Waterbury Bridge #36
Feasibility Study
Existing Conditions Report

September 28, 2018

Prepared for:

Central Vermont Regional Planning Commission

Prepared by:

Stantec Consulting Services
55 Green Mountain Drive
South Burlington, VT 05403

Stantec

Sign-off Sheet

This document entitled Waterbury Bridge #36 Feasibility Study: Existing Conditions Report was prepared by Stantec Consulting Services Inc. (“Stantec”) for the account of Central Vermont Regional Planning Commission (the “Client”). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by Ruthanne Daniels

(signature)

Reviewed by Sean Neely

(signature)

Approved by APPROVED
By Thomas Knight PE at 1:21 pm, Oct 01, 2018

(signature)

Table of Contents

1.0 EXECUTIVE SUMMARY

The Waterbury Bridge #36 Feasibility Study was undertaken in 2018 by Central Vermont Regional Planning Commission (CVRPC), in partnership with the Town of Waterbury, to document existing conditions, and identify opportunities for improvements at two intersections and the bridge between them, at the northern terminus of Stowe Street, in the Town of Waterbury, Vermont. Public input was received during a local concerns meeting held by the project team, as well as through a Local & Regional Input Questionnaire. Existing conditions were documented, including field observations and follow-up analyses, for traffic operations and safety, roadway geometry, and bridge condition inspection and assessment.

Improvements identified to consider include: pedestrian accommodations at the Stowe Street / VT 100 intersection; a dedicated right-turn lane for the Stowe Street approach to this intersection; geometric improvements for the STOP-controlled intersection of Lincoln Street / Stowe Street; and rehabilitation or replacement options for Bridge 36, the town-owned bridge carrying Stowe Street over Thatcher Brook, between the intersections with VT 100 and Lincoln Street.

This report aims to provide the basis for a subsequent VTrans scoping study to evaluate alternatives for improving the intersections and bridge.

One notable conclusion of this study is that wetlands or wetland buffers are not located within the anticipated project area. Class I wetlands were identified on Vermont Agency of Natural Resources (VANR) map, however, Stantec's environmental scientist located and flagged the estimated wetland boundary, and the actual limits are not in the immediate vicinity of anticipated disturbance.

2.0 INTRODUCTION

Stowe Street connects VT Route 100 to the north, with the Village of Waterbury to the south. The northern-most part of Stowe Street includes a signalized intersection with VT 100, and a STOP-controlled intersection with Lincoln Street, connected by a 175 FT segment crossing Thatcher Brook via Bridge 36. Bridge 36 is a town-owned bridge located on Stowe Street approximately 110 FT south of the junction with Vermont 100. The current bridge is in need of rehabilitation or replacement. The bridge is situated between two busy intersections and decisions regarding the proposed work on the bridge should consider the context of the adjacent intersections. The purpose of this project is to summarize existing conditions in the project area to be used as part of a later study that will evaluate alternatives for improving the crossing as part of the VTrans project development process. This report follows the same outline as a typical VTrans Bridge scoping report with the intent that once the project is funded by VTrans, the information in this report can be easily adapted into a scoping study.

3.0 BACKGROUND

Background information, including existing physical and environmental conditions, were documented to understand the need for and potential impacts of improvements. Team members researched and reviewed available information, solicited input from the Town and project stakeholders, and completed a field review of the project area. Sources of information include site visits, inspection reports, route logs, Operations Input Questionnaire, Local & Regional Input Questionnaire, Local Concerns Meeting, and previous studies, including the Colbyville Pedestrian/Bicycle Scoping Study.

3.1 PROJECT AREA

The project area is centered around Bridge 36, where Stowe Street passes over Thatcher Brook. The project area also includes the intersection of VT 100 / Stowe Street and Stowe Street / Lincoln Street, as shown in Figure 1.

Figure 1 Project Location Plan

3.2 CLASSIFICATION

Roadway Classification (Stowe Street):	Local Town Road
Bridge Type:	Concrete T-Beam Bridge
Bridge Length:	42 feet
Year Built:	1928
Ownership:	Waterbury

3.3 ROADWAY DESCRIPTIONS

Existing conditions within the project area are shown in Figure 2 – Existing Conditions Layout. The existing bridge and roadway width is too narrow for the roadway classification, pedestrian and cycle traffic, and traffic volumes. Commuter buses making turning movements onto Lincoln Street often utilize the bridge sidewalk or cross the centerline. Stowe Street continues south as a principally residential street to Main Street (US 2) in Waterbury Village. Lincoln Street is a two-lane roadway that provides access to a Park and Ride Lot, and to numerous intersecting residential streets. The area accessed by Lincoln Street has a second connection to VT100 via Perry Hill Road/Kneeland Flats Road/Guptil Road.

Stowe Street is a Class 2 Town Highway, two-lane variable width roadway, with 0- to1-foot shoulders along the 175-foot distance between the Lincoln Street and VT 100 intersections. There is a sidewalk on the west side of the bridge, which continues southerly along Stowe Street towards downtown Waterbury. The Stowe Street roadway width, which is 22 feet on Bridge 36, widens north of the bridge due to the corner radii at VT 100 and Stowe Street. There is continuous guardrail on both edges of the Stowe Street roadway, from VT 100 to the bridge, where the parapet is continuous across the bridge. Guardrail continues on both sides of Stowe Street from bridge to Lincoln Street. The Stowe Street vertical profile rises by approximately 8 percent from Lincoln Street to VT 100. The pavement markings on Stowe Street between VT 100 and the bridge consist of a double yellow centerline, white edge lines, and a stop line on the approach to VT 100. The intersection of VT 100 and Stowe Street is traffic signal controlled. Lincoln Street, near Stowe Street, has approximately the same 22-foot width. As Lincoln Street slopes down to Stowe Street, there is approximately 75 feet of guardrail on the northerly side of the road, wrapping around the corner with Stowe Street to the bridge, protecting the slope down to Thatcher Brook. Pavement markings on Lincoln Street, near the intersection with Stowe Street, consist of a white edge line on the north side of the street connecting to the sidewalk curb. There are no pavement markings on Stowe Street at the intersection with Lincoln Street. Lincoln Street is STOP sign controlled on its approach to Stowe Street. The Stowe Street approaches are not controlled.

3.4 TRAFFIC

A traffic study of the project area was performed by Stantec. The traffic volumes are projected for the years 2018 and 2043.

TRAFFIC DATA	2018	2043
AADT	3,000	3,330
DHV	430	475
ADTT	120	135
%T	3%	3%
%D	52%	52%

VT ROUTE 100

HALL, CONRAD F., JR.

STATE OF VERMONT

VT STATE PLANE GRID

BRIDGE 36

THATCHER BROOK

N/F
ATCHINSON, JAMES K.

JAMES & JEANNE ATCHINSON
116 STOWE STREET

STOWE STREET

N/F
HADLEY, JUSTIN F.

LINCOLN STREET

RANDALL & CINDY BRONSON
3 LINCOLN STREET

TIMOTHY & CLAUDETTE PARKS
1 LINCOLN STREET

APPROX. LOCATION OF WATERLINE.
EXACT LOCATION TO BE DETERMINED

APPROX. ROW LINE (CL OF RIVER)

WETLAND BUFFER AS IDENTIFIED BY
STANTEC'S ENVIRONMENTAL SCIENTIST

CLASS I WETLAND AS IDENTIFIED BY
STANTEC'S WETLAND SCIENTIST

FIGURE 2

0 20 40
SCALE IN FEET

Stantec

PROJECT NAME:	BRIDGE 36 STUDY
PROJECT NUMBER:	195311625
FILE NAME: Existing Conditions Layout.dgn	PLOT DATE: 9/18/2018
PROJECT LEADER: T. KNIGHT	DRAWN BY: R. DANIELS
DESIGNED BY: R. DANIELS	CHECKED BY: T. KNIGHT
EXISTING CONDITIONS LAYOUT SHEET	SHEET 1 OF 1

Stowe Street and Lincoln Street are two-way streets. There is significant commuter travel through their intersection and the Stowe Street intersection with VT 100. Peak period turning movement volumes were observed by Stantec during the 4:30 to 5:30 PM and 7:30 to 8:30 AM hours on July 5 and 6th, 2018 at the Lincoln Street intersection. Prior peak period turning movement counts, conducted during the 4:30 to 5:30 PM and 7:45 to 8:45 AM hours by VTrans on August 15 and 17, 2016 at the VT 100 intersection, were also obtained for this report.

The recent counts at the Stowe Street / Lincoln Street intersection were compared and adjusted to balance with the VT 100 / Stowe Street intersection counts, which required no seasonal adjustment. All volumes were adjusted by 2 percent to reflect 2018 Design Hour Volume (DHV) conditions as provided in the appendix. The data indicates 73-74 vehicles per hour on the Lincoln Street approach during the peak hours; 98 AM and 259 PM peak hour vehicles on the Stowe Street northbound approach to Lincoln Street; and 166 AM and 166 PM peak hour vehicles on the Stowe Street southbound approach to Lincoln Street.

The VT 100 / Stowe Street traffic signal operates as part of a coordinated system on VT 100. The Stowe Street / Lincoln Street intersection is close to VT 100 (175 feet) and traffic queues on the Stowe Street approach to VT 100 extend past Lincoln Street during peak hours, as observed in the field.

Operating level of service (LOS) is a term used to describe the quality of traffic flow on a roadway. It is an aggregate measure of travel delay, travel speed, congestion, driver discomfort, convenience, and safety based on a comparison of roadway capacity to travel demand. Operating levels of service are reported on a scale of A to F, with LOS A representing the best operating conditions (little or no delay to motorists) and LOS F representing the worst operating conditions (long delays and with traffic demands sometimes exceeding roadway capacity). Delay criteria are shown in Table 1 below.

Table 1 Signalized Intersection Level of Service Criteria

Level of Service	Average Delay per Vehicle (Seconds)
A	≤10.0
B	10.1 to 20.0
C	20.1 to 35.0
D	35.1 to 55.0
E	55.1 to 80.0
F	>80.0

The intersection peak hour operating levels of service were calculated following procedures described in the *2010 Highway Capacity Manual* and as applied by the Synchro software package. Analysis of the existing DHV provides results as presented in Table 2. Analysis results indicate that while the VT 100 intersection operates at LOS C or D, the Stowe Street approach operates at LOS F during the evening peak period when queues of up to 9 vehicles extend beyond the Lincoln Street intersection. The queue length of up to 9 vehicles is considered very low according to some residents who witness the condition daily. The Lincoln Street unsignalized intersection would be affected by those queues, but otherwise would operate at level of service B.

Table 2 Existing Capacity Analysis Results

Time Period	VT 100 / Stowe Street		Stowe Street Approach to VT 100			Lincoln St / Stowe St
	Overall LOS	Overall V/C	LOS	V/C	95Th Queue	LOS
AM	C	0.83	D	0.39	3 veh.	B
PM	D	0.91	F	1.23	9 veh.	B

3.5 CRASH HISTORY

Stantec reviewed the crash history on Stowe Street at the Lincoln Street and VT 100 intersections. VTrans records were obtained for the 5-year period between 2012 and 2016. During this time there were no crashes reported at the Lincoln Street intersection. At the VT 100 intersection, a total of 8 crashes were reported. Six were rear-end type crashes and four rear-end crashes occurred on the northbound VT 100 approach. One rear-end crash occurred on the Stowe Street approach to VT 100. None of the crashes resulted in personal injury. The crash rate is computed as 0.19 crashes per million vehicle miles. The statewide crash rate for local streets is 1.43 in rural areas and 2.62 in urban areas.

VTrans maintains a listing of High Crash Locations (HCL) within the state. A 0.3-mile highway segment or intersection must have at least 5 crashes over a 5-year period and the actual crash rate (number of crashes per million vehicles) must exceed a critical crash rate to be classified as an HCL. The critical crash rate is based on the average crash rate for similar highways in Vermont and is related to the functional class of a highway and whether it is located in an urban or rural area. The VTrans High Crash Report: Sections and Intersections 2012-2016 does not list this segment of Stowe Street or either intersection within the project area.

3.6 TURNING GEOMETRY

Figure 3 and Figure 4 illustrate the turning geometry of a commuter bus when making turns between Stowe Street and Lincoln Street. The existing geometry of the intersection of Stowe Street and Lincoln Street results in commuter buses crossing over to the oncoming traffic lane on both streets for right turns onto Stowe Street. The existing geometry also results in commuter buses turning left onto Lincoln Street from Stowe Street driving up onto the bridge sidewalk and crossing over to the oncoming traffic lane on Lincoln Street.

