,000 feet east of the I-89 centerline—is US 7, an undivided principal/minor arterial running in a general north-south direction through the study area.[2] US 7 provides crucial access between I-89 and the Town of Milton, a growing semi-rural/suburban

[1] US 2 transitions from a principal arterial to a minor arterial at the northbound off-ramps intersection
[2] US 7 transitions from a principal arterial to a minor arterial at the Chimney Corners intersection

community with some light industrial activity, as well as western Colchester, also semi-rural/suburban. US 2 and US 7 form a three-way intersection known locally as Chimney Corners, a busy signalized intersection that experiences high traffic volumes during the AM and PM peak periods and is currently reaching maximum capacity. The Chimney Corners intersection consists of exclusive turn lanes wherever applicable. US 7 has two lanes in each direction north and south of Chimney Corners. The horizontal alignment of US 7 in the study area is relatively straight, with some slight curving beginning 600 feet north of and 300 feet south of Chimney Corners, respectively.

3.1.2 Topography

The vast majority of the study area is dominated by man-made topography resulting from construction of the Exit 17 interchange. Roadway grades in the study area are flat or slightly gradual, and generally less than 5 percent. The most notable grade change occurs between I-89 and US 2 on the Exit 17 ramps. Figure 3-1, a contour map, shows existing topography in the study area. Natural slopes in the study area are gentle, with some small outcrops away from the main roads. East of US 7, the terrain slopes more steeply downward towards Allen Brook, which flows into Mallets Bay and Lake Champlain.

3.2 Access Management

I-89, US 2, and US 7 in the study area are subject to VTrans access management policies that regulate ingress and egress (i.e., driveways) to abutting properties. I-89 has Category 1 access management, which allows access only at grade separated interchanges. US 2 from Chimney Corners westward to Jasper Mine Road, and US 7 in the vicinity of the Chimney Corners intersection falls under Category 2 access management. Under Category 2, direct driveway access is not allowed without Vermont Transportation Board approval. The remainder of US 2 and US 7 in the study area are regulated by Category 3 access management. Direct access may be denied by VTrans if safer and more efficient alternatives can be found on a side street. In addition, VTrans can restrict certain movements (e.g., left in/left out).

3.3 Drainage and Hydraulics

Except for the Exit 17 ramps, roadways in the study area are not known to have formal drainage systems such as catch basins, drop inlets, surface water channels, or ditches. Drainage in the study area generally follows the slope of the existing roadways and the natural topography of the land. Stormwater along the study area roadways flows into the interchange detention basins, nearby wetlands, Allen Brook, or Malletts Bay. Roadway flooding is not known to be an issue in the study area.

3.4 Bicycle and Pedestrian Facilities

The study area has no formal pedestrian facilities such as crosswalks, sidewalks, or walk/don't walk signals. However, US 2 (and US 7 south of the Chimney Corners intersection) carries a popular bicycle route—the Lake Champlain Bikeway—which connects Chittenden County/Greater Burlington with Grand Isle County, New York State, and Quebec. US 2 and US 7 in the study area mostly have paved shoulders suitable for bicycle travel. However, some sections (particularly those approaching Chimney Corners from the west and north) have less than the 3-foot wide minimum shoulder recommended by

VTrans for design of on-road bicycle facilities.[3] For roads where the outside lane has 30 or more heavy vehicles per hour in the outside lane, a minimum paved shoulder of 5 feet is recommended. US 2 westbound over I-89 has less than the 3-foot wide recommended minimum. Bicycle accommodations, which are limited to the US 2 and US 7 roadway shoulders, vary as follows:

Table 3-1: Study Area Shoulder Widths and Bicycle Compatibility

Road	Segment	Direction	Shoulder Width	VTrans Minimum for Bikes
US 2	Jasper Mine Road to I-89 Overpass	EB	4- 11'	Yes
		WB	3-11'	No
	I-89 Overpass	EB	5'	Yes
		WB	2'	No
	I-89 Overpass to US 7	EB	2-11'	No
		WB	2-4'	No
US 7	US 7 – North of Chimney Corners	NB	5-7'	Yes
		SB	5-7'	Yes
	US 7 – South of Chimney Corners	NB	5'	Yes
		SB	6-12'	Yes

3.5 Utilities

The study area has gas, electric, phone, and cable utility lines as noted below:

- A natural gas pipeline is located along the east side of the I-89 right-of-way
- Above ground electric, phone, and cable utilities are located in an easement that is set back approximately 50 feet from US 7 northbound, as well in an easement that is set back approximately 50 feet from US 2 westbound, then Jasper Mine Road eastbound
- Electrical utilities associated with lighting and signals at the Chimney Corners intersection are located underground but appear linked to nearby overhead utility poles via conduits
- Lighting and signal utilities associated with the Exit 17 interchange ramps on US 2 are located underground
- All public utility lines in the study area appear to be within VTrans right-of-way

3.6 Right-of-Way

Most of the study area consists of VTrans right-of-way, including I-89, existing ramps for the Exit 17 interchange, and right-of-way for US 2 and US 7. This right-of-way extends anywhere from roughly 50 feet to 300 feet beyond the I-89, US2, and US7 centerlines. The yellow shaded area shown on Figure 3-2 delineates existing VTrans right-of-way.

3.7 Land Use and Zoning

The built character of the study area is semi-rural, with open fields and low density highway-oriented commercial uses geared towards pass-by traffic. Land use is comprised of general development (GD4), a

[3] Source: Vermont Agency of Transportation. *Vermont Pedestrian and Bicycle Facility Planning and Design Manual*. December 2002.

flexible zoning category in the Town of Colchester that balances residential and commercial development with open space. Under GD4 zoning, commercial uses should be low intensity (less than 20,000 square feet) and intended to serve pass-by traffic and nearby development. The western edge of the study area consists of land zoned R1 (Town of Colchester) for residential use. Some single family residential development has recently occurred in land zoned R1 located south of US 2 west of the interchange. Just north of the study area, in the Town of Milton, industrial uses and land zoned I2 Industrial predominate. Current zoning in the study area is shown in Figure 3-3.

3.8 Public Transportation

Public transportation in the study area is limited to weekday-only bus service to/from Burlington, Milton, and St. Albans provided by CCTA. Buses serve one stop near the study area: the Chimney Corners Park-and-Ride lot. The Park-and-Ride is located just north of the study area boundary on the east side of US 7 with a capacity of approximately 100 spaces (see Figure 3-3). It is served by CCTA Routes 56 and 96. Route 56 (Milton Commuter) connects central Milton with downtown Burlington and operates peak hour service plus one midday roundtrip. Route 96 (St. Albans LINK Express) connects downtown Burlington with St. Albans via I-89, and offers service during the AM and PM peak hours. Stops at the Chimney Corners Park-and-Ride can be by request only depending on the route and time of day.

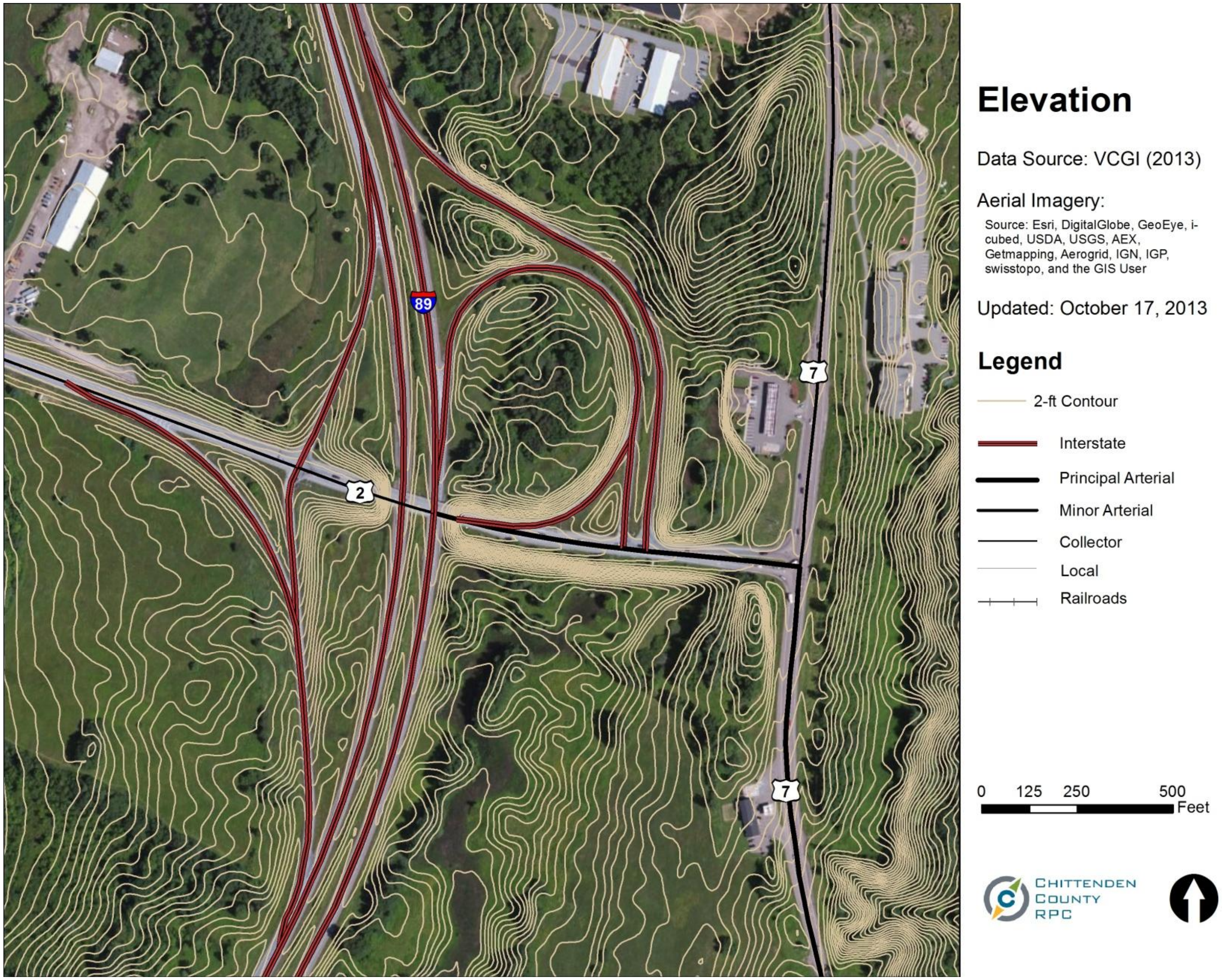


Figure 3-1: Study Area Topography

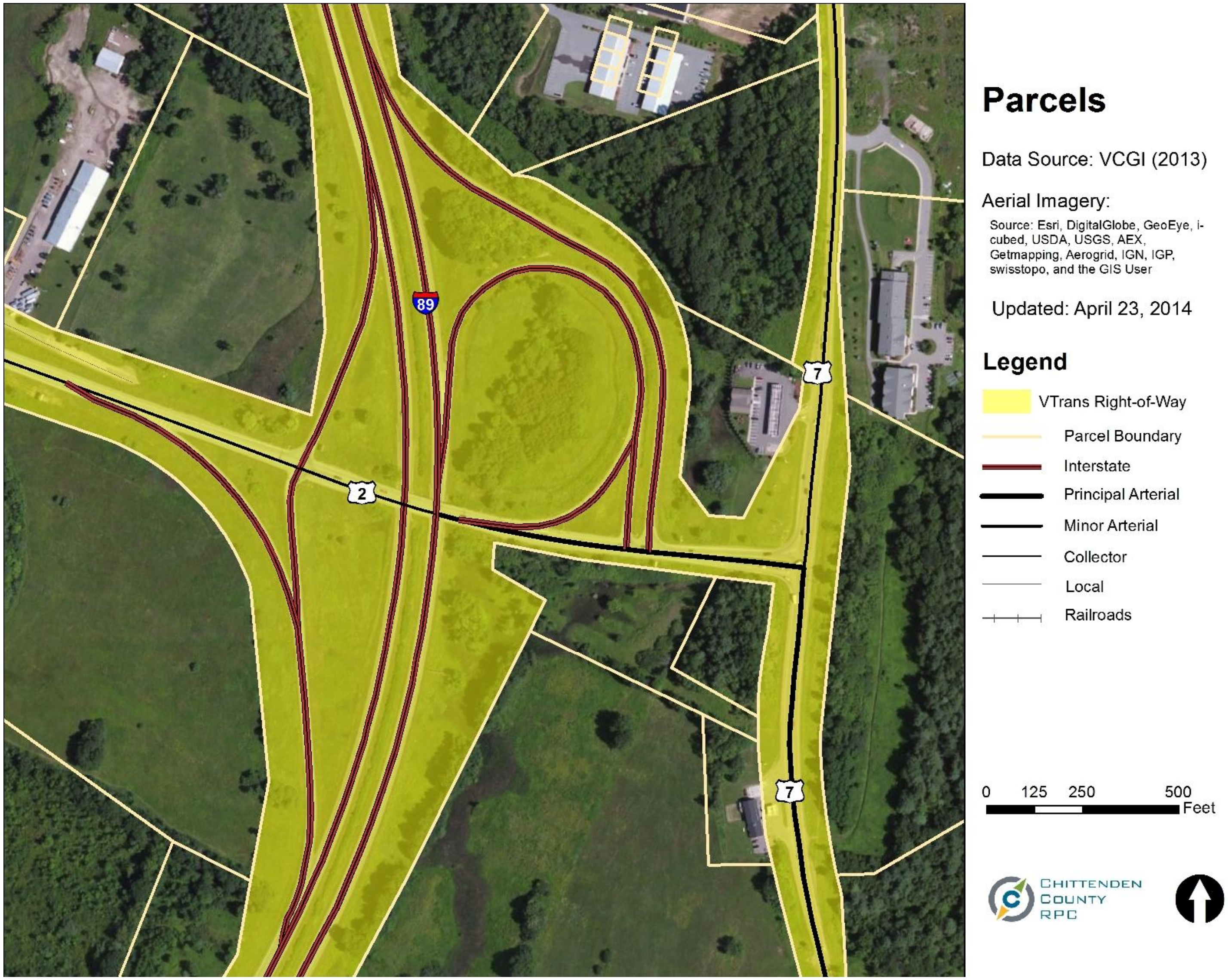


Figure 3-2: Study Area Parcels and VTrans Right-of-Way

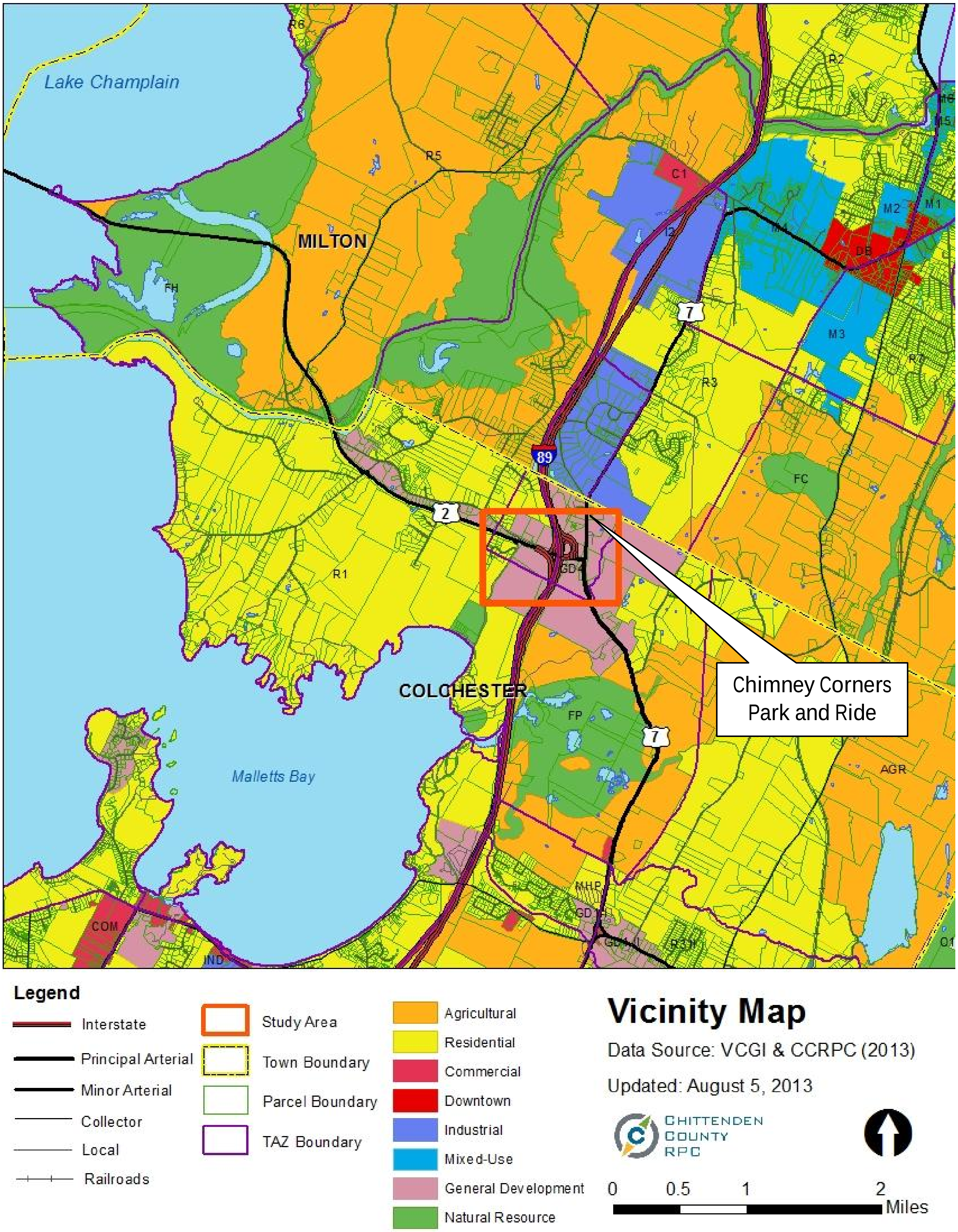


Figure 3-3: Land Use in the Vicinity of the Study Area

3.9 Traffic

3.9.1 Traffic Counts

VTrans currently maintains permanent traffic count stations at multiple locations in the study area. These counts, which were checked against peak period counts performed by the CCRPC and subsequently balanced, were used to project future traffic volumes. Data from VTrans count stations located in the study area are presented in Table 3-2 below.

Table 3-2: Study Area Traffic Counts (Source: VTrans)

Location	Count Station Number	AADT	Year
US 2	S6DO19	13,500	2010
US 7 – North of Chimney Corners	S6D102	10,600	2012
US 2/US7 – South of Chimney Corners	S6D103	11,600	2012
I-89 NB On-ramp	S6D600	2,300	2012
I-89 NB Off-ramp	S6D599, S6D597	6,700	2012
I-89 SB On-ramp	S6D604	7,000	2012
I-89 SB Off-ramp	S6D601	2,200	2012
I-89 – North of Exit 17	S6D093	20,800	2012
I-89 – South of Exit 17	S6D604	30,100	2012

3.9.2 Future Roadway Link Volumes – CCRPC Model

CCRPC projections for roadway link volumes provide a general impression of how traffic is projected to change in the study area over the next 20 years. For the 2015 model year, I-89 south of Exit 17 exhibits the highest projected traffic volume in the study area, followed by I-89 north of Exit 17, US 2, US 7 (north of Chimney Corners), and US 2/US 7 (south of Chimney Corners). This is consistent with VTrans traffic count data shown in Table 2-2 and remains true for the 2035 model year.

All roadway links in the study area are projected to experience moderately higher traffic volumes by 2035, with increases in the range of 10–27 percent. The greatest absolute change in traffic volume is projected to occur on US 7 north of Chimney Corners. Figure 3-4 and Figure 3-5 show CCRPC model link volumes in 2015 and 2035. 2015–2035 traffic volume growth, as shown in Table 3-3 below, indicates that the greatest travel demand is anticipated to occur on links between Milton (via US 7) and points south on I-89.

Table 3-3: Study Area Roadway Traffic Volume Projections (CCRPC)

Location	2015 AADT	2035 AADT	2015-2035 AADT Change	2015-2035 AADT % Increase	Current Design Hourly Volume (DHV)
US 2	21,000	25,000	+4,000	+19%	1,600
US 7 – North of Chimney Corners	17,500	22,300	+4,800	+27%	1,200
US 2/US7 – South of Chimney Corners	15,200	18,000	+2,800	+18%	1,400
I-89 NB On-ramp	2,900	3,200	+300	+10%	300
I-89 NB Off-ramp	11,100	13,100	+2,000	+18%	800
I-89 SB On-ramp	11,500	13,600	+2,100	+18%	800
I-89 SB Off-ramp	2,800	3,100	+300	+11%	300
I-89 NB – North of Exit 17	13,900	15,700	+1,800	+13%	2,400
I-89 NB – South of Exit 17	22,100	25,600	+3,500	+16%	3,500
I-89 SB – North of Exit 17	13,700	15,400	+1,700	+12%	2,400
I-89 SB – South of Exit 17	22,400	25,900	+3,500	+16%	3,500

3.9.3 Future Intersection Volumes

Future intersection volumes (used to project the future intersection performance results presented in Section 3.10) are based on the traffic growth rates predicted for all possible entrances and exits to the study area over a twenty year period. These include US 2, US 7 and I-89. Growth rates are based on the 20-year change in volumes recorded at VTrans count stations located at or near the study area entrances between the years 1990 and 2010 (balanced using CCRPC peak period counts). Projected population, household, and employment changes in Milton, Colchester, and Chittenden County are also a factor in the projected growth rates. Existing and future intersection volume calculations are presented in Appendix A.

3.10 Congestion Analysis

Several roadway links and signalized intersections in the study area currently experience moderate congestion during the AM and PM peak periods. On I-89 northbound approaching Exit 17, backups extending past the off-ramp onto the I-89 mainline have been observed during the PM peak. In addition, eastbound left turns at the I-89 northbound on-ramp intersection block through movements on US 2 due to the through and left turn movements sharing a single lane. The Chimney Corners intersection also has inadequate capacity to meet future peak period demand, as evidenced by poor intersection and approach level-of-service (LOS). The sections below describe current and future LOS at study intersections.

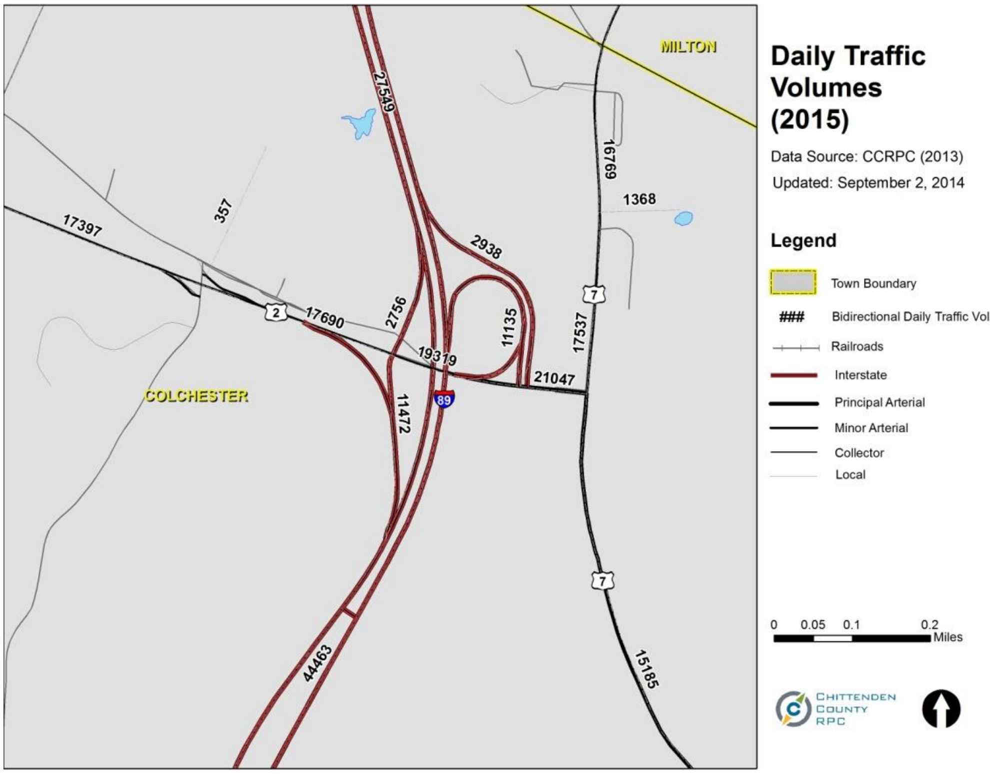


Figure 3-4: Daily Traffic Volumes in 2015 (Source: CCRPC)

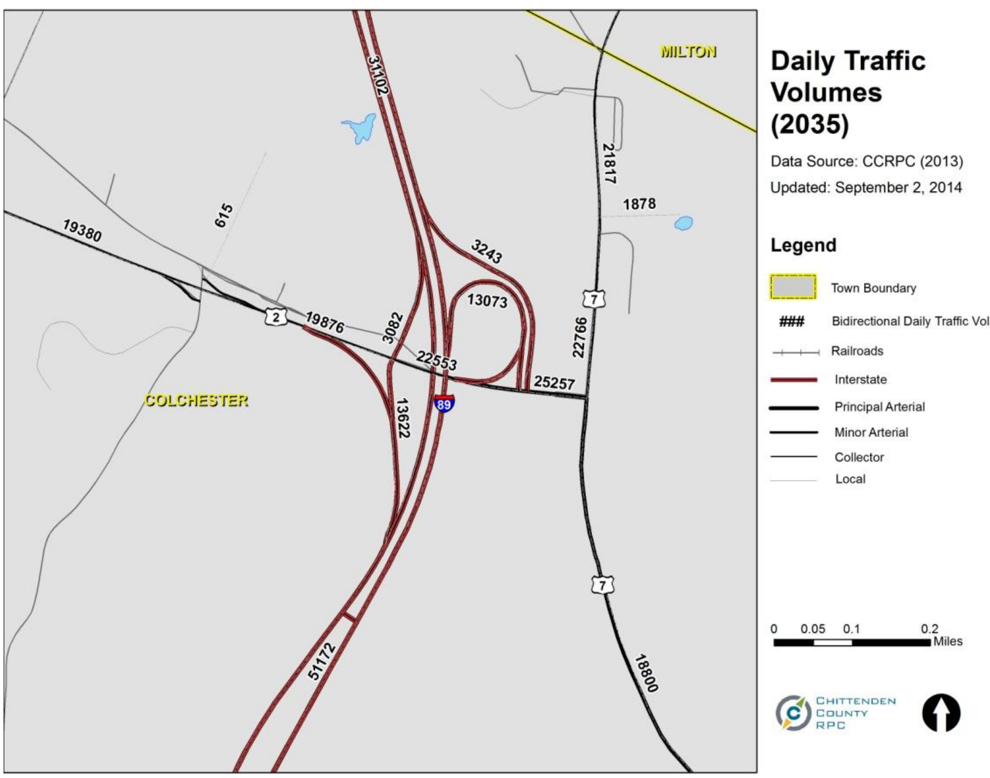


Figure 3-5: Daily Traffic Volumes in 2035 (Source: CCRPC)

3.10.1 Level-of-Service Definition

Signalized intersection Level-of-Service (LOS) is calculated by following procedures outlined in the *Highway Capacity Manual*. LOS is a widely accepted measure of the quality of traffic flow on a roadway facility. LOS grades are based on average delay per vehicle and are shown in Table 3-4. Intersection, approach and movement LOS were calculated for existing and future AM and PM peak periods. Results are shown in Table 3-5.

