Prepared by the

MONTACHUSETT REGIONAL PLANNING COMMISSION (MRPC)

Westminster – Gardner – Winchendon
Route 140 North Corridor Profile

Route 140 at Route 101, Gardner, MA
Source: Google Street View

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January 2012

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Route 140 North
Safety Improvement Steering Committee
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Steve Wallace, Westminster Town Planner
Marie Auger, Westminster Planning Board

City of Gardner
Rob Hubbard, Planning Director
Robert Hankinson, City Engineer (Gardner)
Edward Goss, GIS Coordinator (Gardner Engineering Dept)
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Neil Janssens, Gardner City Council

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Jim Kreidler, Winchendon Town Manager
Ellen DeCoteau, Winchendon Planning Agent
John White, Winchendon Planning Board Chair

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1.0 INTRODUCTION

1.1 The Route 140 North Safety Improvement Steering Committee

The Route 140 North Steering Committee was established after the completion of a corridor profile of Route 140 from Route 2 south to I-190 conducted by the MRPC and the Central Mass Regional Planning Commission (CMRPC) for the communities of Westminster, Sterling and Princeton. This Route 140 Task Force and Corridor Profile sought to identify potential safety improvements along Route 140 with a primary emphasis on improving roadway safety, reducing periodic congestion, preserving and improving roadway pavement and drainage as well as investigating how to improve the roadway for bicycle and pedestrian accommodation. Through public discussion of this study, as well as the involvement of the town of Westminster, inquiries from local officials were made to the MRPC to conduct a similar examination of Route 140 from Route 2 north to Route 12 in Winchendon. In addition, the three communities recently participated in a build out analysis for the Route 140 north corridor through the District Local Technical Assistance (DLTA) program of the MRPC. This study examined "the maximum amount of new growth that could occur if all available land attains its full development potential" (*Route 140 North Corridor Buildout Analysis Gardner, Westminster and Winchendon, MA*, MRPC and William Scanlan November 2010). This study helped to highlight the importance of the roadway and possible safety issues.

1.2 Transportation Management System "Corridor Profile"

A Corridor Profile correlates the information generated by the Transportation Management Systems along a particular highway corridor and analyzes performance-based data, suggests both operational and physical improvements, and may identify candidate projects for further study. From the range of data and analyses produced and maintained by the Montachusett Regional Planning Commission (MRPC), a corridor profile allows for the comprehensive integration and consideration of a wide range of transportation planning factors. The end result is usually a number of suggested improvement options for the identified issues for the consideration of the communities involved and the Massachusetts Department of Transportation (MassDOT) Highway Division. These proposed improvement projects have the potential to be advanced through the MassDOT project development process and possible programming in the annual Transportation Improvement Program (TIP) document.

The Route 140 Corridor Profile includes the following Management System data:

- **Traffic Counting:** Daily Automatic Traffic Recorder (ATR) counts and associated historical growth rates;
- **Congestion Management Process (CMP):** Historical and current peak-hour Turning Movement Counts at study intersections and associated Level of Service (LOS) analyses;
- **Transportation Safety Planning Program:** In-depth vehicle crash research in cooperation with the local Police Departments utilizing a three-year history of reported crashes and subsequent analysis, including the compilation of collision diagrams and crash rates;
- **Pavement Management System (PMS):** Observation of pavement surface distress and extent in the field along with subsequent analysis and calculated condition rating;
- **Freight Planning:** Daily percentage of heavy vehicles utilizing Route 140 roadway segments.

1.3 Route 140 Corridor Profile: Characteristics

The roadway segment of Route 140 through the three communities has a total length of 9.48 miles and is functionally classified as a Principal Arterial road. This classification makes the highway federal-aid eligible for funding of any potential improvements. In addition, this section of the highway is part of the National Highway System (NHS).

"The NHS is a network of strategic highways within the United States, including the Interstate Highway System and other roads serving major airports, ports, rail or truck terminals, railway stations, pipeline terminals and other strategic transport facilities." These roads are "important to the nation's economy, defense, and mobility. The NHS was developed by the United States Department of Transportation (DOT) in cooperation with the states, local officials, and metropolitan planning organizations (MPOs). Individual states are encouraged to focus federal funds on improving the efficiency and safety of this network which makes up 4% of the nation's roads, but carries 40% of the traffic and 75% of heavy truck traffic."

[Source: Wikipedia (wikipedia.org/wiki/National_Highway_System_(United_States)) and Federal Highway Administration website (fhwa.dot.gov/planning/nhs/)]

Jurisdictional responsibility for Route 140 lies either with the Massachusetts Department of Transportation or the community of Gardner or Winchendon. Based upon information provided by MassDOT Highway Division District 2, jurisdiction for Route 140 in Gardner from the Westminster town line northerly to Green Street belongs to the state. From Green Street north to the Winchendon town line is under Gardner's jurisdiction. From this point north to Teel Road in Winchendon jurisdiction reverts back to MassDOT and finally from Teel Road to Route 12 the road is under Winchendon's jurisdiction. The jurisdiction for the segment from the Gardner/Winchendon line to Teel Road was turned over to MassDOT in 2002/2003 through legislation. Additionally, MassDOT has an agreement with the town of Winchendon to provide snow and ice clearing for the entire segment of Route 140 within the town, i.e. for the Gardner line to Route 12.

Statewide, MassDOT oversees and takes a major role in improvements suggested and eventually implemented along the federal-aid highway system. The following table summarizes these characteristics for Route 140 in the three communities. A map of the study area is shown in Figure 1-1.

Route 140 Characteristics by Community

Community	From/To	Length (miles)	Functional Classification	Jurisdiction
Westminster	Route 2 to Gardner City Line	1.02	Principal Arterial	MassDOT
Gardner	Westminster Town Line to Green Street	3.62	Principal Arterial	MassDOT
	Green Street to Winchendon Town Line	1.51	Principal Arterial	City of Gardner
Winchendon	Gardner City Line to Teel Road	2.12	Principal Arterial	MassDOT
	Teel Road to Route 12	1.21	Principal Arterial	Town of Winchendon
	Total	9.48		

Route 140 also has varying characteristics throughout its entire length within this study area. For the most part, it is a two lane undivided roadway with surface widths that vary from 50 to 70+ feet. Within the town of Westminster, the road is mostly divided with two travel lanes in each direction. Turning lanes are present at various locations to allow for access to some intersections. Refer to the intersection descriptions later in this report regarding the location of turning and acceleration/deceleration lanes.

Speed limits generally vary from 40 to 50 miles per hour along Route 140. The higher speeds are found in Westminster approaching the line with Gardner; in Gardner approaching Route 101 and Green Street and in Winchendon along the majority of Route 140. The table below and Figure 1-2 highlight the speed limits and locations found along the corridor.

Route 140 Speed Limits – North and South Bound

		Northbound		Southbound	
Community	Location	Distance of (miles)	Speed Limit (mph)	Distance of (miles)	Speed Limit (mph)
Westminster	Route 2	0.1	40	0.5	40
		0.4	40	-	-
		0.5	50	0.5	50
Gardner	Westminster Town Line	1.6	50	1.6	50
		0.4	40	0.3	40
		1.4	50	1.5	50
		1.7	40	0.4	40
		-	-	1.3	50
Winchendon	Gardner City Line	3.1	50	3.1	50
	Route 12	0.2	35	0.2	35

1.4 Corridor Issues Within the Communities

As part of the development process to identify various areas of concern within each community along the Route 140 corridor, Committee members were asked to highlight issues/problems within their respective town. These concerns would focus on perceived and/or known safety problems as well as other issues that needed to be addressed from the towns' perspective.

The following issues/concerns related to Route 140 were identified by Committee participants for the city of Gardner:

- Speed, particularly at curves and intersections
- Turns onto and from Matthews Street
- Lane configuration on Route 140 south just north of Matthews Street
- Turns onto and from North Central Correctional Institution (NCCI) (Colony Road)
- Turns onto and from Green Street
- Fencing to keep deer and moose from the roadway (many animals are killed yearly)
- Design controls over curb cuts
- Signage and roadway markings per previous Lane Departure report
- Drainage problems directly or indirectly caused by 140
- North Central Pathway link
- Impacts of possible future developments, especially curb cuts and increased traffic volumes

1.5 Intersection Figures

Through discussions with the Steering Committee, nine intersections were identified for review and analysis as part of this study. AM and PM peak hour turning movement counts were conducted at these locations.

The intersections from north to south are:

Community	Route 140 Intersection with
Winchendon	Spring Street (Route 12)
	Old Gardner Road
	Teel Road
Gardner	Green Street
	Matthews Street
	Pearl Street (Route 101)
	Colony Road
Westminster	Betty Spring Road
	Simplex Drive

The following are aerial photographs of the intersections examined.

Winchendon

Route 140 and Spring Street (Route 12)

Route 140 and Old Gardner Road

Route 140 and Teel Road

Gardner

Route 140 and Green Street

Route 140 and Matthews Street

Route 140 and Pearl Street (Route 101)

Route 140 and Colony Road

Westminster

Route 140 and Betty Spring Road

Route 140 at Simplex Drive/Route 2 Westbound Ramp

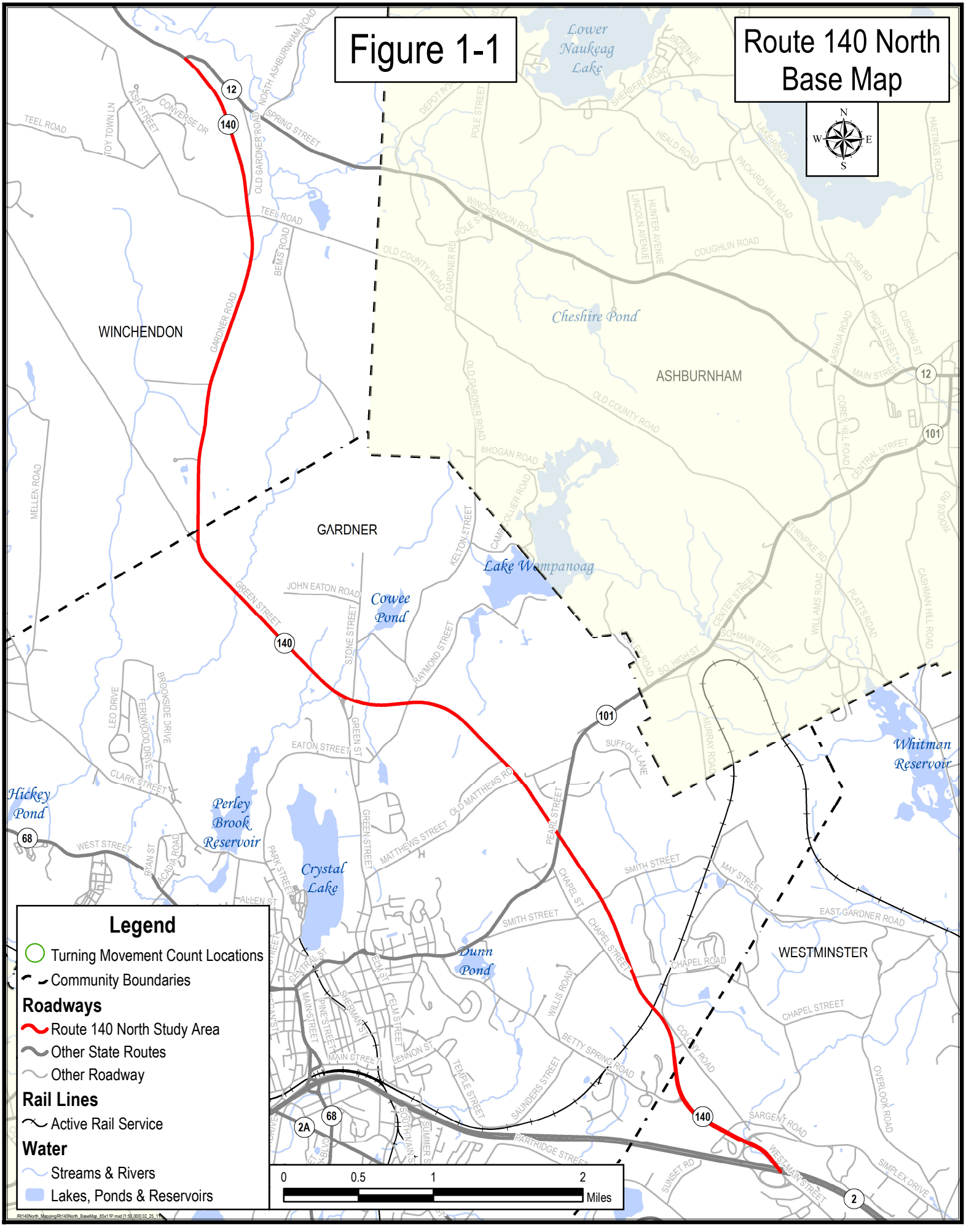
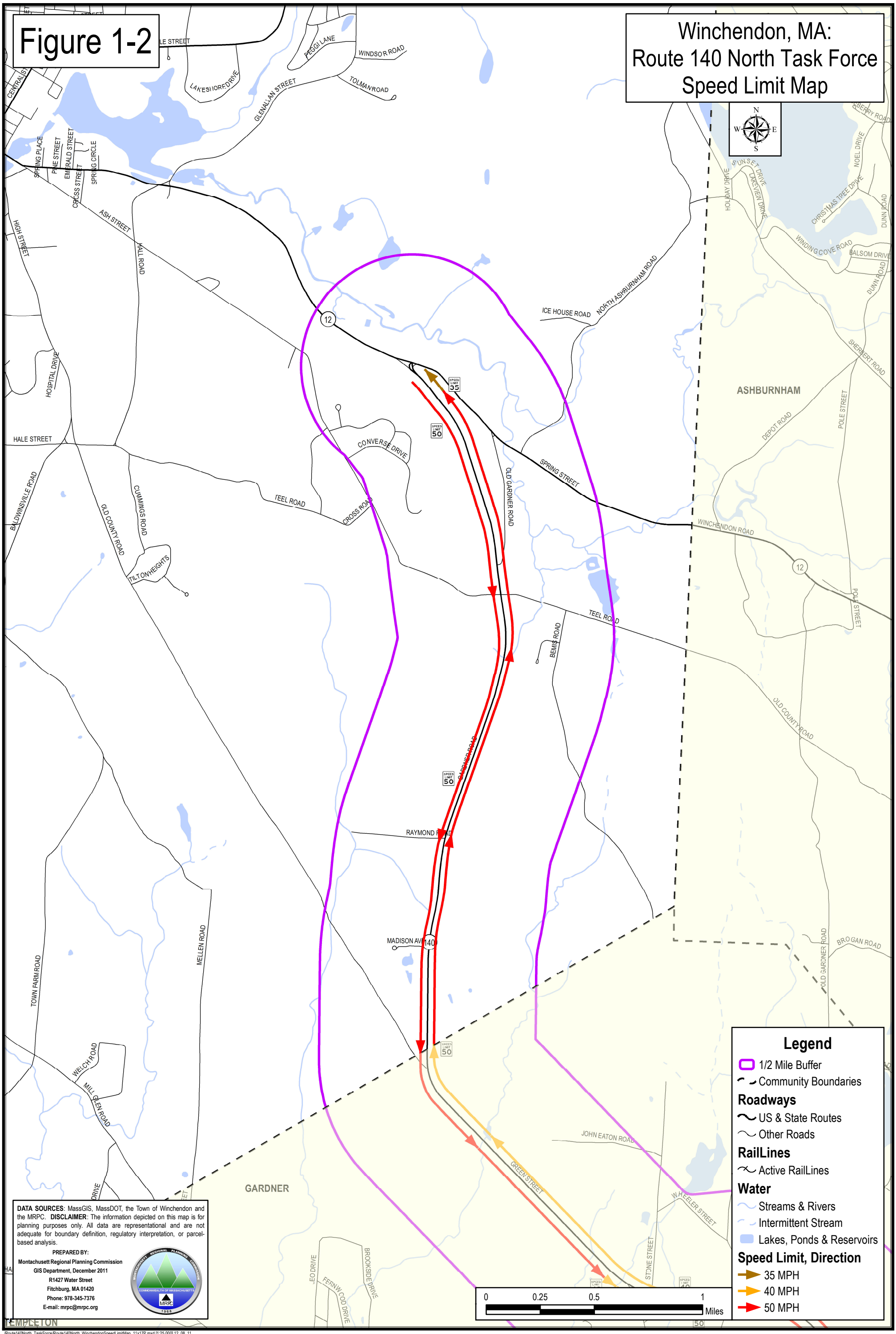


Figure 1-1
Route 140 North Base Map
N
W
E
S
Lower Naukeag Lake
Cheshire Pond
Lake Wampanoag
Cowee Pond
Hickey Pond
Perley Brook Reservoir
Crystal Lake
Dunn Pond
Whitman Reservoir
WINCHENDON
ASHBURNHAM
GARDNER
WESTMINSTER
Legend
Turning Movement Count Locations
Community Boundaries
Roadways
Route 140 North Study Area
Other State Routes
Other Roadway
Rail Lines
Active Rail Service
Water
Streams & Rivers
Lakes, Ponds & Reservoirs
0
0.5
1
2
Miles

Figure 1-2

Winchendon, MA: Route 140 North Task Force Speed Limit Map



DATA SOURCES: MassGIS, MassDOT, the Town of Winchendon and the MRPC. **DISCLAIMER**: The information depicted on this map is for planning purposes only. All data are representational and are not adequate for boundary definition, regulatory interpretation, or parcel-based analysis.

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Legend

- 1/2 Mile Buffer
- Community Boundaries

Roadways
- US & State Routes
- Other Roads

RailLines
- Active RailLines

Water
- Streams & Rivers
- Intermittent Stream
- Lakes, Ponds & Reservoirs

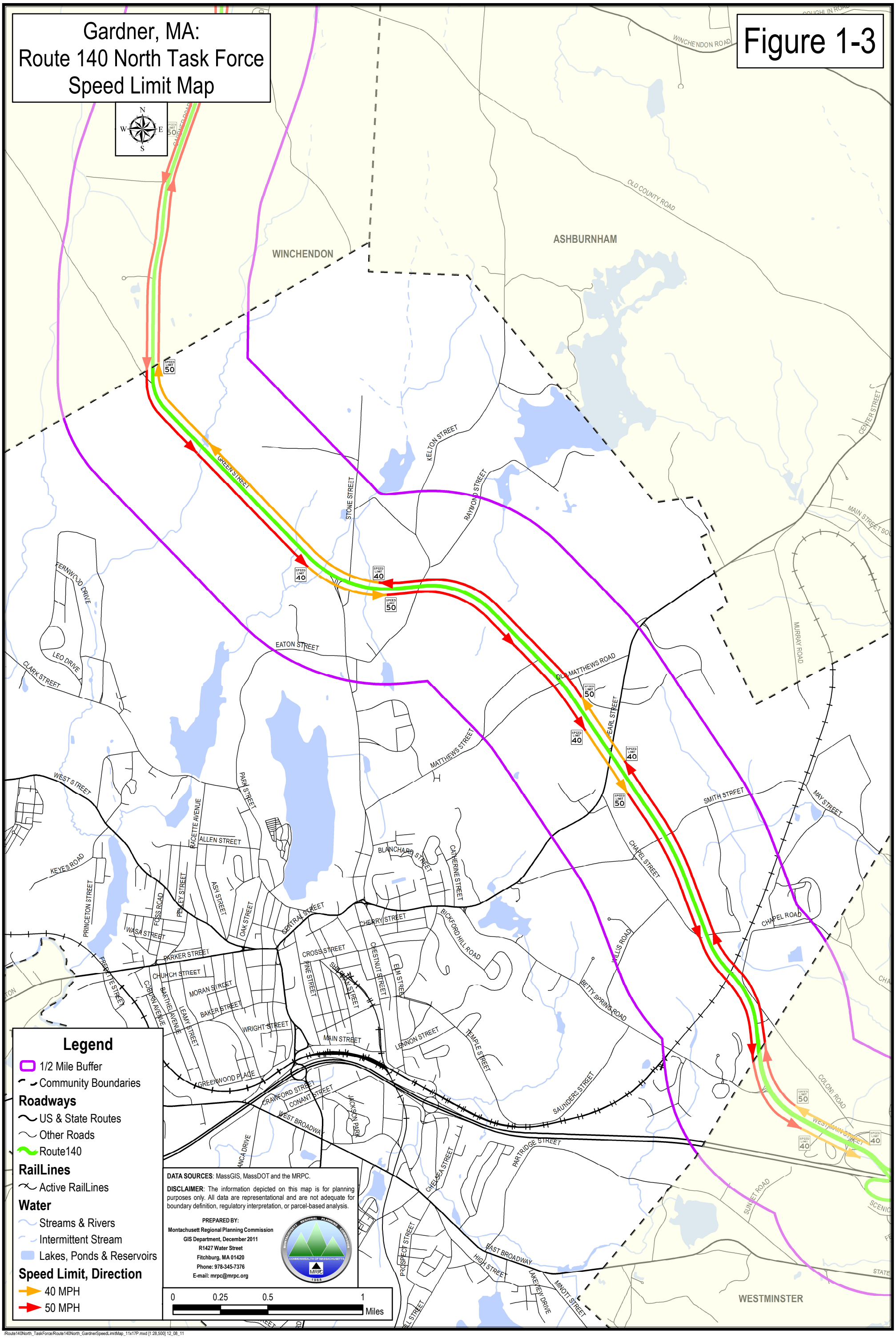
Speed Limit, Direction
- 35 MPH
- 40 MPH
- 50 MPH

0 0.25 0.5 1 Miles

/Route140North_TaskForce/Route140North_WinchendonSpeedLimitMap_11x17P.mxd [1:25,000] 12_08_11

Gardner, MA:
Route 140 North Task Force
Speed Limit Map

Figure 1-3



Legend

- 1/2 Mile Buffer
- Community Boundaries

Roadways
- US & State Routes
- Other Roads
- Route140

RailLines
- Active RailLines

Water
- Streams & Rivers
- Intermittent Stream
- Lakes, Ponds & Reservoirs

Speed Limit, Direction
- 40 MPH
- 50 MPH

DATA SOURCES: MassGIS, MassDOT and the MRPC.

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0 0.25 0.5 1 Miles

/Route140North_TaskForce/Route140North_GardnerSpeedLimitMap_11x17P.mxd [1:28,500] 12_08_11

Westminster, MA:
Route 140 North Task Force
Speed Limit Map

Figure 1-4

N
W E
S

GARDNER

SMITH STREET
MAY STREET
GARDNER STATE HOSPITAL ROAD
EAST GARDNER ROAD
CHAPEL STREET
CHAPEL ROAD
WILLIS ROAD
ROUTE 140
UNNAMED ROAD
UNNAMED ROAD
BEECH HILL
OVERLOOK ROAD
BETTY SPRING ROAD
CARLSON LANE
LINUS ALLAIN AVENUE
MCHANCE STREET
COLONY ROAD
BEECH HILL ROAD
SARGENT ROAD
WEST MAIN STREET
SIMPLEX DRIVE
RAMP-RT 140 TO RT 2 WB
RAMP-RT 140 TO RT 2 WB TO RT 140
ROUTE 2
RAMP-RT 140 TO RTE 2
RAMP-RT 2 EB TO RT 140
PARTRIDGE STREET
SHADY AVENUE
GOODRIDGE DRIVE
SUNSET ROAD
SCENIC DRIVE
FENNO DRIVE
WILSON ROAD
UNNAMED ROAD
LIVERMORE HILL ROAD
ROUTE 2
STATE ROAD WEST
BROOKS AVENUE
MAIN STREET
LOVELL STREET
SMITH AVENUE
HOWARD AVENUE
NICHOLS STREET
RIPLEY ROAD
CAMELOT ROAD
OLD COUNTY ROAD
ELLIS ROAD
LAKE DRIVE EAST

SPEED LIMIT 50
SPEED LIMIT 40
SPEED LIMIT 40

Legend

- 1/2 Mile Buffer
- Community Boundaries

Roadways

- US & State Routes
- Other Roads

RailLines

- Active RailLines

Water

- Streams & Rivers
- Intermittent Stream
- Lakes, Ponds & Reservoirs

Speed Limit, Direction

- 40 MPH
- 50 MPH

0 0.125 0.25 0.5 Miles

DATA SOURCES: MassGIS, MassDOT and the MRPC.

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/Route140North_TaskForce/WestminsterSpeedLimitMap_11x17P.mxd [1:14,000] 12_08_11

2.0 ROUTE 140 ENVIRONMENTAL

2.1 Environmental Profiles

In order to assess the environmental conditions along the Route 140 corridor, various Geographic Information System (GIS) datasets were compiled and analyzed. As part of the analysis, a one half mile buffer was developed around Route 140. The following summarizes the datasets compiled and the environmental features found within the three communities.

Wetlands

The following tables provide a snapshot of the identified wetlands areas classified as marsh/bog or wooded marsh that lie within the corridor buffer for each community. Additionally, within the town of Winchendon, a wooded marsh wetland directly abuts the western edge of Route 140 both north and south of Teel Road. Refer to Figures 2-1, 2-2 and 2-3 for maps of the wetland areas.

Wetlands Acreage Within Route 140 Corridor

	Wetland Category	Acres	
Winchendon	Marsh/bog	67.0	
	Wooded marsh	366.6	
	Wooded marsh Acreage Abutting Rt 140	177.7	*
Gardner	Marsh/Bog	74.7	
	Wooded marsh	317.3	
Westminster	Marsh/Bog	13.6	
	Wooded marsh	163.0	

*Note: Acreage included within the Total Acreage figure of 366.6.

Open Space

Identified open space locations within the corridor buffer are summarized in the following table. Within Winchendon, only two conservation parcels directly abuts Route 140. Gardner has the greatest amount of acreage with the classified as open space with abutting parcels classified as water supply or conservation. Westminster has the smallest amount of open space acreage within the Route 140 buffer zone with no parcels directly abutting Route 140 in the study area, i.e. from Route 2 north into Gardner. Refer to Figures 2-4, 2-5 and 2-6 for a map of each community.

Open Space Acreage Within Route 140 Corridor

	Open Space Category	Acres
Winchendon	In Perpetuity	520.07
	Recreation and Conservation	47.15
	Conservation	431.46
	Water Supply	41.46
Gardner	In Perpetuity	1,275.61
	Recreation and Conservation	139.95
	Conservation	438.52
	Recreation	62.81
	Water Supply	677.10
Westminster	Permanent, Westminster	14.51
	Permanent, MA-DFWELE*	83.94
	Permanent, Non- Profit Conservation	38.97
	Unprotected, Westminster	4.34
	Unprotected, Private	1.26

*MA Division of Fisheries and Wildlife

National Heritage & Endangered Species Program (NHESP)

The overall goal of the NHESP is the protection of the state's wide range of native biological diversity. NHESP is responsible for the conservation and protection of hundreds of species that are not hunted, fished, trapped, or commercially harvested in the state. Available geographic data layers identified within the corridor include:

- *Certified Vernal Pools*
- *Potential Vernal Pools*
- *BioMap Core Habitat* - This depicts the most viable habitats for rare species in Massachusetts.
- *BioMap2 Critical Natural Landscape*
- *Priority Habitats of Rare Species* – These are the geographical extents of habitat for all state-listed rare species, both plants and animals. They are officially used under the Massachusetts Endangered Species Act (MESA).

Critical natural landscape areas are the most prevalent throughout the three communities along the corridor. Gardner has the most identified certified and potential vernal pools of the three communities. With the majority situated south of the Route 140/Route 101 signalized intersection. NHESP conservation areas are summarized in the table below and are depicted in maps in Figures 2-7, 2-8 and 2-9.

NHESP Data Within Route 140 Corridor

	Dataset	Acres or No. of Sites
Winchendon	NHESP BioMap Core Habitat	653.27
	NHESP Priority Habitat for Rare Species	808.58
	NHESP BioMap2 Critical Natural Landscape	795.69
	NHESP Potential Vernal Pools	3 Locations
	NHESP Certified Vernal Pools	0 Locations
Gardner	NHESP BioMap Core Habitat	69.00
	NHESP Priority Habitat for Rare Species	97.75
	NHESP BioMap2 Critical Natural Landscape	468.51
	NHESP Potential Vernal Pools	12 Locations
	NHESP Certified Vernal Pools	4 Locations

NHESP Data Within Route 140 Corridor (cont.)

	Dataset	Acres or No. of Sites
Westminster	NHESP BioMap Core Habitat	92.83
	NHESP BioMap2 Critical Natural Landscape	118.75
	NHESP Potential Vernal Pools	4 Locations
	NHESP Certified Vernal Pools	1 Location

Figure 2-1

Winchendon, MA: Route 140 North Task Force Wetlands Map

N
W E
S

PEGGI LANE
WINDSOR ROAD
TOLMAN ROAD
GLENALLAN STREET
LAKESIDE DRIVE
SPRING PLACE
PINE STREET
EMERALD STREET
CROSS STREET
SPRING CIRCLE
ASH STREET
HIGH STREET
HALL ROAD
HOSPITAL DRIVE
HALE STREET
BALDWINSVILLE ROAD
OLD COUNTY ROAD
CUMMINGS ROAD
TILTON HEIGHTS
TEEL ROAD
CROSS ROAD
CONVERSE DRIVE
ICE HOUSE ROAD
NORTH ASHBURNHAM ROAD
SUNSET DRIVE
LAKEVIEW DRIVE
HOLIDAY DRIVE
NOEL DRIVE
CHRISTMAS TREE DRIVE
WINDING COVE ROAD
BALSOM DRIVE
DUNN ROAD
ABERRY ROAD
SHERBERT ROAD
ASHBURNHAM
DEPOT ROAD
POLE STREET
SPRING STREET
OLD GARDNER ROAD
WINCHENDON ROAD
BEMIS ROAD
GARDNER ROAD
RAYMOND ROAD
MADISON AV
MELLEN ROAD
TOWN FARM ROAD
WELCH ROAD
MILL GLEN ROAD
JOHN EATON ROAD
GREEN STREET
WHEELER STREET
STONE STREET
BROOKSIDE DRIVE
FERNWOOD DRIVE
BROGAN ROAD
GARDNER
TEMPLETON
12
140

DATA SOURCES: MassGIS, MassDOT, the Town of Winchendon and the MRPC. **DISCLAIMER**: The information depicted on this map is for planning purposes only. All data are representational and are not adequate for boundary definition, regulatory interpretation, or parcel-based analysis.