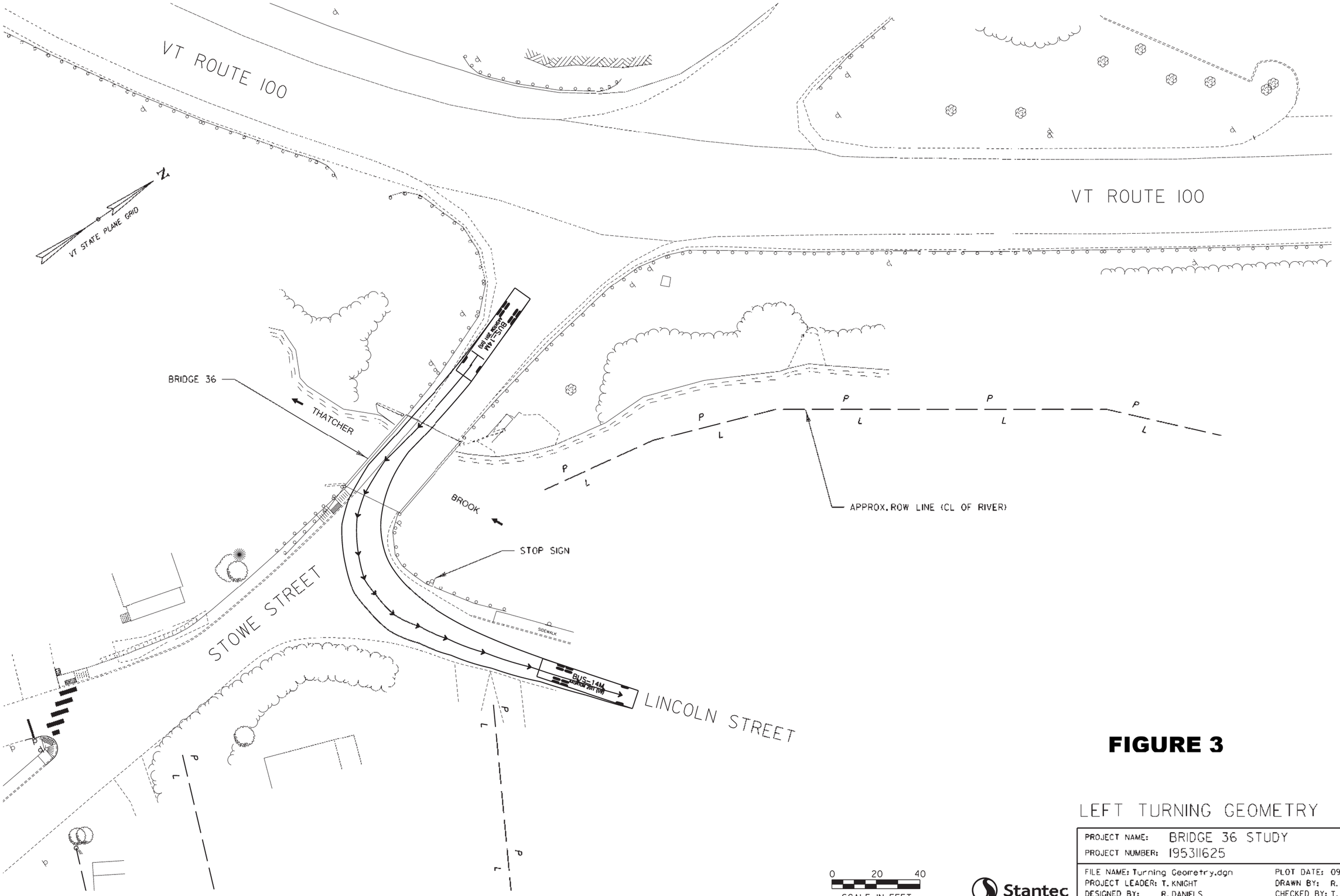


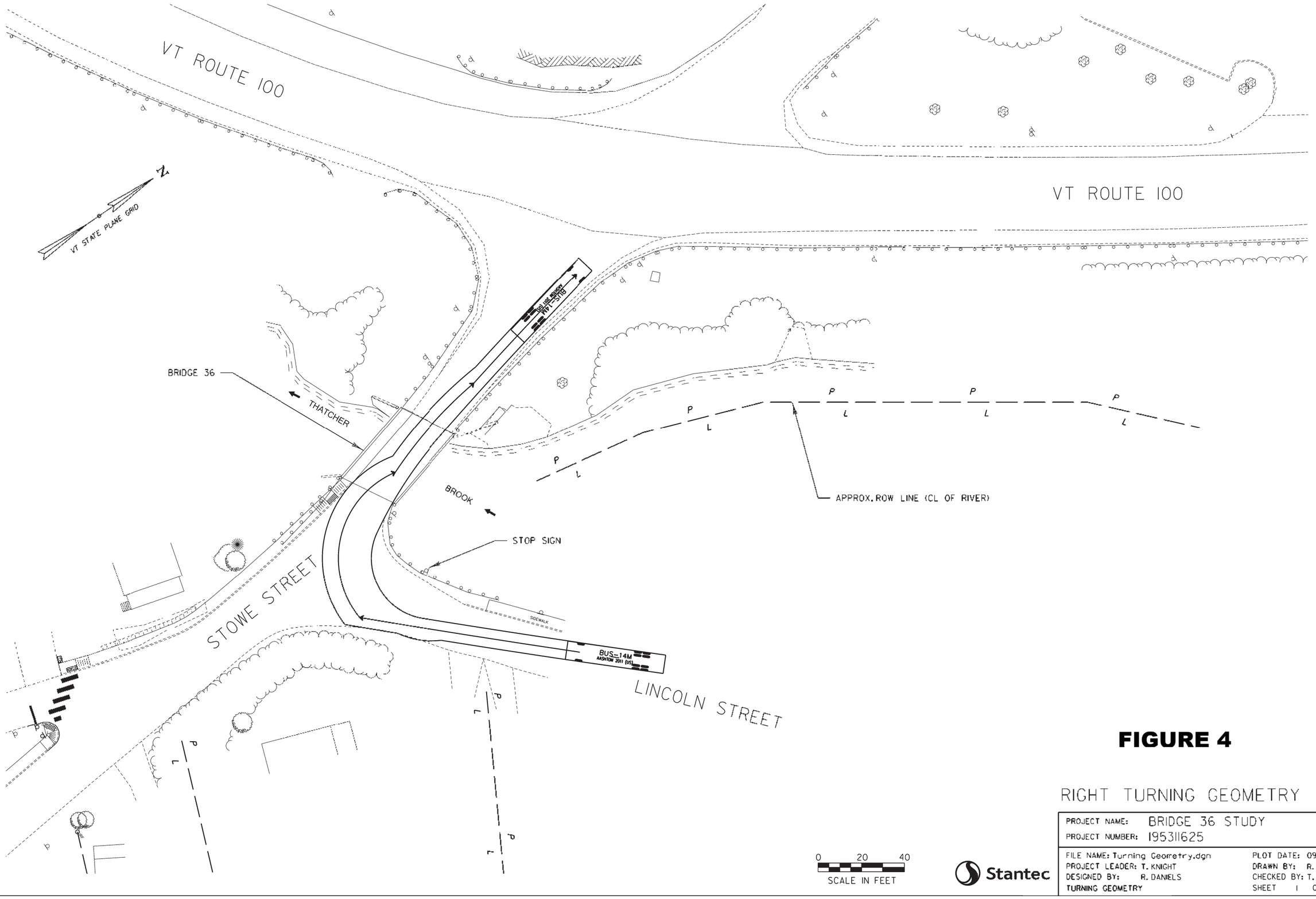
FIGURE 3

LEFT TURNING GEOMETRY

PROJECT NAME:	BRIDGE 36 STUDY
PROJECT NUMBER:	195311625

FILE NAME: Turning Geometry.dgn	PLOT DATE: 09/24/18
PROJECT LEADER: T. KNIGHT	DRAWN BY: R. DANIELS
DESIGNED BY: R. DANIELS	CHECKED BY: T. KNIGHT
TURNING GEOMETRY	SHEET 1 OF 1

Stantec



0 20 40
SCALE IN FEET

Stantec

FIGURE 4

RIGHT TURNING GEOMETRY

PROJECT NAME:	BRIDGE 36 STUDY
PROJECT NUMBER:	195311625

FILE NAME: Turning Geometry.dgn	PLOT DATE: 09/24/18
PROJECT LEADER: T. KNIGHT	DRAWN BY: R. DANIELS
DESIGNED BY: R. DANIELS	CHECKED BY: T. KNIGHT
TURNING GEOMETRY	SHEET 1 OF 1

3.7 SIGHT DISTANCE – LINCOLN STREET STOP CONDITION

Vehicles at the STOP sign, on the Lincoln Street approach to the STOP controlled intersection with Stowe Street, have terrain and vegetation obstructions within their sight triangle that prevent them from seeing vehicles approaching from the left. Figure 5 displays the AASHTO recommended sight lines for this movement, indicating 280 FT of visibility along the Stowe Street alignment, looking to the driver's left, for a vehicle at the STOP sign. Figure 6 displays actual sight lines, indicating only 70 FT of actual visibility along the Stowe Street alignment, looking to the driver's left, for a vehicle at the STOP sign, due to the terrain and vegetation obstructions shown. These obstructions are partially located outside of the road Right of Way, on the southeasterly corner of the intersection. This condition forces motorists to pull substantially forward past the STOP sign in order to see oncoming traffic from their left. This condition causes conflict when commuter buses are making a left turn onto Lincoln Street from Stowe Street.

3.8 BRIDGE INSPECTION REPORT SUMMARY

VTrans conducts Bridge Safety inspections on a biennial basis to meet the National Bridge Inspection Standards (NBIS). As part of that process VTrans rates the condition of various elements within the bridge using a numeric rating that corresponds to the condition of the element. Based on recent inspections, VTrans has opted to reduce the inspection frequency for the structure to annual. This change reflects the fact that this bridge is nearing the end of its service life and is likely to begin deteriorating more rapidly than it has in the past. The following is a summary of VTrans recent inspection history for Bridge 36:

When interpreting the inspection history, please note the following:

- NBIS defines the criteria for the numeric condition rating, but there is an accepted tolerance associated with the subjective nature of assigning a numeric value to the bridge element condition. In general, if a bridge were inspected by 2 different inspectors, you can expect that the numeric rating assigned to a given element will be within a numeric value of 1 of a numeric rating from another independent inspector. Thus, if one inspector were to rate the bridge as a "5 Fair", it would be acceptable for another independent inspector to rate that element as a "4 Poor", or perhaps a "6 Satisfactory", and still be within the accepted precision of the NBIS.

- Inspectors sometimes make anecdotal comments regarding the anticipated longevity of the structure and/or the need for repair or replacement of the structure at large. Engineers will take the inspectors comments under advisement when determining the need for repair or replacement of the structure, but these comments are understood to be somewhat subjective, as no inspector or engineer can predict the longevity of bridge elements with certainty. The anecdotal predictions are intended to highlight the degree of attention that is warranted for maintenance of the element.

Deck Rating:	*5 Fair*
Superstructure Rating:	*5 Fair*
Substructure Rating:	*5 Fair*
Channel Rating:	*6 Satisfactory*

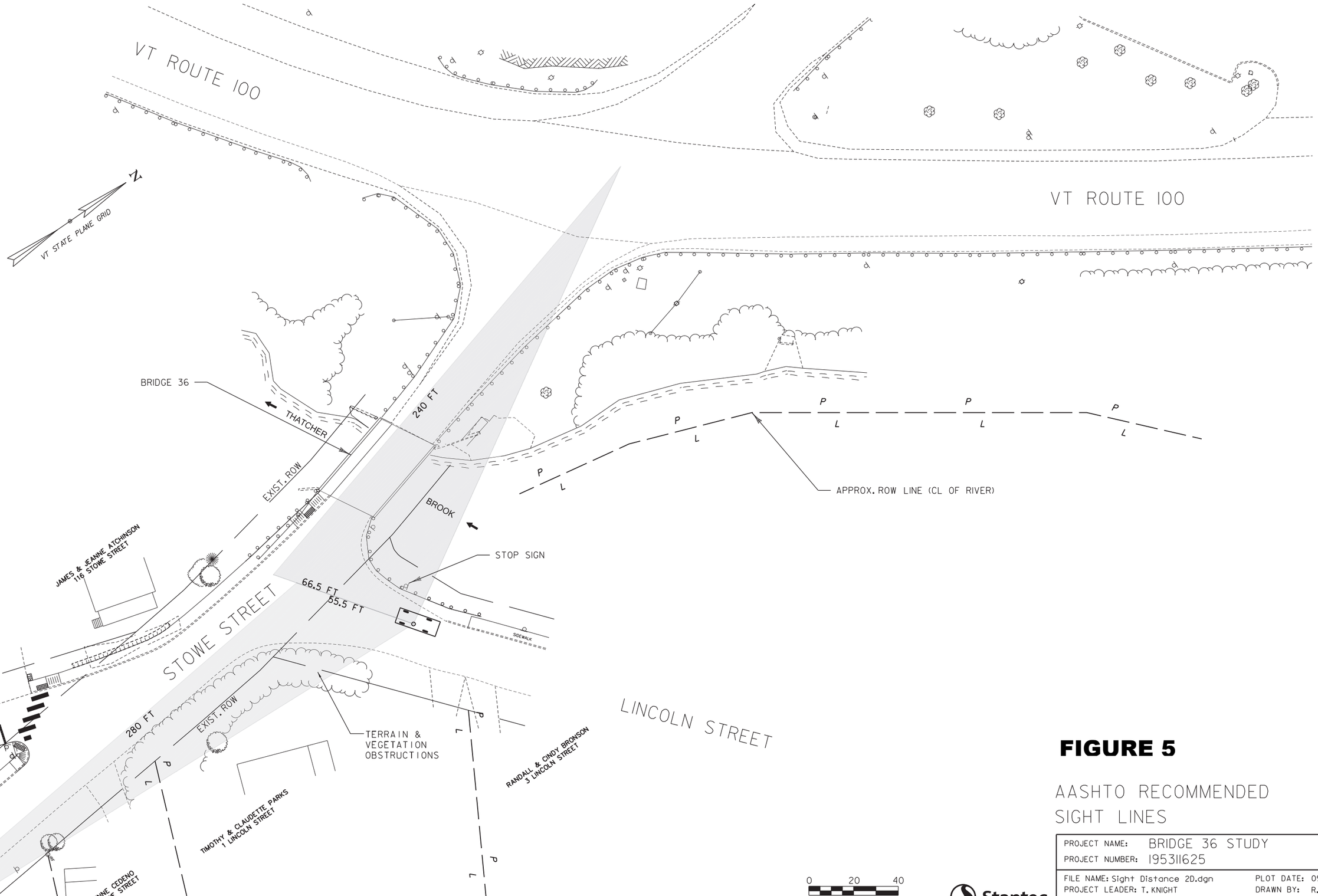


FIGURE 5

AASHTO RECOMMENDED SIGHT LINES

PROJECT NAME:	BRIDGE 36 STUDY
PROJECT NUMBER:	195311625
FILE NAME: Sight Distance 2D.dgn	PLOT DATE: 09/24/18
PROJECT LEADER: T. KNIGHT	DRAWN BY: R. DANIELS
DESIGNED BY: R. DANIELS	CHECKED BY: T. KNIGHT
SIGHT DISTANCE	SHEET 1 OF 1