Table 3-4: Level-of-Service Definition

Level of Service	Delay (sec/veh)	Generalized Description (Signalized Intersection)
A	≤10	Free Flow
B	>10 – 20	Stable Flow (slight delays)
C	>20 – 35	Stable Flow (acceptable delays)
D	>35 – 55	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	>55 – 80	Unstable flow (intolerable delays, will wait through at least one cycle before proceeding)
F	>80	Forced flow (close if not over capacity, saturated conditions, lengthy delays)

3.10.2 2035 AM and PM Peak No Build LOS Results

Should no capacity improvements in the study area occur, LOS in the year 2035 is projected to be much worse during the AM and PM peak periods due to anticipated increases in traffic. During the PM Peak, the intersection of US 2 and the I-89 northbound ramps will experience LOS F conditions, with an average vehicle delay of more than 2 minutes. The I-89 northbound off-ramp PM Peak left turn movement will experience the worst congestion throughout the study area. Delays are expected to average more than 4 minutes which will exacerbate existing backups onto the I-89 northbound mainline. Chimney Corners is expected to exhibit failing movements during the PM Peak as well. To the west, the I-89 southbound off-ramp approach to US 2 is expected to deteriorate to LOS F conditions for both AM and PM peak periods. The intersection itself shows unstable flows (LOS E) during the AM peak. Intersection performance throughout the study area will be worse during the PM peak than the AM peak, just as it is currently. Existing and future LOS with the current roadway and intersection configuration is shown graphically in Figure 3-6 through Figure 3-9.

Table 3-5: Existing and Future Level-of-Service in the Study Area

	AM Peak				PM Peak			
	Existing*		Future (2035)**		Existing*		Future (2035)**	
	LOS	Avg Delay/ Veh	LOS	Avg Delay/ Veh	LOS	Avg Delay/ Veh	LOS	Avg Delay/ Veh
US 2 at I-89 NB Ramps								
Intersection LOS	B	14.0	C	34.7	E	61.5	F	129.8
US 2 Eastbound	A	8.2	D	50.4	A	9.8	F	161.1
US 2 Westbound	B	13.7	B	16.6	B	12.5	C	23.2
I-89 NB off-ramp	D	37.7	D	39.6	F	165.9	F	266.0
Right Turn	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Left Turn	D	37.7	E	70.8	F	165.9	F	266.0
US 2 at I-89 SB Ramps								
Intersection LOS	C	21.9	E	57.4	B	11.9	C	29.0
US 2 Eastbound	A	9.6	E	61.2	A	7.9	A	7.3
US 2 Westbound	B	17.4	D	49.1	A	8.0	B	17.2
Left Turn	C	23.6	E	69.9	A	2.7	A	0.6
Through	A	4.2	A	5.3	A	8.8	B	19.9
I-89 SB off-ramp	D	49.9	F	82.5	D	41.2	F	131.3
US 2 at US 7								
Intersection LOS	C	20.3	C	34.7	C	28.1	D	51.1
US 2 Eastbound	B	11.9	B	16.6	B	13.8	C	32.4
Left Turn	C	25.6	C	23.5	B	19.6	D	45.4
Right Turn	A	3.9	B	12.6	A	0.7	A	2.5
US 7 Northbound	D	35.3	D	50.4	C	34.2	E	68.2
Left Turn	D	50.9	E	76.4	D	50.0	F	110.7
Through	B	12.4	B	12.5	B	19.1	C	27.4
US 7 Southbound	B	19.5	D	39.6	D	40.2	D	50.6
Right Turn	A	9.4	C	27.7	B	13.7	B	19.0
Through	D	19.5	E	70.8	F	102.8	F	124.9

Note: Yellow highlighting denotes LOS E or F conditions present

*Existing condition is for the year 2012

**Future LOS and delay accounts for signal optimization efforts

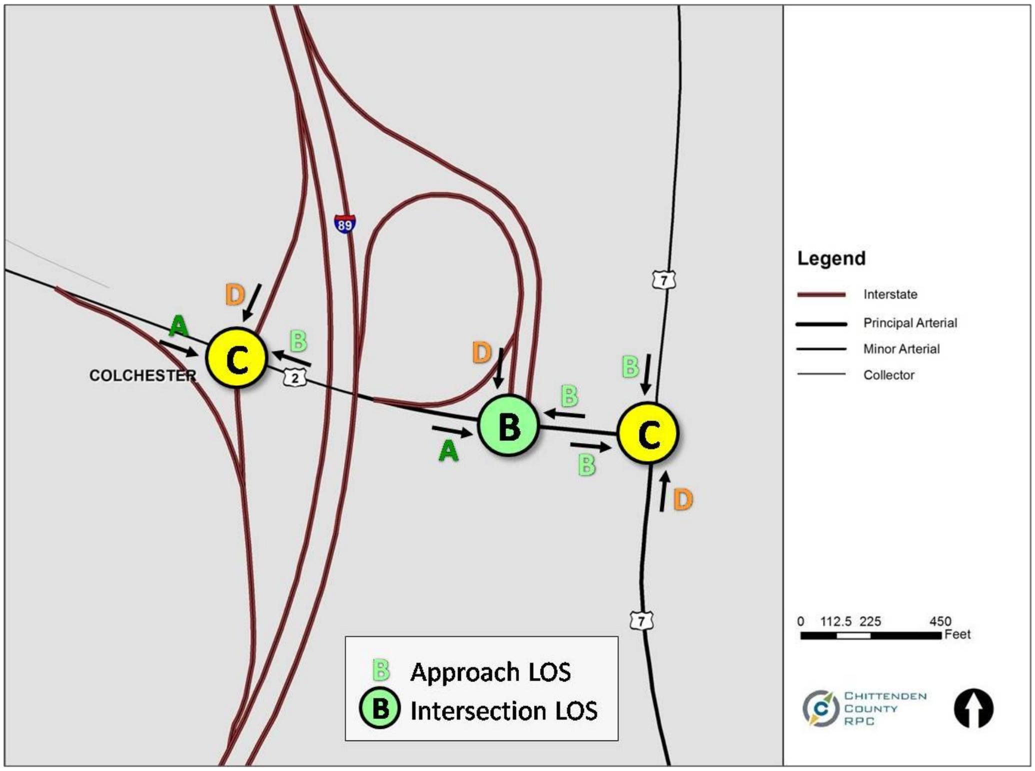


Figure 3-6: Existing AM Peak Intersection Level-of-Service (LOS)

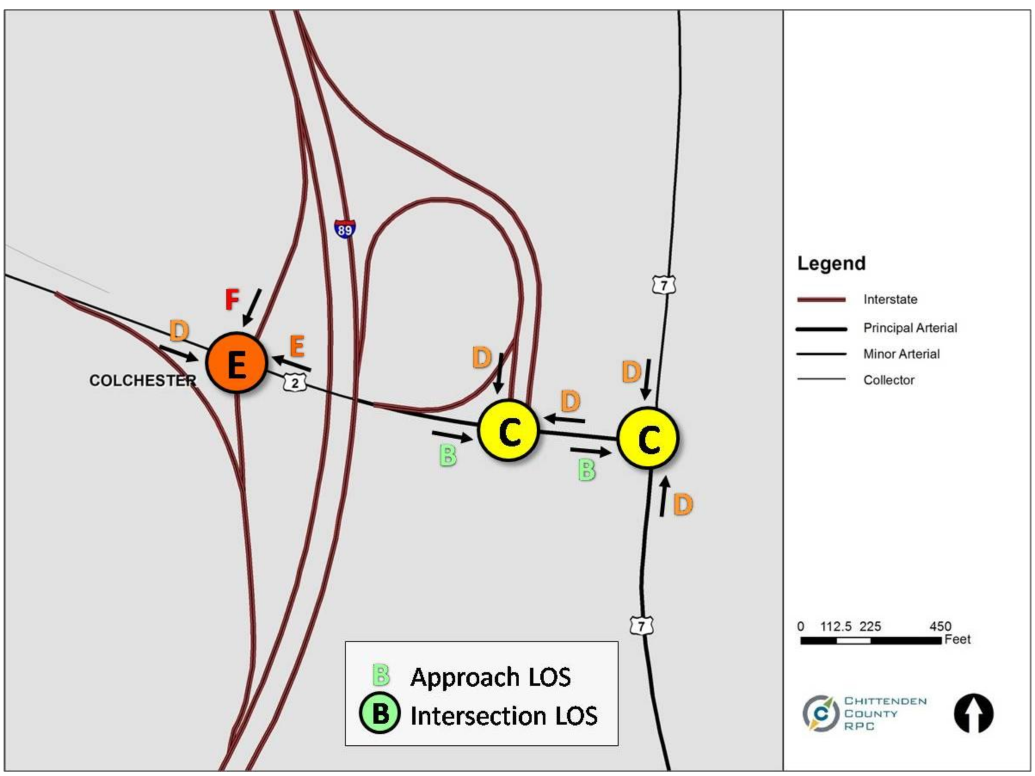


Figure 3-7: 2035 AM Peak Intersection Level-of-Service (LOS)

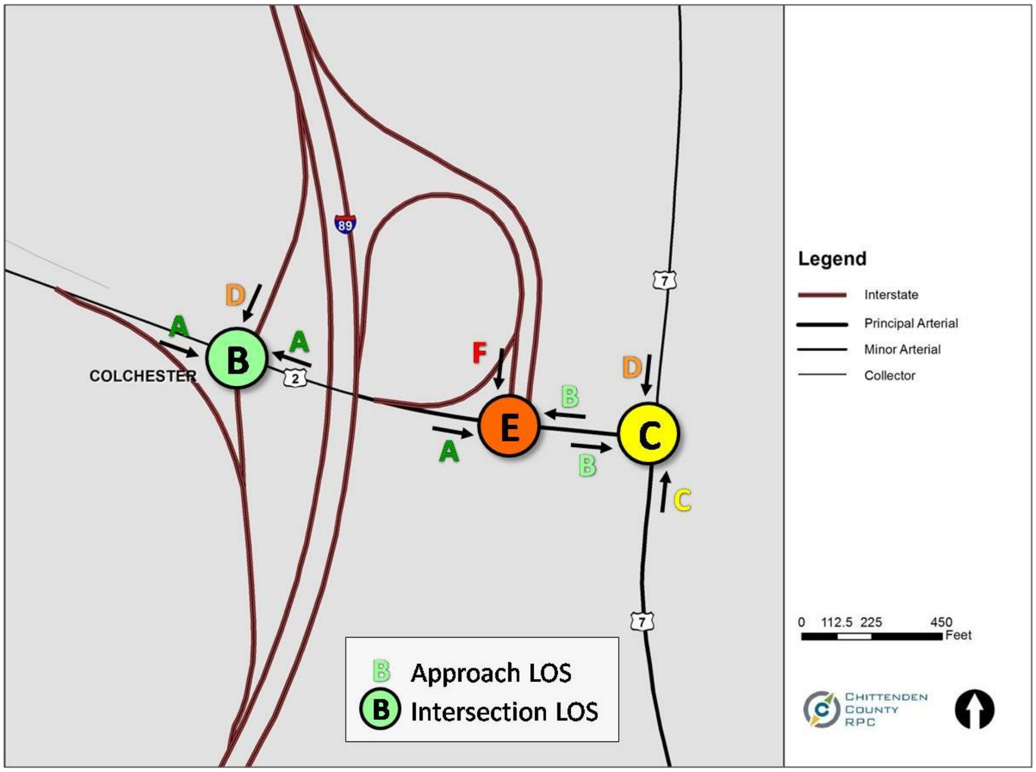


Figure 3-8: Existing PM Peak – Intersection and Approach Level-of-Service (LOS)

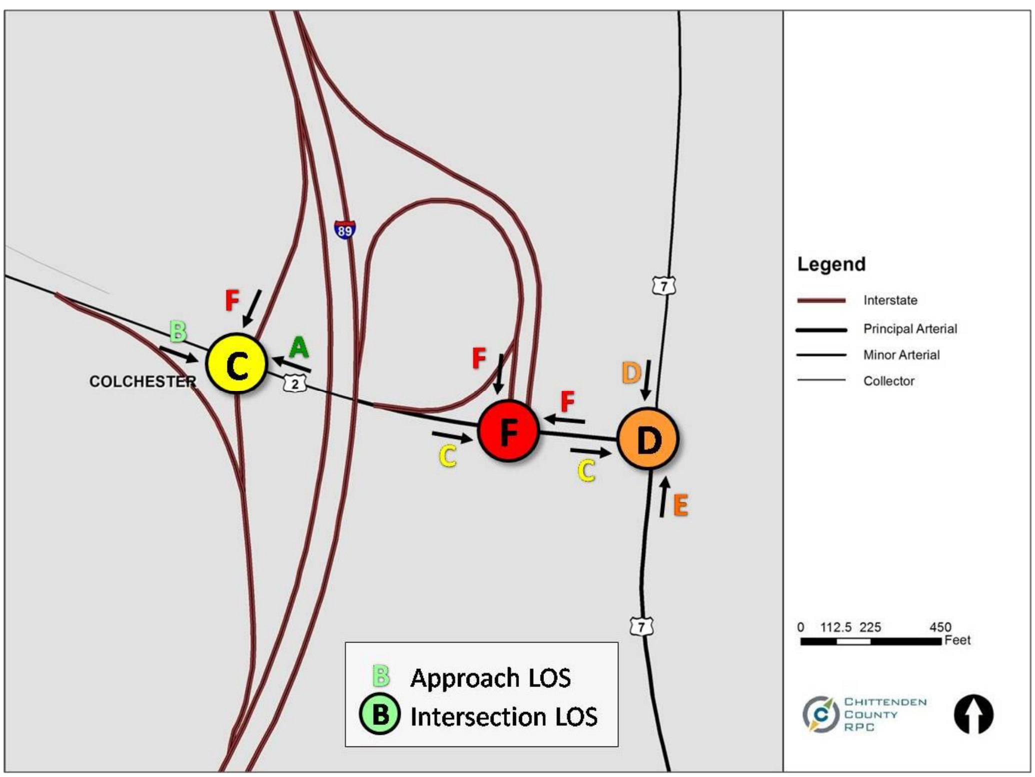


Figure 3-9: 2035 PM Peak – Intersection and Approach Level-of-Service (LOS)

3.11 Safety Analysis

Documented safety issues in the study area are mainly limited to US 2. Both of the I-89 ramp intersections on US 2 are considered High Crash Locations (HCL's)—intersections or highway segments that experience a higher than expected number of crashes relative to the roadway's functionality and traffic demands. High Crash Locations based on data between 2008 and 2012 are depicted graphically in Figure 2-10. As noted in the Section 3.9.3, queuing on the I-89 northbound off-ramp during the PM peak period may create a hazard on I-89 by forcing mainline traffic in the right lane to brake or slow down suddenly for the queue. I-89, US 2, and US 7 all have high speed limits (65 mph for I-89; 50 mph for US 2 and US 7) that require special attention to intersection safety. US 2 and US 7 both lack pedestrian accommodations (however, "goat tracks"—dirt paths created as a consequence of foot traffic—are not all that evident, suggesting low pedestrian demand). Inadequate bicycle accommodations (explained in Section 3.4) also pose potential threats to traffic safety in the study area, especially in light of high summertime demand for the Lake Champlain Bikeway and potential conflicts with the high-speed right turn ramps to/from I-89.

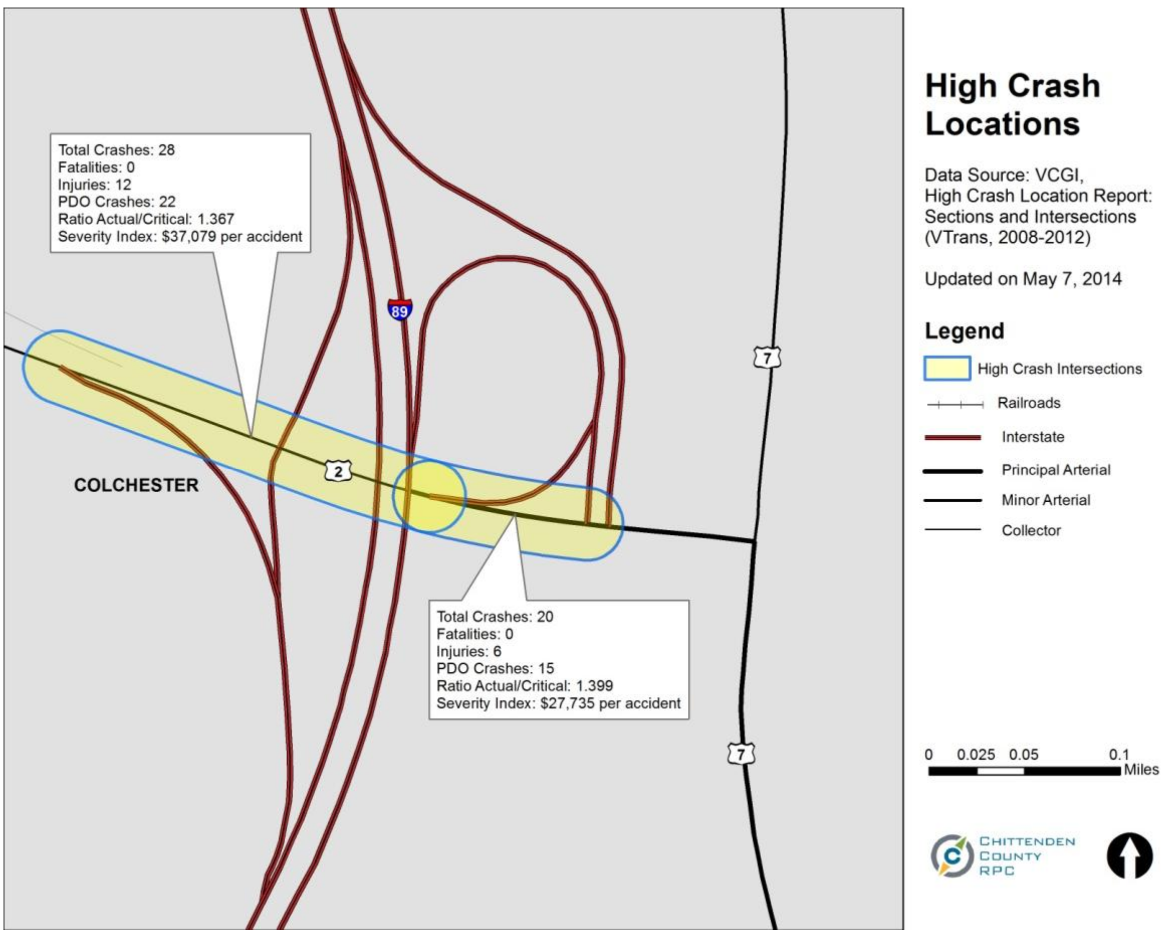


Figure 3-10: High Crash Locations in the Study Area

3.12 Travel Demand Patterns and Forecasts

A basic assessment of data from the CCRPC travel demand model reveals that modest housing and employment growth is expected to occur in and around the study area looking out to 2035. As expected, this growth will increase congestion at the I-89/US 2 ramps and Chimney Corners (see Section 3.9.3). By 2035, the number of households in the Exit 17 service area is expected to increase by 40 percent, with the largest absolute increase in households projected to occur in the suburban residential area southwest of the interchange (TAZ 264 in Colchester). Similarly, the number of jobs in and around the study area is expected to increase by 96 percent, with the greatest absolute growth in employment expected to occur in the light industrial area located just to the north of Exit 17 in the Town of Milton (TAZ 295). Traffic analysis zones (or TAZ's), which are embedded with CCRPC housing and employment existing data and future estimates, are used to predict future travel demand and mapped in Figure 3-11. 2005-2035 changes in housing and employment are shown in Table 3-6.

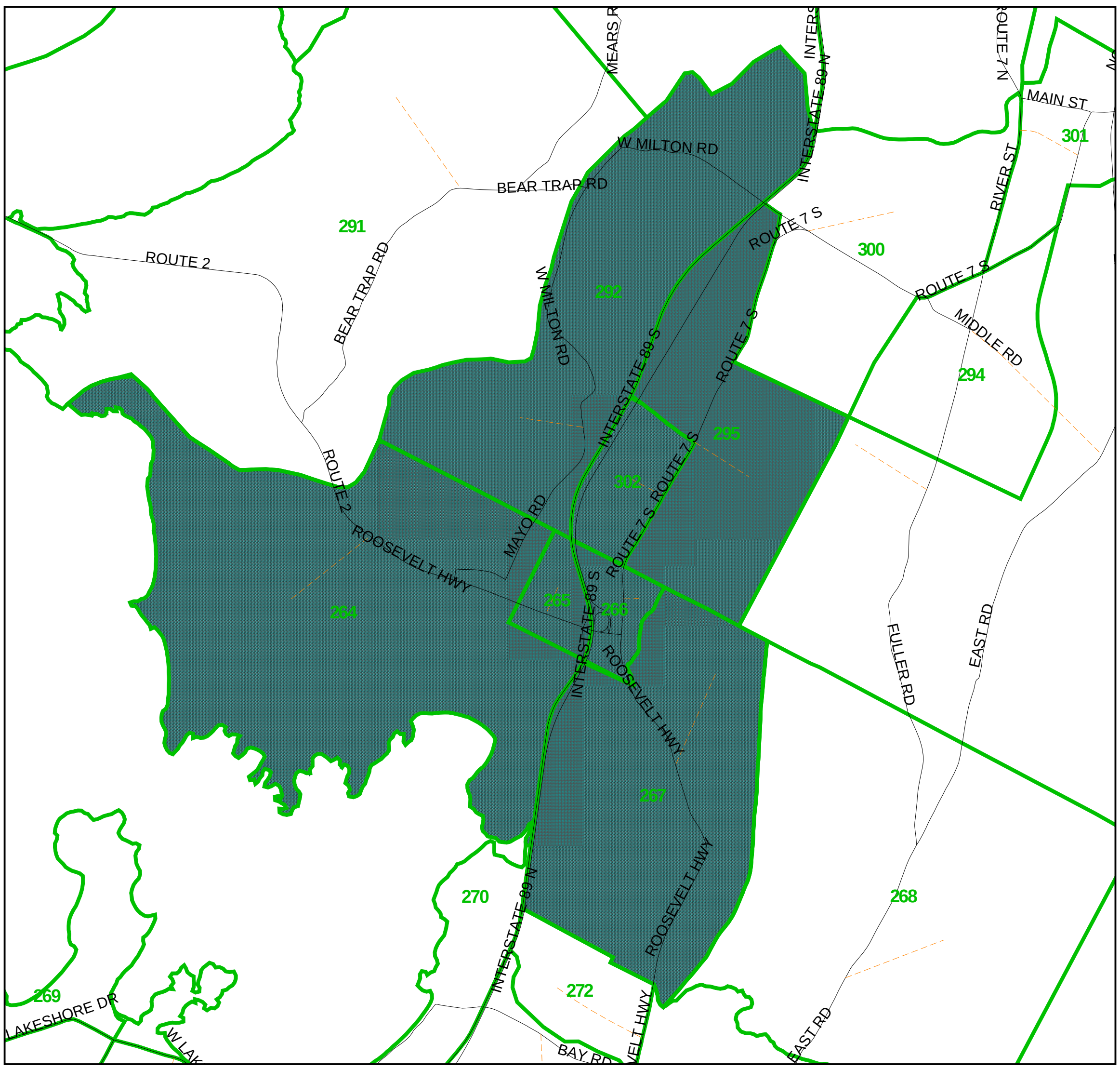


Figure 3-11: Traffic Analysis Zones (TAZ's) in the Exit 17 Service Area (Source: CCRPC)

Table 3-6: Exit 17 Service Area Household and Employment Growth (2005-2035)

Household Growth									
Town/TAZ	2005	2010	2015	2020	2025	2030	2035	2005-2035 Absolute Change	2005-2035 Percent Change
Colchester	508	559	625	691	753	809	860	301	53.8%
264	410	419	425	430	435	439	443	24	5.7%
265	17	18	25	32	38	44	49	31	172.2%
266	5	43	56	69	81	92	102	59	137.2%
267	76	79	119	160	199	234	266	187	236.7%
Milton	403	403	409	415	420	424	428	25	6.2%
292	295	295	295	295	295	295	295	0	0.0%
295	91	91	97	103	108	112	116	25	27.5%
302	17	17	17	17	17	17	17	0	0.0%
Grand Total	911	962	1,034	1,106	1,173	1,233	1,288	326	33.9%

Employment Growth									
Town/TAZ	2005	2010	2015	2020	2025	2030	2035	2005-2035 Absolute Change	2005-2035 Percent Change
Colchester	331	340	378	409	441	476	515	175	51.5%
264	107	109	115	121	127	133	140	31	28.4%
265	34	36	44	49	55	61	70	34	94.4%
266	166	169	183	194	205	218	232	63	37.3%
267	24	26	36	45	54	64	73	47	180.8%
Milton	871	925	1,143	1,317	1,511	1,728	1,966	1,041	112.5%
292	25	36	83	123	168	218	273	237	658.3%
295	133	157	245	314	393	482	582	425	270.7%
302	713	732	815	880	950	1,028	1,111	379	51.8%
Grand Total	1,202	1,265	1,521	1,726	1,952	2,204	2,481	1,216	96.1%

Source: CCRPC. *Chittenden County Regional Transportation Model.*

3.13 Environmental and Cultural Resources

Noteworthy environmental and cultural resources are summarized graphically in Figure 3-12 and in the sections below. For a more detailed discussion of environmental and cultural resource issues in the study area, please refer to the *Natural Resources Assessment* performed by EIV Technical Services and the *Archeological Resource and Historical Assessment* performed by Hartgen located in Appendices C and D, respectively.

