US Route 5/I-91 Exit 11 Bicycle and Pedestrian Improvements Scoping Study

Final Report

Hartford, Vermont

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Prepared for:

Town of Hartford, Vermont

Department of Planning and Development Services
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This study is the result of the support and strong interest of the Project Team. Much of the background, history, local input, existing conditions, and consensus documented in the study is attributed to the team members' involvement. The study's quality and success is due to their contributions.

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1.0 Introduction

The Town of Hartford has identified the need for safe bicycle and pedestrian facilities along US Route 5 through the Interstate 91 (I-91) Exit 11 Interchange. Route 5 is identified as a regional bicycle route; and within the study area is a major collector State Highway that connects two busy commercial districts.

While US Route 5 connects the two commercial districts, the I-91 Exit 11 Interchange represents a divide between the two districts from a bicycle and pedestrian standpoint. Currently, there are no sidewalks or dedicated bicycle facilities on Route 5 within the study limits. In spite of the lack of pedestrian facilities, there is significant pedestrian activity that passes through the interchange area. Very little bicycle use of the corridor has been observed likely due to the interchange geometry, high traffic volumes and speeds, wide travel lanes and lack of adequate bicycle facilities.

The Town received funding through the Vermont Agency of Transportation Enhancements Grant Program to study potential bicycle and pedestrian infrastructure improvements along this section of Route 5. The ultimate goal of the study is to identify recommended improvements; and their impacts and cost so that funding may be pursued for engineering, permitting and construction. In January 2012, the Town of Hartford contracted with Stantec to lead and complete the study. Various project stakeholders were consulted throughout the study including representatives from the Town, Two Rivers Ottaquechee Regional Planning Commission (TRORPC), and the Vermont Agency of Transportation (VTrans). This report summarizes the study, recommendations for improvements and future steps.

The study process is generally defined by the following outline:

- Investigating existing conditions (Section 2.0)
- Soliciting public input on existing conditions (Section 3.0)
- Establishing the project purpose and needs (Section 4.0)
- Evaluating alternatives and recommending a preferred alternative (Section 5.0)
- Making final recommendations including next steps (Section 6.0)

2.0 Existing Conditions

Existing physical and environmental conditions were documented to assist with identifying and evaluating alternative improvements. Team members researched and reviewed available information, solicited input from the Town and VTrans, and field reviewed the project area. This field review included recording conditions and taking numerous photographs. The following details the results of these efforts.

2.1 Study Area

The project area begins at the intersection of US Route 5/Ballardvale Drive/Windsor Drive and extends east through the I-91 Exit 11 Interchange to a proposed roundabout at the intersection with US 5 and Sykes Mountain Avenue. Although US 5 is a north-south route, the road runs east-west within the study area. For purposes of this study, US 5 traffic will be referred to as being in the eastbound or westbound direction. See Figure 1 for a project location map.

US 5 within the study area is a major collector State Highway that connects two busy commercial districts. The Veterans Affairs (VA) Hospital, a regional hospital located south of the project area that was established in 1939, continues to expand. Across the street from the VA Hospital is a complex of over 400 hotel/motel rooms as well as a number of local businesses. Located further south along Route 5, the Upper Valley Aquatic Center, a 36,000 square foot regional swimming facility, draws many visitors to the area. North of the interchange is the Sykes Mountain Avenue commercial area that houses a regional post office facility with 500 employees, state offices and many local businesses.

The I-91 Exit 11 interchange is located within the study area and includes five ramps (see Figure 2). Ramp A is used to access I-91 southbound via US 5 westbound. Ramp B is used to access I-91 southbound via US 5 eastbound. Ramps A and B merge together prior to merging with I-91. Ramp F is adjacent to Ramp B and is used to access US Route 5 from I-91 southbound. Ramp C is used to exit I-91 northbound and consists of a left-turn lane to access US Route 5 westbound and a right-turn slip lane to access US Route 5 eastbound. Ramp D is used to access I-91 northbound via US 5.

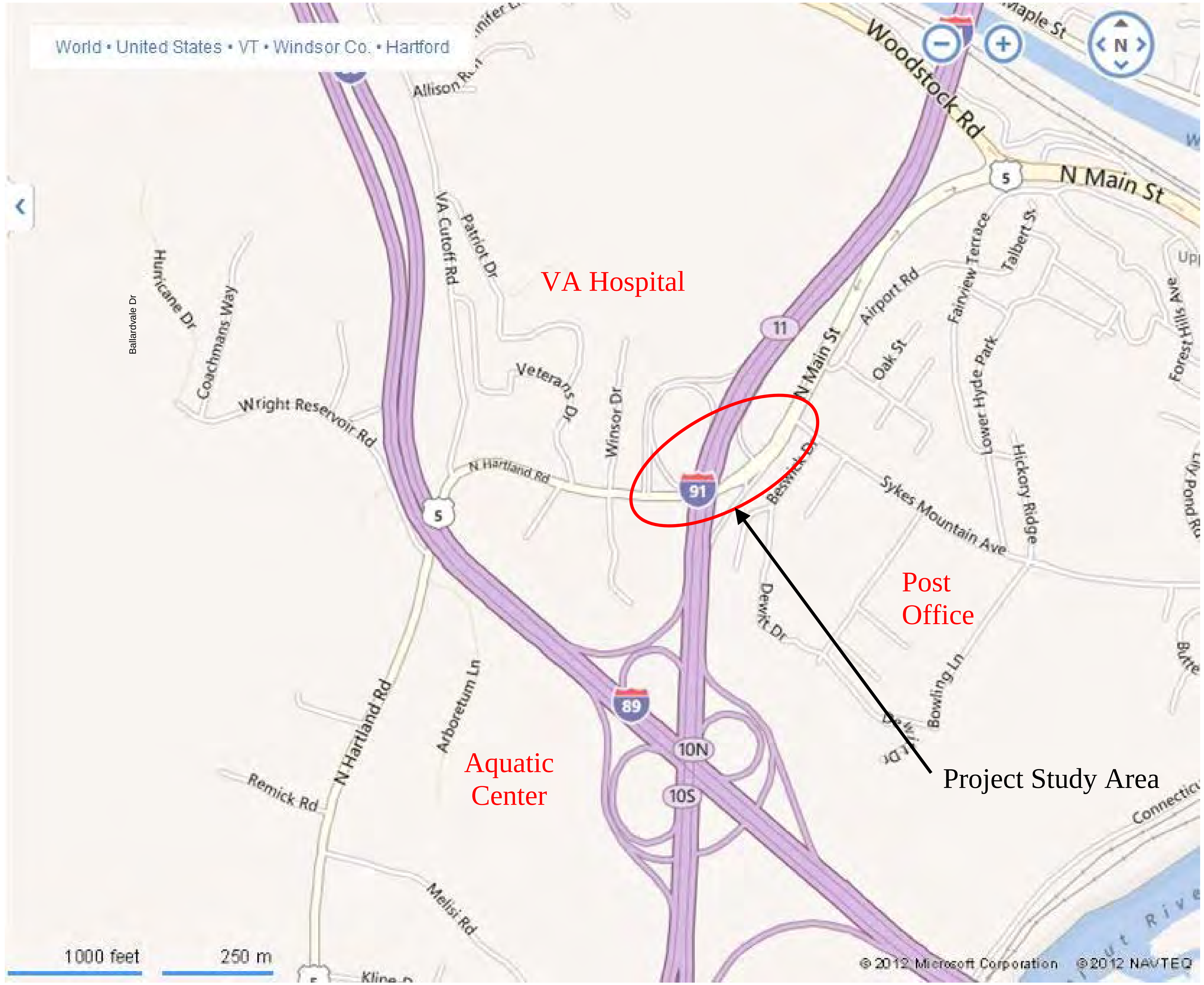

Figure 1 - Project Location Map

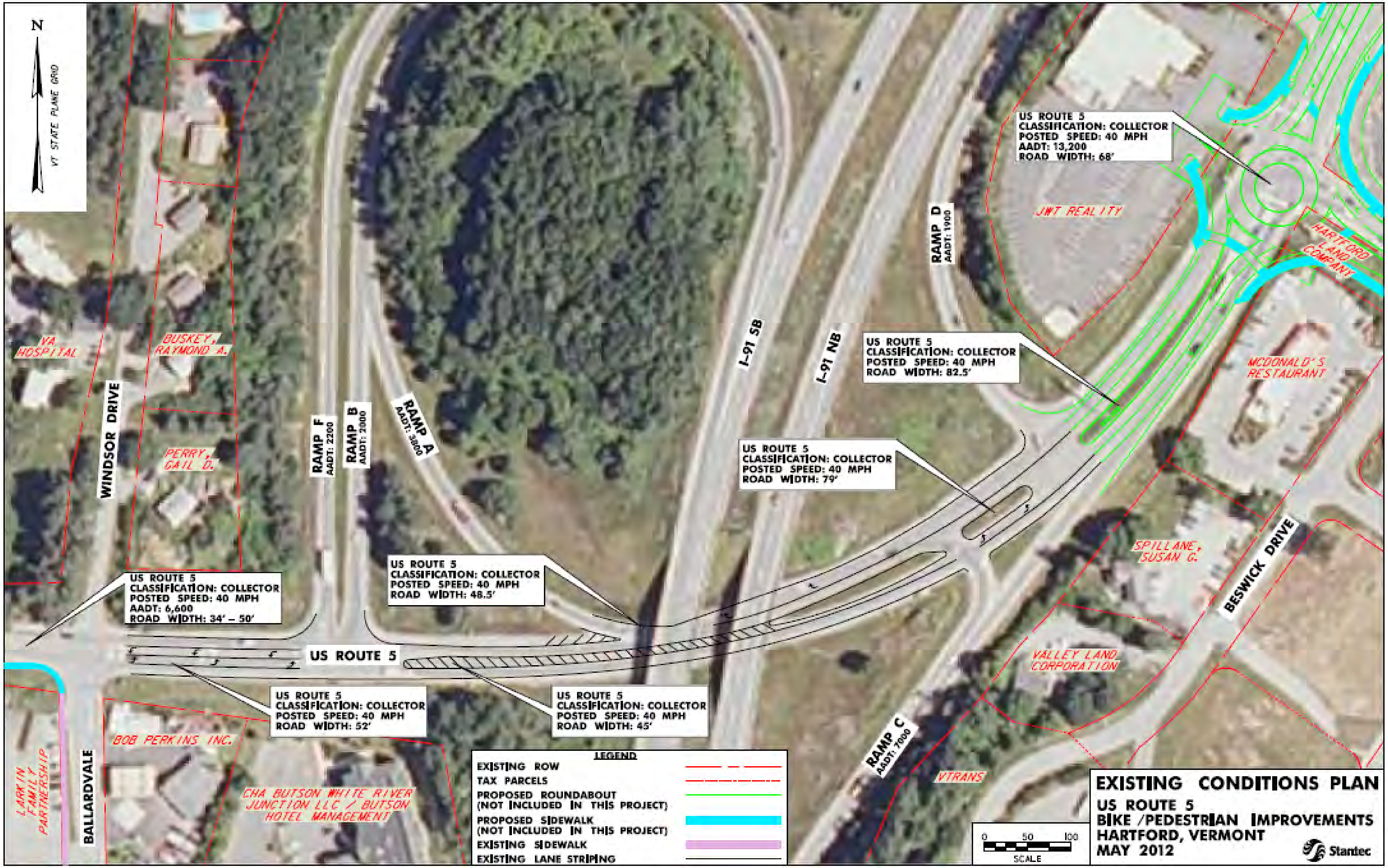

Figure 2 - Existing Conditions Plan

2.2 Regional and Local Plans/Studies

Up until around 2000, highway design and development patterns in this area of Hartford have historically focused on motor vehicles; and not much consideration had been given to the accommodation of pedestrians and bicyclists. Since then the Town and the Regional Planning Commission have conducted a number of plans and studies in an effort to refocus these patterns. Pertinent plans and studies include:

1. *Sykes Mountain Avenue/Route 5 Bicycle/Pedestrian Scoping Study, 2004.* The study included all of Sykes Mountain Avenue and ½ mile of Route 5 through the Interchange area. At that time, VTrans did not embrace the accommodation of bicyclists and pedestrians through the interchange area.

2. *Hartford Master Plan 2007.* The transportation element of the Master Plan had a strong multi-modal emphasis. One of the recommendations was to develop a Town-wide Pedestrian and Bicycle Plan.

3. *Hartford Pedestrian and Bicycle Plan, 2009.* Sidewalks and bike lanes are recommended along this corridor and were ranked #2 for new facilities in the Plan. This plan was approved by the Town Selectboard on July 28th, 2009.

4. *Hartford Master Plan 2012.* This plan acknowledges that “While the majority of trips are made by the single-occupant vehicle driver, the Town continues its commitment to providing accessibility options to all populations and for all transportation modes.”

Generally, these plans emphasize the importance and value of safe bicycle and pedestrian facilities within Hartford.

As a consequence of the prior studies, a new sidewalk on the south side of US Route 5 from Arboretum Lane to Ballardvale Drive is currently in the engineering phase and is anticipated to be constructed in 2013. US Route 5/Sykes Mtn Avenue intersection improvements consisting of a roundabout and a 10’ wide shared-use path are also currently in the engineering phase and are anticipated to be constructed in the next 2 to 3 years. The study area links these two projects.

Completion of this study will increase the likelihood that a pedestrian/bicycle link can be constructed in a reasonable time frame after construction of the two projects on each end of the study area.

2.3 Land Uses / Zoning

US Route 5 south of I-91 and within the project area consists of residential land use (zoning district R-3) to the west and industrial/commercial land use to the east (zoning district I-C2). Land use to the north of I-91 and within the project area is zoned industrial/commercial (zoning districts I-C and I-C2). Figure 3 shows zoning in the vicinity of the project area.

At this time, there are no known planned changes in land use or zoning in the immediate vicinity of the study limits. New development and redevelopment is anticipated along the Route 5 corridor south of the study area and along Sykes Mountain Avenue located to the north of the study area, however specific development plans have not been presented at this time.

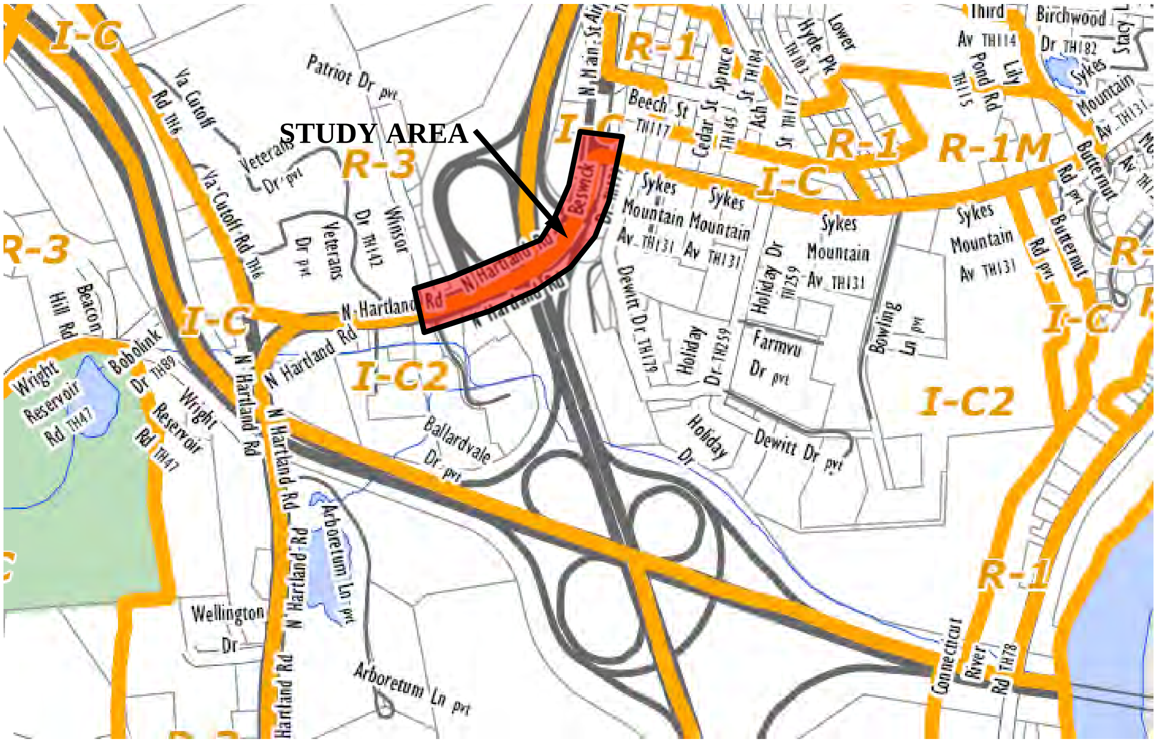

Figure 3 - Hartford Zoning District map within vicinity of project study area. Project study area shown in red. Map clipped from map entitled "ZONING DISTRICTS Hartford, VT: Adopted 10/14/08"

2.4 Transportation Facilities

2.4.1 Bicycle/Pedestrian

Currently, there are no sidewalks or dedicated bicycle facilities on US Route 5 within the project limits to link the two commercial districts on each side of the interchange . In spite of the lack of pedestrian facilities, there is significant pedestrian activity that passes through the interchange area. A well-worn path exists on the outside of the guardrail under the I-91 overpass and along the shoulders of US 5. Over 170 pedestrians were observed walking along US 5 during a pedestrian count from 6 am to 6 pm conducted by VTrans in June 2010. Very little bicycle use of the corridor has been observed likely due to the interchange geometry, high traffic volumes and speeds, wide travel lanes and lack of adequate bicycle facilities.

New sidewalk on the south side of US Route 5 from Arboretum Lane to Ballardvale Drive is currently in the engineering phase and is anticipated to be constructed in 2014. US Route 5/Sykes Mtn Avenue intersection improvements consisting of a roundabout and a 10’ wide shared-use path are also currently in the engineering phase and are anticipated to be constructed in the next 2 to 3 years. The study area links these two projects.

US Route 5 is identified as a regional bicycle route. Providing pedestrian and on-road bicycle facilities on US Route 5 from the VA Cutoff Road to Sykes Mountain Avenue received a #2 priority ranking in the *Town of Hartford Pedestrian and Bicycle Plan, 2009*. In addition, construction of sidewalks along US Route 5 within the study area is specifically mentioned in the *Hartford Master Plan 2012*.

2.4.2 Roadways and Intersections

US Route 5 is a major collector State Highway with approximately 6,600 vehicles per day south of the I-91 Interchange and 13,200 vehicles per day north of the interchange. The number of lanes and lane widths vary significantly through the study area. The overall width of the roadway varies significantly from 45' under the I-91 overpass to 82.5' between Ramp C and Sykes Mountain Avenue. The right-of-way width varies significantly and is abundant due to the presence of the I-91 Interchange.

Item	US Route 5
Classification	Major Collector
Posted Speed (mph)	40
AADT (vpd)	6,600 – 13,200
Trucks %	4 - 9%
Road Width	45'-82.5'
Right-of-Way Width	Varies

Table 1 - US Route 5 Roadway Characteristics

Roadways that intersect US 5 in the study area are shown on Figure 2 and include:

- I-91 Ramps B/F
- I-91 Ramp A
- I-91 Ramp C
- I-91 Ramp D
- Sykes Mountain Avenue
- Ballardvale Drive/Windsor Drive.

Existing roadway and intersection characteristics are summarized as follows.

Ballardvale/Windsor Drive to Ramps B/F
Route 5 between Ballardvale Drive and Ramps B/F has four lanes consisting of a travel lane and a left-turn lane in each direction as shown on Figure 2. Travel lanes are 12' wide. The existing paved shoulders are approximately 2' wide and are inadequate for bicycle lanes.

Ballardvale Drive is a dead end street that serves numerous hotels and other local businesses. Windsor Drive is a dead end street that serves a small number of residences. There are no commercial drives within the study area.

Ramp B is utilized by vehicles travelling westbound on US Route 5 to access I-91 northbound. Ramp F is utilized by vehicles exiting I-91 southbound onto Route 5. A stop sign controls vehicles exiting Ramp F .

Figure 4 - Route 5 looking eastbound from Ballardvale Drive. Roadway consists of two travel lanes and two left lanes in each direction.

Figure 5 - Intersection of Ramp B/F with US Route 5 looking eastbound. Traffic exiting from Ramp F is controlled by stop sign.

Ramps B/F to Ramp A

Route 5 between Ramps B/F and Ramp A has a travel lane in each direction and a striped, uncurbed median of varying width. Travel lanes are 12' wide. The existing paved shoulder is approximately 2' wide in the eastbound direction; and 6' wide in the westbound direction.

Figure 6 - Route 5 looking eastbound between Ramps B/F (not in picture) and Ramp A (foreground on left). Roadway consists of two travel lanes in each direction with striped median .

Figure 7 - Route 5 looking eastbound at Ramp A.

Ramp A to Ramp C
Route 5 between Ramp A and Ramp C has three lanes consisting of a travel lane eastbound, a travel lane and right-turn lane westbound, and a wide, striped, uncurbed median. Travel lanes are 12' wide. In the eastbound direction, the existing paved shoulder is approximately 2' wide until after the I-91 overpass where it transitions to a 6' width. The existing paved shoulder is 1' wide in the westbound direction. Sloped granite curb and guardrail protect motor vehicles from striking the I-91 overpass pier.

Figure 8 - Route 5 looking eastbound under I-91 overpass. Roadway consists of a travel lane in eastbound direction (right), a travel lane and right turn lane to access Ramp A in westbound direction (left), and painted/curbed median.

The right-turn lane begins at Ramp D, as shown in Figure 2; and is used to access Ramp A. Ramp A is used by vehicles on US 5 westbound to access I-91 southbound. Traffic on Ramp A must yield to vehicles on Ramp B as shown in Figure 2.

Ramp C to Sykes Mountain Avenue
In the eastbound direction from Ramp C to Ramp D, Route 5 consists of a through lane and a left-turn lane. The left-turn lane is used by vehicles travelling east on Route 5 to access I-91 northbound via Ramp D. From Ramp D to Sykes Mountain Avenue, Route 5 consists of a through lane and right-turn lane. The right-turn lane is used by vehicles travelling east on Route 5 and vehicles exiting Ramp C to turn right onto Sykes Mountain Avenue. A weaving condition exists on this stretch of Route 5 for vehicles exiting Ramp C that proceed through the Sykes Mountain Avenue intersection and vehicles travelling east on Route 5 that turn right onto Sykes Mountain Avenue.

Figure 9 - Route 5 looking eastbound toward Ramp C (on right).

Figure 10 - Route 5 looking westbound toward Ramp C.

Ramp C consists of a left-turn lane and right slip lane. The left-turn lane forms a t-intersection with Route 5. Vehicles turning left onto Route 5 are controlled by a stop sign. The right slip lane is uncontrolled and has an average annual daily traffic (AADT) volume of 7000 vehicles per day. In the westbound direction, Route 5 consists of two through lanes and a right-turn lane to access Ramp D. The right through lane drops to the right-turn lane for Ramp A immediately west of Ramp D.

Figure 11 - Route 5 looking westbound toward Ramp D (on right).

2.4.3 Traffic

VTrans estimates the 2010 Annual Average Daily Traffic (AADT) for the section of US Route 5 south of the interchange up to Ballardvale Drive to be 6,600 vehicles per day and north of the interchange from Ramp C to be 13,200 vehicles per day. AADT's for each of the ramps are as follows:

I-91 Interchange	AADT (veh/day)
Ramp F	2200
Ramp B	2000
Ramp A	3800
Ramp C	7000
Ramp D	1900

Table 2- AADT's for I-91 Interchange Ramps

Based on 2010 turning movement counts performed by VTrans in the study area, there are approximately 7-9% heavy trucks during the AM Peak Hour and 4% heavy trucks during the PM Peak Hour.

Intersection capacity analysis was completed using Synchro 8.0 software to obtain a baseline of existing performance. The baseline analysis is used to determine if the proposed bicycle and pedestrian improvements increase queues or delays at the intersections. For discussion purposes, the capacity analysis is identified by two major intersections located in the study area: US Route 5/Ramp B/Ramp F and US Route 5/Ramp C/Ramp D.

The results of the analysis are summarized in Table 3. Existing traffic counts indicate hourly traffic volumes on US 5 are highest during the morning peak from 7:00-8:00 AM. Therefore, the analysis was limited to the AM Peak Hour. The results of the Synchro analysis are included in the appendix.

		AM Peak Hour			
Intersection	Peak Hour/Approach/Lane Group	V/C Ratio	Delay (sec)	LOS	95th %ile Queue (ft)
US 5/Ramp B/Ramp F	SB Left and Right (Ramp F to US 5)	0.77	52	F	142 (6 veh)
	EB Left (US 5 to Ramp B)	0.22	9	A	21 (1 veh)
US 5/Ramp C/Ramp D	NB Left (Ramp C to US 5)	0.80	46	E	169 (7 veh)

V/C Ratio = Volume-to-capacity ratio; Delay = Average delay per vehicle in seconds; LOS = Level of Service.

Table 3 - Baseline Operational Performance for Route 5 Intersections

The analysis indicates that Ramp F operates at a level of service (LOS) of F under existing traffic conditions. Although, the ramp operates at a LOS F, the analysis indicates the volume to capacity ratio is less than 1.0 and the 95th percentile queue length is approximately six vehicles.

The traffic analysis indicates that the left-turn lane on Ramp C operates at a level of service (LOS) E under existing traffic conditions.

Proposed bicycle and pedestrian improvements that increase delays already experienced at these ramps are not desirable from the Town's perspective.

2.4.5 Crash History

High Crash Locations

VTrans maintains a listing of High Crash Locations (HCL) within the state. A 0.3 mile highway segment or intersection must have at least 5 crashes over a 5-year period and the actual crash rate (number of crashes per million vehicles) must exceed a critical crash rate to be classified as an HCL. The critical crash rate is based on the average crash rate for similar highways.

The *VTrans High Crash Report: Sections and Intersections 2006-2010* lists one intersection of US 5 and Sykes Mountain Avenue as an HCL. There are no sections within the project study area listed as an HCL. The crash history at this HCL is summarized in Table 5. The VTrans High Crash Report is contained in the appendix.

Sykes Mountain Avenue/US5 Intersection							**2006-2010**
Ranking	Mile Marker	ADT	Crashes	Fatalities	Injuries	Actual / Critical Ratio	Severity Index
#72	3.050-3.080	17534	28	0	3	1.269	$14,511

Table 4 - High Crash Locations Summary

As noted earlier, the Sykes Mountain Avenue is expected to be constructed as a modern roundabout which will improve the intersection safety performance.

Crash Summaries

A General Yearly Summary Crash Listing for the period January 1, 2006 to December 31, 2010 within the study area (Mile Marker 2.740 - 3.050) is summarized in Table 4. It is VTrans policy to report crashes on federal aid highways involving injuries, fatalities, or those that exceed $1,000 in property damage. The VTrans listing is contained in the appendix.

Area	US 5 MM-MM	Crash Type Rear End	Broad-side	Side-swipe	Head-on	Un-known	Total
Ballardvale Dr. to Ramp F	2.68-2.90	6	6	4	0	1	15
Ramp F to Ramp C/D	2.90-3.00	2	2	1	0	1	6
Ramp C/D to Sykes Mtn Ave.	3.00-3.07	2	6	3	1	2	14
TOTAL		**10**	**14**	**8**	**1**	**4**	**35**

Table 5 - US Route 5 Crash Summary

The data indicates that the greatest percentage of reported crashes on US 5 is broad-side and rear-end collisions. Rear end collisions are typically associated with stop and go traffic and traffic signal operations.

The broadside type crashes are typically associated with turning traffic at intersections. The greatest number occur in the area of Ramp F and Ramp D/Sykes Mountain Avenue intersections and involve mostly left turning traffic.

Approximately 20% of the reported crashes along US 5 were sideswipes. Typically, these involve vehicles changing lanes and/or driver confusion. Project area factors contributing to this include high traffic volumes and lane changes at the west approach of the Sykes Mountain Avenue intersection.

In addition to the crashes reported on US 5, many crashes have been reported on the interchange ramps. Table 6 summarizes the crashes.

Area	Crash Type Rear End	Broad-side	Side-swipe	Head-on	Single Vehicle	Un-known	Total
Ramp A/B	14	0	0	0	0	0	14
Ramp C	2	0	0	0	0	0	2
Ramp F	1	0	0	0	0	0	0
TOTAL	**17**	**0**	**0**	**0**	**0**	**0**	**17**

Table 6 – Exit 11 Ramps Crash Summary

All collisions reported on the ramps were rear end collisions likely associated with exiting traffic on Ramp C and Ramp F or the merging condition at Ramp A and Ramp B. A majority of these accidents were reported to be a result of driving too fast or following the vehicle in front too closely. The current I-91 Ramp A and C geometries promote high motor vehicle speeds and include merging conditions, which may be a factor in some of these crashes. There were 4 injuries as result of these crashes. Although the Interchange ramps aren't listed as high crash locations, improvements related to bicycle and pedestrian safety should consider the potential for reducing crashes at the interchange ramps within the study area.

2.4.6 Transit Facilities

Numerous transit providers utilize the US 5 corridor within the study area including Stagecoach Transportation Services, Connecticut River Transit and Advance Transit Lines. There are no stops for these transit providers within the project study area, however a sidewalk through the corridor will serve as a pedestrian link between the commercial districts and existing bus stops located to the north and south of the project area.

2.5 Natural / Cultural Resources

There are no potential impacts to environmental resources since the entire project involves areas of existing pavement or areas that have previously been disturbed by roadway construction and other development.

William D. Countryman – Environmental Assessment and Planning performed an assessment of the natural resources within the project limits as part of the *Sykes Mountain Avenue/Route 5 Bicycle/Pedestrian Scoping Study, 2004.* A summary is presented below. The Countryman report is contained in the appendix.

2.5.1 Waterways / Streams / Floodplains

The Vermont Agency of Natural Resource (ANR) Interest Locator program indicates that the project area is not in an impaired watershed. There are no waterways, streams or floodplains within the project limits.

Proposed improvements will require a stormwater discharge permit if the new impervious area exceeds 5,000 square feet and the total impervious area within the construction limits exceeds 1 acre.

Proposed improvements will require a Vermont Construction General Permit if the area of disturbance exceeds 1 acre.

2.5.2 Wetlands

There are no wetlands in the study area.

2.5.3 Rare, Threatened, and Endangered Species

No Rare, Threatened and Endangered species have been identified within the project limits.

2.5.4 Agricultural Lands

There are no lands within the Study Area that are considered Farmland of Statewide Importance.

2.5.5 Historic and Archaeological Resources

Historic and archeological resources were studied by Pamela Daly and GEOARCH, Inc. as part of the the *Sykes Mountain Avenue/Route 5 Bicycle/Pedestrian Scoping Study, 2004.* There are no historic or archeological resources within the study area. Copies of the Daly and GEOARCH reports are contained in the appendix.

2.5.6 Land and Water Conservation Fund Projects (LWCF)

No designated state or town conservation zones are present within the study area.

2.5.7 Hazardous Waste Sites / Facilities

The Vermont Agency of Natural Resource (ANR) Interest Locator program indicates that no hazardous waste sites or facilities are located within the study area.

2.6 Utilities

2.6.1 Aerial Utilities

There are aerial utilities on the south side of US 5 from Ballardvale Avenue to Ramps B and F. These utilities consist of Green Mountain Power, Fairpoint and Comcast. The aerial utilities turn to the south and leave the study area at the Ramp B/F intersection with US 5. These aerial utilities are will not be impacted by proposed improvements.