Stantec

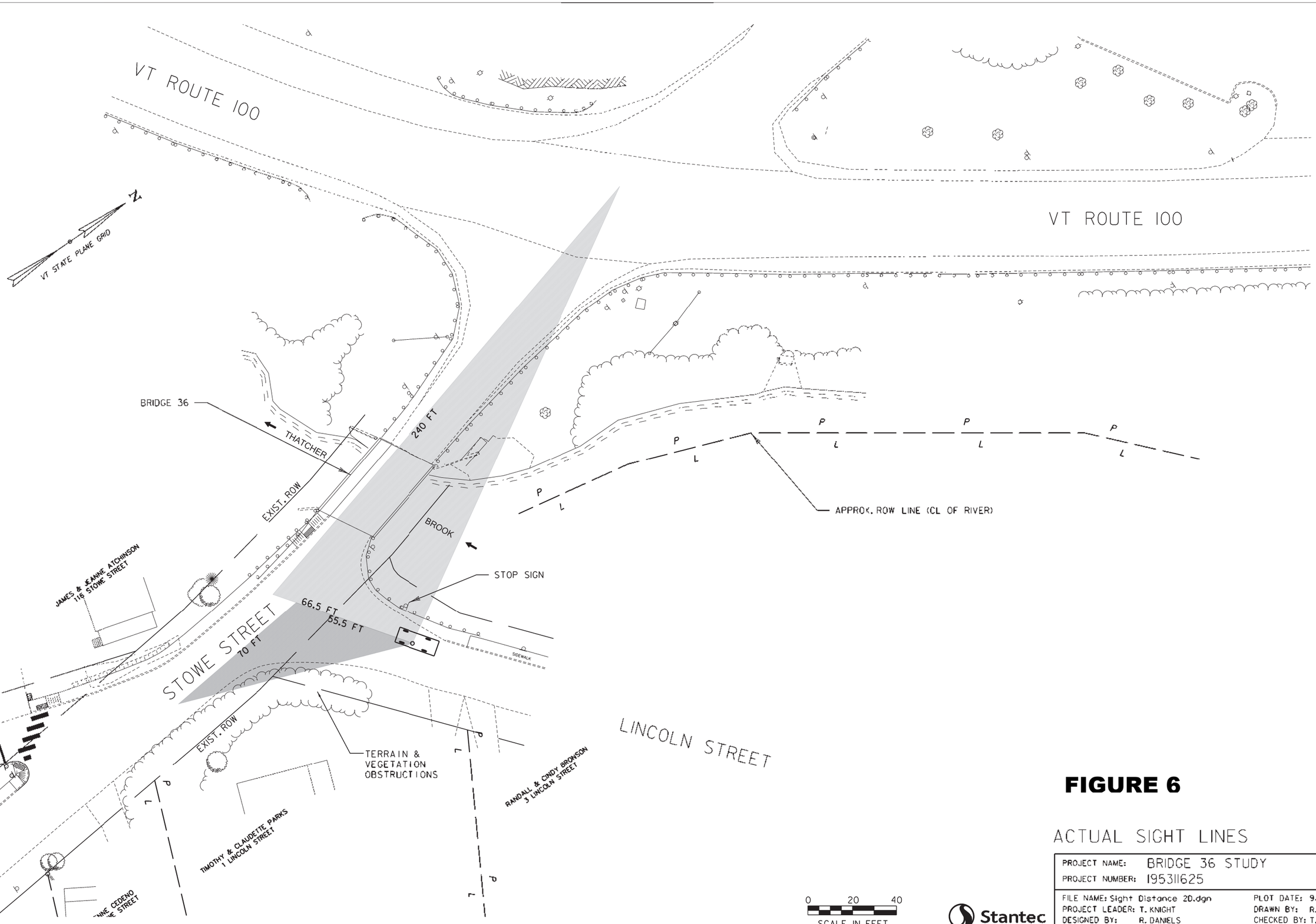


FIGURE 6

ACTUAL SIGHT LINES

PROJECT NAME:	BRIDGE 36 STUDY
PROJECT NUMBER:	195311625
FILE NAME: Sight Distance 2D.dgn	PLOT DATE: 9/24/2018
PROJECT LEADER: T. KNIGHT	DRAWN BY: R. DANIELS
DESIGNED BY: R. DANIELS	CHECKED BY: T. KNIGHT
SIGHT DISTANCE	SHEET 1 OF 1

Stantec

Inspection History:

04/12/2018 - Special 12-month inspection of the concrete deck. The deck surface needs cold planning and repaving, as it is getting quite rough. The deck and sidewalk could use some patch repair work when the wearing surface is removed. The northwest wingwall is degrading with some heavy scaling and needs repair to prevent erosion of the approach fill material behind it. The deck is showing its age (90 years) in certain spots, but overall appears generally sound at this time. The deck rating will be raised back up to a 5, as fair for now. However, since the bridge is slowly degrading and extensive repairs are not advised, plans should be made to upgrade the bridge in its entirety in the next 10 to 20 years. ~ MJ/JS

9/6/2017 Deck has advanced to poor with heavy saturation bay 2, other areas along deck soffit also has saturation but not as severe. Failures along the deck is possible. Superstructure & substructure continues to deteriorate at steady pace. Abutment 1 upstream wing has very heavy scaling. Structure should be considered for full replacement. Structure will be moved to 12-month frequency inspection. MJK AC

09/09/15 Fair condition, structure continues to deteriorate along deck soffit, T beams and abutments. Structure should be considered for recon or replacement. MJK SP

09/06/13 Deck & T beams continue to deteriorate at a slow pace, approaches need to be shimmed. Structure should be considered for replacement in the next 10 +/- years. Recent repairs to fix undermining is a big improvement. MJK FE

05/05/11 Fair condition. Deck soffit has areas of saturation and t-beams are breaking down with cracking and spalling with exposed rebar. Structure should be replaced in near future. MJK & PH

05/08/09 - The bridge is in fair to satisfactory condition. - The deck and tee beams continue to deteriorate. Full depth holes could occur any time, any place in the deck; especially in bay 2. Abutment 2's approach guard rail needs repair. DCP

Stantec's bridge engineers conducted a site visit in August 2018 to verify the inspection findings in the current VTrans Bridge inspection report dated 4/12/2018. Stantec concurs with the findings of the inspection report, however, they noted that the Town of Waterbury has made repairs to the northeast wingwall and the adjacent corner of the north abutment since the April inspection.

3.9 HYDRAULICS

Hydraulics condition will be determined when the final conceptual analysis is conducted.

3.10 UTILITIES

The existing identified utilities consist of the following:

Municipal Utilities

- An existing sewer main runs from a sewer manhole (SMH) near the signal control cabinet at the southeast corner of the intersection of VT Route 100 and Stowe Street. The sewer then runs south paralleling Stowe Street about 10' from the shoulder on the upstream side before daylighting to parallel the bridge on a separate structure. It appears that north of the bridge, the sewer main is encased in concrete for about a 15' length; this needs verification. The sewer main crosses Thatcher Brook and into a manhole before crossing Lincoln Street and continuing down the east side of Stowe Street.
- Traffic signal conduit runs under Stowe Street for the signal at the intersection of VT Route 100, Stowe Street and Blush Hill Road, approximately 60' south of the intersection. Electrical utility wire runs from the pull box on the east side of Stowe Street to the signal cabinet located south of the intersection.
- A storm sewer collects runoff from catch basins on each side of Blush Hill Road, just north of the intersection with VT 100, crosses VT 100, and discharges into Thatcher Brook upstream of the bridge. A storm sewer also collects runoff from a catch basin on the south side of Lincoln Street and a catch basin located approximately 100' east of the intersection of Lincoln Street and Stowe Streets before daylighting into Thatcher Brook, upstream of the bridge.
- An existing 12-inch water main is buried below Thatcher Brook, upstream of Bridge 36, and runs along Stowe Street and Lincoln Street. Water lines are located in the area of the intersection of Stowe Street and VT 100, with valve boxes.
- A fire hydrant is located approximately 50' south of the bridge and across from Lincoln Street.

Public Utilities (Overhead)

- Overhead utilities run along the east side of Stowe Street. Utility poles are located: southeasterly of the intersection of Route 100 and Stowe Street; a guy pole crossing Stowe Street northerly of the bridge; approximately 40 FT easterly of the northerly corner of the Lincoln Street and Stowe Street intersection; and on the southerly corner of the Lincoln Street and Stowe Street intersection.

The impact of the construction project to the sewer, water and overhead utility lines and poles will depend on the size and scope of the proposed bridge structure and may require relocation or temporary support. Coordination with the Municipality and public utility company will be necessary during design of any construction project. If replacement is pursued, carrying the existing sewer on the bridge should be considered.

3.11 RIGHT OF WAY

There are existing 3-rod (49.5 ft.) (approximate) rights of way centered on both Stowe Street and Lincoln Street. The Right-of-Way boundary for Route 100 varies by location. The southern Route 100 Right of Way

boundary is located at the middle of Thatcher Brook on either side of the bridge. Due to the large amount of Right-of-Way clearance on the north side of the bridge, no permanent or construction easements should be required. On the south side the bridge, Stowe Street Right-of-Way is within 12 feet of the bridge fascia and may require additional Right-of-Way acquisition. The existing Right-of-Way is plotted on the Existing Conditions Layout Sheet (Figure 2).

As discussed earlier regarding sight distance obstructions for the Lincoln Street STOP condition, there are existing terrain and vegetation obstructions on the southeasterly corner of the Stowe Street / Lincoln Street intersection. Those obstructions appear to be partially located outside of the Town Right of Way.

3.12 RESOURCES

The environmental resources present at this project are shown on the Existing Conditions Layout Sheet (Figure 2) and are as follows:

Biological

Wetlands/Watercourses

Wetlands or wetland buffers are not located within the project area. Class I wetlands were identified on Vermont Agency of Natural Resources (VANR) map; however, Stantec's environmental scientist located and flagged the estimated wetland boundary. The boundary is located approximately 370 feet upstream of the project site, thus, the wetland and the wetland buffer are outside of the project limits. A figure depicting this location is included in the appendix of this report.

Impact below OHW/Fisheries/AOP

Thatcher Brook is the only regulated natural resource in the immediate project area and only impacts below ordinary high water (OHW) are regulated. Thatcher Brook is a tributary to the Winooski River. The current structure passes fish and other aquatic organisms. Thatcher Brook is not classified as Essential habitat or a Navigable Waterway. In-stream construction would be limited to between July 15 and October 1 under Section 404 Corp of Engineers Permit unless a Category 2 general permit is obtained.

Species / Habitats of Special Concern

The Northern Long Eared Bat is the only species with habitat of special concern. No other threatened or endangered species were identified within the project area.

Agricultural Soils / Floodplains

The project area is within a mapped flood hazard area located along the river. No agricultural soils have been identified within the project area.

Hazardous Materials

According to the Vermont Agency of Natural Resources (VANR) Vermont Hazardous Sites List, there are numerous hazardous waste sites located near the project area. It is anticipated that none of these sites will be impacted. A list of hazardous sites in the project area can be found in the appendix.

Historic

The bridge is in the northern end of the Mill Village Historic District, with ordinary houses and a mill, dating back to the 19th century. Some of the houses and the mill remain in existence today, although converted into modern houses and a commercial space. The project area will not be impacting either the houses nor the mill.

Archaeological

There are no known or apparent archaeological resources given the rural nature of the river upstream and more developed nature downstream. However, the downstream mill and houses date to the 19th century and should be considered archaeological sites.

Storm water

Bridge 36 is south and downhill of the intersection of Stowe Street and VT Route 100. The runoff from the road between the bridge and the intersection runs down and off the road under the transition barrier onto the substructure at the north end of the bridge. Due to the heavy rutting in the bridge surface, stormwater also ponds on the bridge deck and freezes in the winter.