3.13.1 Agricultural Land

Most of the study area is made up of prime agricultural soils.[4] Specifically, these soils are comprised of Scantic, Munson, and Raynham silt loams. Within the study area, approximately 9 acres of land (just west of the existing I-89 southbound off-ramp) are used for farming. Any future roadway projects or expansions should not reduce the potential of prime agricultural soils if work occurs within a previously disturbed area.

3.13.2 Floodplain

Federal Emergency Management Agency (FEMA) maps show that there are no flood hazard zones in the study area.

3.13.3 Streams, Wetlands, Rare and Endangered Species, Wildlife Habitat, Rare and Irreplaceable Natural Areas

Hydric soils are present throughout the study area. If it is anticipated these areas will be impacted, a wetland delineation survey will need to be completed. Wetlands in the study area are Class II, which includes a 50 foot buffer, and are protected under Vermont wetland rules. Class II wetlands are clustered on public and private land in the vicinity of the Exit 17 southbound off-ramp. Additional wetlands are located just to the northwest of the US 2/I-89 northbound intersection and along I-89 northbound immediately south of the US 2 overpass. No necessary wildlife habitat areas, rare and endangered species, or deer wintering areas are located within the study area. Four types of significant natural communities are located within one mile of the study area: Mesic, Clayplain Forest, Transition Hardwood Talus Woodland, Mesic Maple-Ash-Hickory-Oak Forest, and Red Cedar Woodland.

3.13.4 Land and Water Conservation Fund (LWCF) Sites

According to the Vermont Department of Forest Parks and Recreation, there are no Land and Water Conservation Fund (LWCF) sites located within the study area.

3.13.5 Hazardous Waste Sites

Two hazardous waste sites are located within the study area (all are on commercial properties in the vicinity of Chimney Corners). These include underground storage tanks (UST's) at the Mobil and Shell service stations located on US 7 north and south of Chimney Corners intersection, respectively.

3.13.6 Archaeological and Historic Structures/Sites

[4] Prime soils in the study area are classified as "Statewide" and "Statewide (b)" by the USDA Natural Resource Conservation Service of Vermont.

There are no Section 4(f), Section 6(f), or Section 106 properties in the study area. However, according to the Hartgen screening (see *Appendix D: Archeological and Historical Assessment Report)*, there are several areas of archeological sensitivity within the study area, including the low-lying farm field adjacent to the I-89 southbound off-ramp, and the grassed interchange area located west of I-89 and south of US 2. Key findings from the *Archeological and Historical Assessment Report* are summarized below:

- Five Vermont Division for Historic Preservation sites (pre-contact) were identified within three-quarters of a mile of the project APE.
- Undisturbed areas within the project area of potential effect (APE) are considered to have high pre-contact sensitivity.
- No National Register of Historic Places (NHRP) sites are located in the study area.
- No historic structures listing on the Vermont State Register or inventoried in the Vermont Historic Sites and Structures Survey are located in the study area.
- There are no cemeteries in the study area.
- There are no VDHP historic archaeological sites reported within one mile of the project area.
- No Section 4(f) or Section 6(f) properties are located in the study area.

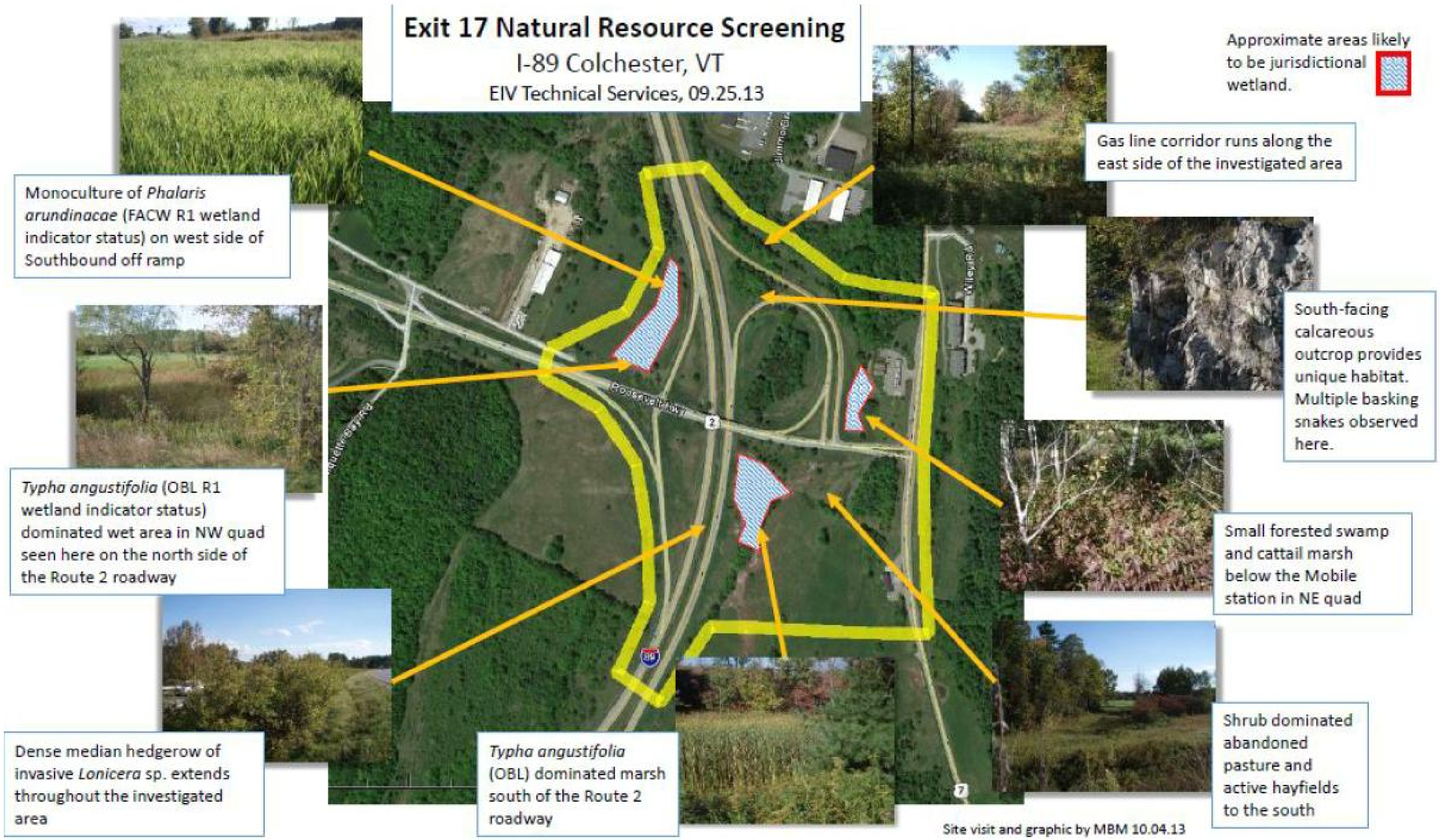


Figure 3-12: Environmental Constraints Map

4 Alternatives Investigation

4.1 Description of Alternatives

4.1.1 No-Build Alternative

The No-Build Alternative geometrically consists of what is described in the Existing Conditions section of this report and shown in Figure 1-2. In addition, it includes all projected future land use and traffic growth. The No-Build Alternative's traffic performance provides a critical understanding of what would happen in the study area if no action were taken to improve transportation deficiencies. It also allows for comparisons to the build alternatives.

4.1.2 6-Lane Bridge Alternative (Long-Term Option 1)

The 6-Lane Bridge Alternative, shown graphically in Figure 4-2 through Figure 4-4, would construct a new 6-lane bridge across I-89. Complementing the new bridge would be reconfigured signalized intersections at Chimney Corners and the I-89 ramps. The existing high-speed right-turn ramps from I-89 northbound to US 2 westbound and US 2 eastbound to I-89 southbound would be removed, and replaced by more traditional (un-channelized or slightly channelized) signalized intersections with greater traffic capacities. The 6-lane bridge would consist of four lanes in the westbound direction and two lanes in the eastbound direction.

The new 6-lane bridge centerline would be located approximately 30-40 feet north of the existing. Replacement of the existing high-speed right-turn ramps with more traditional signalized T-intersections would reduce conflicts with bicyclists on US 2 and subsequently the Lake Champlain Bikeway. The elimination of right-turn-on-red (RTOR) onto US 2 westbound from both off-ramps may reduce these conflicts even further without greatly compromising intersection LOS. The 6-Lane Bridge Alternative has enhanced bicycle facilities consistent with the *Vermont Pedestrian and Bicycle Facility Planning and Design Manual*, including 6-foot shoulders on US 2 and US 7 in the study area and a standard bicycle lane with signs at the eastbound approach to the I-89 southbound on-ramp (see Figure 4-8).

4.1.3 Loop Ramp Alternative (Long-Term Option 2)

The Loop Ramp Alternative, shown graphically in Figure 4-5 through Figure 4-7, would construct a new 3-lane bridge across I-89. The bridge would be complemented by a new loop ramp in the northwest quadrant of the interchange which would serve as an I-89 southbound on-ramp for traffic proceeding westbound on US 2. Existing signalized intersections at Chimney Corners and the I-89 ramps would be reconfigured to provide greater traffic capacity. The US 2/I-89 southbound ramps intersection would be relocated approximately 300 feet west of the current location. Existing westbound left turns would be reallocated to right turns due to the new loop ramp. The existing high-speed right-turn ramp from I-89 northbound to US 2 westbound would be replaced with an un-channelized or slightly channelized approach controlled by a traffic signal. Similar to Option 1, this would reduce conflicts with cyclists on the Lake Champlain Bikeway. Again, the elimination of RTOR onto US 2 westbound from both off-ramps may reduce these conflicts even further without greatly compromising intersection LOS.

The new 3-lane bridge would be slightly wider than the existing bridge, with two travel lanes in westbound direction and one in the eastbound direction with 6-foot shoulders on both sides. The bridge centerline would shift approximately 50-60 feet northward from the existing. The reconfigured I-89 southbound ramps, including the loop ramp and realigned off-ramp, would require additional right-of-way on private land currently used for farming. The Loop Ramp Alternative has enhanced bicycle facilities consistent with the *Vermont Pedestrian and Bicycle Facility Planning and Design Manual*, including 6-foot shoulders on US 2 and US 7 in the study area and a separated bike path and crossing (perpendicular to the ramp centerline for enhanced safety) at the realigned I-89 southbound on-ramp to minimize conflicts between cyclists and right turning vehicles (see Figure 4-9).

4.1.4 Short and Near-Term Options

Early in the process the Study Committee recognized the need for a short-term (less than 7 years) solution that could be implemented prior to the long-term. It was determined that traffic capacity expansion at the I-89 northbound ramps and Chimney Corners could be pursued and constructed in advance of a new bridge. This would be compatible with and not preclude both long-term Options 1 and 2 through minor realignment of the I-89 northbound ramps intersection. This can be seen in Figure 4-1.

Near-term (less than 2 years) options for study area improvements focus on those that can be conducted through minimal construction efforts. The following improvements were identified:

- Operational improvements
  - Implementing reduced speed zone in interchange area
  - Upgrading signal controllers and considering adaptive signal control technologies
  - Prohibiting right-turn on red from southbound US 7 to US 2 (conflicts with northbound left turns)
- Bicycle improvements
  - Implementing reduced speed zone in interchange area
  - Striping and signage at slip ramps
  - Installing a crosswalk at the US 2/US 7 intersection to allow for bicycle left turns onto US 2 westbound

4.1.5 Additional Alternatives Considered

Previously, several roundabout combinations were considered but ruled out due to unfavorable level-of-service results, cost considerations, and a general lack of support from the Study Committee. Similarly, and in addition to environmental concerns, a new off ramp in the southeast quadrant of the study area was not carried forward.

Figure 4-1: Short-Term Alternative

Figure 4-2: 6-Lane Bridge Alternative (1 of 3)

Figure 4-3: 6-Lane Bridge Alternative (2 of 3)

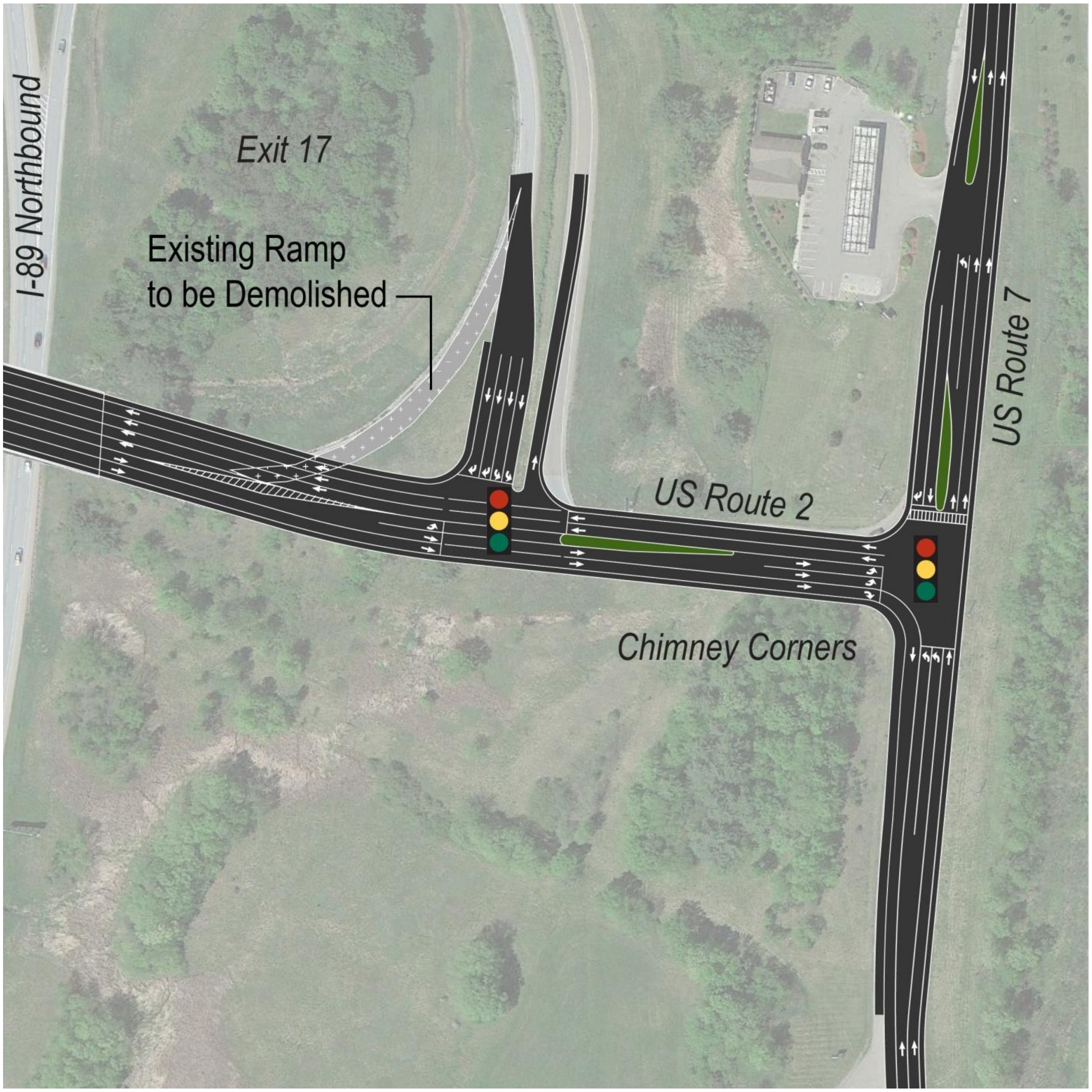


Figure 4-4: 6-Lane Bridge Alternative (3 of 3)

Figure 4-5: Loop Ramp Alternative (1 of 3)

Figure 4-6: Loop Ramp Alternative (2 of 3)

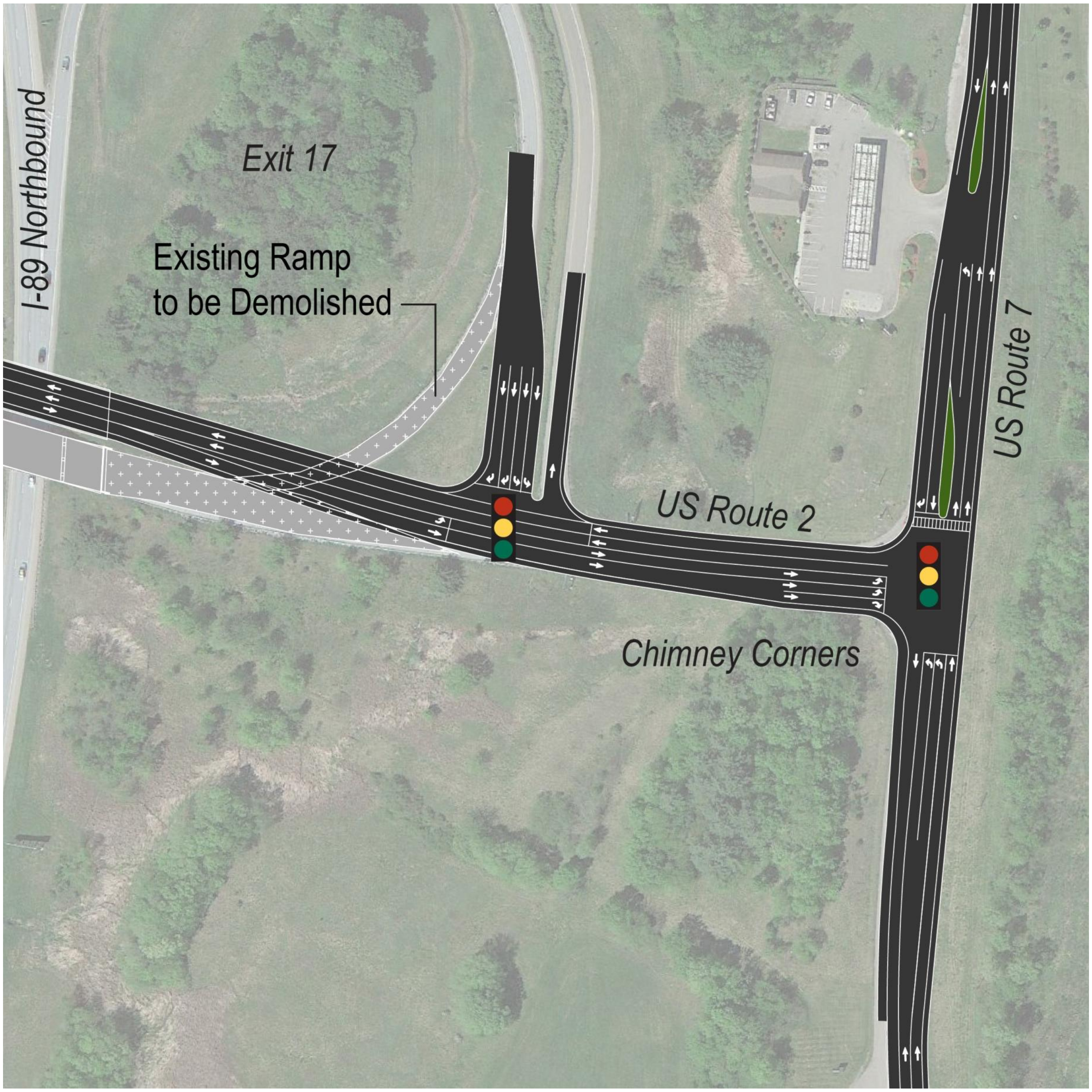


Figure 4-7: Loop Ramp Alternative (3 of 3)

Figure 4-8: 6-Lane Bridge Alternative – Bicycle Improvements at I-89 SB Ramps

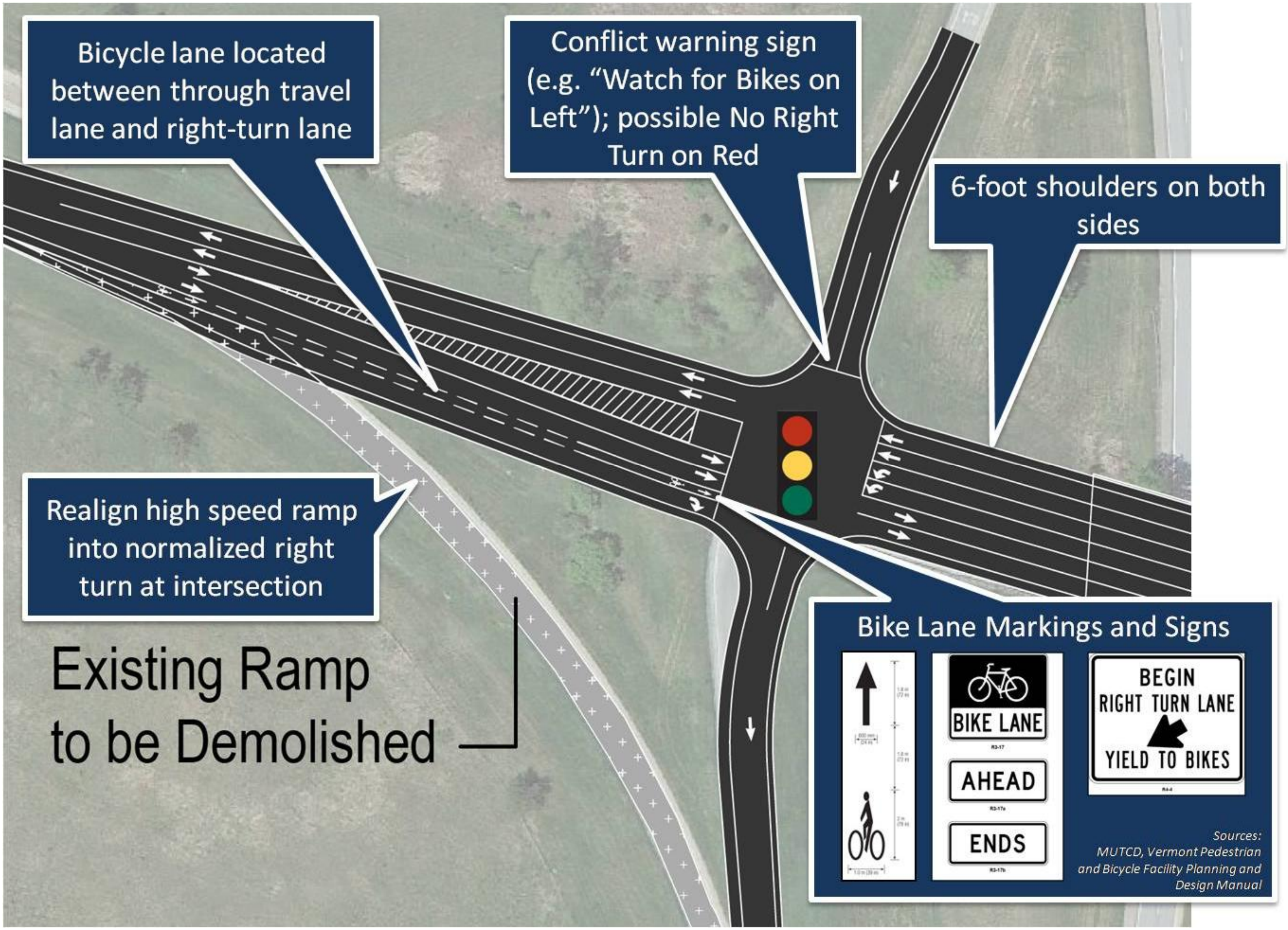
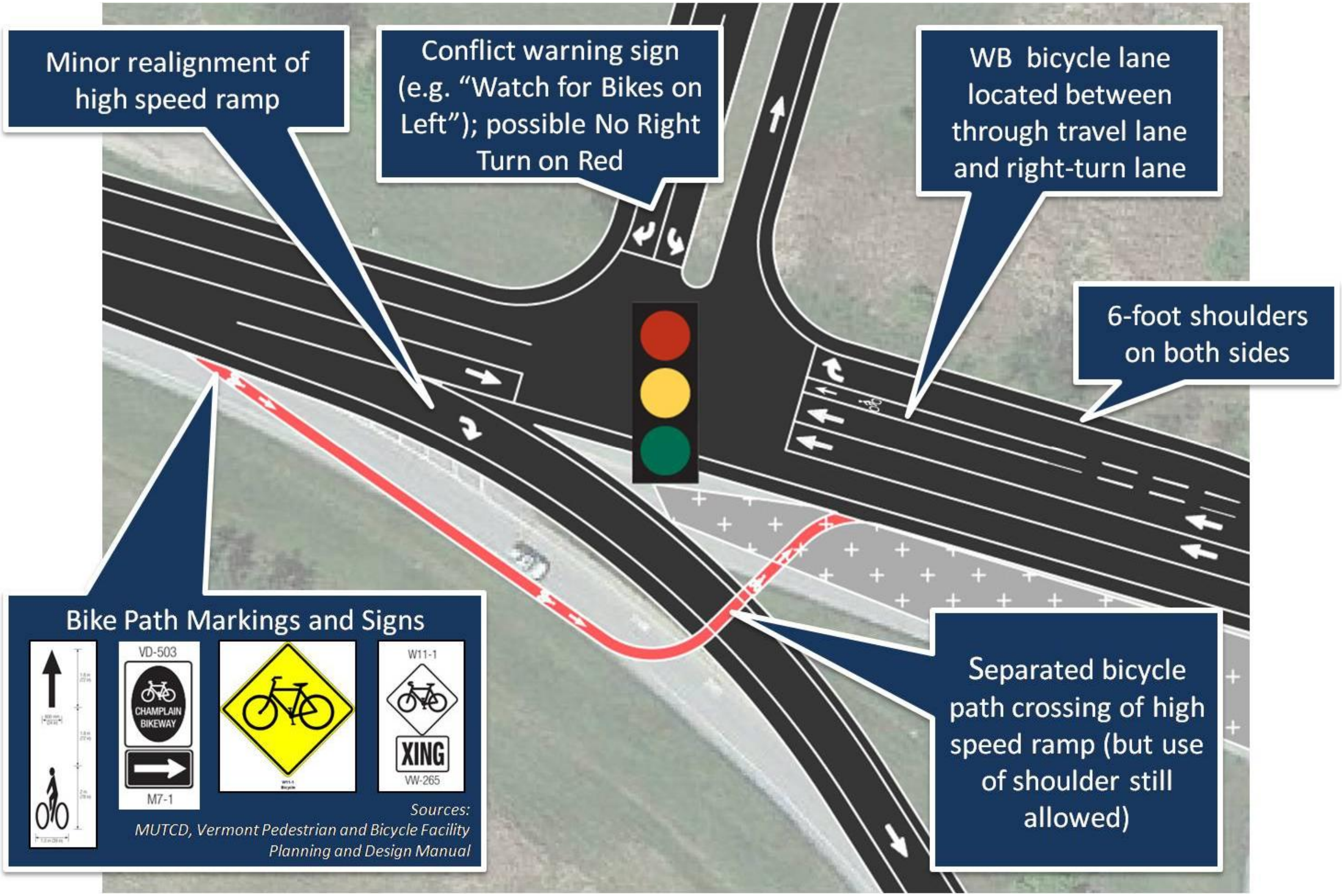