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0 0.25 0.5 1 Miles

Legend

- 1/2 Mile Buffer
- Community Boundaries

Roadways
- US & State Routes
- Other Roads

RailLines
- Active RailLines

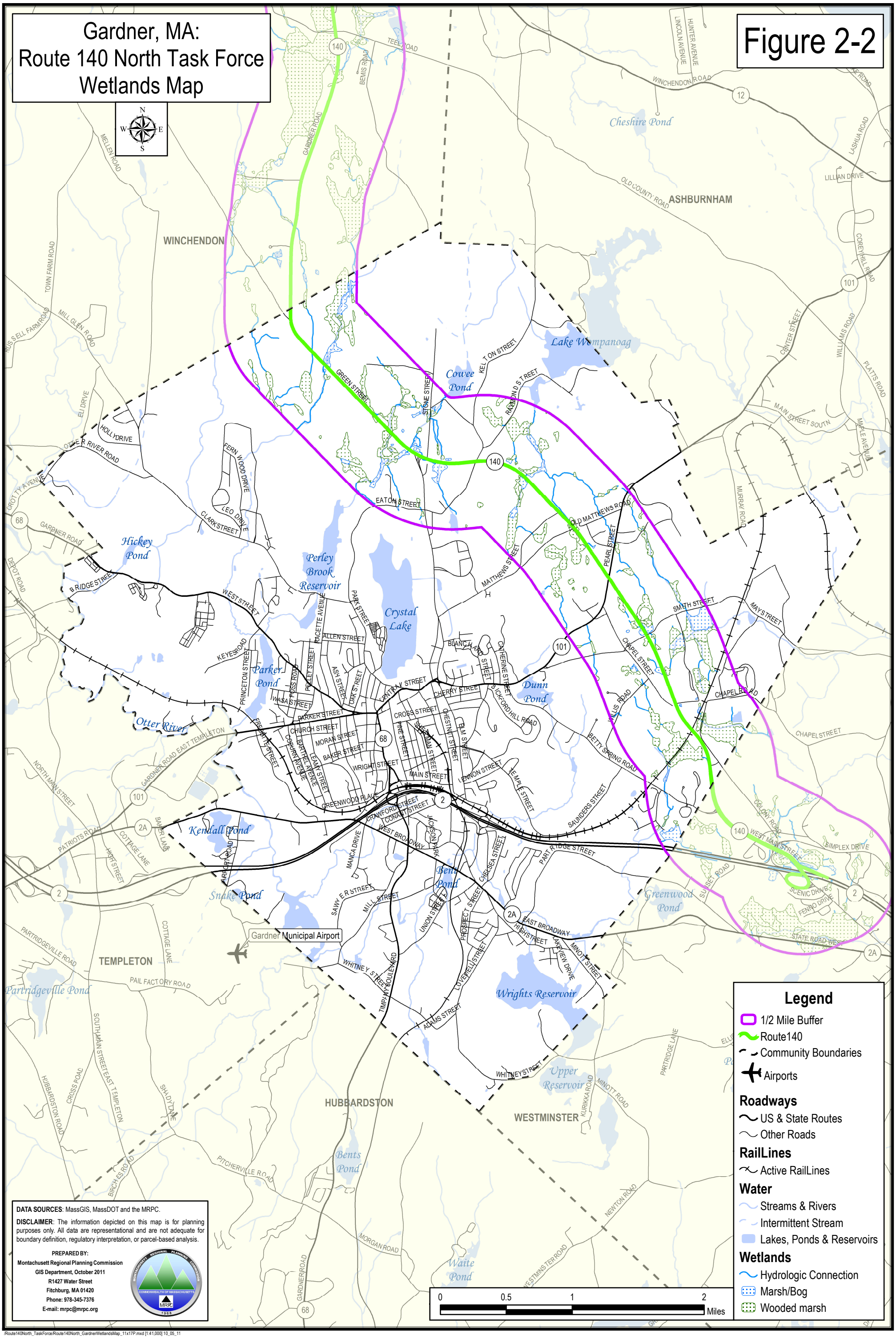
Water
- Streams & Rivers
- Intermittent Stream
- Lakes, Ponds & Reservoirs

Wetlands
- Hydrologic Connection
- Marsh/Bog
- Wooded marsh

/Route140North_TaskForce/Route140North_WinchendonWetlandsMap_11x17P.mxd [1:25,000] 10_05_11

Figure 2-2

Gardner, MA: Route 140 North Task Force Wetlands Map



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Legend

- 1/2 Mile Buffer
- Route140
- Community Boundaries
- Airports

Roadways
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- Other Roads

RailLines
- Active RailLines

Water
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Wetlands
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- Marsh/Bog
- Wooded marsh

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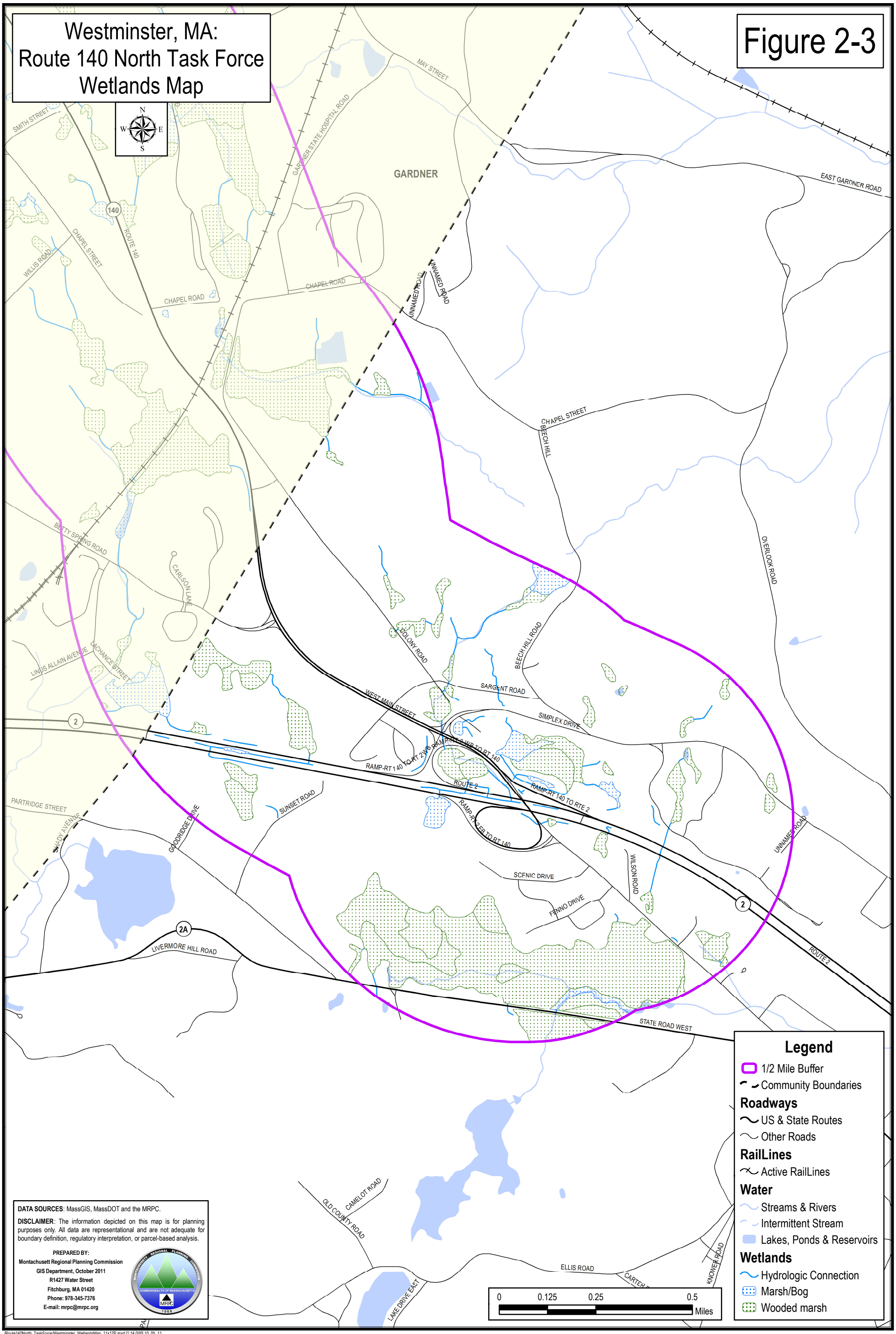
Westminster, MA:
Route 140 North Task Force
Wetlands Map

Figure 2-3



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Legend

- 1/2 Mile Buffer
- Community Boundaries

Roadways
- US & State Routes
- Other Roads

RailLines
- Active RailLines

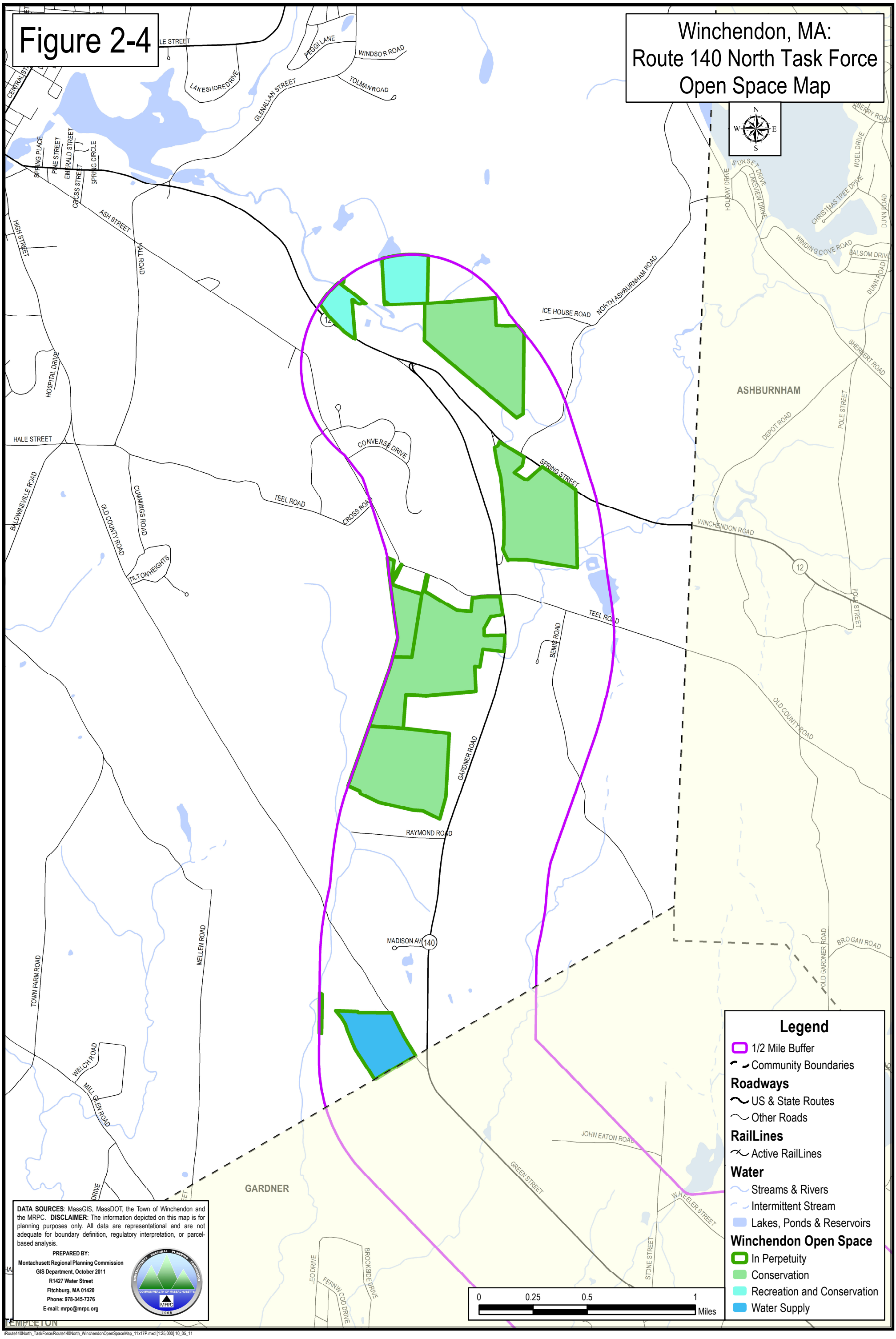
Water
- Streams & Rivers
- Intermittent Stream
- Lakes, Ponds & Reservoirs

Wetlands
- Hydrologic Connection
- Marsh/Bog
- Wooded marsh

/Route140North_TaskForce/Westminster_WetlandsMap_11x17P.mxd [1:14,000] 10_05_11

Figure 2-4

Winchendon, MA: Route 140 North Task Force Open Space Map



DATA SOURCES: MassGIS, MassDOT, the Town of Winchendon and the MRPC. **DISCLAIMER**: The information depicted on this map is for planning purposes only. All data are representational and are not adequate for boundary definition, regulatory interpretation, or parcel-based analysis.

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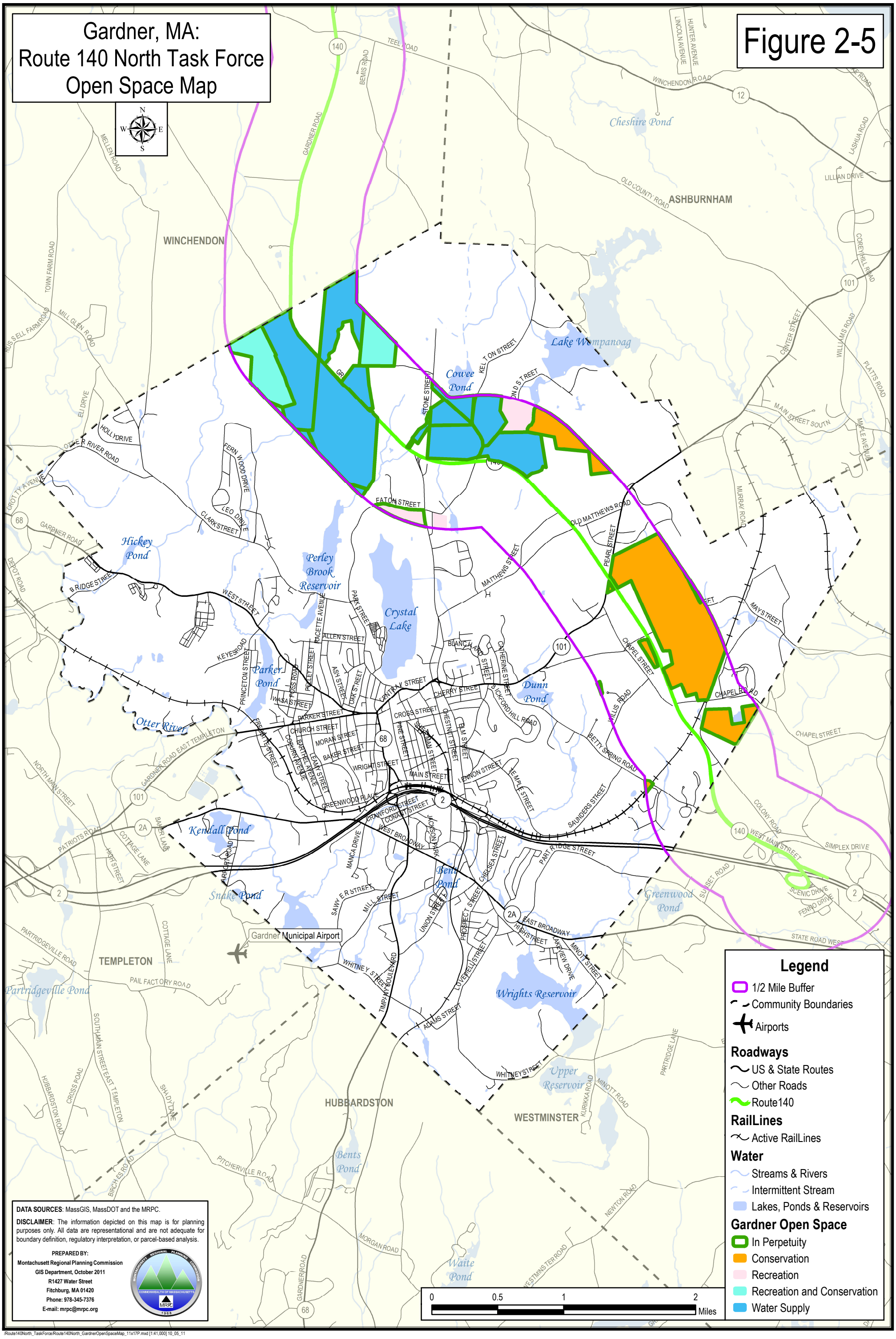
- Lakes, Ponds & Reservoirs

Winchendon Open Space
- In Perpetuity
- Conservation
- Recreation and Conservation
- Water Supply

/Route140North_TaskForce/Route140North_WinchendonOpenSpaceMap_11x17P.mxd [1:25,000] 10_05_11

Gardner, MA:
Route 140 North Task Force
Open Space Map

Figure 2-5



Legend

- 1/2 Mile Buffer
- Community Boundaries
- Airports

Roadways

- US & State Routes
- Other Roads
- Route140

RailLines

- Active RailLines

Water

- Streams & Rivers
- Intermittent Stream
- Lakes, Ponds & Reservoirs

Gardner Open Space

- In Perpetuity
- Conservation
- Recreation
- Recreation and Conservation
- Water Supply

DATA SOURCES: MassGIS, MassDOT and the MRPC.

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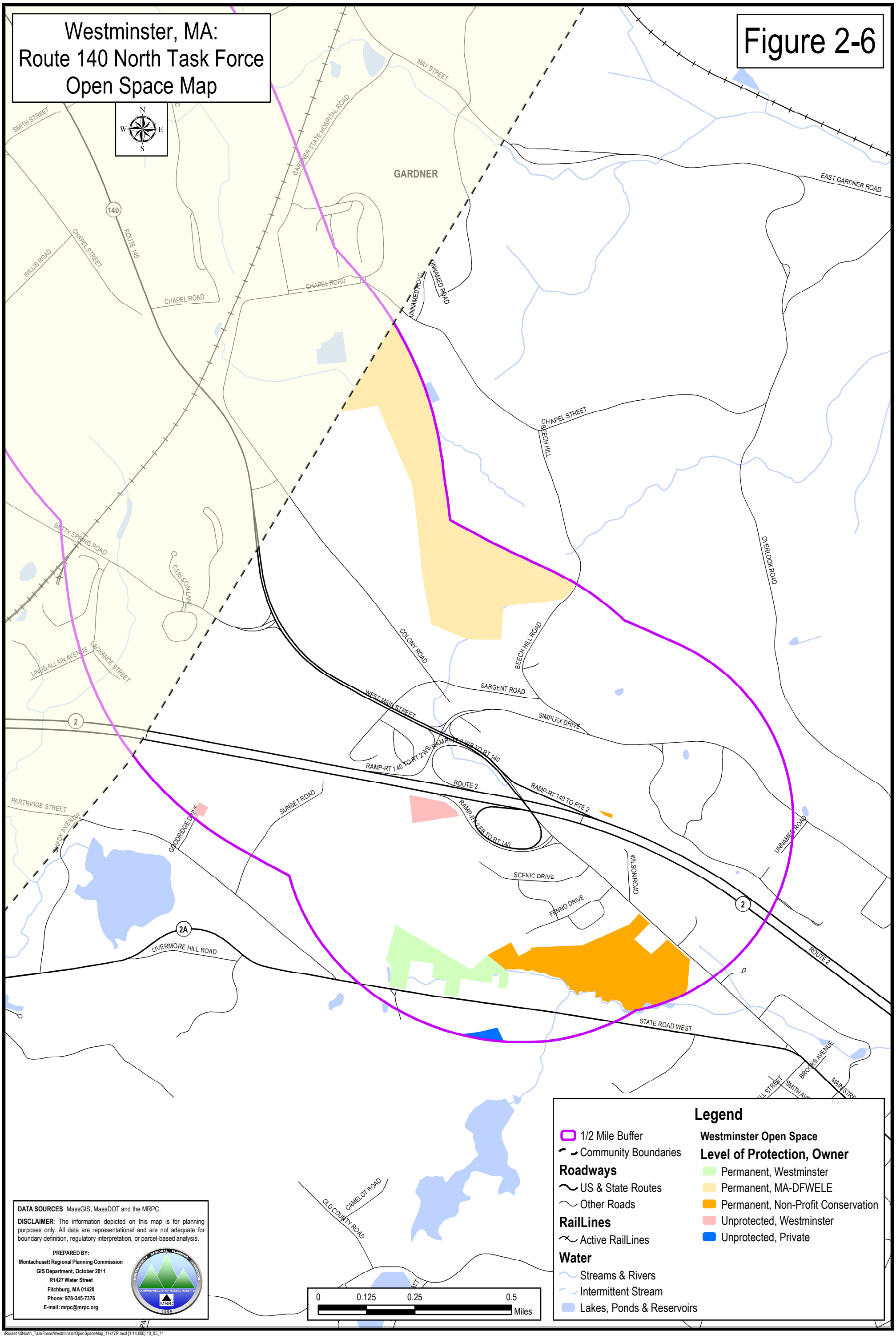
/Route140North_TaskForce/Route140North_GardnerOpenSpaceMap_11x17P.mxd [1:41,000] 10_05_11

Westminster, MA:
Route 140 North Task Force
Open Space Map

Figure 2-6



DATA SOURCES: MassGIS, MassDOT and the MRPC.

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Legend

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- Community Boundaries

Roadways
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- Other Roads

RailLines
- Active RailLines

Water
- Streams & Rivers
- Intermittent Stream
- Lakes, Ponds & Reservoirs

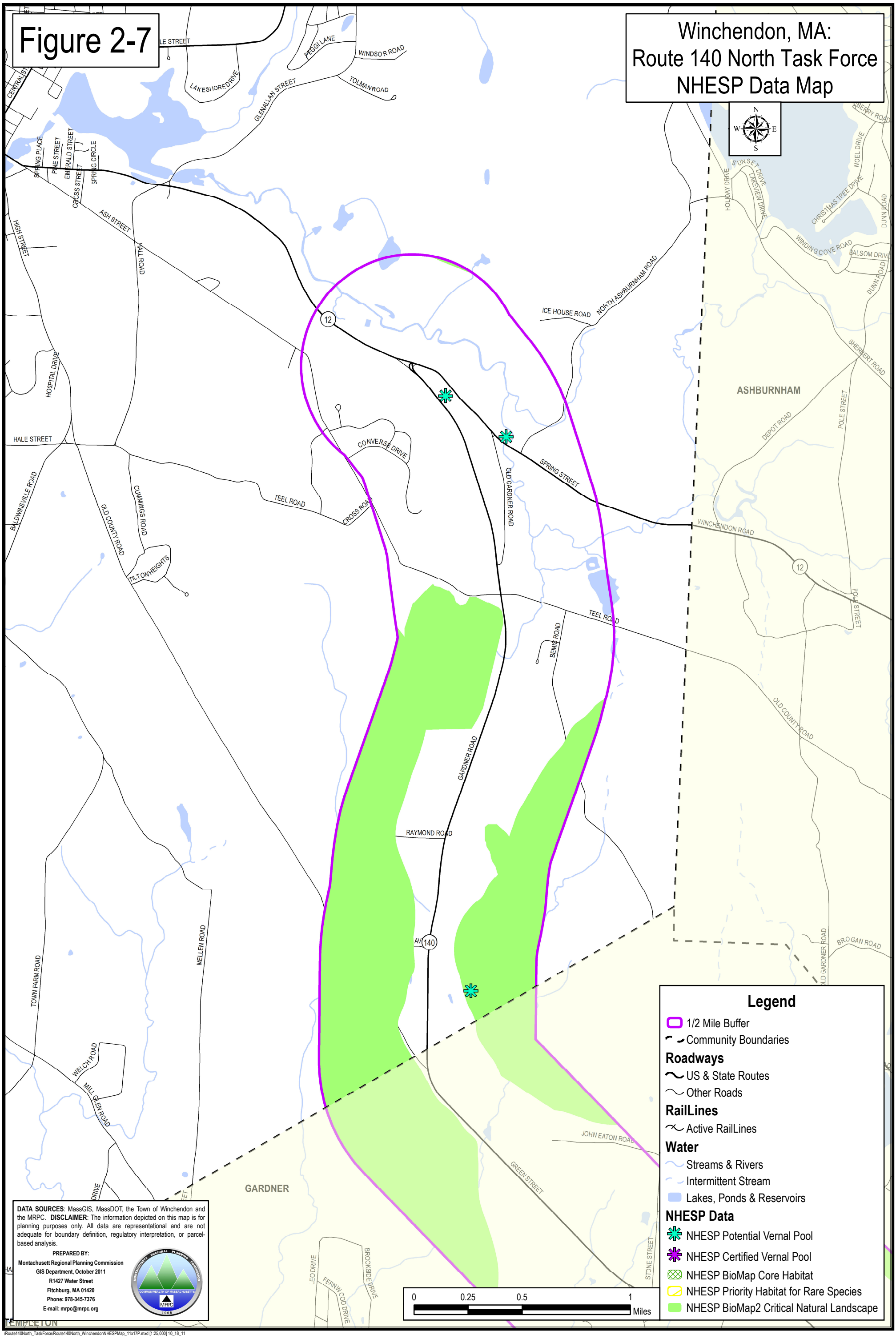
Westminster Open Space

Level of Protection, Owner
- Permanent, Westminster
- Permanent, MA-DFWELE
- Permanent, Non-Profit Conservation
- Unprotected, Westminster
- Unprotected, Private

/Route140North_TaskForce/WestminsterOpenSpaceMap_11x17P.mxd [1:14,000] 10_05_11

Figure 2-7

Winchendon, MA: Route 140 North Task Force NHESP Data Map



DATA SOURCES: MassGIS, MassDOT, the Town of Winchendon and the MRPC. **DISCLAIMER**: The information depicted on this map is for planning purposes only. All data are representational and are not adequate for boundary definition, regulatory interpretation, or parcel-based analysis.

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0 0.25 0.5 1 Miles

Legend

- 1/2 Mile Buffer
- Community Boundaries

Roadways
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- Other Roads

RailLines
- Active RailLines

Water
- Streams & Rivers
- Intermittent Stream
- Lakes, Ponds & Reservoirs

NHESP Data
- NHESP Potential Vernal Pool
- NHESP Certified Vernal Pool
- NHESP BioMap Core Habitat
- NHESP Priority Habitat for Rare Species
- NHESP BioMap2 Critical Natural Landscape

/Route140North_TaskForce/Route140North_WinchendonNHESPMap_11x17P.mxd [1:25,000] 10_18_11

Gardner, MA:
Route 140 North Task Force
NHESP Data Map

Figure 2-8

N
W E
S

WINCHENDON
ASHBURNHAM
TEMPLETON
HUBBARDSTON
WESTMINSTER

Cheshire Pond
Lake Wompanoag
Cowee Pond
Hickey Pond
Perley Brook Reservoir
Crystal Lake
Parker Pond
Dunn Pond
Otter River
Kendall Pond
Snake Pond
Bents Pond
Greenwood Pond
Wrights Reservoir
Upper Reservoir
Partridgeville Pond
Waite Pond

Gardner Municipal Airport

DATA SOURCES: MassGIS, MassDOT and the MRPC.

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0 0.5 1 2 Miles

Legend

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Roadways
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- Route140

RailLines
- Active RailLines

Water
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- NHESP BioMap2 Critical Natural Landscape
- NHESP Priority Habitat for Rare Species
- NHESP BioMap Core Habitat

/Route140North_TaskForce/Route140North_GardnerNHESPMap_11x17P.mxd [1:41,000] 10_18_11

Westminster, MA:
Route 140 North Task Force
NHESP Data Map

Figure 2-9

GARDNER

Legend

- 1/2 Mile Buffer
- Community Boundaries

Roadways

- US & State Routes
- Other Roads

RailLines

- Active RailLines

Water

- Streams & Rivers
- Intermittent Stream
- Lakes, Ponds & Reservoirs

NHESP Data

- NHESP Potential Vernal Pool
- NHESP Certified Vernal Pool
- NHESP BioMap Core Habitat
- NHESP Priority Habitat for Rare Species
- NHESP BioMap2 Critical Natural Landscape

0 0.125 0.25 0.5 Miles

DATA SOURCES: MassGIS, MassDOT and the MRPC.

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/Route140North_TaskForce/WestminsterNHESPMap_11x17P.mxd [1:14,000] 10_18_11

3.0 TRAFFIC CONGESTION ANALYSIS

3.1 Overview of Traffic Congestion Analysis Methods

The following analysis methods were used to evaluate traffic congestion on Route 140 in Westminster.

Traffic Volume Counts and Peak Hour Determination

MRPC staff conducts twenty-four hour (minimum) traffic counts at key locations on the road segment. Besides total traffic volume data, speed and vehicle class data was also counted. The count data are then analyzed to determine AM and PM peak hours. Once the AM and PM peak hours are determined, peak hour intersection turning movement traffic counts are completed at the study area intersections. Locations for traffic counts were determined with the Steering Committee. See Figure 3-1.

Intersection Peak Hour Level-of-Service (LOS) Analysis

The Level Of Service (LOS) of a roadway traffic facility represents the quality of traffic flow and is used to assess the operation of that traffic facility during peak hours. LOS analyses are based on the methods in the *Highway Capacity Manual* (2000) (HCM). LOS is defined differently for each type of traffic facility, such as an unsignalized intersection, signalized intersection, two-lane road, or multi-lane road.

Intersection LOS Criteria

LOS criteria are defined by the average amount of delay experienced by a vehicle at the intersection due to the traffic controls (i.e., signs or signals). For unsignalized intersections each approach is assessed independently, since the LOS of the major and minor approaches may differ greatly. LOS E and F indicate unacceptable intersection operation. The table below summarizes the LOS average control delay criteria for intersections controlled by STOP signs and those controlled by traffic signals.

Level of Service (LOS) Criteria

LOS	Average Control Delay (seconds per vehicle)	
	Stop Controlled	Signalized
A	<10.0	<10.0
B	10.1 – 15.0	10.1 – 20.0
C	15.1 – 25.0	20.1 – 35.0
D	25.1 – 35.0	35.1 – 55.0
E	35.1 – 50.0	55.1 – 80.0
F	>50.0	>80.0

3.2 Historical Traffic Count Observations

The following table lists Route 140 average daily traffic (ADT) based on the traffic counts the MRPC conducted at comparable locations from 1999 to 2010. From the counts available, traffic along Route 140 has maintained moderate growth through Gardner while a decline is seen in Winchendon near Route 12. The intersection of Route 140 at Route 12 was reconfigured into a signalized “T” crossing in early 2005. This change may have had an effect on travel volumes at this location.

Route 140 Traffic Volume Annual Growth Rates

	Winchendon		Gardner		Gardner	
	South of Spring St (Rt 12)	Approximate Annual Growth Rate	North of Green Street	Approximate Annual Growth Rate	SE of Pearl St (Rt 101)	Approximate Annual Growth Rate
YEAR	ADT		ADT		ADT	
1999					11,668	
2000						
2001						
2002						
2003	12,751					1.08%
2004						
2005						
2006		-1.10%				
2007	12,589		13,361			
2008		-2.13%		1.07%		
2009					12,995	
2010	11,802		13,793		13,135	1.08%

A comparison to traffic volume growth factors for the entire Montachusett Region (based upon multiple locations from the MRPC count database) has shown a decrease in overall volumes for both urban and rural communities. Between 2006 and 2010, traffic volumes regionwide have seen an annual growth rate of -0.81 percent. Slowdowns in the economy as well as gas price increases may have contributed to these reductions.

The following table shows the annual growth rates for the Montachusett Region based upon the count history from 2006 to 2010 for 93 locations across the region.

Montachusett Traffic Volume Annual Growth Factors

	No. of Locations	2006 Total Volumes	2010 Total Volumes	Annual Growth Rates 2006-2010
Total - Regionwide	93	749,935	725,959	-0.81%
Urban Only	41	478,081	469,255	-0.46%
Rural Only	52	271,854	256,704	-1.42%

3.3 Existing Daily Traffic Volumes

MRPC conducted twenty-four hour automatic traffic counts at eight locations along the Route 140 corridor; two in Westminster; four in Gardner and two in Winchendon. Locations are listed in the following table and are shown on Figure 3-1 and were conducted during the months of July and September 2010.

Route 140 Average Daily Traffic Volumes

Municipality	Route	Location of Count	Date	Raw Count Total	Northbound	Percent	Southbound	Percent	AADT*
Winchendon	Rt. 140	S. of Spring St (Rt 12)	9/21/2010	11,802	5,856	49.6%	5,946	50.4%	10,900
Winchendon	Rt. 140	N. of Teel Rd	9/21/2010	12,839	6,372	49.6%	6,467	50.4%	11,600
Gardner	Rt. 140	N. of Green Street	9/21/2010	13,793	6,833	49.5%	6,960	50.5%	12,700
Gardner	Rt. 140	N. of Matthews St	9/21/2010	9,044	4,470	49.4%	4,574	50.6%	8,300
Gardner	Rt. 140	N. of Pearl St (Rt 101)	9/21/2010	11,997	5,896	49.1%	6,101	50.9%	11,000
Gardner	Rt. 140	S. of Pearl St (Rt 101)	9/21/2010	13,135	6,527	49.7%	6,608	50.3%	12,100
Westminster	Rt. 140	W. of Simplex Drive	7/22/2010	15,563	7,658	49.2%	7,905	50.8%	14,200
Westminster	Rt. 140	E. of Simplex Drive	7/22/2010	17,349	8,564	49.4%	8,785	50.6%	15,800

* Adjusted Average Daily Traffic

Volumes range from a high of 17,349 at Simplex Drive near Route 2 in Westminster to a low of 9,044 north of Matthews Street in Gardner. Volumes then increase significantly north of Green Street in Gardner reflecting traffic heading into and away from Mount Wachusett Community College, Henry Heywood Hospital (both located along Green Street) and downtown Gardner.

Traffic is split almost 50/50 between north and south bound travel throughout the corridor as expected from a road that serves as a major connector between communities and highways.

3.4 Route 140 Intersection Peak Hour Traffic Volumes

MRPC conducted AM and PM turning movement counts (TMCs) at each study area intersection in along the corridor during the months of September through December of 2010. The intersections and the A.M. and P.M. turning volumes are shown on Figures 3-2 and 3-3 and peak hour traffic volumes are listed in the table below.