2.6.2 Underground Utilities

The Town of Hartford has water, sewer and storm drainage utilities within the study area. There is also underground power to feed the existing street lights along US 5. Underground utility impacts due to the proposed improvements are expected to be limited to elevation adjustments of catch basins, sewer manholes, water valves and other utility appurtenances and minor adjustment of drainage pipes and catch basin locations.

There is also ledge located within the study area. The ledge is visible from the surface on both sides of US Route 5 at the intersection with Ramp C. If the proposed improvements require the ledge to be removed, it will likely need to be removed by means other than blasting to avoid impact damage to the existing underground utilities nearby. It is recommended that ledge probes be conducted during the preliminary engineering phase to determine the location of ledge in areas of excavation.

3.0 Local Concerns Meeting

A Local Concerns Meeting was held at the Hartford Municipal Building on May 2, 2012. The meeting was noticed to the general public. The purpose of the meeting was to present the need for the project, existing conditions within the project area, and solicit input from the public regarding the project. The meeting was a useful step in the data gathering phase and many public comments were insightful. Notes from this meeting are contained in the appendix. The most notable concerns from this meeting included:

- It is unsafe to walk or bike through the interchange area.
- There is a large amount of truck and bus traffic through the interchange area.
- Excessive speed is a serious problem.
- There is lots of pavement and unclear lane designation through the interchange area. Consider restriping and lane reconfigurations like the ones done in Norwich by Exit 13.
- Ramps C and A (southbound on-ramp and the northbound off-ramp) are particularly challenging for pedestrians and bicyclists to navigate past due to high traffic volumes and vehicular speeds.
- Safer facilities for bicyclists and pedestrians are likely to encourage more people to walk to the Aquatic Center and other destinations from motels.
- The VA Hospital has a lot of pedestrian activity.
- Use bike symbols to inform motorists to expect bicyclists in the area.
- There appears to be a spike in pedestrian traffic during swim meets at the Aquatic Center.
- Observed that motorists often change lanes at the last second by Ramp A.
- As a bicyclist, Ramps A & C are the most uncomfortable to cross.

The overwhelming response from the attendees was that current roadway and ramp configurations, as described in Section 2.0 of the report, make it unsafe and uncomfortable for bicyclists and pedestrians and adequate bicycle and pedestrian facilities are needed along this stretch of US 5.

4.0 Purpose and Need Statement

The Purpose and Need statement summarizes what the study is intending to accomplish and for what reasons. The Purpose defines the problem to be solved. The Need provides the data to support the Purpose. The Purpose and Need Statement is a fundamental requirement for projects that will pursue federal funding; and sets the stage for developing alternative solutions to the transportation problem.

Working with the Town and VTrans; and using the input received at the Local Concerns meeting, the following Purpose and Need statement was developed.

Purpose:

The purpose of this project is to transform the Interstate 91, Exit 11 Interchange area from a transportation facility that gives sole consideration to motor vehicles to one that balances motor vehicle mobility and safety with pedestrian/bicyclist accessibility, mobility and safety.

Need:

The project needs include the following:

1. <u>Sidewalk along the project corridor.</u> Currently, pedestrians walk on the roadway shoulders or just off the road. A sidewalk along the south side of Route 5 will link proposed sidewalks located at each end of the corridor that are currently in design.

2. <u>Substantial and consistent shoulders or bike lanes for use by cyclists along the project corridor.</u> With an Average Annual Daily Traffic (AADT) of 13,200 vehicles moving and a speed limit of 40 mph, the lack of these facilities discourages bicycle use through the corridor.

3. <u>Clearly defined lanes with reduced and consistent widths for motorists.</u> Numerous lane configurations and excessive widths, 12’ plus, encourage high motor vehicle speeds without consideration for bicyclists and pedestrians.

4. <u>Improved ramp geometry.</u> The current ramp A and ramp C geometries promote high motor vehicle speeds and include merging conditions. Crash histories reveal sideswipe and rear-end collisions at these locations which may be a result of the ramp geometries.

5. <u>Motor vehicle mobility.</u> Proposed bicycle and pedestrian improvements must not substantially decrease intersection performance along the corridor and not detrimentally impact traffic operations on Interstate 91.

5.0 Alternatives

Various alternatives were developed to address the project purpose and need as defined in Section 4.0. The following summarizes the alternatives developed and the recommended alternative.

5.1 Design Criteria

Based on pertinent standards and references, applicable roadway, bicycle and sidewalk design criteria was researched and summarized. These references include the Vermont Pedestrian and Bicycle Facility Planning and Design Manual, the Vermont State Design Standards, and the AASHTO Guide for the Development of Bicycle Facilities. This design criteria serves as the basis for developing alternatives and is contained in the appendix.

5.2 Alternatives Considered

The project committee reviewed the existing conditions, design criteria and discussed many potential alternatives for improvements. These discussions focused on determining which alternative would best fulfill the purpose and need statement. All improvements assume that the roundabout at Sykes Mountain Avenue will be constructed.

Many alternatives were considered, and include:

- Alternative 1 – No-build
- Alternative 2 – Restripe US Route 5
- Alternative 3 – Restripe US Route 5 and Construct Ramp A and C Improvements
- Alternative 4 – Realign Ramps C and D with Sykes Mountain Avenue roundabout

All alternatives with the exception of Alternative 1 proposes to construct a 5' wide sidewalk with 5' green strip buffer on the south side of US Route 5. The sidewalk is proposed on the south side to serve as a link between the proposed sidewalk currently being designed that terminates on the south side of Ballardvale Drive and the proposed 10' shared-use path currently being designed as a part of the Sykes Mountain Avenue roundabout. Constructing the sidewalk on this side of the road will link both commercial districts discussed previously in the report; and create a continuous pedestrian facility from the intersection of Arboretum Lane/US Route 5 to the intersection of Butternut Lane/Sykes Mountain Avenue.

The following summarizes improvements, potential benefits and impacts/considerations for each alternative.

5.2.1 Alternative 1 – No Build

This alternative proposes to do nothing. US Route 5 will remain a high speed facility that is unfriendly to bicyclists and pedestrians. The project committee decided to eliminate this alternative from further consideration as it does not meet the project purpose and need. However, it is carried forward as a baseline for comparison among other alternatives.

5.2.2 Alternative 2 – Restripe US Route 5

Figure 12 graphically depicts Alternative 2 improvements. This alternative represents a minimalistic approach as it consists solely of re-striping US Route 5 to provide dedicated bicycle facilities. Proposed improvements are described as follows:

- Resurface roadway with ¾" overlay, or per VTrans Pavement Management Section recommendations
- Re-stripe roadway to provide 6' bike lanes and 11' travel lanes on both sides of Route 5
- Add bicycle signage as necessary including a rapid flashing pedestrian beacon at the Ramp C slip ramp
- Construct sidewalk with 5' green strip on south side of Route 5

The main benefit to this alternative is that the roadway re-striping can be implemented quickly within the existing roadway footprint and at a low-cost as a trial for bicyclists in the area. Re-striping the roadway to 11' travel lanes with 6' bicycle lanes will represent a significant improvement over the existing wide roadway and narrow shoulders. The re-striping will eliminate one of the westbound through lanes between Sykes Mountain Avenue and Ramp D and will significantly decrease the right-turn lane length between Ramp D and Ramp A. Eliminating unnecessary travel lanes is often referred to as a "road diet". The lane reductions will have the potential of slowing vehicles on US Route 5 and creating a safer, more accessible facility for bicycle use.

Although dedicated bicycle facilities will improve conditions, Ramp A and Ramp C will remain as high speed facilities that may be difficult or uncomfortable to cross. A rapid flashing pedestrian beacon is recommended to be installed to make the pedestrian crossing at the Ramp C slip ramp more visible.

While this alternative represents a low-cost solution to improve bicycle and pedestrian conditions, it does not fully address the local concern of high motor vehicle speeds entering Ramp A and exiting Ramp C.

5.2.3 Alternative 3 – Restripe US Route 5 and Construct Ramp A and C Improvements

Alternative 3 includes geometric improvements to Ramp A and Ramp C that are intended to reduce motor vehicle speeds using these ramps; and consequently provide safer and more comfortable bicycle and pedestrian facilities through the interchange. Proposed improvements for bicyclist and pedestrians include:

- Re-stripe roadway to provide 6' bike lanes and 11' travel lanes on both sides of Route 5
- Construct sidewalk with 5' green strip on south side of Route 5
- Construct Ramp A and Ramp C intersection improvements

Various options for ramp intersection improvements were explored to reduce vehicle speeds entering onto Ramp A via US Route 5 westbound and exiting onto US Route 5 eastbound via Ramp C. Table 8 lists the options explored for each intersection.

Ramp A Options	Ramp C Options
A-1. Eliminate Ramp A	C-1. Tighten Ramp C slip ramp
A-2. Eliminate Ramp A and Construct Channelized Right-Turn Lane	C-2. Re-align Ramp C to a T-intersection with Stop Control
	C-3. Re-align Ramp C and D and Construct Roundabout

Table 7 – Alternative 3 Intersection Improvement Options

The following describes the proposed Ramp A and C intersection improvement options in greater detail.

5.2.3.1 Ramp A Options

Option A-1: Eliminate Ramp A

Figure 13 graphically depicts Option A-1 improvements which entails eliminating Ramp A and shifting westbound access to I-91 southbound to Ramp B. Eliminating Ramp A was considered to reduce vehicle speeds and address the crash histories due to the merge condition at the intersection of Ramp A and Ramp B. Right-turns from Route 5 would occur at a slower speed at this location when compared with the existing condition. However, the change will bring more traffic to the Route 5/Ramp B/Ramp F intersection; and consequently will increase delays on Ramp F and for westbound left-turns onto Ramp B. Given the baseline Level of Service (LOS) of F for Ramp F, increasing delays at this intersection does not meet the needs of the project.

Option A-2: Eliminate Ramp A and Construct Channelized Right-Turn Lane

Figure 14 graphically depicts Option A-2 improvements which entails the same improvements as Option A-1 plus a channelized right-turn lane onto Ramp B from US 5 westbound. The addition of the right-turn lane relative to Option A-1 allows Ramp A to be removed without impacting intersection performance. Delays for Ramp F and eastbound left-turns will remain unchanged from the existing condition because vehicles turning right onto Ramp B will move to the right-turn lane in advance of the intersection. Analysis results are contained in the appendix.

The right-turn lane will be yield controlled to give left-turns from US 5 eastbound priority; and will slow down motor vehicles as they enter onto Ramp B, which addresses both the vehicle crash histories and bicyclist safety.

5.2.3.2 Ramp C Options

Option C-1: Tighten Ramp C Slip Ramp

Figure 13 graphically depicts Option C-1 improvements. Option C-1 entails re-aligning and creating a tighter radius on the existing Ramp C slip ramp. Tightening the radius on the Ramp C slip ramp will create a safer bicycle/pedestrian crossing by slowing vehicles exiting off of Ramp C. Slowing vehicles off of Ramp C also has the potential to reduce the number and severity of vehicle crashes due to the weaving condition on US Route 5 between Ramp C and Sykes Mountain Avenue. Tightening the slip ramp does not impact existing traffic operations because the improvements maintain free-flow traffic off the ramp onto US Route 5 eastbound.

The left-turn operation will remain unchanged from the existing stop controlled condition; and therefore the level of service and queue lengths will remain unchanged. The left-turn lane will need to be shifted to the west to accommodate the tightening of the slip ramp; and provide sufficient geometry for turning trucks.

Option C-2: Realign Ramp C to a T-intersection with Stop Control

Figure 14 graphically depicts Option C-2 improvements. Option C-2 entails realignment of both the left and right-turn lanes of Ramp C to a stop controlled T-intersection with US Route 5. Bicycles traveling eastbound on US Route 5 will have the right-of-way over vehicles attempting to make a left or right-turn off of the ramp. A potential bicycle/vehicle conflict can occur if a vehicle waiting to turn left onto US Route 5 obstructs the view of a vehicle waiting to turn right, and consequently, the vehicle in the right-turn lane may creep into the proposed crosswalk and bicycle lane.

Bringing the Ramp C right-turn lane to a stop condition will create delays for this movement that do not exist under existing conditions. The proposed stop condition changes this approach from a free-flow condition to a LOS D with an 8 vehicle 95%ile queue length. Analysis results are contained in the appendix.

Option C-3: Re-align Ramp C and D and Construct Roundabout

Figure 15 graphically depicts Option C-3 improvements. Option C-3 proposes to re-align both Ramp C and D at a new roundabout to form one intersection. Bicycles and pedestrians will cross the Ramp C roundabout approach using a crosswalk. The roundabout will create a safer bicycle/pedestrian crossing by slowing vehicles exiting off of Ramp C; and will create safer bicycle lanes by reducing speeds along Route 5. Slowing vehicles off of Ramp C and along Route 5 also has the potential to reduce the number and severity of vehicle crashes due to the weaving condition on US Route 5 between Ramp C and Sykes Mountain Avenue.

In addition, the roundabout will improve traffic performance for vehicles exiting Ramp C. An intersection capacity analysis for a roundabout was performed using the methodology outlined in the *2010 Highway Capacity Manual* (HCM), published by the Transportation Research Board to assess its impact on ramp queues. Note that the results of the HCM methodology are conservative. The HCM methodology is based on the assumption that driver familiarity with roundabouts is low. As driver familiarity with roundabouts increases, roundabout performance is expected to increase.

The 2010 traffic counts performed by VTrans were adjusted assuming a construction year of 2015 and 1% growth per year from 2010 to 2015. Table 9 summarizes the results of the analysis. Table 9 also considers a variation of the single lane roundabout to address queuing issues on Ramp C. Based on this methodology, the analysis suggests a single lane roundabout will provide LOS C or better for the US 5 approaches, but will lead to long delays and a LOS F on the Ramp C approach. The addition of a bypass lane for right-turns off of Ramp C will reduce the delays for this approach so that vehicles do not back up onto the I-91 northbound as shown in Table 9. Adding the bypass lane will result in a LOS C or better for the Ramp C approach, which compares to a LOS E for left-turns from Ramp C under existing conditions. Analysis results are contained in the appendix.

	Without Bypass Lane				With Bypass Lane			
Peak Hour/Approach/Lane Group	V/C Ratio	Delay (sec)	LOS	95th %ile Queue (ft)	V/C Ratio	Delay (sec)	LOS	95th %ile Queue (ft)
WB (US 5 South)	0.76	23	C	185	0.76	23	C	185
NB (Ramp C)	1.28	155	F	896	0.46	11	B	62
EB (US 5 North)	0.38	7	A	45	0.38	7	A	45

Table 8 – Option C-3 Roundabout Operational Performance

5.2.4 Alternative 4 – Realign Ramps C And D With Sykes Mountain Avenue Roundabout

Figure 16 graphically depicts Alternative 4 improvements. The proposed improvements are described as follows:

- Re-stripe roadway to provide 6’ bike lanes and 11’ travel lanes on both sides of Route 5
- Re-align Ramp C to exit I-91NB into north approach of Sykes Mountain Avenue roundabout

- Re-align Ramp D to enter I-91NB from the north approach of Sykes Mountain Avenue roundabout

This alternative will eliminate three ramp crossings for bicyclists and all ramp crossings for pedestrians through the re-alignment of Ramps C and D. The re-alignment of Ramp C will eliminate the weave condition on I-91 at Exit 11 between vehicles entering I-91 northbound from I-89 and vehicles exiting I-91 northbound.

This alternative represents the most significant improvements to bicycle and pedestrian safety, but comes at a high expense in terms of cost, private property impact, construction duration, timeline for implementation and impact to the proposed roundabout at Sykes Mountain Avenue.

The construction cost of this alternative is high in relation to other alternatives considering that the new Ramp C alignment will require widening of the existing I-91 northbound bridge over US Route 5, acquisition of a commercial property and redesign of the proposed roundabout at Sykes Mountain Avenue. However, excess land created in the existing interchange could be sold to offset costs.

The proposed roundabout at Sykes Mountain Avenue will need to be redesigned to a two-lane roundabout to accommodate the additional traffic volumes that normally turn left onto US Route 5 westbound from Ramp C and turn right onto Ramp D from US Route 5 westbound. Increasing the roundabout size will likely require additional right-of-way from properties already being impacted by the currently proposed roundabout.

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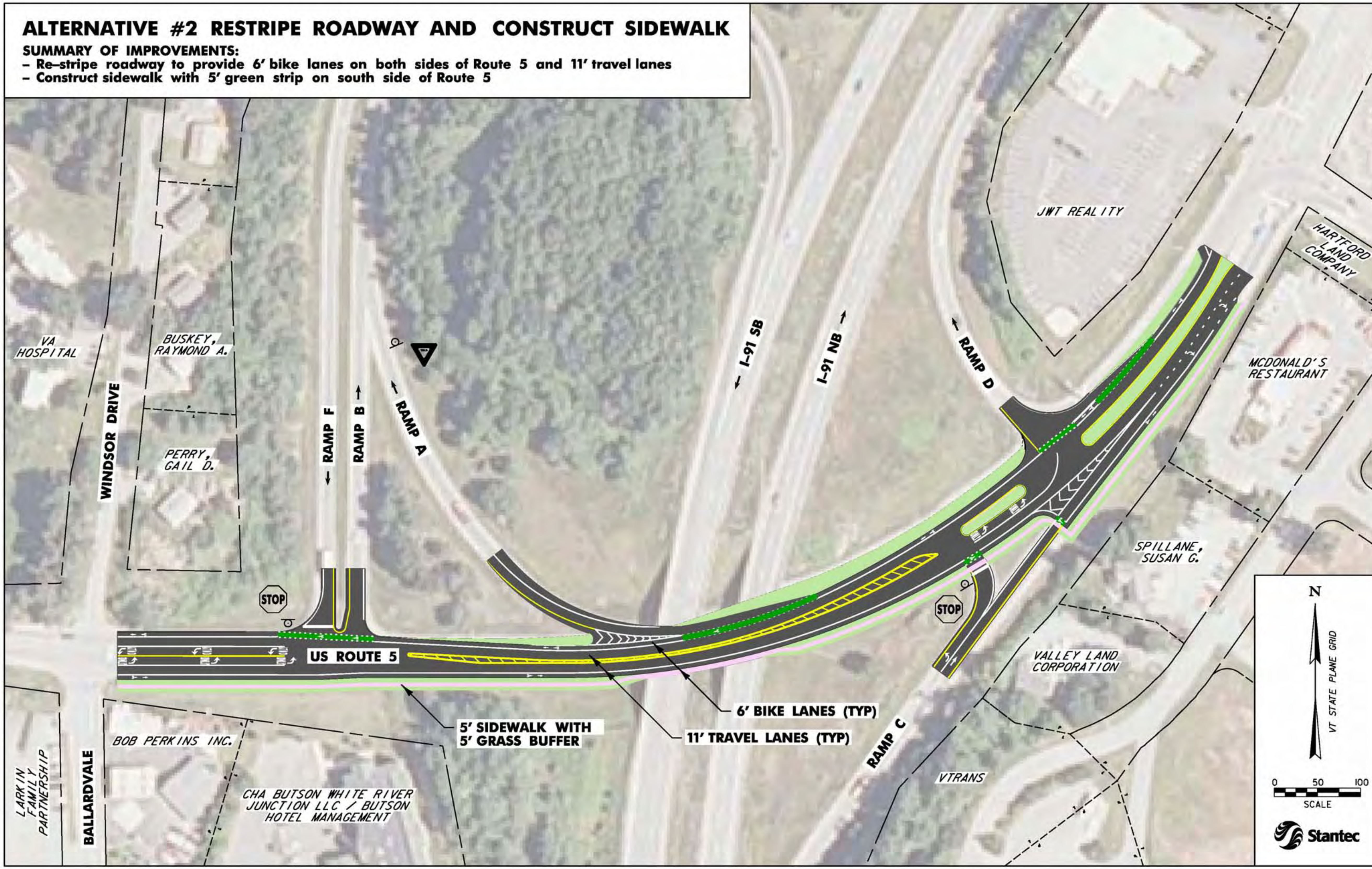

Figure 12- Alternative 2 improvements. Improvements include restriping US Route 5 to add 6' bike lanes and 11' travel lanes and constructing a 5' sidewalk with green strip on the south side of US Route 5.

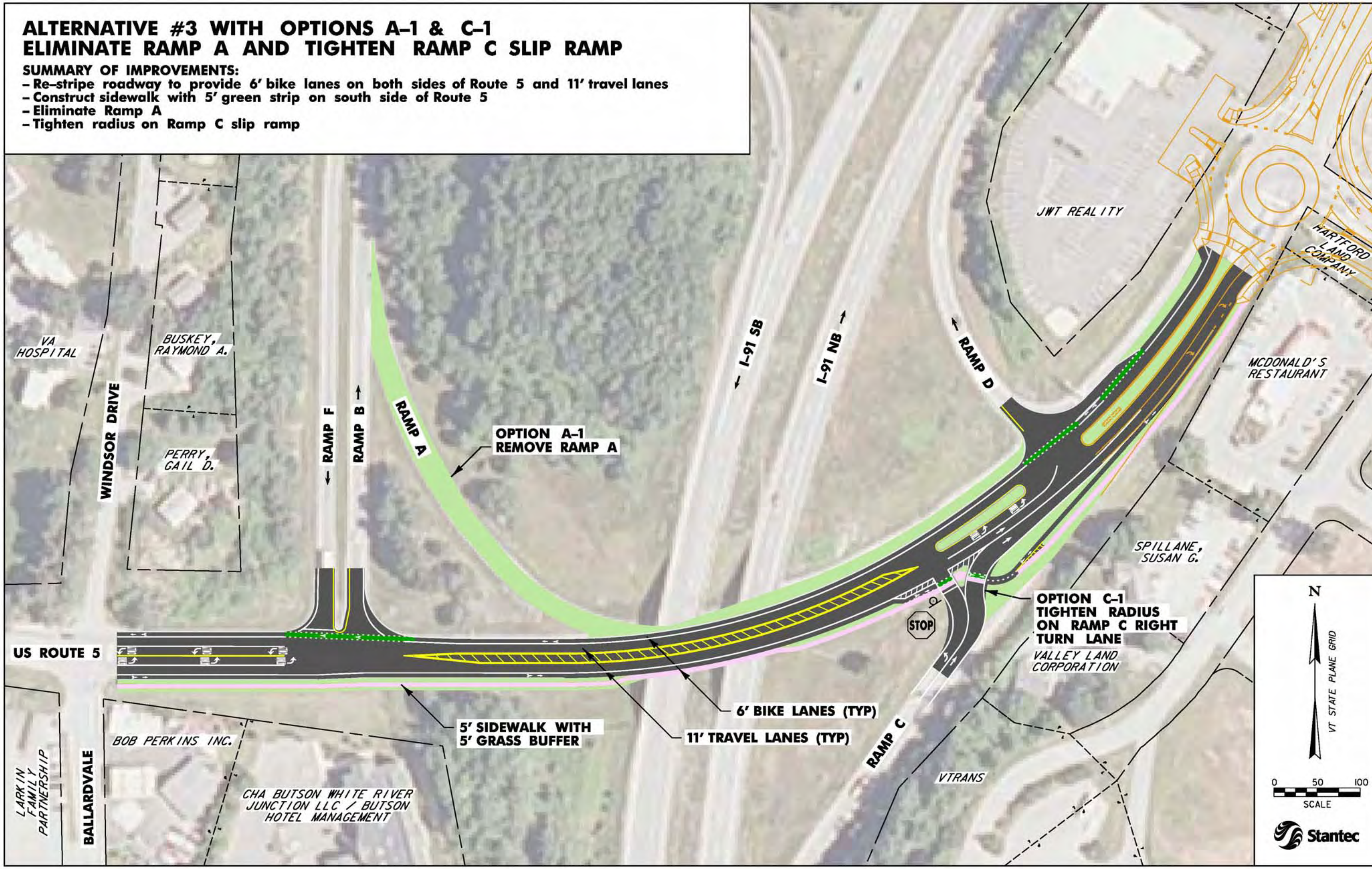

Figure 13 - Alternative 3 improvements with Option A-1 and C-1.

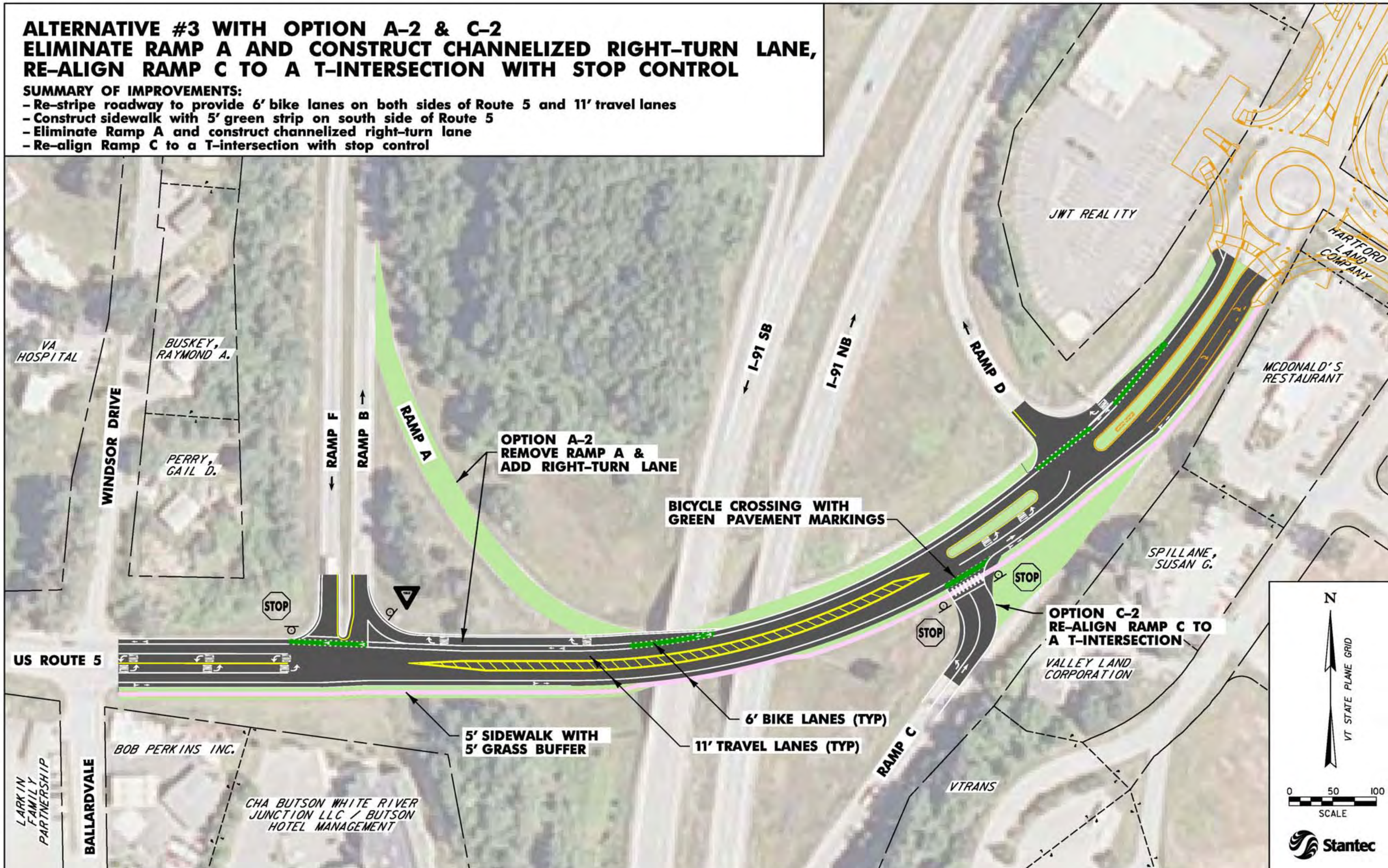

Figure 14 - Alternative 3 improvements with Options A-2 and C-2.

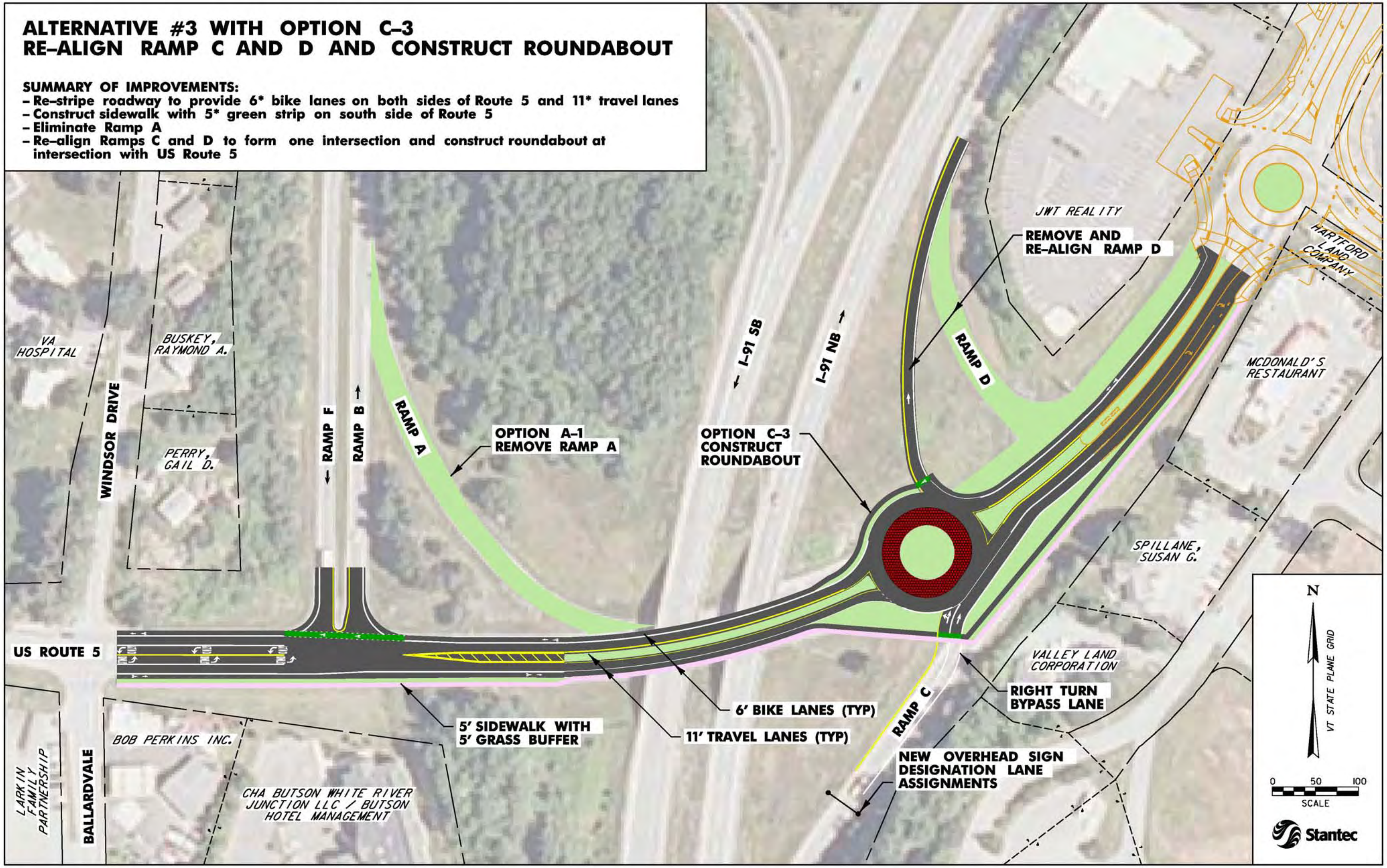

Figure 15 - Alternative 3 improvements with Options A-1 and C-3.