Figure 4-9: Loop Ramp Alternative – Bicycle Improvements at I-89 SB Ramps



4.2 Build Alternative Design Criteria

The table below summarizes design criteria utilized in the conceptual build alternative alignments for the Exit 17 Scoping Study. These criteria were derived from relevant standards, including *A Policy on Geometric Design of Highways and Streets, 6th Edition, AASHTO (2011)* and *Vermont State Design Standards, VTrans (1997)*.

Table 4-1: Build Alternative Design Criteria

	I-89 Ramps	US 2/US 7	US 2 and US 7 (north and west of Chimney Corners)	Reference Source
Functional Classification	Urban Interstate	Urban Principal Arterial	Urban Minor Arterial	N/A
Posted Speed	N/A	50 mph current 45 mph proposed	50 mph current 35 mph proposed US 2 45 mph proposed US 7	N/A
Design Speed	30 mph (loop ramp) 45 mph (diagonal)	45 mph	45 mph	AASHTO Table 10-1 (Interstate ramps) VSS (arterials)
Stopping Sight Distance	360 ft	360 ft	360 ft	AASHTO Tables 7-1 and 9-21
Corner Sight Distance		495 ft	495 ft	VTrans tables 3.2 & 4.2
Travel Lane Width	13 ft (loop) 12 ft (tangent)	11-12 ft	11-12 ft	AASHTO Table 3-29 VTrans secs 3-5 and 4-5.
Shoulder width (paved)	8 ft right 4 ft left	6 ft min	6 ft min	AASHTO VTrans secs 3-5 and 4-5.
Clear zone		16 ft fill (1:4 or flatter) 14 ft cut	16 ft fill (1:4 or flatter) 14 ft cut	VTrans
Design vehicle	WB-62	WB-62	WB-62	N/A
Horizontal Alignment E_{max} 4%	250 ft (loop) 711 ft (diagonal)	711 ft	711 ft	AASHTO Table 3-8
Horizontal Alignment E_{max} 6%	231 ft (loop) 643 ft (diagonal)	643 ft	643 ft	AASHTO Table 3-9
Maximum Grade	7% (loop) 5% (diagonal)	6% to 7%	6% to 7%	AASHTO Table 7-4 VTrans Table 3-5
Acceleration Lane Length	1120 ft (loop ramp) 600 ft (diagonal) 150 ft (onramp to onramp merge)	-	-	AASHTO Table 10-3
Onramp Taper	50:1	-	-	AASHTO

4.3 Evaluation of Long-Term Alternatives

Each long-term alternative was evaluated to assess its feasibility (alignment, lane configuration, cost, et cetera), effectiveness (traffic and safety performance), and impacts (environmental, cultural resources, right-of-way, et cetera).

4.3.1 Traffic Volumes

Traffic volumes were developed for the future year 2035. Future volumes account for background traffic growth and development growth resulting from additional households and jobs internal and external to the Exit 17 Study Area. Both build alternatives were analyzed for 2035 future year traffic conditions.

4.3.2 Traffic Analysis Results

An analysis of each long-term alternative's impact on traffic conditions in the study area was performed in Trafficware Synchro 9 with SimTraffic, a macroscopic analysis and optimization software application. Projected traffic volumes (explained in Section 4.3.1 above) were used to estimate future level-of-service (LOS) and delay for both long-term alternatives. Table 4-2: Level of Service Results presents the LOS and delay results for the No-Build and each long-term alternative in the AM and PM peak hours. LOS results for each alternative are also depicted graphically in Figure 4-10 through Figure 4-13.

4.3.2.1 Observations – AM Peak Hour Results

Both long-term alternatives improve traffic flow considerably during the AM Peak Hour, with LOS D conditions or better predicted for all possible traffic movements. Overall intersection LOS is C or better. In terms of future delay (seconds of delay per vehicle experienced while waiting to proceed through the intersection), the Loop Ramp Alternative performs slightly better than the 6-Lane Bridge Alternative. The US 2/I-89 southbound ramps intersection experiences LOS B under the Loop Ramp Alternative versus LOS C under the 6-Lane Bridge Alternative. Note that the AM peak hour results for both alternatives assume no right-turn-on-red (RTOR) from the I-89 northbound/southbound off-ramps to US 2 westbound. Full LOS results with RTOR allowed from the off-ramps are reported in Appendix A.

4.3.2.2 Observations – PM Peak Hour Results

Both long-term alternatives improve traffic flow considerably during the PM Peak Hour, with LOS D or better predicted for all traffic movements. Overall intersection LOS is B or better. In terms of future delay, the Loop Ramp Alternative performs somewhat better than the 6-Lane Bridge Alternative. Overall LOS at the US 2/I-89 southbound intersection is LOS A under the Loop Ramp Alternative versus LOS B for the 6-Lane Bridge Alternative. When compared to the 6-Lane Bridge Alternative, the Loop Ramp Alternative has approximately 20 fewer seconds of delay for the US 2 westbound through movement. Note that the AM peak hour results for both alternatives assume no RTOR from the I-89 northbound/southbound off-ramps to US 2 westbound. Full LOS results with RTOR allowed from the off-ramps are reported in Appendix A.

Table 4-2: Level of Service Results

	AM Peak								PM Peak							
					Build Alternatives								Build Alternatives			
	No Build Alternative				6-Lane Bridge (Opt. 1)		Loop Ramp (Opt. 2)		No Build Alternative				6-Lane Bridge (Opt. 1)		Loop Ramp (Opt. 2)	
	Existing		Future (2035)		Future (2035)		Future (2035)		Existing		Future (2035)		Future (2035)		Future (2035)	
	LOS	Avg Delay/ Veh	LOS	Avg Delay/ Veh	LOS	Avg Delay/ Veh	LOS	Avg Delay/ Veh	LOS	Avg Delay/ Veh	LOS	Avg Delay/ Veh	LOS	Avg Delay/ Veh	LOS	Avg Delay/ Veh
US 2 at I-89 NB Ramps																
Intersection LOS	B	14.0	C	34.7	A	9.9	A	9.2	E	61.5	F	129.8	B	17.5	B	18
US 2 Eastbound	A	8.2	D	50.4	-	-	-	-	A	9.8	F	161.1	-	-	-	-
Left Turn	-	-	-	-	A	7.4	A	3.6	-	-	-	-	B	10.6	A	7.8
Through	-	-	-	-	A	6.3	A	4.4	-	-	-	-	A	5.5	A	8.2
US 2 Westbound	B	13.7	B	16.6	A	4.2	A	3.9	B	12.5	C	23.2	B	15.2	B	16.2
I-89 NB off-ramp	D	37.7	D	39.6	-	-	-	-	F	165.9	F	266.0	-	-	-	-
Left Turn	D	37.7	E	70.8	C	34.6	C	34.4	F	165.9	F	266.0	C	25.2	C	25
Right Turn	-	-	-	-	D	36.1	D	36	-	-	-	-	C	20.3	B	19.8
US 2 at I-89 SB Ramps																
Intersection LOS	C	21.9	E	57.4	C	28.5	B	10.3	B	11.9	C	29.0	B	11	A	8.4
US 2 Eastbound	A	9.6	E	61.2	-	-	-	-	A	7.9	A	7.3	-	-	-	-
Through	-	-	-	-	C	25.2	B	10.7	-	-	-	-	B	14.2	A	6.0
Right Turn	-	-	-	-	B	18.5	A	2.9	-	-	-	-	A	3.6	A	1.6
US 2 Westbound	B	17.4	D	49.1	-	-	-	-	A	8.0	B	17.2	-	-	-	-
Left Turn	C	23.6	E	69.9	D	42	-	-	A	2.7	A	0.6	C	28.9	-	-
Through	A	4.2	A	5.3	A	6	A	7.7	A	8.8	B	19.9	A	5.7	A	7.8
Right Turn	-	-	-	-	-	-	A	1.7	-	-	-	-	-	-	A	0.1
I-89 SB off-ramp	D	49.9	F	82.5	-	-	-	-	D	41.2	F	131.3	-	-	-	-
Left Turn	-	-	-	-	D	50	D	49.4	-	-	-	-	D	35.3	D	35.7
Right Turn	-	-	-	-	C	24.5	C	20.1	-	-	-	-	C	26.3	C	26.3
US 2 at US 7																
Intersection LOS	C	20.3	C	34.7	C	22.4	C	23.4	C	28.1	D	51.1	B	19.3	B	19.5
US 2 Eastbound	B	11.9	B	16.6	-	-	-	-	B	13.8	C	32.4	-	-	-	-
Left Turn	C	25.6	C	23.5	A	7.1	B	12.9	B	19.6	D	45.4	B	15.8	B	16.6
Right Turn	A	3.9	B	12.6	A	5	A	6.3	A	0.7	A	2.5	A	0.9	A	1.1
US 7 Northbound	D	35.3	D	50.4	-	-	-	-	C	34.2	E	68.2	-	-	-	-
Left Turn	D	50.9	E	76.4	D	48.4	D	48.4	D	50.0	F	110.7	C	32.5	C	32.5
Through	B	12.4	B	12.5	B	16.0	B	16.0	B	19.1	C	27.4	B	19.2	B	19.2
US 7 Southbound	B	19.5	D	39.6	-	-	-	-	D	40.2	D	50.6	-	-	-	-
Through	D	19.5	E	70.8	D	52.9	D	52.9	F	102.8	F	124.9	D	41.3	D	41.3
Right Turn	A	9.4	C	27.7	B	18.2	B	18.2	B	13.7	B	19.0	B	11.3	B	11.3

Note: Yellow highlighting denotes LOS E or F conditions present

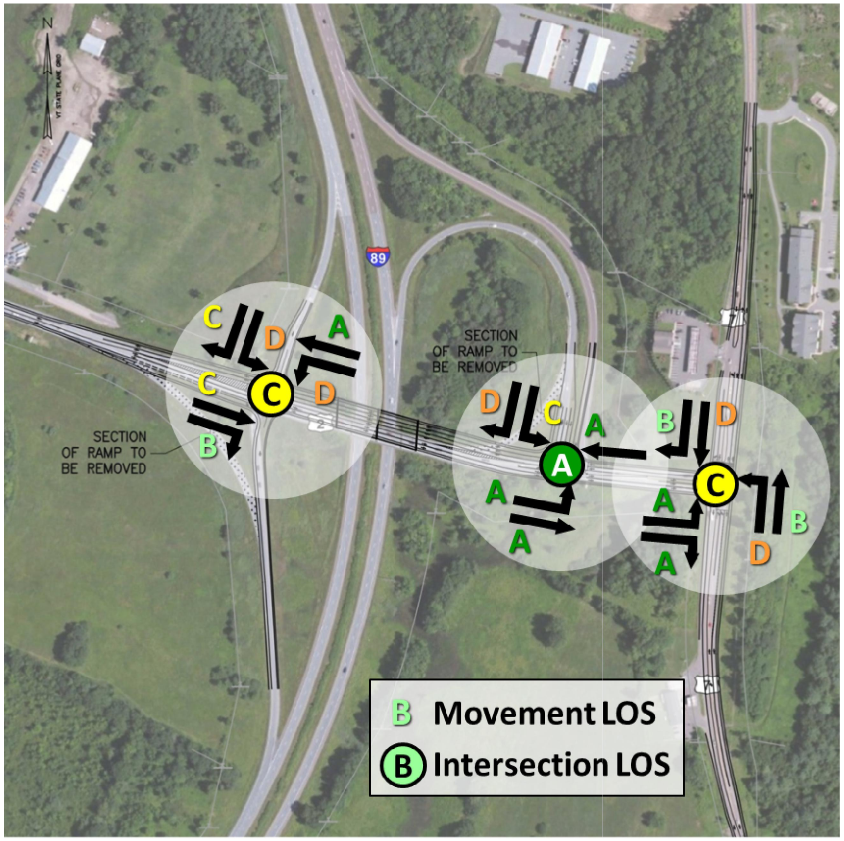


Figure 4-10: 6-Lane Bridge Alternative – 2035 Level of Service (AM Peak)

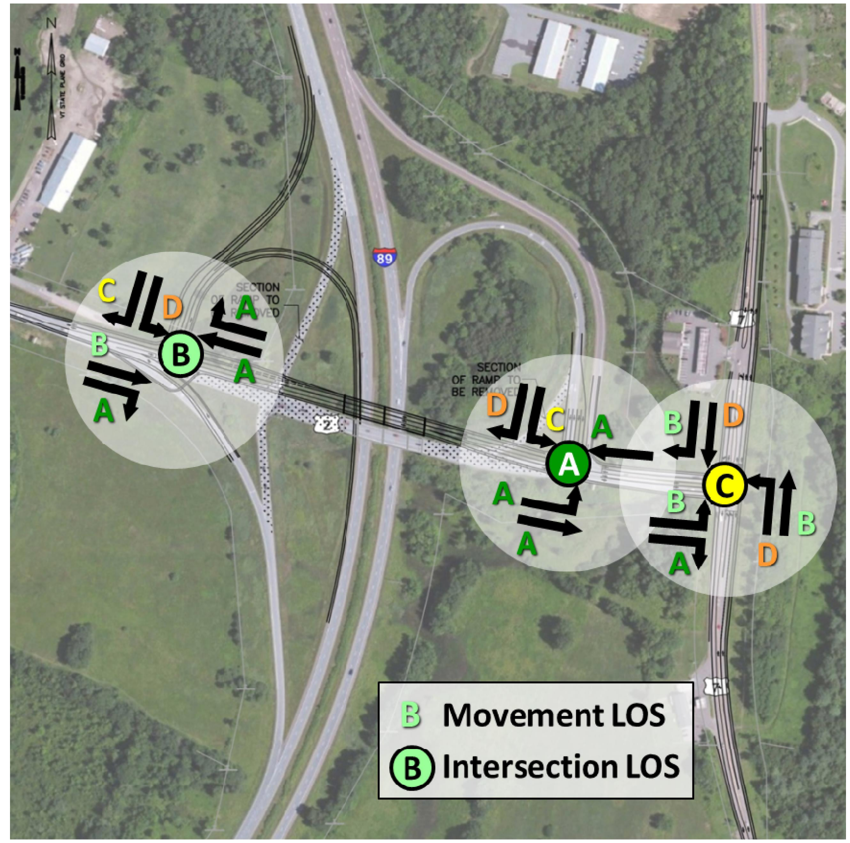


Figure 4-11: Loop Ramp Alternative – 2035 Level of Service (AM Peak)

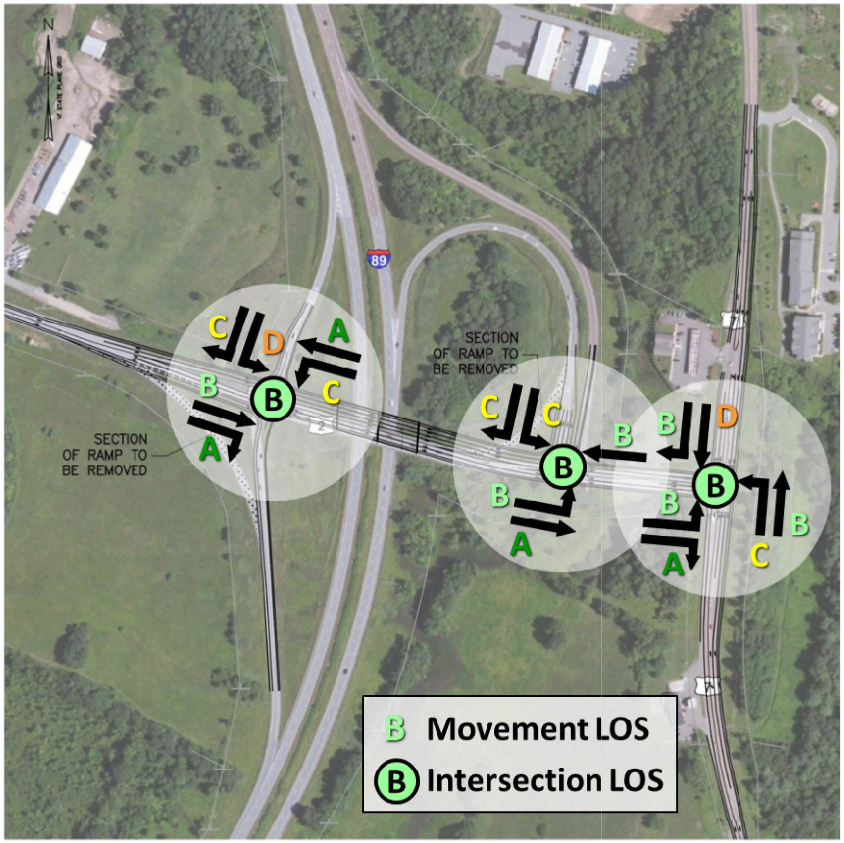


Figure 4-12: 6-Lane Bridge Alternative – 2035 Level of Service (PM Peak)

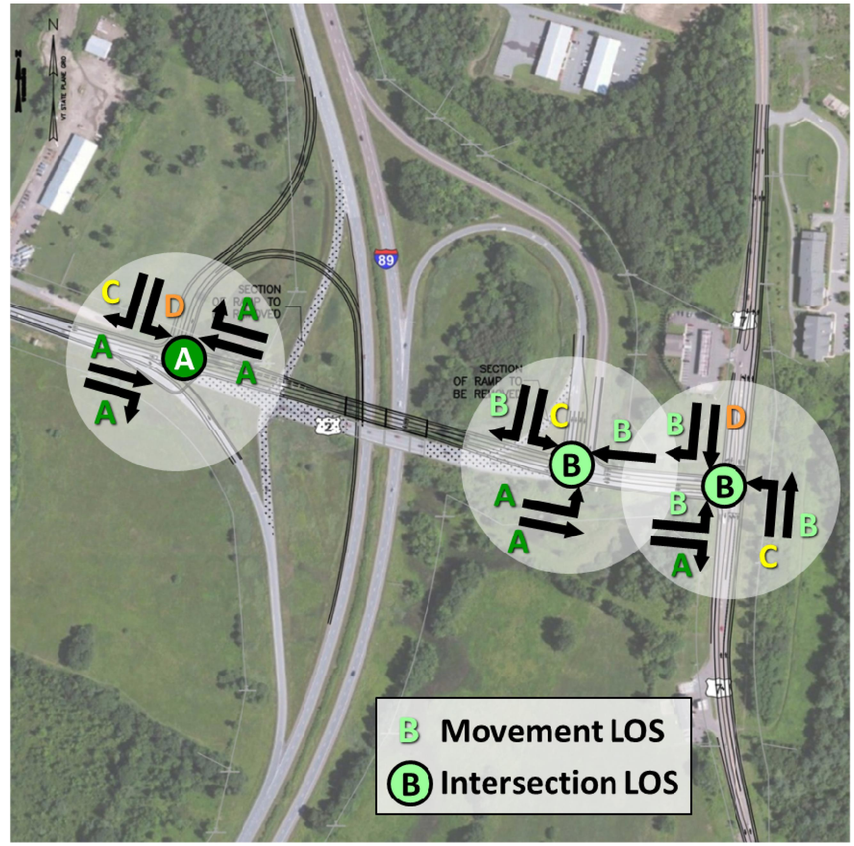


Figure 4-13: Loop Ramp Alternative – 2035 Level of Service (PM Peak)

4.3.3 Impacts of Long-Term Alternatives

4.3.3.1 Agricultural Lands

A portion of 9-acres of private agricultural land adjacent to the existing I-89 southbound off-ramp would be affected by the Loop Ramp Alternative. To construct the loop ramp, approximately 2 acres of this land would need to be acquired by VTrans.

4.3.3.2 Archaeological

Archaeological impacts could occur with either alternative, although the Loop Ramp Alternative may have greater potential for archeological impact because of the need for additional land in an area identified by Hartgen as having archeological sensitivity.

4.3.3.3 Historic Resources

Neither option would have impacts to historic resources/properties covered under Section 106 of the National Historic Preservation Act.

4.3.3.4 Floodplains

Neither option would have floodplain impacts. The study area does not have any FEMA designed flood zones in it.

4.3.3.5 Fish and Wildlife Habitats

Neither alternative would have fish and wildlife impacts. Existing wildlife habitat areas are located well outside the study area.

4.3.3.6 Rare, Threatened and Endangered Species

No rare, threatened, and endangered species occur within the study area.

4.3.3.7 Section 4(f) Public Lands

No Section 4(f) lands are located within the study area.

4.3.3.8 Section 6(f) LWCF Act

No Section 6(f) Land and Water Conservation Act lands are located within the study area.

4.3.3.9 Wetlands

The Loop Ramp Alternative may impact approximately 2 acres of wetlands located on private farmland adjacent to the existing I-89 southbound off-ramp. These wetlands are classified as FACW R1 and OBL 1, and would likely be jurisdictional wetlands requiring permitting for impacts to them and their buffers. The 6-Lane Bridge Alternative is unlikely to have wetlands impacts.

4.3.3.10 Hazardous Waste

Neither alternative would impact existing hazardous waste sites in the study area. Both sites are located some distance away from the area of disturbance associated with both alternatives.

4.3.3.11 *Aesthetics/Visual*

The 6-Lane Bridge Alternative would have a somewhat greater visual impact than the Loop Ramp Alternative due the 6-lane bridge being wider than the 3-lane bridge. A narrower bridge may have less visual impact on the semi-rural character of the surrounding area.

4.3.3.12 *Noise*

Neither alternative is expected to dramatically increase ambient noise above current levels.

4.3.3.13 *Economy*

Improved travel times and reliability for regular users of the Exit 17 interchange for local and regional travel would be the primary economic benefit of both alternatives. As discussed in Section 4.3.2, the Loop Ramp Alternative would result in greater travel time savings from lower traffic delays than the 6-Lane Bridge Alternative.

4.3.3.14 *Abutting Properties*

Approximately two acres of private farm adjacent to the existing I-89 southbound off-ramp would need to be acquired to construct the Loop Ramp Alternative. The 6-Lane Bridge Alternative has no impacts to abutting properties.