4.0 COMMUNITY ENGAGEMENT

4.1 LOCAL CONCERNS MEETING AND QUESTIONNAIRE FINDINGS

Residents at the local concerns meeting held July 17th, 2018 expressed the following safety concerns regarding the Stowe Street intersection with Lincoln Street:

- Sight distance from the stop sign location on Lincoln Street is poor, and traffic needs to pull partially out onto Stowe Street in order to see oncoming vehicles.
- Vehicles often exceed the speed limit and residents are concerned that speeds are excessive in the residential area beyond the Lincoln Street intersection.
- Due to the poor sight distance of traffic maneuvering from Lincoln Street, traffic is often not focusing on pedestrian traffic and pedestrians feel unsafe crossing the road.
- Residents noted the narrowness of the sidewalk and minimal separation from traveling public feels unsafe.

Safety issues presented in the Operations Input Questionnaire

- Narrowness of the bridge and alignment causes vehicles to utilize the sidewalk to turn left onto Lincoln Street. Likewise, traffic turning right onto Stowe Street often crosses centerline to turn.
- When snow falls, plowing operation pushes snow onto the sidewalk. Current configuration of the railing does not allow snow to be pushed over bridge. Sidewalk plowing operation pushes some snow into roadway, causing bridge to retain more snow.
- Snow plows with wings are not able to drive over bridge without crossing centerline.

5.0 PURPOSE AND NEED

The following **Draft Purpose and Need Statement** summarizes what the project is intending to accomplish and for what reasons.

Purpose: The purpose of the project is to provide a safe crossing of Thatcher Brook for the traveling public, including pedestrians and bicyclists and to address the current structural deficiencies and ongoing deterioration of the bridge.

Need: Recognizing the importance of this route in the transportation system for the Town of Waterbury and the surrounding communities, the following needs for the project have been identified:

- The existing concrete beams and deck are in fair to poor condition, with holes and heavy wheel rutting in the pavement.
- The concrete sidewalk is spalling, particularly in interface with roadway.
- The beams are cracked and spalled where previous repairs have failed to bond. There are large delaminated areas throughout the deck and beams, and large spalled areas with exposed rebar.
- The T-beams continue to deteriorate, spall, and crack due to corrosion of the reinforcement.
- The approach railing and bridge rail do not meet the current standard.
- The existing bridge width is inadequate to accommodate turning movements of the commuter bus that regularly uses the bridge to access the Park and Ride on Lincoln Street.
- The bridge is not wide enough to accommodate cyclists on the roadway shoulder.
- The adjacent intersection with Lincoln street has inadequate site distance to the west.

6.0 DESIGN CONSIDERATIONS

6.1 BRIDGE DESIGN CRITERIA

The design standards for this bridge project are the Vermont State Design Standards, dated October 22, 1997. Minimum standards are based on an ADT of 3,330 (2043), a DHV of 475 and a design speed of 25 mph for a local town road.

Table 3 Bridge Design Criteria

Design Criteria	Source	Existing Condition	Minimum Standard	Comment
Approach Lane and Shoulder Widths	VSS Table 6.3	11'/0' (22')	11'/3' (28')	Substandard
Bridge Lane and Shoulder Widths	VSS Section 6.7	10'/0' (20') with 5' sidewalk	11'/3' (28')	Substandard
Clear Zone Distance	VSS Table 6.5	Bridge and guardrail located in clear zone	7' fill / 7' cut (1.5 behind curb)	Substandard
Banking	VSS Section 6.12	Normal Crown	8% (max)	No super elevation on low speed urban streets
Speed		25 mph (Posted)	25 mph (design)	
Horizontal Alignment	AASHTO Green Book Table 3-10b	R = ∞	R_{min} = 2370' @ NC	
Vertical Grade	VSS Table 6.6	-1.02% (max)	7% (max) for level terrain	
K Values for Vertical Curves	VSS Table 6.1	Ksag = 209	20' crest / 30' sag	
Stopping Sight Distance	VSS Table 6.1	TBD	150'	
Bicycle/Pedestrian Criteria	VSS Table 6.8	No shoulder	3' Shoulder	Substandard for Bicycles

Design Criteria	Source	Existing Condition	Minimum Standard	Comment
Bridge Railing	Structures Design Manual Section 13	Concrete railing	TL-2	
Hydraulics	VTrans Hydraulics Section	To be determined in later study	Pass Q_{50} storm event with 1.0' of	Substandard
Structural Capacity	SM, Ch. 3.4.1	Not Structurally Deficient, but current condition is deteriorating.	Design Live Load: HL- 93	

6.2 PEDESTRIAN AND RIGHT TURN LANE ACCOMMODATION CONSIDERATION

Stantec analyzed three alternatives for the VT 100 / Stowe Street intersection for the year 2043. These alternatives include:

- 2043 Baseline: Do nothing
- 2043 Pedestrian Phase: Add exclusive pedestrian signal phase
- 2043 Pedestrian Phase and Stowe St approach Right Turn Lane: Add exclusive pedestrian signal phase and Stowe Street approach dedicated right turn lane

The results of this future capacity analysis are presented in Table 4.

Table 4 Future Capacity Analysis

Scenario	Time Period	Stowe St at VT 100		Stowe St Approach to VT 100			Lincoln St at Stowe St
		Overall LOS	Overall V/C	LOS	V/C	95Th Queue	LOS
Baseline	AM	D	0.95	D	0.48	4 veh.	B
	PM	E	1.04	F	1.43	11 veh.	B
Ped Phasing	AM	D	1.02	E	0.69	6 veh	B
	PM	E	1.09	F	1.54	12 veh	B
Ped Phasing & RTL	AM	D	1.02	D	0.69	4 veh.	B
	PM	C	0.97	D	0.73	4 veh.	B

LOS = Level of Service; V/C = volume to capacity ratio; 95th Queue = 95th percentile queue; RTL = Right Turn Lane

Future conditions analysis of the year 2043 indicate reduced overall operating conditions at the VT 100 / Stowe Street intersection, in terms of level of service, during the morning peak period, from LOS C to LOS D, due to traffic volume growth and the addition of an exclusive pedestrian signal phase. During the evening peak hours, the overall reduction is greater, as LOS E is expected.

The existing queuing on the Stowe Street approach to VT 100, that extends beyond Lincoln Street during peak periods, would worsen due to future traffic growth, if left unmitigated. The benefit of a dedicated right turn was analyzed for this approach. The Stowe Street approach right turn lane would operate as a dedicated right turn lane as it would be intended to accommodate 75 percent of the traffic on this approach. A right turn lane that would extend over Bridge 36 would mitigate both the future traffic growth and pedestrian phasing impacts on the Stowe Street approach to VT 100.

7.0 TRAFFIC MAINTENANCE DURING CONSTRUCTION

The Vermont Agency of Transportation reviews each new project to determine suitability for the Accelerated Bridge Program, which focuses on faster delivery of construction plans, permitting, and Right-of-Way, as well as faster construction of projects in the field. One practice that will help in this endeavor is closing bridges for portions of the construction period, rather than providing temporary bridges. In addition to saving money, the intention is to minimize the closure period with faster construction techniques and incentives to contractors to complete projects sooner. The Agency considers the closure option on all projects where rapid reconstruction or rehabilitation is feasible. The use of prefabricated elements in new bridges will also expedite construction schedules. This can apply to decks, superstructures, and substructures. VTrans Accelerated Bridge Construction Program has demonstrated that accelerated construction often provides enhanced safety for the workers and the traveling public by removing traffic from the immediate vicinity of the construction work while maintaining project quality.

7.1 OPERATION 1: OFF-SITE DETOUR

This option would close the bridge on Stowe Street and depending on the limits of work, may also limit access to Lincoln Street. Traffic would be rerouted onto an offsite detour. Since the bridge is located on a Class 2 Town Highway, it would be the responsibility of the Town of Waterbury to choose the preferred detour route, and to sign it according to the MUTCD manual.

The anticipated detour route is: Stowe Street ➔ VT Route 100 ➔Union Street ➔ back to Stowe Street. This route has an end-to-end distance of 1.4 miles.

Since there is a sidewalk on the existing bridge, a pedestrian detour may be necessary. The above route includes a section of VT Route 100, over Interstate 89 that doesn't have sidewalks and the interstate ramp configuration is not ideal for pedestrian traffic. One possible pedestrian detour route is: Lincoln Street ➔ Waterbury Community Path ➔ Laurel Road ➔ VT Route 100 ➔ Stowe Street. Another possible, but longer, pedestrian detour route is: Lincoln Street ➔ Perry Hill Road ➔ Kneeland Flats Road ➔ Guptil Road ➔ VT Route 100 ➔ Stowe Street. This route is 7.0 mi end to end, which is excessive for pedestrians.

A map of these detour routes can be found in the Appendix.

Considerations to be explored during the alternatives phase include:

- Providing an alternate temporary location for the Waterbury Park and Ride
- Maintaining pedestrian access at the site during construction
- Access to Lincoln Street
- Emergency services response time to Lincoln Street
- School bus access to Thatcher Brook Elementary School

Advantages: This option would eliminate the need for phasing construction and a temporary bridge, which would significantly decrease cost and time of construction. This option reduces the time and cost of the project both at the development stage and construction.

Disadvantages: Traffic flow would not be maintained through the project site during construction. Maintaining pedestrian mobility through the project area will be difficult. Further alternatives would need to be considered for Park and Ride users, pedestrian traffic and school bus traffic.

7.2 OPERATION 2: PHASED CONSTRUCTION

Phased construction is the maintenance of traffic on the existing bridge while building the proposed structure one lane at a time. This allows keeping the road open during construction, while having minimal impacts to adjacent property owners and environmental resources. Given the narrow width of the existing structure, and limited length for queuing traffic on the VT 100 side of the bridge, phased construction is likely not preferable and may not even be feasible at this site; however, phasing the project to accommodate pedestrians, may be a viable option. A pedestrian facility could be built first upstream of the existing bridge, used throughout construction to maintain pedestrian mobility, and incorporated into the final design.

7.3 OPERATION 3: TEMPORARY BRIDGE

This is a very small site to fit a temporary bridge on. Stowe Street's straight-line geometry, accompanied with the proximity of the VT Route 100 intersection, make constructing a temporary alignment sufficient for transit traffic and larger vehicles very tight. Permanent or temporary Right-of-Way would need to be acquired and utilities relocated. The exploration and feasibility of this alternative will need to be explored more, depending on the alternatives pursued.

Significant additional costs would be incurred to use a temporary bridge, including the cost of the bridge itself, installation and removal, restoration of the disturbed area, and the time and money associated with the temporary Right-of-Way. If used, a two-way temporary bridge would be appropriate based on the daily traffic volumes.

A temporary bridge is likely not preferred; however, including a temporary bridge to accommodate pedestrians, may be a viable option. A pedestrian facility could be built first upstream of the existing bridge and used throughout construction to maintain pedestrian mobility.

8.0 ALTERNATIVES TO CONSIDER FOR FUTURE STUDY AND SCOPING EVALUATION

One question that comes up while considering improvements is whether there is another location that would be more suitable for a Park and Ride. VTrans and Regional Planning recently completed a study to explore this question, finding no better alternatives than the current location.

Improvements to consider must address the turning geometry of commuter buses, sight distance for the Lincoln Street STOP condition, and right turn lane for the Stowe Street approach to VT 100. Figure 7 shows some possible geometric improvements to address these issues. Incorporating a right turn lane, and extending it past the bridge, will result in a substantially wider bridge than the current structure. Moving the stop bar on Lincoln Street far enough forward to provide adequate sight distance, to see oncoming motorists from the left, brings the stop bar much closer to the edge of travel way. Figure 8 displays sight distance for that location. The wider bridge width would help the turning movements for commuter buses either turning left onto Lincoln Street, or turning right onto Stowe Street from Lincoln Street, as shown in Figure 9. A mountable truck apron could be considered to assist commuter buses making a right turn from Lincoln Street onto Stowe Street. The geometric improvements shown, obviously do not fit well with a traditional rectilinear bridge structure, however, a buried structure such as a flat arch or rigid frame could accommodate most of the geometric improvements outlined, provided they can accommodate the hydraulic and geomorphology requirements for waterway opening and clear span. This bridge type should be considered for further study.

HALL, CONRAD F., JR.

VT ROUTE 100

VT ROUTE 100

VT STATE PLANE GRID

STATE OF VERMONT

STATE OF VERMONT

STATE OF VERMONT

BRIDGE 36

PROPOSED STOP SIGN

THATCHER BROOK

N/F
ATCHINSON, JAMES K.

N/F
HADLEY, JUSTIN F.

MOUNTABLE TRUCK APRON

APPROX. ROW LINE (CL OF RIVER)

STOWE STREET

LINCOLN STREET

FIGURE 7

GEOMETRY IMPROVEMENTS

0 20 40
SCALE IN FEET

Stantec

PROJECT NAME: BRIDGE 36 STUDY	
PROJECT NUMBER: 195311625	
FILE NAME: 11625nul.dgn	PLOT DATE: 9/24/2018
PROJECT LEADER: T. KNIGHT	DRAWN BY: R. DANIELS
DESIGNED BY: R. DANIELS	CHECKED BY: T. KNIGHT
TURNING GEOMETRY	SHEET 1 OF 1

VT ROUTE 100

HALL, CONRAD F., JR.