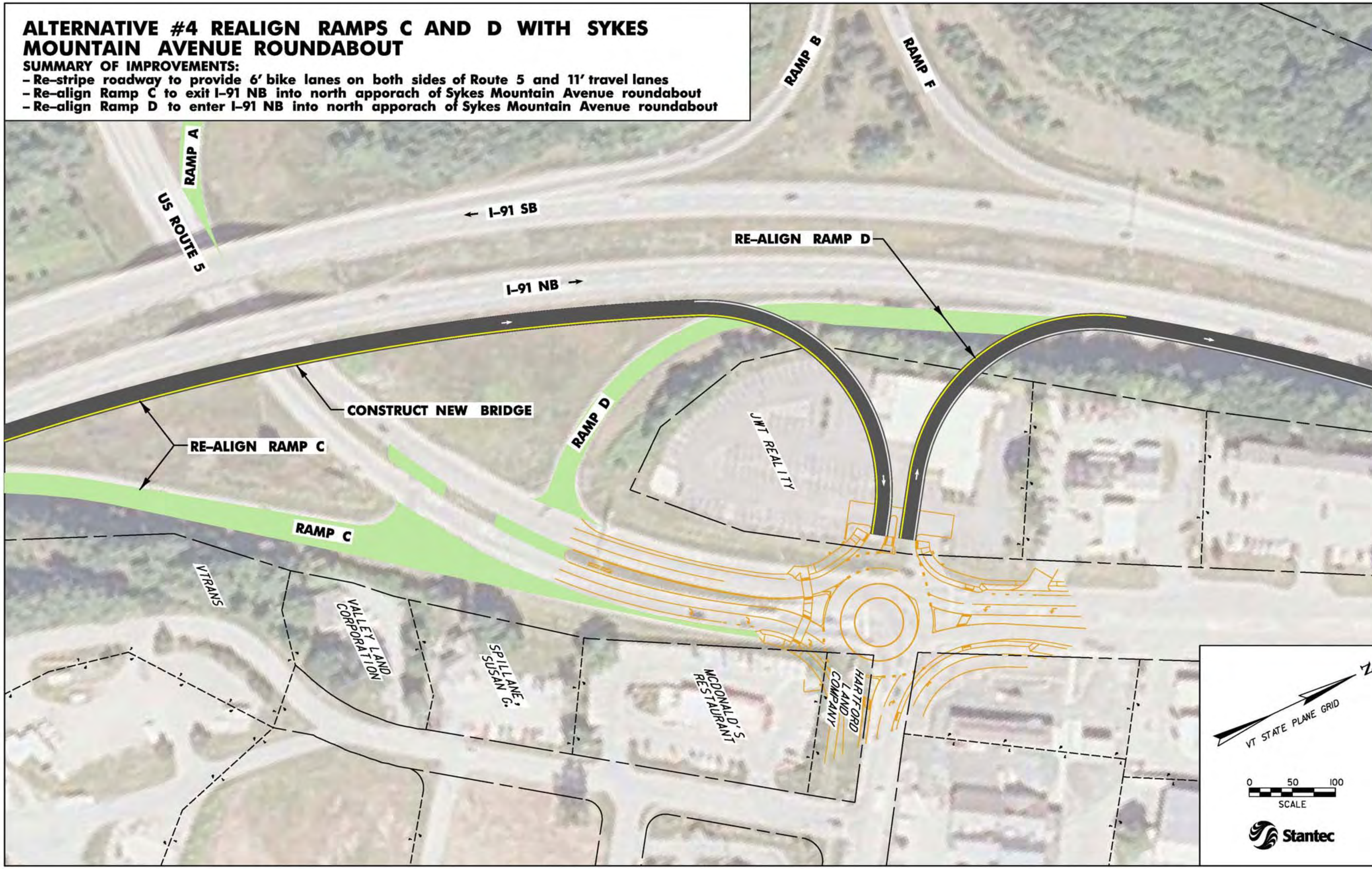

Figure 16 - Alternative 4 improvements. Improvements include realigning Ramps C and D to intersect with proposed roundabout at Sykes Mountain Avenue that is currently in design.

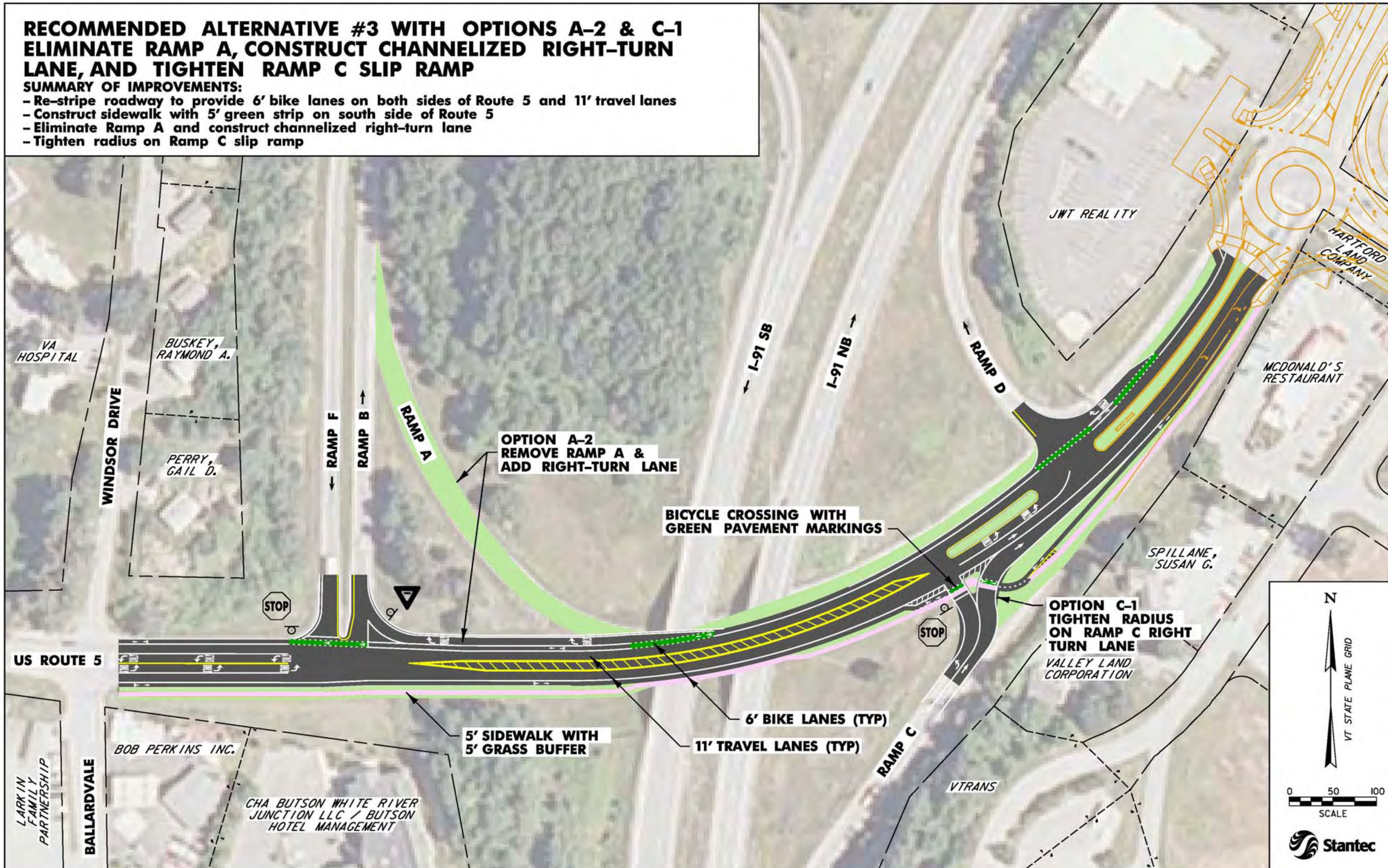

Figure 17 - Recommended Alternative

5.3 Recommended Alternative

Based on public input, the alternatives evaluation, stakeholder consensus, and the need to balance benefits, impacts, and costs, the recommended alternative is Alternative 3 with Options A-2 and C-1. Figure 17 graphically depicts this alternative. The other alternatives do not fully achieve the project purpose and need or come at too great of an expense in terms of cost and property owner impacts. Alternative 3 is the preferred alternative for the following reasons:

- Satisfies the purpose and need of the project.
- Provides dedicated bicycle and pedestrian facilities linking the facilities on either end of the study area that are currently in design.
- Reduces motor vehicle speeds of traffic exiting Ramp C which has the potential to reduce the number and severity of vehicle crashes due to the weaving condition on US Route 5 between Ramp C and Sykes Mountain Avenue.
- Eliminates Ramp A which has the potential to reduce the number and severity of vehicle crashes due to the existing merge condition of Ramp A and Ramp B.
- Maintains existing intersection operational performance and does not create traffic mobility issues on US Route 5, I-91 or the ramps.
- A traffic signal can easily be added to Ramp B/F and Ramp C intersections to address operational deficiencies.
- Results in minimal impact to natural and cultural resources.
- Does not require extensive permitting.
- Maintenance does not overburden VTrans or the Town

5.4 Alternatives Presentation Meeting

An Alternatives Presentation Meeting was held on August 16, 2012 at the Hartford Municipal Building. The purpose of the meeting was to present the alternatives developed including the recommended alternative, and solicit public comment. Many comments at the meeting were received, and notes from the meeting are contained in the appendix. The consensus from those in attendance was that the recommended alternative, Alternative #3 with Options A-2 and C-1 should be pursued. Alternative #2 should be pursued as a short-term solution if a near-term (1-3 years) resurfacing project is planned. The VTrans Pavement Management group indicated that this segment of Route 5 is currently not planned to be repaved in the next four years.

5.5 VTrans District #4 Review

A meeting with VTrans District #4 was held on September 17th, 2012. The purpose of the meeting was to review the alternatives including the recommended alternative with the VTrans District; and discuss maintenance considerations. The consensus at the meeting was that the alternatives will not involve substantially increased maintenance effort over the existing conditions. Notes from this meeting are contained in the appendix.

5.6 VTrans Review Meeting

A meeting with VTrans staff was held on September 19th, 2012 to review the alternatives, phasing, funding and logistics on how to move forward with the recommended alternative.

The recommended alternative was discussed, and no objections to this alternative were expressed by VTrans. The discussion shifted to funding of the recommended alternative. VTrans indicated that the Town can pursue funding through an Enhancement Grant or Bicycle & Pedestrian Grant for the sidewalk portion of the recommended alternative. Possible funding sources for the roadway and ramp improvements were not fully understood by those in attendance.

Since the sidewalk can be built ahead of the roadway improvements in a relatively short timeframe; and the roadway improvements would not likely be programmed through VTrans in the near term, the consensus was that pushing forward with the sidewalk improvements would allow some pedestrian improvements to be made in the near term while the Town continues to explore funding sources for the roadway and ramp improvements.

Notes from this meeting are included in the appendix.

5.7 Coordination with I-91 Bridge Scoping Study

On October 3rd, 2012, the Town received an email from VTrans regarding a study that was being completed for the reconstruction of the I-91 bridges over Route 5 within the project limits. A coordination meeting was held at VTrans on November 2nd, 2012 to discuss how to best coordinate the roadway and ramp improvements with the bridge improvements.

The possibility of changing the recommended alternative to include a 10' shared-use path instead of a 5' sidewalk was discussed as well. It was determined that since a sidewalk is proposed to be constructed between Ballardvale Drive and Arboretum, a 10' wide shared-use path will not provide any added benefit at this time. It was recommended that the Town formally request VTrans to plan for a future 10' shared-use path in the opening width between the abutments for the I-91 bridges. This way the Town will be able to widen the sidewalk to a 10' path in the future should the need arise.

At this meeting, it was explained that possible funding sources for the sidewalk were clearly understood, however possible funding sources for the roadway and ramp improvements were not. Reconstruction of the I-91 bridges could be viewed as an opportunity to build the roadway and ramp improvements concurrently. However, VTrans is currently not open to combining these projects primarily due to schedule and the uncertainty in funding for the roadway and ramp improvements. VTrans is open to designing the bridge so that the opening between abutments will be able to accommodate the future roadway and/or path improvements.

Ken Robie, Program Manager for VTrans Highway Safety and Design, mentioned that the roadway and ramp improvements will become eligible as a candidate for the VTrans Capital Program if it is ranked on the prioritization list with the regional planning commission. Mr. Robie recommended that the Town and Two Rivers-Ottauquechee Regional Planning Commission (TRORC) discuss the possibility of adding these improvements to the Regional Project Prioritization List. The higher the ranking on the TRORC listing, the more likely that VTrans will add the project to their Capital Program.

6.0 Final Recommendations

6.1. Recommended Improvements

It is recommended the Town pursue funding for further development of Alternative 3 with Options A-2 and C-1 as shown in Figure 17 and summarized in Section 5.3. These improvements include the following:

Roadway & ramp improvements

- Re-stripe roadway to provide 6' bike lanes and 11' travel lanes on both sides of Route 5
- Eliminate Ramp A and construct channelized right-turn lane
- Tighten slip ramp radius at Ramp C

Sidewalk Improvements

- Construct sidewalk with 5' green strip on south side of Route 5

Estimated cost for all improvements listed is $1,300,000. Estimated costs include Preliminary Engineering, Right-of-Way, Legal Fees, Construction Engineering, and Construction. A detailed summary of these costs is contained in the appendix.

6.2. Next Steps

The next step is to secure funding for the recommended sidewalk and roadway/ramp improvements. The following recommended actions will improve the likelihood that the project receives funding.

- Add the recommended improvements to the TROTC Regional Project Prioritization List. If project is added, follow-up with TROTC and VTrans regularly to review ranking and likelihood of becoming a funded project.
- Study possible improvements from Route 5/Ramp B/Ramp F and Route 5/Ramp C/Ramp D intersections to address operational performance.

If the roadway and ramp improvements are not likely to be funded in the near future, the Town can consider the following actions.

- Pursue grant funding for the sidewalk portion of the recommended improvements. Estimated costs of the sidewalk improvements is $250,000.
- Determine when Route 5 is scheduled to be resurfaced, and work with VTrans Pavement Management Section to implement re-striping improvements similar to those shown in Alternative 2. Estimated cost to resurface this section of Route 5 including striping and signing is $330,000.

The following additional project considerations are recommended once funding has been secured and the project moves into the engineering phase.

- Meet with FHWA early in the plan development to determine steps required to construct improvements within I-91 right-of-way.

- Work with local garden club to re-establish plantings that will be lost near Ramp C due to geometric improvements

These early steps may facilitate a more successful and timely developed project.

The final recommendations were presented to the Town Selectboard on November 27th, 2012, and were unanimously accepted. Minutes from the meeting are contained in the appendix.

Appendices

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Appendix A

AM PEAK

Intersection	
Intersection Delay (sec/veh):	11.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Volume (vph)	230	215	475	0	95	110
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length	0			0	0	0
Median Width		12	12		14	
Grade (%)		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles(%)	9	9	9	9	9	9
Movement Flow Rate	230	215	475	0	95	110
Number of Lanes	1	1	1	0	1	0

Major/Minor		Major 1	Major 2			
Conflicting Flow Rate - All	475	0	0	-	1150	475
Stage 1	0	0	0	-	475	0
Stage 2	0	0	0	-	675	0
Follow-up Headway	2.281	-	0	-	3.581	3.381
Pot Capacity-1 Maneuver	1051	-	-	-	212	576
Stage 1	-	-	-	-	611	-
Stage 2	-	-	-	-	493	-
Mov Capacity-1 Maneuver	1051	-	-	-	165.6	576
Mov Capacity-2 Maneuver	-	-	-	-	165.6	-
Stage 1	-	-	-	-	# 0	-
Stage 2	-	-	-	-	385	-

Approach	EB	WB	SB
HCM Control Delay (s)	4.8	0	51.7
HCM LOS	A	A	F

Lane	EBL	EBT	WBT	SBLn1
Capacity (vph)				268
HCM Control Delay (s)	9.382	-	-	51.7
HCM Lane VC Ratio	0.219	-	0	0.765
HCM Lane LOS	A	-	-	F
HCM 95th Percentile Queue (veh)	0.834	-	0	5.674

EXISTING

AM PEAK

Intersection	
Intersection Delay (sec/veh):	12

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Volume (vph)	360	0	0	435	280	0
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length		0	0		200	0
Median Width	0			0	12	
Grade (%)	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles(%)	7	7	7	7	7	7
Movement Flow Rate	360	0	0	435	280	0
Number of Lanes	1	0	0	1	1	0

Major/Minor	Major 1			Major 2		
Conflicting Flow Rate - All	0	-	-	0	795	-
Stage 1	0	-	-	0	360	-
Stage 2	0	-	-	0	435	-
Follow-up Headway	-	-	-	0	3.563	-
Pot Capacity-1 Maneuver	-	-	-	-	350	-
Stage 1	-	-	-	-	695	-
Stage 2	-	-	-	-	642	-
Mov Capacity-1 Maneuver	-	-	-	-	350	-
Mov Capacity-2 Maneuver	-	-	-	-	350	-
Stage 1	-	-	-	-	# 0	-
Stage 2	-	-	-	-	# 0	-

Approach	EB	WB	NB
HCM Control Delay (s)	0	0	46
HCM LOS	A	A	E

Lane	NBLn1	EBT	WBT
Capacity (vph)	350		
HCM Control Delay (s)	46	-	-
HCM Lane VC Ratio	0.8	0	0
HCM Lane LOS	E	-	-
HCM 95th Percentile Queue (veh)	6.767	0	0

Appendix B

AM PEAK

Intersection						
Intersection Delay (sec/veh):	11.3					

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Volume (vph)	230	215	475	0	95	110
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	Yield	Yield	None	None
Storage Length	0			0	0	0
Median Width		12	12		14	
Grade (%)		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles(%)	9	9	9	9	9	9
Movement Flow Rate	230	215	475	0	95	110
Number of Lanes	1	1	1	0	1	0

Major/Minor	Major 1		Major 2			
Conflicting Flow Rate - All	475	0	0	-	1150	475
Stage 1	0	0	0	-	475	0
Stage 2	0	0	0	-	675	0
Follow-up Headway	2.281	-	0	-	3.581	3.381
Pot Capacity-1 Maneuver	1051	-	-	-	212	576
Stage 1	-	-	-	-	611	-
Stage 2	-	-	-	-	493	-
Mov Capacity-1 Maneuver	1051	-	-	-	165.6	576
Mov Capacity-2 Maneuver	-	-	-	-	165.6	-
Stage 1	-	-	-	-	# 0	-
Stage 2	-	-	-	-	385	-

Approach	EB	WB	SB
HCM Control Delay (s)	4.8	0	51.7
HCM LOS	A	A	F

Lane	EBL	EBT	WBT	SBLn1
Capacity (vph)				268
HCM Control Delay (s)	9.382	-	-	51.7
HCM Lane VC Ratio	0.219	-	0	0.765
HCM Lane LOS	A	-	-	F
HCM 95th Percentile Queue (veh)	0.834	-	0	5.674

NO RIGHTS

Option C-2

AM PEAK

Intersection	
Intersection Delay (sec/veh):	16.6

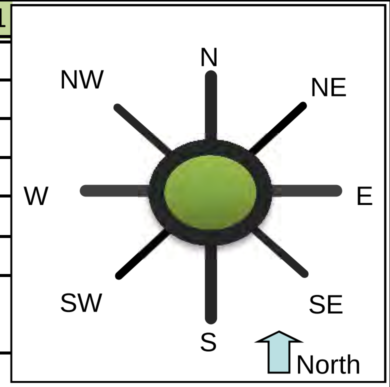
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Volume (vph)	360	0	0	435	280	520
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length		0	0		150	0
Median Width	0			0	12	
Grade (%)	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles(%)	7	7	7	7	7	7
Movement Flow Rate	360	0	0	435	280	520
Number of Lanes	1	0	0	1	1	1

Major/Minor	Major 1			Major 2		
Conflicting Flow Rate - All	0	-	-	0	795	360
Stage 1	0	-	-	0	360	0
Stage 2	0	-	-	0	435	0
Follow-up Headway	-	-	-	0	3.563	3.363
Pot Capacity-1 Maneuver	-	-	-	-	350	674
Stage 1	-	-	-	-	695	-
Stage 2	-	-	-	-	642	-
Mov Capacity-1 Maneuver	-	-	-	-	350	674
Mov Capacity-2 Maneuver	-	-	-	-	350	-
Stage 1	-	-	-	-	# 0	-
Stage 2	-	-	-	-	# 0	-

Approach	EB	WB	NB
HCM Control Delay (s)	0	0	33
HCM LOS	A	A	D

Lane	NBLn1	NBLn2	EBT	WBT
Capacity (vph)	350	674		
HCM Control Delay (s)	46	26	-	-
HCM Lane VC Ratio	0.8	0.772	0	0
HCM Lane LOS	E	D	-	-
HCM 95th Percentile Queue (veh)	6.767	7.335	0	0

General & Site Information	v2.1
Analyst:	Greg Goyette, PE
Agency/Co:	Stantec
Date:	5/30/2012
Project or PI#:	Hartford US Route 5 Scoping Study
Year, Peak Hour:	2015, AM Peak
County/District:	
Intersection Name:	US Route 5/Ramp C Option C-3 No Bypass Lane



Volumes		Entry Legs (FROM)							
		N (1)	**NE (2)**	**E (3)**	**SE (4)**	**S (5)**	**SW (6)**	**W (7)**	**NW (8)**
	N (1), vph			**57**		0		**63**	
Exit	NE (2), vph								
Legs	E (3), vph					**544**		**317**	
(TO)	SE (4), vph								
	S (5), vph			0				0	
	SW (6), vph								
	W (7), vph			**456**		**304**			
	NW (8), vph								
Output	Total Vehicles	0	0	513	0	848	0	380	0

Volume Characteristics	**N**	**NE**	**E**	**SE**	**S**	**SW**	**W**	**NW**
% Cars	90%	100%	90%	100%	90%	100%	90%	100%
% Heavy Vehicles	**5%**	0%	**5%**	0%	**5%**	0%	**5%**	0%
% Bicycle	**5%**	0%	**5%**	0%	**5%**	0%	**5%**	0%
# of Pedestrians **(ped/hr)**	**10**	0	**10**	0	**10**	0	**10**	0
PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
F_{HV}	1.000	1.000	0.976	1.000	0.976	1.000	0.976	1.000
F_{ped}	0.999	1.000	0.999	1.000	0.999	1.000	0.999	1.000

Entry/Conflicting Flows	**N**	**NE**	**E**	**SE**	**S**	**SW**	**W**	**NW**
Flow to Leg # N (1), pcu/h	0	0	64	0	0	0	70	0
NE (2), pcu/h	0	0	0	0	0	0	0	0
E (3), pcu/h	0	0	0	0	606	0	353	0
SE (4), pcu/h	0	0	0	0	0	0	0	0
S (5), pcu/h	0	0	0	0	0	0	0	0
SW (6), pcu/h	0	0	0	0	0	0	0	0
W (7), pcu/h	0	0	508	0	339	0	0	0
NW (8), pcu/h	0	0	0	0	0	0	0	0
Entry flow, pcu/h	0	0	572	0	945	0	423	0
Conflicting flow, pcu/h	0	0	409	0	423	0	0	0

Roundabout Type	**Standard Single Lane or Urban Compact**
Enter type here…	Standard Single Lane

Results: Approach Measures of Effectiveness

HCM 2010 Model (build)	N	NE	E	SE	S	SW	W	NW
Entry Capacity, vph	NA	NA	731	NA	721	NA	1101	NA
Entry Flow Rates, vph	NA	NA	558	NA	922	NA	413	NA
V/C ratio			**0.76**		**1.28**		**0.38**	
Control Delay, s/veh			**23**		**155**		**7**	
LOS			C		F		A	
95th % Queue (ft)			**185**		**896**		**45**	
Calibrated Model (future)	**N**	**NE**	**E**	**SE**	**S**	**SW**	**W**	**NW**
Entry Capacity, vph	NA	NA	936	NA	926	NA	1299	NA
Entry Flow Rates, vph	NA	NA	558	NA	922	NA	413	NA
V/C ratio			**0.61**		**1.02**		**0.33**	
Control Delay, sec/pcu			**13**		**56**		**6**	
LOS			B		F		A	
95th % Queue (ft)			**110**		**514**		**37**	

Notes:

v2.1

Unit Legend:
vph = vehicles per hour
PHF = peak hour factor
F_{HV} = heavy vehicle factor
pcu = passenger car unit

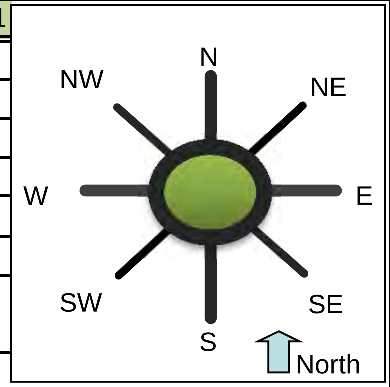
Bypass Lane Merge Point Analysis (if applicable)

Bypass Characteristics	Bypass #1	Bypass #2	Bypass #3	Bypass #4	Bypass #5	Bypass #6
Select Entry Leg from Bypass (FROM)						
Select Exit Leg for Bypass (TO)						
Does the bypass have a dedicated receiving lane?						
Volumes						
Right Turn Volume removed from Entry Leg						
Volume Characteristics (for entry leg)						
PHF						
F_{HV}						
F_{ped}						
NOTE: Volume Characteristics for Exit Leg are already taken into account						
Entry/Conflicting Flows						
Entry Flow, pcu/hr						
Conflicting Flow, pcu/hr						
Bypass Lane Results (HCM 2010 Model)						
Entry Capacity of Bypass, vph						
Flow Rates of Exiting Traffic, vph						
V/C ratio						
Control Delay, s/veh						
LOS						
95th % Queue (ft)						
Approach w/Bypass Delay, s/veh						
Approach w/Bypass LOS						

General & Site Information

v2.1

Analyst:	Greg Goyette, PE
Agency/Co:	Stantec
Date:	5/30/2012
Project or PI#:	Hartford US Route 5 Scoping Study
Year, Peak Hour:	2015, AM Peak
County/District:	
Intersection Name:	US Route 5/Ramp C Option C-3 with Bypass Lane



Volumes

		Entry Legs (FROM)							
		N (1)	NE (2)	E (3)	SE (4)	S (5)	SW (6)	W (7)	NW (8)
	N (1), vph			57		0		63	
Exit	NE (2), vph								
Legs	E (3), vph					0		317	
(TO)	SE (4), vph								
	S (5), vph			0				0	
	SW (6), vph								
	W (7), vph			456		304			
	NW (8), vph								
Output	Total Vehicles	0	0	513	0	304	0	380	0

Volume Characteristics

Volume Characteristics	N	NE	E	SE	S	SW	W	NW
% Cars	90%	100%	90%	100%	90%	100%	90%	100%
% Heavy Vehicles	5%	0%	5%	0%	5%	0%	5%	0%
% Bicycle	5%	0%	5%	0%	5%	0%	5%	0%
# of Pedestrians **(ped/hr)**	10	0	10	0	10	0	10	0
PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
F_{HV}	1.000	1.000	0.976	1.000	0.976	1.000	0.976	1.000
F_{ped}	0.999	1.000	0.999	1.000	0.999	1.000	0.999	1.000

Entry/Conflicting Flows

Entry/Conflicting Flows	N	NE	E	SE	S	SW	W	NW
Flow to Leg # N (1), pcu/h	0	0	64	0	0	0	70	0
NE (2), pcu/h	0	0	0	0	0	0	0	0
E (3), pcu/h	0	0	0	0	0	0	353	0
SE (4), pcu/h	0	0	0	0	0	0	0	0
S (5), pcu/h	0	0	0	0	0	0	0	0
SW (6), pcu/h	0	0	0	0	0	0	0	0
W (7), pcu/h	0	0	508	0	339	0	0	0
NW (8), pcu/h	0	0	0	0	0	0	0	0
Entry flow, pcu/h	0	0	572	0	339	0	423	0
Conflicting flow, pcu/h	0	0	409	0	423	0	0	0

Roundabout Type

Standard Single Lane or Urban Compact

Enter type here… Standard Single Lane

Results: Approach Measures of Effectiveness								
HCM 2010 Model (build)	**N**	**NE**	**E**	**SE**	**S**	**SW**	**W**	**NW**
Entry Capacity, vph	NA	NA	731	NA	721	NA	1101	NA
Entry Flow Rates, vph	NA	NA	558	NA	330	NA	413	NA
V/C ratio			**0.76**		**0.46**		**0.38**	
Control Delay, s/veh			**23**		**11**		**7**	
LOS			C		B		A	
95th % Queue (ft)			**185**		**62**		**45**	
Calibrated Model (future)	**N**	**NE**	**E**	**SE**	**S**	**SW**	**W**	**NW**
Entry Capacity, vph	NA	NA	936	NA	926	NA	1299	NA
Entry Flow Rates, vph	NA	NA	558	NA	330	NA	413	NA
V/C ratio			**0.61**		**0.37**		**0.33**	
Control Delay, sec/pcu			**13**		**8**		**6**	
LOS			B		A		A	
95th % Queue (ft)			**110**		**43**		**37**	

Notes: v2.1

Unit Legend:
vph = vehicles per hour
PHF = peak hour factor
F_{HV} = heavy vehicle factor
pcu = passenger car unit

Bypass Lane Merge Point Analysis (if applicable)						
Bypass Characteristics	**Bypass #1**	**Bypass #2**	**Bypass #3**	**Bypass #4**	**Bypass #5**	**Bypass #6**
Select Entry Leg from Bypass (FROM)	**S (5)**					
Select Exit Leg for Bypass (TO)	**E (3)**					
Does the bypass have a dedicated receiving lane?	**Yes**					
Volumes						
Right Turn Volume removed from Entry Leg	**544**					
Volume Characteristics (for entry leg)						
PHF	0.92					
F_{HV}	0.98					
F_{ped}	1.00					
NOTE: Volume Characteristics for Exit Leg are already taken into account						
Entry/Conflicting Flows						
Entry Flow, pcu/hr	606					
Conflicting Flow, pcu/hr	0					
Bypass Lane Results (HCM 2010 Model)						
Entry Capacity of Bypass, vph	1101					
Flow Rates of Exiting Traffic, vph	591					
V/C ratio	**0.54**					
Control Delay, s/veh	**0.0**					
LOS	A					
95th % Queue (ft)	**85**					
Approach w/Bypass Delay, s/veh	***4.1***					
Approach w/Bypass LOS	*A*					

Appendix C

Vermont Agency of Transportation

Statewide Intersections - Route Log Order /2 - Statewide

Years: 2006 - 2010

H.C.L No.	/3.	Route	System	Town	Mileage	ADT	Years	Crashes	Fatalities	Injuries	PDO Crashes	Critical Rate	Actual Rate	Ratio Actual/Critical	Severity Index ($/Accident/ 1.)
	81	VT-2A, INDUSTRIAL AVE., WILLISTON, MT. VIEW ROAD, WILLISTON	Minor Arterial (u)/Urban Collector (u)	Williston	4.780 - 4.800	22320	5	43	0	4	41	0.867	1.055	1.216	$13,821
	100	US-4, FAS 0168, TOWN ROAD 0008	Principal Arterial (r)/Major Collector (r)	Hartford	2.440 - 2.540	9129	5	15	0	5	11	0.811	0.9	1.109	$27,253
	47	US-4, FAS 0168	Principal Arterial (r)/Major Collector (r)	Hartford	3.310 - 3.390	8889	5	19	0	3	16	0.816	1.171	1.434	$17,016
	101	US-4, QUEECHE STATE HIGHWAY	Principal Arterial (r)	Hartford	5.780 - 5.940	9700	5	17	0	5	14	0.865	0.96	1.109	$25,512
	64	US-4, I-89	Principal Arterial (r)/Minor Arterial (r)	Hartford	6.430 - 6.590	5188	5	14	0	9	8	1.152	1.478	1.283	$45,564
	56	VT-4A, VT-30	Minor Arterial (r)/Major Collector (r)	Castleton	1.760 - 1.860	10340	5	26	0	16	17	1.026	1.377	1.342	$44,504
	94	US-5, VT-5A, TOWN ROAD 0035	Major Collector (r)	Burke	4.030 - 4.110	2121	5	5	0	4	4	1.124	1.291	1.148	$57,440
	88	US-5, VT-25	Major Collector (r)	Bradford	1.380 - 1.480	8055	5	14	0	3	11	0.81	0.952	1.175	$20,129
	110	US-5, VT-25B	Major Collector (r)	Bradford	2.370 - 2.430	6135	5	10	0	0	10	0.862	0.893	1.035	$8,300
* #	117	US-5, VT-142	Minor Arterial (u)	Brattleboro	2.120 - 2.140	17606	5	26	0	2	24	0.8	0.809	1.011	$12,546
	77	US-5, VT-123	Minor Arterial (r)	Westminster	5.140 - 5.240	6500	5	11	0	0	11	0.756	0.927	1.226	$8,300
*	72	US-5, FAS 0325	Major Collector (r)	Hartford	3.050 - 3.080	17534	5	28	0	3	26	0.689	0.875	1.269	$14,511
#	118	US-5, US-4	Minor Arterial (r)/Major Collector (r)	Hartford	3.490 - 3.660	11294	5	21	0	4	17	1.008	1.018	1.009	$18,814
#	11	US-5, VT-14, US-4	Minor Arterial (r)/Major Collector (r)	Hartford	4.060 - 4.160	14367	5	52	0	6	46	0.964	1.983	2.056	$14,669

General Yearly Summaries - Crash Listing: State Highways and All Federal Aid Highway Systems

From 01/01/06 To 12/31/10 General Yearly Summaries Information

Route: US-5 Continued ...