4.3.4 *Satisfaction of Purpose and Need*

Both the 6-Lane Bridge and Loop Ramp alternatives meet the Purpose and Need by relieving congestion and improving facilities in the study area for all users. Insofar as reducing congestion, the Loop Ramp Alternative outperforms the 6-Lane Bridge Alternative because it achieves somewhat better intersection level-of-service results, particularly at the intersection of US 2 and the I-89 southbound. In addition, the Loop Ramp Alternative has a slimmer cross-section with fewer lanes, which bicyclists on the Lake Champlain Bikeway may prefer. The No Build Alternative does not meet purpose and need because it does not improve safety, relieve congestion, or provide adequate access to the Interstate.

4.4 Engineering

4.4.1 *Utilities – Above Ground*

Relocation of existing above ground utilities is not anticipated for the 6-Lane Bridge Alternative. The Loop Ramp Alternative would require the relocation of at least one above ground utility pole, including its transformer and conduit, located approximately 50 feet to the north of US 2 and 200 feet to west the existing I-89 southbound off-ramp.

4.4.2 *Utilities – Underground*

For both build alternatives, underground utilities for street lighting and signals associated with the Exit 17 interchange and overpass would need to be altered and/or reconstructed. The underground conduit of a utility pole located roughly halfway between the existing I-89 southbound off-ramp and Jasper Mine Road terminus may need to lengthened and/or relocated with the Loop Ramp Alternative.

4.4.3 *Design Exceptions*

As per table Table 4-1: Build Alternative Design Criteria, both build alternatives meet the desirable minimum standards laid out in the design criteria. There is adequate length between the bridge, the intersection, and the limit of work to grade out and meet existing grade. The site provides adequate space for lane and shoulder widths and lane taper lengths. Sight distance and clear zones minimum desirable criteria can also be achieved. This scoping study has found no need for deviation from the established design criteria.

4.5 Permitting Requirements and Regulatory Issues

4.5.1 *Act 250 (Vermont Law) – Land Use and Development Act*

The issuance of an Act 250 Land Use permit may be needed for both long-term alternatives, as a similar interchange improvement project—the Exit 16 Diverging Diamond interchange in southern Colchester—sought an Act 250 permit.

4.5.2 *NEPA*

Both long-term alternatives would likely be eligible for Categorical Exclusion because they require minimal additional rights-of-way and are not expected to have significant environmental or cultural impacts.

4.5.3 *Wetlands*

A permit (Conditional Use Determination) for the Loop Ramp Alternative will likely be required from the Vermont Department of Conservation for impacts to wetlands noted in Section 4.3.3.9. The USACE General Permit, which only covers impacts limited to 3,000 square feet (.068 acres), would not apply. An individual permit would likely be needed to cover the 2-acre wetland noted in Section 4.3.3.9.

4.5.4 Stormwater Permit

A stormwater permit is required when a project yields 1 acre of redeveloped impervious area and/or 5,000 square feet of new impervious surface area. Both the 6-Lane Bridge Alternative and the Loop Ramp Alternative would meet this criterion. Therefore, stormwater permits would be required for either long-term alternative. The pavement area of each long-term alternative is compared with the no-build in the table below:

Table 4-3: Build Alternative Impervious Surface

6-Lane Bridge Alternative (Option 1)			3-Lane Bridge with Loop Ramp (Option 2)		
Proposed	*ft^2*	*acres*	*Proposed*	*ft^2*	*acres*
-	-	-	Loop Ramp (to/from I-89 SB)	50,249	1.15
6-Lane Bridge*	64,595	1.48	3-Lane Bridge*	61,067	1.40
East Ramp (to/from I-89 NB)	20,888	0.48	East Ramp (to/from I-89 NB)	22,599	0.52
Other	283,081	6.50	Other	228,136	5.24
Total	368,564	8.46	Total	362,051	8.31
Existing	*ft^2*	*acres*	*Existing*	*ft^2*	*acres*
Total	329,878	7.57	Total	329,878	7.57
Increase in Pavement	38,686	0.89	Increase in Pavement	32,173	0.74

*Includes pavement between I-89 NB and SB ramp signalized intersections.

4.5.5 Other Permits

None of the following permits are expected to be applicable to either alternative: Section 401 Water Quality, Section 404 USACE, Stream Alteration, or Endangered/threatened species.

4.5.6 SHPO Consultation

The State Historic Preservation Office should be consulted to ensure consistency with the findings of the *Appendix D: Archeological and Historical Assessment Report*.

4.5.7 Consistency with Local, Regional, and State Plans

4.5.7.1 2035 Chittenden County Metropolitan Transportation Plan (2013)

The CCRPC *2035 Metropolitan Transportation Plan* (adopted in 2013 as part of the ECOS Plan) lists the reconstruction of I-89 Exit 17 interchange and intersection modifications/improvements to US 2 at I-89 Exit 17 as a recommended corridor strategy/project.[5]

[5] pp. 188

4.5.7.2 Regional Bicycle-Pedestrian Plan Update (2008)

The CCRPC *Regional Bicycle-Pedestrian Plan Update* lists the US 2 Exit 17 Overpass as a "critical crossing".[6] Both long-term alternatives involve enhanced bicycle facilities on the overpass, including wider shoulders and dedicated signage, striping and/or paths on the eastbound approach. According to the plan, I-89 serves as "a barrier to connecting the regional bicycle network". The plan also states that key crossings should be "built and well maintained as part of a comprehensive bicycle and pedestrian network". Both long-term alternatives help minimize the I-89 barrier for bicyclists and improve a problematic segment of the Lake Champlain Bikeway.

4.5.8 FHWA Access Modification Approval

Under FHWA rules, any change in the design of an existing access point to/from the Interstate System is considered a change to the interchange configuration, even though the number of actual points of access may not change. For example, replacing the direct ramps of a diamond interchange with a loop, or changing a cloverleaf interchange into a fully directional interchange, would be considered revised access for the purpose of applying this policy.

The 6-Lane Bridge Alternative is unlikely to require FHWA access modification approval because it does not change the number of access points to/from I-89. No new entrance or exit ramps are added with the 6-Lane Bridge, although the existing high-speed right turn ramps to/from US 2, a non-Interstate, would be removed.

The Loop Ramp Alternative fundamentally changes the location of the I-89 southbound off-ramp (shifts the exit point approximately 500 feet north) while adding a new southbound on-ramp (loop ramp) that enters I-89 just underneath the overpass. These changes would likely require FHWA access modification approval at least at the divisional level. Typically, a justification report that includes a safety and operational analysis is required to gain access modification approval.

4.6 Cost Estimates

The Loop Ramp Alternative will cost less to construct than the 6-Lane Bridge Alternative, excluding right-of-way acquisition costs ($17 million versus $22.8 million). A full breakdown of costs for the long-term alternatives is provided in Appendix A: Intersection Volume Calculations.

4.7 Evaluation Matrix

Anticipated costs, property impacts, engineering elements, environmental and cultural resource impacts, and permit requirements for each alternative are summarized in Table 4-4 on the next page.

[6] p. 30

Table 4-4: Alternatives Evaluation Matrix

	Alternative	No Build	6-Lane Bridge (Option 1)	3-Lane Bridge and Loop Ramp (Option 2)
COST	Conceptual Cost Estimate	-	$22.7M	$17M
	Properties Affected:			
	Temporary Easements		None	1-2
	Permanent Easements	-	None	1-2
ENGINEERING	Eligible for Safety Funding	Yes	Yes	Yes
	Alignment/Geometric Changes	-	Yes	Yes
	Bike/Ped Impacts	-	Positive	Positive
	Underground Utilities	-	Yes	Yes
	Overhead Utilities	-	No Change	1 pole impact
	LOS 2035 (PM) – Overall			
	US 2 at I-89 NB Ramps	F	B	A
	US 2 at I-89 SB Ramps	C	B	B
	US 2 at US 7 (Chimney Corners)	D	B	B
ENVIRONMENTAL RESOURCES	Agricultural Lands	No Impact	No Impact	Impact
	Archaeological	No Impact	Impact	Impact
	Historic Structures/Sites	No Impact	No Impact	No
	Floodplain	No Impact	No Impact	No
	Fish and Wildlife	No Impact	No Impact	No
	Rare, Threatened & Endangered	No Impact	No Impact	No
	Public Lands – Section 4(f)	No Impact	No Impact	No
	LWCF-Section 6(f)	No Impact	No Impact	No
	Noise	No Impact	No Impact	No
	Wetlands	No Impact	No Impact	Impact
	Hazardous Waste Sites	No Impact	No Impact	No
LOCAL AND REGIONAL ISSUES	Satisfies Purpose and Need	No	Yes	Yes
	Community Character	No Impact	No Impact	No Impact
	Economic Impacts	Negative	Positive	More Positive
	Conformance to Regional Plan	-	Yes	Yes
POSSIBLE PERMITS	Act 250	No	Yes	Yes
	401 Water Quality	No	No	No
	404 Corps of Engineers Permit	No	No	No
	Stream Alternation	No	No	No
	Conditional Use Determination	No	No	Yes
	Storm Water Discharge	No	Yes	Yes
	Shoreland Encroachment	No	No	No
	Endangered/Threatened Species	No	No	No
	VTrans Clearance	No	Yes	Yes
	SHPO Clearance	No	Yes	Yes
	FHWA Access	No	No	Yes
	NEPA Process Required	No	Yes	Yes

Note: Yellow highlighting denotes LOS E or F conditions, (negative) impacts associated, or permits likely

5 Municipal Preferred Alternative

5.1 Public Meetings / Participation

Consultation with the Exit 17 Scoping Study Committee (see Section 1.3) occurred over several meetings held between August 2013 and May 2014 with dates summarized in the list below. In addition to the four Study Committee Meetings, two public meetings were held in September and October 2013 to gather comments and feedback from the community. Two alternatives presentations were held at the end of the study to present the findings to elected officials and the community.

Study Committee Meetings	Date
Study Committee Meeting #1	August 6, 2013
Study Committee Meeting #2	September 12, 2013
Study Committee Meeting #3	October 10, 2013
Study Committee Meeting #4	December 18, 2013

Public Meetings	Date
Public Meeting #1	September 10, 2013
Public Meeting #2	October 22, 2013
Town of Milton Selectboard	May 19, 2014
Town of Colchester Selectboard	May 27, 2014

5.2 Municipal Preferred Alternative

A critical piece of every scoping study is the municipal preferred alternative. This is typically granted to the municipality in which the study area resides. It is important to note that while the Vermont Agency of Transportation (VTrans) and the Federal Highway Administration (FHWA) take this into strong consideration when moving into permitting and design, it does not represent the final decision. This is largely due to unforeseen circumstances that may come about as an alternative advances.

The Colchester Selectboard at their meeting on May 27, 2014 endorsed the Loop Ramp Alternative (Option 2) as their preferred alternative. The Loop Ramp Alternative reduces congestion somewhat more effectively at the ramp intersections than the 6-Lane Bridge Alternative. It is also the less costly alternative, as explained in Section 4.6, and better suited for local and regional bicycle travel because of its narrower width and smaller number of vehicular travel lanes. Ultimately, the Loop Ramp Alternative may provide a more comfortable cycling environment than the 6-Lane Bridge Alternative. Collectively, this package will provide a comprehensive solution to reducing congestion; improving safety, access, and mobility in the Exit 17 Study Area.

Appendix A: Intersection Volume Calculations and Full LOS Results

AM Peak

Existing

VTrans				SB Off							NB On/Off							US 7			
			271		0					267		164					933		348		
			19	0	252					131	0	136					691	242	0		
	293	0				0	850	888	28				136	893	918	208				0	0
US 2		302				274			509				757			0				0	
	302					576	554	537	0				0	645	628	420				0	0
			0	0	0					0	0	0					227	140	0		
			576		0					0		0					662		367		
				SB On														US 7			

CCRPC				SB Off							NB On/Off							US 7			
			233		0					245		212					907		411		
			11	2	220					115	0	130					646	261	0		
	256	0				0	810	784	30				182	851	861	255				0	0
US 2		292				245			517				669			0				0	
	831	539				565	512	547	0				0	647	639	384				0	0
			0	0	0					0	0	0					215	156	0		
			1106		0					0		0					645		371		
				SB On														US 7			

Post-Processed				SB Off							NB On/Off							US 7			
			250		0					260		190					920		380		
			15	0	235					125	0	135					670	250	0		
	275	0				0	830	840	30				160	875	890	230				0	0
US 2		295				260			515				715			0				0	
	835	540				570	530	545	0				0	650	630	400				0	0
			0	0	0					0	0	0					220	150	0		
			1110		0					0		0					650		370		
				SB On														US 7			

Balanced				SB Off							NB On/Off							US 7			
			250		0					260		190					910		385		
			15	0	235					125	0	135					660	250	0		
	285	0				0	845	845	30				160	880	880	235				0	0
US 2		295				270			500				720			0				0	
	835	540				575	530	530	0				0	635	635	400				0	0
			0	0	0					0	0	0					220	150	0		
			1115		0					0		0					650		370		
				SB On														US 7			

2035

				SB Off							NB On/Off							US 7			
			315		0					325		255					1230		490		
			20	0	295					155	0	170					890	340	0		
	375	0				0	1115	1115	40				215	1175	1175	295				0	0
US 2		370				355			625				960			0				0	
	1045	675				760	665	665	0				0	795	795	500				0	0
			0	0	0					0	0	0					285	195	0		
			1435		0					0		0					840		480		
				SB On														US 7			

PM Peak

Existing

VTrans				SB Off							NB On/Off							US 7			
			137		0					804		191					421		944		
			20	0	117					297	0	507					292	129	0		
	965	0				0	1124	1124	36				155	982	718	597				0	0
US 2		220				945			520				827			0				0	
	220					179	337	556	0				0	1027	776	179				0	0
			0	0	0					0	0	0					426	347	0		
			179		0					0		0					308		773		
				SB On														US 7			

CCRPC				SB Off							NB On/Off							US 7			
			181		0					1128		301					617		1021		
			43	1	137					648	0	480					437	180	0		
	1172	0				0	1279	1161	32				269	782	807	541				0	0
US 2		226				1129			357				513			0				0	
	509	283				150	363	389	0				0	837	809	268				0	0
			0	0	0					0	0	0					370	480	0		
			434		0					0		0					448		850		
				SB On														US 7			

Post-Processed				SB Off							NB On/Off							US 7			
			155		0					970		245					520		985		
			30	0	125					475	0	495					365	155	0		
	1065	0				0	1200	1145	35				210	880	765	570				0	0
US 2		225				1035			440				670			0				0	
	510	285				165	350	475	0				0	935	795	225				0	0
			0	0	0					0	0	0					400	415	0		
			450		0					0		0					380		815		
				SB On														US 7			

Balanced				SB Off							NB On/Off							US 7			
			180		0					1145		285					520		985		
			45	0	135					650	0	495					365	155	0		
	1045	0				0	1165	1165	35				250	765	765	570				0	0
US 2		225				1000			325				515			0				0	
	560	335				165	360	360	0				0	820	820	250				0	0
			0	0	0					0	0	0					400	415	0		
			500		0					0		0					405		815		
				SB On														US 7			

2035

				SB Off							NB On/Off							US 7			
			225		0					1435		375					705		1255		
			55	0	170					815	0	620					495	210	0		
	1345	0				0	1500	1500	45				330	1015	1015	715				0	0
US 2		280				1290			405				685			0				0	
	700	420				210	450	450	0				0	1025	1025	310				0	0
			0	0	0					0	0	0					520	540	0		
			630		0					0		0					520		1060		
				SB On														US 7			

RTOR Allowed

2035 AM 3-Lane Bridge				
Cycle Length- 80 Seconds				
Intersection	Approach	Delay (s/veh)	LOS	95th Percentile Queue
US 2 & I-89 SB Ramps	I-89 SB Off Ramp LT	49.4	D	214
	I-89 SB Off Ramp RT	8.5	A	15
	US 2 EB Thru	10.7	B	166
	US 2 EB RT	2.9	A	49
	US 2 WB Thru	7.4	A	48
	US 2 WB LT	1.9	A	21
	Overall	10.2	B	-
US 2 & I-89 NB Ramps	I-89 NB Off Ramp LT	35.4	D	72
	I-89 NB Off Ramp RT	9.3	A	29
	US 2 EB LT	3.4	A	m7
	US 2 EB Thru	3.9	A	67
	US 2 WB Thru/RT	4	A	m121
	Overall	7	A	-
US 2 & US 7	US 7 SB Thru	52.9	D	#324
	US 7 SB RT	18.2	B	#657
	US 2 EB LT	12.6	B	73
	US 2 EB RT	6.6	A	68
	US 7 NB LT	48.4	D	#129
	US 7 NB Thru	16.0	B	112
	Overall	23.4	C	-

2035 PM 3-Lane Bridge				
Cycle Length- 70 Seconds				
Intersection	Approach	Delay (s/veh)	LOS	95th Percentile Queue
US 2 & I-89 SB Ramps	I-89 SB Off Ramp LT	35.7	D	130
	I-89 SB Off Ramp RT	12.4	B	33
	US 2 EB Thru	6.0	A	83
	US 2 EB RT	1.6	A	29
	US 2 WB Thru	7.2	A	278
	US 2 WB LT	0.1	A	0
	Overall	7.7	A	-
US 2 & I-89 NB Ramps	I-89 NB Off Ramp LT	29	C	189
	I-89 NB Off Ramp RT	17.4	B	205
	US 2 EB LT	7.3	A	m13
	US 2 EB Thru	7.2	A	75
	US 2 WB Thru/RT	13.9	B	135
	Overall	17.2	B	-
US 2 & US 7	US 7 SB Thru	41.3	D	#180
	US 7 SB RT	11.3	B	211
	US 2 EB LT	16.3	B	119
	US 2 EB RT	1.1	A	m4
	US 7 NB LT	32.5	C	165
	US 7 NB Thru	19.2	B	272
	Overall	19.4	B	-

2035 AM 6-Lane Bridge				
Cycle Length- 80 Seconds				
Intersection	Approach	Delay (s/veh)	LOS	95th Percentile Queue
US 2 & I-89 SB Ramps	I-89 SB Off Ramp LT	46.6	D	#264
	I-89 SB Off Ramp RT	10.4	B	17
	US 2 EB Thru	25.9	C	124
	US 2 EB RT	18.1	B	#290
	US 2 WB Thru	40.8	D	#278
	US 2 WB RT	4.9	A	44
	Overall	28	C	-
US 2 & I-89 NB Ramps	I-89 NB Off Ramp LT	35.4	D	72
	I-89 NB Off Ramp RT	7.2	A	25
	US 2 EB LT	3.5	A	m7
	US 2 EB Thru	2.7	A	48
	US 2 WB Thru/RT	6	A	m168
	Overall	7.6	A	-
US 2 & US 7	US 7 SB Thru	52.9	D	#324
	US 7 SB RT	18.2	B	#657
	US 2 EB LT	10.6	B	59
	US 2 EB RT	6.2	A	77
	US 7 NB LT	48.4	D	#129
	US 7 NB Thru	16.0	B	112
	Overall	23.1	C	-

2035 PM 6-Lane Bridge				
Cycle Length- 70 Seconds				
Intersection	Approach	Delay (s/veh)	LOS	95th Percentile Queue
US 2 & I-89 SB Ramps	I-89 SB Off Ramp LT	35.3	D	130
	I-89 SB Off Ramp RT	12.4	B	33
	US 2 EB Thru	14.2	B	65
	US 2 EB RT	3.6	A	50
	US 2 WB Thru	28.4	C	m69
	US 2 WB RT	6.1	A	214
	Overall	10.8	B	-
US 2 & I-89 NB Ramps	I-89 NB Off Ramp LT	29	C	189
	I-89 NB Off Ramp RT	17.8	B	205
	US 2 EB LT	7.4	A	m10
	US 2 EB Thru	4	A	75
	US 2 WB Thru/RT	12.5	B	152
	Overall	16.5	B	-
US 2 & US 7	US 7 SB Thru	41.3	D	#180
	US 7 SB RT	11.3	B	211
	US 2 EB LT	16	B	132
	US 2 EB RT	1	A	m6
	US 7 NB LT	32.5	C	165
	US 7 NB Thru	19.2	B	272
	Overall	19.3	B	-

NO RTOR

2035 AM 3-Lane Bridge- NO RTOR FOR OFF-RAMPS

Cycle Length- 80 Seconds

Intersection	Approach	Delay (s/veh)	LOS	95th Percentile Queue
US 2 & I-89 SB Ramps	I-89 SB Off Ramp LT	49.4	D	214
	I-89 SB Off Ramp RT	20.1	C	23
	US 2 EB Thru	10.7	B	166
	US 2 EB RT	2.9	A	49
	US 2 WB Thru	7.7	A	56
	US 2 WB LT	1.7	A	15
	Overall	10.3	B	-
US 2 & I-89 NB Ramps	I-89 NB Off Ramp LT	34.4	C	71
	I-89 NB Off Ramp RT	36.0	D	73
	US 2 EB LT	3.6	A	m7
	US 2 EB Thru	4.4	A	84
	US 2 WB Thru/RT	3.9	A	m130
	Overall	9.2	A	-
US 2 & US 7	US 7 SB Thru	52.9	D	#324
	US 7 SB RT	18.2	B	#657
	US 2 EB LT	12.9	B	75
	US 2 EB RT	6.3	A	139
	US 7 NB LT	48.4	D	#129
	US 7 NB Thru	16.0	B	112
	Overall	23.4	C	-

2035 PM 3-Lane Bridge- NO RTOR FOR OFF-RAMPS

Cycle Length- 70 Seconds

Intersection	Approach	Delay (s/veh)	LOS	95th Percentile Queue
US 2 & I-89 SB Ramps	I-89 SB Off Ramp LT	335.7	D	130
	I-89 SB Off Ramp RT	26.3	C	51
	US 2 EB Thru	6.0	A	83
	US 2 EB RT	1.6	A	29
	US 2 WB Thru	7.8	A	291
	US 2 WB LT	0.1	A	0
	Overall	8.4	B	-
US 2 & I-89 NB Ramps	I-89 NB Off Ramp LT	25	C	180
	I-89 NB Off Ramp RT	19.8	B	235
	US 2 EB LT	7.8	A	m14
	US 2 EB Thru	8.2	A	81
	US 2 WB Thru/RT	16.2	B	136
	Overall	18	B	-
US 2 & US 7	US 7 SB Thru	41.3	D	#180
	US 7 SB RT	11.3	B	211
	US 2 EB LT	16.6	B	139
	US 2 EB RT	1.1	A	5
	US 7 NB LT	32.5	C	165
	US 7 NB Thru	19.2	B	272
	Overall	19.5	B	-

2035 AM 6-Lane Bridge- NO RTOR FOR OFF-RAMPS

Cycle Length- 80 Seconds

Intersection	Approach	Delay (s/veh)	LOS	95th Percentile Queue
US 2 & I-89 SB Ramps	I-89 SB Off Ramp LT	50	D	#275
	I-89 SB Off Ramp RT	24.5	C	27
	US 2 EB Thru	25.2	C	121
	US 2 EB RT	18.5	B	#298
	US 2 WB Thru	42	D	#279
	US 2 WB RT	6	A	35
	Overall	28.5	C	-
US 2 & I-89 NB Ramps	I-89 NB Off Ramp LT	34.6	C	71
	I-89 NB Off Ramp RT	36.1	D	74
	US 2 EB LT	7.4	A	m23
	US 2 EB Thru	6.3	A	m122
	US 2 WB Thru/RT	4.2	A	m134
	Overall	9.9	A	-
US 2 & US 7	US 7 SB Thru	52.9	D	#324
	US 7 SB RT	18.2	B	#657
	US 2 EB LT	7.1	A	49
	US 2 EB RT	5.0	A	77
	US 7 NB LT	48.4	D	#129
	US 7 NB Thru	16.0	B	112
	Overall	22.4	C	-

2035 PM 6-Lane Bridge- NO RTOR FOR OFF-RAMPS

Cycle Length- 70 Seconds

Intersection	Approach	Delay (s/veh)	LOS	95th Percentile Queue
US 2 & I-89 SB Ramps	I-89 SB Off Ramp LT	35.3	D	130
	I-89 SB Off Ramp RT	26.3	C	51
	US 2 EB Thru	14.2	B	65
	US 2 EB RT	3.6	A	50
	US 2 WB Thru	28.9	C	m65
	US 2 WB RT	5.7	A	208
	Overall	11	B	-
US 2 & I-89 NB Ramps	I-89 NB Off Ramp LT	25.2	C	180
	I-89 NB Off Ramp RT	20.3	C	235
	US 2 EB LT	10.6	B	m13
	US 2 EB Thru	5.5	A	91
	US 2 WB Thru/RT	15.2	B	164
	Overall	17.5	B	-
US 2 & US 7	US 7 SB Thru	41.3	D	#180
	US 7 SB RT	11.3	B	211
	US 2 EB LT	15.8	B	125
	US 2 EB RT	0.9	A	3
	US 7 NB LT	32.5	C	165
	US 7 NB Thru	19.2	B	272
	Overall	19.3	B	-

Appendix B: Construction Costs

6-Lane Bridge Alternative (Option 1)