Route 140 Turning Movement Count Locations and Volumes

Municipality	Route	Location of Count	Date	AM Peak	PM Peak
Winchendon	Rt. 140	At Spring St (Rt. 12)	10/13/2010	1,139	1,315
Winchendon	Rt. 140	At Old Gardner Road	9/29/2010	962	1,079
Winchendon	Rt. 140	At Teel Road	10/13/2010	1,080	1,181
Gardner	Rt. 140	At Green Street	9/29/2010	1,098	1,108
Gardner	Rt. 140	At Matthews St	12/2/2010	790	910
Gardner	Rt. 140	At Pearl St (Rt 101)	10/20/2010	1,537	1,587
Gardner	Rt. 140	At Colony Road	10/21/2010	1,289	1,161
Westminster	Rt. 140	At Betty Spring Road	10/13/2010	1,616	1,448
Westminster	Rt. 140	At Simplex Drive	11/16/2010	1,828*	1,395*

The complete TMC datasheets can be found in the Technical Appendix.

***The counts do not include the right turn traffic onto the Route 2 westbound ramp from Route 140 southbound or the Route 2 westbound traffic coming off the ramp heading southbound onto Route 140. Also, traffic volume was most likely altered due to ongoing construction of the nearby Route 2 bridge.

3.5 Route 140 Intersection Peak Hour Level-of-Service (LOS) Analysis

Level of Service analysis was then conducted for the AM and PM peak hours based upon the TMC's listed above to determine the operational conditions of Route 140. The following tables provide the results of this analysis for the non-signalized and signalized intersections. An analysis was not conducted for the signalized intersection of Route 140 with Simplex Drive/Route 2 Westbound Ramp due to problems with the counting equipment and the subsequent travel pattern changes occurring at this intersection due to the start of construction by MassDOT to the Route 2 bridges over Route 140. Closures to the ramp system during construction resulted in travel pattern changes and therefore would affect any turning movement count. However, visual review of the intersection indicated that the signal was operating properly and providing adequate times for vehicles resulting in no significant delays or congestion.

Complete LOS worksheets can be found in the Technical Appendix. Refer to Figures 3-2 and 3-3 for AM and PM intersection volumes and Figures 3-4 and 3-5 for AM and PM LOS.

Route 140 Intersection Peak Hour Level of Service (LOS) – Non-Signalized Locations

		Approach	Lane Group				
Community	Route 140 Intersection With	Approach	Lane Group	AM		PM	
				Delay (sec.)	LOS	Delay (sec.)	LOS
Winchendon	Old Gardner Road	Old Gardner Road	Left and Right	23.3	C	25.9	D
		Route 140 Southbound	Left	8	A	9.1	A
	Teel Street	Teel Street Eastbound	Left, Right, Thru	17.8	C	16.4	C
		Teel Street Westbound	Left, Right, Thru	23.3	C	21.3	C
		Route 140 Southbound	Left	7.9	A	9.2	A
		Route 140 Northbound	Left	9.4	A	8.5	A
Gardner	Green Street	Green Street	Left	20.3	C	35.3	E
			Right	11.8	B	9.5	A
			All Lanes	18.3	C	33.8	D
		Route 140 Northbound	Left	8.5	A	7.7	A
	Matthews Street	Matthews Street	Left and Right	9.6	A	9.6	A
		Route 140 Northbound	Left	8.7	A	7.9	A
	Colony Road	Colony Road	Left, Right	13.3	B	15.5	C
		Route 140 Southbound	Left	8.7	A	9.3	A
Westminster	Betty Spring Road	Betty Spring Road	Left	36	E	33.1	D
			Right	30.2	D	11.5	B
			All Lanes	30.7	D	13.2	B
		Route 140 Northbound	Left	10	A	8.8	A

Route 140 Intersection Peak Hour Level of Service (LOS) – Signalized Locations

Community	Intersection - Overall: Route 140 Intersection With	Intersection - Overall: AM Delay (sec.)	Intersection - Overall: AM LOS	Intersection - Overall: PM Delay (sec.)	Intersection - Overall: PM LOS	Approach	Lane Group	Lane Group: AM Delay (sec.)	Lane Group: AM LOS	Lane Group: PM Delay (sec.)	Lane Group: PM LOS
Winchendon	Route 12	11.3	B	21.1	A	Rt 12 Northbound	Left and Right	23.5	C	27.1	C
						Rt 140 Northbound	Right and Thru	14.6	B	31.2	C
						Rt 140/Rt 12 Southbound	Left and Thru	9.0	A	7.6	A
Gardner	Route 101	19.8	B	21	C	Rt 101 Eastbound	Left Turn	24.6	C	26.4	C
							Thru	26.4	C	29.9	C
							All Lanes	26.3	C	29.7	C
						Rt 101 Westbound	Left Turn	28.6	C	29.7	C
							Thru	26.7	C	29.1	C
							All Lanes	27.7	C	29.3	C
						Rt 140 Northbound	Left Turn	38.5	D	36.5	D
							Thru	16.1	B	17.5	B
							All Lanes	16.3	B	17.9	B
						Rt 140 Southbound	Left Turn	39.8	D	37.6	D
							Thru	16.0	B	14.5	B
							All Lanes	17.5	B	17.4	B

The following can be observed:

- The majority of the unsignalized intersection approaches and turn lane maneuvers operate at or above a LOS of “C” indicating no major delays or operational issues.
- Three locations; Old Gardner Road in Winchendon, Green Street in Gardner and Betty Spring Road in Westminster experienced a turning maneuver that had a LOS of “D” or “E”. These LOS only occurred for one turning movement, usually a left turn from the minor street, and only during the P.M. peak hour. The one exception occurs at Betty Spring Road where in the A.M., right and left turns from Betty Spring Road onto Route 140 experience a LOS of “D” and “E”, respectively. Volumes for the movements affected range from light (approximately 1.2 vehicles every 2 minutes) at Old Gardner Road to significant at Green Street and Betty Spring Road in the A.M. (approximately 3.9 turning vehicles per minute).
- LOS at the two signalized intersections operates at “A” or “C” indicating no issues related to delay or capacity. The Route 101 intersection does experience a LOS of “D” for Route 140 north and south bound left turning vehicles in both the A.M. and P.M. peak hours. These maneuvers have dedicated turn lanes and have relatively light volumes, ranging from 4 and 32 left turns in the A.M. to 15 and 41 left turns in the P.M.

In general, the intersections examined on Route 140 operate at an acceptable Level of Service indicating no real issues related to congestion or delays.

3.6 Route 140 Speed and Vehicle Classification Analysis

As part of the information collected for traffic volumes along the corridor, speed and vehicle classification data was also obtained. This provides a better picture of the traffic along the route.

Speed Data

Speeds along the corridor are a concern of the communities and the Steering Committee. To assess the conditions along the corridor, at the locations where 24 hour counts were being conducted, data on the traffics speed was obtained. Data presented indicates the 85th percentile speed at each location. The 85th percentile speed is that speed at which 85 percent of the traffic is traveling at or below. It is often used to help establish speed limits and can indicate if speeding is an issue for a road or segment. From this data the following table was developed that summarizes and highlights conditions on Route 140:

Route 140 85th Percentile Speed Data

		Northbound			Southbound			
Municipality	Location of Count	85th Percentile Speed (PS)	Posted Speed Limit	MPH Above or Below (-) Speed Limit	85th Percentile Speed	Posted Speed Limit	MPH Above or Below (-) Speed Limit	Functional Classification
Winchendon	S. of Spring St (Rt 12)	55	35	20	47	35	12	RPA*
Winchendon	N. of Teel Rd	56	50	6	53	50	3	RPA
Gardner	N. of Green Street	51	40	11	49	40	9	UPA**
Gardner	N. of Matthews St	58	50	8	59	50	9	UPA
Gardner	N. of Pearl St (Rt 101)	62	40	22	57	40	17	UPA
Gardner	S. of Pearl St (Rt 101)	50	40	10	50	50	0	UPA
Westminster	W. of Simplex Drive	53	40	13	50	40	10	UPA
Westminster	E. of Simplex Drive	46	40	6	43	40	3	UPA

*RPA: Rural Principal Arterial (see note) **UPA: Urban Principal Arterial (see note)

NOTE: In same class only difference is urban/rural designation

Arterial: provide longer through travel between municipalities and other areas. Provide a high level of service at the greatest speed for the longest uninterrupted distance, with some degree of access control.

As seen in the table, all locations have an 85th percentile speed that exceeds the posted speed limit. In some instances the difference exceeds 20 plus mile per hour. To address concerns by the Steering Committee regarding safety along the corridor, one recommendation would be continued enforcement by local and state authorities of the current speed limits.

Vehicle Classification

At each location where traffic counts were conducted, data was also collected on the number and types of vehicles encountered. Traffic was categorized into 13 separate groupings that approximately correspond to the Federal Highway Administration (FHWA) vehicle classification definitions. Vehicle classification counts were categorized as follows:

- Bikes/Motorcycles -- All two or three-wheeled motorized vehicles and includes motorcycles, motor scooters, mopeds, motor-powered bicycles, and three-wheel motorcycles.
- Cars & Trailers -- All sedans, coupes, and station wagons manufactured primarily for the purpose of carrying passengers and including those passenger cars pulling recreational or other light trailers.

- Two Axle Long (Four Tire Single Unit Vehicles) -- All two axle, four tire, vehicles, other than passenger cars Including pickups, panels, vans, and other vehicles such as campers, motor homes, ambulances, hearses, carryalls, and minibuses.
- Buses -- All vehicles manufactured as traditional passenger-carrying buses with two axles and six tires or three or more axles.
- Two Axle, Six Tire, Single Unit Trucks -- All vehicles on a single frame including trucks, camping and recreational vehicles, motor homes, etc., with two axles and dual rear wheels.
- Three Axle Single Unit Trucks -- All vehicles on a single frame including trucks, camping and recreational vehicles, motor homes, etc., with three axles.
- Four Axle Single Unit Trucks -- All trucks on a single frame with four axles.
- Less Than Five Axles Double Unit Trucks -- All vehicles with fewer than five axles consisting of two units, one of which is a tractor or straight truck power unit.
- Five Axle Double Unit Trucks -- All five axle vehicles consisting of two units, one of which is a tractor or straight truck power unit.
- Less Than Six Axles Multi Unit Trailer Trucks -- All vehicles with less than six axles consisting of three or more units, one of which is a tractor or straight truck power unit.
- Six Axle Multi-Trailer Trucks -- All six axle vehicles consisting of three or more units, one of which is a tractor or straight truck power unit.
- More Than Six Axle Multi-Trailer Trucks -- All vehicles with more than six axles consisting of three or more units, one of which is a tractor or straight truck power unit.

The following table provides a breakdown of buses and heavy truck traffic for each direction at each count location as well as a summary for the entire Route 140 corridor. Heavy trucks were defined as all vehicles classified Two Axle, Six Tire, Single Units and above.

Route 140 Vehicle Classification Counts

Municipality	Location of Count (north to south)	Direction	Count Volumes	Buses	Percent Buses of Volume	Trucks	Percent Trucks of Volume	Total Trucks & Buses	Percent Trucks & Buses of Volume
Winchendon	S. of Spring St (Rt 12)	Northbound	5,856	37	0.6%	178	3.0%	215	3.7%
		Southbound	5,946	4	0.1%	161	2.7%	165	2.8%
		Total	*11,802*	*41*	*0.3%*	*339*	*2.9%*	*380*	*3.2%*
	N. of Teel Rd	Northbound	6,372	25	0.4%	137	2.2%	162	2.5%
		Southbound	6,467	24	0.4%	130	2.0%	154	2.4%
		Total	*12,839*	*49*	*0.4%*	*267*	*2.1%*	*316*	*2.5%*
Gardner	N. of Green Street	Northbound	6,833	13	0.2%	138	2.0%	151	2.2%
		Southbound	6,960	6	0.1%	154	2.2%	160	2.3%
		Total	*13,793*	*19*	*0.1%*	*292*	*2.1%*	*311*	*2.3%*
	N. of Matthews St	Northbound	4,470	5	0.1%	110	2.5%	115	2.6%
		Southbound	4,574	26	0.6%	150	3.3%	176	3.8%
		Total	*9,044*	*31*	*0.3%*	*260*	*2.9%*	*291*	*3.2%*
	N. of Pearl St (Rt 101)	Northbound	5,896	67	1.1%	215	3.6%	282	4.8%
		Southbound	6,101	48	0.8%	189	3.1%	237	3.9%
		Total	*11,997*	*115*	*1.0%*	*404*	*3.4%*	*519*	*4.3%*
	S. of Pearl St (Rt 101)	Northbound	6,527	18	0.3%	175	2.7%	193	3.0%
		Southbound	6,608	7	0.1%	158	2.4%	165	2.5%
		Total	*13,135*	*25*	*0.2%*	*333*	*2.5%*	*358*	*2.7%*

Route 140 Vehicle Classification Counts (cont.)

Municipality	Location of Count (north to south)	Direction	Count Volumes	Buses	Percent Buses of Volume	Trucks	Percent Trucks of Volume	Total Trucks & Buses	Percent Trucks & Buses of Volume
Westminster	W. of Simplex Drive	Northbound	7,658	64	0.8%	250	3.3%	314	4.1%
		Southbound	7,905	25	0.3%	270	3.4%	295	3.7%
		Total	*15,563*	*89*	*0.6%*	*520*	*3.3%*	*609*	*3.9%*
	E. of Simplex Drive	Northbound	8,564	48	0.6%	279	3.3%	327	3.8%
		Southbound	8,785	9	0.1%	245	2.8%	254	2.9%
		Total	*17,349*	*57*	*0.3%*	*524*	*3.0%*	*581*	*3.3%*
DIRECTIONAL TOTALS		**Northbound**	**52,176**	**277**	**0.5%**	**1,482**	**2.8%**	**1,759**	***3.4%***
		Southbound	**53,346**	**149**	**0.3%**	**1,457**	**2.7%**	**1,606**	***3.0%***
		Total	**105,522**	**426**	**0.4%**	**2,939**	**2.8%**	**3,365**	***3.2%***

Count data shows that truck volumes for Route 140 did not go below 2.0 percent for either north or south bound traffic at any of the eight count locations. Truck volumes were highest at each end of Route 140 at Route 12 and Route 2, ranging from 2.7 to 3.4 percent, respectively. Overall truck volumes were significantly higher around the Simplex Drive intersection where counts showed 116 more vehicles then the next highest location (i.e. north of Pearl Street).

For the corridor as a whole, the average truck traffic is 3.2 percent of the total traffic volume. This compares closely to the most recent data (2010) collected for the Montachusett region as a whole, which showed an average truck percentage of 3.16 percent. Refer to the following table.

Montachusett Region Vehicle Classification Counts 2007-2010

	2007	2010
Total Vehicles	142,567	98,741
Total Trucks	3,556	3,125
% of Trucks	2.49%	3.16%
% Change		0.67%

Number of Count Locations Surveyed: 13

As part of the MRPC's annual traffic count program, data has been collected on vehicle classification at various locations across the region. Based upon a comparison of counts conducted at 13 common locations in 2007 and 2010, percentages of truck traffic and its growth rate have been calculated for the Montachusett region. Data for 2010 shows that at the 13 locations surveyed, the truck percentage of the total volume was 3.16 percent. This is an increase from 2007 data, where the truck percentage was calculated at 2.49 percent.

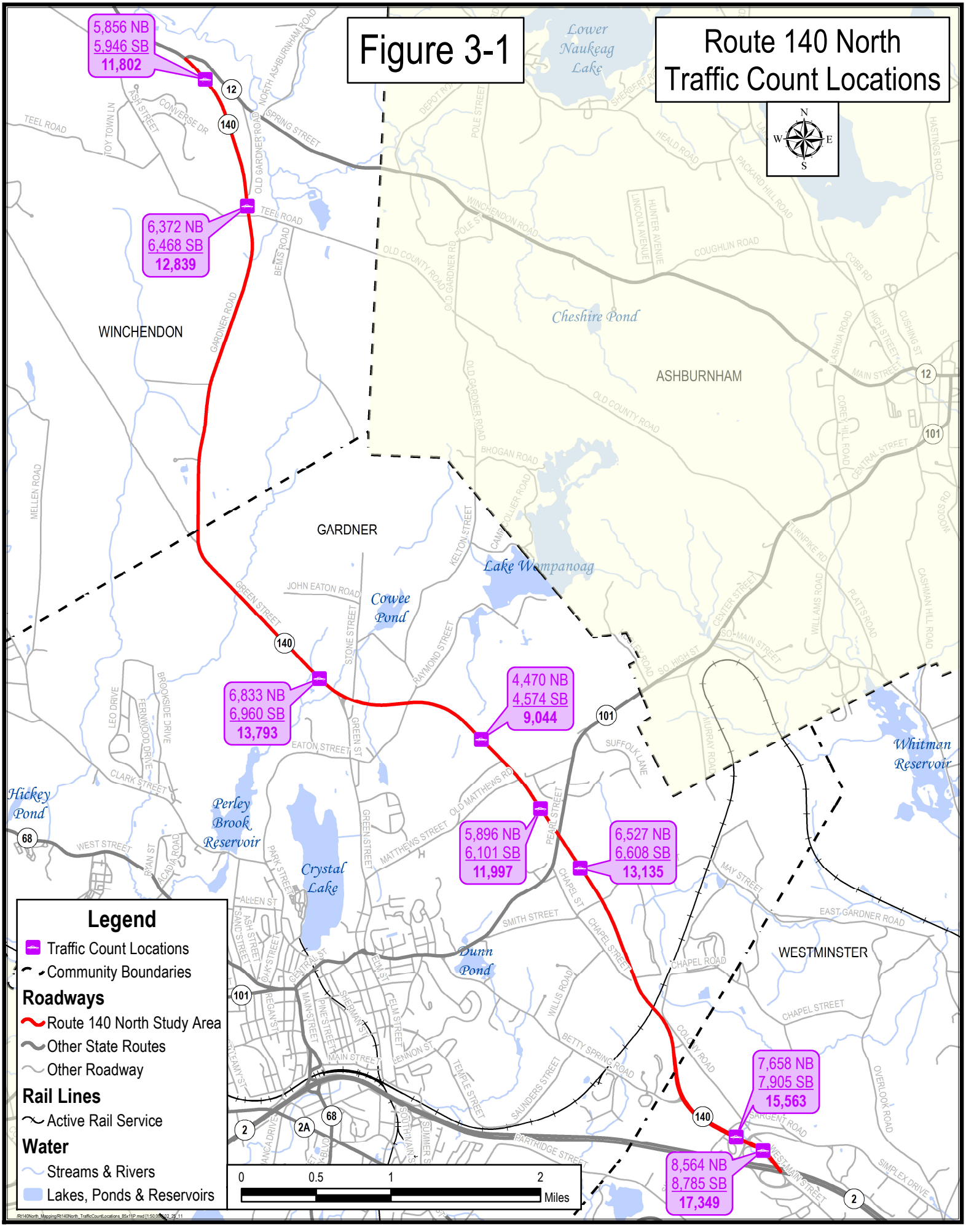


Figure 3-1
Route 140 North
Traffic Count Locations
5,856 NB
5,946 SB
11,802
6,372 NB
6,468 SB
12,839
6,833 NB
6,960 SB
13,793
4,470 NB
4,574 SB
9,044
5,896 NB
6,101 SB
11,997
6,527 NB
6,608 SB
13,135
7,658 NB
7,905 SB
15,563
8,564 NB
8,785 SB
17,349
WINCHENDON
GARDNER
ASHBURNHAM
WESTMINSTER
Lower Naukeag Lake
Cheshire Pond
Lake Wampanoag
Cowee Pond
Hickey Pond
Perley Brook Reservoir
Crystal Lake
Dunn Pond
Whitman Reservoir
Legend
Traffic Count Locations
Community Boundaries
Roadways
Route 140 North Study Area
Other State Routes
Other Roadway
Rail Lines
Active Rail Service
Water
Streams & Rivers
Lakes, Ponds & Reservoirs
0
0.5
1
2
Miles

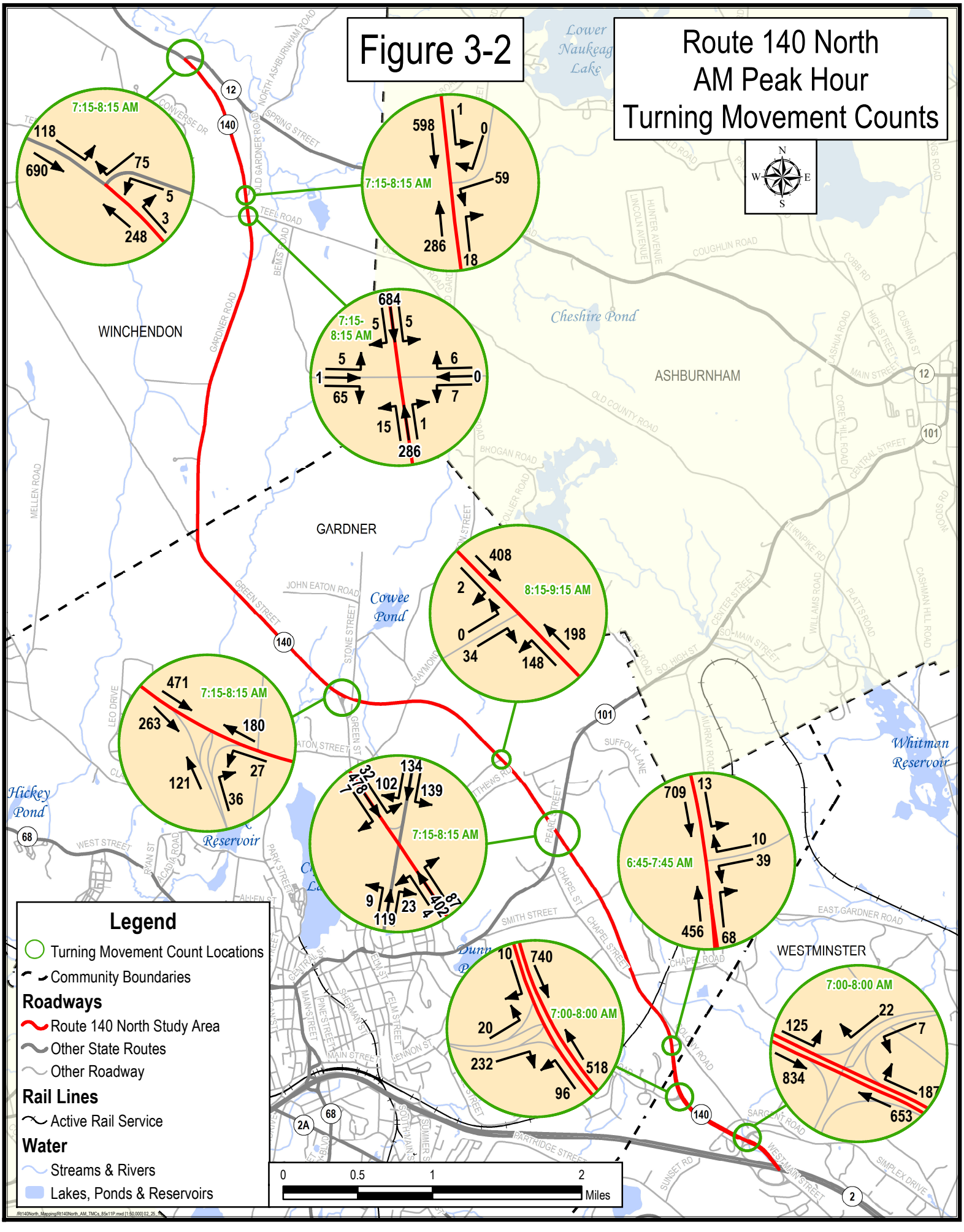


Figure 3-2
Route 140 North
AM Peak Hour
Turning Movement Counts
7:15-8:15 AM
118
690
75
5
3
248
7:15-8:15 AM
598
1
0
59
286
18
7:15-8:15 AM
684
5
5
5
1
65
6
0
7
15
1
286
8:15-9:15 AM
408
2
0
34
198
148
7:15-8:15 AM
471
263
180
121
27
36
7:15-8:15 AM
32
478
102
134
139
9
119
23
402
87
4
6:45-7:45 AM
709
13
10
39
456
68
7:00-8:00 AM
10
740
20
232
518
96
7:00-8:00 AM
125
22
7
834
187
653
WINCHENDON
GARDNER
ASHBURNHAM
WESTMINSTER
Lower Naukeag Lake
Cheshire Pond
Cowee Pond
Hickey Pond
Whitman Reservoir
Legend
Turning Movement Count Locations
Community Boundaries
Roadways
Route 140 North Study Area
Other State Routes
Other Roadway
Rail Lines
Active Rail Service
Water
Streams & Rivers
Lakes, Ponds & Reservoirs
0
0.5
1
2
Miles

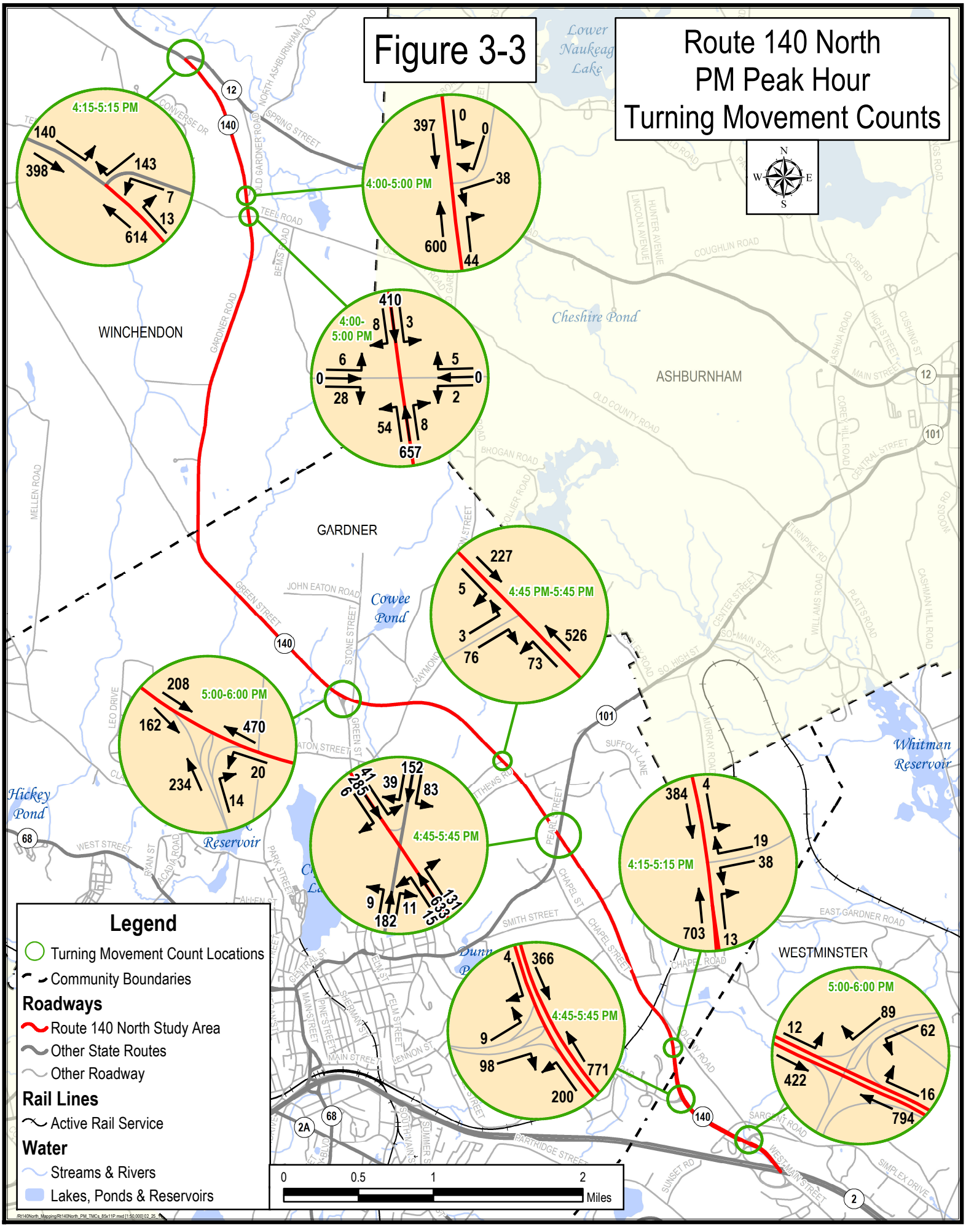


Figure 3-3
Route 140 North
PM Peak Hour
Turning Movement Counts
4:15-5:15 PM
140
398
143
7
13
614
4:00-5:00 PM
397
0
0
38
600
44
4:00-
5:00 PM
410
8
3
6
0
5
0
28
2
54
8
657
4:45 PM-5:45 PM
227
5
3
526
76
73
5:00-6:00 PM
208
162
470
234
20
14
4:45-5:45 PM
41
285
6
39
152
83
9
182
11
633
131
15
4:15-5:15 PM
384
4
19
38
703
13
4:45-5:45 PM
4
366
9
98
771
200
5:00-6:00 PM
12
89
62
422
16
794
WINCHENDON
GARDNER
ASHBURNHAM
WESTMINSTER
Lower Naukeag Lake
Cheshire Pond
Cowee Pond
Hickey Pond
Whitman Reservoir
Legend
Turning Movement Count Locations
Community Boundaries
Roadways
Route 140 North Study Area
Other State Routes
Other Roadway
Rail Lines
Active Rail Service
Water
Streams & Rivers
Lakes, Ponds & Reservoirs
0
0.5
1
2
Miles