*	Reporting Agency/ Number	Town	Mile Marker	Date MM/DD/YY	Time	Weather	Contributing Circumstances	Direction Of Collision	Number Of Injuries	Number Of Fatalities	Direction	Road Group
	1408/7319-06	Hartford	1.4	05/22/2006	12:56	Cloudy	Operating vehicle in erratic, reckless, careless, negligent, or aggressive manner, Other improper action	Single Vehicle Crash	1	0		SH
	1408/6079-06	Hartford	1.49	05/04/2006	14:59	Clear	Failure to keep in proper lane, Inattention	Same Direction Sideswipe	0	0		SH
	1408/15996-06	Hartford	1.59	12/03/2006	19:35	Clear	No improper driving	Single Vehicle Crash	0	0	S	SH
	VT0140300/10HF0 3060	Hartford	1.7	07/26/2010	18:14	Clear	No improper driving	Single Vehicle Crash	0	0	S	SH
	VT0140300/08HF0 7843	Hartford	1.79	11/20/2008	13:49	Cloudy	No improper driving, Followed too closely	Rear End	0	0	S	SH
	VT0140300/08HF0 3253	Hartford	1.82	06/04/2008	03:09	Rain	Fatigued, asleep, Failure to keep in proper lane	Single Vehicle Crash	2	0		SH
	1408/52-06	Hartford	1.87	09/05/2006	11:39	Clear	Failure to keep in proper lane, Unknown, No improper driving	Opp Direction Sideswipe	1	1	S	SH
	VT0140300/08HF0 3867	Hartford	2.16	07/01/2008	03:49	Fog, Smog, Smoke	Failure to keep in proper lane, Swerving or avoiding due to wind, slippery surface, vehicle, object, non-motorist in roadway etc	Single Vehicle Crash	1	0	N	SH
	VT0140300/09HF0 4554	Hartford	2.46	06/19/2009	12:09	Cloudy	Followed too closely, No improper driving	Rear End	0	0	S	SH
	1408/9552-06	Hartford	2.5	07/24/2006	15:05	Clear	Followed too closely, No improper driving	Rear End	0	0	N	SH
	1408/6387-07	Hartford	2.5	05/11/2007	08:35	Cloudy	No improper driving, Operating defective equipment	Rear End	1	0	S	SH
	VT0140300/08HF0 0848	Hartford	2.5	02/16/2008	11:10	Cloudy	Failed to yield right of way, No improper driving	Left Turn and Thru, Angle Broadside -->v--	0	0		SH
	VT0140300/10HF0 3287	Hartford	2.5	08/10/2010	08:55	Clear	Disregarded traffic signs, signals, road markings, No improper driving	No Turns, Thru moves only, Broadside ^<	0	0	E	SH
	1408/1508-06	Hartford	2.51	01/26/2006	18:26	Clear	Inattention, No improper driving	Right Turn and Thru, Angle Broadside -->^--	0	0		SH
	VT0140300/09HF0 6083	Hartford	2.51	08/13/2009	17:07	Clear	Failed to yield right of way, Inattention, No improper driving	Left Turn and Thru, Broadside v<--	0	0	E	SH
	1408/15898-06	Hartford	2.52	12/01/2006	16:41	Rain	Wrong side or wrong way, Inattention, No improper driving	Opp Direction Sideswipe	0	0	N	SH
	1408/4458-06	Hartford	2.53	03/24/2006	11:46	Rain	Inattention	Rear End	0	0	N	SH
	1408/6316-07	Hartford	2.54	05/03/2007	07:44	Clear	Failure to keep in proper lane, Inattention	Same Direction Sideswipe	0	0	S	SH
	1408/7195-07	Hartford	2.54	05/30/2007	07:41	Clear	Followed too closely, Inattention, No improper driving	Rear End	0	0	N	SH
	VT0140300/08HF0 1937	Hartford	2.54	04/11/2008	10:23	Cloudy		Rear-to-rear	0	0	E	SH
	VT0140300/08HF0 6963	Hartford	2.54	10/19/2008	11:25	Clear	Failed to yield right of way, Inattention, No improper driving	No Turns, Thru moves only, Broadside ^<	0	0	S	SH
	1408/2540-06	Hartford	2.64	02/16/2006	16:46	Clear	Distracted, Followed too closely, No improper driving	Rear End	1	0	W	SH
	1408/7249-06	Hartford	2.68	06/06/2006	16:45	Clear	No improper driving, Inattention	Rear End	0	0		SH
	1408/4684-07	Hartford	2.68	03/21/2007	14:33	Clear	Inattention, Followed too closely, No improper driving	Rear End	0	0	W	SH
	1408/8145-06	Hartford	2.69	06/15/2006	06:28	Cloudy	No improper driving, Followed too closely	Rear End	0	0	N	SH
	VT0140300/09HF0 7731	Hartford	2.7	10/13/2009	11:17	Rain	Failed to yield right of way, No improper driving		2	0	E	SH
	VT0140300/10HF0 5299	Hartford	2.71	12/26/2010	16:40	Clear	Technology Related Distraction, Inattention, No improper driving	Rear End	0	0	S	SH
	1408/3194-07	Hartford	2.72	01/25/2007	12:12	Clear	No improper driving, Inattention, Failed to yield right of way	Left Turn and Thru, Broadside v<--	0	0	N	SH
	1408/11644-07	Hartford	2.72	09/12/2007	07:56	Clear	Followed too closely, No improper driving	Rear End	0	0	N	SH
	1408/1492-06	Hartford	2.73	01/25/2006	17:43	Cloudy	No improper driving, Inattention, Fatigued, asleep	Left Turn and Thru, Broadside v<--	0	0	S	SH
	1408/3812-07	Hartford	2.76	03/12/2007	09:28	Cloudy	No improper driving, Swerving or avoiding due to wind, slippery surface, vehicle, object, non-motorist in roadway etc	Opp Direction Sideswipe	0	0		SH
	VT0140300/10HF0 4281	Hartford	2.8	10/05/2010	16:44	Cloudy	Failed to yield right of way, No improper driving	No Turns, Thru moves only, Broadside ^<	0	0	S	SH

Crash occurred prior to the last Highway Improvement Project. This data should not be used in a crash analysis. UNK indicates the Mile Marker is Unknown.

Vertmont Agency of Transportation

General Yearly Summaries - Crash Listing: State Highways and All Federal Aid Highway Systems

From 01/01/06 To 12/31/10 General Yearly Summaries Information

Route: US-5 Continued ...

*	Reporting Agency/ Number	Town	Mile Marker	Date MM/DD/YY	Time	Weather	Contributing Circumstances	Direction Of Collision	Number Of Injuries	Number Of Fatalities	Direction	Road Group
	1408/1770-06	Hartford	2.81	02/01/2006	12:53	Cloudy	No improper driving, Failure to keep in proper lane	Same Direction Sideswipe	0	0	S	SH
	1408/2864-07	Hartford	2.81	02/23/2007	16:17	Clear	Failed to yield right of way, Disregarded traffic signs, signals, road markings, No improper driving	Left Turn and Thru, Broadside v<--	0	0		SH
	VT0140300/10HF0 2647	Hartford	2.83	07/01/2010	11:57	Clear	Inattention, No improper driving	Left Turn and Thru, Broadside v<--	0	0	E	SH
	VT0140300/10HF0 1442	Hartford	2.85	04/13/2010	14:41	Clear	Failure to keep in proper lane, No improper driving	Same Direction Sideswipe	0	0	S	SH
	1408/3361-06	Hartford	2.87	02/28/2006	15:58	Clear	No improper driving, Distracted	Rear End	0	0		SH
	1408/371-06	Hartford	2.88	01/05/2006	10:45	Snow	Made an improper turn, No improper driving	No Turns, Thru moves only, Broadside ^<	0	0		SH
	VT0140300/09HF0 1413	Hartford	2.89	03/06/2009	11:20	Clear	Disregarded traffic signs, signals, road markings, Inattention, No improper driving	Same Direction Sideswipe	0	0	S	SH
	VT0140300/10HF0 5175	Hartford	2.9	12/14/2010	12:00	Clear	Exceeded authorized speed limit	Single Vehicle Crash	0	0	S	SH
	1408/14566-06	Hartford	2.93	10/31/2006	07:20	Cloudy	Technology Related Distraction, Failure to keep in proper lane	Single Vehicle Crash	0	0	S	SH
	1408/13138-06	Hartford	2.94	09/29/2006	17:53	Cloudy	Followed too closely, Inattention, No improper driving	Rear End	0	0	N	SH
	1408/4892-06	Hartford	2.97	03/30/2006	17:02	Clear	Failed to yield right of way, Inattention, No improper driving	Same Direction Sideswipe	0	0	N	SH
	1408/5500-07	Hartford	2.97	04/11/2007	12:42	Clear	Followed too closely, Inattention, No improper driving	Rear End	0	0	S	SH
	VT0140300/10HF0 5012	Hartford	2.97	12/01/2010	10:51	Rain	No improper driving, Failed to yield right of way, Inattention	Left Turn and Thru, Angle Broadside -->v--	0	0	S	SH
	1408/10168-07	Hartford	2.98	08/03/2007	16:46	Clear	Failed to yield right of way, Unknown	Left Turn and Thru, Angle Broadside -->v--	0	0		SH
	1408/7682-06	Hartford	3	05/24/2006	12:11	Clear	No improper driving, Inattention	Same Direction Sideswipe	0	0	E	SH
	1408/6906-06	Hartford	3.01	05/26/2006	15:28	Clear	No improper driving, Failed to yield right of way, Made an improper turn	Opp Direction Sideswipe	0	0	S	SH
	1408/7757-07	Hartford	3.01	06/06/2007	14:58	Clear	Failed to yield right of way, No improper driving	Same Direction Sideswipe	0	0	N	SH
	1408/320-06	Hartford	3.02	01/01/2006	02:49	Cloudy	Unknown, Under the influence of medication/drugs/alcohol	No Turns, Thru moves only, Broadside ^<	2	0	N	SH
	1408/2632-06	Hartford	3.02	02/19/2006	01:04	Clear	No improper driving, Failed to yield right of way, Disregarded traffic signs, signals, road markings	Left Turn and Thru, Angle Broadside -->v--	0	0		SH
	VT0140300/08HF0 2042	Hartford	3.02	04/15/2008	15:59	Clear	Disregarded traffic signs, signals, road markings, Unknown, No improper driving	Left Turn and Thru, Angle Broadside -->v--	0	0	E	SH
	VT0140300/08HF0 4082	Hartford	3.02	07/10/2008	16:10	Clear	Other improper action	Head On	0	0	E	SH
	VT0140300/08HF0 7880	Hartford	3.02	11/22/2008	13:28	Clear	No improper driving, Followed too closely	Rear End	0	0	S	SH
	VT0140300/10HF0 0221	Hartford	3.03	01/18/2010	23:59	Cloudy	Operating vehicle in erratic, reckless, careless, negligent, or aggressive manner, Under the influence of medication/drugs/alcohol	Single Vehicle Crash	0	0		SH
	1408/686-07	Hartford	3.04	01/18/2007	00:57	Clear	Under the influence of medication/drugs/alcohol, Failure to keep in proper lane	Single Vehicle Crash	0	0		SH
	1408/6955-07	Hartford	3.06	05/25/2007	16:42	Clear	No improper driving, Followed too closely	Rear End	0	0		SH
	VT0140300/08HF0 6737	Hartford	3.06	10/11/2008	00:47	Clear	Failed to yield right of way, Operating vehicle in erratic, reckless, careless, negligent, or aggressive manner, No improper driving	Left Turn and Thru, Angle Broadside -->v--	0	0		SH
	VT0140300/08HF0 7968	Hartford	3.06	11/26/2008	14:11	Cloudy	Failed to yield right of way	Right Turn and Thru, Same Direction Sideswipe/Angle Crash ^^--	0	0	N	SH
	1408/13136-06	Hartford	3.07	09/15/2006	08:47	Cloudy	Failed to yield right of way, No improper driving	Same Direction Sideswipe	0	0	E	SH
	1408/1726-07	Hartford	3.07	02/02/2007	19:36	Snow	No improper driving	No Turns, Thru moves only, Broadside ^<	0	0	N	SH
	1408/11446-07	Hartford	3.07	08/29/2007	05:52	Clear	No improper driving, Failed to yield right of way, Disregarded traffic signs, signals, road markings	Left Turn and Thru, Angle Broadside -->v--	2	0		SH

**Crash occurred prior to the last Highway Improvement Project. This data should not be used in a crash analysis. UNK indicates the Mile Marker is Unknown.*

Exit 11 Ramp Crash Data

General Yearly Summaries - Crash Listing: State Highways and All Federal Aid Highway Systems

From 01/01/07 To 12/31/11 General Yearly Summaries Information

REPORT NUMBER	Town	Mile Marker	Date	Time	Weather	Contributing Circumstances	Direction of Collision	# of Injuries	# of Fatalities	Direction	Road Group	Street Adress	Intersection With
11D305158	Hartford	0.05	12/5/2011	15:25	Clear	Followed too closely, Disregarded traffic signs, signals, road markings, No improper driving	Rear End	2	0		Ramp/Spur	I91 S On Ramp	US RT 5 S
11D30524	Hartford	0.4	02/03/2011	7:54	Clear	Followed too closely, No improper driving	Rear End	0	0	S	Ramp/Spur	I91 S On Ramp	US RT 5 S
11D30740	Hartford	0.21	2/17/2011	9:12	Clear	No improper driving, Followed too closely	Rear End	0	0	N	Ramp/Spur	I91 S On Ramp	US RT 5 S
11D30753	Hartford	0.21	2/18/2011	12:06	Cloudy	No improper driving, Followed too closely, Inattention	Rear End	0	0		Ramp/Spur	I91 S On Ramp	US RT 5 S
11D30839	Hartford	0.36	02/23/2011	18:36	Clear	No improper driving, Driving too fast for conditions, Failed to yield right of way	Rear End	0	0		Ramp/Spur	I91 S On Ramp	US RT 5 S
3874-07	Hartford	0.06	2/23/2007	14:33	Clear	No improper driving, Followed too closely	Rear End	0	0	S	Ramp/Spur	Exit 11 onramp A I-91 SB	Rt 5
10HF03055	Hartford	0.03	7/26/2010	17:02	Clear	No improper driving, Followed too closely	Rear End	0	0	S	Ramp/Spur	Interstate 91 Exit 11 Off RampF	North Hartland Road (US#5)
5047-07	Hartford	0.08	4/2/2007	13:45	Rain	Inattention, No improper driving	Rear End	0	0	N	Ramp/Spur	Exit 11 Ramp A I-91 NB	North Hartland Rd
8087-07	Hartford	0.08	5/18/2007	12:22	Cloudy	Followed too closely, Inattention, Unknown	Rear End	1	0	N	Ramp/Spur	Exit 11 On Ramp I-91 SB	North Hartland Rd
09D301025	Hartford	0.09	3/25/2009	10:19	Clear	Inattention, Failed to yield right of way, No improper driving	Rear End	0	0	N	Ramp/Spur	I-91 SB Exit 11 Ramp A	NO DATA
12538-07	Hartford	0.21	9/29/2007	18:18	Clear	No improper driving, Followed too closely	Rear End	0	0	N	Ramp/Spur	Exit 11 Ramp C I-91	NO DATA
3683-07	Hartford	0.08	3/8/2007	13:03	Clear	No improper driving, Followed too closely	Rear End	0	0	S	Ramp/Spur	Exit 11 Ramp A I-91 SB	NO DATA
09D301653	Hartford	0.05	4/19/2009	8:34	Clear	No improper driving, Followed too closely,	Rear End	0	0	N	Ramp/Spur	I-91 Southbound on Ramp A	Exit 11 Sb On Ramp A
14211-07	Hartford	0.08	11/7/2007	17:19	Clear	Disregarded traffic signs, signals, road markings, Unknown	Rear End	0	0	N	Ramp/Spur	Exit 11 Ramp A I-91 NB	Exit 11 SB on ramp
09D303259	Hartford	0.01	9/8/2009	17:36	Clear	Other improper action, Inattention	Rear End	1	0	S	Ramp/Spur	I-91 SB Exit 11 Sb Ramp B	Exit 11 Sb
08D301297	Hartford	0.11	3/20/2008	23:09	Cloudy	Driving too fast for conditions, Followed too closely, No improper driving	Rear End	0	0	N	Ramp/Spur	Exit 11 Nb Off Ramp C	Exit 11 Off Ramp MM 70/40
11D303222	Hartford	0.21	8/2/2011	7:57	Clear	Inattention, No improper driving	Rear End	0	0	N	Ramp/Spur	89n - 91n Ramp A	Exit 11
11D30357	Hartford	0.19	1/22/2011	15:30	Clear	No improper driving, Followed too closely, Inattention	Rear End	0	0	N	Ramp/Spur	89n - 91n Ramp A	Exit 11
11D30483	Hartford	0.55	01/31/2011	14:32	Clear	No improper driving, Followed too closely	Rear End	0	0		Ramp/Spur	89n - 91n Ramp A	Exit 11
10D303859	Hartford	0.33	10/13/2010	8:00	Clear	Followed too closely, No improper driving	Rear End	0	0	N	Ramp/Spur	I-91 Exit 11 Ramp B	7 91 S On Ramp

Appendix D

633002L
CSP
GAE

WM. D. COUNTRYMAN
Environmental Assessment and Planning
868 Winch Hill Road
Northfield, Vermont 05663
(802) 485-8421
wdcenv@together.net

25 June 2003

Chris Pecor, P.E.
Dufresne-Henry, Inc.
P.O. Box 2246
South Burlington., VT 05407

Dear Chris,

I visited the proposed route of the Hartford Bike/Pedestrian project on Route 5 and Sykes Mountain Avenue on 6 June 2003 to investigate environmental constraints to the project.

Wetlands

There are no Class Two wetlands on the route, the closest being Lily Pond off Lily Pond Road. That wetland, classified as palustrine open water and palustrine scrub/ shrub, is 250 to 300 feet away from Sykes Mountain Avenue. Other nearby Class Two wetlands are on the other side of Interstate 89.

There is one wetland in the project area, beside Route 5 at the intersection of the VA Cut-off Road.River Road (see attached photos). This is a Class Three wetland at the toe-of-slope on the inside of the curve, and can be easily avoided.

Streams & Ponds

There are no streams or ponds on the proposed route. As noted above, Lily Pond lies 250 to 300 feet north of Sykes Mountain Avenue, well beyond any impacts of work along that roadway.

Fish and Wildlife

Because the area is generally built up and landscaped, there is little likelihood that the area supports populations of wildlife other than species common to settled areas such as raccoon, skunk, and other small mammals. There is no fisheries habitat on the route.

Rare, Threatened and Endangered Species

There is a 1981 record of a grasshopper sparrow (*Ammodramus savannarum*) occurring near Sykes Mountain Avenue just west of Lily Pond Road. There is one small hayfield in this section that might provide suitable habitat for this species. At the time of the site visit, this field had been hayed, however, eliminating useable cover of a tall grass canopy. Furthermore, because this record is over 20 years old, and because much of the area has been developed, it is unlikely that this species still occurs here. Given the nature of the project – a sidewalk adjacent to the existing street – any reduction of potential habitat can be minimized by utilizing the existing roadway footprint in this area, and by placing the sidewalk/path on the south side of the roadway..

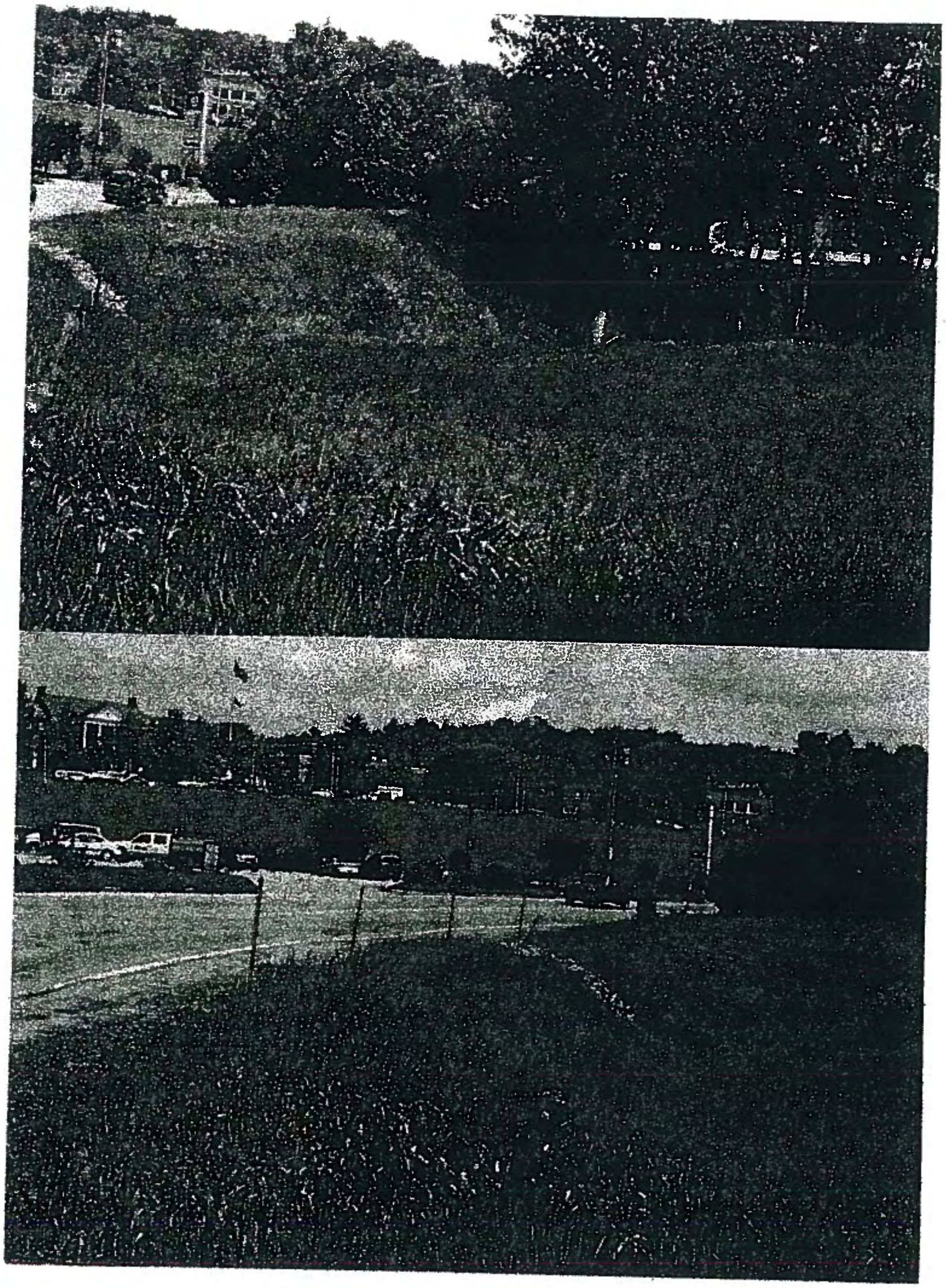
Prime agricultural soils

According to the Windsor County Interim Soil Survey, there are two areas mapped as prime agricultural soils along the proposed route. These are small areas of Windsor loamy fine sand and Belgrade silt loam (5B and 2B on enclosed soil survey) between Lily Pond Road and Upper Hyde Park. Because the project will occupy areas immediately adjacent to existing heavily traveled streets (typically filled land), it is unlikely that lands to be used would still retain the characteristics of the original soil types, and therefore there will be no loss or agricultural soils. The remainder of the route is either too steep for agriculture or is classified as Urban Land-Windsor-Agawam complex (32B).

Sincerely,

Errol C. Briggs

ECB/s
Encls



Class Three wetland in meadow at toe-of-slope near Route 5 and VA Cut-off Road, Hartford, Vermont. The Veterans Administration Hospital is shown in the background.

Windsor County Soil Survey Field Sheet for Hartford. Soils along proposed route include Urban Land Windsor-Agawam Complex 32B), Windsor loamy fine sand (5B) and Belgrade silt loam (2B). The latter two, highlighted, are considered to have high potential for agriculture.

Appendix E

6330001
Pecor
Smith
File

Pamela Daly
1601 Barton Road, Apt 3409, Redlands, CA 92373
daly.redlands@verizon.net

12 September 2003

RECEIVED

SEP 2 6 2003

DUFRESNE - HENRY
SOUTH BURLINGTON, VT

Scott Newman
VAOT Historic Preservation Officer
Vermont Agency of Transportation
Drawer 33
Montpelier, VT 05633-5001

Project: Bicycle and Pedestrian Planning and Feasibility Study
Sykes Mountain Avenue and Route 5
Town of Hartford, Vermont

Dear Mr. Newman;

This Reconnaissance Level Historic Resource Identification report will assist the Vermont Agency of Transportation (VAOT) and the Federal Highway Administration (FHWA) with compliance under Section 106 of the National Historic Preservation Act. Project review is being conducted according to the standards set forth in 36 C.F.R., regulations established by the Advisory Council on Historic Preservation to implement Section 106. The purpose of this report is to identify historic buildings, structures, districts, landscapes and settings that may be affected by this project.

Introduction

The Town of Harford has received funding through the Vermont Agency of Transportation (VTrans) 2002 Bicycle and Pedestrian Technical Assistance program to plan for, and identify issues with, the construction of a sidewalk and bicycle lanes in White River Junction.

The Sykes Mountain Avenue/Route 5 section of the Town of Hartford is located in close proximity to the junction of Interstate 89 and Interstate 91 highways and includes a highway interchange. Commonly referred to as the "uptown" area of White River Junction, the area has experienced extensive commercial development in the past two decades and together with "downtown" White River Junction, the uptown area serves as the two primary commercial growth centers in town.

In cooperation with the Town, Dufresne-Henry will be responsible for identifying potential alignment(s) for the sidewalk/bike lanes utilizing the information compiled for the base plan, and site visits. Conceptual alignments for the sidewalk/bike lanes will also include roadway crossing needs.

The firm of Daly & Associates has been retained by the engineering firm of Dufresne-Henry to perform a reconnaissance level survey of the area of possible effect (APE) to identify historic buildings, structures, districts, landscapes and settings that may be affected by the above mentioned undertaking.

Personnel

All work was conducted by Pamela Daly, an architectural historian with a M.S. in Historic Preservation from the University of Vermont. Ms. Daly meets 36 C.F.R. Part 61 standards set for review and documentation of historic resources established by the National Park Service. Pamela Daly, Consultant, is a registered D.B.E. firm in the state of Vermont.

Method

A site visit was conducted on May 28, 2003. During the site visit the entire route of the proposed project was reviewed on foot or by car, and photographs were taken of the historic resources within the project area. Literature review included investigation of old maps of the area, and the State Historic Sites and Structures Survey and National Register of Historic Places files at the Vermont Division for Historic Preservation in Montpelier, Vermont. The determination of National Register Eligibility follows guidelines established in *National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation*, published by the National Park Service.

Project Area and Findings

The project will determine the feasibility of constructing curb, sidewalk and bicycle lanes from the VA Cutoff Road on Route 5, extending north to the intersection of Route 5 and Sykes Mountain Avenue, continuing to its end at the intersection with South Main Street. The total distance of the project area is 1.5 miles. The result will be a continuous pedestrian loop between the uptown and downtown areas of White River Junction. (See attached photos of project segments.)

<u>Route 5 – Segment 1 & 2</u>

There are no historic resources on either side of this section of Route 5, from the VA Hospital cutoff, north to the intersection with Sykes Road that will be affected by the proposed project. The only two possible historic resources in the area are the VA Hospital and the Coach n' Four Motel, and they sit well back from the roadway.

<u>Sykes Mountain Road – Segment 3</u>

This segment of the project area is relatively free of any historic resources, except for two houses. One is located at the northeast corner of Sykes Mountain Avenue and Hyde Park Avenue and the other at the northeast corner of Hickory Ridge and Sykes Mountain Avenue. The house are not currently in the Vermont Historic Sites and Structures Survey but could possibly be eligible individually or as part of a historic district.

The current sidewalk/bikeway paths do not encroach on the integrity of the properties, but if plans were redesigned that would bring the sidewalk/bikeway closer to the houses the affect to the houses would have to be reviewed.

<u>Sykes Mountain Road – Segment 4 & 5</u>

This portion of the proposed project is free of affected properties except at the very end of Sykes Mountain Road, where it intersects with South Main Street. There are three houses, at 933, 926 South Main Street and 11 Connecticut Run Road, where the proposed sidewalk/bikeway would be built very close to the houses. For two of the houses, those at 926 Sykes Mountain Road and 11 Connecticut

Run Road, the road itself is almost up to the foundation of the houses. These houses are not currently listed in the Vermont Historic Sites and Structures Survey.