PARSONS BRINCKERHOFF

Route I-89 Option 1: 6-Lane Bridge Project	Qty	U/M	U/C	$
Northbound On-Ramp				
Construct New NB On-Ramp (1-lane) (16' width)	340	lf	$ 405.00	$ 137,700
Northbound Off-Ramp				
Construct New NB Off-Ramp (4 lanes) (62' width)	150	lf	$ 1,568.00	$ 235,200
Construct New NB Off-Ramp (transition from 4 to 3 lanes) (47' width)	60	lf	$ 1,188.00	$ 71,280
Construct New NB Off-Ramp (transition from 3 to 2 lane) (33' width)	50	lf	$ 834.00	$ 41,700
Construct New NB Off-Ramp (2 lane) (24' width)	80	lf	$ 607.00	$ 48,560
Mainline				
Mainline (east of bridge) (transition from NB On/Off ramp to intersection) (110' width)	20	lf	$ 1,332.00	$ 26,640
Mainline (east of bridge) (5 lanes) (70' width)	140	lf	$ 847.00	$ 118,580
Mainline (east of bridge) (transition from 4 to 5 lanes) (67' width)	190	lf	$ 811.00	$ 154,090
Mainline (east of bridge) (transition from 5 lanes + median to 4 lanes, through intersection) (75' width)	150	lf	$ 908.00	$ 136,200
Mainline (east of bridge) (6 lanes) (84' width)	340	lf	$ 1,017.00	$ 345,780
Mainline (west of bridge) (6 lanes) (84' width)	140	lf	$ 1,017.00	$ 142,380
Mainline (west of bridge) (2 lanes) (30' width)	190	lf	$ 363.00	$ 68,970
Mainline (west of bridge) (transition from 4 to 2 lanes) (51' width)	270	lf	$ 617.00	$ 166,590
Mainline (west of bridge) (5 lanes+median) (82' width)	310	lf	$ 993.00	$ 307,830
Mainline (west of bridge) (transition from 5 lanes + median to intersection) (142' width)	40	lf	$ 1,719.00	$ 68,760
Mainline (west of bridge) (transition from 6 lanes to intersection) (134' width)	40	lf	$ 1,622.00	$ 64,880
SB On-Ramp SB Off-Ramp Intersection				
Intersection between SB On-Ramp and SB Off-Ramp (2 lanes) (36' width)	183	lf	$ 436.00	$ 79,788
SB On-Ramp				
Construct New SB On-Ramp (transition from 2 to 1 lanes) (34' width)	290	lf	$ 860.00	$ 249,400
Construct New SB On-Ramp (transition from 2 to 1 lanes) (30' width)	500	lf	$ 759.00	$ 379,500
SB Off- Ramp				
Construct New SB Off-Ramp (transition from 2 to 1 lane) (34' width)	140	lf	$ 860.00	$ 120,400
Construct New SB Off-Ramp (transition from 2 to 1 lane) (30' width)	70	lf	$ 759.00	$ 53,130
Demo Existing Bridge				
	10800	sf	$ 76.00	$ 820,800
Construct New 6-Lane Bridge				
	20900	sf	$ 620.00	$ 12,958,000
Demo Existing Roads				
Existing NB On-Ramp	4350	sf	$ 6.00	$ 26,100
Existing NB Off-Ramp	13500	sf	$ 6.00	$ 81,000
Existing SB Off Ramp	8620	sf	$ 6.00	$ 51,720
Existing SB On-Ramp	1120	sf	$ 6.00	$ 6,720
Existing Pavement to be demolished and reconstructed				
	16600	sf	$ 3.00	$ 49,800
	15300	sf	$ 3.00	$ 45,900
	7650	sf	$ 3.00	$ 22,950
	8360	sf	$ 3.00	$ 25,080
	6600	sf	$ 3.00	$ 19,800
	33400	sf	$ 3.00	$ 100,200
	19000	sf	$ 3.00	$ 57,000
	4900	sf	$ 3.00	$ 14,700
	4200	sf	$ 3.00	$ 12,600
	7300	sf	$ 3.00	$ 21,900
Fill				
	10000	cy	$ 20.00	$ 200,000
TOTAL				$ 17,531,628
Contingency 30%				$ 5,259,488
SubTotal				$ 22,791,116
Total Construction Cost				*$ 22,791,116*

3-Lane Bridge and Loop Ramp Alternative (Option 2)

PARSONS BRINCKERHOFF

Route I-89 Option 2: 3-Lane Bridge and Loop Ramp Project	Qty	U/M	U/C	$
Southbound Off Ramp				
Construct new SB Off Ramp (1 lane) (26' width)	750	lf	$ 657.00	$ 492,750
Construct new SB Off Ramp (transition from 1 to 2 lanes) (29' width)	70	lf	$ 733.00	$ 51,310
Construct new SB Off Ramp (2 lanes) (37' width)	250	lf	$ 216.00	$ 54,000
Construct new SB Off Ramp (2 lanes) (60' width)	30	lf	$ 1,517.00	$ 45,510
Southbound On Ramp				
Construct new SB On Ramp (1 lane) (24' width)	90	lf	$ 607.00	$ 54,630
Construct new SB On Ramp (1 lane) (24' width)	1300	lf	$ 607.00	$ 789,100
Construct new SB On Ramp (1 lane) (42' width)	30	lf	$ 607.00	$ 18,210
Construct new SB On Ramp (1 lane) (7' width)	210	lf	$ 177.00	$ 37,170
Construct new SB On Ramp (transition to full lane) (21' width)	90	lf	$ 531.00	$ 47,790
Construct new SB On Ramp (1 lane) (28' width)	370	lf	$ 708.00	$ 261,960
Northbound On/Off Ramp				
Construct new NB On/Off Ramp (intersection transition) (130' width)	10	lf	$ 3,287.00	$ 32,870
Construct new NB On Ramp (1 lane) (20' width)	220	lf	$ 506.00	$ 111,320
Construct new NB On Ramp (intersection approach) (28' width)	20	lf	$ 708.00	$ 14,160
Construct new NB Off Ramp (intersection transition) (66' width)	30	lf	$ 1,669.00	$ 50,070
Construct new NB Off Ramp (4 lanes) (56' width)	70	lf	$ 1,416.00	$ 99,120
Construct new NB Off Ramp (transition from 4 to 3 lanes) (50' width)	99	lf	$ 1,264.00	$ 125,136
Construct new NB Off Ramp (transition from 3 to 2 lane) (40' width)	70	lf	$ 1,011.00	$ 70,770
Construct new NB Off Ramp (2 lane) (24' width)	90	lf	$ 607.00	$ 54,630
Mainline				
Mainline (east of bridge) (5 lanes) (68' width)	230	lf	$ 823.00	$ 189,290
Mainline (east of bridge) (4 lanes) (61' width)	360	lf	$ 738.00	$ 265,680
Mainline (east of bridge) (transition to 3 lanes) (54' width)	95	lf	$ 654.00	$ 62,130
Mainline (east of bridge) (3 lanes) (48' width)	140	lf	$ 581.00	$ 81,340
Mainline (west of bridge) (3 lanes) (48' width)	70	lf	$ 581.00	$ 40,670
Mainline (west of bridge) (transition to 4 lanes) (54' width)	130	lf	$ 654.00	$ 85,020
Mainline (west of bridge) (4 lanes) (60' width)	310	lf	$ 726.00	$ 225,060
Mainline (west of bridge) (3 lanes) (48' width)	250	lf	$ 581.00	$ 145,250
Mainline (west of bridge) (transition from 2 to 3 lanes) (43' width)	110	lf	$ 521.00	$ 57,310
Mainline (west of bridge) (2 lanes) (36' width)	80	lf	$ 436.00	$ 34,880
Demo Existing Bridge				
	10800	sf	$ 76.00	$ 820,800
Construct New 3-Lane Bridge				
	11800	sf	$ 596.00	$ 7,032,800
Bike Lane (5' width)				
	240	lf	$ 50.00	$ 12,000
Demo Existing Roads				
Existing SB Off Ramp	15000	sf	$ 6.00	$ 90,000
Existing Mainline (west of bridge)	20500	sf	$ 6.00	$ 123,000
Existing Mainline (east of bridge)	12900	sf	$ 6.00	$ 77,400
Existing SB On Ramp	3300	sf	$ 6.00	$ 19,800
Existing SB On Ramp	8700	sf	$ 6.00	$ 52,200
Existing NB Off Ramp	8000	sf	$ 6.00	$ 48,000
Existing NB On-Ramp	2200	sf	$ 6.00	$ 13,200
Existing Pavement to be demolished and reconstructed				
	18700	sf	$ 3.00	$ 56,100
	6600	sf	$ 3.00	$ 19,800
	4100	sf	$ 3.00	$ 12,300
	3500	sf	$ 3.00	$ 10,500
	29400	sf	$ 3.00	$ 88,200
	9400	sf	$ 3.00	$ 28,200
Fill				
	54000	cy	$ 20.00	$ 1,080,000
TOTAL				$ 13,181,436
Contingency 30%				$ 3,954,431
SubTotal				$ 17,135,867
Total Construction Cost				*$ 17,135,867*

Appendix C: Natural Resources Assessment Report

EIV TECHNICAL SERVICES
55 Leroy Rd, Suite 15
Williston, VT 05495
Tel: 802-497-3653 Fax: 802-497-3656

October 12th, 2013

Stephen Rolle, P.E.
Senior Supervising Transportation Engineer
Parsons Brinckerhoff
75 Arlington Street
Boston, MA 02116

Mr. Rolle:

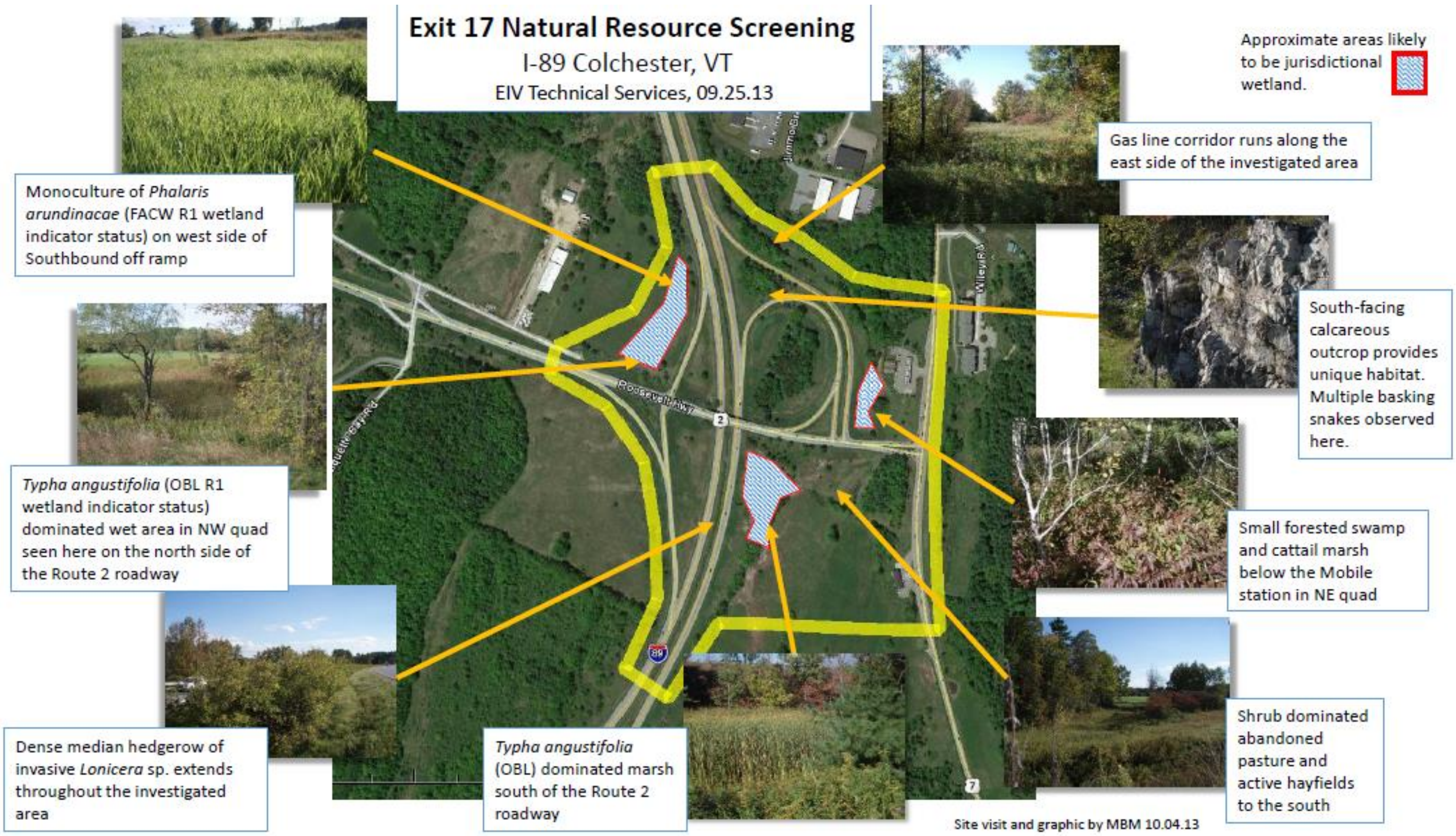
EIV Technical Services has completed a natural resource assessment for the project study area at Exit 17 on I-89 in Colchester, Vermont. We understand that the proposed project at this location incorporates the I-89 Exit 17 highway interchange and Chimney Corner intersection of US Route 2 and US Route 7. Jurisdictional resources found within the study area and their permitting requirements have been identified within this report. We believe the information provided below will be useful in developing alternatives which will avoid, minimize or mitigate, to the extent possible, any potential natural resource impacts.

Rare, Threatened and Endangered (RTE) Species
A query of the NHIP database returned ten known element occurrences (EOs) of state RTE species within a one-mile radius of the project study area (see Appendix A. Natural Resource Maps). Only two species are State-listed Threatened, and no species have the Federal-listed endangered classification. Of the mapped EOs, none are mapped within the study area. Based on the database review and initial on-site habitat inspections, EIV believes that no rare, threatened or endangered species occur within the project study area.

Prime Agricultural Soils
A database search of NRCS-mapped soils indicates there are mapped prime agricultural soils within the project study area (see Appendix A. Natural Resource Maps). These soil types include Scantic silt loam, and Munson and Raynham silt loams. The project should not reduce the agricultural potential of the prime agricultural soils if work occurs within a previously disturbed area. If work is to occur beyond existing disturbed soil, coordination with the VT Department of Agriculture is recommended.

Wetlands

The project study area has hydric soils throughout the entire area, and three cattail and reed canary-grass dominated emergent marsh areas were identified during our field assessment (9/25/2013 and 10/3/2013). The approximate locations of these areas are highlighted within the graphic below and would likely be jurisdictional wetlands requiring permitting for impacts to them and their buffers. They are largely dense monocultures of two species, *Typha angustifolia* and *Phalaris arundinacae*, and are of marginal habitat quality due to their direct proximity to the interstate travel lanes.



The area identified within the Northwest quadrant of the study area is within the VSWI state mapped Class II wetland inventory. A map of this wetland area and nearby VSWI wetlands are included in Appendix A. Natural Resource Maps.

If it is anticipated that these areas will be impacted, a wetland delineation and survey will need to be completed by a wetland scientist to determine classification and extent of the wetland area. A Vermont Wetland Permit through the Agency of Natural Resources will need to be acquired prior to disturbing any jurisdictional wetlands or their buffers (50 feet from the delineated wetland area).

Significant Natural Communities

A query of the NHIP database returned four types of significant natural communities within a one mile search radius of the study area: Mesic Clayplain Forest (S2 – rare in the state), Transition Hardwood Talus Woodland (S3- high quality examples are uncommon in the State), Mesic Maple-Ash-Hickory-Oak Forest (S3), and Red Cedar Woodland (S2). Although these significant natural communities exist nearby, none were found within the project study area.

Site visits were made on September 25th and October 3rd, 2013 by Matthew Montgomery. With the exception of the southeast quadrant, the vast majority of the investigated land area was dominated by man-made topography as a result of constructing the interstate travel-lanes and associated on and off ramps. All of the roadway shoulders and median areas between the exit/entrance ramps are seasonally mowed. These areas were dominated by grasses such as *Bromus, Poa, Dactylis,* and *Lolium* species. Identification to species was difficult as the area had been recently mowed. The ditch-lines in most of these open areas supported hydric species but these would be unlikely to be protected legally as wetland. Other common and often weedy herbaceous species that were observed to be present in varying abundances in all roadside areas are listed below:

Artemisia vulgaris	*Conyza canadensis*	*Medicago lupulina*	*Phleum pratense*
Asclepias syriaca	*Daucus carota*	*Melilotus officinalis*	*Setaria pumila*
Bidens frondosa	*Digitaria sp.*	*Pastinaca sativa*	*Solidago canadensis*
Calystegia sepium	*Elytrigia repens*	*Phalaris arundinacea*	*Sonchus oleraceus*
Cichorium intybus	*Festuca sp.*		*S. arvensis*
Cirsium arvense			*Vicia sp.*

Other community types within the project study area include:

> *Gas line corridor:* There is a natural gas pipeline present along the east side of the interstate ROW corridor. Tree growth had been removed from a majority of this corridor and a habitat of diverse assemblage of herbaceous species was created. While diverse, no uncommon species were observed.
>
> *Forested Outcrop:* Patches of upland forest on a few calcareous outcrops exist throughout the area and have remained largely undisturbed since the interstate construction. Several mature high quality specimens of both white and red oak, as well as shagbark hickory were observed. This community would be best described as a mid-successional Mesic Maple-Ash-Hickory-Oak forest and may represent the best quality habitat in the investigated area for migratory bird species or other small animals that require mature oak woodlands. Several basking reptiles were observed on the rocky outcrops.
>
> *Dense shrub thicket:* A dense monocultural hedgerow of a non-native honeysuckle (*Loniceria*) species occurs in the median between the north and southbound travel lanes. These species can become invasive in some settings as the fruits are disseminated by birds.

Old pasture: What appears to be abandoned pasture land that is in the process of reverting to forest and shrub land is found near the Route 2 roadway in the southeast quadrant of the investigated area. This area likely provides habitat to common small mammals and birds.

Agricultural field: This field is found in the southeast quadrant of the investigated area, behind Simon's chimney corners convenience store and south of the abandoned pasture land that abuts the Route 2 roadway to the north and the cattail marsh to the west. It is dominated by common forage grasses such as *Plelum pratense, Dactylus glomerata,* and *Bromus* species and appears to be regularly used for forage production.

It is EIV's opinion that none of the onsite natural or otherwise vegetative communities should be considered significant. Representative photographs of on-site habitat conditions can be found on Page 2 of this report.

Necessary Wildlife Habitat
The ANR database review identified a state-mapped white-tailed deer wintering area approximately 1 mile Southwest of the project area. This wildlife habitat is approximately 267 acres and is contained within the Niquette Bay State Park. Field review of the on-site habitat within the project area found no necessary wildlife habitat areas.

Hazardous Waste Sites
Within the Exit 17 project study area, there are two underground storage tanks and two hazardous waste sites. These are located at the Chimney Corner's Mobil Gas Station and the Simon Chimney Corners properties.

- The hazardous waste site at *Chimney Corner's Mobil Gas Station (#20033114)* is where four gasoline underground storage tanks (UST) and one heating oil UST were removed. During the excavation elevated PID ratings were found and monitoring was required from 2003 to 2004. The contamination levels fell below VGES in 2004 and the site was closed. The water supply is believed to be unaffected.
- The hazardous waste site at *Simon Chimney Corners (#982420)* had contamination discovered during the removal of two gasoline tanks, which were found to be in excellent condition. Contamination may have originated from overfill(s) during tank refills or dispensing. Following the environmental investigation, contamination is believed to be focused in soils from 4 to 7 feet below grade. Soil samples taken from borings showed several elevated VOC concentrations, though none were above the EPA Region IX PRGs. Residual contamination remains in the subsurface soil and/or groundwater at this site's location. The Vermont Department of Environmental Conservation, Waste Management Division, should be contacted prior to disturbance at this site.

Feel free to contact myself or Matthew Montgomery regarding the natural resource information above, 802-497-3653.

Sincerely,

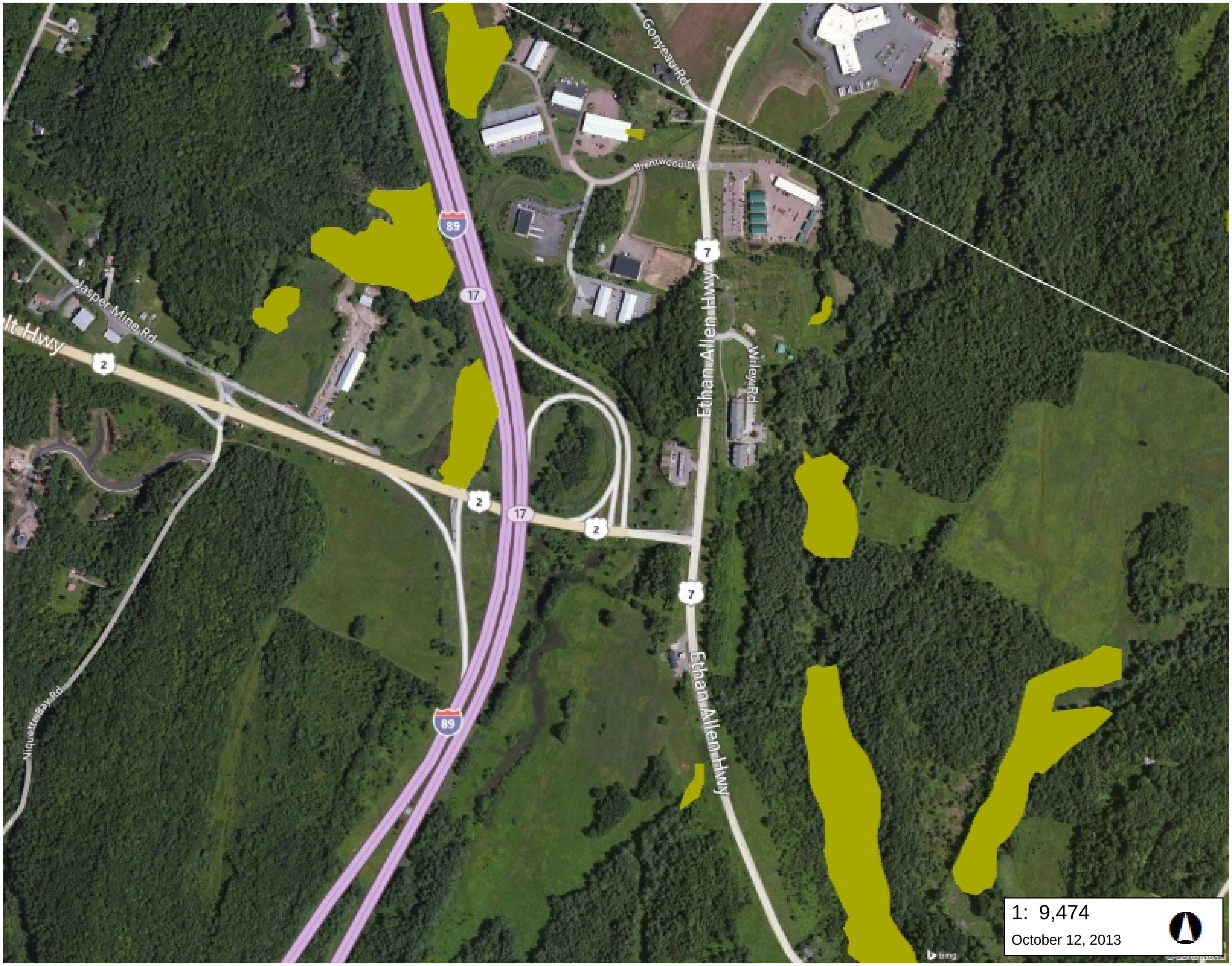
Jacqueline Dagesse

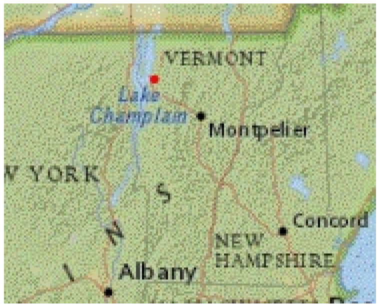
Appendix A. Natural Resource Maps

Exit 17 - VSWI Wetlands

Vermont Agency of Natural Resources

vermont.gov





LEGEND

Wetlands - VSWI

- Class 1 Wetland
- Class 2 Wetland

Wetlands - VSWI Advisory Lay

Town Boundary

481.0 0 240.00 481.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 790 Ft. 1cm = 95 Meters

THIS MAP IS NOT TO BE USED FOR NAVIGATION

DISCLAIMER: This map is for general reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. ANR and the State of Vermont make no representations of any kind, including but not limited to, the warranties of merchantability, or fitness for a particular use, nor are any such warranties to be implied with respect to the data on this map.