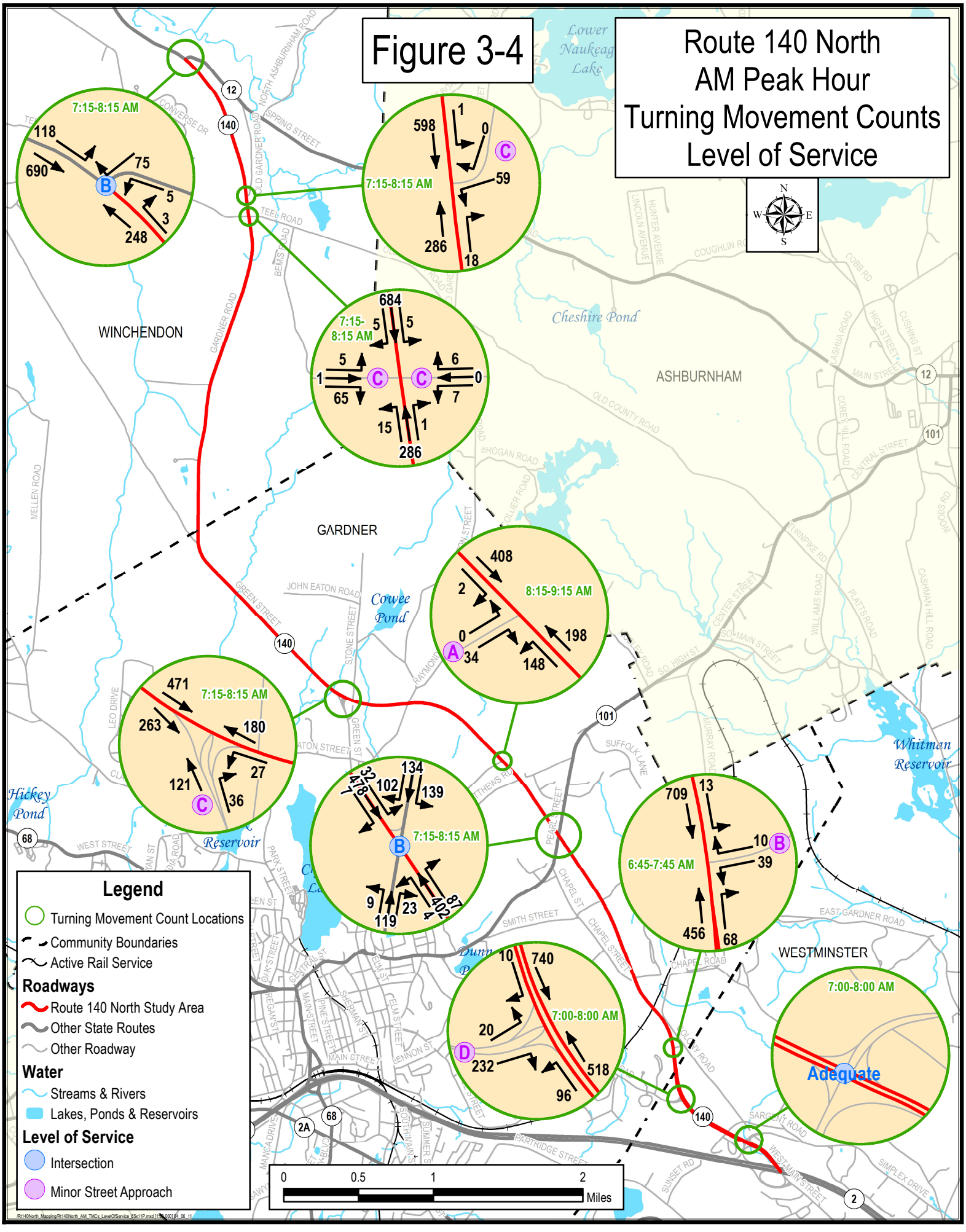


Figure 3-4
Route 140 North
AM Peak Hour
Turning Movement Counts
Level of Service
7:15-8:15 AM
118
690
75
B
5
3
248
7:15-8:15 AM
598
1
0
C
59
286
18
7:15-
8:15 AM
684
5
5
5
1
C
C
6
0
65
7
15
1
286
8:15-9:15 AM
408
2
0
A
34
198
148
7:15-8:15 AM
471
263
180
121
C
27
36
7:15-8:15 AM
32
478
102
134
139
B
9
23
119
402
87
4
6:45-7:45 AM
709
13
10
B
39
456
68
7:00-8:00 AM
10
740
20
D
232
518
96
7:00-8:00 AM
Adequate
WINCHENDON
GARDNER
ASHBURNHAM
WESTMINSTER
Lower Naukeag Lake
Cheshire Pond
Cowee Pond
Hickey Pond
Reservoir
Whitman Reservoir
Dunn Pond
GARDNER ROAD
OLD GARDNER ROAD
NORTH ASHBURNHAM ROAD
SPRING STREET
TEEL ROAD
BEMIS ROAD
BROGAN ROAD
OLD COUNTY ROAD
JOHN EATON ROAD
GREEN STREET
STONE STREET
MELLEN ROAD
LEO DRIVE
WEST STREET
PARK STREET
MAIN STREET
SMITH STREET
CHAPEL STREET
PEARL STREET
SUFFOLK LANE
EAST GARDNER ROAD
CHAPEL ROAD
OLD WAY ROAD
SARGENT ROAD
WESTMAIN STREET
SIMPLEX DRIVE
PARTRIDGE STREET
SUNSET RD
SOUTH MAIN ST
SUMMER ST
MANCA DRIVE
CENTRAL STREET
SO. MAIN STREET
SO. HIGH ST
CENTER STREET
TURNPIKE RD
WILLIAMS ROAD
PLATTS ROAD
CASHMAN HILL ROAD
COREY HILL ROAD
HIGH STREET
CUSHING ST
COBB RD
COUGHLIN RD
HUNTER AVENUE
LINCOLN AVENUE
JOSHUA ROAD
OAK STREET
ELM STREET
SHERMAN ST
PINE STREET
REGAN ST
CENTRAL ST
GLENNON ST
12
140
101
68
2A
2
N
S
E
W
Legend
Turning Movement Count Locations
Community Boundaries
Active Rail Service
Roadways
Route 140 North Study Area
Other State Routes
Other Roadway
Water
Streams & Rivers
Lakes, Ponds & Reservoirs
Level of Service
Intersection
Minor Street Approach
0
0.5
1
2
Miles

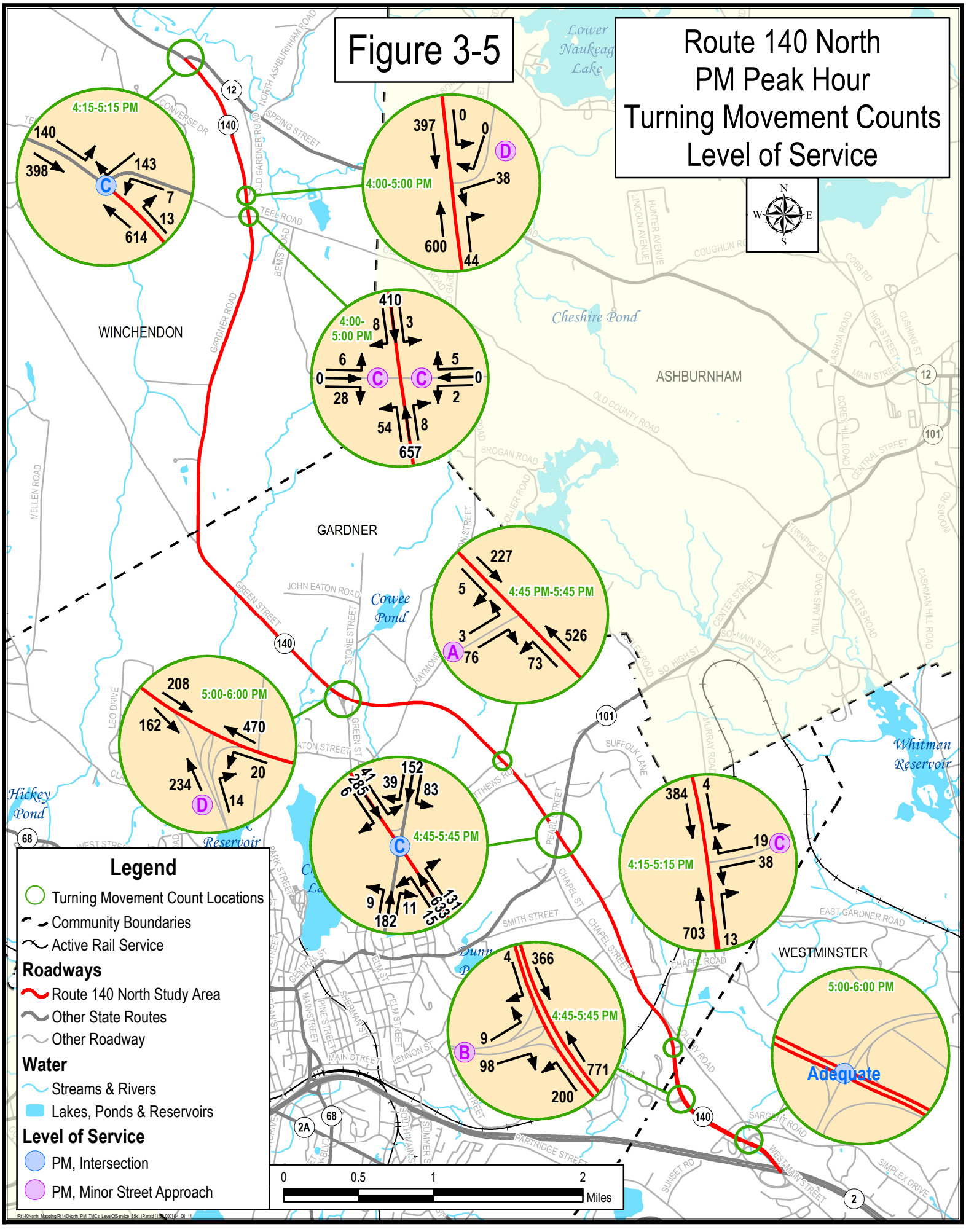


Figure 3-5
Route 140 North
PM Peak Hour
Turning Movement Counts
Level of Service
4:15-5:15 PM
140
398
143
C
7
13
614
4:00-5:00 PM
397
0
0
D
38
600
44
4:00-
5:00 PM
410
8
3
6
0
C
C
5
0
28
2
54
8
657
4:45 PM-5:45 PM
227
5
3
A
76
526
73
5:00-6:00 PM
208
162
470
234
D
20
14
4:45-5:45 PM
41
285
6
39
152
83
C
9
182
11
633
131
15
4:15-5:15 PM
384
4
19
C
38
703
13
4:45-5:45 PM
4
366
9
B
98
771
200
5:00-6:00 PM
Adequate
WINCHENDON
GARDNER
ASHBURNHAM
WESTMINSTER
Lower Naukeag Lake
Cheshire Pond
Cowee Pond
Hickey Pond
Whitman Reservoir
Dunn Pond
Legend
Turning Movement Count Locations
Community Boundaries
Active Rail Service
Roadways
Route 140 North Study Area
Other State Routes
Other Roadway
Water
Streams & Rivers
Lakes, Ponds & Reservoirs
Level of Service
PM, Intersection
PM, Minor Street Approach
0
0.5
1
2
Miles

4.0 ROUTE 140 SAFETY ANALYSIS

4.1 Overview of Safety Analysis

For the 3-year period of January 1, 2008 to December 31, 2010, a total of 125 crashes occurred on Route 140 in Winchendon, Gardner, and Westminster from Route 12 to Route 2. Figures 4-1 and 4-2 that follow on pages 4-2 and 4-3 show the crash locations that were mapped (see note on page 4-5). A companion document to this analysis is the *MRPC Highway Safety Improvement Program - Candidate Eligibility Criteria* (see Technical Appendix) which provides thresholds for Highway Safety Improvement Program eligibility and an explanation of the deference between incapacitating injury and non-fatal injury crashes.

4.2 Crash Analysis

Total Crashes (TC) per Municipality (Table 4-1)

Route 140 in Winchendon experienced the most crashes with 57 (of 125 TC or 45.6%) followed by Gardner with 50 (40%) crashes. Westminster experienced the fewest crashes with 18 (14.4%).

TC / Road Segment Crashes (RSC) (Table 4-1) and Lane Departure Crashes (LDC) (Table 4-2)

- RSC, or non-intersection crashes that occur at midblock locations (i.e. between intersections), accounted for 69 (55.2%) of the 125 TC for the full length of Route 140.
    - Winchendon experienced the most RSC with 36 (52.2% of the 69 total RSC). This accounts for 63.2% of the 57 total Winchendon crashes.
        - 13 occurred between/at the Gardner City Line and Raymond Road.
        - 9 occurred in the area around #93 Gardner Road.
        - 5 occurred in the area around Teel Road.
        - 7 occurred in the area south of Route 12.
    - Gardner experienced the second most RSC with 29 (42% of the 69 total RSC). This accounts for 58% of the 50 total Gardner crashes.
        - 7 occurred between the Westminster Town Line and Smith Street.
        - 4 occurred in the area around Matthews Street.
        - 3 occurred in the area around the Kelton Street overpass.
        - 3 occurred in the area around Green/Stone Street.
        - 3 occurred near the Winchendon Town Line.
        - 2 occurred in the area around Route 101.
    - Westminster experienced the least RSC with 4 (5.8% of the 69 total RSC). This accounts for 22.2% of the 18 total Westminster crashes.
        - 4 occurred between the Gardner City Line and Route 2.
    - LDC accounted for 43 (62.3%) of the 69 RSC and is 34.4% of the 125 TC along Route 140. Of the LDC:
        - Winchendon accounted for 24 or 55.8% of the 43 LDC on Route 140. This is also 42.1% of the 57 total Winchendon crashes.
        - Gardner accounted for 15 or 34.9% of the 43 LDC on Route 140. This is also 30% of the 50 total Gardner crashes.
        - Westminster accounted for 4 or 9.3% of the 43 LDC on Route 140. This is also 22.2% of the 18 total Westminster crashes.
    - Of the other 12 RSC that occurred in Winchendon, 4 involved wildlife; 4 were sideswipes; and 3 were rear-end crashes.
    - Of the other 14 RSC that occurred in Gardner, 7 involved wildlife. No other crash type was significant.
    - In Westminster, all the RSC were LDC.

Figure 4-1

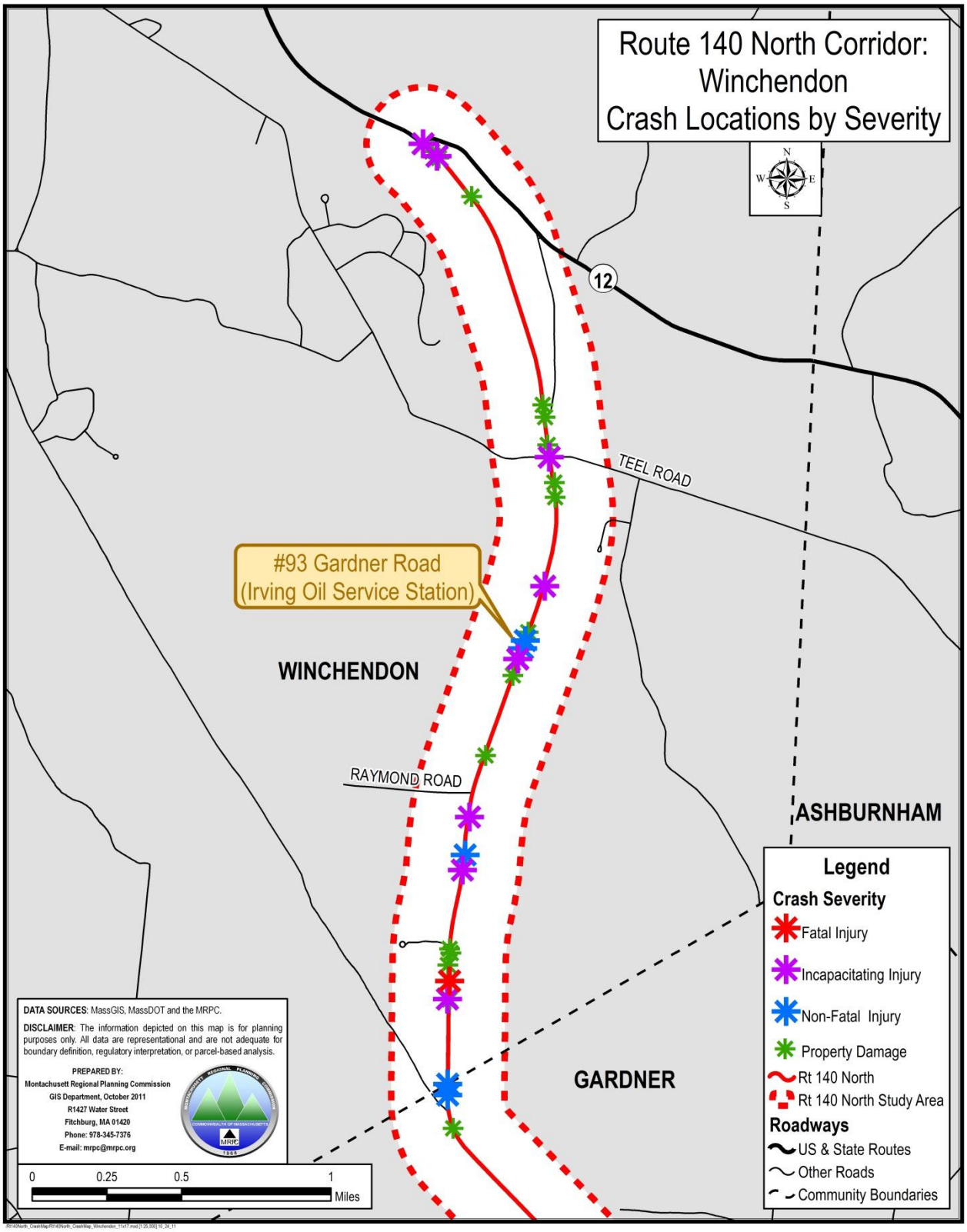
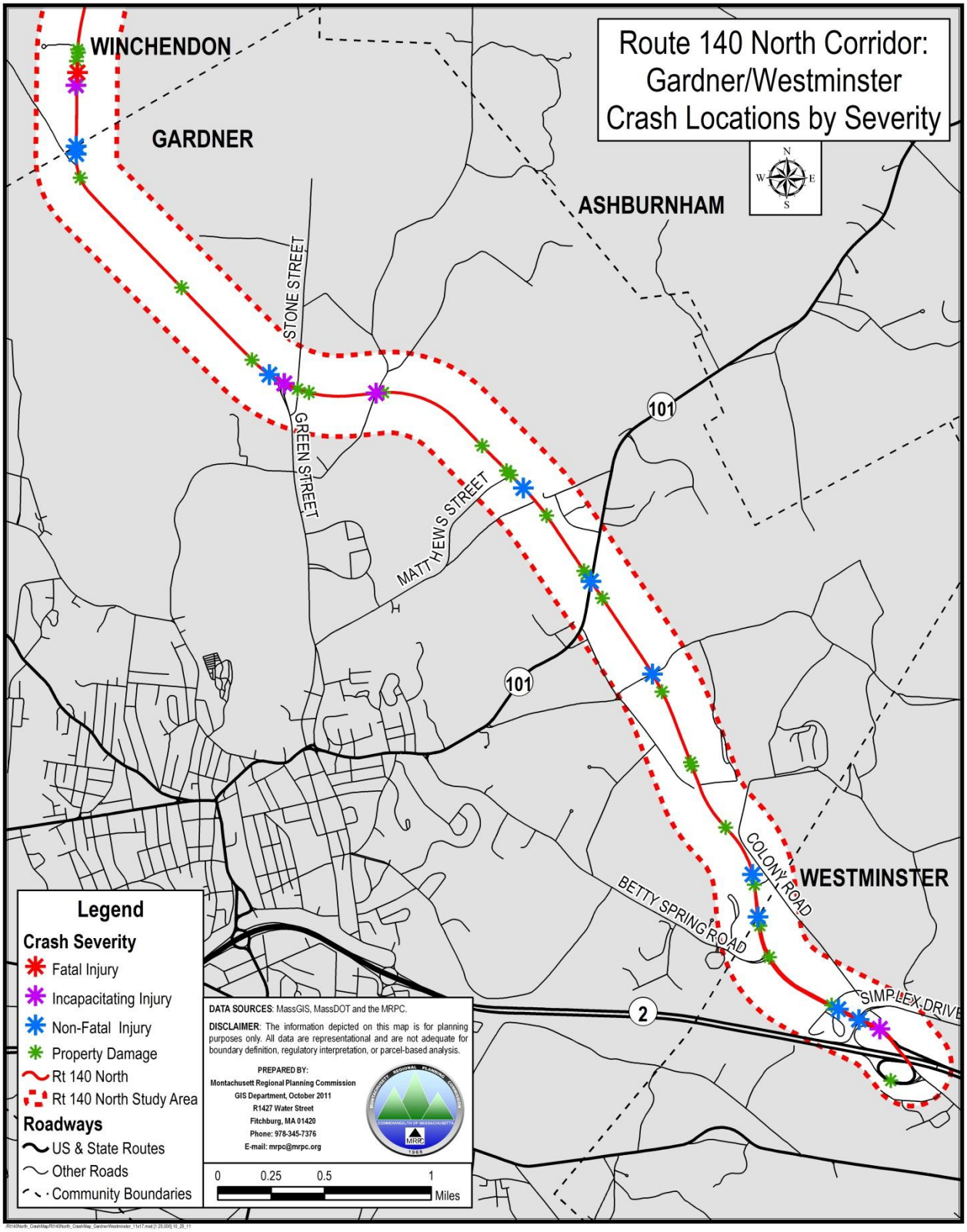

Route 140 North Corridor:
Winchendon
Crash Locations by Severity
N
W
E
S
12
TEEL ROAD
#93 Gardner Road
(Irving Oil Service Station)
WINCHENDON
RAYMOND ROAD
ASHBURNHAM
GARDNER
Legend
Crash Severity
Fatal Injury
Incapacitating Injury
Non-Fatal Injury
Property Damage
Rt 140 North
Rt 140 North Study Area
Roadways
US & State Routes
Other Roads
Community Boundaries
DATA SOURCES: MassGIS, MassDOT and the MRPC.
DISCLAIMER: The information depicted on this map is for planning purposes only. All data are representational and are not adequate for boundary definition, regulatory interpretation, or parcel-based analysis.
PREPARED BY:
Montachusett Regional Planning Commission
GIS Department, October 2011
R1427 Water Street
Fitchburg, MA 01420
Phone: 978-345-7376
E-mail: mrpc@mrpc.org
0
0.25
0.5
1
Miles

Figure 4-2


Route 140 North Corridor:
Gardner/Westminster
Crash Locations by Severity
WINCHENDON
GARDNER
ASHBURNHAM
WESTMINSTER
STONE STREET
GREEN STREET
MATTHEWS STREET
COLONY ROAD
BETTY SPRING ROAD
SIMPLEX DRIVE
101
101
2
N
S
E
W
Legend
Crash Severity
Fatal Injury
Incapacitating Injury
Non-Fatal Injury
Property Damage
Rt 140 North
Rt 140 North Study Area
Roadways
US & State Routes
Other Roads
Community Boundaries
DATA SOURCES: MassGIS, MassDOT and the MRPC.
DISCLAIMER: The information depicted on this map is for planning purposes only. All data are representational and are not adequate for boundary definition, regulatory interpretation, or parcel-based analysis.
PREPARED BY:
Montachusett Regional Planning Commission
GIS Department, October 2011
R1427 Water Street
Fitchburg, MA 01420
Phone: 978-345-7376
E-mail: mrpc@mrpc.org
0
0.25
0.5
1
Miles

TC / Intersection Crashes (IC) (Tables 4-1 and 4-2)

- IC accounted for 43 (34.4%) of the 125 TC on Route 140.
    - Gardner experienced the most IC with 21 (48.8% of the 43 total IC). This accounts for 42% of the 50 total Gardner crashes.
        - 13 occurred at the *Green/Stone Street* intersection (see Crash Diagram on page 4-7). The crash types were diverse. Of the 13 crashes:
            - 4 (30.8%) were Ran off Road (RR) crashes.
            - 3 (23.1%) were Angle (ANG) crashes.
            - 3 (23.1%) were Sideswipe (SWP) crashes.

          This intersection experienced a crash cluster with an *Equivalent Property Damage Only* (EPDO) point total of 37 which exceeds the crash cluster threshold of 33 points as described in the *MRPC Highway Safety Improvement Program - Candidate Eligibility Criteria* to become an HSIP eligible candidate location.
        - No other intersection experienced a significant number of crashes.
    - Westminster experienced the second most IC with 14 (32.6% of the 43 total IC). This accounts for 77.8% of the 18 total Westminster crashes.
        - 8 occurred at the *Simplex Drive* intersection (see Crash Diagram below). Of the 8 crashes:
            - 6 were rear-end crashes of which 4 occurred on the southbound approach.
        - No other intersection experienced a significant number of crashes.
    - Winchendon experienced the lowest with 8 IC.
        - No specific intersection experienced a significant number of crashes.
        - 5 of the 8 were rear-end crashes.

TC / Driveway Crashes (Tables 4-1 and 4-2)

- The driveway at address number 93 Gardner Road in Winchendon experienced a significant crash cluster. The driveway accounted for 13 or 10.4% of the 125 TC on Route 140.
- The driveway crash cluster had an EPDO total of 33 points which meets the crash cluster threshold of 33 points as described in the *MRPC Highway Safety Improvement Program - Candidate Eligibility Criteria* to become an HSIP eligible candidate location.
- 9 of the 13 were rear-end crashes, 8 of which occurred in the northbound direction which resulted from vehicles stopping to make a left into the driveway.
- New left turns to be taken by southbound vehicles will be added to this location due to the new plant across the street creating additional safety issues.

Fatal Injury (FI), Non-fatal Injury (NFI), Incapacitating Injury (INCI) Crashes (Table 4-1)

A total of 42 crashes along Route 140 (33.6% of the 125 TC) resulted either in an FI, NFI, or INCI crash.

- The one FI crash occurred in 2008 in Winchendon just north of the Gardner City Line and resulted from a RSC which was also a LDC.
- 14 were INCI crashes, or 33.3% of the 42 total FI, NFI, and INCI crashes.
    - 10 (71.4% of 14 total INCI crashes) occurred in Winchendon as follows:
        - 4 resulted from RSC which were also LDC.
        - 3 resulted from IC, 1 each at 3 different intersections.
        - 3 resulted from the driveway crashes that occurred at number 93 Gardner Road.
    - 3 occurred in Gardner as follows:
        - 2 resulted from RSC which were also LDC.
        - 1 resulted from an IC that occurred at the *Green/Stone Street* intersection.
    - 1 occurred in Westminster at the Route 2W OFF Ramp intersection.

- 27 were NFI crashes, or 64.3% of the 42 total FI, NFI, and INCI crashes.
    - 14 (51.9% of 27 total NFI crashes) occurred in Gardner as follows:
        - 8 resulted from RSC.
        - 6 resulted from an IC including 5 at the *Green/Stone Street* intersection.
    - 9 (33.3% of 27 total NFI crashes) occurred in Winchendon as follows:
        - 6 resulted from RSC.
        - 1 resulted from an IC.
        - 2 resulted from the driveway crashes that occurred at number 93 Gardner Road in Winchendon.
    - 4 (14.8% of 27 total NFI crashes) occurred in Westminster.
- The FI and INCI crash totals for the RSC that were also LDC equals 7 for the full length of Route 140 which exceeds the threshold described in the *MRPC Highway Safety Improvement Program - Candidate Eligibility Criteria* to potentially become an HSIP eligible candidate project.
    - Alone, Route 140 in Winchendon exceeds the threshold.
    - Combined, Gardner and Westminster would not meet the threshold.

Wildlife (WL) Crashes (Table 4-2)

A total of 17 WL crashes occurred along the full length of Route 140 (13.6% of the 125 TC).

- 10 WL crashes occurred in Gardner as follows:
    - 4 occurred as RSC in the area of Matthews Street.
    - 2 occurred at the Matthews Street intersection.
    - 4 occurred as RSC at various locations along Route 140.
- Winchendon experienced 5 WL crashes that were RSC.
- Westminster experienced 2 WL crashes that occurred at 2 different intersections.

Notes on Mapped Crashes

The following is a list of crashes that were not mapped. These crashes can be mapped as needed if further analysis is required.

Crash ID	Route 140 Location	Municipality	Date	Year	Type	Severity
GRS-12	25 feet south of Ma Elec pole # 9	Gardner	8/7/2009	2009	Ran into opposing lane (LD) & sideswipe & overturn	Personal Injury
GRS-2	Near telephone pole # 41	Gardner	11/24/2008	2008	Ran off road (LD)	Property Damage
GRS-26	500 feet south of mile marker 160	Gardner	11/11/2010	2010	Mechanical failure	Property Damage
GRS-28	300 feet north of mile marker 102	Gardner	12/21/2010	2010	Deer	Property Damage
WI-5	At signal ahead sign south of Rte 12	Winchendon	7/10/2009	2009	Rear end	Personal Injury
WIRS-15	Utility pole #25&1/2	Winchendon	12/27/2008	2008	Ran into opposing lane (LD)	Property Damage

After further review the following crash was moved from a RSC (ID# WIRS-36) to a #93 Gardner Road crash (WIAP-14) but the analysis was not updated due to its low impact on the analysis. However, the crash adds to and confirms the existing analysis.

WIAP-14	93 Gardner Road	Winchendon	12/28/2010	2010	Rear end & ran off road & ran into opposing lane	Property Damage

Crash Location Type Key for Tables 4-1 & 4-2 Below

	Driveway Location
	Intersection Location
	Road Segment Crashes

Table 4-1: Route 140 Crash Analysis 2008-2010

Route 140 Crash Totals		# of Crashes	% of Total Municipal Crashes	% of Grand Total Crashes		# Fatal Injury & Non-fatal Injury Crashes	# of Incapacitating Injury (INCI) Crashes	% of Grand Total Fatal, Non-fatal & INCI Crashes		Estimated # of Crashes with Excessive Vehicular Speed	Estimated % of Grand Total Crashes with Excessive Vehicular Speed
Winchendon											
	Driveway Crashes (DC)	13	22.8%	-		2	3	-		12	-
	Intersection Crashes (IC)	8	14.0%	18.6%		1	3	-		5	-
	Rd Segment Crashes (RSC)	36	63.2%	52.2%		7	4	-		30	-
	Winchendon Total	**57**	**-**	**45.6%**		**10**	**10**	-		**-**	**-**
	Winchendon Total Fatal, Non-fatal & INCI Crashes					**20**		**47.6%**		**-**	**-**
	Winchendon Total Crashes with Excessive Vehicular Speed									**47**	**47.5%**
Gardner											
	Driveway Crashes (DC)	-	-	-		-	-	-			-
	Intersection Crashes (IC)	21	42.0%	48.8%		6	1	-		18	-
	Rd Segment Crashes (RSC)	29	58.0%	42.0%		8	2	-		22	-
	Gardner Total	**50**	**-**	**40.0%**		**14**	**3**	-		**-**	**-**
	Gardner Total Fatal, Non-fatal & INCI Crashes					**17**		**40.5%**		**-**	**-**
	Gardner Total Crashes with Excessive Vehicular Speed									**40**	**40.4%**
Westminster											
	Driveway Crashes (DC)	-	-	-		-	-	-		-	-
	Intersection Crashes (IC)	14	77.8%	32.6%		2	1	-		9	-
	Rd Segment Crashes (RSC)	4	22.2%	5.8%		2	-	-		3	-
	Westminster Total	**18**	**-**	**14.4%**		**4**	**1**	-		**-**	**-**
	Westminster Total Fatal, Non-fatal & INCI Crashes					**5**		**11.9%**		**-**	**-**
	Westminster Total Crashes with Excessive Vehicular Speed									**12**	**12.1%**

Route 140 Grand Totals	# of Crashes	-	% of Grand Total Crashes		# Fatal Injury & Non-fatal Injury Crashes	# of Incapacitating Injury (INCI) Crashes	% of Grand Total Fatal, Non-fatal & INCI Crashes		Estimated # of Crashes with Excessive Vehicular Speed	Estimated % of Grand Total Crashes with Excessive Vehicular Speed
Driveway Crashes (DC) Total	**13**	-	**10.4%**		**2**	**3**	**11.9%**		**12**	**12.1%**
Intersection Crashes (IC) Total	**43**	-	**34.4%**		**9**	**5**	**33.3%**		**32**	**32.3%**
Road Segment Crashes (RSC) Total	**69**	-	**55.2%**		**17**	**6**	**54.8%**		**55**	**55.6%**
Grand Total All Crashes	**125**	**-**	**-**		**28**	**14**	-		**-**	-
Grand Total Fatal, Non-fatal & INCI Crashes					***42***		***33.6%***		**-**	**-**
Grand Total Crashes with Excessive Vehicular Speed									***99***	***79.2%***