For the house at 533 South Main Street, on the northwest corner of the intersection, the proposed sidewalk/bikeway as planned would be detrimental to a historic concrete/stone wall and curbing which runs along the north side of Sykes Mountain Road from the intersection South Main Street and Sykes Mountain Road, west along Sykes Mountain Road for a distance of about 60 feet. The house and structures located at 533 South Main Street would be eligible for listing for listing on the Vermont State Register and the National Register of Historic Places either individually or as part of a historic district.

Summary

When the final plans for the sidewalk and bikeway project have been developed they will have to be reviewed for the possible effects to the houses at the intersection of Sykes Mountain Road and South Main Street and in particular to the curbing and concrete/stone wall that is located on the south edge of the lawn of the house at 533 South Main Street.

Further research may also reveal important information concerning the significance of the historic resources in the project area and the eligibility of these resources for listing in the State Register and the National Register of Historic Places.

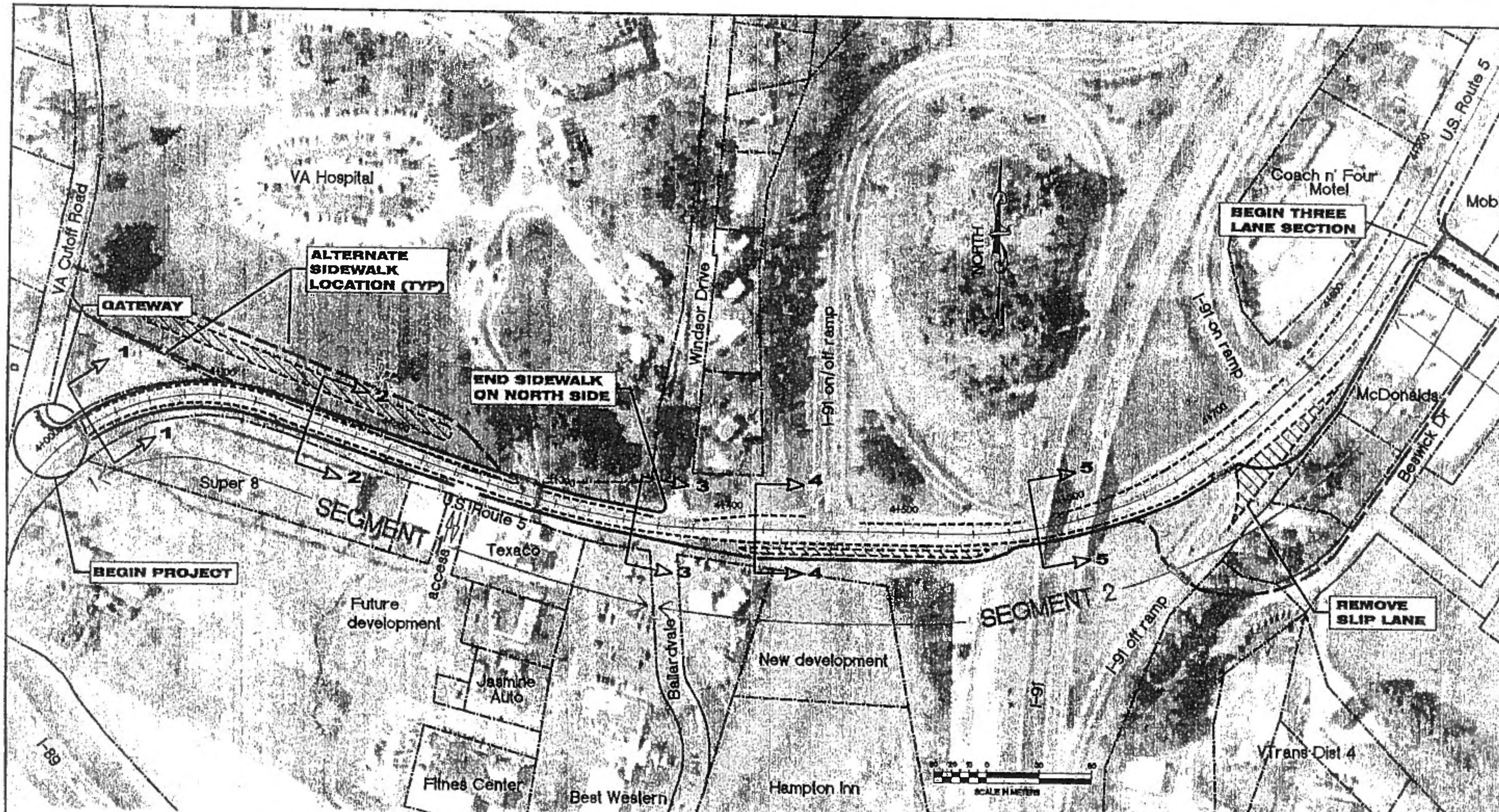
Please contact me if you have questions or require further information.

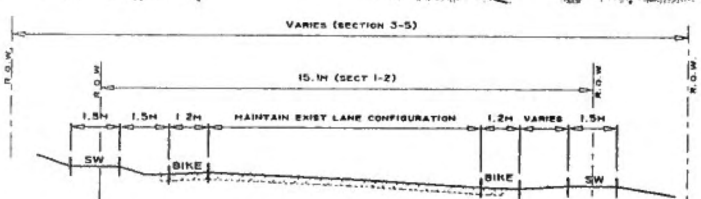
Sincerely,

Pamela Daly
Historic Resource Consultant

Cc: Chris Pecor, Dufresne-Henry, Inc.

Attachments: Project plans
Photos
Maps





TYPICAL SECTION

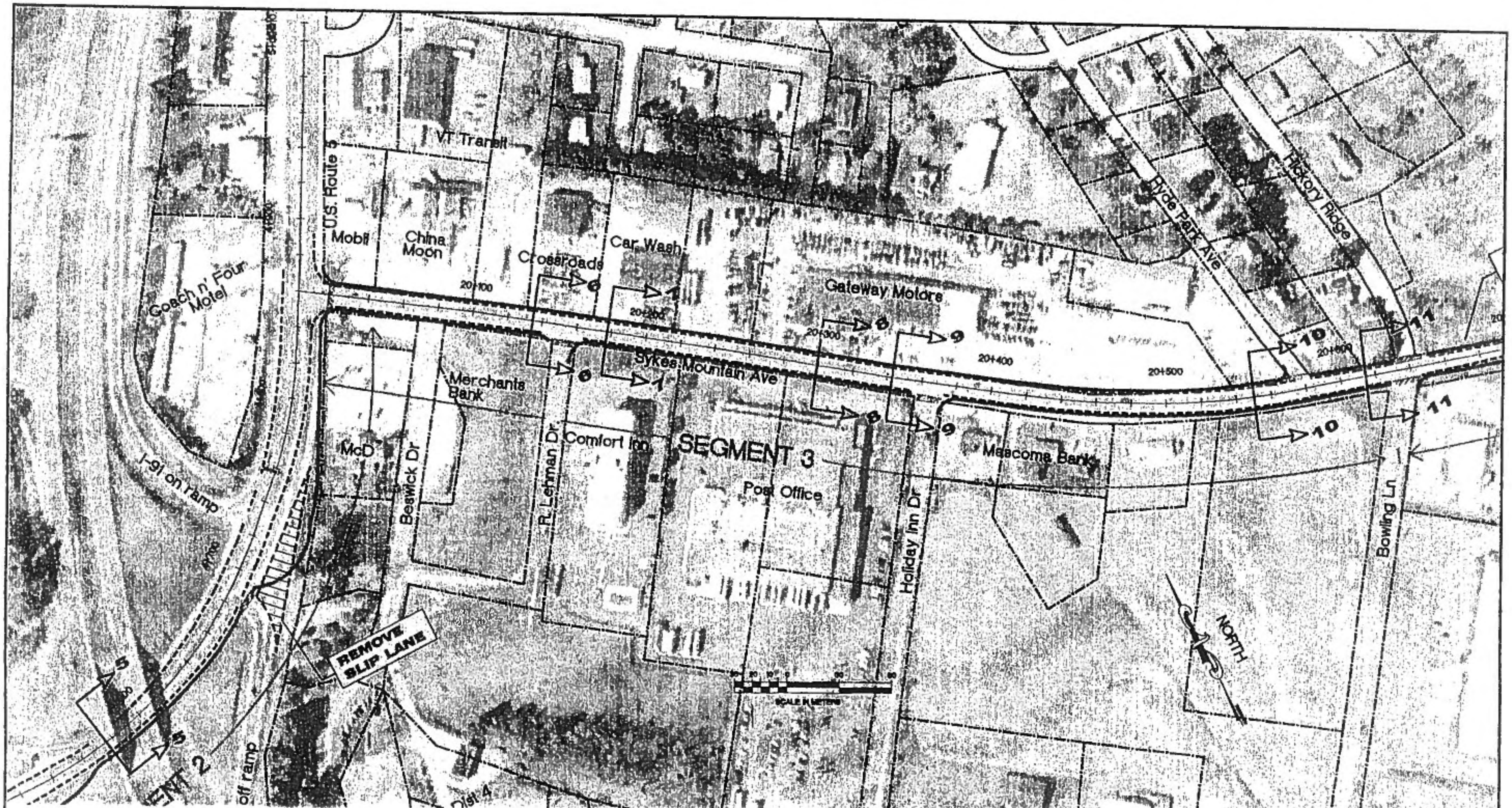
LEGEND

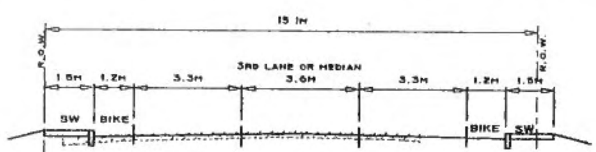
- TOWN PARCEL MAPPING
- ON STREET BIKE LANE
- SIDEWALK — OPTION
- SEE CROSS-SECTION
- CROSSWALK
- LANDSCAPING OPPORTUNITY

Dufresne-Henry

PLANNERS, ENGINEERS
LANDSCAPE ARCHITECTS

SEGMENTS 1 & 2
BICYCLE AND PEDESTRIAN STUDY
SYKES MOUNTAIN AVE &
ROUTE 5
HARTFORD, VERMONT





TYPICAL SECTION

LEGEND

TOWN PARCEL MAPPING

BIKE LANE

SIDEWALK

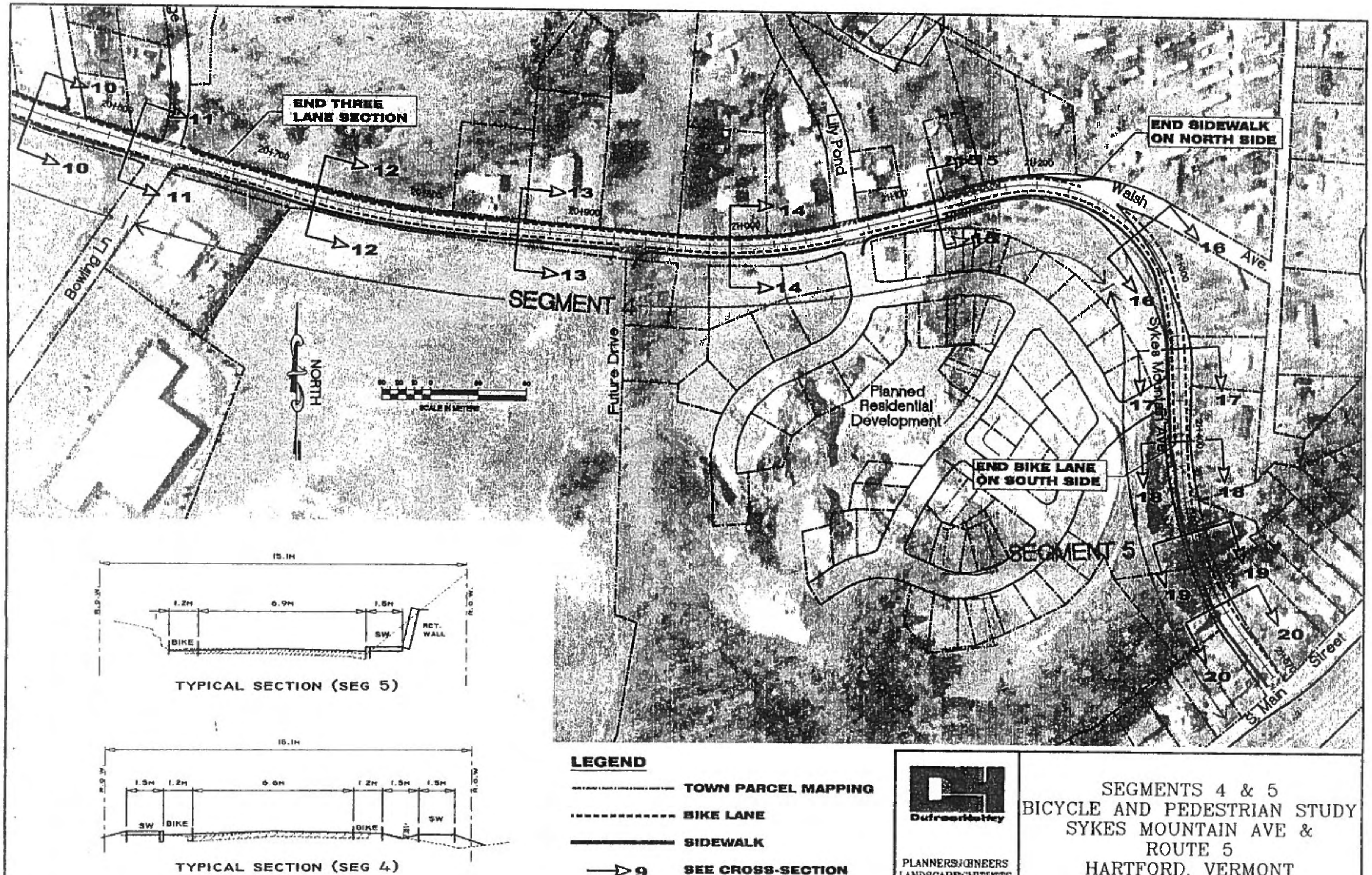
9 SEE CROSS-SECTION

CROSSWALK

Dufresne-Henry

PLANNERS, ENGINEERS
LANDSCAPE ARCHITECTS

SEGMENT 3
BICYCLE AND PEDESTRIAN STUDY
SYKES MOUNTAIN AVE &
ROUTE 5
HARTFORD, VERMONT



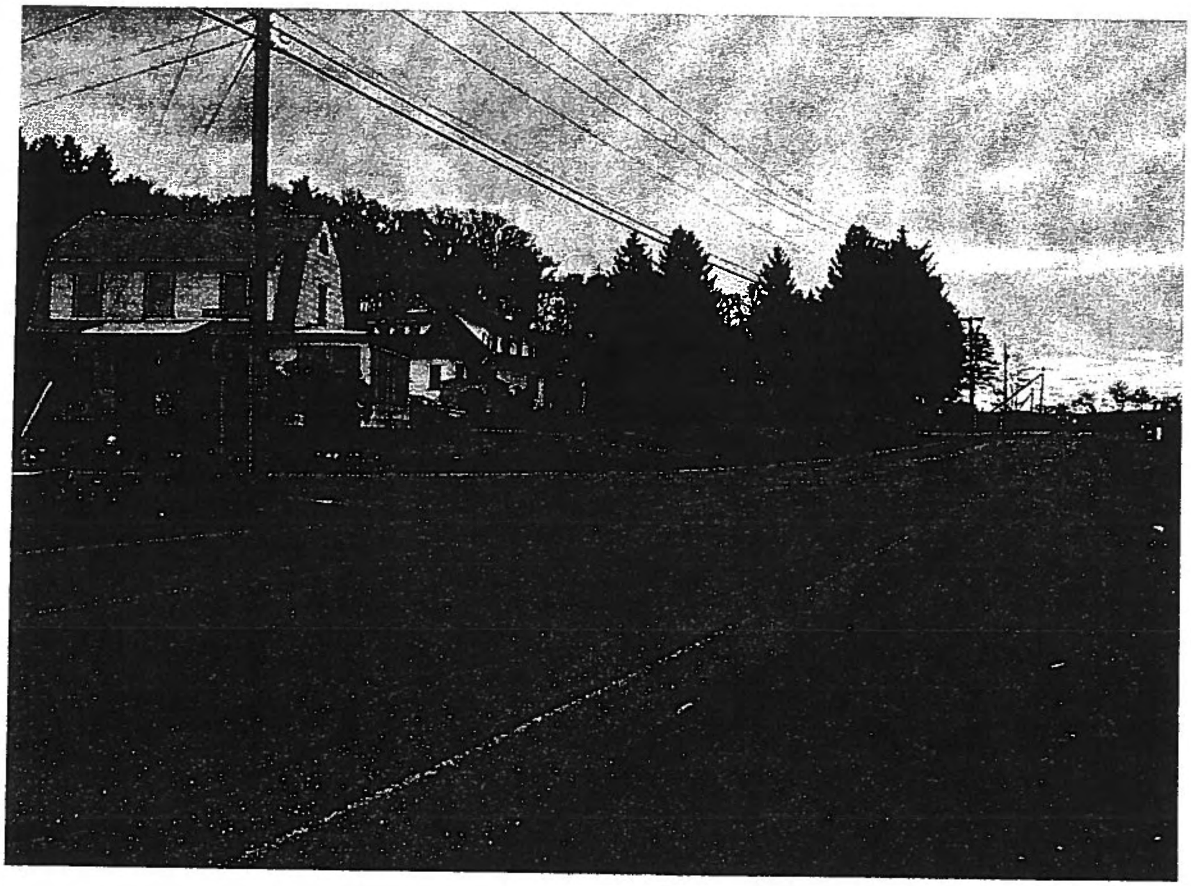
LEGEND

....	TOWN PARCEL MAPPING
- - - - - -	BIKE LANE
———	SIDEWALK
—▷9	SEE CROSS-SECTION
//////	CROSSWALK

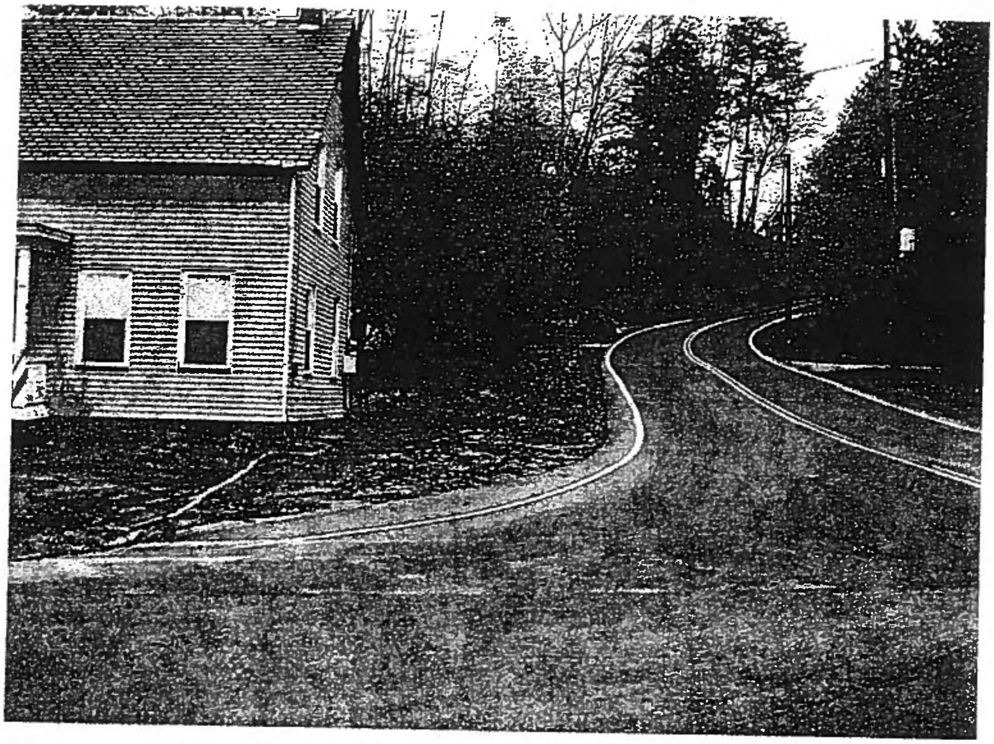
DufresneHenry

PLANNERS/ENGINEERS
LANDSCAPE ARCHITECTS

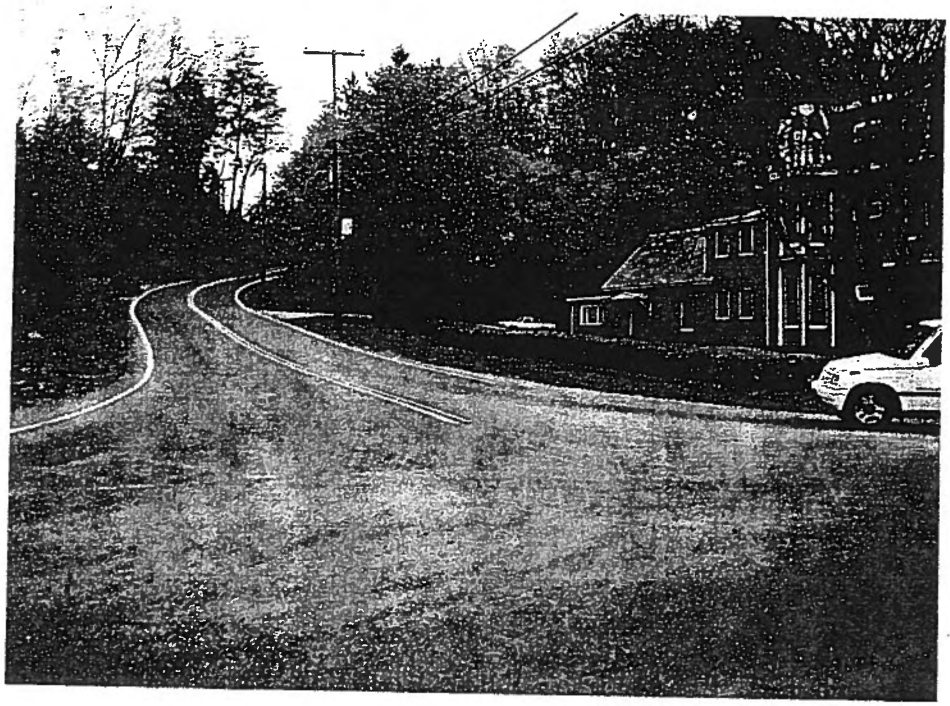
SEGMENTS 4 & 5
BICYCLE AND PEDESTRIAN STUDY
SYKES MOUNTAIN AVE &
ROUTE 5
HARTFORD, VERMONT



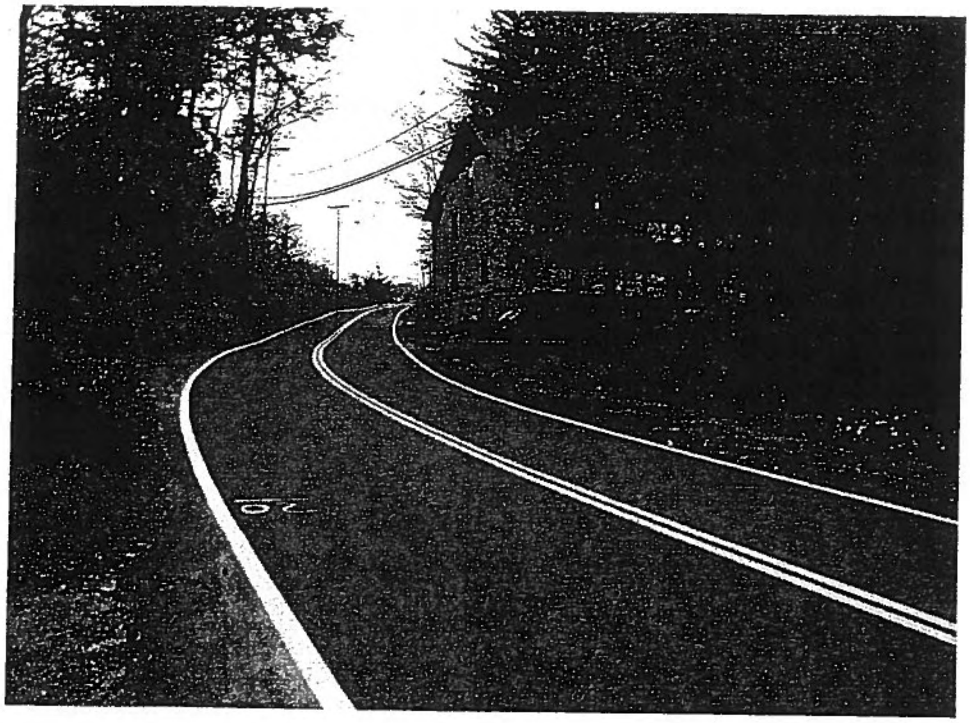
Houses at corners of Hyde Park Avenue, Hickory Ridge, and Sykes Mountain Avenue (looking east.)



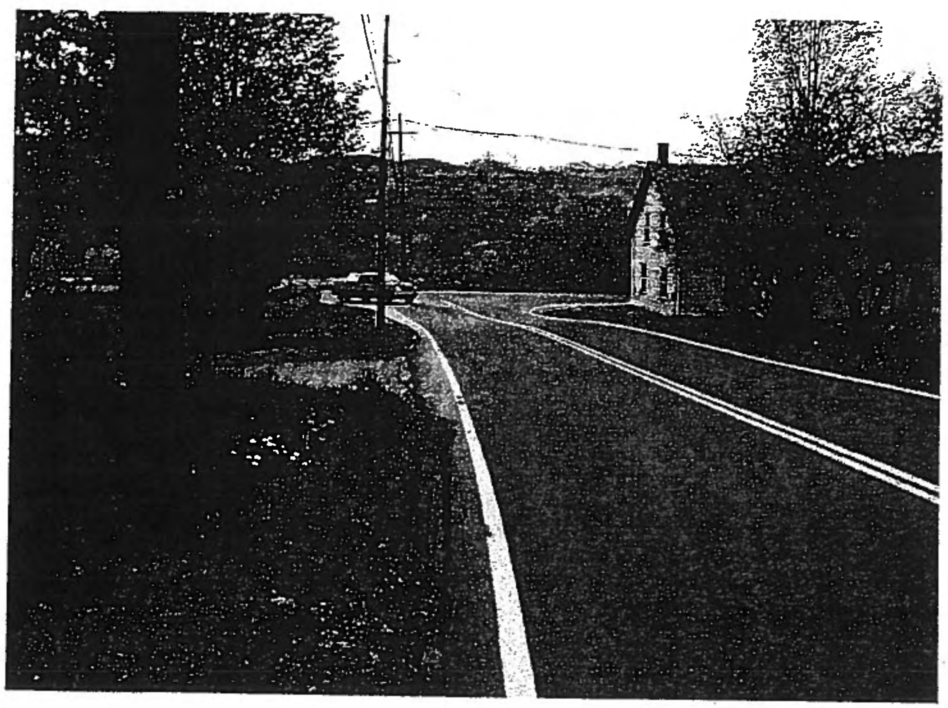
Sykes Mountain Avenue at the intersection with South Main Street (looking west.)
North façade of 11 Conneticut River Road.



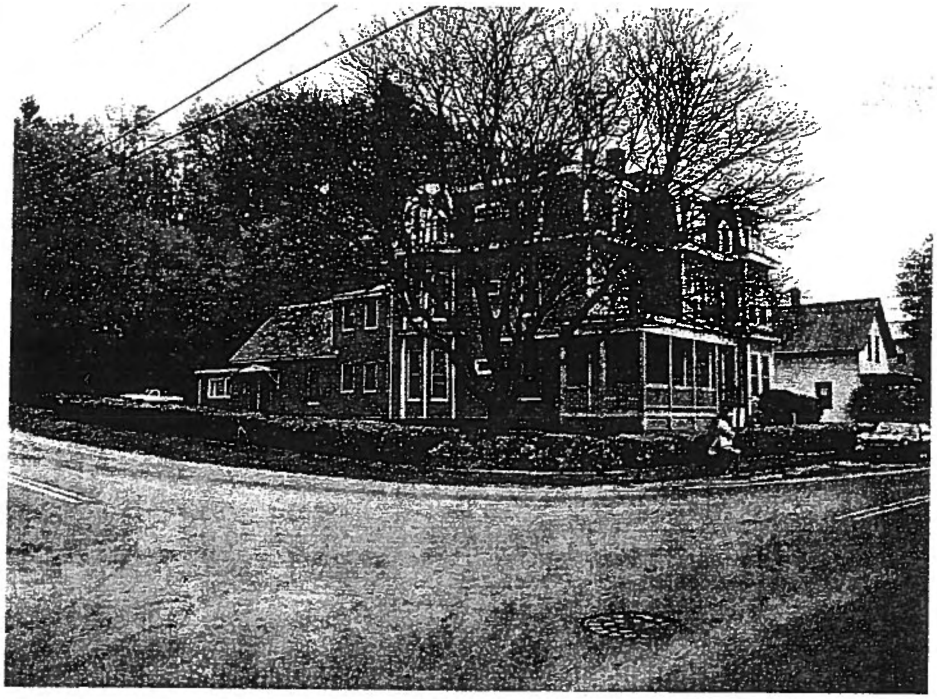
Intersection of Sykes Mountain Road and South Main Street (looking west.)
South façade and hedge of 533 South Main Street.



926 Sykes Mountain Road (looking west.)

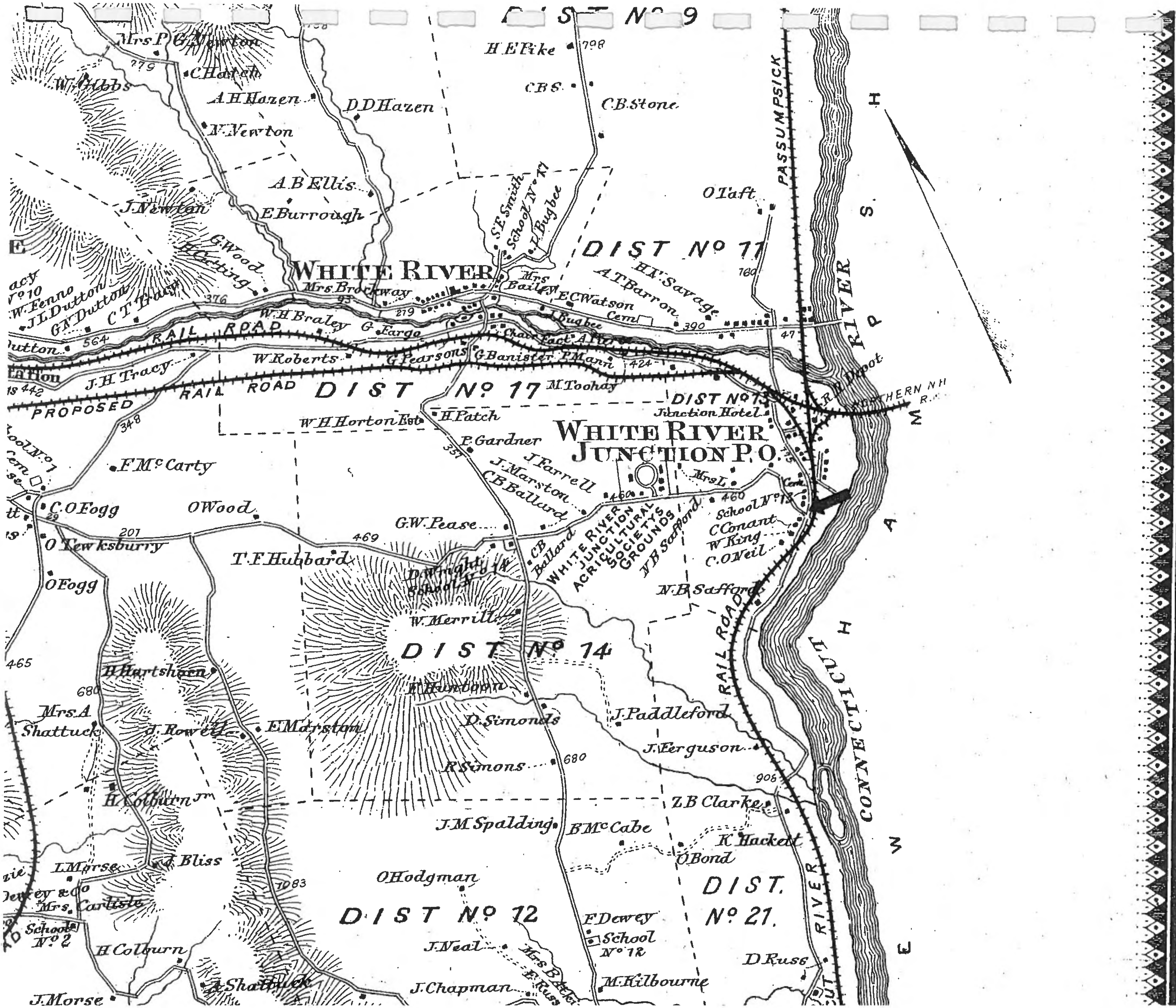


Intersection of Sykes Mountain Road and South Main Street (looking east.)
11 Conneticut River Road on the right.