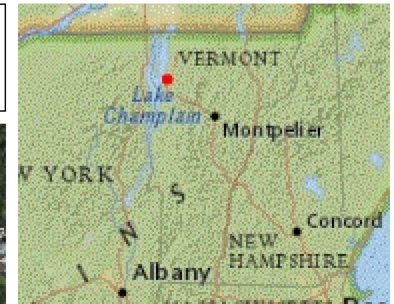
NOTES

Map created using ANR's Natural Resources Atlas

Exit 17-Significant Natural Communities

Vermont Agency of Natural Resources

vermont.gov



LEGEND

- Significant Natural Community
- Town Boundary

963.0 | 0 | 482.00 | 963.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere

1" = 1579 Ft. 1cm = 189 Meters

THIS MAP IS NOT TO BE USED FOR NAVIGATION

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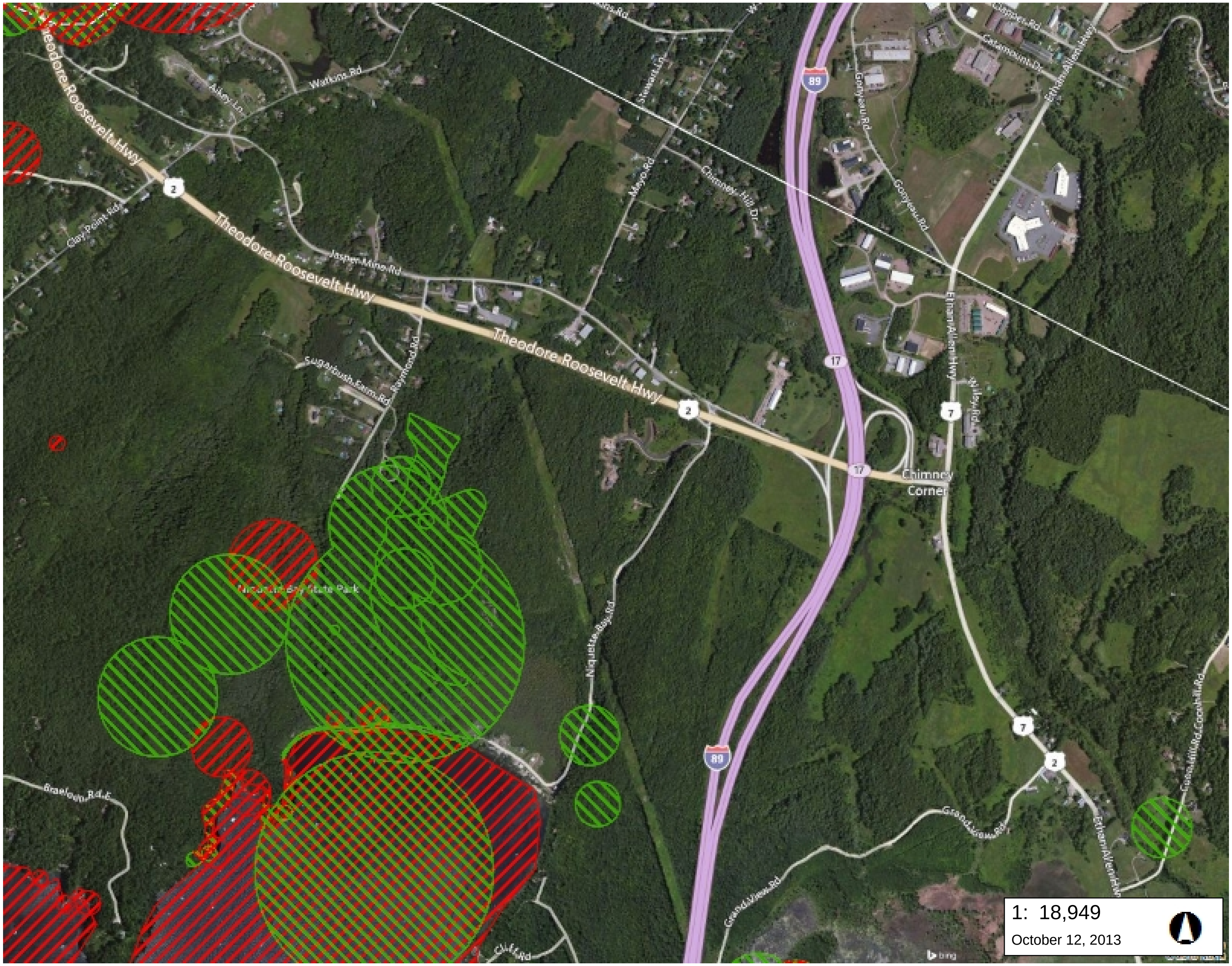
NOTES

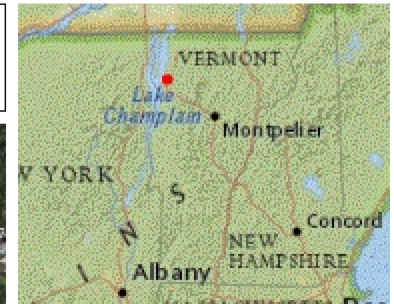
Map created using ANR's Natural Resources Atlas

Exit 17-Rare, Threatened & Endangered Species

Vermont Agency of Natural Resources

vermont.gov





LEGEND

Rare Threatened Endangered

- Threatened or Endangered
- Rare

Town Boundary

1: 18,949

October 12, 2013

963.0 | 0 | 482.00 | 963.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere

1" = 1579 Ft. 1cm = 189 Meters

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NOTES

Map created using ANR's Natural Resources Atlas

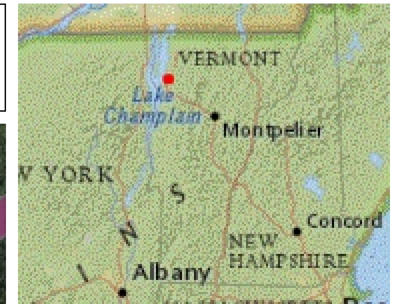
Exit 17 - Prime Agricultural Soils

Vermont Agency of Natural Resources

vermont.gov

1: 18,949

October 12, 2013



LEGEND

Soils - Prime Agricultural

- Local
- Local (b)
- Not rated
- Prime
- Prime (b)
- Prime (f)
- Statewide
- Statewide (a)
- Statewide (b)
- Statewide (c)

Town Boundary

NOTES

Map created using ANR's Natural Resources Atlas

963.0 0 482.00 963.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 1579 Ft. 1cm = 189 Meters

THIS MAP IS NOT TO BE USED FOR NAVIGATION

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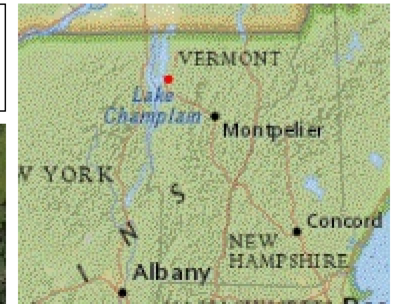
Exit 17 - Hazardous Waste

Vertmont Agency of Natural Resources

vermont.gov

1: 9,474

October 12, 2013



LEGEND

- Hazardous Waste Site
- Hazardous Waste Generators
- Brownfields
- Town Boundary

481.0 0 240.00 481.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere

1" = 790 Ft. 1cm = 95 Meters

THIS MAP IS NOT TO BE USED FOR NAVIGATION

DISCLAIMER: This map is for general reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. ANR and the State of Vermont make no representations of any kind, including but not limited to, the warranties of merchantability, or fitness for a particular use, nor are any such warranties to be implied with respect to the data on this map.

NOTES

Map created using ANR's Natural Resources Atlas

VERMONT

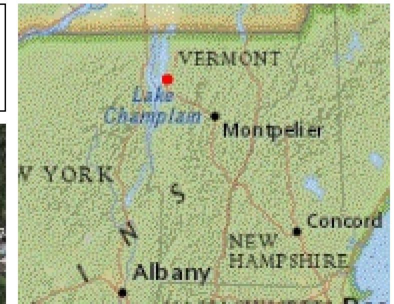
Exit 17 - Deer Wintering Areas

Vermont Agency of Natural Resources

vermont.gov

1: 18,949

October 12, 2013



LEGEND

- Deer Wintering Areas
- Town Boundary

963.0 | 0 | 482.00 | 963.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere

1" = 1579 Ft. 1cm = 189 Meters

THIS MAP IS NOT TO BE USED FOR NAVIGATION

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NOTES

Map created using ANR's Natural Resources Atlas

Appendix D: Archeological and Historical Assessment Report

ARCHEOLOGICAL RESOURCE AND HISTORICAL ASSESSMENT

I-89 Exit 17 Scoping Study

Town of Colchester
Chittenden County, Vermont

HAA # 4620.11

Submitted to:
Jacqueline Dagesse, MBA, PMP
EIV Technical Services
55 Leroy Road, Suite 15
Williston, Vermont 05495
802.497.3653
e. jdagesse@eivtech.com

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An ACRA Member Firm
www.acra-crm.org

July 2013

ARCHEOLOGICAL RESOURCE AND HISTORICAL ASSESSMENT

INTRODUCTION

Hartgen Archeological Associates, Inc. (Hartgen) was retained by EIV Technical Services to conduct an Archeological Resource Assessment (ARA) and Historical Assessment for the proposed Scoping Study of the I-89 Exit 17 improvements project located in the Town of Colchester, Chittenden County, Vermont (Map 1). The proposed project incorporates the I-89 Exit 17 highway interchange and Chimney Corner intersection of US Route 2 and US Route 7. The project is contracted by the Chittenden County Regional Planning Commission (CCRPC) and financially supported with Federal, State and local funding. The project will be reviewed by the Vermont Agency of Transportation (VTrans).

The primary objective of the ARA is to identify areas of archeological sensitivity based on environmental factors, known site information and historical information for the project Area of Potential Effects (APE). Reference to the general project vicinity is provided as appropriate to understanding the local cultural and historical context. Background research was conducted at the Vermont Division for Historic Preservation (VDHP) where archeological site files, National Register (NR), State Register (SR) and town information were reviewed. A site visit was conducted by Elise Manning Sterling on June 7, 2013 to observe and photograph existing conditions within the project area.

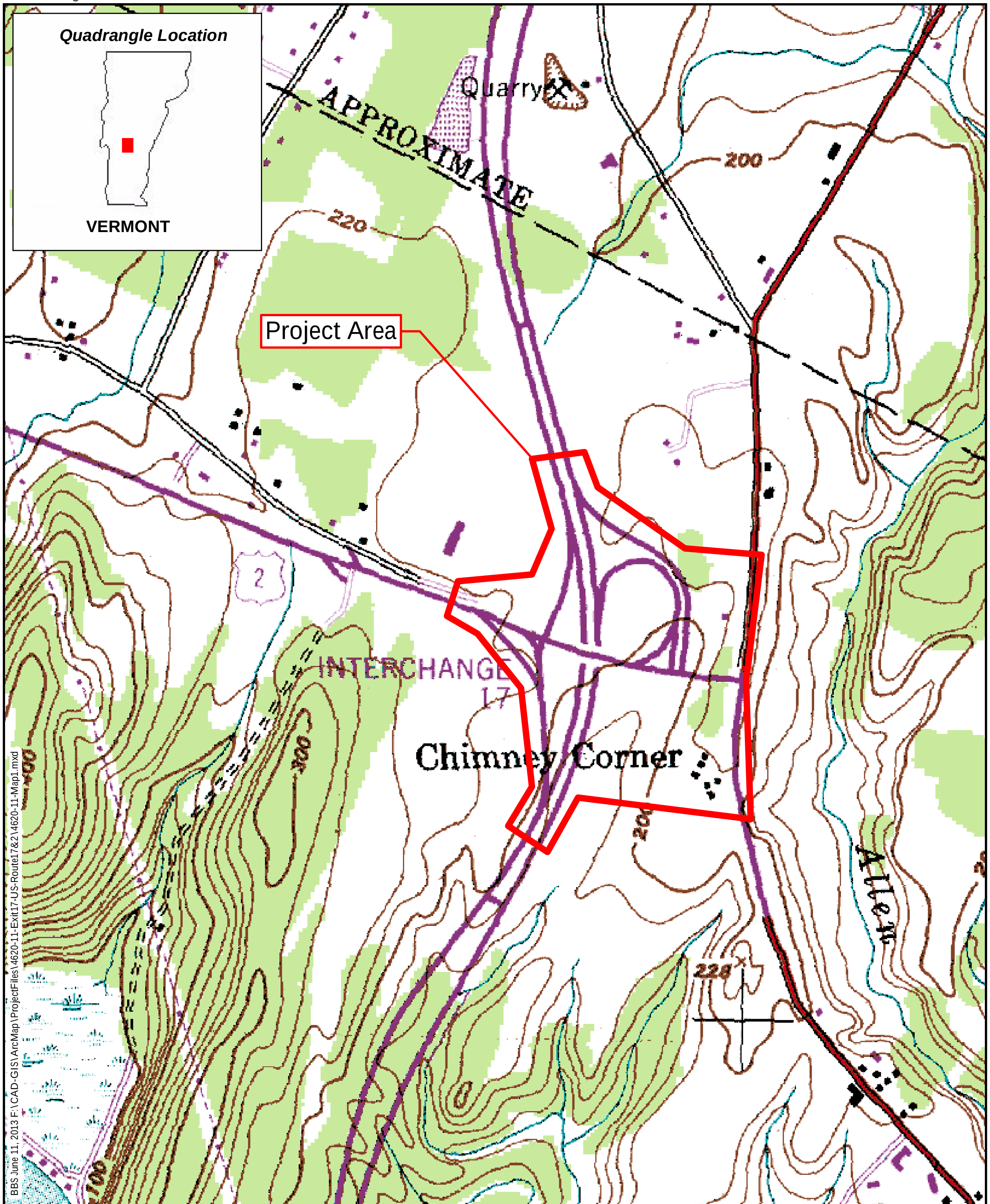
Current Conditions and Environmental Overview

The project APE is large, encompassing the Exit 17 interchange, including the access ramps and areas beyond to Route 7 to the east, covering an approximate area of 64 acres (Map 2). The areas of obvious disturbance include the I-89 northbound and southbound highway lanes, cloverleaf and access ramps and areas directly adjacent. The landforms not directly adjacent to the roadways may remain relatively undisturbed. There is a variety of landforms within the project area, including level low-lying areas adjacent to small streams and wetlands (west of I-89), elevated land on large bedrock formations (encompassed within the cloverleaf east of I-89, and directly southwest of Chimney Corner), and gently sloping terrain overlooking wetlands (east of I-89). The only standing structures located within the project area are two gas stations, one located at the northwest corner of Chimney Corner, and the other located west of Route 7, at the southeast corner of the project area.

Environmental characteristics of an area are significant for determining the sensitivity for archeological resources. Precontact and historic groups often favored level, well-drained locations near wetlands and waterways. Therefore, topography, proximity to wetlands, and soils are examined to determine if there are landforms in the project area that are more likely to contain archeological resources. In addition, bedrock formations or other lithic sources may contain resources that were quarried by precontact groups. Other locations can also be special purpose sacred and traditional use sites. Soil conditions can provide a clue to past climatic conditions, as well as changes in local hydrology.

The I-89 Exit 17 project APE is located in the Vermont Lowlands physiographic region within the Lake Champlain basin. The terrain within the APE is varied, exhibiting low level terraces adjacent to wetlands, gentle and steep slopes, and exposed bedrock faces situated at approximate elevations of 180 to 220 feet (55 to 67 m) above mean seal level (amsl). The project area is located approximately one mile (1.6 km) northeast of Malletts Bay on Lake Champlain, and two miles (3.2 km) southeast of the Lamoille River. There are a number of wetlands and small named and unnamed streams and drainages in the project vicinity which flow south and west, channeling into the extensive wetlands located east of Malletts Bay.

The primary soils types represented in the project area include Munson and Belgrade silt loams at 2 to 12 percent slopes. These soil types are located on level terrace landforms on lake plains. The Munson and Belgrade series are characterized as somewhat poorly drained silt loam derived from coarse-silty glaciolacustrine deposits over clayey glaciolacustrine deposits (USDA 2013) These soils are predominant in



N

0 1,000 2,000 Feet

0 200 400 600 Meters

Note: Contour interval is 20 feet.

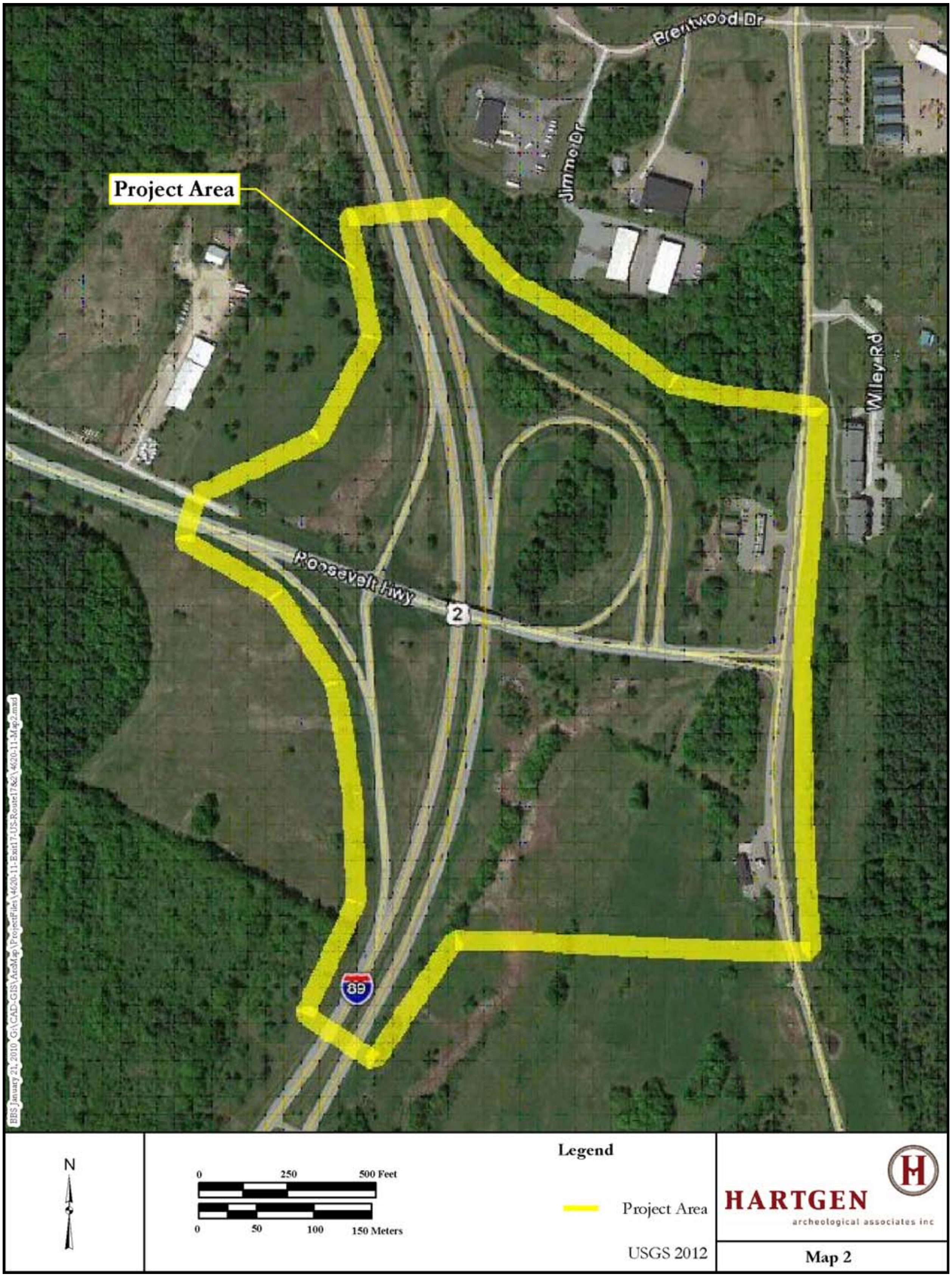
Legend

Project Area

USGS 1961, Photorevised 1980
Pico Peak, Vermont

HARTGEN
archeological associates inc

Map 1


Project Area
Brentwood Dr
Jimmo Dr
Willey Rd
Roosevelt Hwy
2
89
BBS January 21, 2010 G:\CAD-GIS\ArcMap\ProjectFiles\4620-11-Exit17-US-Route17&2\4620-11-Map2.mxd
N
0 250 500 Feet
0 50 100 150 Meters
Legend
Project Area
USGS 2012
HARTGEN
archeological associates inc
Map 2

all but the northeastern portion of the project area. Farmington extremely rocky loam series, 5 to 60 percent slope, are located along the eastern and northeastern section of the project area where the land slopes steeply down toward Allen Brook (East of Route 7).

DOCUMENTARY RESEARCH

Precontact Site File Research and Archeological Sensitivity

Examination of VDHP site files indicates that there are several hundred precontact sites located within a few miles of the project area, situated adjacent to wetlands, Lake Champlain, the Winooski River, and their numerous tributaries, including Allen and Muddy Brooks. Many of the sites are open-air camps of short term occupation, which contain scatters of lithic debitage, stone tools and fire-cracked rock. Since these sites often contain few artifacts, their cultural and temporal affiliations are unknown. A few of the nearby sites contain diagnostic tools, with greater concentrations of lithics, pottery, and/or buried features that can be associated with particular time periods. Nearby are sites which date from the Contact, Woodland, Archaic and Paleoindian Periods, demonstrating the favorability of the project area for hunting and occupation throughout the precontact era.

The VDHP site files were studied for sites located within a one mile (1.6 km) radius of the project area. There were five sites identified within three-quarters of a mile (1.2 km) of the project APE, which include:

VT-CH-138 is located either within or directly adjacent to the northwestern section of the project area. The site, situated on a large level terrace next to a small tributary of Allen Brook, was identified based on the recovery of quartzite flakes in a plowed field.

VT-CH-885 is located approximately 1,000 feet (305 m) northeast of the northeastern corner of the project APE, situated on a large terrace overlooking Allen Brook. Two areas of precontact activity were identified at this site, which covered an area of approximately 1.1 acres (0.45 ha). One of the precontact areas dates to the Late Archaic Period, and is considered eligible for listing on the National Register (NR) of Historic Places.

Three multi-component sites, situated in close proximity to one another, are located approximately 3,000 feet (0.91 km) to the north of the project APE. All three of these sites are considered NR eligible, and include:

VT-CH-21 contains Late Archaic, Terminal Archaic, and Late Woodland components, based on the recovery of a number of projectile point types, including Otter Creek, Vosburg, Susquehanna, Orient Fishtail, and Levanna.

VT-CH-54 has components dating to the Paleoindian, Late Archaic and Middle to Late Woodland Periods, based on the recovery of two spurred scrapers, and Narrow Point Tradition and Levanna projectile points.

VT-CH-101 has five different activity loci, which date to the Late Archaic, Early Woodland, Middle Woodland and Late Woodland Periods. Projectile point types recovered at the site include Jack's Reef, Meadowood, Normanskill, and Levanna.

The VDHP Environmental Predictive Model was completed for the project area and produced an overall rating of 84 (Appendix 1), with a rating of 32 or above indicating precontact sensitivity. The project area received points based on its location within a travel corridor, situated near wetlands and streams in an area of high precontact site density. Undisturbed areas within the project APE are considered to have high precontact sensitivity.

Historic Site File Search and Archeological Sensitivity

National Register

There are no National Register listed sites located within or adjacent to the project area.

Vermont State Register

There are no historic structures listed on the Vermont State Register or inventoried in the Vermont Historic Sites and Structures Survey located within or adjacent to the project area.

Cemeteries

There are no known cemeteries located within or adjacent to the project area (Hyde and Hyde 1991).

Historic Sites

An examination of the VDHP archeological site files indicated that there are no historic archeological sites reported within one mile of the project area.

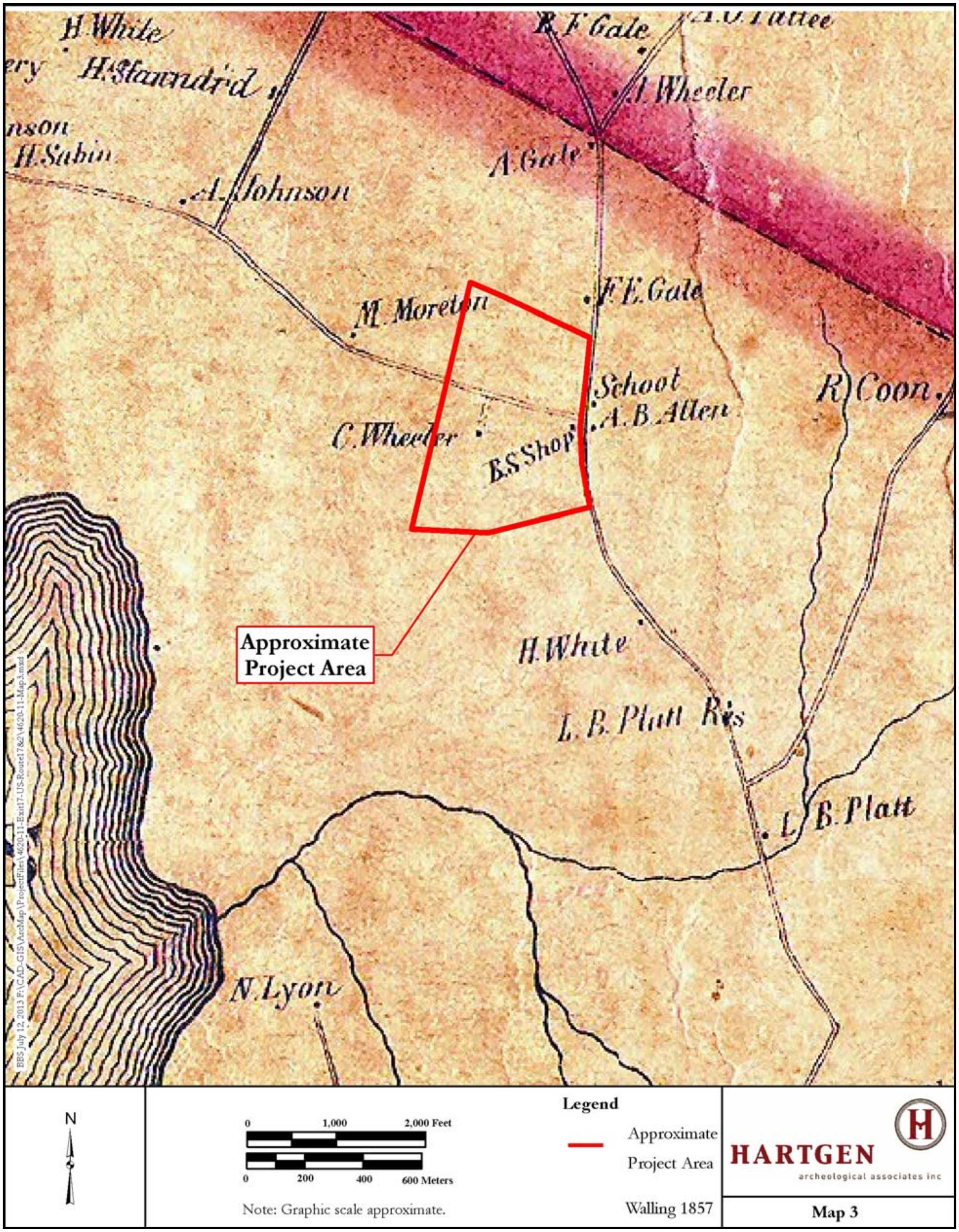
Historic Maps

A review of historic maps of the project area was conducted to attain an overview of the changing historical and environmental landscape within the project area. This review includes the study of historic structures that may be or may no longer be extant, alterations to road and rail systems, and changes in stream and river courses. Two 19th-century maps, the 1857 Walling map and the 1869 Beers map, depict the roadways and river and stream courses in the project area, as well as the names of the residents who lived there in those years (Maps 3 & 4).