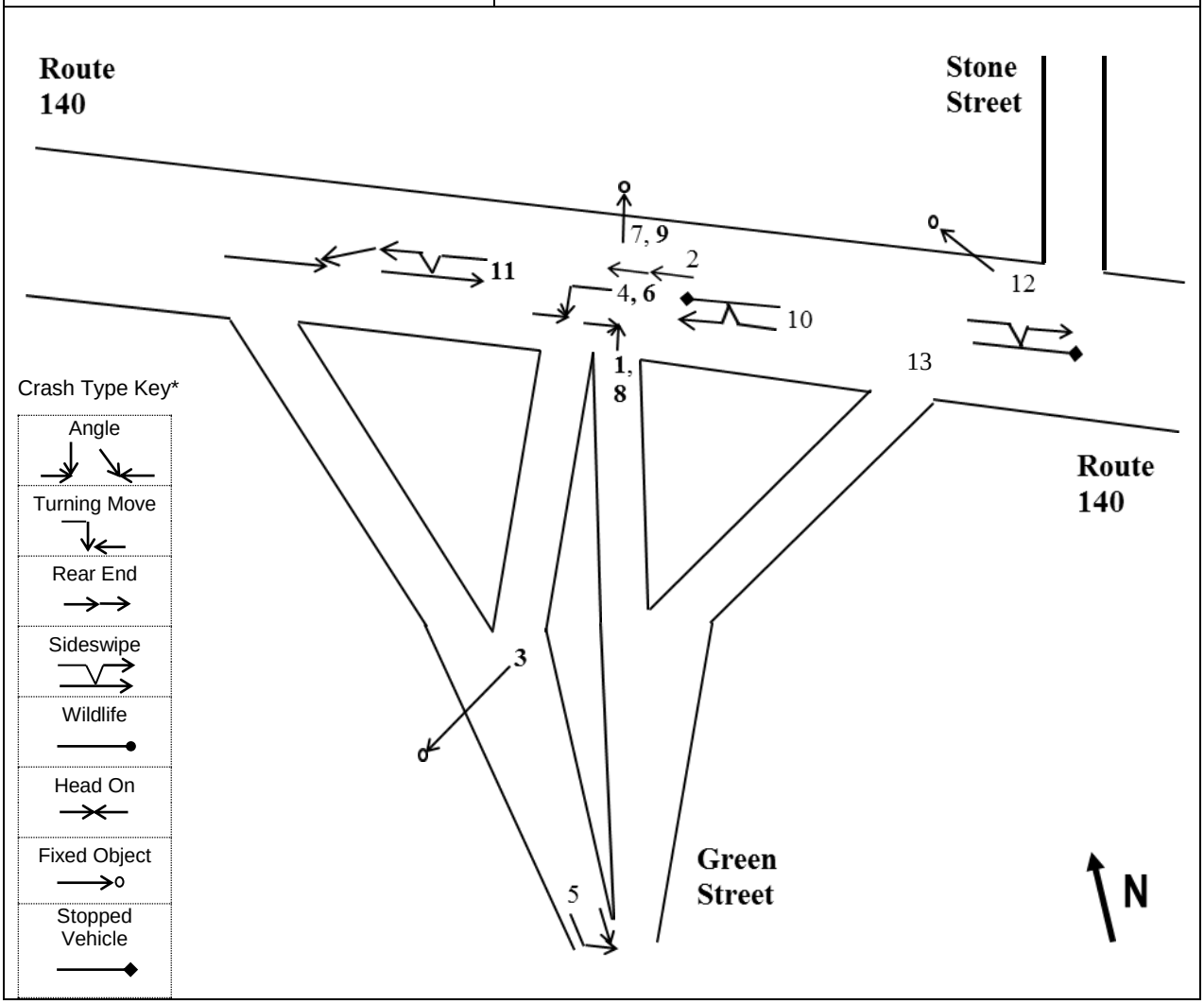
Note: **Red Number** includes 1 Fatal Crash

Table 4-1 (continued)

Top Location within Each Municipality		# of Crashes	% of Total Municipal Crashes	% of Grand Total Crashes		# Fatal Injury & Non-fatal Injury Crashes	# of Incapacitating Injury (INCI) Crashes	Crash Cluster EPDO**		Estimated # of Crashes with Excessive Vehicular Speed
Winchendon	Driveway - 93 Gardner Rd	13	22.8%	-		2	3	34		12
Gardner	Green/Stone Street*	13	26.0%	-		5	1	37		12
Westminster	Simplex Drive*	8	44.4%	-		2	-	16		7

*intersection **EPDO = Equivalent Property Damage Only

VEHICLE CRASH DIAGRAM	Municipality: Gardner
Dates: 1/7/08-12/31/10	Location: **Route 140 at Green/Stone Street**

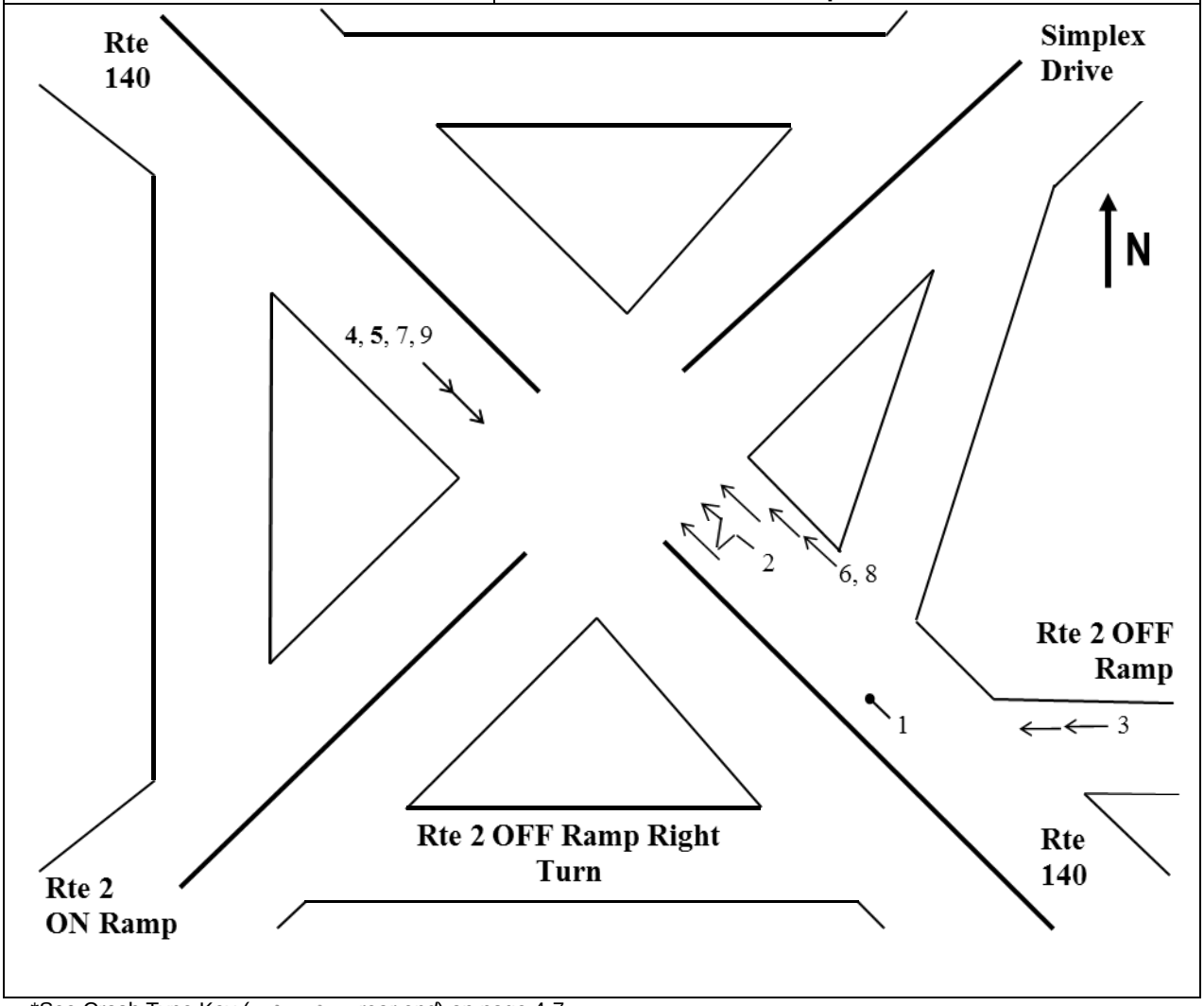


Route 140 at Green/Stone Street Intersection Crash Table for Crash Diagram Above (page 4-7)						
ID #	**DATE**	**TIME**	**DAY**	**SEV***	**LC***	**RC***
1	3/18/2008	15:31	TUE	**PI**	1	
2	7/7/2008	15:11	MON	PD	1	
3	10/12/2008	0:48	SUN	**PI**	3	
4	10/16/2008	18:47	THU	PD	1	
5	2/28/2009	9:25	SAT	PD	1	
6	3/1/2009	15:03	SUN	**PI**	1	
7	9/13/2009	14:07	SUN	PD	1	
8	12/16/2009	7:20	WED	**PI**	1	
9	8/27/2010	0:19	FRI	**PI**	3	
10	10/6/2010	6:37	WED	PD	1	
11	12/17/2010	18:56	FRI	**PI**	3	
12	2/5/2008	9:38	TUE	PD	1	
13	6/16/2008	17:05	MON	PD	1	
BOLD/Shaded Crash # = PI. *See Crash Table Key below						

Crash Table Key

SEVERITY of CRASH CODES (SEV)		Light Condition (LC)	Road Condition (RC)
		1 - Daylight	1 - Dry
Property damage	PD	2 - Dawn or Dusk	2 - Wet
Personal Injury	PI	3 - Darkness	3 - Snow or Icy
Fatality	F	4 - Unknown	4 - Unknown

VEHICLE CRASH DIAGRAM	Town: Westminster
Dates: 1/7/08-12/31/10	Location: **Route 140 at Simplex Drive**



*See Crash Type Key (⟶⟶ = *rear end*) on page 4-7

Route 140 at Simplex Drive Intersection Crash Table for Crash Diagram Above						
ID #	**DATE**	**TIME**	**DAY**	**SEV***	**LC***	**RC***
1	9/5/2008	15:08	FRI	PD	1	
2	10/23/2008	17:23	THU	PD	2	
3	10/30/2008	8:57	THU	**PI**	1	
4	9/25/2009	8:03	FRI	**PI**	1	
5	9/27/2009	14:55	SUN	**PI**	1	
6	12/17/2009	7:36	THU	PD	2	
7	12/23/2009	12:41	WED	PD	1	
8	5/5/2010	8:08	WED	PD	1	
9	10/9/2010	9:56	SAT	PD	1	
BOLD/Shaded Crash # = PI. *See Crash Table Key on page 4-8 above						

Table 4-2: Route 140 Crash Analysis 2008-2010

Route 140 Crash Locations	# of Crashes	Months		Key Days of Week			Key Crash Types						
		Cold	Warm				LDC	LDC+	RR	WL	ANG	SWP	RE
Winchendon													
Driveway Crashes (DC)	13	10	3	-	-	-	-	-	-	-	-	-	9
% of Total		76.9%	23.1%	-	-	-	-	-	-	-	-	-	69.2%
Intersection Crashes (IC)	8	5	3	-	-	-	-	-	-	-	-	-	-
% of Total		62.5%	37.5%	-	-	-	-	-	-	-	-	-	-
Rd Segmt Crashes (RSC)	36	22	14	-	-	-	14	10	-	5	-	4	3
% of Total		61.1%	38.9%	-	-	-	38.9%	27.8%	-	13.9%	-	11.1%	8.3%
Winchendon Totals	**57**	**37**	**20**	**-**	**-**	**-**	**14**	**9**	**-**	**5**	**-**	**4**	**12**
% of Winchendon Totals		**64.9%**	**35.1%**	**-**	**-**	**-**	**24.6%**	**17.5%**	**-**	**8.8%**	**-**	**7.0%**	**21.1%**
Difference		**17**				**Combined %**	**42.1%**						
Gardner				TUE	WED	THU							
Driveway Crashes (DC)	-	-	-	-	-	-	-	-	-	-	-	-	-
% of Total		-	-	-	-	-	-	-	-	-	-	-	-
Intersection Crashes (IC)	21	13	8	-	-	-	-	-	5	2	5	3	-
% of Total		61.9%	38.1%	-	-	-	-	-	23.8%	9.5%	23.8%	14.3%	-
Rd Segmt Crashes (RSC)	29	18	11	8	5	6	6	9	-	8	-	-	-
% of Total		62.1%	37.9%	27.6%	17.2%	20.7%	20.7%	31.0%	-	27.6%	-	-	-
Gardner Totals	**50**	**31**	**19**	**-**	**-**	**-**	**6**	**9**	**5**	**10**	**5**	**3**	**-**
% of Gardner Totals		**62.0%**	**38.0%**	**-**	**-**	**-**	**12.0%**	**18.0%**	**10.0%**	**20.0%**	**10.0%**	**6.0%**	**-**
Difference		**12**				**Combined %**	**30.0%**						
Westminster													
Driveway Crashes (DC)	-	-	-	-	-	-	-	-	-	-	-	-	-
% of Total		-	-	-	-	-	-	-	-	-	-	-	-
Intersection Crashes (IC)	14	9	5	-	-	-	-	-	-	2	-	-	8
% of Total		64.3%	35.7%	-	-	-	-	-	-	14.3%	-	-	57.1%
Rd Segmt Crashes (RSC)	4	2	2	-	-	-	3	1	-	-	-	-	-
% of Total		50.0%	50.0%	-	-	-	75.0%	25.0%	-	-	-	-	-
Westminster Totals	**18**	**11**	**7**	**-**	**-**	**-**	**3**	**1**	**-**	2	**-**	**-**	**8**
% of Westminster Totals		**61.1%**	**38.9%**	**-**	**-**	**-**	**16.7%**	**5.6%**	**-**	**11.1%**	**-**	**-**	**44.4%**
Difference		**4**				**Combined %**	**22.2%**						

Table 4-2 (continued)

Route 140 Grand Totals	# of Crashes	Months		Key Days of Week			Key Crash Types						
		Cold	Warm				LDC	LDC+	RR	WL	ANG	SWP	RE
Driveway Crashes (DC) Totals	13	10	3	-	-	-	-	-	-	-	-	-	9
% of Total		76.9%	23.1%	-	-	-	-	-	-	-	-	-	69.2%
Intersection Crashes (IC) Totals	43	27	16	-	-	-	-	-	5	4	5	3	8
% of Total		62.8%	37.2%	-	-	-	-	-	11.6%	9.3%	11.6%	7.0%	18.6%
Rd Seg Crashes (RSC) Totals	69	42	27	-	-	-	23	20	-	13	-	4	3
% of Total		60.9%	39.1%	-	-	-	33.3%	29.0%	-	18.8%	-	5.8%	4.3%
Grand Total All Crashes	**125**	**79**	**46**	**-**	**-**	**-**	**23**	**20**	**5**	**17**	**5**	**7**	**20**
% of Grand Total All Crashes		**63.2%**	**36.8%**	**-**	**-**	**-**	**18.4%**	**16.0%**	**4.0%**	**13.6%**	**4.0%**	**5.6%**	**16.0%**
Difference		**33**			**Combined %**		**34.4%**						

Top Location within Each Municipality	Total Crashes	Months		Key Days of Week for Each Location			Key Crash Types for Each Location						
		Cold	Warm										
Winchendon				MON	TUE	SAT							RE
Driveway - #93 Gardner Rd	13	10	3	3	2	4	-	-	-	-	-	-	9
% of #93 Gardner Street Total		76.9%	23.1%	23.1%	23.1%	30.8%	-	-	-	-	-	-	69.2%
Gardner									RR	WL	ANG	SWP	
Green/Stone Street	13	9	4	-	-	-	-	-	4	-	3	3	-
% of Green/Stone intersection Total		69.2%	30.8%	-	-	-	-	-	30.8%	-	23.1%	23.1%	-
Matthews Street intersection	-	-	-	-	-	-	-	-	-	2	-	-	-
*These WL were RSC crashes that		-	-	-	-	-	-	-	-	4*	-	-	-
occurred in the area of Matthews St		-	-	-	-	-	-	-	-	-	-	-	-
Westminster				WED	THU	FRI							RE
Simplex Drive	8	4	4	2	2	3	-	-	-	-	-	-	6
% of Simplex Drive intersection Total		50.0%	50.0%	22.2%	22.2%	33.3%	-	-	-	-	-	-	77.8%

Table 4-2 Key Crash Types Key	
LDC	Lane Departure crash
LDC+	Lane Departure crash with 2nd event such as crash with fixed object or another vehicle
RR	Ran off Road at intersection crash
WL	Crash with Wildlife
ANG	Angle crash
SWP	Sideswipe crash
RE	Rear-end crash

Cold Months
October - March
Warm Months
April - September

Contributing Factors

Excessive Vehicular Speed (Table 4-1)

Vehicular speed is excessive on Route 140 as discussed in Section 3.6 of the full report. This is reflected in the crash experience as many of the crash diagrams and narratives indicate speed as an issue. The totals reached in Table 4-1 are an estimate because many crash narratives do not specifically discuss speed. However, in many cases speed is assumed to be a factor based on the way vehicles behaved after the crash occurred which is also depicted on the crash diagrams.

A total of 99 crashes along Route 140 (79.2% of the 125 TC) resulted from excessive speed.

- 47 crashes, or 47.5% of the 125 TC, occurred in Winchendon.
  - 12 occurred at number 93 Gardner Road (driveway).
  - 30 occurred at RSC locations.
  - 5 occurred at intersections.
- 40 crashes, or 40.4% of the 125 TC, occurred in Gardner.
  - 12 occurred at the Green/Stone Street intersection.
  - 22 occurred at RSC locations.
  - 6 occurred at other intersections.
- 12 crashes, or 12.2% of the 125 TC, occurred in Westminster.
  - 7 occurred at the Simplex Drive intersection.
  - 3 occurred at RSC locations.
  - 2 occurred at other intersections.

Cold versus Warm Months (Table 4-2)

Typically warm months provide drivers with better visibility, more daylight hours, and better road surface conditions than cold months. These factors contribute to improved reaction time for a driver to avoid a crash.

A total of 79, or 63.3% of the 125 TC, occurred during cold months.

- 37 (64.9%) of the 57 Winchendon total crashes occurred during cold months.
- 31 (62%) of the 50 Gardner total crashes occurred during cold months.
- 11 (61.1%) of the 18 Westminster total crashes occurred during cold months.

Dark versus Light Conditions

Typically good light conditions will provide drivers with better visibility than dark conditions which will contribute to improved reaction time for a driver to avoid a crash.

A total of 35, or 28% of the 125 TC, occurred under dark conditions.

- 18 (31.6%) of the 57 Winchendon total crashes occurred under dark conditions.
- 14 (28%) of the 50 Gardner total crashes occurred under dark conditions.
- 3 (16.7%) of the 18 Westminster total crashes occurred under dark conditions.

Days of Week (Table 4-2)

There may be a special event that takes place during a weekday or a weekend that contributes to an increase in crashes. Weekends may also provide different roadway users that may not be familiar with a roadway.

Overall on Route 140, no day stands out as being problematic.

- However 4, or 30.8%, of the 13 total crashes that occurred at number 93 Gardner Road in Winchendon occurred on Saturday indicating some drivers are not familiar with negotiating how, or where, to enter the driveway.

Distracted or Sleepy Driver / Adverse Road Conditions

- 17 (29.8%) of the 57 total Winchendon crashes occurred after the driver was distracted or fell asleep at the steering wheel.
- 5 (10%) of the 50 total Gardner crashes occurred after the driver was distracted or fell asleep at the steering wheel.
- 2 (11.1%) of the 18 total Westminster crashes occurred after the driver was distracted or fell asleep at the steering wheel.
- 9 (15.8%) of the 57 total Winchendon crashes occurred under adverse road conditions.
- 7 (14%) of the 50 total Gardner crashes occurred under adverse road conditions.
- 3 (16.7%) of the 18 total Westminster crashes occurred under adverse road conditions.

Traffic Signs / Pavement Markings & Markers / Guardrail Tabs / Rumble Strips

- There is a severe lack of many types of traffic warning signs on Route 140. The signs are needed to inform drivers of upcoming curves; intersections; changes in posted speed limits; slippery pavement when wet; and other conditions.
- Pavement markings do not fully reflect the standards of the *Manual on Uniform Traffic Control Devices* (MUTCD). Upgrades such as retroreflectorization, centerline retroreflective markers, and others are needed.
- Guardrails lack retroreflective tabs. Many lack state of the art end terminals (flared or energy absorbing).
- Rumble strips are lacking at many locations.

Other Observations

Vehicles often speed to pass slower vehicles before they reach merge or lane drop points along the full length of Route 140.

Vehicles often use the breakdown lane to pass stopped left turning vehicles at many locations along the full length of Route 140. Vehicles often use the northbound breakdown lane south of Matthews Street as a travel lane.

Years of Crashes (Table 4-3)

- For the full length of Route 140, TC increased annually with an absolute increase of 11 crashes between 2008 and 2010 or a 30.6% increase over 2008.
- Over the 3-year period, year 2010 experienced the highest total number of crashes with a total of 47 crashes (37.6% of the total) followed by year 2009 with a total of 42 crashes (33.6% of the total) and lastly year 2008 with a total of 36 (28.8% of the total).
- Winchendon had the highest single year of TC with 22 crashes in 2010 or 38.6% of its 3-year total and the second highest year with 21 in 2008. Winchendon also saw the largest absolute year-to-year increase with 8 crashes from 2009-2010.

Table 4-3

Winchendon	Route 140 Crashes	Years		
		2008	**2009**	**2010**
	Road Segment Crashes	16	8	12
	Percent	44.4%	22.2%	33.3%
	Intersection Totals	0	4	4
	Percent	0.0%	50.0%	50.0%
	Totals	21	14	22
	Percent	36.8%	24.6%	38.6%
	2009 - 2010 Difference		8	
	2008 - 2010 Difference	1		
Gardner	Road Segment Crashes	3	14	12
	Percent	10.3%	48.3%	41.4%
	Intersection Totals	9	5	7
	Percent	42.9%	23.8%	33.3%
	Totals	12	19	19
	Percent	24.0%	38.0%	38.0%
	2008 - 2009 Difference	7		
	2008 - 2010 Difference	7		
Westminster	Road Segment Crashes	0	3	1
	Percent	0.0%	75.0%	25.0%
	Intersection Totals	3	6	5
	Percent	21.4%	42.9%	35.7%
	Totals	3	9	6
	Percent	16.7%	50.0%	33.3%
	2009 - 2010 Difference		-3	
	2008 - 2010 Difference	3		
	Grand Total Each Year	**36**	**42**	**47**
	Percent	**28.8%**	**33.6%**	**37.6%**
	2008 - 20010 Difference	**11**		
	Percent Difference	**30.6%**		

4.3 Conclusions for Developing Countermeasures

Based on the above analysis developing countermeasures to improve safety on Route 140 in Winchendon, Gardner, and Westminster should be undertaken to address the following conclusions:

- RSC are the most prolific crash occurrence on Route 140 with 55.2% of the 125 TC. RSC locations are dispersed all along Route 140.
    - Winchendon experienced the most with 52.2% of the RSC total.
        - 13 occurred on the roadway between Raymond Road the Gardner City Line.
    - Gardner experienced the second most with 42% of the RSC total.
        - 7 occurred on the roadway between Smith Street and Westminster Town Line.
    - Westminster experienced the least with 5.8% of the RSC total.

- LDC accounted for 62.3% of the RSC:
    - Winchendon accounted for 55.8% of the LDC total.
    - Gardner accounted for 34.9% of the LDC total.
    - Westminster accounted for 9.3% of the LDC total.

- RSC and FI / INCI / NFI crashes. As stated above, Route 140 has the potential to become an HSIP eligible project with the goal of reducing FI and INCI crashes that were also RSC.
    - The one FI crash occurred in Winchendon resulted from a RSC, was also a LDC and occurred on the roadway just north of the Gardner City Line.
    - 6 INCI crashes resulted from RSC.
        - 4 occurred in Winchendon of which all were also LDC.
        - 2 occurred in Gardner of which all were also LDC.
    - 17 NFI crashes resulted from RSC.
        - 8 occurred in Gardner and of which 3 were also LDC.
        - 7 occurred in Winchendon of which 4 were also LDC.

- Crash totals increased each year of the 3-year period.

- The driveway at address number 93 Gardner Road in Winchendon experienced a crash cluster with an EPDO total of 33 points. As stated above, this driveway has the potential to become an HSIP eligible project.
    - 3 INCI and 2 NFI crashes occurred here.
    - 9 (69.2%) of the 13 crashes that occurred here resulted in rear-end crashes.
    - Also, 9 RSC occurred in the area around this driveway. These crashes are not included in the EPDO total for this driveway.

- Although intersection crashes accounted for 34.4% of the 125 TC they are widely dispersed among many intersections and are a significant safety issue at only one intersection. The Green/Stone Street intersection in Gardner experienced a crash cluster with an EPDO total of 37 points. As stated above, this intersection has the potential to become an HSIP eligible project.
    - 1 INCI and 5 NFI crashes occurred here.
    - The crash types were diverse. The three most significant are - RR, ANG, and SWP.
    - Also, 3 RSC occurred in the area around this intersection.

  The Simplex Drive intersection in Westminster has a modest safety problem as 50% of the crashes that occurred there involved southbound vehicles that resulted in RE crashes.

- FI / INCI / NFI crash totals for the full length of Route 140 are significant at 34% of the 125 TC. They occurred as follows:
    - 1 FI crash; 14 INCI crashes; 27 NFI crashes.

- Crashes involving wildlife accounted for 13.6% of the 125 TC which were dispersed along the full length of Route 140. However, the Matthews Street intersection in Gardner experienced 6 (35% of the total WL crashes) at or in the area around the intersection.

- Contributing Factors:
    - Excessive vehicular speed is the top factor.
    - Although it is not measured, reckless driver behavior and excessive vehicular speed at merge or lane drop points and the use of the breakdown for passing or as a travel lane are factors.
    - Lack of traffic warning signs; inadequate pavement markings and guardrails; lack of rumble strips.
    - Nearly two-thirds occurred during cold months.
    - Nearly one-third occurred under dark conditions.
    - Nearly one-third of the crashes that occurred at 93 Gardner Road occurred on Saturday.
    - Distracted or sleepy drivers are a factor in about one-sixth of the total crashes.
    - Adverse road conditions are also a factor in about one-sixth of the total crashes.

5.0 Pavement Management System (PMS)

5.1 Introduction

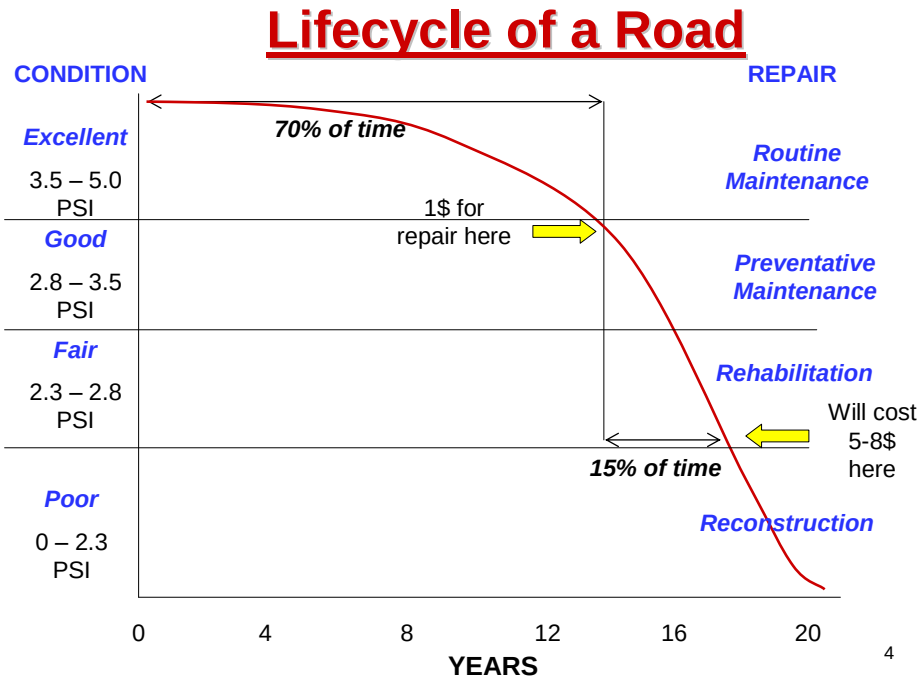
Pavements are the single largest capital investment in any highway system. MRPC in cooperation with MassDOT maintains pavement condition data on all Federal Aid eligible miles of roadway in the Montachusett region in what is known as a Pavement Management System (PMS). The Montachusett Pavement Management System is a tool used to provide an ongoing inventory of pavement conditions along this network in the region. The data maintained is utilized when prioritizing projects for federal funding and assessing current and future needs in our infrastructure.

The existing pavement conditions were not determined to be a major contributing factor to the safety or overall operability of Route 140 in Westminster, Gardner or Winchendon. Since Gardner and Winchendon are responsible for the maintenance of the various road segments throughout the corridor, analysis was conducted to determine the condition and needs of the pavements in order to recognize the maintenance efforts and associated costs necessary to implement appropriate repairs.

5.2 Concepts

Pavement condition is expressed by assigning a Pavement Serviceability Index (PSI) number from 0 to 5 to segments along the roadway. A PSI of 5 is indicative of optimal pavement conditions, usually a newly paved stretch of road, while a PSI of 0 indicates a road that is failing, to the point of being impassable by an average passenger vehicle. See Figure 5-1 below for details of the numerical values projected in the PSI.

Figure 5.1



The graph above displays PSI scores and correlating repair strategies. Also displayed is the curve representing deterioration of the pavement over time. As shown in the graph the cost of repair increases dramatically at a certain point in a pavements “lifecycle”. Ideally routine and preventative

maintenance techniques should be applied at strategic times to keep costs low while maintaining an acceptable PSI, however, implementing this principle can prove to be challenging as budgets often do not keep up with a large network of deteriorating roadways.

5.3 Pavement Condition along Corridor

The most recent data on the Rte. 140 study area was collected by MassDOT in 2009 using an Automatic Road Analyzer (ARAN) vehicle mounted with various cameras, lasers and measuring instruments to determine a pavements overall condition and updated by MRPC surveys in 2011. Refer to Figure 5-2.

The following tables are meant to provide a magnitude of scale estimate for various road repair strategies. An estimated repair cost was developed through consultation with MassDOT and other Regional Planning Agencies during the development of the 2012 Regional Transportation Plan. These estimates are used to illustrate the potential cost needs to bring or maintain the various road segments to an "excellent" condition. Actual costs would depend on a more precise review of conditions and repair needs.

Pavement Repair Costs

Gardner

Condition	Repair	Centerline Miles	Sq. Yards Cost	Sq. Yards	Projected Cost
Poor	Reconstruction	0.00	$45	0	$0
Fair	Rehabilitation	0.95	$18	40,010	$720,175
Good	Preventative Maintenance	0.00	$8.50	0	$0
Excellent	Routine Maintenance	4.35	$0.75	242,284	$181,713
					$901,888

- Pavement conditions in Gardner are generally "Excellent" (4.35 mi.) although a 0.95 mile section South of Route 101 was surveyed as being in "Fair" condition requiring rehabilitation repairs to return the pavement to a similar condition as the remainder of the road and prevent further decay into "Poor" condition.

Westminster

Condition	Repair	Centerline Miles	Sq. Yards Cost	Sq. Yards	Projected Cost
Poor	Reconstruction	0.00	$45	0	$0
Fair	Rehabilitation	0.10	$18	4,304	$77,477
Good	Preventative Maintenance	0.14	$8.50	5,740	$48,794
Excellent	Routine Maintenance	0.65	$0.75	22,625	$16,969
					$143,240

- In Westminster the majority of the pavement is in "Excellent" condition (0.65 mi.) while small sections of "Fair" (0.10 mi.) and "Good" (0.14 mi.) conditions may warrant minor repair efforts to prevent further decay.

Winchendon

Condition	Repair	Centerline Miles	Sq. Yards Cost	Sq. Yards	Projected Cost
Poor	Reconstruction	0.00	$45	0	$0
Fair	Rehabilitation	0.00	$18	0	$0
Good	Preventative Maintenance	1.30	$8.50	60,982	$518,346
Excellent	Routine Maintenance	1.99	$0.75	93,342	$70,006
					$588,353

- Winchendon pavement conditions are mostly "Excellent" (1.99 mi.) while "Good" (1.30 mi.) pavement condition sections in the middle of the towns segment of the road may benefit from Preventative Maintenance repairs.

Corridor

Condition	Repair	Centerline Miles	Sq. Yards Cost	Sq. Yards	Projected Cost
Poor	Reconstruction	0.00	$45.00	0	$0
Fair	Rehabilitation	1.05	$18.00	44,314	$797,652
Good	Preventative Maintenance	1.44	$8.50	66,722	$567,140
Excellent	Routine Maintenance	6.99	$0.75	358,251	$268,689
					$1,633,480

- The overall condition of the Route 140 North Corridor is acceptable as most of the road is in "Excellent" condition (6.99 mi.) and only 1.44 miles and 1.05 miles are in either "Good" or "Fair" condition respectively.

The theory behind a pavement management system is that it is far more economical to preserve roads than to delay repairs and reconstruct roads. Hence investing more frequently in system wide preventative maintenance allows for a reduction in the need to perform more costly reconstruction projects which eat up budgets. Route 140 through this corridor is federal aid eligible as well as mostly State Jurisdiction, meaning the State is responsible for general maintenance of the road. The exception is a 1.51 mi. stretch of road in Gardner from Green St. to the Winchendon town line, and a 1.21 mi. stretch in Winchendon from Teel Rd. to Route 12 which are Town Jurisdiction meaning the town is responsible for general maintenance. It is important for decision makers in Gardner and Winchendon to consider the importance of Route 140 and the possibility of high reconstruction costs when scheduling maintenance and repairs. Ideally focus should be on investments in routine and preventative maintenance to deter the deterioration of the road surface and delay the need for a complete reconstruction, however, shrinking budgets, the rising cost of materials and accounting for a large network of decaying roads make investing in these low cost road preservation efforts a challenge.