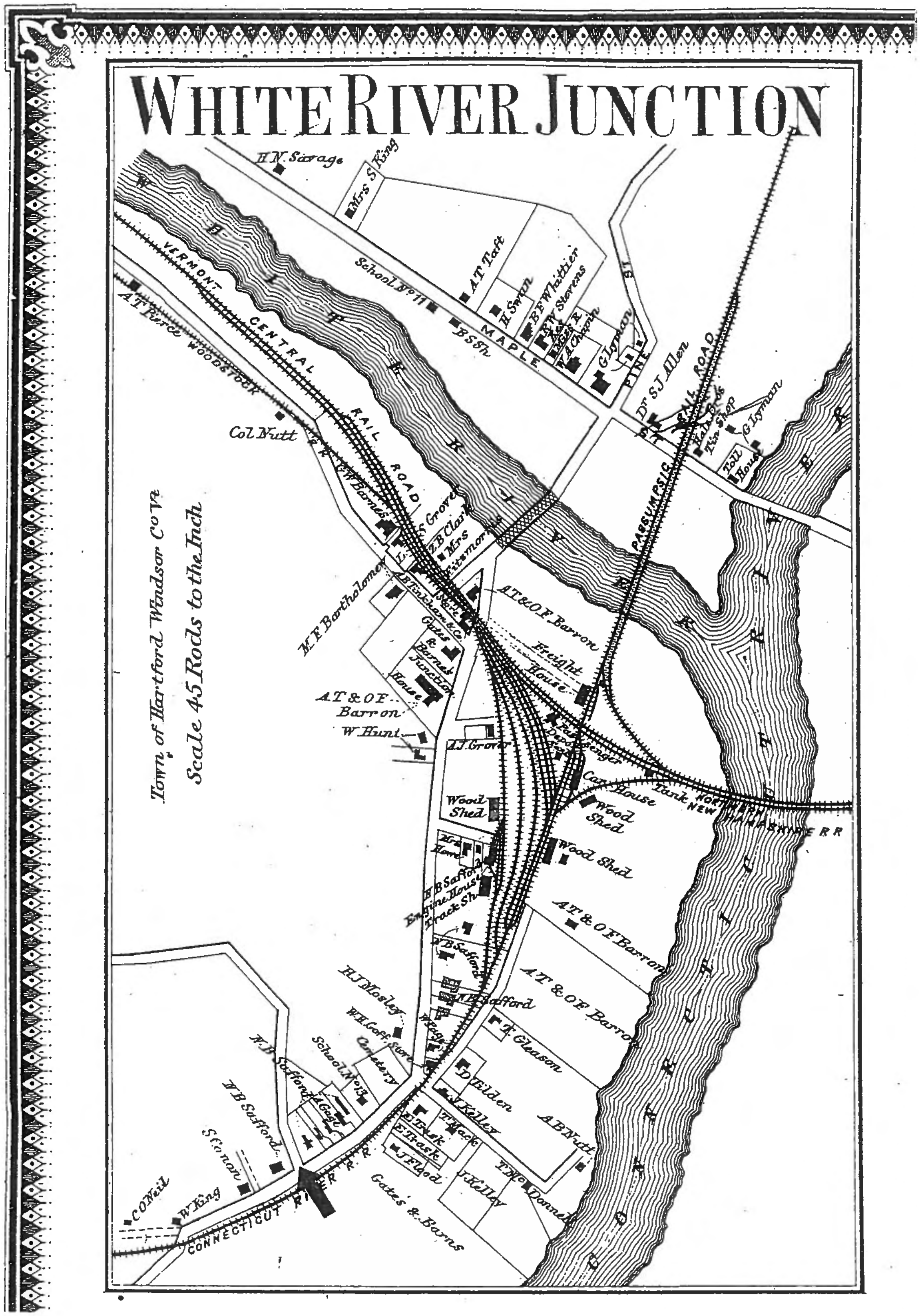


533 South Main Street at intersection with Sykes Mountain Road (looking northwest.)
Note the curbing from So. Main Street onto property with hedge.

Concrete wall and hedge on south boundary of 533 South Main Street.
(looking east)



WHITE RIVER
WHITE RIVER JUNCTION P.O.
DIST Nº 9
DIST Nº 11
DIST Nº 13
DIST Nº 14
DIST Nº 17
DIST Nº 12
DIST. Nº 21.
CONNECTICUT RIVER
RIVER
NEW HAMPSHIRE
PASSUMPSICK
RAIL ROAD
PROPOSED RAIL ROAD
NORTHERN N.H. R.R.
R.R. Depot
Junction Hotel
WHITE RIVER JUNCTION AGRICULTURAL SOCIETYS GROUNDS
H.E.Pike
C.B.Stone
D.D.Hazen
A.H.Hazen
N.Newton
A.B.Ellis
E.Burrough
J.Newton
G.Wood
O.Taft
H.V.Savage
A.T.Barron
E.C.Watson
Mrs.Brockway
W.H.Braley
G.Fargo
W.Roberts
G.Pearsons
G.Banister
P.Mann
M.Toohay
J.H.Tracy
C.T.Tracy
G.N.Dutton
J.L.Dutton
W.H.Horton Est.
H.Patch
P.Gardner
J.Farrell
J.Marston
C.B.Ballard
F.McCarty
C.O.Fogg
O.Wood
O.Tewksbury
O.Fogg
G.W.Pease
T.F.Hubbard
W.Merrill
N.B.Safford
C.Conant
W.King
C.O.Neil
D.Simonds
R.Simons
J.Paddleford
J.Ferguson
E.Marston
H.Hartshorn
Mrs.A Shattuck
H.Colburn
Z.B.Clarke
J.M.Spalding
B.McCabe
K.Hackett
O.Bond
O.Hodgman
F.Dewey
School Nº 12
J.Neal
J.Chapman
M.Kilbourne
D.Russ
J.Morse
A.Shattuck
I.Morse
Mrs.Carlisle


WHITE RIVER JUNCTION
Town of Hartford Windsor Co. Vt.
Scale 45 Rods to the Inch
H.N. Savage
Mrs S. King
A.T. Taft
School No 11
H. Swan
E.F. Whittier
B.S.Sh.
MAPLE
PINE
ST
G. Lyman
Dr S.J. Allen
PASSUMPSIC
RAIL ROAD
Tin Shop
G. Lyman
Toll House
VERMONT CENTRAL RAIL ROAD
WOODSTOCK
A.T. Pierce
Col. Nutt
C.W. Barnes
M.F. Bartholomew
A.T. & O.F. Barron
Freight House
Gates & Barnes
Junction House
A.T. & O.F. Barron
W. Hunt
A.J. Grover
Wood Shed
Car House
Tank
Wood Shed
NORTHERN NEW HAMPSHIRE R R
Wood Shed
H.B. Safford
Engine House
A.T. & O.F. Barron
A.T. & O.F. Barron
H.B. Safford
H.J. Mosley
Cemetery
School No 13
T. Gleason
J. Kelley
A.B. Nutt
H.B. Safford
H.B. Safford
E. Trask
J. Kelley
C. O'Neil
W. King
CONNECTICUT RIVER R R
Gates & Barns

Appendix F

GEOARCH Inc

594 Indian Trail, Leicester, VT 05733 Phone 802-247-8127 Fax 802-247-0107 E-mail: geoarch@sover.net

August 30, 2003

RECEIVED

SEP 0 4 2003

DUFRESNE - HENRY
SOUTH BURLINGTON, VT

6310013.14
CSP
File
Mark Smith

Mr. Christopher S. Pecor, P.E.
Dufresne-Henry, Inc.
55 Green Mountain Drive
P.O. Box 2246
South Burlington, VT 05407
TEL: (802) 864-0223
FAX: (802) 864-0165
E-mail: cpecor@dufresne-henry.com

RE: End-of-Field Letter for an Archeological Resource Assessment (ARA) of the Bicycle and Pedestrian Planning and Feasibility Study, Sykes Mountain Avenue and Route 5, Village of White River Junction, Town of Hartford, Windsor County, Vermont

Dear Mr. Pecor:

Thank you for selecting GEOARCH, Inc. to conduct an Archeological Resource Assessment (formerly called a Field Inspection) of the proposed bicycle and pedestrian planning and feasibility study along Sykes Mountain Avenue and Route 5 in the Village of White River Junction, Town of Hartford, for your firm, Dufresne-Henry, Inc. The Sykes Mountain Avenue and Route 5 project area is located in the Village of White River Junction, Town of Hartford, Windsor County, Vermont and is depicted on the USGS Hanover Quadrangle, New Hampshire-Vermont (USGS 2001) 7.5 minute series topographic quadrangle map (Figure 1).

GEOARCH identified three locations as sensitive for Precontact period Native American or sites Historic period Euro-American archeological sites. One location is considered sensitive for Historic period Euro-American archeological sites. A second location is considered sensitive presence of both Historic period Euro-American and Precontact period Native American archeological sites. The third location is considered sensitive for the presence of Precontact period Native American archeological sites. Each location should be avoided or subject to further archeological investigation.

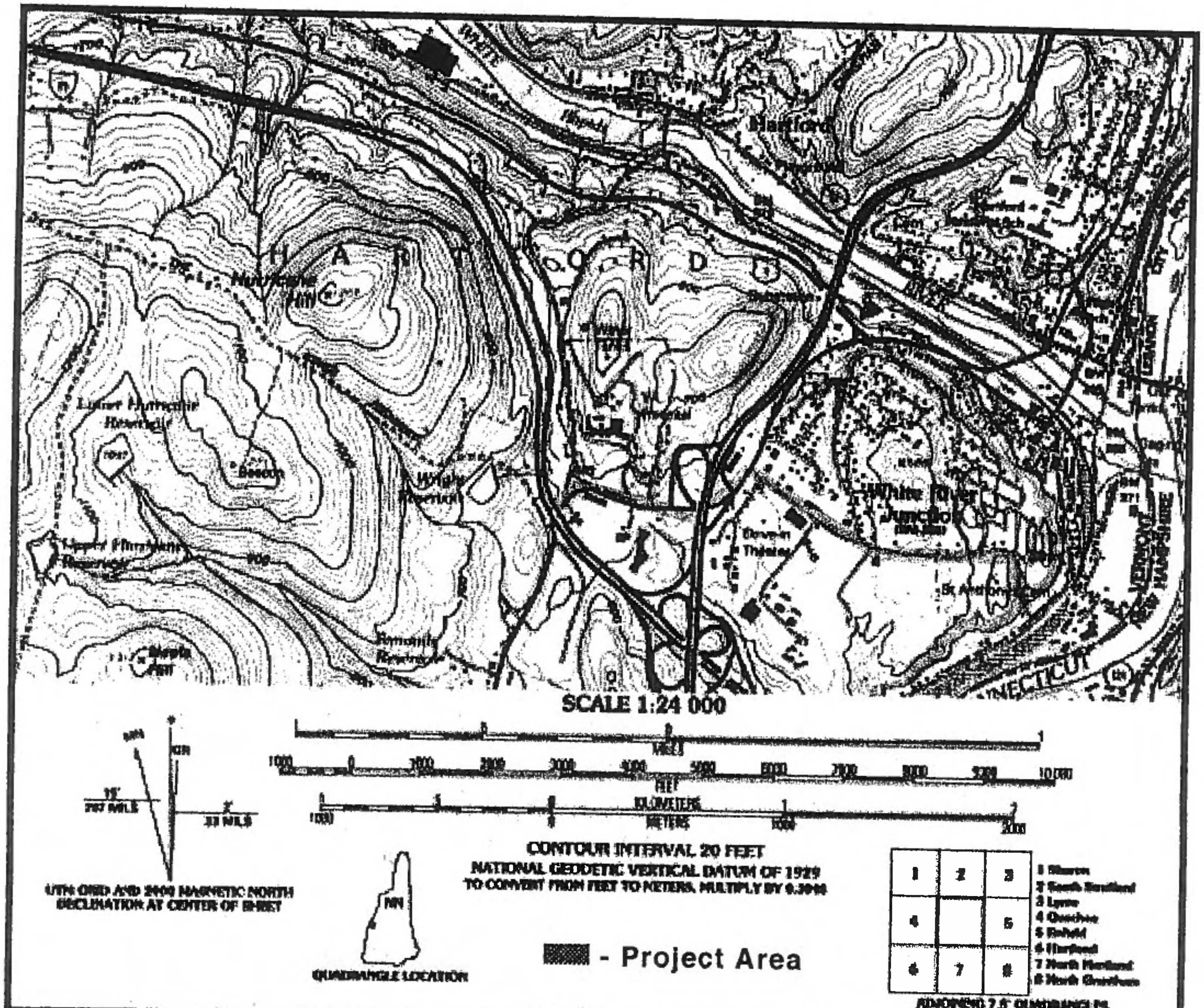


Figure 1. Project Area Located in the Town of Hartford, Windsor County, Vermont Depicted on the USGS Hanover Quadrangle, New Hampshire-Vermont (USGS 2001) 7.5 Minute Series Topographic Quadrangle Map

REGULATORY REVIEW

Archeological investigation is required prior to this project under Section 106 of the National Historic Preservation Act, 36 CFR 800, the federal regulations that implement Section 106, NEPA (National Environmental Policy Act of 1969; 42 USC §§ 4321-4347), section 4(f) of the Department of Transportation Act of 1966 (PL 89-670), and the amendments to it contained in the Federal-Aid Highway Act of 1968 (PL 90-495). Dufresne-Henry's early involvement in the archeological planning process expedites project completion, enhances cost-efficiency, and greatly benefits the cultural and historic appeal of Vermont. Heritage tourism information gained from compliance projects like this one can become a marketable commodity for your firm, the Town of Hartford, village of White River Junction, and Vermont.

PROJECT DESCRIPTION

The Town of Hartford received funding through the Vermont Agency of Transportation's (VAOT), aka VTrans, Bicycle and Pedestrian Technical Assistance Program to plan for and identify issues with construction of a sidewalk and bicycle lanes in the Village of White River Junction. This project will determine the feasibility of constructing curb, sidewalk and bicycle lanes the entire length of Sykes Mountain Avenue (Formerly Sykes Avenue and Mountain Avenue), then extending along Route 5 to the VA Cutoff Road. Currently, project area landuse is dominated by residential and commercial development with some limited agriculture. The project area also closely follows known historic transportation routes. Total project distance is 1.5 miles (2.41 kilometers). The result will be a continuous pedestrian loop between the Uptown area to Downtown White River Junction. This project is funded by VAOT and the Federal Highway Administration (FHWA).

ARCHEOLOGICAL RESOURCE ASSESSMENT

GEOARCH Chief Principal Investigator, Kathleen E. Callum and Chief Project Manager, Robert Sloma gathered archival information on regional bedrock geology, surficial geology, soil taxonomic interpretation, and historic properties documented in various files at the Vermont Division for Historic Preservation.

Chief Project Manager, Robert Sloma reviewed the proposed Hartford project area on location on June 13, 2003. Results of GEOARCH's archival research and field visit are presented below. GEOARCH reviewed potential impacts to historic properties west and east along Route 5 from its intersection with VA Cutoff Road to the Route 5 intersection with Sykes Mountain Avenue and continuing along its entire length.

Archival Review

Based on archival review, Precontact period Native American and late eighteenth to early twentieth century historic sites are generally expected in this region, particularly in association with upland knolls and high, high elevation terraces associated with Glacial Lake Hitchcock, and the Connecticut River. Regional settlement patterns indicate that glacial lake and postglacial riverine terrace and stream bank landforms were preferred sites from the Precontact period through the historic period. Fairly level terraces well above the present level of the White and Connecticut Rivers could contain Native American sites of great antiquity. Euro-American settlement generally concentrated along roadways that developed through the village of White River Junction. By the mid-nineteenth century there was more use of upland areas with perhaps a decline in population, or consolidation of farms, in the latter half of the nineteenth century. The potential for encountering intact, undocumented prehistoric sites and historic sites is reduced dramatically due to extensive urban development throughout most areas likely to be directly affected by the proposed project. Some limited portions of high terraces may be moderately to highly sensitive for archaeological sites of varying age.

Environmental Context

The project area lies in the Vermont Piedmont Physiograhic region (after Jacobs 1950). Stewart and MacClintock (1969:22) describe the Vermont Piedmont, through which the Connecticut River and its tributaries, such as the White River, flow, as a plateau that has been "dissected by streams" and "subdued by glaciation." These processes have resulted in an undulating to rough topography with steep-sided streams.

The Connecticut and White Rivers form the most significant water systems in the project area. "In area, the Connecticut River drains a basin of some 11,260 square miles [2,916,329 square hectares], representing roughly one-third of New Hampshire, Massachusetts, and Connecticut and a slightly larger fraction of Vermont" (Delaney 1983:18; cf., Pierce 1917:156). The Connecticut lakes of New Hampshire form the Connecticut River's headwaters (Pierce 1917:156). In Vermont alone, it drains a basin of 3,000 square miles (776,997 square hectares), or 41% of the Green Mountain state's area (Meeks 1986). Some of the largest upper Connecticut River tributaries on the Vermont side include the Nulhegahan, Passumpsic, Wells, West, and White Rivers. New Hampshire boasts the Israel, Amoonoosuc, Mascoma, Sugar, and Aschuelot Rivers as the larger, upper Connecticut River tributaries. "The White River valley and its tributaries held the longest branch of Lake Hitchcock during deglaciation" (Van Diver 1987:79). Headwaters of the White River are in the town of Ripton. Tributaries continue eastward through Granville, then southeast passing across Hancock, and through Rochester. The White River continues southeast through Royalton and Sharon to its junction with the Connecticut River in Hartford. In addition to draining the eastern slopes of the Green Mountains, the

White River provided a natural travel corridor for animals and humans. The flood of 1927 caused considerable damage in White River Junction along both the banks of the White and Connecticut Rivers (*cf.*, Johnson 1928). Damage is not anticipated in the project area from the 1927 flood, or any other Historic period deluge. However, extensive urban development, presents a challenge for accurate and precise reconstruction of past drainage patterns. It does appear that the central portion of Route 5 in the project area follows a past White River tributary and the western end of Route 5 lies near the headwaters of an unnamed Connecticut River tributary.

Multiple orogenic mountain building, or tectonic cycles, led to the development of the Appalachian Mountain chain at the eastern margin of North America and have influenced the physical characteristics of the project area in White River Junction to this day. Topography was also been smoothed by glaciation (Stewart 1975). Topographic relief in the Piedmont closely reflects trends exerted by the lower Paleozoic metamorphic bedrock substrate. The Appalachians are composed of complexly deformed thrusts and folds, all trending north-south. Most topographic features such as mountain ranges and drainages also trend north-south because the strike of metamorphic bedrock formations and faulting. A few of the Connecticut River and other northeast tributaries, such as the main trunk of the White River, cross-cut, or are "superimposed," on the dominant north-south physiographic trend of mountains and river valleys. This occurrence typically predates the landscape "subduing" of the last glacial regime, originating in the early Cenozoic (65 million years ago) Era.

A large structural trough called the Connecticut-Gaspé synclinorium lies between the Green Mountain arch (anticlinorium) and mountains of New Hampshire (Stewart 1975). An island arc complex, called the Bronson Hill volcanics, lies to the east of the synclinorium. The present-day upper Connecticut River largely follows the western edge of the collapsed north-south trending ribbon of Bronson Hill volcanics. The Connecticut River Valley is open to view near White River Junction. Van Diver (1987:63) believes that the river here appears controlled by the Ammonoosuc fault that can be traced for about 80 miles further north hand 3-4 miles south of White River Junction. "White River Junction lies almost on top of the western margin of the Bronson Hill Island arc complex, perhaps the single most important element in plate tectonics interpretation of Vermont and New Hampshire" (Van Diver 1987:63) The breakup of the supercontinent of Pangaea about 200 million years ago in the Triassic Period led to early crustal stretching and the development of block-fault basins along the eastern coast of North America. The White Mountain series volcanics and intrusives were emplaced during this time, cross-cutting the metamorphosed rocks of the upper Connecticut River and surrounding region. Despite their wide separation geographically, Mount Ascutney and Mount Jasper are two examples of these White Mountain series intrusive bodies. The proposed project area falls primarily within the Orfordville formation, and namely Post Pond Volcanics member (Doll 1961). Some unfifferentiated granitic Rocks are also present. The Orfordville formation is composed primarily of carbonaceous phyllite and limited amounts if quartzite. The Post Pond Volcanics member is characterized by greenstone and green chloritic schist commonly interbedded with schistose felsite and quartz-feldspar-sericite schist, also fine-grained chloritic and biotitic gneiss west of the Ammonoosuc fault, with mainly amphibolite east of the fault. The green schists of the Post Pond volcanic member are presumably part of the collapsed island arc.

Glacial Lake Hitchcock, blocked by ice damming in Connecticut, occupied the Connecticut River Valley after the recession of the Shelburne Glacier (Stewart 1975:17). Narrow fingers of water extended up tributaries. One of Glacial Lake Hitchcock's far-flung arms reached up the White River drainage, separated by a drainage divide (or col) from a branch of Glacial Lake Vermont that resided in the Winooski basin. Shorelines of glacial Lake Hitchcock therefore extended far up into the West River valley (Van Diver 1987:77, 79). For a time, Glacial Lake Winooski waters were rerouted south into the Connecticut River by ice dams. Proglacial lakes like those in the Connecticut River Valley quickly became filled due to the abundant sediment load carried by glacial streams. Glacial deltas comprise an important indicator for lake level reconstruction and chronology (Stewart and MacClintock 1969). Meeks (1986:47) notes that "some of the best glacial deltas in the state [of Vermont] . . . are along the Connecticut Valley where most present streams drain into the river." Glacial deltas can be distinguished from the kame-terraces by better sorting and absence of ice-contact push or slump features. Another proglacial lake level marker is "shoaling gravels." Stewart and MacClintock (1969) describe deltaic deposits associated with Lake Hitchcock through the project area. "The most reliable shore features of the lake consist as deltas built into the lake at the mouths of small tributary streams along the sides of the main valley or up the tributary valleys at the maximum extension of lake waters" (Stewart and MacClintock 1969:105). Furthermore, they estimate the top elevation of Lake Hitchcock in this section to be 700 feet (231.36 meters) above present mean sea level (Stewart and MacClintock 1969:104).

In addition to the importance of the structural geology as a physiographic or topographic control, the bedrock geology also provides lithic resources for human exploitation. While the Orfordville formation, and namely Post Pond Volcanics member are not associated with intensive Native American lithic material use, populations prior to European contact may have utilized local greenstone, schist, and felsite for stone tool manufacture - even sometimes if only as expedient tools. However, neither the White River Junction area nor this specific formation have been the focus of detailed lithic raw material investigations pertaining to Precontact period Native American or Historic period Euro-American resource extraction and use. Local quartz and silica-rich deposits in could have provided lithic raw material for Precontact Native American populations. Similarly undocumented volcanic sills and dikes could represent another potential Native American lithic resource. Native American lithic materials thought to originate or "source" from the Piedmont have included artifacts tentatively attributed to intrusive igneous sources such as Mount Ascutney (e.g., Heckenberger and Petersen 1988).

Recently, at least three variants of fine-grained volcanic lithic types have been recovered in archeological contexts associated with the Israel River, an upper Connecticut tributary (Boisvert 1997b, personal communication). Only some of these appear to originate from Mount Jasper near Berlin, New Hampshire (Boisvert 1997a). Another archeological site on the Passumpsic River, also a Connecticut River tributary, yielded fine-grained volcanics (Callum and Sloma 1996). Therefore, it is likely that there are other northern New Hampshire or Vermont quarry sources attributable to the White Mountain series volcanics, in addition to the better known Mount Jasper or poorly described quarry source at Mount Ascutney. Origin of these fine-grained volcanics from the region around the project area remains a possibility.

Nearby historic rock quarries or mineral extraction areas are not depicted on historic maps (*i.e.*, Doton 1855; Beers 1869; USGS 1908). At least one historic mine, a chalcopyrite mine, is documented in the town of Hartford, village of White River Junction, west of the Project area roughly where the Interstate 91 underpass exists now (F. M. Beck, Inc. 1998:274). Determining the exact age of the mine would require further research, but it certainly dates before 1964 and may date to the nineteenth century. If the mine is more than 50 years old, construction of Interstate 91 undoubtedly adversely affected the resource. The proposed project should not affect the mine. Modern topographic maps (USGS 2001) also depict a sand and gravel quarry south of the eastern end of Sykes Mountain Road.

There is usually a good correlation between surficial geology (or sometimes bedrock) and soil association. The duration of landform stability is also a significant soil-forming factor. Soil order classification can provide some sense of genesis and antiquity (Brady 1990), as well as vegetation suites, farming practices, animal habitat, and archeological material preservation. Draft surficial maps depict the project area primarily as sandy littoral sediment, with some glacial lacustrine gravel, and till at the western end of what is now Route 5 in the project area (Doll 1970; Stewart n.d.). Most of these deposits may be associated with a White River Delta formed following recession of glacial Lake Hitchcock.

In Vermont, there has been little emphasis on correlation of specific soil series or orders to develop scientific valid, objective models that can explain the location of specific Historic period or Precontact period cultural activities. Since certain soil types might have been more favorable for settlement locations than others, archeologists examine soil types to determine where, or on what landforms, sites of different ages might be found. For example, Spodosols (one of 11 USDA taxonomic soil orders depending upon what classification system is used) are often associated with the older, high terraces and Inceptisols or Entisols with younger alluvial settings (Brakenridge *et al.* 1988). Predictive models draw on soil typology for insight into these patterns as well as into the visibility and integrity of sites. Archeological sites associated with young soils on unstable landforms may be quickly buried, altered, or destroyed, depending on the geomorphic formation process involved. In contrast, archeological sites on bedrock outcrop or upland till soils may be highly visible for a considerable time--only becoming compromised through subsequent cultural use of the landform. Cultural modifications (*e.g.*, topsoil stripping, agriculture, logging) and archeological site preservation both vary dramatically with soil type. Expressing the formal pedological classification for soils in the project area, therefore, can assist with an assessment of surficial landform, landform and potential archeological site antiquity, associated past and present resources of interest to humans, archeological site visibility, and cultural materials integrity.

Draft Windsor County Soil Survey maps (NRCS n.d.) classify project area soils into five distinct units (Figure 2; Table 1). Inceptisols dominate the project area with three soil series. These soils are not fully evolved, and could be considered "adolescent" (Fanning and Fanning 1989:239). As such, Inceptisols possess less well-developed B or spodic horizons. In contrast to younger Entisols, Inceptisols may indicate mid-antiquity rather than very young alluvial settings. In other topographic positions, they may not have developed into Spodosols due to high water table or absence of certain soil elements. Inceptisol soils through the project area locale are characteristically deep and exhibit slopes ranging from 0-15%. These soils formed either in dense loamy till on uplands, or in glaciolacustrine material on terraces. Cultural deposits of intermediate age could be expected on landforms bearing Inceptisol soils.

Figure 2. Project Area Soils (NRCS n.d.)

Members of the Entisol soil order also occur in the project area, but are not as common. Entisols are recently developed, less evolved soils that are undergoing active development. Entisols generally occur on dynamic or wet landscapes such as eroding slopes, floodplains, and recently deposited man-made surfaces and "scalped" surfaces from which preexisting soils have been removed (Fanning and Fanning 1989:226). Therefore Entisols might not develop into Inceptisols or Spodosols due to a lack of certain minerals in the soil profile or recent landscape disturbance. This is particularly true of Entisols of the great group Udipsamments. In Chittenden County, for example, Windsor soils are mapped as Spodosols (Allen 1989), and may represent a more recent NRCS classification of the Windsor soil series than shown in the Windsor County soil survey. As Entisol soils are relatively young, generally more recent cultural deposits are expected on landforms possessing these soils. Organic archeological materials, and sometimes even lithics, are attacked rather quickly in these mildly acidic soils.

Table 1. Project Area Soils

UNIT	ORDER	TEXTURE	SLOPE
Belgrade(2A, 2B)	Inceptisol (mesic Aquic Dystric Eutrudepts)	coarse silty	(0-8% slopes) (3-8% slopes)
Buckland (25D)	Inceptisol (frigid Aquic Dystric Eutrudepts)	loam	(15-25% slopes)
Urban Land, Windsor- Agawam Complex (32B)	Inceptisol-Entisol (mesicTypic Dystrochrepts and mesicTypic Udipsamments)	fine sandy loam	(0-8% slopes)
Vershire-Dummerston Complex (19C)	Inceptisol (frigid Typic Dystrudepts and frigid Humic Dystrudepts)	silty loam and coarse loamy	(8-15% slopes) Rocky
Windsor (5B, 5E)	Entisol (mesicTypic Udipsamments)	loamy fine sandy	(0-8% slopes) (25-60% slopes)

Based on NRCS maps, Urban Land, Windsor-Agawam complex soils cover the greatest geographic area across most of the western and central portion of the project area. Urban land is the result of Historic period development in the village of White River Junction. Windsor and Agawam soils are mapped together. Originally, these soils are found on terraces and sandy plains and formed on deltaic or glacial outwash sand that was deposited in or next to proglacial lake basins. There is some possibility (a moderate potential) for locating Native American sites in Urban Land Windsor-Agawam complex soils, in addition to finding Historic period sites. These geographic settings could contain archeological sites of great antiquity. Well-drained

Windsor-Agawam complex soils exhibit well-developed soil profiles in areas that have experienced minimal disturbance from Historic period or modern activity.