VT ROUTE 100

VT STATE PLANE GRID

STATE OF VERMONT

STATE OF VERMONT

STATE OF VERMONT

BRIDGE 36

PROPOSED STOP SIGN

THATCHER BROOK

N/F
ATCHINSON, JAMES K.

N/F
HADLEY, JUSTIN F.

MOUNTABLE TRUCK APRON

APPROX. ROW LINE (CL OF RIVER)

STOWE STREET

LINCOLN STREET

FIGURE 8

GEOMETRY IMPROVEMENTS
SIGHT LINES

0 20 40
SCALE IN FEET

Stantec

PROJECT NAME: BRIDGE 36 STUDY	
PROJECT NUMBER: 195311625	
FILE NAME: 11625nul.dgn	PLOT DATE: 9/24/2018
PROJECT LEADER: T. KNIGHT	DRAWN BY: R. DANIELS
DESIGNED BY: R. DANIELS	CHECKED BY: T. KNIGHT
TURNING GEOMETRY	SHEET 1 OF 1

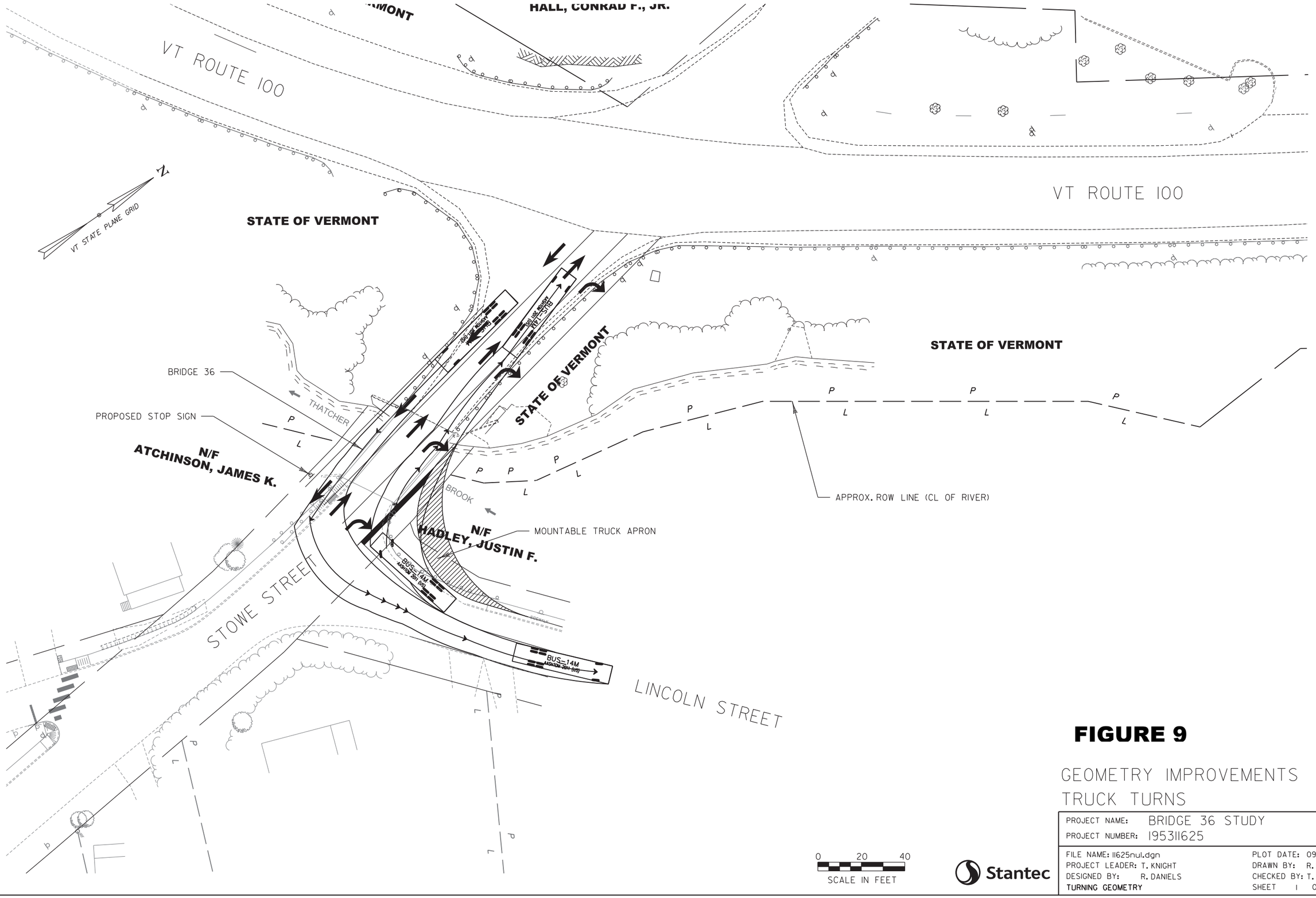


FIGURE 9

GEOMETRY IMPROVEMENTS
TRUCK TURNS

0 20 40
SCALE IN FEET

Stantec

PROJECT NAME: BRIDGE 36 STUDY	
PROJECT NUMBER: 195311625	
FILE NAME: 11625nul.dgn	PLOT DATE: 09/24/18
PROJECT LEADER: T. KNIGHT	DRAWN BY: R. DANIELS
DESIGNED BY: R. DANIELS	CHECKED BY: T. KNIGHT
TURNING GEOMETRY	SHEET 1 OF 1

Appendix
Waterbury Bridge 36 Existing Conditions Report

A. EXISTING CONDITIONS LAYOUT SHEET

B. COLBYVILLE PEDESTRIAN/BICYCLE SCOPING STUDY

C. LOCAL & REGIONAL INPUT QUESTIONNAIRE

D. OPERATIONS INPUT QUESTIONNAIRE

E. STRUCTURE INSPECTION, INVENTORY AND APPRAISAL SHEET WITH PHOTOS

F. WATERBURY STOWE STREET BRIDGE ANR MAP

G. WETLAND BOUNDARY LOCATION FROM STANTEC'S WETLAND SCIENTIST

H. CONTAMINATED SITE LIST IN WATERBURY

I. WATERBURY BRIDGE 36 TRAFFIC MEMO

J. WATERBURY VILLAGE ZONING MAP (2013)

K. WATERBURY FUTURE LAND USE TOWN MAP (2018)

L. LOCAL CONCERNS MEETING MINUTES

A. EXISTING CONDITIONS LAYOUT SHEET

Plan sheet showing project location and site geometry including surrounding houses, utilities, adjacent roads and intersections, and rights of way.

VT ROUTE 100

18 RCP

24 RCP

VT STATE PLANE GRID

N

STATE OF VERMONT

HALL, CONRAD F., JR.

2596

VTHD 4X4 CONC

BND

AER E&T

18 CPEP

18 CGMP

CONCRETE

4 PVC

VT ROUTE 100

STATE OF VERMONT

STATE OF VERMONT

BENCHMARK ELEV. = 997.39 ON BRIDGE

BRIDGE 36

THATCHER BROOK

TOP OF CONC. HEADWALL

24 CGMP

N/F
ATCHINSON, JAMES K.

N/F
HADLEY, JUSTIN F.

APPROX. ROW LINE (CL OF RIVER)

APPROX. LOCATION OF WATERLINE.
EXACT LOCATION TO BE DETERMINED

WETLAND BUFFER AS IDENTIFIED BY
STANTEC'S ENVIRONMENTAL SCIENTIST

CLASS I WETLAND AS IDENTIFIED BY
STANTEC'S WETLAND SCIENTIST

JAMES & JEANNE ATCHINSON
116 STOWE STREET

PORCH

STOWE STREET

LINCOLN STREET

SIDEWALK

GRAVEL DRIVE

PAVED DRIVE

RANDALL & CINDY BRONSON
3 LINCOLN STREET

TIMOTHY & CLAUDETTE PARKS
1 LINCOLN STREET

STREET

PORCH

NNE CEDENO
E STREET

0 20 40
SCALE IN FEET

Stantec

PROJECT NAME:	BRIDGE 36 STUDY		
PROJECT NUMBER:	195311625		
FILE NAME: Existing Conditions Layout.dgn		PLOT DATE:	8/7/2018
PROJECT LEADER:	T. KNIGHT	DRAWN BY:	R. DANIELS
DESIGNED BY:	R. DANIELS	CHECKED BY:	T. KNIGHT
EXISTING CONDITIONS LAYOUT SHEET		SHEET	1 OF 1

B. COLBYVILLE PEDESTRIAN/BICYCLE SCOPING STUDY

A study conducted by Broadreach Planning & Design, which studies the alternatives of facilitating pedestrian and bicycle traffic from the Colbyville area to Waterbury Village. The study recommends repairing the existing sidewalk on Bridge 36 and extending the sidewalk to intersection of Stowe Street and VT Route 100. The study can be found at the following website:

https://www.waterburyvt.com/news/item/post/colbyville-pedestrianbicycle-scoping-study-1/

C. LOCAL & REGIONAL INPUT QUESTIONNAIRE

When bridge is identified for scoping, the local community is surveyed to get input relating to potential socio-economic and community concerns. These comments were incorporated into the scoping report and are considered during the alternatives review.

Town of Waterbury, Stowe St. Bridge – Existing Conditions Study - Community Considerations

1. *Are there any scheduled public events in the community that will generate increased traffic (e.g. vehicular, bicycles and/or pedestrians), or may be difficult to stage if the bridge is closed during construction? Examples include bike races, festivals, parades, cultural events, farmers market, concerts, etc. that could be impacted? If yes, please provide date, location and event organizers' contact info.*

   Currently the events that generate the heaviest traffic are the Stowe Lacrosse Tournament that was on July 14-15 and July 21-22. This impacts traffic that is primarily traveling north on Route 100 / Waterbury-Stowe Rd. from Exit 10 but the traffic also backs up into Waterbury village. The other heavy traffic weekend is the Antique Car Show that will be on August 10, 11 and 12 at Farr's Field on Route 2, west of Waterbury village. This event will impact congestion in the I-89 Exit 10 interchange area.

2. *Is there a "slow season" or period of time from May through October where traffic is less?*

   There is not very much of a "slow season" for the vicinity of I-89 Exit 10. The spring months, once the ski areas close, are somewhat "slow". The period in September from Labor Day to the start of foliage season may be "slow" as well.

3. *Please describe the location of emergency responders (fire, police, ambulance) and emergency response routes.*

   The Waterbury Fire Stations are located at 43 S. Main St. in Waterbury village and 158 Maple St. in Waterbury Center. The State Police serve Waterbury from their barracks in Middlesex. The Waterbury Ambulance Service is located at 1727 Guptil Rd. in Waterbury Center. Stowe St. is not a common route for these emergency services unless there is a call for response to a site on or directly off Stowe St.

4. *Are there businesses (including agricultural operations) that would be adversely impacted either by a detour or due to work zone proximity?*

   The Grist Mill is located at 92 Stowe St. and houses three businesses including the Hen of the Wood Restaurant. The restaurant is a popular destination eating establishment that requires reservations well in advance and is easily accessed from the south end of Stowe St. It is unlikely that a detour would adversely impact the restaurant or the other businesses in the building that include an upholstery shop and ceramic studio / gallery. The businesses in the most southerly block of Stowe St. are typically accessed from Main St. or other nearby side streets and should not be adversely impacted by a detour either.

5. *Are there important public buildings (town hall, community center, senior center, library) or community facilities (recreational fields, town green, etc.) close to the project?*

   The Waterbury Area Senior Center is located in the first block of Stowe St. off Main St. and would not be adversely impacted.

6. *What other municipal operations could be adversely affected by a road/bridge closure or detour?*

   The Water, Wastewater, and Highway Departments all use Stowe St. frequently but could still serve the Stowe St. and Perry Hill Rd. areas adequately with detours. Winter plow routes in the area would have to be altered with some small additional time required.

7. *Are there any town highways that might be adversely impacted by traffic bypassing the construction on another local road?*

   There would be some impact to Perry Hill Rd. since it would be one of the detour routes. A significant portion of Perry Hill Rd. is gravel surfaced so additional grading may be needed during the time of the closure of Stowe St. at the bridge.

8. *Is there a local business association, chamber of commerce or other downtown group that we should be working with?*

   Revitalizing Waterbury, Inc. is very involved in our transportation projects and assisting the businesses that may be negatively impacted during the construction periods for these projects.

Schools

1. *Where are the schools in your community and what are their schedules?*

   The Thatcher Brook Primary School is located at 47 Stowe St. The regular school schedule starts at about 7:45 a.m. and ends at about 2:30 p.m. Closure of Stowe St. at the bridge would impact the bus routes that access the school since many of the buses come and go from the school on Stowe St. to serve the most populous areas of Waterbury. Most of these buses could detour the bridge without a serious impact to their service and schedules.

2. *Is this project on the specific routes that students use to walk to and from school?*

   Most of the students that walk or bike to school live to the south and east of the bridge and would not be seriously impacted by a bridge closure.

3. *Are there recreational fields associated with the schools (other than at the school)?*

   The Town has recreation fields at Dascomb Rowe Field located at 32 N. Main St. and Anderson Field, that includes our Municipal Pool and Recreation Building, located at 25-29 Butler St. off N. Main St. These facilities would not be seriously impacted by a bridge closure.