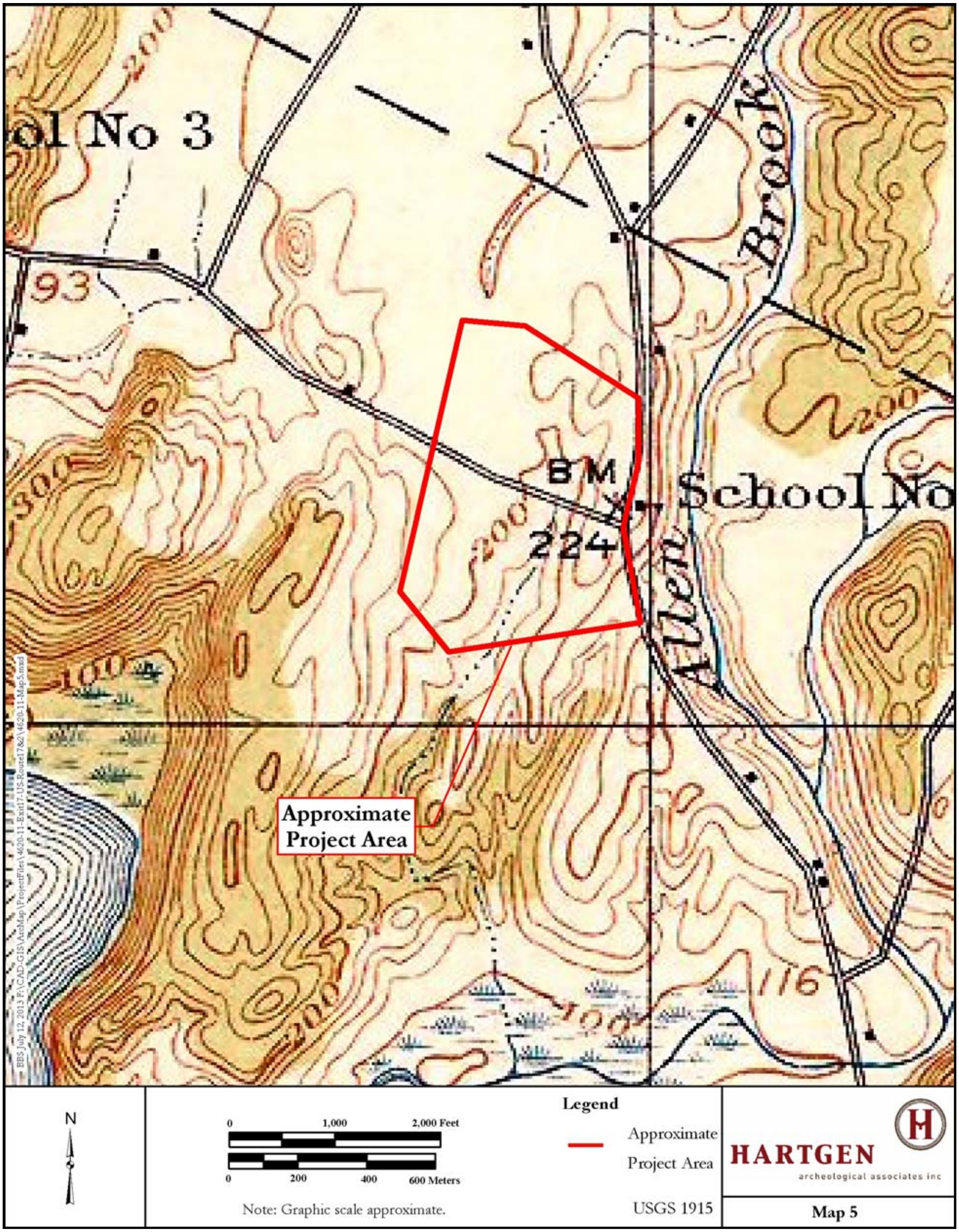
The 1857 Walling map depicts the road intersection of Chimney Corner with several adjacent structures, including a Blacksmith (BS) Shop on the southwest corner, a School to the northeast, and the residence of A. B. Allen to the southeast. The school and the Allen residence are situated on the east side of (present day) US Route 7, outside of the APE. The location of the BS shop is included within the APE, as is the residence of C. Wheeler, depicted further to the west on the south side of (present day) US Route 2. The 1869 Beers atlas also shows these same four structures, and no others within the project area.

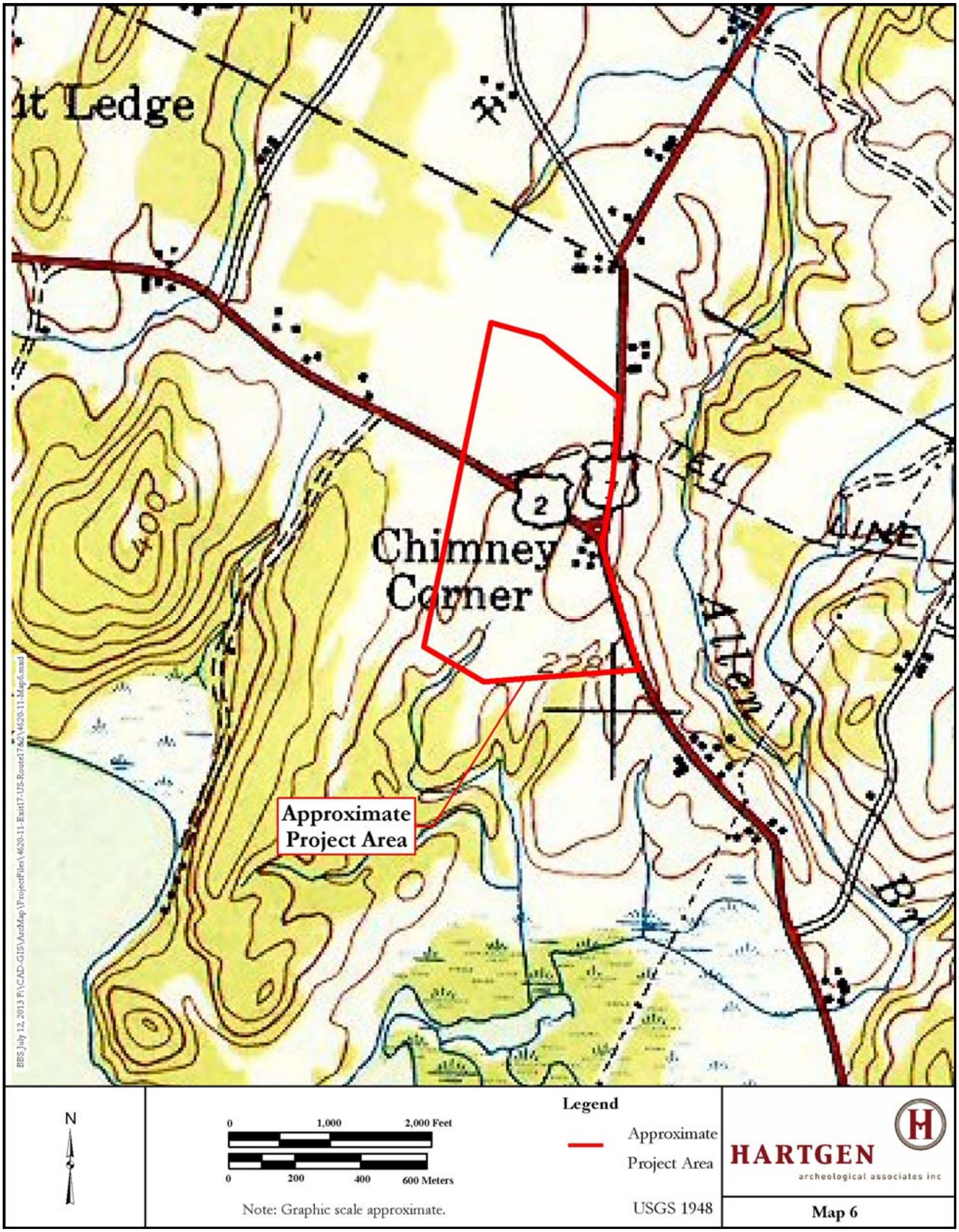
The 1913 United States Geological Survey (USGS) map indicates that of these four structures, only the school – School No. 9 – was standing at that time (Map 5). The1948 USGS map indicates that there had been some alteration to the Chimney Corner design, with the T-intersection changing to a triangular configuration (Map 6). The 1948 map also shows a cluster of structures had been built to the south of Chimney Corner. The most recent USGS map of Colchester, photorevised in 1984, shows this same cluster of structures located to the south, as well as a return to the original T-intersection design (Map 1). The only structure remaining in this general locale is the gas station located west of US Route 7.

The primary development within the project area is the Exit 17 Interchange. Its construction significantly altered this otherwise rural crossroads. The historic map research indicates that there were at least two 19th-century structures located within the project APE – the blacksmith shop, and the C. Wheeler residence. By comparing the various maps, the previous location of the C. Wheeler home, which was no longer standing in 1913, is approximated to be within the I-89 highway corridor. The blacksmith shop was located on the south side of US Route 2, to the southwest of Chimney Corner. Today, a high bedrock outcrop is located at this corner. It is likely that the blacksmith shop was located at the lower road level, and was destroyed through modern road widening.


H. White
H. Sabin
A. Johnson
A. Gale
I. Wheeler
F. E. Gale
M. Moreton
School
A. B. Allen
C. Wheeler
B.S. Shop
R. Coon
H. White
L. B. Platt Res
L. B. Platt
N. Lyon
Approximate Project Area
N
0
1,000
2,000 Feet
0
200
400
600 Meters
Note: Graphic scale approximate.
Legend
Approximate Project Area
Walling 1857
HARTGEN
archeological associates inc
Map 3


B.F. Gale
J. Galvin
A.N. Johnson
F.E. Gale
School No. 9
R. Coon
J. Cain
B.S.S.
A. Allen
F.F. Mitchell
M. Martin
P. Mason
A. Robb
T. Burns Jr.
A. Allen
DIST No 9
DIST No 1
Approximate Project Area
N
0 1,000 2,000 Feet
0 200 400 600 Meters
Note: Graphic scale approximate.
Legend
Approximate Project Area
Beers 1869
HARTGEN
archeological associates inc
Map 4


ol No 3
93
200
300
100
BM
224
School No
Brook
Allen
116
Approximate
Project Area
N
0
1,000
2,000 Feet
0
200
400
600 Meters
Note: Graphic scale approximate.
Legend
Approximate
Project Area
USGS 1915
HARTGEN
archeological associates inc
Map 5


Ledge
Chimney Corner
2
400
Allen Br
TEL LINE
228
Approximate Project Area
BBS July 12, 2013 F:\CAD-GIS\ArcMap\ProjectFiles\4620-11-Exit17-US-Route17&2\4620-11-Map6.mxd
N
0 1,000 2,000 Feet
0 200 400 600 Meters
Note: Graphic scale approximate.
Legend
Approximate Project Area
USGS 1948
HARTGEN
archeological associates inc
Map 6

Due to previous disturbance within the APE, the project area is considered to have a low sensitivity for historic archeological sites. The only standing structures located within the project area are two gas stations/convenience stores. There are no structures located within or adjacent to the APE listed on the Vermont State Register. The proposed project does not pose threats to historic structures or features.

ARCHEOLOGICAL POTENTIAL AND RECOMMENDATIONS

A site visit was made to the I-89 Exit 17 project area on June 7, 2013 under rainy and warm conditions. The field reconnaissance identified areas of obvious disturbance, as well as areas of archeological sensitivity, which are shown on Map 7. Areas of disturbance include the northbound and southbound highway lanes, the cloverleaf and access ramps, and areas directly adjacent (Photos 1-2). The northwest corner of Chimney Corner, the location of the modern gas station and convenience store, has been disturbed through construction and earthmoving activities (Photo 3). The gas station located south of Route 2 and west of Route 7 is also considered to be disturbed (Photo 4). These developments have significantly limited the potential for intact historic archeological deposits to be located in these specific portions of the APE.

Photo 1. Area of disturbance located between US Route 2 and the I-89 southbound access ramp. View is to the east.

Photo 2. Area of disturbance located between US Route 2 and the cloverleaf access road. View is to the east.

Photo 3. The disturbed area adjacent to the gas station located at the northwest corner of the US Route 2 and US Route 7 intersection. View is to the south toward US Route 2.

There are a variety of landforms within the APE not directly adjacent to the highway alignment and access ramps that are considered to have precontact sensitivity. These sensitive areas are shown on Map 6, and include: level lowlying areas adjacent to small streams and wetlands located west of I-89 (Photos 4-5), high bedrock formations that are located within the cloverleaf east of I-89, and directly southwest of Chimney Corner (Photos 6-7), and gently sloping terrain overlooking wetlands, located east of I-89, both north and south of US Route 2 (Map 6, Photos 8-11). It is recommended that Phase IB archeological testing be conducted in any of these sensitive areas that will be affected by proposed Exit 17 improvements.

Photo 4. The gas station and parking lot located on the west side of US Route 7 intersection, south of US Route 2. View is to the northwest.

Photo 5. The low-lying archeological sensitivity area located west of I-89 and north of US Route 2. Archeological site VT-CH-138 was identified near this locale. View is to the north.

Photo 6. The low-lying archeological sensitivity area located west of I-89 and south of US Route 2. View is to the south.

Photo 7. The bedrock outcrop and land located within the cloverleaf access ramp located east of I-89 and north of US Route 2. View is to the north.

Photo 8. The bedrock outcrop and terrain located at the southwest corner of US Route 2 and US Route 7 intersection. View is to the northwest.

Photo 9. The terrain and wetlands located west of the gas station at the northwest corner of US Route 2 and US Route 7 intersection. View is to the northwest.

Photo 10. The gently sloping terrain and the low-lying wetlands located between I-89 and US Route 7, south of US Route 2. View is to the west toward I-89.

Photo 11. The gently sloping terrain and the low-lying wetlands located between I-89 and US Route 7, south of US Route 2. View is to the north toward US Route 2.

Photo 12. The raised level terrain located north of the gas station on the west side of US Route 7 (on the right). View is to the north toward the US Route 2/US Route 7 intersection.

REFERENCES

Beers, F.W.
1869 *Atlas of Chittenden County, Vermont*. F.W. Beers & Co., New York. Reprinted in 1971 by Charles E. Tuttle Company, Rutland, Vermont.

Consulting Archaeology Program
2001 *End-of-Field Letter for Phase II Archaeological Site Evaluation for the Proposed Arbor Gardens Apartments Development, Colchester, Chittenden County, Vermont,* Consulting Archaeology Program, University of Vermont. Report on file at the VDHP, Montpelier.

Doll, Charles G., Wallace M. Cady, James B. Thompson, Jr. and Marland P. Billings
1961 *Centennial Geologic Map of Vermont*. State of Vermont Geological Survey, Waterbury, Vermont.

Hyde, Arthur L. and Frances P. Hyde, editors
1991 *Burial Grounds of Vermont*. The Vermont Old Cemetery Association, Bradford, Vermont.

United States Department of Agriculture (USDA)
2013 Web Soil Survey 2.0, National Cooperative Soil Survey, accessed on June 6, 2013 at http://websoilsurvey.nrcs.usda.gov/app/.

United States Geological Survey (USGS)

1913 *Colchester, Vermont 7.5' Topographic Quadrangle*. Surveyed 1948. U.S. Government Printing Office, Washington, D.C.
1948/72 *Colchester, Vermont 7.5' Topographic Quadrangle*. Surveyed 1948. U.S. Government Printing Office, Washington, D.C.

Vermont Division for Historic Preservation (VDHP)
2002 *Guidelines for Conducting Archeology in Vermont*. The Vermont State Historic Preservation Office, Montpelier, VT.

Vermont Geological Survey
2013

Walling, H. F.
1857 *Map of Chittenden County, Vermont*. Republished in 2005 by Old Maps, West Chesterfield, NH.

APPENDIX 1: VDHP Archeological Predictive Model Form

Vermont Division for Historic Preservation
Archeological Resources Assessment Form
Exit 17 Scoping Study

DHP#
Organization & Recorder: **HAA. INC./ E. Manning**
Date: 6/27/2013

Envronmental Predictive Model				ArcheoMapTool GIS Model	Field Inspection Comments
Variable	Proximity	Value	Assigned Score	Variable	
A. Rivers and Streams (Existing or relict)					
1) Proximity to Rivers and Permanent Streams	0–90 m	12		Layer 1: Proximity to Rivers and Permanent Streams (0-180 m)	
	90-180 m	6			
2) Proximity to Intermittent Streams	0–90 m	12	**12**	-	
	90-180 m	6			
3) Proximity to Permanent River/Stream Confluences	0–90 m	8		Layer 6: Proximity to River/Stream Confluences (0-180 m)	
	90-180 m	4			
4) Proximity to Intermittent Stream Confluences	0–90 m	12		-	
	90-180 m	6			
5) Proximity to Waterfalls	0–90 m	8		Layer 7: Proximity to Waterfalls (0-180 m)	
	90-180 m	4			
6) Proximity to Heads of Drainages	0–90 m	8	**4**	Layer 5: Proximity to Heads of Permanent Drainages (0-300 m)	
	90-180 m	4			
7) Major Floodplain - Alluvial Terrace	0–90 m	8		Layer 10: Floodplain Soils Presence	
	90-180 m	4			
8) Knoll or Swamp Island		32		Layer 1: Proximity to Rivers and Permanent Streams (0-180 m)	
9) Stable Riverine Island		32		Layer 2: Proximity to Waterbodies (0-180 m)	
B. Lakes and Ponds					
10) Proximity to Pond or Lake	0–90 m	12		Layer 2: Proximity to Waterbodies (0-180 m)	
	90-180 m	6			
11) Proximity to Stream-Waterbody Confluences	0–90 m	12		Layer 4: Proximity to Stream-Waterbody Confluences (0-180 m)	
	90-180 m	6			
12) Lake Coves, Peninsulas, and Bayheads	0–90 m	12		Layer 2: Proximity to Waterbodies (0-180 m)	
	90-180 m	6			
C. Wetlands					
13) Proximity to Wetlands*	0–90 m	12	**12**	Layer 3: Proximity to Wetlands (0-180 m)	
	90-180 m	6			

Envronmental Predictive Model				ArcheoMapTool GIS Model	Field Inspection Comments
Variable	Proximity	Value	Assigned Score	Variable	
14) Knoll or Swamp Island		32		Layer 3: Proximity to Wetlands (0-180 m)	
D) Valley edge and Glacial Landforms					
15) High Elevated Landform (e.g. Knoll Top, Ridge Crest, Promontory)		12		See Landmarks (Info Layers) and Catchment layers (Water-related Layers)	
16) Valley Edge Features (e.g. Kame Outwash Terrace)		12		Layer 9 Glacial Outwash and Kame Terrace Soils	
17) Marine/Lake Delta Complexes		12		Layer 9 Glacial Outwash and Kame Terrace Soils Presence	
18) Champlain Sea or Glacial Lake Shore Line**		12	**12**	Layer 8: Paleo Lake Soils Proximity (0-180 m)	
E. Other Environmental Factors					
19) Caves and Rockshelters		32		-	
20) Natural Travel Corridors (e.g. Drainage Divides)		12	**12**	See Landmarks (Info Layers) and catchment layers (Water-related Layers)	
21) Existing or Relict Springs	0–90 m	8		-	
	90–180 m	4			
22) Potential or Apparent Prehistoric Quarry for Lithic Material Procurement	0–90 m	8		See Soils with "M" parent material (Under Construction)	
	90–180 m	4			
23) Special Environmental or Natural Area~	0–180 m	32		-	
F. Other High Sensitivity Layers					
24) High Likelihood of Burials		32		See VAI layer (Under Construction)	
25) High Recorded Archeological Site Density		32	**32**	See VAI layer (Under Construction)	
26) High likelihood of containing significant site based on recorded or archival data or oral tradition		32		See VAI layer (Under Construction)	

Envronmental Predictive Model				ArcheoMapTool GIS Model	Field Inspection Comments
Variable	Proximity	Value	Assigned Score	Variable	
G. Negative Factors					
27) Excessive (>15%) or Steep Erosional (>20%) Slopes		-32		See Slope Layer (Info Layers folder)	
28) Previously Disturbed Land***		-32		See Land Use ND Building Footprint Layers (Info Layers folder)	
Total Score:			**84**		

** remains incompletely mapped; digital layer includes paleo lakes and wetlands based on soils data

*** as evaluated by a qualified archeological professional or engineer based on coring, earlier as-built plans, or obvious surface evidence (such as a gravel pit)

~such as Milton acquifer, mountain top, etc. (historic or prehistoric sacred or traditional site locations, other prehistoric site types)

*Environmental predictive model limits wetlands to those > one acre in size; ArchSensMap

Appendix E: Local Motion Comments

Island Line Trail
Causeway Bike Ferry
Bike Recycle Vermont
Safe Routes to School
Online Trail Finder
Trailside Center

Trails and Bikeways

1 Steele Street #103
Burlington, VT 05401
(p) 802.652.2453
(f) 802.861.2700
info@localmotion.org
www.localmotion.org

To: Town of Colchester Selectboard
From: Katelin Brewer-Colie, Complete Streets Project Manager
Date: November 7, 2013

RE: I-89 Exit 17 Interchange and Chimney Corners Intersection (US 2 and US 7)

CC: Jason Charest, CCRPC; Amy Bell, VAOT; Jon Kaplan, VAOT

As part of the project team, Local Motion appreciates the opportunity to comment on the Exit 17 & Chimney Corners interchange project. As northwest Vermont's advocate for people-powered transportation, we work with a wide range of partners to incorporate improved facilities for walking and biking into transportation projects and plans. The project area includes part of the Champlain Bikeway (US Route 2) and serves as the major gateway to the Champlain Islands, a popular cycling destination. The intersection at Chimney Corners represents the intersection of the US 7 and US 2 Bike Routes. For these reasons, it is critical that the project include elements to maximize the safety of cyclists. We appreciate the opportunity to provide input on the project design.

Near Term Recommendations

Local Motion supports closing the westbound merge loop from I-89 Northbound. It is imperative that cyclists have the opportunity to safely cross the US 2 Bridge over I-89. The current configuration of slip lanes and substandard shoulders pose grave safety risks in this high-crash area.

We also urge **narrowing the travel lanes to 11-ft** wide across the US 2 bridge so that the marked shoulders can be expanded to 4-ft, giving cyclists adequate space to travel through this “critical crossing.” Narrowing travel lane widths will also have the effect of slowing motorist speed as they move through this major interchange, which will have safety benefits for motorists as well.

Local motion supports the inclusion of a **bike crosswalk located on the north side of the Chimney Corners intersection (US 2 and US 7).** This intersection represents the intersection of two designated bike routes, and it is important to assist cyclists to make a westbound turn from Route 7. We recommend including a protected phase (no conflicting turning movements) for bikes in the signal phasing, which cyclists could activate by pressing a button.

We recommend **removal of the slip lane providing eastbound access to I-89 southbound.** Such lanes are dangerous for cyclists because they are intended as high speed entry points for motorists and leave cyclists unprotected across a wide access area. The alternative, a right angle intersection with a dual right turn lane is preferred, because a bike lane could be striped to the left of the dual right turn lanes. **If the slip lane remains in place**, we recommend **replacing the “bike crosswalk” concept with a colored through lane to**

the left of the slip lane. A colored (or otherwise marked) through lane allows bikes to remain in the flow of traffic, shows cars where to be especially aware of bikes and show bikes where it is safest for them to stay so that everything is more predictable for everyone. Cyclists are not likely to and should not be expected to stop, dismount and walk across the access (see image below).

Long Term Interchange Alternatives

Overall, Local Motion supports and urges the adoption of the Roundabout at US 2 /NB I-89 off ramp, without maintaining the existing loop ramp. We support this alternative because research shows that this interchange design is the safest not only for motorists, but also for pedestrians and cyclists because of shorter crossing distances and one-directional conflicting movements. We support the adoption of a 5-lane cross section with 11-ft lane widths, and standard shoulders (minimum 4-ft width).

Thank you for the opportunity to participate on the project team for this project. I would be happy to meet to talk more about our comments.