The NRCS maps Agawam soils as part of Urban Land, Windsor-Agawam complex soils. These soils are relatively deep and common on terraces and upland outwash plains (Sheehan 1987). Agawam soils formed in loamy glacial drift underlain by sandy glacial fluvial deposits. Agawam soils are classified in the Inceptisol soil order, and may contain sites of moderate antiquity (e.g., Historic period through Late Archaic period). The NRCS maps Windsor series soils near the eastern end of the project area as part of Urban Land, Windsor-Agawam complex soils. Because of their fragility, however, even plowing can disturb the stability of these sandy soils and promote intermittent eolian reactivation. Other disturbance mechanisms can include devegetation due to fire (accidental or cultural), logging or agricultural clearing, modern construction, increasing wind) intensity (due to climatic change or devegetation), or lowered water tables (either climatic or altered by humans). Modern usage of Windsor soil landscapes include sand extraction, dwellings, white pine production, and pasturage or hay. Erosion is a hazard on the steep slopes and places where cultural practices have denuded the landscape. Dwelling or structure construction can be limited by occasional flooding in areas exhibiting high groundwater tables. Historic use may have been similar, but with less emphasis on sand extraction on the Windsor, and with more diversity of production on the subsistence-style farms of the nineteenth century. The possibility of locating archeological sites in Urban Land, Windsor-Agawam complex soils will ultimately be based upon the extent of prior disturbance.

Belgrade soils are mapped along drainages near the western and eastern ends of the project area and appear to cover the second greatest amount of land within project limits. The drainages and corresponding Belgrade soils in these areas possess a low sensitivity for archeological sites. Windsor soils are mapped independently in the eastern portion of the project area and have been described in the preceding paragraph. Limited past disturbance allows these soils to be distinguished from other related soils. The intact, well-drained Windsor series soils therefore possess moderate to high archeological potential in the project area. A limited amount of Buckland soils may be present at the western end of the project area. The steep slope associated with these rocky till soils would tend to reduce archeological sensitivity.

Cultural Context

Archeologists and the public have learned a great deal more about Windsor County's heritage since the first archeological site was documented in this county in 1973 (*cf.*, Harp 1977). Federal and state regulations have required professional archeologists to complete a moderate number of studies in the Town of Hartford (*i.e.*, Thomas 1980; Mulholland 1985; Hasenstab et al. 1988; Frink and Baker 1994; Bartone et al. 1997; The Cultural Resource Group of Louis Berger & Associates, Inc. 2002). Presently, no archeological sites are listed in VDHP files directly within the project area. One Precontact Native American site is documented about 1500 feet northeast of the project area (i.e., VT-WN-50). Limited excavation in advance of a proposed recreational facility failed to intersect diagnostic artifacts and archeologists concluded that the site was probably not eligible for listing on the National Register. Further than one mile from the project area, avocational and professional archeologists have recorded a small number of other sites based on limited artifactual evidence (Thomas 1980). Eight Precontact Native American (*e.g..*, VT-WN-FS-9, VT-WN-FS-16, VT-WN-1, VT-WN-9, VT-WN-57, VT-WN-60, VT-WN-140, VT-WN-141) sites are known to exist well outside the project area, and sites age and function are typically unknown. Of these, data recovery at VT-WN-57 documented Late Woodland occupation with limited debitage and abundant fire-cracked rock similar to the assemblage recovered from VT-WN-50 (cf., Hasenstab et al. 1988; Thomas 1980). Archeological sites near the current project area were found predominantly on the White River and Connecticut River floodplains, with some sites located near the confluence of associated tributaries, or further upstream along those tributaries. Very little work has been done to identify Precontact Native American sites at different floodplain terrace levels in the vicinity of White River Junction.

The archeological reports listed above do provide some cultural contextual material for the Historic period in the Town of Hartford, however, early cultural resource management studies rarely assigned state site numbers to historic period archeological sites. Only one Historic period archeological site, a black smith's shop (*i.e.*, VT-WN-193), is documented within miles of the proposed project area.

Presently, the central downtown portion of White River Junction is listed as a Historic District on the National Register of Historic Places (VDHP 1999), but the boundaries of that district do not extend as far as the current project area. The nineteenth century Doton (1855) map of White River Junction (Figure 3) depicts five buildings owned by A. Latham & Co. at the eastern end of the Project area, northeast of the intersection of what is now Sykes Mountain Avenue and South Main Street (aka, Connecticut River Road). By 1869, the Beers atlas depicts structures in this location of White River Junction (Figure 4) owned or occupied by N. B. Safford and A. Gage. Roughly a dozen buildings are depicted on the 1869 Beers atlas along the entire project area along what is now Route 5, Sykes Mountain Avenue across part of the project area (Figure 5). By 1905-1906, only ten buildings are depicted on USGS topographic maps (USGS 1908; Figure 6). The reduction in the number of buildings across the project area over time suggests that some structures were either omitted from later mapping efforts, or absent due to fire, abandonment and decay, or intentional removal. For example, the absence of White River Junction Agricultural Society Grounds structures on the USGS map may be due to reconfiguration of the roadway. Modern topographic maps suggest the construction of several new buildings through the project area. Additionally, construction of Interstate 91 and reconstruction of VT Route 5 likely destroyed or displaced may historic structures. Fieldwork may be able to distinguish some new structures from older, historic buildings. No buildings in the project area are listed in the State

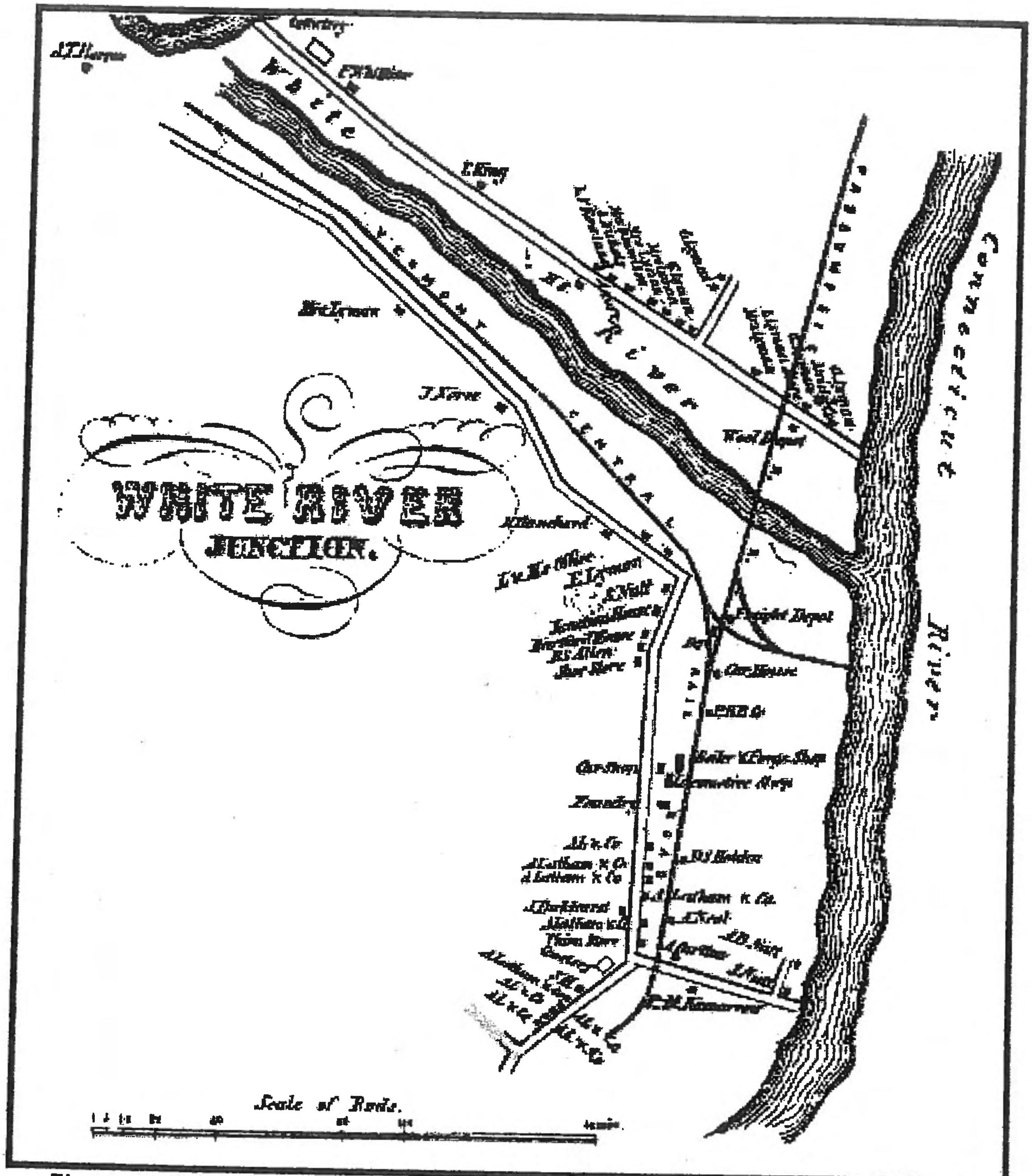


Figure 3. Project Area, Eastern End, ca. 1855 (Modified from Doton 1855)

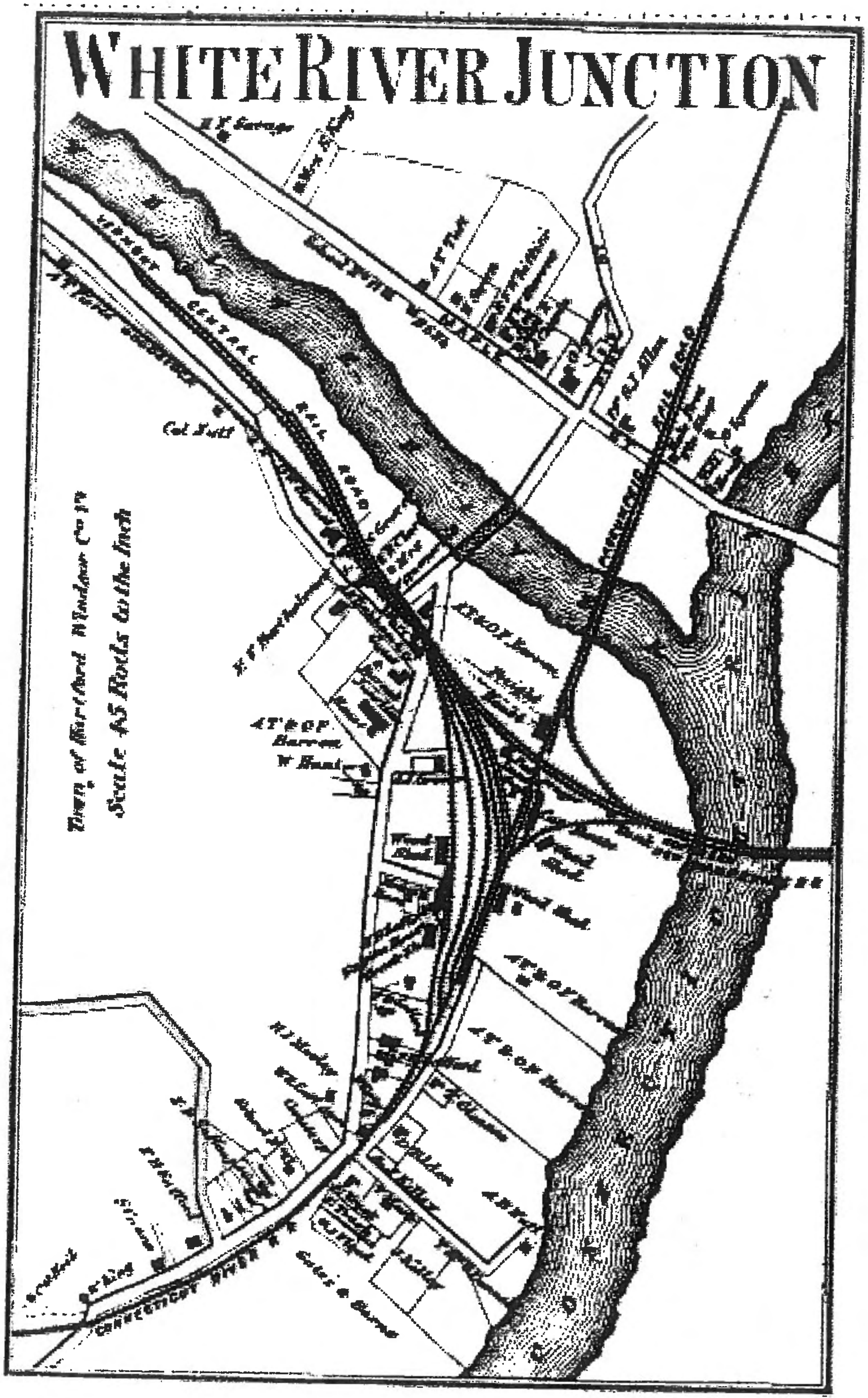


Figure 4. Project Area, Eastern End, ca. 1869 (Modified from Beers 1869:19)

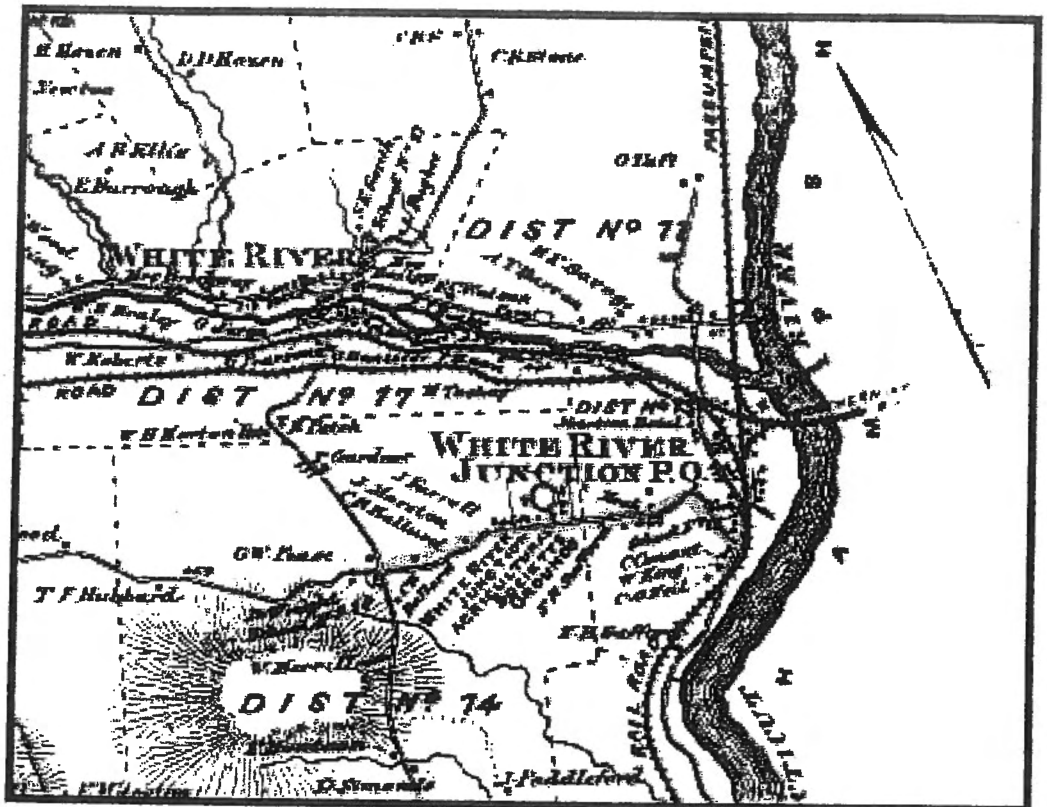


Figure 5. Project Area, ca. 1869, Scale1.5 inches = 1 mile (Modified from Beers 1869:18)

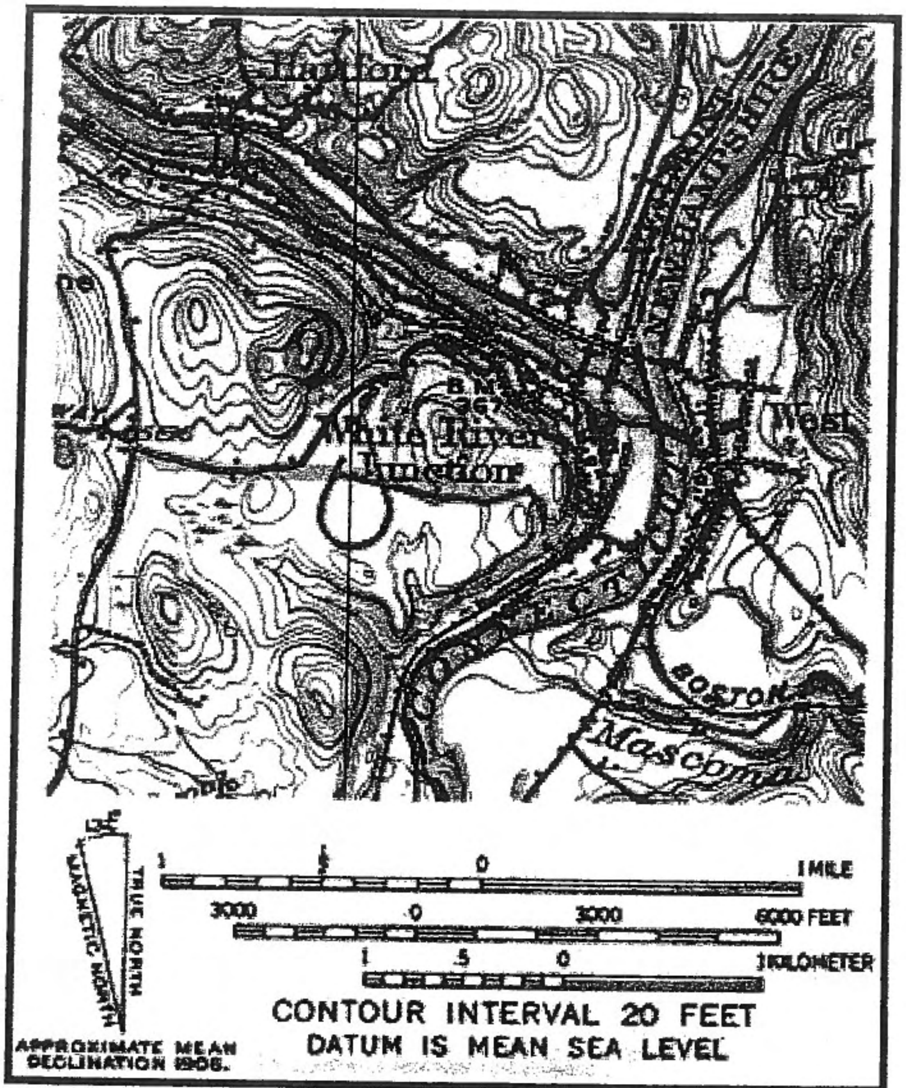


Figure 6. Project Area, ca. 1905-1906 (USGS 1908)

Register Historic Sites and Structures Survey. Letters at the Vermont Division for Historic Preservation suggest that the VA hospital is eligible for inclusion to the National Register, but it does not seem that anyone has actually officially listed the property. Regardless of age, none of the buildings shown on maps appear to be located in areas to be directly affected by the project. However, residential yards and former agricultural fields along existing roads could potentially be affected. While alone these features are not particularly significant, they could contain undocumented archeological features such as past buildings that were not depicted on historic maps, or more ephemeral activities.

Field Visit

GEOARCH Project Manager, Robert Sloma, reviewed the entire project area on location, beginning at the western end of the project area at the intersection of Route 5 and VA Cutoff Road and ending at the eastern end of the project area, at Sykes Mountain Avenue and South Main Street. Observations regarding archeological sensitivity are presented in that order.

Soil cores confirmed the abundance of modern fill and some possible Historic fill across the project area. Steep slopes were noted in two areas that severely limit the possibility of buried archeological resources: along the northern edge of Route 5 near the VA hospital and along the western side of Sykes Mountain Avenue prior to its terminus at South Main Street. A portion of the roadbed near the former intersection of Sykes Avenue and Mountain Avenue appears to have been elevated during the historic period. Past reconstruction of this road segment would be consistent with changes noted on historic maps from 1869 (Beers) to 1908 (USGS) and to the present (2001 USGS). No historic structures appear to be have survived along the western portion of the project area now labeled as Route 5. A stone burial vault (family crypt or tomb) was noted north of the intersection of Route 5 and VA Cutoff Road. Inscriptions and local histories (i.e., St. Croix 1974:41-42) indicate that Major David Wright (1749-1822) had this vault constructed upon his wife's death in 1814. Further research could determine exactly where the Wright farmstead was originally located and define its boundaries. Modern topographic maps indicate that structures once stood where construction is presently underway for the Windsor-Orange County Credit Union north of Interstate 91 and east of Route 5. The age of those buildings in not known, but comparison of historic and modern maps suggests that the last structures to stand in that location probably dated to the twentieth century. Soil cores in seemingly undisturbed areas on either side of Route 5, south of the VA hospital could not penetrate more than 10-15 centimeters below present ground surface due to shallow bedrock. The remainder of Route 5 to its intersection with Sykes Mountain Avenue was extensively disturbed from construction of Interstate 91. None of this part of the project area is considered archeologically sensitive.

Sykes Mountain Avenue, from its intersection with Route 5 to Hickory Ridge road (formerly Upper Hyde Park road; and roughly the western end of what was once called Mountain Avenue), contains predominantly commercial strip development with little exposed ground or lawn. Soil profiles were examined in an open excavation trench about 130 feet (40 meters) south of Sykes Mountain Avenue and east of a McDonalds fast-food restaurant. Despite some recent surface disturbance, a thick weathered B was observed underlying a 10-15 centimeter Ap horizon. It is unlikely that much more of the ground surface at this construction site remained intact. A few historic residences were noted standing north of Sykes Mountain Avenue between Lower Hyde Park road and Hickory Ridge road (formerly Upper Hyde Park road). The very small yards remaining in front of these structures are unlikely to contain intact features or deposits eligible for inclusion to the National Register.

Two archeologically sensitive areas were identified east of Hickory Ridge (formerly Upper Hyde Park road) and west of the terrace edge overlooking the Connecticut River. One location north of Sykes Mountain Avenue is considered sensitive for Historic period Euro-American archeological sites. A second location, south north of Sykes Mountain Avenue is considered sensitive presence of both Historic period Euro-American and Precontact period Native American archeological sites. A short distance east of Hickory Ridge road and north of Sykes Mountain Avenue, is a large, dry-laid stone foundation, presumably for a barn. An adjacent historic residence stands just east and is accompanied by a low stone wall further down the road, perpendicular to Sykes Mountain Avenue. The proximity of the dry-laid stone foundation, residence, and stone wall near Hickory Ridge road suggests that they are related features. A recently constructed Toyota dealership southwest of this site forms the western boundary of an agricultural field. Sykes Mountain Avenue forms the field's northern boundary and a tree line along the crest of a high terrace overlooking the Connecticut River marks the field's eastern boundary. Soil cores could not penetrate dense sediment at the northwestern end of the field, opposite the historic site. Brick and refined ceramics were noted on the ground surface south of the road. The compact sediment and artifacts suggest the presence of historic fill under and/or beside the road. The fill may be associated with the historic site to the north, a site that once existed south of Sykes Mountain Avenue, or another site if fill was simply dumped beside the road. Ground under and beyond the fill south of Sykes Mountain Avenue may be sensitive for Precontact period Native American archeological sites. As Sykes Mountain Avenue continues east the southern edge of the road begins to be cut down. Excess earth was probably used to level the road in this location since there is a fairly steep drop along the northern edge of Sykes Mountain Avenue on the opposite side. The low lying land north of the road and near the terrace edge, may be sensitive, but fill slopes extend fairly far and unless construction will extend far north, this location will probably be avoided.

Near the edge of the high terrace, Sykes Mountain Avenue begins a steep descent toward the Connecticut River. Some structures were noted on what might be a small terrace along Lilly Pond Road, north of Sykes Mountain Avenue, but it is uncertain if the existing structures are historic. Old maps (Beers 1869; USGS 1908) depict structures in this general location. Nevertheless, these existing structures stand some distance from the present roadway. Walsh Avenue (or Walsh Road) appears to be an old abandoned curve of Sykes Mountain Avenue that was straightened in the past (cf., Beers 1869; USGS 1908, 2001; DeLorme 1996:71). Any historic sites in this area would have been located along Walsh Avenue. A dense cluster of Locust trees was noted near the sharp bend at the eastern end of Sykes Mountain Avenue, south of Walsh Avenue. Locust trees were historically used along property boundaries.

A third location south of Walsh Avenue and north of Sykes Mountain Avenue was considered sensitive for the presence of Precontact period Native American archeological sites. Soil cores extracted from the lawn area of a curve along the northern edge of Sykes Mountain Avenue revealed a plowzone underlain by a well-developed B horizon. South of Walsh Avenue and Sykes Mountain Avenue, the sand and gravel pit shown on modern topographic maps (i.e., USGS 2001) has been converted into a residential development.

A small cluster of historic structure was noted near the eastern end of Sykes Mountain Avenue. Two structures stand north and another two buildings stand south of Sykes Mountain Avenue near its eastern terminus with South Main Street. As with the buildings near Lilly Pond Road, these structures stand some distance from the present roadway and are unlikely to be disturbed. The latter four structures also seem to date to the mid to late nineteenth century, and appear to have functioned as duplexes, or tenement buildings with multiple simultaneous occupants. As such, these buildings are unlikely to have possessed outbuildings or activity areas near Sykes Mountain Avenue.

SUMMARY AND MANAGEMENT RECOMMENDATIONS

After reviewing the proposed project area, GEOARCH concludes that the proposed project may have an effect on historic properties in three locations. One location is considered sensitive for Historic period Euro-American archeological sites. A second location is considered sensitive presence of both Historic period Euro-American and Precontact period Native American archeological sites. The third location is considered sensitive for the presence of Precontact period Native American archeological sites. However, there are opportunities to avoid impacting all or most archeologically sensitive areas GEOARCH identified.

Location 1

- No ground disturbance should occur beyond the existing pavement north of Sykes Mountain Avenue where historic structures (dry-laid stone foundation, residence, and stone wall) were identified east of Hickory Ridge road (formerly Upper Hyde Park road) and west of a newly constructed residence. If this archeologically sensitive area cannot be avoided, Phase I Site Identification would be required (Figure 7).

Figure 7. Project Area, Archeologically Sensitive Areas Mapped on a Modern Orthophotograph with Existing Conditions

Location 2

- No ground disturbance should occur beyond the existing pavement south of Sykes Mountain Avenue opposite the historic structures (dry-laid stone foundation, residence, and stone wall) identified east of east of Hickory Ridge road (formerly Upper Hyde Park road) and west of a newly constructed residence. The open agricultural field is sensitive for Precontact period Native American archeological sites great antiquity and later Historic period sites. If this archeologically sensitive area cannot be avoided, Phase I Site Identification would be required (Figure 7).

Location 3

- No ground disturbance should occur beyond the existing pavement near the sharp bend at the eastern end of Sykes Mountain Avenue. This high level terrace overlooking the Connecticut River is considered sensitive for the presence of Precontact period Native American archeological sites of great antiquity. If this archeologically sensitive area cannot be avoided, Phase I Site Identification would be required (Figure 7).

This Archeological Resource Assessment End-of-Field Letter should be submitted by Dufresne-Henry, Inc. and their client the Town of Hartford to the Vermont Agency of Transportation, Transportation Archeologist, for comment or concurrence if the proposed project is to proceed through the compliance process as planned. Please call if you have any questions regarding the archeological compliance process or information contained within this End-of-Field Letter. We are pleased to be able to offer our high quality, responsive services to your firm and the Town of Hartford.

Sincerely yours,

Kathleen E. Callum
President & Chief Principal Investigator

Robert A. Sloma
V.P. & Chief Project Manager

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Appendix G

Minutes of the
I-91, Exit 11 Interchange
Bicycle/Pedestrian Scoping Study
Local Concerns Meeting
Hartford Municipal Building
May 2, 2012

Attendance: Rita Seto, Glen Valentine, Tom Linnell, Frederica Graham, Todd McKee, Chuck Wooster, and Pat Flanagan.

Consultants: Greg Goyette and Karl Richardson of Stantec, Inc.

Town Staff: Allyn Ricker, Highway and Matt Osborn, Planner

The meeting, which was held in the second floor conference room of the Hartford Municipal Building, began at 6:36 p.m. Matt Osborn welcomed everyone to the meeting.

Background: Matt Osborn provided background information for the project, which included a number of plans and studies that led to this project. He noted that highway design and development patterns in this area of Hartford have focused primarily on motor vehicles and that not much consideration has been given to the accommodation of pedestrians and bicyclists. He noted that that began to change around 2000. Matt listed the following plans/studies that have led to changes in policy.

- Sykes Mountain Avenue Study, 2000.
- Route 5 South Study, 2001.
- Sykes Mountain Avenue/Route 5 Bicycle/Pedestrian Scoping Study, 2004. The study included all of Sykes Mountain Avenue & ½ mile of Route 5 through the Interchange area. At that time, the Vermont Agency of Transportation (VTrans) did not embrace the accommodation of bicyclists and pedestrians through the interchange area.
- Hartford Master Plan 2007. Transportation Element had a strong multi-modal emphasis. One of the recommendations was for the Town to undertake a townwide Pedestrian and Bicycle Plan.
- Hartford Pedestrian and Bicycle Plan, 2009. The Plan recommended sidewalks and bike lanes along this corridor

Matt noted that over the last ten years, the Planning Commission has been requiring sidewalks to be constructed during the Subdivision and Site Development Plan review process in the more urban/built up areas of Hartford and includes Sykes Mountain Avenue and Route 5. He also noted that the Town applied for and received transportation enhancement grants for the following projects:

1. 2009 Design and construct sidewalk and bike lanes on Sykes Mountain Avenue.
2. 2010 Design and construct sidewalk and bike lanes on Route 5.
3. 2011 Conduct a bicycle/pedestrian scoping study for the Interchange Area.

Matt noted that the sidewalks for Sykes Mountain Avenue and Route 5 south of Ballardvale Drive are in the conceptual design phase and a community meeting will be scheduled in the coming weeks. Matt reported that staff and the consultant met with Vermont Agency of Transportation officials in March and that the project was well received. This reflects a significant change from the 2004 study.

Meeting Purpose: Matt Osborn noted that tonight's meeting is the first of three public meetings on the interchange area. The purpose of this meeting is to explain the project and to solicit public input. Matt introduced project manager and engineer Greg Goyette and engineer Karl Richardson of Stantec.

Greg Goyette went around the room and asked each person to introduce themselves. Greg Goyette reviewed the project definition.

1. Collect and review existing information.
2. Solicit public concerns and ideas.
3. Establish purpose and needs of project.
4. Identify potential alternatives.
5. Evaluate alternatives and select a preferred alternative.

Greg identified the project committee as Matt Osborn and Rich Menge from the Town of Hartford, Rita Seto from the Two Rivers-Ottauquechee Regional Commission and Kevin Russell from VTrans. Greg Goyette proceeded to go over the items that will be covered under collect and review existing information:

1. Project background (land use change/connectivity)
2. Traffic conditions- volumes, widths, right-of-way
3. Environmental/cultural resources
4. Utilities
5. Bicycle/pedestrian facilities
6. Planned Route 5 improvements

Greg Goyette pointed out that the current interchange design developed in the 1960s is all about moving motor vehicles through the area as quickly as possible. He noted that the project is entirely within the state right-of-way and that there is a great deal of pavement. As a result, there is an opportunity to use the existing footprint which could result in short term solutions.

Draft Project Purpose: Greg Goyette went over the draft project purpose, "Transform US Route 5 through the I-91, Exit 11 Interchange from a transportation facility that gives sole consideration to motor vehicles to one that balances motor vehicle mobility and safety with pedestrian/bicyclists accessibility, mobility and safety."