Pedestrians and Bicyclists

1. *What is the current level of bicycle and pedestrian use on the bridge?*

   There is a moderate amount of pedestrian and bicycle use of the bridge. Since the village sidewalk currently ends on the north side of the bridge, that limits the amount of pedestrian use of the bridge but people still walk up and down Route 100 / Waterbury-Stowe Rd. and Blush Hill Rd. and use the bridge to access Waterbury village.

2. *Are the current lane and shoulder widths adequate for pedestrian and bicycle use?*

   No - the lane and shoulder widths are too narrow for bicycle use and the existing sidewalk on the bridge is in poor condition and is inadequate as well.

3. *Does the community feel there is a need for a sidewalk on the bridge?*

   We definitely need a sidewalk on at least one side of the bridge to tie into the pedestrian facilities for the intersection with Route 100 / Waterbury-Stowe Rd. and its vicinity that are currently in design and will be constructed.

4. *Is pedestrian and bicycle traffic heavy enough that it should be accommodated during construction?*

   There are different opinions about this issue as expressed at the Local Concerns meeting on July 17th. It is unlikely that pedestrian and bicycle traffic is currently heavy enough that it needs to be accommodated with the significant additional cost during construction, especially if the bridge is closed and replaced under the accelerated bridge program. If however, the existing bridge can be used while a new bridge is under construction and pedestrians and bicyclists can be accommodated with a minor amount of additional cost, then those accommodations should be considered.

5. *Does the Town have plans to construct either pedestrian or bicycle facilities leading up to the bridge? Please provide a planning document demonstrating this (scoping study, master plan, corridor study, town plan).*

   The Broadreach Planning & Design, Colbyville Pedestrian/Bicycle Scoping Study and the current VTrans Bike/Ped grant funded design and construction project includes pedestrian and bicycle facilities leading from the bridge through the intersection of Route 100 / Waterbury-Stowe Rd.

and Stowe St. / Blush Hill Rd. A recent VTrans Enhancement Grant funded project constructed sidewalk on Stowe St. from the Thatcher Brook Primary School to the bridge.

6. *In the vicinity of the bridge, is there a land use pattern, existing generators of pedestrian and/or bicycle traffic, or zoning that will support development that is likely to lead to significant levels of walking and bicycling?*

   There is a 26-lot single-family house planned unit development that is off Perry Hill Rd. nearby the bridge that is approximately ½ constructed that is already a generator of additional pedestrian and bike traffic. Also the 60-unit Blush Hill Meadows apartment complex that is across Route 100 / Waterbury-Stowe Rd. from the Shaw's supermarket in Colbyville is a potential generator of both pedestrian and bicycle traffic. Both the nearby Best Western Inn and Fairfield Inn in Colbyville generate a significant amount of pedestrian traffic that includes guests that walk down Stowe St. to downtown Waterbury. Other similar projects could occur in the vicinity of the bridge, especially under revisions / amendments to the current zoning and subdivision regulations that are being considered.

Communications

1. *Please identify any local communication channels that are available for us to use in communicating with the local population. Include weekly or daily newspapers, blogs, radio, public access TV, Front Porch Forum, etc. Also include any unconventional means such as local low-power FM.*

   The following communication channels should be utilized: The Waterbury Record weekly newspaper, WDEV radio, ORCA Media public access TV in Montpelier, Waterbury / Duxbury Front Porch Forum, and the Town of Waterbury website.

Design Considerations

1. *Are there any concerns with the alignment of the existing bridge? For example, if the bridge is located on a curve, has this created any problems that we should be aware of?*

   The alignment of the bridge in relationship to the nearby intersection with Route 100 / Waterbury-Stowe Rd. is skewed which is not ideal, especially for the Link Express bus and school buses which go over the bridge frequently.

2. *Are there any concerns with the width of the existing bridge?*

   The existing bridge has a total roadway width of approximately 20' which is very inadequate, especially for buses.

3. *Are there any special aesthetic considerations we should be aware of?*

   The bridge is a gateway into Waterbury village and aesthetics are very important for the gateways to our villages. There is also a need for traffic calming in this location, especially for vehicles coming off Route 100 / Waterbury-Stowe Rd. and Blush Hill Rd., going south and downhill on Stowe St. There are many families with young children living in this area who walk and bike through the neighborhood. Vehicles need to be encouraged / required to slow down, especially for safety reasons. Lighting on the bridge and the nearby intersections, including the Stowe St. / Lincoln St. intersection should be taken into consideration in conjunction with replacing / rehabilitating the bridge.

4. *Does the location have a history of flooding? If yes, please explain.*

   Thatcher Brook, that flows under the bridge, is prone to flooding. This is more of an issue with potential undermining of and damage to the wing walls and abutments for the bridge than the superstructure and roadway which are well above the 100-year floodplain.

5. *Are there any known Hazardous Material Sites near the project site?*

   There are none that we are aware of.

6. *Are there any known historic, archeological and/or other environmental resource issues near the project site?*

   The bridge is a gateway to the Mill Village Historic District that is south of the bridge along Stowe St. There are numerous old mill sites with remnants of the old dams in the Mill Village area and Colbyville to the north. There is one existing grist mill in Mill Village that has been restored for other uses including the Hen of the Wood restaurant. There are no known archeological or historic sites in the immediate vicinity of the bridge. Our understanding is that there are no mapped wetlands in the immediate vicinity of the bridge as well.

7. *Are there any other comments that are important for us to consider?*

   None at the current time.

Land Use & Zoning (to be filled out by the municipality or RPC).

1. *Please provide a copy of your existing and future land use map or zoning map, if applicable.*

   The Future Land Use Map from the Municipal Plan, and the Zoning Map for Waterbury village from the Zoning Regulations are attached.

2. *Is there any existing, pending or planned development proposal that would impact future transportation patterns near the bridge? If so please explain.*

   There are no major new developments proposed or permitted in the vicinity of the bridge other than the build-out of the 26-lot single-family house planned unit development that is off Perry Hill Rd. and the 60-unit Blush Hill Meadows apartment complex that are described above.

3. *Is there any planned expansion of public transit service in the project area? If not known please contact your Regional Public Transit Provider.*

   We are not aware of any proposed expansions of the public transit service in the project area. The existing Park & Ride lot off Lincoln St. already serves as a hub for the Green Mountain Transit Link Express, Morrisville Commuter, and Waterbury Commuter buses.

D. OPERATIONS INPUT QUESTIONNAIRE

When the bridge is identified for scoping, the operations personnel is surveyed to get input relating to potential geometry, maintenance issues, conditions and infrastructure concerns. These comments were incorporated into the scoping report and are considered during the alternatives review.

E. STRUCTURE INSPECTION, INVENTORY AND APPRAISAL SHEET WITH PHOTOS

Inspection report for Bridge 36, from the Vermont Agency of Transportation's Structures section. The Bridge Management and Inspection Unit conducted a routine inspection dated 4/12/2018 on this bridge. Due to the deteriorated deck condition, a special annual inspection is required for inspecting the concrete deck.

Bridge Scoping Project – To Be Determined
Operations Input Questionnaire

The Structures Section has begun the scoping process for Stowe Street Bridge over Thatcher Brook Bridge 36. This is a Concrete T-Beam bridge constructed in the 1920's. The Structure Inspection, Inventory, and Appraisal Sheet (attached) rates the deck as 5 (Fair), the superstructure as 5 (Fair), and the substructure as 5 (Fair). We are interested in hearing your thoughts regarding the items listed below. Leave it blank if you don't wish to comment on a particular item.

1. Your thoughts on the general condition of this bridge and the general maintenance effort required to keep it in service.

   As VTRANS Bridge Inspection reports state the bridge continues to deteriorate and replacement needs to happen in the next 10 years. VTRANS has increased inspection to annual. In the past 10 years the Town has done three repair projects and prior to that the concrete tee beams were patched. The patching has started to significantly spall exposing rebar. The Town feels it is better to quickly plan for a new bridge rather than to continue to spend monies on short-term repairs.

2. Any comments on the geometry of the bridge (curve, sag, banking, sight distance)?

   Bridge is too narrow for especially large vehicles crossing the bridge in either direction due to the existing alignment. Alignment makes turning off Lincoln Street onto the bridge difficult for any size vehicle. Sidewalk on the bridge is too narrow.

3. Do you feel the posted speed limit is appropriate?
   Yes

4. Is the width adequate for snow plowing?

   Per Randy Guyette, Asst. Highway Foreman, who has plowed the Village for many years the existing bridge width is not adequate for plowing. When his plow truck is carrying the wing he crosses over into the other lane so he ends up sometimes waiting for traffic to move through the bridge. Even without the wing his plow creeps up on the existing sidewalk.

5. Are the joints salvageable or would you recommend replacement?

   There are no visible expansion joints but whatever is there needs to be replaced along with the rest of the entire existing bridge.

6. Are the railings constantly in need of repair or replacement? What type of railing works best for your district?

   Existing bridge railings are concrete and have not required repair. The Town is open to all options for new railing types on a new bridge.

7. Are you aware of any unpermitted driveways within the likely project limits? We frequently encounter driveways that prevent us from meeting railing standards and then discover them to be illegal.

   No

8. Are you aware of abutting property owners that are likely to need special attention during the planning and construction phases? These could be people with disabilities, elderly, or simply folks who feel they have been unfairly treated in the past.

   Property owner directly across from the bridge on Stowe Street has complained about GMTA buses going up on his lawn as well as large vehicles. Need to keep him in the loop during planning phase.

9. Do you find that extra effort is required to keep the slopes and river banks around the bridge in a stable condition? Is there frequent flood damage that demands repair?

   No. The bridge has experienced minor erosion to top of footings when flow rises above the top of footings. Not judge serious enough at this time. Bridge did experience undercutting of easterly footing and the Town had Austin Construction drive sheeting adjacent to the footing to minimize future undercutting of the footing.

10. Does this bridge seem to pick up an unusual amount of debris from the waterway?
    No

11. Do you think a closure with off-site detour and accelerated construction would be appropriate? What should we consider for a detour route, assuming that we use State route for State projects and any route for Town projects?

    This may be the best and fastest option because there is little room for a temporary bridge adjacent to the existing bridge. Detour route will utilize Stowe Street as the main detour. While

much longer in road length access to Perry Hill and side roads off Perry Hill can come off Guptil Road/Kneeland Flats Roads

12. Please describe any larger projects that you have completed that may not be reflected on the attached Appraisal sheet, such as deck patches, paving patches, railing replacement with new type, steel coating, etc.

    The Town has in chronologic order patched the concrete tee beams, rehabbed the upstream ends of both wing walls to better support a critical gravity sewer that crosses Thatcher Brook, drove sheeting on the downstream east side to minimize under cutting of the bridge footing and most recently repaired the west upstream wing wall.

13. If there is a sidewalk on this bridge, how effective are the Town's efforts to keep it snow and ice free?

    A recent sidewalk project brought a new sidewalk up to the bridge sidewalk. This project did bring the sidewalk plow to the bridge sidewalk more often allowing for more frequent sidewalk plowing. However road plowing across the bridge dumps snow onto the sidewalk and with the solid concrete railing snow cannot be pushed through the concrete railing and off the bridge sidewalk.

14. Are there any drainage issues that we should address on this project?

    The existing grade between the bridge and VT 100 results in runoff coming down to the bridge which has resulted in wing wall deterioration. The runoff also deposits sediment onto the bridge.

15. Are you aware of any complaints that the public has about issues that we can address on this project?

    GMTA has complained about the narrowness and alignment issues which requires their large buses to cross over into the other lane or even up on the sidewalk when crossing the bridge. Public complains about the condition of the sidewalk, closeness to the road, narrowness of the sidewalk and that the sidewalk ends on the west end of the bridge.