Figure 5-2

Route 140 North Corridor: Pavement Conditions 2011

N
W E
S

WINCHENDON

ASHBURNHAM

GARDNER

WESTMINSTER

TEMPLETON

NORTH ASHBURNHAM ROAD
SPRING STREET
TOY TOWN LANE
ASH STREET
TEEL ROAD
CROSS ROAD
OLD GARDNER ROAD
BEMIS ROAD
GARDNER ROAD
DEPOT ROAD
SHERBERT ROAD
HEALD ROAD
LAKE ROAD
PACKARD HILL ROAD
SIBLEY ROAD
LINCOLN AVENUE
HUNTER AVENUE
COUGHLIN ROAD
CHESHIRE POND ROAD
WINCHENDON ROAD
COBB ROAD
LASHUA ROAD
CUSHING STREET
HIGH STREET
MAIN STREET
VALERIE CIRCLE
COREY HILL ROAD
JUNIPER ROAD
OLD COUNTY ROAD
OLD GARDNER RCAD
CENTRAL STREET
TURNPIKE ROAD
PLATTS ROAD
FORRISTALL ROAD
COTE AVENUE
WILLIAMS ROAD
CENTER STREET
SCHOOL STREET
MAIN STREET SOUTH
MAPLE AVENUE
HOSLEY ROAD
HIGH STREET
MURRAY ROAD
SUFFOLK LANE
PEARL STREET
PEARLY LANE
DINAN DRIVE
OLD MATTHEWS ROAD
MATTHEWS STREET
CAMP COLLIER ROAD
KELTON STREET
JOHN EATON ROAD
GREEN STREET
WHEELER STREET
STONE STREET
RAYMOND STREET
EATON STREET
LEO DRIVE
BEAR HILL ROAD
BROOKSIDE DRIVE
FERNWOOD DRIVE
CENTURY WAY
CLARK STREET
NOTRE DAME ROAD
SAINT JOHNS ROAD
RYAN STREET
ACADIA ROAD
KEYES ROAD
PRINCETON STREET
SUCMI ROAD
GUILD ROAD
EUCLID STREET
SAND STREET
ALLEN STREET
BANCROFT STREET
ASH STREET
OAK STREET
VERNON STREET
CRYSTAL LAKE DRIVE
WEST STREET
DOUGLAS ROAD
BATES ROAD
WASA STREET
PARKER STREET
CHURCH STREET
RIVERSIDE ROAD
PLANT ROAD
FREMONT STREET
COBURN AVENUE
BARTHELA
LEARY STREET
WATERFORD
BAKER STREET
HARVARD STREET
EMERALD STREET
MAIN STREET
PINE STREET
WASHINGTON STREET
PERRODY STREET
CROSS STREET
SHERMAN STREET
CHESTNUT STREET
RICH STREET
ELM STREET
LAWRENCE STREET
FAIRMAWN AVENUE
TEMPLE STREET
WOODLAND AVENUE
JAMES STREET
BIRCH STREET
CATHERINE STREET
RIDGEWOOD LANE
CARTER ROAD
SHAWN AVENUE
ROUTE 140
SMITH STREET
NEIGHBORHOOD ROAD
MAY STREET
EAST GARDNER ROAD
CHAPEL STREET
CHAPEL ROAD
WILLIS ROAD
BICKFORD HILL ROAD
ASHLEY DRIVE
TEABERRY LANE
FOSTER COURT
BETTY SPRING ROAD
CARLSON LANE
SAUNDERS STREET
LINUS ALLAIN AVENUE
COLONY ROAD
OVERLOOK ROAD
SIMPLEX DRIVE
PARTRIDGE STREET
CHAMPAGNE ROAD
SUNSET ROAD
SCENIC DRIVE
FENNO DRIVE
WEST MAIN STREET
LIVERMORE HILL ROAD
STATE ROAD WEST

12
140
101
2

Legend

- Community Boundaries

Pavement Serviceability Index (PSI), Route 140 Only

- 0 - 2.3 Poor
- 2.3 - 2.8 Fair
- 2.8 - 3.5 Good
- 3.5 - 4.5 Excellent
- Other US & State Routes
- Other Roads

DATA SOURCES: MassGIS, MassDOT and the MRPC.

DISCLAIMER: The information depicted on this map is for planning purposes only. All data are representational and are not adequate for boundary definition, regulatory interpretation, or parcel-based analysis.

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0 0.5 1 2 Miles

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6.0 MULTI-MODAL CONSIDERATIONS

6.1 Bicycle and Pedestrian

Throughout the development of the Corridor Profile, bicycle and pedestrian accommodations were highlighted as issues to be addressed. The Steering Committee felt that it was necessary to examine the role and practicality of bikes and pedestrians along the corridor. The existing layout of the roadway makes it a difficult and potentially dangerous situation for both alternate mode users as well as drivers.

Within the City of Gardner, the North Central Pathway runs alongside Mount Wachusett Community College and continues on road along Kelton, Wheeler, and Stone Street to utilize the existing bridge over Route 140. The pathway then continues north along Route 140 for approximately 0.4 miles where it continues off road along the abandoned railroad bed into Winchendon.

Field investigations where conducted at this location and it was determined that, although there is a substantial breakdown lane for bicyclists, the speeds at this locations are high and pose a safety hazard. Speed counts show an 85th percentile speed of 51 mph, some 11 mph over the posted speed limit of 40 mph for northbound traffic. The MassDOT Design Guidebook recommends shoulder widths of a minimum of 4 feet to accommodate bicycle and pedestrian use on a shared travel lane. Breakdown lanes/shoulders along the east side (i.e. adjacent to the northbound lane) of Route 140 measure approximately 8 to 10 feet in width. It is possible that this could serve as a bike lane with proper signage, etc., however, input from MassDOT should be sought. Alternatively, space along the east edge of Route 140 appears to exist between Stone Street and the trail end to consider a separate trail connection. Issues related to property ownership, right-of-way, easements and driveway crossings would need to be further examined to determine feasibility.

Based upon feedback provided by the North Central Pathway (NCP) regarding the options discussed above creating a trail connection that would follow along the edge of Route 140 would be extremely costly due to the need to bridge a small swale, cross a private driveway and span approximately 250 feet of wetlands (with a floating bridge, etc.). Initial estimates for such a connection could run into millions of dollars. Additionally, utilizing the breakdown lane of Route 140, even with a guardrail, would be too dangerous to implement. To address the connection issue, the NCP has begun discussions with MassDOT on two potential options. Option 1 would follow a discontinued road, John Eaton Road, which would run from Stone Street to the trail. This is the preferred option, however, there are issues related to property ownership to address. Option 2 involves connecting further up Stone Street to the discontinued road past various property owners.

It should also be noted that parking is an issue at the trail head at Route 140. On weekends parked cars seem to overflow onto the busy roadway. There is not adequate parking at this popular location. The North Central Pathway has indicated that parking in this location should be reserved only for handicapped individuals. In addition, future plans are for a parking facility on Stone Street for an estimated 20 to 25 vehicles. The location would depend upon which connection option is selected. Option 1 would potentially see a parking lot at the intersection of Route 140 and Stone Street and for Option 2 the lot would be further up Stone Street. Both potential sites could be on Gardner owned land. Additionally, the Route 140 Task Force has raised the question of the potential for parking for trail users at the new development located further north off of Route 140 in Winchendon across from the current Irving Gas Station facility. Depending upon development plans, an opportunity may exist to work with the site developers to utilize or allocate some parking for the North Central Pathway. The NCP is encouraged to coordinate with the developer and the communities to determine if an arrangement can be reached.

Any and all planned improvements for the Route 140 corridor should make note of the North Central Pathway and coordination should occur to ensure the best feasible alternative.

A separate trail inventory study was conducted by the MRPC for Westminster and Gardner in 2010 and Winchendon in 2005. This inventory includes hiking and biking trails throughout the communities that currently exist. A copies of the maps produced of formal trails within the three communities are included at the end of this section as Figures 6-1, 6-2 and 6-3. Please contact the MRPC for a complete copy of the study. The following trails lie within the vicinity of Route 140.

North Central Pathway - This recreational trail connects the communities of Gardner and Winchendon. The trail was broken down into phases to ease the development process.

- Phase 1 – Dedicated paved trail from Park Street past Crystal Lake to Mount Wachusett Community College (MWCC)
- Phase 2 – Using existing roads from MWCC, Kelton & Stone Streets to Route 140
- Dunn Park Spur – Existing roads from MWCC to Dunn Park with dedicated connector at the Middle School
- Phase 3 –3.2 miles paved from Route 140 to Old Gardner Road in Winchendon.
- Phase 4 – Downtown Winchendon to Glenn Allen Street
- Phase 5 – $1.95 Million is allocated to this phase on the 2013 TIP
- Phase 6 – The North Central Pathway Committee is currently working on developing this phase.
- Phase 7 – Proposed from Phase 1 to Park Street and down Eaton Street.
- Phase 8 - From Eaton Street to the Gardner City Forest on Route 140.

Phases 1-4 are currently complete.

- *Gardner City Forest* – This extensive trail network is located in the northwestern part of Gardner. The trails run from Rt. 140 south to Eaton Street along an abandoned railroad bed and then branches off to the west towards Perley Brook Reservoir and Clark Street and to the northwest to the town of Winchendon. There are parking areas on Rt. 140 near the North Central Pathway as well as further up towards Winchendon, on Eaton Street south of the Golf Course, and on Clark Street across from Perley Brook Reservoir. These trails total approximately 8.9 miles.

- *High Ridge Wildlife Management Area* - This extensive trail network is located in the northwestern part of Gardner. The trails run from Rt. 140 south to Eaton Street along an abandoned railroad bed and then branches off to the west towards Perley Brook Reservoir and Clark Street and to the northwest to the town of Winchendon. There are parking areas on Rt. 140 near the North Central Pathway as well as further up towards Winchendon, on Eaton Street south of the Golf Course, and on Clark Street across from Perley Brook Reservoir. These trails total approximately 8.9 miles.

Figure 6-1

Winchendon, MA: Route 140 North Task Force Trail Inventory Map

Ware River Rail Trail

Power Line

North Central Pathway- Proposed

Mont Grace 19th Hill

Old County Road

North Central Pathway- Existing

Old Gardner Road

Rome Trails

Gardner City Forest

Power Line

Old County Road

ASHBURNHAM

GARDNER

TEMPLETON

LE STREET
PEGGI LANE
WINDSOR ROAD
LAKESIDE DRIVE
TOLMAN ROAD
GLENALLAN STREET
CENTRAL ST
SPRING PLACE
PINE STREET
EMERALD STREET
CROSS STREET
SPRING CIRCLE
ASH STREET
HALL ROAD
HIGH STREET
HOSPITAL DRIVE
HALE STREET
BALDWINSVILLE ROAD
CUMMINGS ROAD
OLD COUNTY ROAD
TILTON HEIGHTS
TEEL ROAD
CROSS ROAD
CONVERSE DRIVE
ICE HOUSE ROAD
NORTH ASHBURNHAM ROAD
OLD GARDNER ROAD
SPRING STREET
WINCHENDON ROAD
BEMIS ROAD
GARDNER ROAD
RAYMOND ROAD
MADISON AV
MELLEN ROAD
TOWN FARM ROAD
WELCH ROAD
MILL GLEN ROAD
JOHN EATON ROAD
GREEN STREET
W HEELER STREET
STONE STREET
BROOKSIDE DRIVE
FERNWOOD DRIVE
LEO DRIVE
ABERRY ROAD
NOEL DRIVE
SUNSET DRIVE
LAKEVIEW DRIVE
HOLIDAY DRIVE
CHRISTMAS TREE DRIVE
DUNN ROAD
WINDING COVE ROAD
BALSOM DRIVE
SHERBERT ROAD
POLE STREET
DEPOT ROAD
OLD GARDNER ROAD
BROGAN ROAD
12
140

0 0.25 0.5 1 Miles

Legend

- 1/2 Mile Buffer
- Community Boundaries

Roadways
- US & State Routes
- Other Roads

RailLines
- Active RailLines

Water
- Streams & Rivers
- Intermittent Stream
- Lakes, Ponds & Reservoirs

Trail Inventory Status
- Existing Formal*
- Existing Informal**
- Potential
- Unknown

DATA SOURCES: MassGIS, MassDOT, the Town of Winchendon and the MRPC. **DISCLAIMER**: The information depicted on this map is for planning purposes only. All data are representational and are not adequate for boundary definition, regulatory interpretation, or parcel-based analysis.

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Gardner, MA:
Route 140 North Task Force
Trail Inventory Map

Figure 6-2

North Central Pathway- Existing
Old County Road
Rome Trails
Gardner City Forest
Gardner City Forest
Gardner City Forest
Gardner City Forest
North Central Pathway- Existing
Wampanoag Trails
Oakmont Trails
High Ridge WMA
High Ridge WMA
High Ridge WMA
Dunn Pond Trail
Otter River Conservation Area
Gardner Municipal Airport
Unknown
Unknown
Unknown

WINCHENDON
ASHBURNHAM
TEMPLETON
HUBBARDSTON
WESTMINSTER

Cheshire Pond
Hickey Pond
Perley Brook Reservoir
Crystal Lake
Parker Pond
Otter River
Kendall Pond
Lake Wampanoag
Cowee Pond
Dunn Pond
Bents Pond
Greenwood Pond
Partridgeville Pond
Wrights Reservoir
Upper Reservoir
Waite Pond

DATA SOURCES: MassGIS, MassDOT and the MRPC.

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0 0.5 1 2 Miles

Legend

- 1/2 Mile Buffer
- Community Boundaries
- Airports

Roadways
- US & State Routes
- Other Roads
- Route140

RailLines
- Active RailLines

Water
- Streams & Rivers
- Intermittent Stream
- Lakes, Ponds & Reservoirs

Trail Inventory Status
- Existing Formal*
- Existing Informal**
- Potential
- Unknown

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Westminster, MA:
Route 140 North Task Force
NHESP Data Map

Figure 6-3

GARDNER

High Ridge WMA

Oakmont Trails

EAST GARDNER ROAD

MAY STREET

GARDNER STATE HOSPITAL ROAD

SMITH STREET

WILLIS ROAD

CHAPEL STREET

ROUTE 140

CHAPEL ROAD

UNNAMED ROAD

BEECH HILL

OVERLOOK ROAD

BETTY SPRING ROAD

CARLSON LANE

LINUS ALLAIN AVENUE

LACHANCE STREET

COLONY ROAD

BEECH HILL ROAD

SARGENT ROAD

WEST MAIN STREET

SIMPLEX DRIVE

RAMP-RT 140 TO RT 2WB

RAMP-RT 2WB TO RT 140

ROUTE 2

RAMP-RT 140 TO RTE 2

RAMP-RTE 2 EB TO RT 140

PARTRIDGE STREET

SHIRLEY AVENUE

GOODRIDGE DRIVE

SUNSET ROAD

SCENIC DRIVE

WILSON ROAD

FENNO DRIVE

LIVERMORE HILL ROAD

STATE ROAD WEST

BROOKS AVENUE

MAIN STREET

LOVELL STREET

SMITH AVENUE

HOWARD AVENUE

NICHOLS STREET

RIPLEY ROAD

CAMELOT ROAD

OLD COUNTY ROAD

ELLIS ROAD

LAKE DRIVE EAST

Legend

- 1/2 Mile Buffer
- Community Boundaries

Roadways
- US & State Routes
- Other Roads

RailLines
- Active RailLines

Water
- Streams & Rivers
- Intermittent Stream
- Lakes, Ponds & Reservoirs

Trail Inventory Status
- Existing Formal*
- Existing Informal**
- Potential
- Unknown

0 0.125 0.25 0.5 Miles

DATA SOURCES: MassGIS, MassDOT and the MRPC.

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7.0 SUGGESTED IMPROVEMENTS

7.1 Introduction

Several alternatives were considered as means to address the safety and functionality issues of Route 140 along the corridor. Technical data as well as steering committee input has been considered in the development of the alternatives and recommendations. The following is a listing of improvement alternatives and recommendations for the corridor intersections and the corridor road segment.

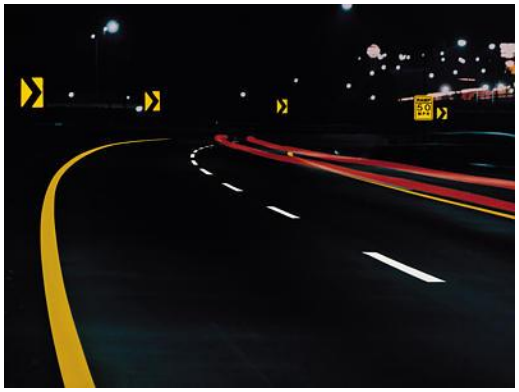
Some of the suggested improvements exist at several locations and the focus should be on making them consistent and uniform along the full length of the corridor while consideration should be given to adding those that have not been applied. Also, other alternatives and recommendations may come forth as a project moves forward for Route 140. Therefore the improvements to be implemented may include but are not limited to the alternatives and recommendations described below.

Retroreflectivity and Improvements

The recommended sign and pavement marking improvements for the corridor intersections and road segments need to be retroreflective. Certain guardrail items should also be retroreflective. Retroreflective signs and pavement markings reflect light back to its source with a minimum scattering of light. The following is an example of a STOP sign:

Photos of Non-retroreflective (left) Versus Retroreflective STOP Sign (right)
Note the street sign above the STOP sign (right) is also non-retroreflective

The use of retroreflective signs and pavement markings allow a driver at night to see a sign or pavement marking sooner to allow the driver to take appropriate actions:



7.2 Corridor Road Segment

The Safety Analysis revealed that Route 140 corridor has the potential to become an HSIP eligible project with the goal of reducing LDC that result in FI and INCI crashes. The suggested improvements should also work to improve the overall safety of the corridor.

The City of Gardner Steering Committee members requested full implementation of the signage and pavement marking recommendations provided in the 2007 *Lane Departure Road Safety Audit for Route 140 in Gardner, Massachusetts* (see Technical Appendix). Many of those recommendations are repeated below and can be applied along the full length of the corridor.

Recommendations

- Based on the results that excessive vehicular speed is a contributing factor in 79% of the crashes on Route 140, it is recommended that:
    - Route 140 either continues as, or become, a high speed enforcement road.
    - Speed data collection should be completed by the City of Gardner and the Towns of Winchendon and Westminster to track current operating speeds throughout the year which may also be useful in the establishment of enforcement thresholds.
    - Speed regulations should be examined for consistency with the current operating practices.
    - Additional Speed Limit signs should be provided along the roadway in an effort to further reinforce the limits for motorists.
    - Install Speed Reduction Ahead warning signs (example right) to inform motorist of an upcoming drop in speed limit.

- Recommendations for reckless driver behavior and excessive speed at merge points:
    - Add Lane Ends Ahead warning signs (example right) along the corridor well in advance of merge points which alert motorists about the lane drop. This sign exist at several merge points already.

    - Add Lane Reduction Ahead Arrow pavement markings (example left) to the lane that will be dropped well in advance of the merge point to alert motorists about the lane drop.
    - Add 2-way Road Ahead warning signs (example right) further down the road from the Lane Ends sign near the merge point to alert motorists of the upcoming opposing lane.

- Recommendations for distracted or sleepy drivers:
  - Rumble strips alert distracted drivers that they are leaving their travel lane by causing an audible rumbling or vibration that is transmitted through the wheels into the car body. Rumble strips can be applied along the right lane edge next to the road edge line (below left photo) and/or to the road centerline (below right photo). In many locations rumble strips have been effective at reducing crashes due to inattention.

  - Route 140 already has rumble strips along many sections of the roadway. However rumble strips should be added to the sections along the roadway where they do not exist today.

- Recommendations for weather related crashes:
  - Add weather related warning signs (examples right) along the corridor which alert motorists about the impact of weather along the roadway.
  - Add variable message signs (VMS) to be used periodically during the winter months to remind motorists about weather issues, and to be cognizant in the selection of their speeds. Candidate locations would include Route 140 near both bordering town lines, and at selected locations in the middle for traffic exiting downtown Gardner.
  - Assess the existing condition of the pavement for sufficient skid resistance.
  - Assess the existing drainage characteristics. Elements for consideration would be the presence of adequate and functional drainage features, roadway pavement conditions, and superelevation at known ice spots.
  - In the vicinity of the Winchendon Town Line the trees that obscure the roadway during the winter resulting in black ice conditions should be trimmed or removed.

- Add Curve Ahead warning signs (below right) for each direction of all horizontal curves. Signs should be placed in advance of a curve to allow adequate response time from motorists. For further delineation, Chevron alignment guide signs (below right) and edge of road reflectors should be considered. A non-retroreflective Curve Ahead sign already exists (but should be replaced with a retroreflective sign) before the horizontal curve heading SB from the Winchendon Town Line but Chevron signs should be added for delineation of the curve.

- Hidden residential driveways are also an issue on the curve at the Winchendon Town Line. Add a Caution Hidden Driveways Ahead warning sign (example right) in advance of the curve to warn motorists of the driveways.

- There are many residential driveways along Route 140 that create many left and right turn movement opportunities in many areas along Route 140. Watch For Turning Vehicles warning signs (example right) inform motorists in advance of upcoming left and right turns into driveways.

- Add Intersection Ahead and Signal Ahead warning signs; upgrade pavement markings; add pavement markers; upgrade guardrails; add roadway delineators:
  - Intersection Ahead warning signs warn of at-grade road crossings. The following are four types that are commonly used:

4-way Intersection

'T' Intersection (major into other approach)

'T' Intersection
(minor side approach)

Skewed Intersection
(minor side approach)

  - Signal Ahead warning signs (example right) warn of an upcoming signalized intersection. They are often used where it is difficult to see that a signal may already be showing red or to warn a driver to prepare to slow down. A Distance Ahead plaque should be located just below it.

NOTE: Intersection Ahead and Signal Ahead warning signs are also included in the suggested intersection signage improvements. They should not be duplicated.

- All pavement markings should be upgraded utilizing retroreflectivity (example left) and the line width should be from four to six inches wide (example right).

- Add retroreflective centerline and lane edge recessed pavement markers (example right) that enhance roadway visibility by reflecting automotive headlights. Recessed markers should be used where snowplowing is frequent such as Route 140. The *Manual on Uniform Traffic Control Devices* (MUTCD) permits the use of pavement markers as a supplement to traditional longitudinal pavement markings. However, pavement markers cannot be used as a replacement for longitudinal pavement markings.

These new pavement markings and recessed pavement makers were installed on Route 140 in Gardner in 2010 that extend from just north of Pearl Street to Green Street. To be consistent and uniform, the same type of pavement markings and pavement markers should be installed on the full length of Route 140.

- Upgrade guardrails by adding retroreflective tabs (example below left) to rails; replacing turned down (buried) end terminals (which can cause rollover crashes) with energy absorbing end terminals (example below right); and increase guardrail height to current standards.

- Install roadway delineators on both sides of the road. Delineators are retroreflective devices mounted on post and placed in a series along the side of the roadway to indicate roadway alignment. The two examples below show delineators being used on ramp interchanges.

Safety benefits of roadway delineators:

- Aid nighttime driving (example below).
- Remain visible when the roadway is wet or snow-covered.
- Remain visible during adverse weather conditions.

They are considered a guidance device rather than a warning device. Delineators are also beneficial at locations where the alignment might be confusing or unexpected and may be used on long continuous sections of highway or through short stretches where there are changes in horizontal alignment.

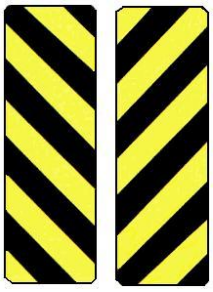
The delineator device can be either circular or rectangular in shape and the post they are mounted on can also be retroreflective and should be flexible for when they are struck by a vehicle. The delineator device can also be placed on barriers and also on medians if the delineator device is post mounted. The color of the delineators should match the color of the adjacent edge line (examples above). For example, on a two-way road such as Route 140, the edge lines on both sides of the road are white, so if delineators are used on the left side and the right side of the road they must both be white.

- Although crashes involving deer accounted for the largest share of crashes with large animals, moose and bear had their share as well. Because of this, Watch for Animals signs (example right) should be added instead of a single species warning sign such as a Watch for Deer warning sign.

- SOLAR GLARE: Although AM and possibly PM solar glare was not identified as a contributing factor in crashes, it is a blinding and unsafe condition that occurs in the spring and fall at the following locations: the Spring Street (Route 12) intersection in Winchendon; the road segment from Green Street to Matthews Street in Gardner; and the road segment from Betty Spring Road to Simplex Drive in Westminster. To warn vehicle operates before they reach those locations, large size solar glare warning signs should be added. This gives vehicle operators time to make driving adjustments.

- Passing zone signs exist at most locations. But there is at least one location that needs a regulatory Do Not Pass sign (example below left) – the passing zone that begins north of Matthews Street.

- Object Marker warning signs (left and right examples to right) exist at many locations. But other locations should be considered. These signs warn vehicle operators of bridges and other road side obstructions in or next to the road.



- Add safety edge treatment (example below right) where breakdown lanes are narrower than four feet or less. When a vehicle leaves the pavement and encounters a right-angle pavement drop-off, it can be very difficult for the operator to return safely to the roadway. As the operator

attempts to steer back onto the pavement, the side of the tire may scrub along a right-angle drop-off, resisting the operator's attempts. This resistance will often lead the operator to overcorrect with more steering input. When the tire finally remounts the pavement, the larger steering angle may cause the vehicle to "slingshot" across the road. This can result in a head-on crash with a vehicle in the opposing lane or a loss of control resulting in a rollover crash either on the roadway or off road.

The safety edge is a new and innovative road edge treatment intended to minimize drop-off-related crashes. With this treatment, the pavement edge is sloped at a 30 degree angle. This angle makes it easier for a vehicle operator to safely return to the roadway after inadvertently driving off the pavement edge.

- All signage along the Route 140 corridor should undergo the following:
    - Oversized signs are recommended where the breakdown lanes are wide. Signs are more difficult to see when they are further away from the lane edge line pavement marking.
    - Maintain general sign maintenance as it is common for signs to be knocked over.
    - Unnecessary signage should be removed as sign clutter may cause some motorists to miss an important sign and will make the necessary signage more visible.
    - Incorrect signage should be corrected so that motorists will be properly informed of upcoming road conditions.
    - Assess the existing condition of current signs to identify faded or non-retroreflectorized signs which should be replaced.
    - The informational sign for the Gardner District Court should be raised as the current location is easily obscured by leading vehicles and possibly by snow during the winter months.

7.2.1 Driveway at 93 Gardner Road, Winchendon

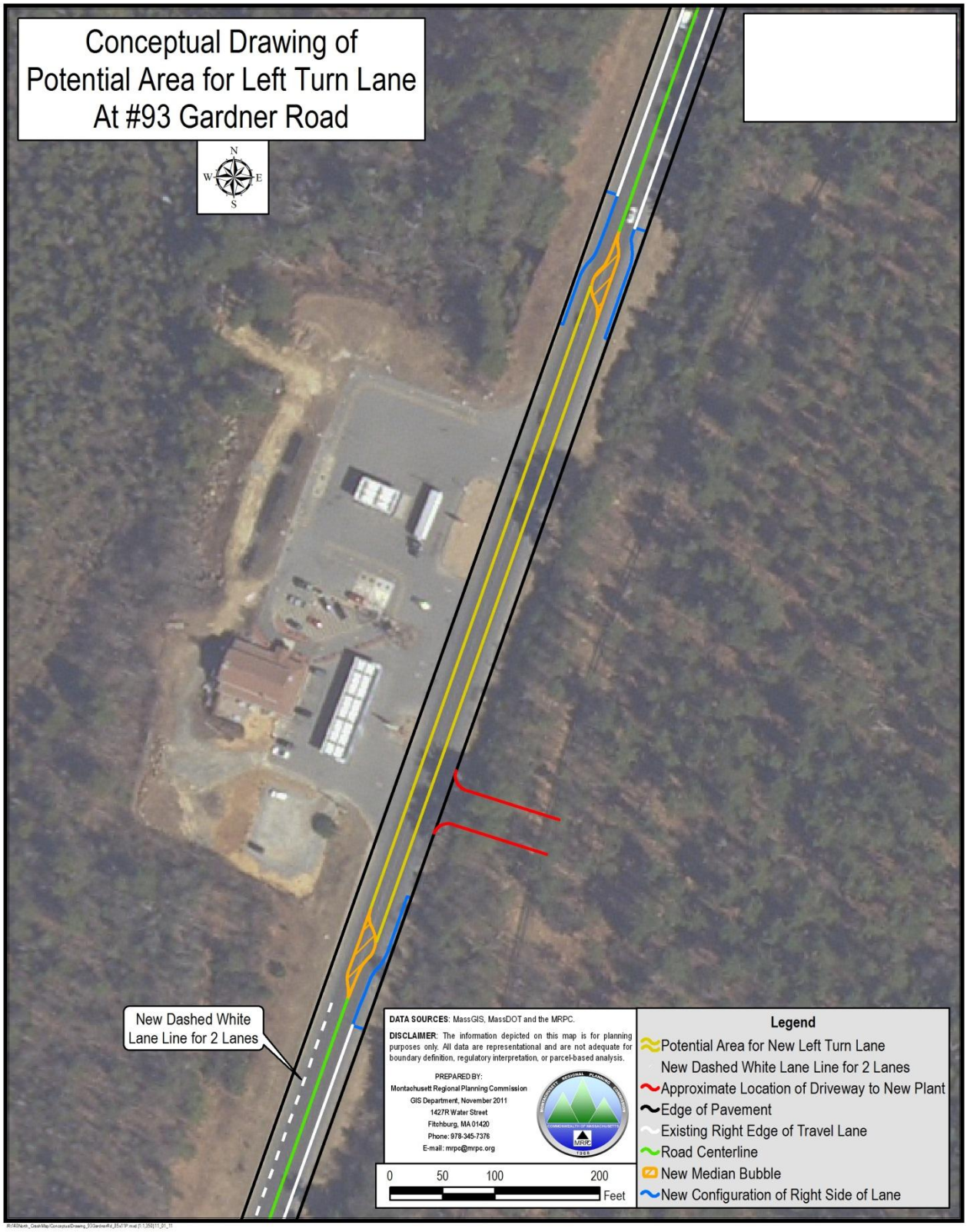
Issues and Alternatives

The Safety Analysis revealed that this convenient store driveway with its wide curb cut that allows for many access points experienced a crash cluster with an EPDO total of 33 points and many RSC occurred in the immediate area around the crash cluster. This indicates that this location has a significant safety issue and thus could be submitted as a potential HSIP eligible project.

Furthermore, new potential safety problems for this location have been created due to the construction of a new industrial plant, two new deck hockey rinks, and two additional commercial buildings yet to be built on the east side of Route 140 opposite the convenient store. These new facilities will generate additional traffic to this location during the AM and PM peak periods which will include large tractor trailers stopping and taking left and right turns into the new driveway. The deck hockey rinks will generate increased traffic during the PM peak hour. The new driveway to these facilities is laid out to become a public road that is likely to be accepted as such at the town meeting in the spring of 2012.

As depicted in Figure 4-1 (page 4-2) and displayed in Figure 7-1 on page 7-8, the convenient store is also a service station with gasoline pumps and also diesel fuel pumps which service large tractor trailers. Figure 7-1 also shows the location of the new driveway to the new facilities. It is located directly across from the southernmost point of the #93 Gardner Road driveway.