Draft Project Needs: Greg Goyette then presented the following project needs:

1. Sidewalk along the project corridor. Currently, pedestrians walk on the roadway shouldersor just off the road. A sidewalk along the south side of Route 5 will link proposed sidewalks located at each end of the corridor that are currently in design.
2. Bicycle lanes along the project corridor. With an AADT of 13,200 moving at high speeds, the lack of these facilities discourages bicycle use through the corridor.
3. Reduced and consistent lane widths for motorists. Numerous lane configurations and excessive widths, 12' plus, encourage high motor vehicle speeds without consideration for bicyclists and pedestrians.
4. Improved ramp geometry. The current ramp A and ramp C geometries promote high motor vehicle speeds and include merging conditions. Crash histories reveal sideswipe and rear-end collisions at these locations.
5. Motor vehicle mobility. Proposed improvements must result in adequate traffic mobility along Route 5 and not impact traffic operations on Interstate 91.

Community Input: Greg Goyette proceeded to ask for comments from the audience. The following are public comments:

- It is unsafe to walk or bike through the interchange area.
- The interchange area is in need of improvements for bicyclists and pedestrians.
- There is lots of pavement and unclear lane designation through the interchange area. Consider restriping and lane reconfigurations like the ones done in Norwich by Exit 13.
- The Ramp C and A (southbound on-ramp and the northbound off-ramp) are particularly challenging for pedestrians and bicyclists to navigate.
- Expressed concern about the hazard of vehicles backing up on I-91.
- Providing safer facilities for bicyclists and pedestrians is likely to encourage more people to walk to the Aquatic Center and other destinations from motels.
- There is a large amount of truck and bus traffic through the interchange area.
- You need to be careful about encouraging more people to walk and bike across a dangerous section such as the Ramps A & C.
- Currently, getting through the Ramp C is very unsafe to cross.
- The VA Hospital has a lot of pedestrian activity.
- Hopes that it is possible to implement short-term improvements such as restriping for bicyclists.
- Would like to see Ramp A eliminated so that all traffic would enter Ramp B at a 90 degree angle.
- Consider improved signage with any alternative.
- Excessive speed is a serious problem. Consider using traffic calming, such as rumble strips to slow down vehicular traffic.
- Use bike symbols to inform motorists to expect bicyclists in the area.
- If the sidewalk was on the north side of Route 5, you would avoid having pedestrians crossing Ramp C.
- Noticed that there is a spike in pedestrian traffic during swim meets at the Aquatic Center.
- Observed that motorists often change lanes at the last second by Ramp A.
- As a bicyclist, Ramps A & C are the most uncomfortable to cross.
- Would like to see complete streets concept applied through the interchange area.

Next Step: Greg Goyette thanked everyone for attending the meeting. He noted that the next step is for the consultant to meet with Town staff, develop the alternatives, then meet with VTrans, refine the alternatives and then present to the public at a community meeting. Greg estimated that the community meeting will take place in 2-3 months. Greg encouraged contacting Matt Osborn or himself if they have comments. Matt noted that if you signed in and gave your e-mail or postal address, you will be notified of future meetings on the Interchange area.

Adjournment: Greg Goyette thanked everyone for attending. The meeting adjourned at 7:44 p.m.

Appendix H

Bicycle & Pedestrian Study for the Exit 11, I-91 Interchange Area
Design Criteria

Parameter	US 5	Reference/Comments
Functional Classification	Major Rural Collector (uncurbed)	
AADT (2012)	13,200 vpd (west of exit) 6,600 vpd (east of exit)	Projected from Actual 2010 AADT Projected from Estimated 2010 AADT
Design Vehicle	WB-67	
Posted Speed	40 mph	
Design Speed	40 mph	
Stopping Sight Distance	275 ft.	VSS Sect. 5.4.1
Corner Sight Distance	440 ft.	VSS Sect. 5.4.2
Travel Lane Width		
Minimum Vermont State Standard	11 ft.	VSS Sect. 5.6
Existing	12 ft.	
Proposed	11 ft.	
Bicycle Lane Width		
Existing	N/A	
Minimum	3 ft. 4 ft.	VSS Sect. 5.14.1 VPBM, Table 4-7
Preferred	6 ft.	VPBM, Table 4-7
Proposed	6 ft	
Clear Zone		
With Vertical Curb	1.5 ft.	VSS Sect. 5.9
Without Vertical Curb	14-16 ft.	VSS Sect. 5.9
Sidewalk Offset from Edge of Pavement		
Minimum	5 ft. (at least 3ft. is green strip)	Assumes no curb installed. VPBM, Section 3.4.8
Proposed	5 ft.	
Sidewalk Width		
Minimum	5 ft.	VPBM, Section 3.4.1
Proposed	5 ft.	
Sidewalk Lateral Clearance to Obstructions		
Minimum	1 ft.	VPBM

Appendix I

Minutes of the
I-91, Exit 11 Interchange
Bicycle/Pedestrian Scoping Study
Alternatives Community Meeting
Hartford Municipal Building
August 16, 2012

Attendance: Chris Lowe, Mark Pippin and Tom Linnell.

Consultants: Greg Goyette and Karl Richardson of Stantec, Inc.

Town Staff: Rich Menge, DPW Director and Matt Osborn, Planner

The meeting, which was held in the second floor conference room of the Hartford Municipal Building, began at 6:36 p.m. Rich Menge welcomed everyone to the meeting.

Background: Rich Menge introduced engineers from Stantec, Greg Goyette and Karl Richardson. He reported that Greg and Karl have been working in Hartford on the design of two sidewalk and bike lane projects; Sykes Mountain Avenue between Ralph Lehman Drive and Butternut Road, and Route 5 between Arboretum Lane and Ballardvale Drive. Rich noted that a sidewalk also will be included with the two roundabouts that are planned for the intersection of Route 5 and Sykes Mountain Avenue and the intersection of Sykes Mountain Avenue and Ralph Lehman Drive. He noted that the interchange area is a key link to providing sidewalk connectivity in this area of town. Rich stated the Vermont Complete Streets Legislation that was passed during the last Legislative session mandates that the State and municipalities look at the accommodation of bicyclists and pedestrians along our roadways. Rich noted that Town staff and consultants have had two meetings with Vermont Agency of Transportation officials in Montpelier and that the project is moving along much more smoothly than the process did in 2003/2004.

Meeting Purpose: Greg Goyette noted that tonight's meeting is the second of three public meetings on the interchange area. The purpose of this meeting is to present the alternatives including the recommended alternative and solicit input and answer any questions. Greg reviewed the project definition.

1. Collect and review existing information.
2. Solicit public concerns and ideas.
3. Establish purpose and needs of project.
4. Identify potential alternatives.
5. Evaluate alternatives and select a preferred alternative.

Greg Goyette noted that there was a local concerns meeting held in May. He went over a list of comments. The consensus is bicycling and walking through the interchange at this time is unsafe. Excessive speed is a factor. Ramp A (southbound on-ramp) and Ramps C (northbound off-ramp) are particularly challenging for pedestrian and bicyclists to navigate. There is a large amount of pavement and unclear lane designation through the interchange.

Greg Goyette presented the project purpose: "Transform US Route 5 through the I-91, Exit 11 Interchange from a transportation facility that gives sole consideration to motor vehicles to one that balances motor vehicle mobility and safety with pedestrian/bicyclists accessibility, mobility and safety." He went on to discuss the project needs:

1. Sidewalk along the project corridor. Currently, pedestrians walk on the roadway shoulders or just off the road. A sidewalk along the south side of Route 5 will link proposed sidewalks located at each end of the corridor that are currently in design.
2. Bicycle lanes along the project corridor. With an AADT of 13,200 moving at high speeds, the lack of these facilities discourages bicycle use through the corridor.
3. Reduced and consistent lane widths for motorists. Numerous lane configurations and excessive widths, 12' plus, encourage high motor vehicle speeds without consideration for bicyclists and pedestrians.
4. Improved ramp geometry. The current ramp A and ramp C geometries promote high motor vehicle speeds and include merging conditions. Crash histories reveal sideswipe and rear-end collisions at these locations.
5. Motor vehicle mobility. Proposed improvements must result in adequate traffic mobility along Route 5 and not impact traffic operations on Interstate 91.

Chris Lowe noted that the speed limit is 40 mph through the project area and that most cars drive faster. He asked if VTrans would consider a speed limit reduction. Greg Goyette responded that the issue was discussed with VTrans and they agreed that it should be considered. Greg noted that the speed limit south of the project area had been reduced within the last year.

Alternatives: Greg Goyette presented the following alternatives.

Alternative 1: No Build. Greg noted that this alternative is always included, but in this case it does not address the purpose and need. It was agreed that this alternative was not acceptable.

Alternative 2: Restripe Route 5/Sidewalk on the South Side of Route 5 .

Benefits:

* Provides dedicated bicycle & pedestrian facilities.
* Narrows & better defines travel lanes
* Low-cost solution
* Can be implemented in a short timeframe

Disadvantages:

* Does not address high speed concerns of motorists exiting Ramp C & entering Ramp A

The consensus was that although there are positive features of this alternative, this does not address the problems associated with Ramp A and Ramp C.

Alternative 4: Realign Ramps C & D with Sykes Mountain Avenue Roundabout.

Benefits:

* Provides dedicated bicycle & pedestrian facilities.
* Narrows & better defines travel lanes
* Eliminates bicycle crossings and 1 pedestrian crossing
* Eliminates weaving condition on I-91 NB at Exit 11.

Disadvantages:

* High cost
* Requires significant redesign of Sykes Mountain Avenue roundabouts
* Requires full acquisition of a large commercial parcel on north side & portions of commercial properties on south side –it will significantly impact existing businesses.

The consensus was that this is unrealistic, too costly and would require approval of the Federal Highway Administration.

Alternative 3, Option A-1 Remove Ramp A/Sidewalk on the South Side of Route 5.

Benefits:

* Provides dedicated bicycle & pedestrian facilities.
* Narrows & better defines travel lanes.
* Eliminates high speed merge conditions at Ramp A/B intersection.

Disadvantages:

* Increases delays for vehicles exiting from Ramp F, not acceptable given delays on Ramp F.

Greg Goyette noted that this alternative increases the delay for vehicles exiting Ramp F, which already has a Level of Service "F". There was consensus that removing Ramp A is an improvement, but increasing delays for vehicles exiting Ramp F was not acceptable.

Alternative 3, Option A-2 Remove Ramp A and Construct Right Turn-Lane/Sidewalk on the South Side of Route 5.

Benefits:

* Provides dedicated bicycle & pedestrian facilities.
* Narrows & better defines travel lanes.
* Eliminates high speed merge conditions at Ramp A/B intersection.
* Does not increase delays on Ramp F.
* Allows for signalization/roundabout at Ramp B/F when when VTrans determines it necessary.

Disadvantages:

*

Greg Goyette noted that this alternative avoids further delay for vehicles exiting Ramp F with the construction of a right turn lane. There was consensus that removing Ramp A is an improvement. The design forces bicyclists to stop to cross the right turn lane. There was some concern about how this works for bicyclists and motorists. Rich Menge noted that it was not consistent with the treatment for Ramp D. Chris Lowe agreed. The consensus was to take a closer look at this design.

Alternative 3, Option C-1 Tighten Ramp C Slip Ramp/Sidewalk on the South Side of Route 5.

Benefits:

* Provides dedicated bicycle & pedestrian facilities.
* Narrows & better defines travel lanes.
* Slows vehicles exiting Ramp C
* Allows for signalization/roundabout at Ramp C Intersection when VTrans determines it necessary.

Disadvantages:

*

The design forces bicyclists to stop to cross the right turn lane. There was agreement that some bicyclists will stay with vehicular traffic and not cross at the deisnated bicyclist and pedestrian crossing. The consensus was that by adding a curve for drivers coming off the off ramp, it would slow down the traffic and would be an improvement.

Alternative 3, Option C-2 Realign Ramp C to T-Intersection/Sidewalk on the South Side of Route 5.

Benefits:

* Provides dedicated bicycle & pedestrian facilities.
* Narrows & better defines travel lanes.
* Slows vehicles exiting Ramp C to a full stop
* Allows for signalization/roundabout at Ramp C Intersection when VTrans determines it necessary.

Disadvantages:

* Increases delays on Ramp C for right Turns, potentially leading to traffic backing up onto I-91.

Chris Lowe asked how much of a delay will be caused by this alternative. Greg Goyette responded that the current Level of Service is F for left hand turns. The consensus was that a full stop for northbound traffic exiting the off-ramp would cause delays and would not be acceptable.

Alternative 3, Option C-3 Realign Ramps C & D and Construct Roundabout/Sidewalk on the South Side of Route 5.

Benefits:

* Provides dedicated bicycle & pedestrian facilities.
* Narrows & better defines travel lanes.
* Slows vehicles exiting Ramp C
* Slows vehicles on US Route 5.
* Addresses existing vehicle delays for Ramp C left turns.

Disadvantages:

* Higher costs when compared with Other alternatives.

The consensus was that this option is expensive and it does not slow down northbound vehicles exiting off ramp.

Evaluation Matrix: Greg Goyette went through the evaluation matrix.

Preferred Alternative, Option A-2 (Remove Ramp A and Construct Right Turn-Lane) C-1 (Tighten Ramp C Slip Ramp) and Construct Sidewalk on the South Side of Route 5. Greg Goyette proceeded to identify the consultant's recommended alternative. Discussion followed.

Mark Pippin asked about winter maintenance of the sidewalk. Rich Menge responded that the Town will plow the sidewalk.

Chris Lowe suggested Alternative 2 (restriping) in the short term and Alternatives A2 and C1 in the long-term. There was consensus with the consultant's recommended alternative with further examination of the bike lane and turn lane with A2.

Next Step: Greg Goyette thanked everyone for attending the meeting. He noted that the next step is for the consultant to meet with Town staff, refine the alternatives, then meet and present the alternatives to Vermont Agency of Transportation officials. Matt Osborn noted that there will be a third community meeting on the project with the Hartford Selectboard and that the meeting likely will occur sometime in September or October. Matt stated that if you signed in and gave your e-mail or postal address, you will be notified of the specific meeting date.

Adjournment: Greg Goyette thanked everyone for attending. The meeting adjourned at 8:00 p.m.

Appendix J

Conference Call at VTrans District 4
Exit 11 Interchange
Scoping Study

Allyn, Rich, Trevor, Andrew, Chris 9/14/12 + Greg

~~Greg~~ went over preferred alternative A2 C1

Ramp C

Chris - dangerous situation for traffic coming off offramp C changing lanes with Rte 5 lane going straight

GG - would be dashed line tighten slip ramp will reduce speed - Crash history

TS - snow plow issues

TS - prefer Option C2

GG - would lead to backup on I91

C - Concerned about bicyclists crossing at cross walk without stop condition

GG improvement over current condition

RM moving intersection to north to alleviate stacking

GG → not stripe as crosswalk is a possibility
can be easily signalized in the future
Biggest issue is ped/bikes crossing slip ramp

C Striping in Norwich is town maintenance
winter maintenance ~~p~~lowing is that bike treated as a shoulder

C crosswalk not making it safer

GG 100 peds crossing off ramp in 24 hour period

C widen ramp C to increase stacking

GG can be done

C Are you widening Route 5?

GG No

Ramp D

- 1 lane exiting roundabout going south
continue roundabout design

2

9/14/12
Conference Call
Exit 11 Interchange

GG - ~~extra~~ extra pavement can be removed

TS if leave pavement, it will be used get rid of pavement

RM Norwich bike lanes seem to be working

Ramp A

GG - eliminate ramp crash data merge condition on Ramp A+B crash history

- eliminate long right turn lane

TR - sight distance decrease

C - warrants probably could be signalized

GG - LOS F

- warrants justify signal

C - Lots of traffic for morning commute

GG - There is a visual cue should address concerns

C - Is there a problem with que for left turns on ramp B + right hand turns onto Ramp B

GG left turns yield

~~GG~~ C - why not signalize?

GG - focus of study on bike/ped improvements

- will discuss with VTrans Wednesday

RM - VTrans meeting consensus to eliminate Ramp A

TS - from a maintenance standpoint - nothing bad

C - Better than it is

RM - Biggest concern Ramp C bike/ped safety vehicles not expecting to stop

AR - Ped crossing/warning signs on Ramp C

Alt 2 Restriping bare bones short term add bike lanes + narrow road

3

9/14/12
Conference Call
Exit 11 Interchange

AR Sidewalk parallel to slip lane could require snow removal not plowing or blowing

RM Town prefers phased approach

$\boxed{\text{Alt 3 A1 C1}}$ incremental alternative

- remove ramp A, not a turn lane onto ramp B
- increase delays ramp F

RM - opposes signal

$\boxed{\text{Alt 3 C3 Roundabout}}$ long term + costly

TS prefers this option
traffic coming off ramp C too fast
could be fine tuned

$\boxed{\text{Alt 4}}$ Extremely expensive

Appendix K

Agenda

Stantec

Recommended Alternative Review Meeting

Bicycle & Pedestrian Study for the Exit 11, I-91 Interchange Area

National Life Building, 4th Floor Conference Room #1, Montpelier, VT

September 19th, 2012

Time:	**Item:**	**Action:**
10:30am	Review recommended alternative	
11:00	Potential phasing/funding	
11:15	Future opportunities to move the project into the next phase	
11:30am	Steps required to complete study/Adjourn	

Exit 11, I-91 Interchange
9/19/12
VTrans, Montpelier

Marcus Miller, Kevin Russell, Jon Kaplan, Amy ~~Gamble~~
Kristen Driscoll

Greg: Background

JK - Sidewalk as a stand alone?
MM - Offramp C concerns about ped. crossing
GG - District 4 same concerns

Alternatives
- consistent ~~elements~~ sidewalk on south side and 6' bike lanes
- Study assumes roundabout will be built before this project. Adjustments can be made without roundabout
MM - Norwich bike lanes - motorists getting accustomed to bike lanes
GG Alt 2 - restriping implemented with resurfacing which is not anticipated in next four years
Alt 3 - same as Alt except reconfigure ramps A + C
- close Ramp A, add radius to Ramp C
- currently LOS of F on Ramp F. Avoid making it worse
- LOS F of Ramp S southbound
MM - ~~[illegible]~~ Need to look at signage
- clean up ledge, trees re. sight lines
Alt 3 - A2 + C2 close ramp A, complete stop at ramp C northbound
MM - conflict with right hand turn Ramp B with left hand turn Ramp B

2

Exit 11, I-91 Interchange
VTrans Mtg
9/19/12

- C2 queuing on Ramp C problem

Alt C 3 roundabout

- right turn bypass lane = high speed crossing 2 lanes uncontrolled

Alt 4 High cost, bike/ped benefits

Preferred Alternative A2 + C1

KR - busy area re. traffic + signage

JK - cost estimate not included in draft
concern about cost between enhancement + safety. sidewalk $500K

GG - $1 Million without ramp work resurfacing + restriping

- Off ramps not high crash location by VTrans

AG - ask VTrans to do analysis
Amy Spicer

JK - Does not have a sense of how VTrans would handle this project

AG - make it black project preventative surf project. Maybe with Pavement management with no R-O-W impacts

JK - Discussion with Kevin Marshia + Rich Tetreault not unheard of (Norwich)

JK - Mike Fowler did not list repaving in 4 years, but he could rate it

KR - talk to Kevin Marshia

- Stand alone or combine it with roundabout + resurfacing

3

Exit 11, I-91 Interchange
VTrans Mtg
9/19/12

GG - TE N. Hartland sidewalk + bike lanes
MM - Crosswalk at VA realistic point to locate crosswalk
GG - reviewed issue with Amy + Jon
GG - 40 mph speed limit seems high
- 40 mph extended to south 800'
GG - Bike path between Ramp C + Sykes will be used by cyclists going south
Stop sign in opposite direction
KR - multi-use path have you ruled it out
GG - narrow under bridge
JK - preferred alt. will improve conditions for bicyclists + pedestrians

Next Steps
- Go to Selectboard will have questions
AG - RPC process may have to regional prioritization
JK - substitution is a possibility
AG - paving project does it go through reg'l process
AR - town could manage
- go to Kevin + Rich before SB mtg
KR - explore options for funding
MO - VTrans endorsement first process?
KR - Need federal highway input
KR - Federal Highway any red flags?
AG - input through project review process
MO - Nov. SB meeting
MO - thanked VTrans process has worked really well.

Appendix L

TOWN OF HARTFORD
Tuesday, November 27, 2012
Selectboard Meeting – 6:00 p.m.
Bugbee Senior Center at 262 North Main Street
White River Junction, VT

Present: Ken Parker, Chairman; F.X. Flinn, Vice Chairman; Bethany Fleishman, Clerk; Sam Romano, Selectman; Alex DeFelice, Selectman; Simon Dennis, Selectman; Hunter Rieseberg, Town Manager; Rich Menge, Director Public Works; Allyn Ricker, Highway Superintendent; Matt Osborn, Planner; Lori Hirshfield, Director Planning and Development; Carole Rivard; Sandy Bergeron; Rita Seto, TRORC; Judith Bettis; Greg Goyette, Stantec; Pierre Boucher; Joann Frampton; Ann Betters; Jon Bouton, Chair Conservation Commission; Bruce Riddle, Chair Planning Commission; John Jalowiec, Planning Commission; Shawn Kelley; Glen Valentine, Mascoma Savings Bank; Richard Kozlowski, Planning Commission; Mary Hutchins; Mary Lou Previte; Tom Linell; Chuck Wooster, Charter Revision Commission; Susanne Abetti; Karol Kawiaka.

Absent: Sonia Knight, Selectman

I. **Call to Order & Pledge of Allegiance:** Mr. Parker called the meeting to order at 6:08 p.m. and Mr. DeFelice led the Pledge.

II. **Citizen, Selectboard Comments, Announcements & Acknowledgments:** Ms. Fleishman talked about the book entitled *The Year In Photos 2011: Hartford, Vermont Celebrates 250 Years* that was published and is available for sale through the Town Clerks Office and at the Garipay House during the mornings.

III. **Appointments:**

a. 2 New Interviews for Hartford Conservation Commission: Mary Hutchins and Shawn Kelley. Ms. Hutchins and Mr. Kelley introduced themselves and were thanked for stepping forward to serve the Town of Hartford.

IV. **Board Reports, Motions & Ordinances:**

a. Consideration of (re)Appointments: Clare Forseth and Joanne Roth reappointment to Tree Board, Mary Hutchins and Shawn Kelley New Appointment to Conservation Commission. **Mr. DeFelice moved to re-appoint Clare Forseth and Joanne Roth to the Tree Board effective December 1, 2012 through December 1, 2015. Ms. Fleishman seconded. All were in favor and the motion carried.**

Mr. DeFelice moved that pursuant to Title 24, Chapter 118, Section 4502(b), Vermont Statutes Annotated, the Board of Selectmen, hereby appoints Mary Hutchins this 27th day of November, 2012, to serve as a member of the Conservation Commission in the Town of Hartford, the County of Windsor, and the State of Vermont, effective through August 22, 2015. Mr. Flinn seconded. All were in favor and the motion carried.

Mr. DeFelice moved that pursuant to Title 24, Chapter 118, Section 4502(b), Vermont Statutes Annotated, the Board of Selectmen, hereby appoints Shawn Kelley this 27th day of November, 2012, to serve as a member of the Conservation Commission in the Town of Hartford, the County of Windsor, and the State of Vermont, effective through August 22, 2014. Mr. Flinn seconded. All were in favor and the motion carried.

b. Reconsideration Turner Drive off Campbell Street Plowing: **Mr. DeFelice moved that the town accept 70 feet of the right away (Turner Drive) off Campbell Street. Mr. Dennis seconded.** Mr. Rieseberg and Mr. Menge said that their positions remain unchanged. **The motion failed with the majority voting nay.**

c. Consider Rogers Road off Campbell Street Plowing: **Mr. DeFelice moved that for safety reasons to remove the snow at the intersection of Campbell Street and Rogers Road. Mr.**

Dennis seconded. It is felt that when the snow builds up from plowing in this area and creates a hazard. Mr. Menge recommends declining the request. **The motion failed 5 to 1.**

d. Sidewalk Presentation: Sidewalk Projects Update: Mr. Menge explained that there are 4 sidewalk projects along the Route 5/Sykes Mountain Avenue corridor for which the Town has obtained approximately $1M of grant monies. The projects are: (1) Final Design and Construction for Route 5/North Hartland Road between Arboretum Lane and Ballardvale Drive; (2) Conceptual Design for I-91/ Exit 11 at Route 5 between Ballardvale Drive and on Sykes Mountain Avenue; (3) Final Design and Construction for Sykes Mountain Avenue from the White River Post Office to Butternut Road; and (4) Final Design and Construction for Sykes Mountain Avenue from Lower Butternut Road to South Main Street (or Connecticut River Road). These projects are in addition to the State funded project for the two roundabouts between Route 5 and Ralph Lehman Drive. Mr. Menge introduced Greg Goyette from Stantec Engineering, the consultant working with the Town on the 1st, 2nd and 3rd sidewalk projects listed above. Mr. Menge is requesting Selectboard approval to submit the I-91/Exit 11 conceptual design recommendations to the State, and to proceed with final design for the Route 5/North Hartland Road sidewalk, and the Sykes Mountain Avenue sidewalk from the Post Office to Butternut Road. **Mr. Flinn moved that the Board adopt the recommendation as presented tonight with regards to sidewalk and bicycle lane improvements and to authorize the staff to authorize staff to submit design and construction for consideration to the State. Mr. DeFelice seconded. All were in favor and the motion carried.**

e. Update on Building Renovation Committee: Mr. Rieseberg said that there were 5 people that he knew of that expressed an interest in this Committee: Robin Adair Logan; David Briggs; Matt Bucy; Jon Appleton and Mike McCrory. **Mr. Dennis moved that in order to construct the most diverse and qualified committee to review the work that has been done; we appoint Mike McCrory, Jon Appleton, Matt Bucy, Robin Adair Logan and Karol Kawiacka as citizen's representation for the Municipal Building advisory committee. Mr. Flinn seconded. The motion carried 4 to 2.** Mr. Flinn moved to appoint Simon Dennis to the Committee. If Ms. Knight is interested she will be appointed. The motion was not called, but agreed upon by consensus with Mr. DeFelice abstaining.

f. Update on Quechee Covered Bridge Project. Mr. Rieseberg reported that we are on budget and still optimistic to vehicle traffic in December depending on weather. The bridge will not be paved this winter, however; as is customary hard pack will be used. Preliminary dedication plans and the Alumni Parade were discussed.

g. Update on West Hartford Library Project: The project is moving along nicely and has moved into the design phrase. The town manager is meeting with abutting landowners.

V. **Selectboard Work Session:**

VI. **Consent Agenda: (The following items will be considered and moved as a block unless there is a request to exempt any one or more items from this list. Mr. Flinn moved to approve the consent agenda including the Payroll November 28, 2012, the AP Processing Report November 21, 2012, ratification of the AP Report November 19, 2012 and to note the Future Meeting Dates of 12/11/2012; 12/13/2012; 12/18/2012; 12/20/2012. Mr. DeFelice seconded. All were in favor and the motion carried. Mr. Flinn moved to adopt the Selectboard Minutes of November 7, and November 13, 2012 as presented. Mr. Dennis seconded. The motion carried with Mr. DeFelice voting nay and all else voting aye.**

VII. **Chairman's Report:**

a. Update Joint Facilities Committee meeting with the School Board: Mr. Parker said the Schoolboard has agreed to move forward with the unified Bond.

VIII. **Town Manager's Report – (Board questions, concerns, requests, project updates, etc.)**
The budget will be a unique challenge.

The Covered Bridges Half Marathon will be held on June 3, 2013. Mr. Flinn asked if this should be Sunday, June 2, 2013 although the application states June 3, 2013, which is a Monday.

IX. **Commission Meeting Reports:** Mr. DeFelice attended the Schoolboard Meeting and the West Hartford Library Trustees Meeting.

X. **Old Business**
a. Formal Signing of Fire Department CBA Final Agreement by Selectboard (previously ratified).

XI. **Executive Session (1 VSA 313):** **Mr. DeFelice moved to go into Executive Session at 9:59 p.m. for the purpose of personnel. The motion was seconded and unanimously passed. Mr. Flinn moved to adjourn at 10:07 p.m. The motion was seconded and unanimously passed**

XII. **Adjournment:** **The motion was made and seconded to adjourn the meeting at 10:08 p.m. The motion unanimously passed.**

Approved at the December 11, 2012 meeting
Bethany Fleishman, Clerk

Appendix M

Stantec

55 Green Mountain Drive
South Burlington, VT 05403
Tel: (802) 864-0223
Fax: (802) 864-0223

Quantity Summary

Hartford, VT

195310702

I91 Interchange

	Initials	Date
Calc'd By:	CAG	1/2/2013
Checked By:	GGG	1/3/2012
Revised By:		
Checked By:		

				ALT 2 Re-Surface/Re-stripe		ALT 3 Road/Ramp		ALT 3 Sidewalk	
Item No.	Item Description	Unit	Unit Price	Quantity	$	Quantity	$	Quantity	$
203.15	Common Excavation	CY	$15.00	0	$ -	2500	$ 37,500	600	$ 9,000
203.16	Solid Rock Excavation	CY	$60.00	0		1100	$ 66,000	60	$ 3,600
203.28	Excavation of Surfaces and Pavements	CY	$25.00	350	$ 8,750	1100	$ 27,500	0	$ -
301.35	Subbase Of Dense Graded Crushed Stone	CY	$40.00	0	$ -	1000	$ 40,000	400	$ 16,000
404.65	Emulsified Asphalt	CWT	$50.00	50	$ 2,500	500	$ 25,000	0	$ -
490.30	Superpave Bituminous Concrete Pavement	TON	$200.00	500	$ 100,000	1000	$ 200,000	0	$ -
616.40	Removing And Resetting Curb	LF	$20.00	250	$ 5,000	500	$ 10,000	200	$ 4,000
618.10	Portland Cement Concrete Sidewalk, 5 Inch	SY	$62.00	0	$ -	0	$ -	1000	$ 62,000
651.35	Topsoil	CY	$30.00	350	$ 10,500	1600	$ 48,000	-	$ -
900.640	Special Provision (Paint)	LF	$1.00	15000	$ 15,000	15000	$ 15,000	400	$ 400

*Unit price for Solid Rock Excavation doubled to include blasting

	ALT 2 Re-Surface/Re-stripe	ALT 3 Road/Ramp	ALT 3 Sidewalk
Sub Total	$ 141,750	$ 469,000	$ 95,000
Mobilization/Demobilization (10%)	$ 14,175	$ 46,900	$ 9,500
Traffic Control (10%)	$ 14,175	$ 46,900	$ 9,500
Drainage (10%)		$ 46,900	$ 9,500
Sub Total	$ 170,100	$ 609,700	$ 123,500
Contingencies (30%)	$ 51,030	$ 182,910	$ 37,050
Total Opinion of Probable Construction Cost	$ 230,000	$ 800,000	$ 170,000
Preliminary Engineering	$ 50,000	$ 125,000	$ 40,000
Right-of-Way Acquisition	$ -	$ -	$ -
Legal Fees	$ -	$ 5,000	$ 5,000
Construction Inspection	$ 25,000	$ 80,000	$ 20,000
Municipal Project Management	$ 25,000	$ 40,000	$ 15,000
Total Project Cost	**$ 330,000**	**$ 1,050,000**	**$ 250,000**