16. Anything else?

F. WATERBURY STOWE STREET BRIDGE ANR MAP

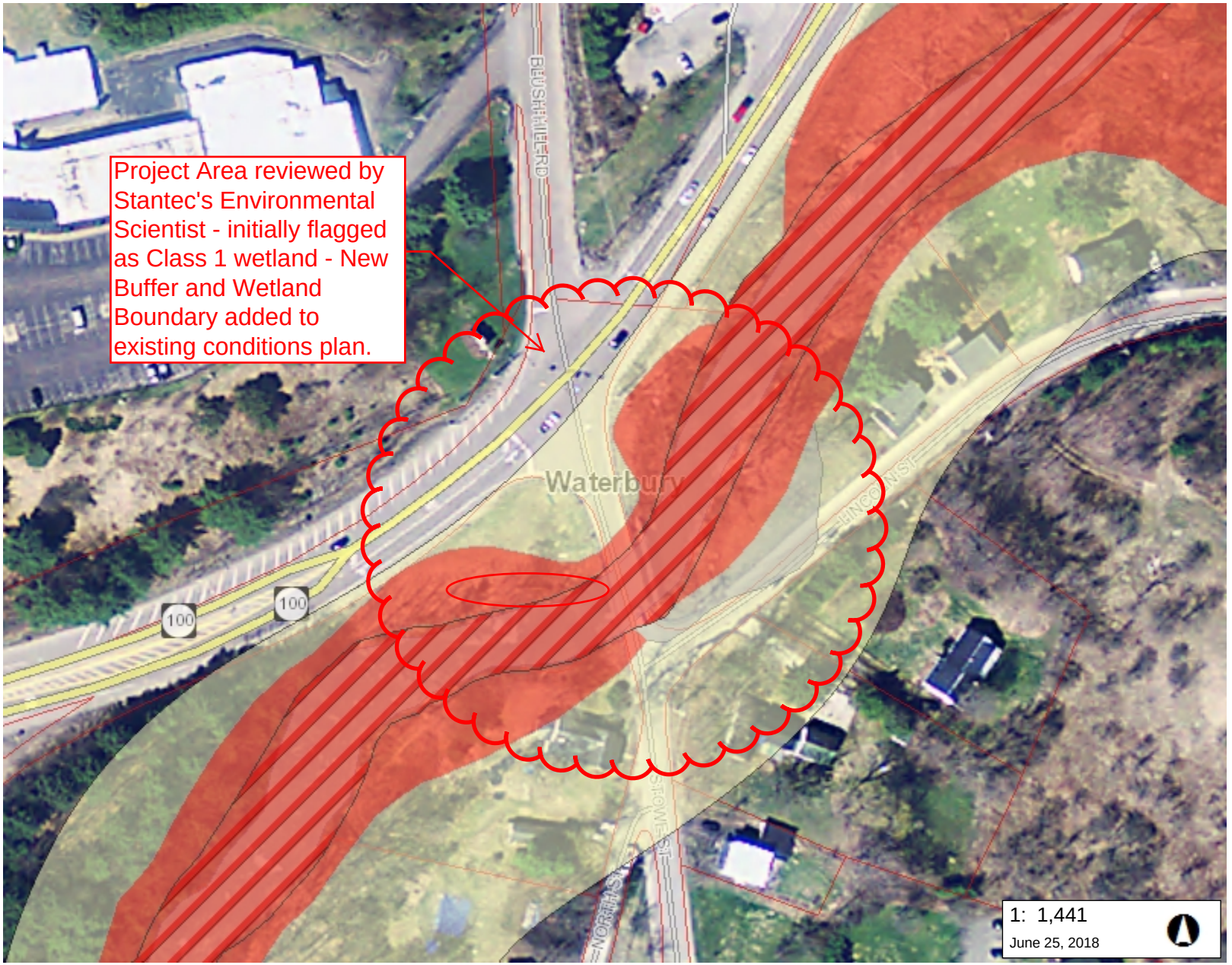
Map from Vermont Agency of Natural Resources website identifying the project area as being inside the floodplain and having Class I wetlands on site. Stantec's environmental scientist surveyed this area for wetlands to identify Class I wetland boundaries.

VERMONT

Waterbury **Stowe Street Bridge** ANR Map

Vermont Agency of Natural Resources

vermont.gov



LEGEND

- Wetland - VSWI
  - Class 1 Wetland
  - Class 2 Wetland
  - Buffer
- Wetlands Advisory Layer
- DFIRM Floodways
- Flood Hazard Areas (Only FEM
  - AE (1-percent annual chance floodp
  - A (1-percent annual chance floodpl
  - AO (1-percent annual chance zone feet)
  - 0.2-percent annual chance flood ha
- River Corridors (Jan 2, 2015)
  - .5 - 2 sqmi.
  - .25-.5 sqmi.
- Rare Threatened Endangered
  - Threatened or Endangered
  - Rare
- Significant Natural Community
- Uncommon Species and Other
  - Animal
  - Plant
  - Natural Community
- Roads
  - Interstate
  - Principal Arterial
  - Minor Arterial
  - Major Collector

NOTES

Map created using ANR's Natural Resources Atlas

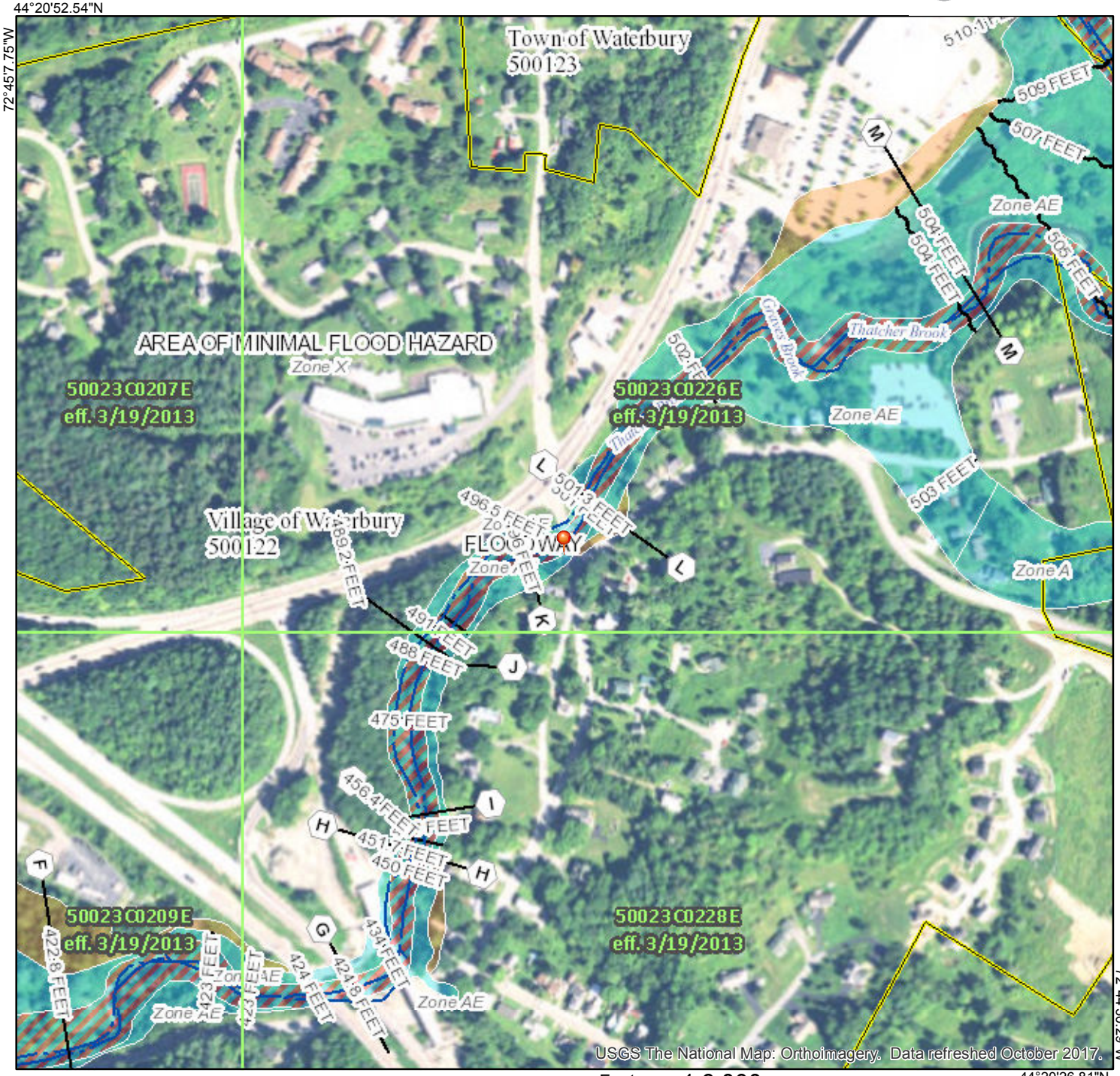
73.0 0 36.00 73.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 120 Ft. 1cm = 14 Meters

THIS MAP IS NOT TO BE USED FOR NAVIGATION

National Flood Hazard Layer FIRMette

FEMA



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/6/2018 at 12:18:31 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

G. WETLAND BOUNDARY LOCATION FROM STANTEC'S WETLAND SCIENTIST

Stantec's environmental scientist surveyed the project area to identify wetlands in the vicinity. The approximate boundary of the wetlands is identified on the map, which is similar to the boundary identified in the Colbyville Pedestrian/Bicycle Scoping Study.

Knight, Tom

From: Knight, Tom
Sent: Friday, August 3, 2018 8:38 AM
To: Daniels, RuthAnne
Subject: FW: Waterbury Stowe Street Bridge - site recon
Attachments: Fig 3 from Colbyville_Report_edited.pdf; Waterbury Stowe St Bridge ANR Map.pdf

---

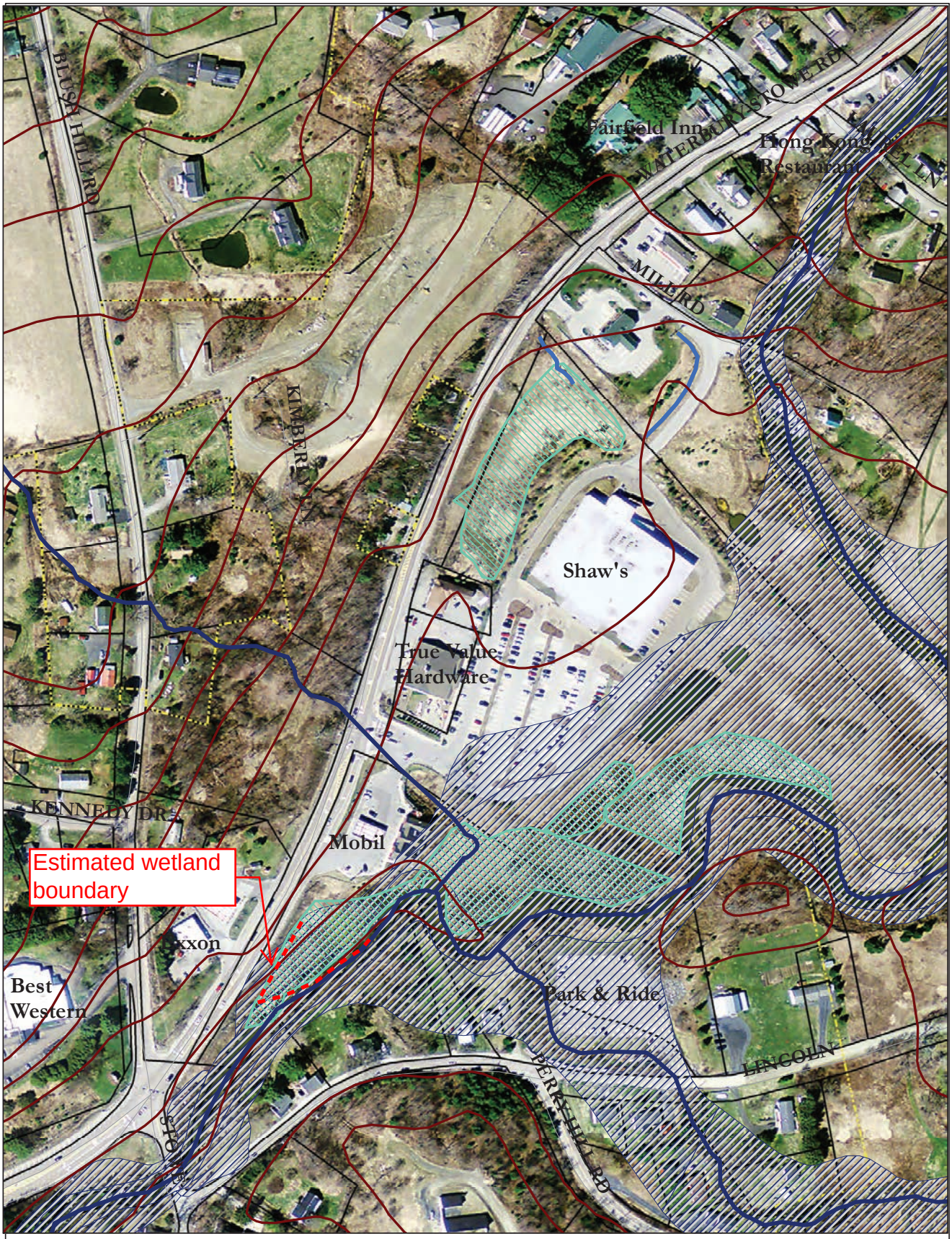
From: Harris, Polly
Sent: Tuesday, July 17, 2018 4:08 PM
To: Knight, Tom <tom.knight@stantec.com>
Subject: Waterbury Stowe Street Bridge - site recon

Tom - I visited the Waterbury Stowe Street Bridge project site on June 27, 2018 to verify the location of wetlands upstream of the project area. These wetlands are not mapped on the ANR database but were mapped as part of the Broadreach/Colbyville project. Based on my site visit, the wetlands mapped on Figure 3 in that report are a bit over-generous – the actual wetlands do not extend downstream (toward the bridge) as far as shown on the sketch. However, even as mapped, the bridge is located outside of the 50-foot buffer to these wetlands. Attached is a revised Figure 3 showing my estimate of the wetland boundary.

With respect to other natural resources, there is a mapped floodplain located along the river. No RTE species have been identified in the project area, but all of Vermont is considered habitat for the Threatened Northern Long-eared bat.

Let me know if you have further questions.