Figure 7-1


Conceptual Drawing of
Potential Area for Left Turn Lane
At #93 Gardner Road
N
W
E
S
New Dashed White
Lane Line for 2 Lanes
DATA SOURCES: MassGIS, MassDOT and the MRPC.
DISCLAIMER: The information depicted on this map is for planning purposes only. All data are representational and are not adequate for boundary definition, regulatory interpretation, or parcel-based analysis.
PREPARED BY:
Montachusett Regional Planning Commission
GIS Department, November 2011
1427R Water Street
Fitchburg, MA 01420
Phone: 978-345-7376
E-mail: mrpc@mrpc.org
0
50
100
200
Feet
Legend
Potential Area for New Left Turn Lane
New Dashed White Lane Line for 2 Lanes
Approximate Location of Driveway to New Plant
Edge of Pavement
Existing Right Edge of Travel Lane
Road Centerline
New Median Bubble
New Configuration of Right Side of Lane

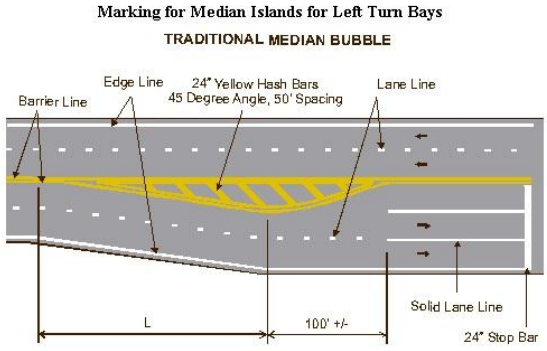
Recommendations

Recommendations, some of which are partially conceptualized in Figure 7-1 above, to address safety related issues such as inadequate and lack of predetermined access points, excessive vehicular speed, and vehicle operator lack of familiarity with the road at this driveway include:

1. Limit the access points to at least two 2-way driveways to eliminate the confusion of where to enter and exit the convenient store. Consideration needs to be given to the drive-up window located on the northern side of the convenient store.
    - Each driveway should have one entry point and one STOP controlled exit point and each point should be marked with an arrow pavement marker and signage.
    - A curbed narrow island should be installed in between the two driveways to prevent access.
    - The southernmost driveway should be located directly across from the new plant driveway to limit conflict points and decision making for vehicle operators. Consideration should be given to limiting this driveway to small vehicles only.
    - The northernmost driveway should be located approximately 400 feet to the north of southern driveway and should end where the existing paved lot ends. Consideration should be given to this being the driveway for tractor trailers and the drive up window.
    - Install an overhead flashing beacon over the center of each driveway.

2. As noted above and especially for this location, speed regulations should be examined for consistency with the current operating practices since excessive speed was the top contributing factor in 98% of crashes that occurred here. In-lane rumble strips are an option here (example in section 7.4.3). They should be placed upstream of either the median bubble or raised median locations.

3. The following left turn lane recommendations (and Figure 7-1 above) do not address the conflict between the northbound left turning vehicles into the northernmost driveway of the convenient store and the southbound left turning vehicles into the new driveway for the new industrial plant. These recommendations propose to show that the Route 140 road surface width can accommodate protected left turn lanes and the potential total length of road where various combinations of left turn lanes may be located.
    - The road surface width of Route 140 in this area is approximately fifty feet that includes wide breakdown lanes. In-line protected left turn lanes measuring twelve feet wide can be accommodated in the center of the road and when two twelve foot wide travel lanes are added the three lanes will combine to occupy thirty-six feet of the road surface width leaving seven feet on each side of the road for a breakdown lane.
    - The full width of the convenient store curb cut is approximately 430 feet. Adding one-hundred feet to both ends of the curb cut brings the potential total length of road where various combinations of protected left turn lanes may be located to 630 feet.
    - A median bubble (example diagram right) should be located at the southern end for left turning vehicles into the southernmost driveway of the convenient store. The pavement markings guide all northbound vehicles to shift to the right then vehicles wanting to enter the convenient store will move to the left into a left turn bay which provides protection from the rear.



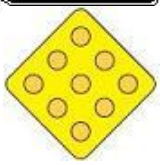
    - Recessed pavement markers can be used to delineate the median bubble.

- Traffic bypassing left turning traffic by swerving into the breakdown lane will be virtually eliminated.
- Just south of the southern median bubble the new southbound through lane will continue in the path of the old breakdown lane until it meets the heavy truck climbing lane which begins several hundred feet to the south. The median bubble will guide passing vehicles to shift to the left into a passing lane.
- At a minimum, a median bubble should be located at the northern end that will guide southbound vehicles to shift to the right so they will move away from the left turn lane.
- The northern median bubble and edge of road pavement markings will guide northbound vehicles to shift to the left and return to the original northbound travel lane and the breakdown lane will be restored.
- Traffic delays associated with the left turns will be virtually eliminated.

An Alternative: Install Raised Medians for Left Turns

Instead of median bubbles, raised medians with protected left turn lanes offer a cost effective way of reducing crashes at a location (example right). As with median bubbles, protected left turns separate the slowing and stopped turning vehicles from through traffic to provide a protected space but with more protection. The raised median provides a physical barrier that is visible to all vehicle operators under adverse driving conditions. Roadway delineators can be posted on the raised median and recessed pavement markers can be installed to delineate them.

Medians provide a safe haven for sign placement. Typical signs to install may include, but are not limited to: a post mounted Keep Right with Arrow symbol to Right of Island sign should be posted as close as possible to the end of a raised median (examples left and above). Below, an Object Marker (example left) to mark the median as an obstruction within the roadway should be installed.



A Median Ahead warning sign (example right) should be placed upstream from the median on the right side of the road.

Two options to designate the lane for left turns only are to install either a Left Turn Only sign at the location point of the turn or the Center Lane Left Turn Only sign (examples left) to prohibit use by through vehicles.

The post mounted Begin Left Turn Lane (example left) sign may be mounted on the median at the upstream end of a left turn lane.

Consideration should be given to the type of control (full stop or yield) for taking a left turn into either the access points of the convenient store or the soon to be public road. If stop controlled, stop bars will need to be installed.

Other pavement markings include a channelizing line and left turn arrows (examples above). Recessed pavement markers could be installed to delineate the channelizing line.

7.2.2 Road Segment South of Matthews Street, Gardner

Issues and Alternatives

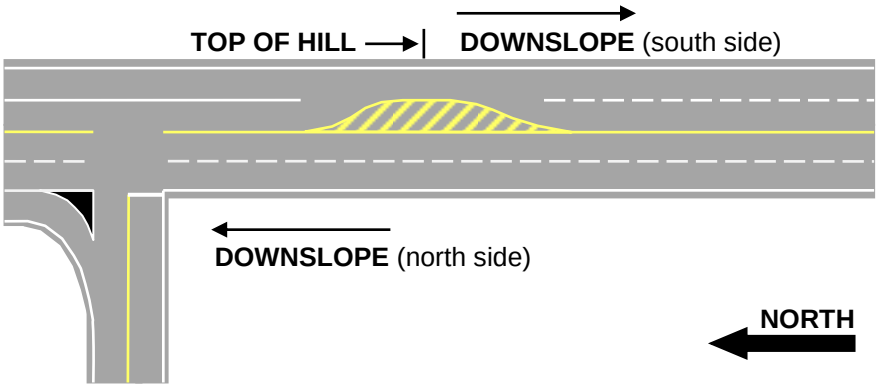
An unsafe condition exists on the road segment south of Matthews Street. The approximate center of this road segment is located on the top of a hill as depicted in the conceptual drawing below. Currently, a northbound vehicle in the right lane on the south side of the hill must merge into the left lane and completes this move approximately near the top of the hill. After completing this move, the northbound vehicle has a good chance of seeing at least one stopped vehicle attempting to make a left turn into Matthews Street. The northbound vehicle must then move to the right utilizing an existing shoulder bypass lane.

Recommendations

The following recommendation, which is conceptualized in the diagram below, is designed to address the safety issue on this road segment:

1. Change the lane to be merged into the adjacent lane from the right lane to the left lane (example right). This will eliminate the extra maneuver into the right lane a northbound vehicle must make to avoid a potential rear end crash with a stopped vehicle. This will also eliminate the use of the existing breakdown lane as a travel lane. This should be completed through the use of a median bubble as depicted below. Add appropriate signage and pavement markings.

2. This recommendation ties into the Matthews Street recommendation. See Section *7.4.2 - Route 140 at Matthews Street* on page 7-17 for more.



7.3 Winchendon Intersections

7.3.1 Route 140 at Spring Street (Route 12)

Issues and Alternatives

This signalized '**T**' intersection currently operates at an overall LOS of "B" and "C" for the A.M. and P.M. peak hours respectively. Traffic from Spring Street (Route 12) northbound experience the longest delays (23 to 27 seconds per vehicle) operating at a LOS of "C" for left and right turns. Volumes for these turns were not overly high (80 left and right turn vehicles in the A.M. and 150 in the P.M.) averaging from 1.3 to 2.5 vehicles per minute. Right turning vehicles from Spring Street northbound also make use of the "Right Turn On Red" option.

Route 140 at Spring Street Peak Hour Level of Service (LOS)

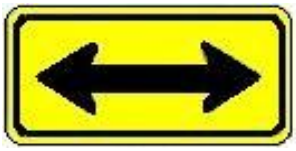
	Intersection - Overall					Approach	Lane Group				
	Route 140 Intersection	AM		PM			Lane Group	AM		PM	
Community		Delay (sec.)	LOS	Delay (sec.)	LOS			Delay (sec.)	LOS	Delay (sec.)	LOS
Winchendon	Route 12	11.3	B	21.1	A	Rt 12 Northbound	Left and Right	23.5	C	27.1	C
						Rt 140 Northbound	Right and Thru	14.6	B	31.2	C
						Rt 140/Rt 12 Southbound	Left and Thru	9.0	A	7.6	A

The Safety Analysis revealed that four crashes occurred at this intersection indicating that safety is not a significant issue at this intersection.

Recommendations

Recommendations to address issues for this intersection include:

1. The following Advanced Warning signs, and other signs, are recommended:
    - A '**T**' Intersection Ahead warning sign on the right side of each major approach and located just below each sign there should be an Advance Street Name plaque and possibly a Distance Ahead plaque.
    - Two-Direction Large Arrow (example below left) warning sign facing traffic on Route 12 to provide direction.
    - Signal Ahead warning signs already exist on all approaches, however the sign on the Route 12 approach is partially hidden by a Curve Ahead sign because they are too close to each other and need to be separated more.
    - Be Prepared To Stop (example below right) warning signs on all approaches.



2. Additional measures such as flashing warning beacons added to the Signal Ahead sign or other Advance Warning Flashers (AWF) should be considered for the Spring Street approach. Examples of AWF include:
    a. *Prepare to stop when flashing* - A BE PREPARED TO STOP warning sign with two yellow flashers that begin to flash a few seconds before the onset of the yellow and

continues to flash throughout the red phase. A WHEN FLASHING plaque is recommended in addition to the sign.

b. *Flashing symbolic signal ahead* - Similar to previous type except the wording on the sign is replaced by a schematic of a traffic signal. The flashers operate as above.
c. *Continuous flashing symbolic signal ahead* - The sign displays a schematic of a traffic-signal symbol but in this case, the flashers operate continuously (i.e. they are not connected to the signal controller). (source: *Making Intersections Safer: A Toolbox of Engineering Countermeasures to Reduce Red-Light Running;* FHWA http://safety.fhwa.dot.gov)

Chevron alignment guide signs already exist along the curve of the Spring Street (Route 12) approach. These signs delineate the almost 90 degree curve of the northbound approach to the intersection especially under adverse light or weather conditions when it can be difficult to ascertain the road geometrics.

Install guide signs as needed.

All signs should be placed at appropriate distances.

3. Add recessed centerline and/or edge of road pavement markers to delineate the path of the approaches under adverse light or weather conditions when it can be difficult to ascertain the road geometrics.

4. Upgraded pavement markings already exist. Maintain and add other markings as needed.

7.3.2 Route 140 at Old Gardner Road

Issues and Alternatives

This non-signalized '**T**' intersection currently operates with a LOS of "C" and "D" for the A.M. and P.M. peak hours, respectively, for left and right turns out of Old Gardner Road. During the peak hours counted, no vehicles attempted to turn right from Old Gardner Road, all vehicles turned right (with approximately one and one-half more turning vehicles in the A.M. than the P.M. – 59 compared to 38, respectively). Left turns from Route 140 into Old Gardner Road operate at a LOS of "A" with delays less than 9 seconds. This maneuver is almost non-existent as only one (1) vehicle attempted a left turn during the peak hours observed.

Route 140 at Old Gardner Road Intersection Peak Hour Level of Service (LOS)

		Approach	Lane Group				
Community	Route 140 Intersection	Approach	Lane Group	AM		PM	
				Delay (sec.)	LOS	Delay (sec.)	LOS
Winchendon	Old Gardner Road	Old Gardner Road	Left and Right	23.3	C	25.9	D
		Route 140 Southbound	Left	8	A	9.1	A

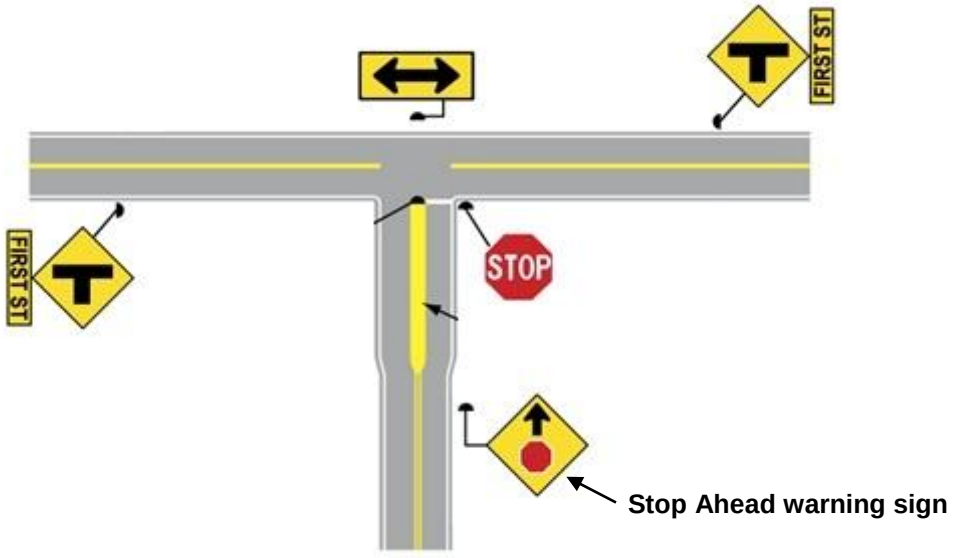
Old Gardner Road also provides access to an off street parking lot for the North Central Pathway rail trail. The trail itself has direct access from Old Gardner Road some 220+ feet from the Route 140 intersection.

The Safety Analysis revealed that no crashes occurred at this intersection indicating that safety is not a significant issue at this intersection.

Recommendations

Recommendations to address issues for this intersection include:

1. The following Advanced Warning signs, which are conceptualized in the diagram below, and other signs should be added:
    - A '**T**' Intersection Ahead warning sign on the right side of each Route 140 major approach and located just below it each sign there should be an Advance Street Name plaque and possibly a Distance Ahead plaque.



    - Two-Direction Large Arrow warning sign for traffic turning from Old Gardner Road.
    - A Stop Ahead warning sign already exist on right side of Old Gardner Road minor approach.

    Add Chevron alignment guide signs along the curve on the left side of Old Gardner Road. The road curves significantly into the intersection with little stopping distance for southbound traffic. A clear delineation of the road curvature would be beneficial to traffic on Old Gardner Road and those turning from Route 140 into the street.

    Add appropriate notification and warning signs related to the bike trail and its users.

    Install guide signs as needed.

    All signs should be placed at appropriate distances.

2. Install an exclusive right (example right) lane on Route 140 northbound for Old Gardner Road by using the existing breakdown lane. Although volumes are relatively light for this maneuver, the volume of through traffic on Route 140 and the speeds travelled (speed limit is 50 mph but data shows vehicles travelling 3 to 6 mph over the posted limit) by the 140 traffic make turning vehicles a potential hazard. This would improve driver decision making for taking a turn movement.

3. Although left turn volume onto Old Gardner Road is low, a typical safety improvement is to add a shoulder bypass lane (example left) to encourage following through drivers to use the shoulder lane to bypass vehicles waiting to turn left. This results in less operator confusion.

4. Add recessed centerline and/or edge of road pavement markers to delineate the path of the approaches under adverse light or weather conditions when it can be difficult to ascertain the road geometrics.

5. Upgrade pavement markings and include arrows for permitted movements.

6. Identify the curb cut for the bike trail parking lot entrance/exit on Old Gardner Road.

7. Clear brush north and south of the bike trail parking lot opening. Brush on the west side of Old Gardner Road at the lot restricts the sight distance for exiting vehicles looking up and down Old Gardner Road. In addition, this should improve the awareness situation for southbound vehicles on Old Gardner Road as they approach the parking lot.

7.3.3 Route 140 at Teel Road

Issues and Alternatives

This non-signalized 4-way intersection currently operates with a LOS of "C" for both the A.M. and P.M. peak hours, respectively, for all maneuvers out of both Teel Road approaches. Left turns from Route 140 into Teel Road east or west bound operated at a LOS of "A" during the peak hours counted. Volumes for all turns for Teel Road were light averaging less than 2 vehicles per minute.

Route 140 at Teel Street Intersection Peak Hour Level of Service (LOS)

		Approach	Lane Group				
Community	Route 140 Intersection	Approach	Lane Group	AM		PM	
				Delay (sec.)	LOS	Delay (sec.)	LOS
Winchendon	Teel Street	Teel Street Eastbound	Left, Right, Thru	17.8	C	16.4	C
		Teel Street Westbound	Left, Right, Thru	23.3	C	21.3	C
		Route 140 Southbound	Left	7.9	A	9.2	A
		Route 140 Northbound	Left	9.4	A	8.5	A

The Safety Analysis revealed that three crashes occurred at this intersection indicating that safety is not a significant issue at this intersection.

Recommendations

Recommendations to address issues for this intersection include:

1. The following Advanced Warning signs, and other signs, should be added:
   - A 4-way Intersection Ahead warning sign on the right side of each Route 140 major approach and located just below each sign an Advance Street Name (example above right) plaque and possibly a Distance Ahead plaque (example below right).

- Two Stop Ahead (example right) warning signs on right side of both Teel Road minor approaches.

Install guide signs as needed.

All signs should be placed at appropriate distances.

2. Add recessed centerline and/or edge of road pavement markers to delineate the path of the approaches under adverse light or weather conditions when it can be difficult to ascertain the road geometrics

3. Upgrade pavement markings and include arrows for permitted movements.

7.3.4 Route 140 at Raymond Road

This is a '**T**' STOP controlled intersection. Although this intersection was not included in this study the same intersection warning sign recommendations for Old Gardner Road should be completed for this intersection. See Section *7.3.2 - Route 140 at Old Gardner Road* above for more.

7.4 Gardner Intersections

7.4.1 Route 140 at Green/Stone Street

Issues and Alternatives

This is a non-signalized offset intersection with four approaches. The Route 140 and Green Street right turns are channelized. Green Street currently operates with a LOS of "C" for the A.M. and "D" for the P.M. peak hours for all maneuvers out of the Green Street approach. Left turns from Route 140 into Green Street operated at a LOS of "A" during the peak hours counted. Left turns from Green Street into Route 140 operated at LOS "E" during the P.M. peak hours counted. Volumes for these turns into Green Street averaged approximately 3 vehicles per minute and for turns out of Green Street approximately 4 vehicles per minute in the P.M. peak hour. Stone Street traffic is not evaluated in this analysis as volumes are extremely low.

Route 140 Intersection at Green Street Peak Hour Level of Service (LOS)

		Approach	Lane Group				
Community	Route 140 Intersection	Approach	Lane Group	AM		PM	
				Delay (sec.)	LOS	Delay (sec.)	LOS
Gardner	Green Street	Green Street	Left	20.3	C	35.3	E
			Right	11.8	B	9.5	A
			All Lanes	18.3	C	33.8	D
		Route 140 Northbound	Left	8.5	A	7.7	A

The Safety Analysis revealed that thirteen crashes occurred at this intersection. The EPDO point total of 37 indicates that safety is a significant issue at this intersection.

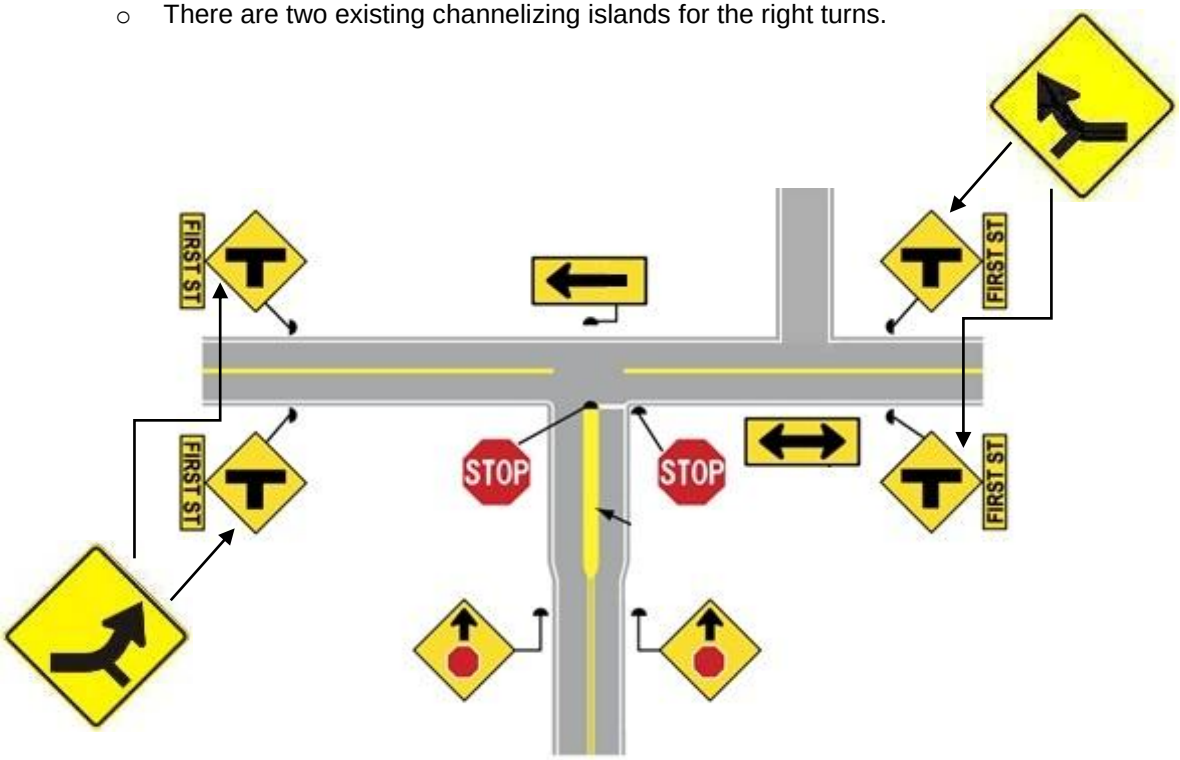
Recommendations

Recommendations to address issues for this intersection include:

1. The following Advanced Warning signs, which are conceptualized in the diagram below, and other signs should be added:
   - Four Curve Ahead with Offset Side Roads (examples shown are of one side road only) warning signs on both sides of the Route 140 major approaches should replace

the four '**T**' Intersection Ahead warning signs shown in the diagram below and located just below it each sign there should be two Advance Street Name plaques for each street and possibly a Distance Ahead plaque.

- A Two-Direction Large Arrow warning sign should be added for the Stone Street approach only. A Left Turn Direction Large Arrow warning sign should be added for left turns from Green Street and a No Right Turn regulatory sign (not shown) should be added.
- A Stop Ahead warning sign already exist on the right side of the Green Street minor approach but an additional sign should be added on the right side of the street.
- Two regulatory Stop signs exist for the left turn.
- One regulatory Yield sign exist for the Green Street channelized right turn.
- There is an existing splitter, or divisional, island on the Green Street approach.
- There are two existing channelizing islands for the right turns.



Install guide signs as needed.

All signs should be placed at appropriate distances.

2. Recessed centerline pavement markers; recessed channelized island and splitter island pavement markers exist. Add other markers as needed.

3. Install an overhead flashing beacon over the center of the intersection.

4. Upgraded pavement markings already exist. Maintain and add other markings as needed and include arrows for permitted movements.

5. Add a protected, or exclusive, left turn lane (example photos on the following page) on the Route 140 north/west bound approach for left turning traffic onto Green Street. However, instead of a median bubble a raised median similar to the one described in section 7.2.1 above may be installed.




The left turn lane would provide protection because it would include a median bubble with crosshatching (example above) that gradually directs vehicles to the right and narrows the breakdown lane on both sides of the road while creating a center lane for storing and protecting left turning vehicles. A median bubble on the other side of the Green Street approach would direct opposing lane through vehicles to the right which would protect left turning vehicles. The photos above provide an example of a recently installed protected left turn lane at an intersection that used most of the breakdown lane. Before this installation, through vehicles would often be indecisive and stop behind left turning vehicles.

7.4.2 Route 140 at Matthews Street

Issues and Alternatives

This non-signalized '**T**' intersection currently operates with a LOS of "A" for the A.M. and "A" for the P.M. peak hours for all maneuvers out of the Matthews Street approach. Left turns from Route 140 into Matthews Street operated at a LOS of "A" during the peak hours counted. Left turns from Matthews Street into Route 140 operated at LOS "A" during the P.M. peak hours counted. Volumes for left turns out of Matthews Street in the P.M. peak hour averaged just over one (1) vehicle per minute. Left turns into Matthews Street from Route 140 were heaviest in the A.M. peak hour averaging 2.5 vehicles per minute. During the P.M. peak hour this volume dropped to just over one (1) vehicle per minute.

Route 140 Intersection at Matthews Street Peak Hour Level of Service (LOS)

		Approach	Lane Group				
Community	Route 140 Intersection	Approach	Lane Group	AM		PM	
				Delay (sec.)	LOS	Delay (sec.)	LOS
Gardner	Matthews Street	Matthews Street	Left and Right	9.6	A	9.6	A
		Route 140 Northbound	Left	8.7	A	7.9	A

The Safety Analysis revealed that three crashes occurred at this intersection indicating that safety is not a significant issue at this intersection.

Recommendations

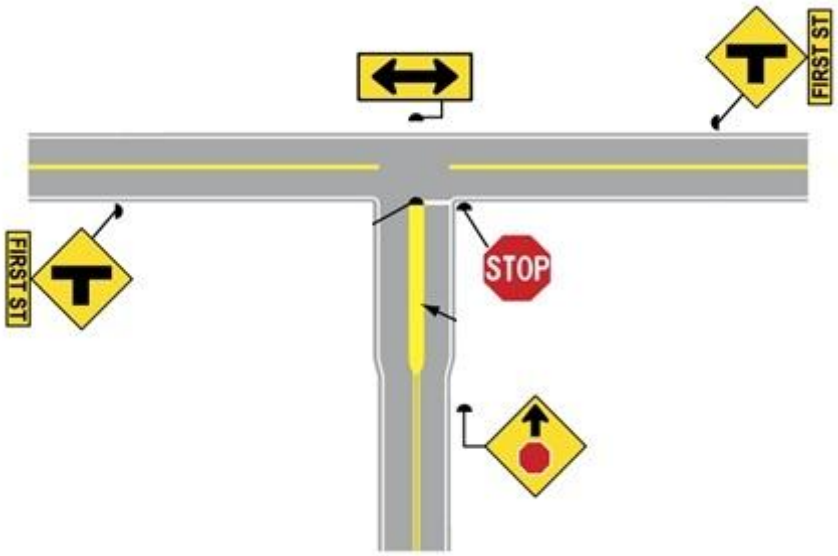
Recommendations to address issues for this intersection include:

1. The following Advanced Warning signs, which are conceptualized in the diagram below, and other signs should be added:
    - A '**T**' Intersection Ahead warning sign on the right side of each Route 140 major approach and located just below it each sign there should be an Advance Street Name plaque and possibly a Distance Ahead plaque.
    - Two-Direction Large Arrow warning sign for traffic turning from Matthews Street.
    - A Stop Ahead warning sign on the right side of Matthews Street minor approach.

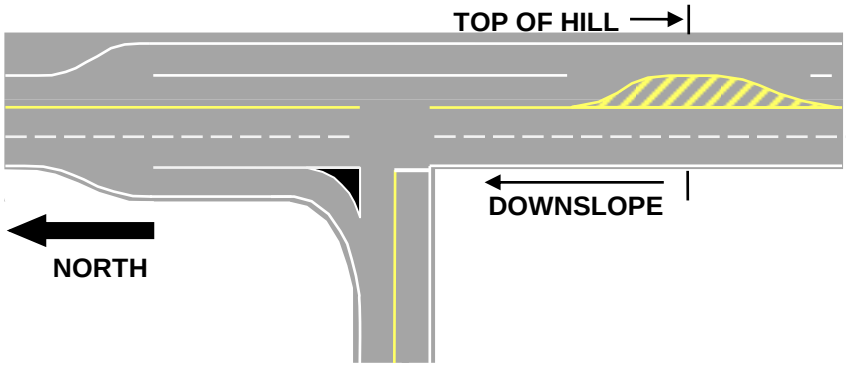
    Install guide signs as needed.

    All signs should be placed at appropriate distances.

2. Recessed centerline pavement markers already exist. Add other markers as needed.
3. Install an overhead flashing beacon over center of intersection.
4. Upgraded pavement markings already exist. Maintain and add other markings as needed and include arrows for permitted movements.



5. Add the following protected, or exclusive, right and left turn lanes and pavement markings as conceptualized in the diagram below. These improvements are recommended because Matthews Street is located on a downslope that creates unsafe safety conditions for Route 140 through traffic and left turn traffic into and out of the street. Also, right turns into Matthews Street cause a problem for heavy trucks using the climbing lane.
    - Add a protected left turn lane on the Route 140 north/west bound approach for left turning traffic onto Matthews Street. The left turn lane would provide protection because it would include a Median Bubble with crosshatching that gradually directs all vehicles to the right and narrows the breakdown lane. This creates a lane for storing and protecting left turning vehicles and also an auxiliary right lane for through traffic.
    - Protect left turning traffic exiting Matthews Street as it enters the north/west bound lane by extending the new auxiliary right lane a few hundred yards to allow the vehicles to get up to speed then merge into one lane.
    - Add a protected right turn lane on the Route 140 south/east bound approach for right turning traffic onto Matthews Street. The right turn lane would provide protection because vehicles would move out of the travel lane allowing following heavy trucks to maintain their speed until they reach the top of the hill.



NOTE: These recommendations are related to the recommendation of moving the north/west bound merge lane from the right lane to the left lane. See the Corridor Road Segment recommendations above for more on this.

6. Many crashes with wildlife occur in area around Matthews Street and the area is known as a wildlife corridor. Add Wildlife Crossing (example right) well in advance of Matthews Street to warn vehicle operators of a potential animal in the roadway. Other suggestions include installing wildlife fencing with a tunnel or constructing a wildlife bridge over Route 140.

7.4.3 Route 140 at Pearl Street (Route 101)

Issues and Alternatives

This signalized intersection currently operates at an overall LOS of "B" and "C" for the A.M. and P.M. peak hours respectively. Total traffic volumes through this intersection were relatively consistent between the A.M. and P.M. peak hours with 1,537 vehicles and 1,587 vehicles respectively. As expected the heaviest volumes were found on Route 140 north and south bound. However, a significant difference in the north/south split can be seen between the A.M. and P.M. time periods. In the A.M. peak hour, north and south bound volumes were split approximately 51 percent southbound and 49 percent northbound. For the P.M. peak hour, this split changes to 30 percent southbound and 70 percent northbound further highlighting the commuter aspects of this roadway.

Route 140 Intersection at Pearl Street (Route 101) Peak Hour Level of Service (LOS)

	Intersection - Overall					Approach	Lane Group				
	Route 140	AM		PM			Lane	AM		PM	
Community	Intersection	Delay (sec.)	LOS	Delay (sec.)	LOS		Group	Delay (sec.)	LOS	Delay (sec.)	LOS
Gardner	Route 101	19.8	B	21	C	Rt 101 Eastbound	Left Turn	24.6	C	26.4	C
							Thru	26.4	C	29.9	C
							All Lanes	26.3	C	29.7	C
						Rt 101 Westbound	Left Turn	28.6	C	29.7	C
							Thru	26.7	C	29.1	C
							All Lanes	27.7	C	29.3	C
						Rt 140 Northbound	Left Turn	38.5	D	36.5	D
							Thru	16.1	B	17.5	B
							All Lanes	16.3	B	17.9	B
						Rt 140 Southbound	Left Turn	39.8	D	37.6	D
							Thru	16.0	B	14.5	B
							All Lanes	17.5	B	17.4	B

The Safety Analysis revealed that four crashes occurred at this intersection indicating that safety is not a significant issue at this intersection.

Recommendations

Recommendations to address issues for this intersection include:

1. The following Advanced Warning signs, and other signs, are recommended:
    - A 4-way Intersection Ahead warning sign on the right side of each Route 140 major approach and located just below each sign there should be an Advance Street Name plaque and possibly a Distance Ahead plaque.
    - Signal Ahead warning signs already exist on all the approaches.
    - Be Prepared To Stop warning signs on all approaches.

    Install guide signs as needed.

    All signs should be placed at appropriate distances.

2. Add recessed centerline and/or edge of road pavement markers to delineate the path of the approaches under adverse light or weather conditions when it can be difficult to ascertain the road geometrics.
3. Upgraded pavement markings already exist. Maintain and add other markings as needed.
4. To address the excessive vehicular speed issue at this intersection add in-lane rumble strips (photo below left) and/or 'SLOW SPEED AHEAD' advanced word pavement markings in advance of the approaches (photo below right shows layout of word markings only):

7.4.4 Route 140 at Smith Street

This is a '**T**' STOP controlled intersection. Although this intersection was not included in this study the same recommendations for Colony Road should be completed for this intersection. See Section *7.4.4 - Route 140 at Colony Road* below for more information.

7.4.5 Route 140 at Colony Road

Issues and Alternatives

This non-signalized '**T**' intersection currently operates with a LOS of "B" for the A.M. and "C" for the P.M. peak hours for all maneuvers out of the Colony Road approach. Left turns from Route 140 into Colony Road operated at a LOS of "A" during the peak hours counted. Volumes for these turns into and out of Colony Road averaged less than 1 vehicle per minute. The highest volumes occurred in the A.M. time period when 112 vehicles turned right from Route 140 northbound into Colony Road over a 2 hour period.

Route 140 Intersection at Colony Road Peak Hour Level of Service (LOS)

		Approach	Lane Group				
Community	Route 140 Intersection	Approach	Lane Group	AM		PM	
				Delay (sec.)	LOS	Delay (sec.)	LOS
Gardner	Colony Road	Colony Road	Left, Right	13.3	B	15.5	C
		Route 140 Southbound	Left	8.7	A	9.3	A

The Safety Analysis revealed that one crash occurred at this intersection indicating that safety is not a significant issue at this intersection.

Recommendations

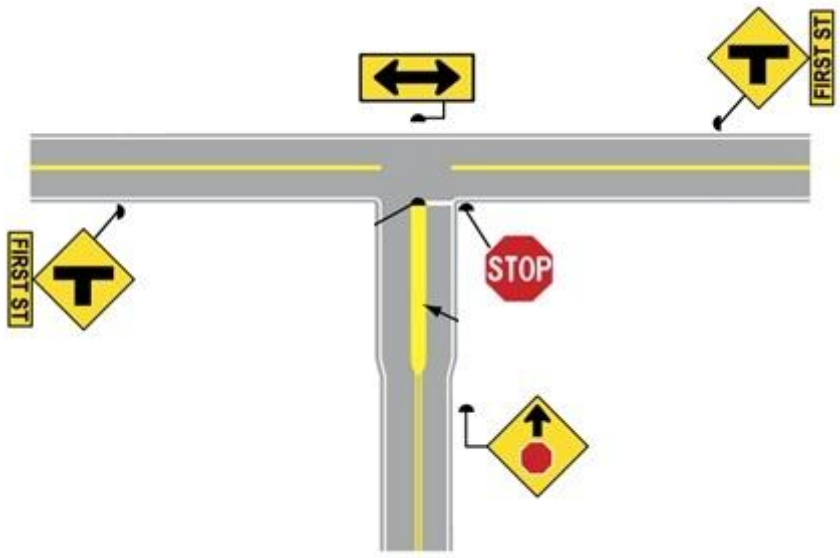
Recommendations to address issues for this intersection include:

1. The following Advanced Warning signs, which are conceptualized in the diagram below, and other signs should be added:
   - A '**T**' Intersection Ahead warning sign on the right side of each Route 140 major approach and located just below it each sign there should be an Advance Street Name plaque and possibly a Distance Ahead plaque.
   - Two-Direction Large Arrow warning sign for traffic turning from Colony Road.
   - A Stop Ahead warning sign on the right side of the Colony Road minor approach.

   Install guide signs as needed.

   All signs should be placed at appropriate distances.

2. Add recessed centerline and/or edge of road pavement markers to delineate the path of the approach under adverse light or weather conditions when it can be difficult to ascertain the road geometrics.



3. Add a channelizing line for right turns into Colony Road from Route 140 to guide and protect vehicles turning into Colony Road.
4. Upgrade pavement markings and include arrows for permitted movements.

7.5 Westminster Intersections

7.5.1 Route 140 at Betty Spring Road

Issues and Alternatives

This non-signalized '**T**' intersection but the Route 140 southbound and Betty Spring Road right turns are channelized. Betty Spring Road left turns currently operates with a LOS of "E" for the A.M. and "D" for the P.M. peak hours counted. Left turns from Route 140 into Green Street operated at a LOS of "A" during the peak hours counted. Left turn volumes out of Betty Spring Road averaged less than 0.5 vehicles per minute during the A.M. and P.M. peak hours. Left turns into Betty Spring Road were heaviest during the P.M. peak hour with 200 vehicles counted however this averages out to approximately 3 vehicles per minute.

Route 140 Intersection at Betty Spring Road Peak Hour Level of Service (LOS)

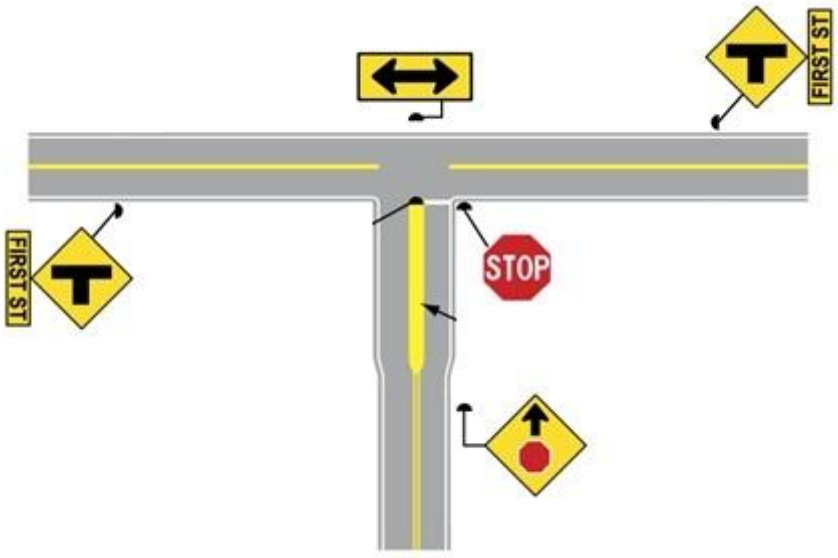
		Approach	Lane Group				
Community	Route 140 Intersection	Approach	Lane Group	AM		PM	
				Delay (sec.)	LOS	Delay (sec.)	LOS
Westminster	Betty Spring Road	Betty Spring Road	Left	36	E	33.1	D
			Right	30.2	D	11.5	B
			All Lanes	30.7	D	13.2	B
		Route 140 Northbound	Left	10	A	8.8	A

The Safety Analysis revealed that three crashes occurred at this intersection indicating that safety is not a significant issue at this intersection.

Recommendations

Existing intersection geometry and pavement markings provide adequate information to a vehicle operator to negotiate the intersection. Pavement markings need to be maintained and other markings should be added as needed. Further recommendations for this intersection include:

1. The following Advanced Warning signs, which are conceptualized in the diagram below, should be added:
    - A '**T**' Intersection Ahead warning sign on the right side of each Route 140 major approach and located just below it each sign there should be an Advance Street Name plaque and possibly a Distance Ahead plaque.



- Two-Direction Large Arrow warning sign for traffic turning from Betty Spring Road.
- A Stop Ahead warning sign on the right side of the Betty Spring Road minor approach.

Install other guide signs as needed.

All signs should be placed at appropriate distances.

2. Add recessed centerline and/or edge of road pavement markers to delineate the path of the approaches under adverse light or weather conditions when it can be difficult to ascertain the road geometrics.

7.5.2 Route 140 at Sargent Street

This is a 4-way STOP controlled intersection. Although this intersection was not included in this study the same recommendations for Teel Road in Winchendon should be completed for this intersection. See Section *7.3.3 - Route 140 at Teel Road* above for more.

7.5.3 Route 140 at Simplex Drive/Route 2 Westbound Ramp

Issues and Alternatives

A formal LOS analysis was not conducted at this location due to issues related to counts and recent construction on the Route 2 bridges over Route 140 that affects travel patterns. However, from an observational review this signalized intersection appears to operate at an acceptable level. Excessive delays or backups were not observed on any of the approaches.

The Safety Analysis revealed that eight crashes occurred at this intersection indicating that safety is not a significant issue at this intersection.

Recommendations

Recommendations to address issues for this intersection include:

1. The following Advanced Warning signs are recommended:
   - A 4-way Intersection Ahead warning sign on the right side of each Route 140 major approach and located just below it each sign there should be an Advance Street Name plaque and possibly a Distance Ahead plaque.
   - Signal Ahead warning signs exist on the southbound approach but not on the northbound approach due to the construction of the bridge. The sign also exist on the Simplex Drive approach.
   - Be Prepared To Stop warning signs on all approaches.

   Install other guide signs as needed.

   All signs should be placed at appropriate distances.

2. Add recessed centerline and/or edge of road pavement markers to delineate the path of the approaches under adverse light or weather conditions when it can be difficult to ascertain the road geometrics.
3. Upgraded pavement markings already exist. Maintain and add other markings as needed.

8.0 SUGGESTED NEXT STEPS

8.1 Project Development

Project Development is the process that takes a transportation improvement from concept through construction.

Every year the Montachusett region receives federal and state funds for projects to improve the transportation network in local communities. These funds and projects are prioritized through the Montachusett Metropolitan Planning Organization, a regional advisory group that annually develops the Montachusett Transportation Improvement Program (TIP).

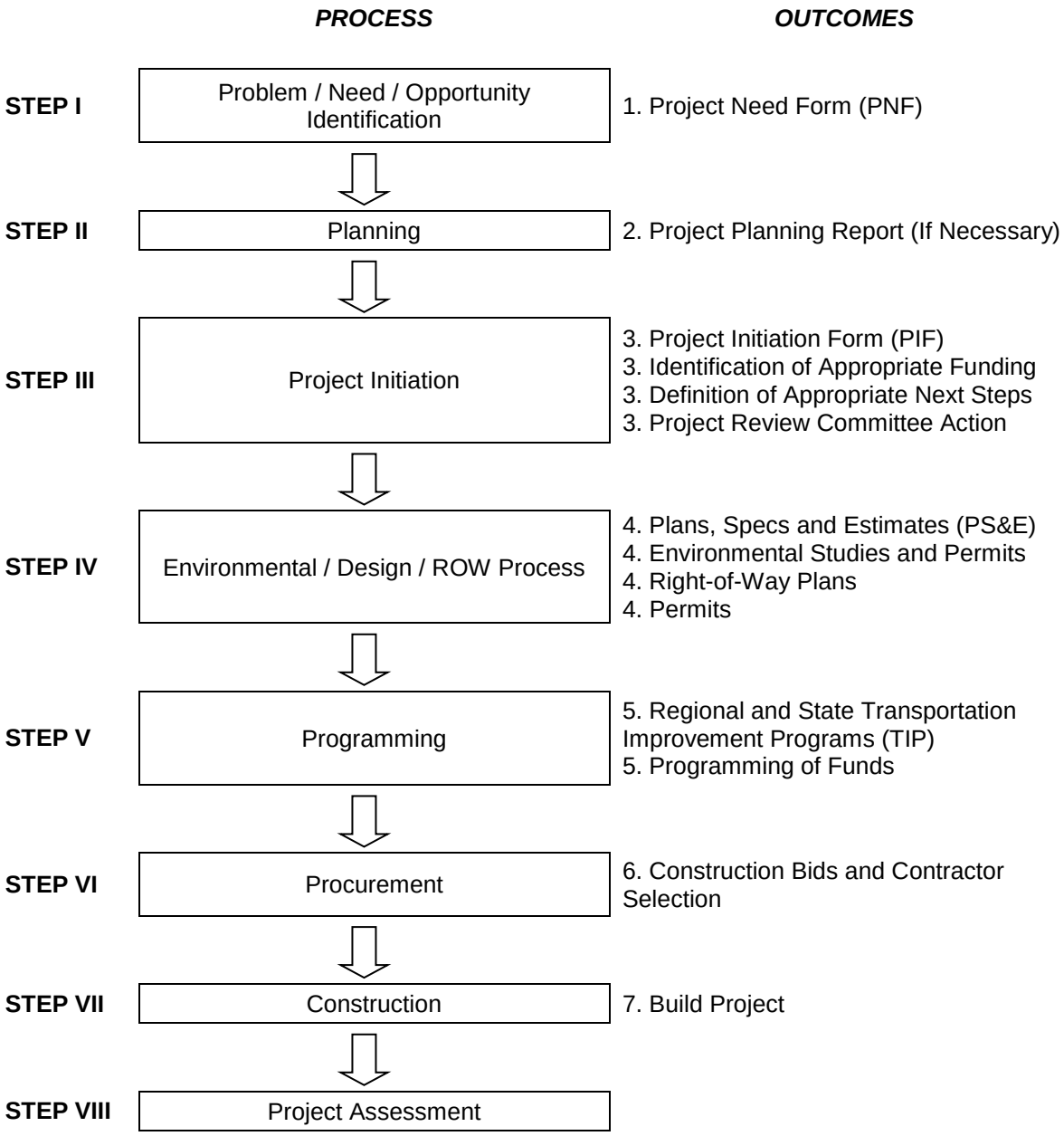
For a community to receive funds, the project must follow a multi-step review and approval process required by the Massachusetts Department of Transportation (MassDOT) Highway Division. This process is summarized in the flowchart below.

Project proponents are required to follow this process whenever MassDOT Highway Division is involved in the decision-making process. The project development procedures are, therefore, applicable to any of the following situations:

- When MassDOT is the proponent; or
- When MassDOT is responsible for project funding (state or federal-aid projects); or
- When MassDOT controls the infrastructure (projects on state highways).

Projects with local jurisdiction and local funding sources are not required to go through this review process unless the project is located on the National Highway or Federal-Aid Systems. The segment of Route 140 that is part of this corridor profile is part of the National Highway System.

Project Development Process



Source: MassDOT Highway Division

The project development process is designed to progressively narrow the projects focus in order to develop a project that addresses identified needs at that location. There should be opportunities for public participation throughout.

The eight steps in the above figure are described in detail in Chapter 2, Project Development Guide of the MassDOT Highway Division Design Guidebook (http://www.mhd.state.ma.us/default.asp?pgid=content/designGuide&sid=about).

In summary, to get a project constructed, a community should:

1. Meet with the District Office of the MassDOT Highway Division to review and discuss the potential project. The District office can provide the community with information and feedback about the possible project's scope, cost, issues, etc.
2. Submit a Project Need Form (PNF), along with any support materials, on the potential project to the District office.
3. After review and feedback from MassDOT Highway Division on the PNF, a Project Initiation Form (PIF), again with any supporting materials, is prepared and submitted to the District office.
4. MassDOT and the Project Review Committee (PRC) act upon the PIF. If the project is approved by the PRC, the community is notified and, if applicable, initiates the design process for the project.
5. The municipality hires a design consultant and also begins work on the right of way plans as well as any permits, local approvals, etc.
6. During this phase the project is incorporated into the regional Transportation Improvement Program (TIP) by the MPO. Placement and prioritization of the project is based upon available funds, evaluation criteria scoring, design status and public support and comments.
7. Design public hearing is held at the 25% design phase.
8. Design progresses to 100% and all plans, specifications and estimates (PS&E) are completed. Project is then ready for advertisement by MassDOT.

Copies of the PNF and PIF can be found in the Technical Appendix of this report.

8.2 Montachusett Metropolitan Planning Organization (MMPO)

All urbanized areas with a population greater than 50,000 are required by the U.S. Department of Transportation (USDOT) Federal regulations to designate an MPO for the area. The establishment of an MPO is necessary for the State to receive Federal transportation funds. In the Montachusett Region, the Montachusett Regional Planning Commission (MRPC) serves as staff for the MPO. The MRPC staff annually produces a Transportation Improvement Program (TIP) and Unified Planning Work Program (UPWP). In addition, a Regional Transportation Plan is updated periodically to reflect the changing transportation needs of the area. A 2012 Regional Transportation Plan was prepared and endorsed by the MPO on August 24, 2011.

The MPO in the Montachusett Region (after reorganization in October 2001) is currently comprised of the following signatories:

- Secretary and CEO of the Massachusetts Department of Transportation (MassDOT);
- Administrator of MassDOT Highway Division;
- Chairman of the MRPC;
- Chairman of Montachusett Regional Transit Authority (MART)*;
- Mayor of the City of Fitchburg
- Mayor of the City of Gardner
- Mayor of the City of Leominster
- Four Representatives from the four identified Subregions of towns in the MRPC region

*This member will be represented by one of the Mayors from Fitchburg, Gardner or Leominster.

The MMPO Subregions are composed as such:

Subregion 1 - Athol, Hubbardston, Petersham, Phillipston, Royalston, Templeton, Winchendon;
Subregion 2 - Ashburnham, Ashby, Groton, Townsend, Westminster;
Subregion 3 - Ayer, Harvard, Lunenburg and Shirley;
Subregion 4 - Clinton, Lancaster, Sterling.

These 10 members serve as the MPO Policy Board for the regional "3C" (comprehensive, cooperative, and continuing) transportation planning process.

8.3 The Transportation Improvement Program (TIP) – Development and Process

The TIP is a prioritized listing of transportation projects proposed for implementation during the future four federal fiscal years and is updated every year by the MMPO. TIP projects are identified by funding category so that where necessary priorities may be established for projects within each funding program. Unless otherwise noted, the agency responsible for implementing highway projects is the Massachusetts Department of Transportation Highway Division and, for transit projects, the Montachusett Regional Transit Authority.

MRPC staff annually develops the TIP project listing from sources that include the MassDOT's Project Information System, MassDOT Highway Division Districts 2 and 3, local officials, the Montachusett Joint Transportation Committee (MJTC), the Long and Short Range Elements of the Regional Transportation Plan (RTP), and the Montachusett Metropolitan Planning Organization (MPO).

Prioritization of projects is based upon input from MassDOT regarding project design and implementation status, local prioritization from chief elected officials, scoring of the project based upon the Transportation Evaluation Criteria (TEC), fiscal constraints for the Montachusett Region, consensus vote by the MJTC and formal adoption by the MPO. Throughout this procedure, input from local citizens are reviewed and considered where appropriate in the prioritization process.

An initial project listing is obtained from MassDOT and the local communities. These projects are then reviewed one by one to ascertain their current status as to design and potential advertising dates. Projects are then scored and evaluated utilizing the Transportation Evaluation Criteria (TEC) developed by the MassDOT. The TEC is a series of criteria to "be applied by the appropriate implementing agency during the project development stage to ensure that our limited budgetary and staff resources are committed to the best proposals; to assist the MPO process of programming federal funding through the regional Transportation Improvement Programs; and to examine existing projects in the pipeline to determine which should ultimately proceed to design and construction." Final scores based upon the TEC then become part of the decision and prioritization process.

From this information, a project listing by fiscal year is developed. This fiscal listing is then compared to the Federal funding target allocation for the region. The listing is then reviewed by state and local officials, as well as the MJTC and the MMPO, to determine fiscal constraint by funding year. Any problems are then identified. Through the MMPO, projects are adjusted and prioritized in order to resolve the identified problems.

In conformance established procedures with the MMPO Public Participation Program (PPP), developed to ensure a "proactive public involvement process ... in developing plans and TIPs, the draft TIP is distributed for a federally mandated 30 day public review and comment period. Following completion of the 30 day review period, any comments or issues received are addressed and reflected in the final TIP. This document is then reviewed by the MJTC, MRPC and MMPO and is recommended for endorsement by the MMPO at a subsequent MMPO meeting.

The fully endorsed TIP is then distributed to Federal, State and local agencies and groups, including FTA, FHWA, the Environmental Protection Agency (EPA) and the Department of Environmental Protection (DEP) again in conformance with the PPP.

At any time during the Federal Fiscal Year, an amendment to the TIP can be developed and endorsed by the MMPO following similar procedures established for the TIP, i.e. a draft amendment is prepared and released for a 30 day public review and comment period, reviewed by the MJTC, MRPC and the MMPO and endorsed if deemed appropriate.

8.4 Funding Sources

Several funding sources exist on the federal and state level that may be applicable to the preferred projects identified by the communities within this report. As the municipality begins the project development process, the following funding sources/options may come into play during the design, implementation and construction phases. The community should note that a funding program need not be identified as part of the PNF or PIF process but can be determined as the project limits and scope become defined.

The following is a brief listing of Federal, State and Local funding programs that may be potential sources for road, bridge, trail and sidewalk projects identified in this corridor profile. For further information on some of these programs please contact the MRPC or MassDOT Highway Division.

Federal Sources:

- *National Highway System (NHS) Funds* - The program provides funding for improvements to rural and urban roads that are part of the NHS, including the Interstate System and designated connections to major intermodal terminals. Under certain circumstances, NHS funds may also be used to fund transit improvements in NHS corridors.
- *Surface Transportation Program (STP) Funds* - The Surface Transportation Program provides flexible funding that may be used by States and localities for projects on any Federal-aid highway, including the NHS, bridge projects on any public road, transit capital projects and intracity and intercity bus terminals and facilities.
- *Congestion Mitigation and Air Quality (CMAQ) Improvements Program Funds* - The Congestion Mitigation and Air Quality Improvement Program (CMAQ) provides funding for projects and programs in air quality nonattainment and maintenance areas for ozone, carbon monoxide (CO), and particulate matter (PM-10, PM-2.5) which reduce transportation related emissions. [123 USC 149(a)]
- *Highway Safety Improvement Program (HSIP)* - SAFETEA-LU enacted in August 2005 authorized funding for the Federal surface transportation programs for highways, highway safety, and transit for 2005 to 2009. As part of this legislation, funding was increased in the HSIP and, additionally, required each state to develop a Strategic Highway Safety Plan (SHSP) that addresses the critical "4Es" of highway safety (engineering, enforcement, education, and emergency medical services). The HSIP is a "core funding" program administered by the FHWA, which apportions funds to states for a range of eligible activities focused primarily on infrastructure-related safety improvements. HSIP projects must meet eligibility criteria outlined by the state, FHWA and the MPO's.
- *Scenic Byways Program Funds* -The program recognizes roads having outstanding scenic, historic, cultural, natural, recreational, and archaeological qualities and provides for designation of these roads as National Scenic Byways, All-American Roads or America's Byways.
- *Transportation, Community and System Preservation (TCSP) Program Funds* - The TCSP Program is intended to address the relationships among transportation community, and system preservation plans and practices and identify private sector-based initiatives to improve those relationships.
- *Transportation Enhancement Program Funds* - The Transportation Enhancements Program strengthens the cultural, aesthetic, and environmental aspects of the Nation's intermodal transportation system. As of November 1, 2010, Massachusetts has revised the TE program development process in order to eliminate confusion, redundancy and time. The proposed TE projects now enter the MassDOT Highway Division project development process directly. TE project proponents submit a Project Need Form (PNF) then a Project Initiation Form (PIF) to initiate the Highway Division project development process
- *Safe Routes to School (SR2S) Program Funds* -The Safe Routes to School Program enables and encourages children, including those with disabilities, to walk and bicycle to school; to make walking and bicycling to school safe and more appealing; and to facilitate the planning,

development and implementation of projects that will improve safety, and reduce traffic, fuel consumption, and air pollution in the vicinity of schools.

- *Recreational Trails Program* – The Recreational Trails Program provides funds to the States to develop and maintain recreational trails and trail-related facilities for both non-motorized and motorized recreational trail uses.

State Sources:

- *Community Development Block Grants (CDBG) Funds* - The CDBG program is a federally funded, competitive grant program designed to help small cities and towns meet a broad range of community development needs.
- *Public Works Economic Development (PWED) Funds* -The PWED program was created by the State Legislature to assist municipalities in funding transportation infrastructure for the purpose of stimulating economic development.
- *Small Town Road Assistance Program (STRAP) Funds* -The STRAP program provides funding for transportation projects that improve public safety and promote economic development in small towns with a population less than 7,000. Eligible costs include: (1) Project design costs; (2) Cost of updating plans, specifications and estimates where preliminary engineering and related planning has already been undertaken; (3) Costs associated with standard construction activities as allowed under M. G. L., Chapter 90. Section 34, Subsection 2(a); (4) Payment for outside engineering services for design and construction provided that engineering services will be performed by a registered professional engineer or a registered land surveyor with a background of satisfactory performance.
- *Community Development Action Grants (CDAG)* -The CDAG program provides funding for publicly owned or managed projects that have a significant impact on the overall economic condition of a city or town, including activities that will significantly improve the conditions of low and moderate income persons through: (a) the support of workforce housing needs across a range of incomes; (b) the generation and/or retention of long term employment; (c) the leveraging of significant private investment; and (d) the improvement of physical conditions
- *Massachusetts Opportunity Relocation and Expansion (MORE) Funds* - The Massachusetts Opportunity Relocation and Expansion (MORE) Jobs Capital Program provides grant funding for public infrastructure improvements needed to support business expansion in the Commonwealth of Massachusetts. The program stimulates job creation and economic growth across the state by providing the public infrastructure development companies need.

Local Sources:

- *Chapter 90 Transportation Funds* -The Chapter 90 Program entitles municipalities to reimbursement of documented expenditures for Capital Improvement Projects for Highway Construction, Preservation and Improvement Projects that create or extend the life of Capital Facilities under the provisions of General Laws Chapter 90, Section 34, Clause 2(a) on approved Projects. Eligible Highway Construction projects include resurfacing, microsurfacing, pug mill mix (cold mix), drainage, intersections, sidewalks, footbridges, berms and curbs, traffic controls and related facilities, right-of-way acquisition, street lighting (excluding operating costs and decorative enhancements), bridges, and tree planting/landscaping in association with a project.
- *Tax Increment Financing (TIF)* -Tax Increment Financing (TIF) is an alluring tool that allows municipalities to promote economic development by earmarking property tax revenue from increases in assessed values within a designated TIF district. The rules for tax increment financing, and even its name, vary across the 48 states in which the practice is authorized. TIF expenditures are often debt financed in anticipation of future tax revenues.
- *Business Improvement Districts (BID)* - Business Improvement Districts (BID) are special assessment districts in which property owners vote to initiate, manage and finance supplemental services or enhancements above and beyond the baseline of services already provided by their local city or town governments. A special assessment, or common area fee,

is levied only on property within the district and the assessments are collected and expended within the district for a range of services and/or programs, including marketing and public relations, improving the downtown marketplace or city/town center, capital improvements, public safety enhancements, and special events.
- Specific local taxes to residential property owners for sidewalk construction and/or repair
- Town Meeting Warrant articles/budgetary line items
- Subdivision Regulation requirements for developers to construct sidewalks for new residential developments and similar regulations for commercial developments

Other Possible Funding Sources:

- Private contributions (foundations, businesses, individuals, etc.)
- Local bank grants, loans or bonds

Other Ideas for Sidewalk/Trail Construction:

- Donated time and/or materials from local contractors
- Volunteers to clear and build trails (Wachusett Greenways model)
- Eagle Scout projects
- Tax credits for citizens who repair/build public sidewalks in front of their property with their own funds

8.5 Highway Safety Improvement Program (HSIP)

As indicated above, several programs have eligibility requirements that must be met before these specific funds can be allocated to the project. In particular, one program HSIP may have the potential to address potential projects outlined in this corridor profile. Discussions with MassDOT, the Montachusett MPO and the MRPC can help to determine project eligibility. The following provides additional information on the HSIP program.

- **What is HSIP?**
  HSIP is the Highway Safety Improvement Program. The Safe, Accountable, Flexible, Efficient Transportation Equity Act - A Legacy for Users (SAFETEA-LU) enacted in August 2005 authorized funding for the Federal surface transportation programs for highways, highway safety, and transit for 2005 to 2009. As part of this legislation, funding was increased in the HSIP and, additionally, required each state to develop a Strategic Highway Safety Plan (SHSP) that addresses the critical "4Es" of highway safety (engineering, enforcement, education, and emergency medical services). The HSIP is a "core funding" program administered by the FHWA, which apportions funds to states for a range of eligible activities focused primarily on infrastructure-related safety improvements. (Source: http://safety.fhwa.dot.gov/safetealu/hsipprocguide1.htm)

- **What is SHSP?**
  The Strategic Highway Safety Plan (SHSP) encourages states to take a multidisciplinary and multi-agency look at highway safety problems and solutions on all public roads, and to share resources to implement countermeasures that will be most effective in terms of reducing deaths and serious injuries. Through the process of developing an SHSP, a state analyzes safety data and establishes strategies to address these problems with a comprehensive set of actions incorporating the "4Es" of safety. States are required to adopt strategic and performance goals in their SHSPs that "focus resources on areas of greatest need." The Massachusetts SHSP was completed in September 2006 and provides a comprehensive framework, and specific goals and objectives, for reducing highway fatalities and serious injuries on all public roads. The statewide document, developed by MassDOT in a cooperative process, includes input from public and private safety stakeholders. (Source:

http://www.mhd.state.ma.us/default.asp?pgid=content/traffic/shsp&sid=level2) The Massachusetts SHSP is also available online at this web link.

- **How is a HSIP Project Determined?**
  As part of the implementation of the HSIP program in Massachusetts, MassDOT has been working with FHWA and the Metropolitan Planning Organizations (MPO's) to establish a selection process for safety projects through a HSIP Task Force. The task force includes personnel from MassDOT, the Massachusetts Association of Regional Planning Agencies (MARPA) and FHWA. This task force will review candidate projects submitted by the MPOs and Regional Planning Agencies (RPAs) based upon criteria established and determined by the task force. All candidate projects will be approved by the HSIP task force.

- **What is an HSIP Eligible Project?**
  Candidate projects submitted by the RPAs to the task force will be reviewed based upon factors such as number of crashes, crash severity, traffic volumes and location, and recommended countermeasures. MassDOT HSIP Project Selection Criteria states that one of three documents must be prepared in order for a candidate location to be considered. Either one of these documents can be used to feed into Steps one through three of the Project Development Process. The HSIP Project Selection Criteria states that "All HSIP candidate locations will require an accompanying Road Safety Audit (RSA) report, or an engineering or planning report to determine eligibility. The report must include a detailed analysis of crash data/crash reports to identify the nature of the crash problem as well as identify appropriate corrective measures to address the problem." These studies should provide crash analysis and many of the corrective measures needed to address the problems. MassDOT has indicated that HSIP should allow enough flexibility to accomplish a number of goals and should include, but not be limited to, the following:

    - Working on eliminating locations from the Top Intersection Crash Locations
    - Funding lighting projects based upon locations with a high incidence of crashes that occurred under dark, nighttime conditions.
    - Funding Low Cost Safety Improvements based upon the results of Road Safety Audits
    - Reducing pedestrian crash locations by using crash data to select locations
    - Reducing median crossover crashes at high incidence locations
    - Reducing bicycle crash locations by using crash data to select locations
    - Reducing lane departure locations by using crash data to select locations and better understand safety deficiencies
    - Providing funding for public service announcements

- **What is a Road Safety Audit (RSA)?**
  A RSA is a formal on-site safety performance examination of an existing or future transportation facility (roadway, intersection, etc.) by an independent, multidisciplinary audit team that studies the facility from a variety of perspectives. Potential RSA team members include people with expertise in disciplines such as roadway design; road safety; traffic operations; road maintenance and construction; law enforcement; local officials; first responders; pedestrian and bicycle issues; and possibly an individual who is not involved in any of these disciplines but who is extremely familiar with the safety issues of the facility. The final RSA provides qualitative estimates and reports on potential road safety issues and also identifies opportunities for improvements in safety for all road users. The MRPC recommends that an RSA be completed based upon the benefits outlined above.

TECHNICAL APPENDIX

Published Under Separate Cover

HSIP Criteria

Traffic Volumes

Speed Data

Vehicle Classification

Turning Movement Counts

Capacity Analysis

Lane Departure Road Safety Audit for Route 140 Gardner, MA

Crash Tables