Polly Harris
Environmental Project Manager
Stantec
55 Green Mountain Drive South Burlington VT 05403-7824
Phone: (802) 497-6407
Polly.Harris@stantec.com



Colbyville Pedestrian/Bicycle Scoping Study

Waterbury, Vermont

Existing Conditions: Natural

Legend

- Watercourse
- Twenty Ft Contours
- Drainage Way
- Wetland
- Flood Hazard
- Parcel Line
- Village Boundary

BROADREACH Planning & Design

Lamoureux & Dickinson

Heritage Landscapes

UVM CAP

200 100 0 200 Feet

June 2, 2017

Figure 3

H. CONTAMINATED SITE LIST IN WATERBURY

List of contaminated sites in Waterbury from the ANR hazardous sites website. Of note is the Best Western in Waterbury, which is the first property on Blush Hill Rd, across the road from Stowe Street. Billings Mobile/Waterbury Mobile is located as the next property northbound on Route 100.

Waterbury Contaminated Site List

Site#	Site Name	Site Address	Site Town	Site County	Priority	Discovery Date	Closure Date	Primary Consultant
20134435	Best Western Waterbury	45 Blush Hill Rd.	Waterbury		LOW	06-12-2013		Wheeler Environmental Services
890359	Billings Mobil	Route 100	Waterbury	Washington	SMAC	01-01-1989	10-22-2012	GES
992666	Waterbury Mobil	758 Waterbury Stowe Rd	Waterbury	Washington	SMAC	09-17-1998	08-10-2001	Groundwater and Environmental Services
972296	Ben And Jerrys Homemade Inc	Route 100	Waterbury	Washington	SMAC	09-01-1997	01-30-2004	Sprague Geoscience
20184788	14 South Main Street	14 South Main Street	Waterbury		LOW	05-10-2018		Ross Environmental Assoc. Inc.
992722	A G Anderson	Railroad St	Waterbury	Washington	SMAC	11-29-1999	11-16-2005	EIV Technical Services
20114145	Bourne's Energy Waterbury Bulk Plant	1983 Waterbury Stowe Rd.	Waterbury		LOW	08-05-2010		Weston & Sampson
20063556	Burt Residence	39 High St	Waterbury	Washington	SMAC	06-26-2006	06-13-2008	Ross Environmental Assoc. Inc.
982502	Caforia Market	Route 100	Waterbury	Washington	LOW	09-28-1998		Vermont HydroGeo LLC
972214	Champlain Farms	1 Main St	Waterbury	Washington	MED	06-27-1997		Aquaterra
921288	D S B Soils	Main St	Waterbury	Washington	NFAP		09-28-1993	N/A
992586	Eagle Oil	Batchelder St	Waterbury	Washington	SMAC	01-05-1999	03-04-1999	Heindel & Noyes
900521	Eagle Oil Co	n/a	Waterbury	Washington	NFAP			N/A
900618	Estroffs Store	Rt 100	Waterbury	Washington	SMAC		08-01-1998	N/A
20022958	Flanders Residence	21 Elm St	Waterbury	Washington	SMAC	11-02-2001	02-19-2003	Heindel & Noyes
20053431	former Coffin/Farnham Property	944 Waterbury-Stowe Rd, Rt 100	Waterbury	Washington	SMAC	09-01-2005	06-28-2007	Environmental Compliance Services Inc
20164673	Former Emery's Store	3627 VT Route 100 (Waterbury-S	Waterbury				01-04-2018	Environmental Compliance Services Inc
20043226	former Keil Property	2032 U S Rt 2	Waterbury	Washington	SMAC	05-14-2004	04-04-2005	Ross Environmental Assoc. Inc.
20144520	GMP Winooski Street Substation	Winooski Street	Waterbury		LOW	08-26-2014		Green Mountain Power Corporation
20144474	Larkin Building	3 South Main St	Waterbury		SMAC	10-23-2013	05-07-2014	Environmental Compliance Services Inc
20053408	Luce Residence	94 Lake View Terrace	Waterbury	Washington	SMAC	07-12-2005	12-21-2005	Ross Environmental Assoc. Inc.
20114231	Northfield Savings Bank	29 South Main St	Waterbury		MED	08-29-2011		Wheeler Environmental Services
20144536	O'Kane Residence	1566 Shaw Mansion Rd	Waterbury		SMAC	09-25-2014	08-03-2015	Environmental Compliance Services Inc
890440	Park Street Well	Park Street	Waterbury	Washington	NFAP	03-01-1989	10-21-1994	Heindel & Noyes
20124285	Ray's Autobody, Inc.	327 US Route 2	Waterbury		LOW	03-12-2012		ATC Group Services LLC
951834	S T Paving	Coffee Lane	Waterbury	Washington	SMAC	04-10-1995	01-22-2001	Hoffer Associates
20053448	Sanders Residence	225 Stuart Lane	Waterbury	Washington	SMAC	10-27-2005	08-10-2007	Wheeler Environmental Services
911158	Smiths Store	Route 100	Waterbury	Washington	LOW	11-21-1991		Sites Management Section - DEC
911184	Snow Valley Sunoco	Route 100	Waterbury	Washington	SMAC	01-01-1992	12-03-2010	DB Environmental
20043253	Thatcher Brook Inn	1017 Waterbury-Stowe Rd	Waterbury	Washington	SMAC	07-22-2004	12-04-2006	EIV Technical Services
20023022	Valley Rent-All	53 N Main St	Waterbury	Washington	SMAC	04-10-2002	06-18-2010	Griffin International Inc
20033131	Vermont Clay Studio	Rt 100N	Waterbury	Washington	SMAC	08-01-2003	04-05-2004	EIV Technical Services
870109	Village Garage	Rt 2, Main St	Waterbury	Washington	SMAC	06-06-1987	06-19-2009	N/A
870155	Walter Pavitt	n/a	Waterbury	Washington	NFAP			N/A
890405	Waterbury B.P.	145 South Main St	Waterbury	Washington	NFAP		12-01-1993	Hoffer Associates
982499	Waterbury Citgo	49 S Main St	Waterbury	Washington	SMAC	08-24-1998	09-23-2002	Griffin International Inc
20144508	Waterbury Community Garden	28 North Main Street	Waterbury		SMAC	07-30-2014	02-23-2016	KAS Inc
20083796	Waterbury Crossroads Citgo	52 N Main St	Waterbury	Washington	SMAC	05-23-2008	05-08-2012	KAS Inc
962068	Waterbury Elementary School	47 Stowe St	Waterbury	Washington	SMAC	09-01-1996	04-01-1997	Griffin International Inc
992710	Waterbury Municipal Dump	Old Dump Rd	Waterbury	Washington	SMAC	11-15-1999	06-20-2008	Heindel & Noyes
870069	Waterbury School	n/a	Waterbury	Washington	NFAP			N/A
911057	Waterbury Town Garage	Guptil Rd	Waterbury	Washington	LOW	01-01-1991		LE Environmental
20012888	WDEV Radio Station	Blush Hill Rd	Waterbury	Washington	SMAC	07-19-2001	07-31-2001	Environmental Products and Services Inc
20144543	Wtby State Office Complex Berm Material	103 South Main Street	Waterbury		LOW			Ross Environmental Assoc. Inc.

I. WATERBURY BRIDGE 36 TRAFFIC MEMO

Stantec's Traffic engineer analyzed the Lincoln Street/Stowe Street and the VT Route 100/Stowe Street/ Blush Hill Road intersections for safety and capacity. The memo and appendix includes findings and supporting calculation and documentation, summarized in the body of the Bridge 36 report.

Stantec

Memo

To:	Tom Knight S Burlington VT	From:	David DeBaie Auburn NH
File:	195311625	Date:	July 11, 2018

Reference: Waterbury Stowe St Bridge 36 - Traffic Conditions

Description of Roadways

Bridge 36 is located over Graves Brook on the northern end of Stowe Street between Vermont Route 100 (VT100) and Lincoln Street. Stowe Street continues south as a principally residential street to Main Street (US 2) in Waterbury Village. Lincoln Street is a two-lane roadway that provides access to a Park and Ride Lot and to numerous intersecting residential streets. This area access by Lincoln Street has a second connection to VT100 via Guptil Road.

Stowe Street is a two-lane variable width roadway with 0 to1-foot shoulders along this 175-foot distance between the Lincoln Street and VT 100 intersections. There is a sidewalk on the westside of the bridge and from the southern end of the bridge past Lincoln Street to North Street. The Stowe Street roadway width which is 22 feet on Bridge 36 widens due to the corner radii at VT 100 and Lincoln Street. There is a continuous guardrail on the edge of the Stowe Street roadway from VT 100 to the bridge where the parapet is continuous across the bridge; between the bridge and Lincoln Street there is a continuous guardrail on both sides of Stowe Street. The Stowe Street vertical profile rises by about 8 percent from Lincoln Street to VT 100. The pavement markings on Stowe Street between VT 100 and the bridge consist of a double yellow centerline, white edgelines and a stopline on the approach to VT 100. The intersection of VT 100 and Stowe Street is traffic signal controlled.

Lincoln Street in the vicinity of Stowe Street has approximately the same 22-foot width. Lincoln Street slopes down to Stowe Street and along the 75 feet back away from Stowe Street. There is a guardrail protecting the slope down to Graves Brook. There are no pavement markings on Lincoln Street or on Stowe Street at their intersection. Lincoln Street is STOP sign controlled on its approach to Stowe Street. The Stowe Street approaches are not controlled.

Existing Conditions

Stowe Street and Lincoln Street are two-way streets. There is significant Commuter travel through their intersection and the Stowe Street intersection with VT 100. Peak period turning movement volumes were observed by Stantec during the 4:30 to 5:30 PM and 7:30 to 8:30 AM hours on July 5 and 6th, 2018 at the Lincoln Street intersection and prior counts conducted by VTrans on August 15 and 17, 2016 at the VT 100 intersection were obtained for this report.

The recent counts at the Lincoln Street and Stowe Street intersection were compared and adjusted to match the Stowe Street and VT 100 intersection counts which required no seasonal adjustment. All were adjusted by 2 percent to reflect 2018 design hour Volume (DHV) conditions as provided in the appendix. The data indicates 73-74 vehicles on the Lincoln Street approach during the peak hours; 98 AM and 259 PM peak hour vehicles on the Stowe Street northbound approach to Lincoln Street; and the 166 AM and PM peak hour vehicles on the Stowe Street southbound approach to Lincoln Street.

Capacity Analysis

The Stowe Street and Lincoln Street intersection is fairly close to VT 100 (175 feet) and queuing back from VT 100 queues past Lincoln Street during peak hours due to the operation of the traffic signal. The VT 100/ Stowe Street traffic signal operates on an 88-second cycle during the morning and 96-second cycle during the evening as part of a coordinated system on VT 100. Analysis of the existing DHV provides results as presented in Table 1. Analysis results indicate that while the VT 100 intersection operates a t Level of Service C or D, the westbound Stowe Street approach operates at LOS F during the evening peak period with queues of up to 9 vehicles which pass beyond the Lincoln Street intersection. The Lincoln Street unsignalized intersection would be affected by those queues but otherwise would operate at LOS B.

Table 1 Existing Capacity Analysis Results

Time Period	Stowe Street at VT 100		Stowe Street WB Approach to VT 100			Lincoln St at Stowe Street
	Overall LOS	Overall V/C	LOS	V/C	95Th Queue	LOS
AM	C	0.83	D	0.39	3 veh.	B
PM	D	0.91	F	1.23	9 veh.	B

Crash Analysis

Stantec also reviewed the crash history on Stowe Street at the Lincoln Street and VT 100 intersections. VTrans records were obtained for the 5-year period between 2012 and 2016. During this time there were no crashes reported at the Lincoln Street intersection. At the VT 100 intersection, a total of 8 crashes were reported. All but two were rear end type crashes and four rear end crashes occurred on the northbound VT 100 approach. One rear end crash occurred on Stowe Street westbound. None of the crashes resulted in personal injury. The crash rate is computed as 0.191 crashes per million vehicle miles. The statewide crash rate for local streets is 1.4298 in rural areas and 2.62 in urban areas.

Future Conditions

Future traffic conditions out to the year 2043 (a 25-year horizon) were determined by applying the VTrans adjustment factors as found in the “Redbook”. For this purpose, the 2018 traffic volumes were adjusted by 11 percent. No know specific land development projects were identified. The computation of the 2043 DHV is presented on worksheets including volume networks provided in the appendix.

Future conditions are expected to include pedestrian improvements to the VT 100/ Stowe Street intersection. Planning for these improvements is actually ongoing at this time. It is expected that VT 100 will be crossed just north of the intersection accommodated with pedestrian phasing, signal heads and pushbuttons. In addition, for the purposes of this study, a future scenario has been analyzed that includes a second approach lane on Stowe Street at VT 100. This lane would operate as a dedicated right turn lane as it would be

intended to accommodate 75 percent of the traffic on the Stowe Street approach. In total, three future scenarios were analyzed. They are:

- 2043 Baseline (No pedestrian accommodation and no right turn)
- 2043 Ped Phase (Only pedestrian accommodation)
- 2043 Ped Phase and Westbound Right Turn Lane

The results of this future capacity analysis are presented in Table 2.

Scenario	Time Period	Stowe Street at VT 100		Stowe Street WB Approach to VT 100			Lincoln St at Stowe Street
		Overall LOS	Overall V/C	LOS	V/C	95Th Queue	LOS
Baseline	AM	D	0.95	D	0.48	4 veh.	B
	PM	E	1.04	F	1.43	11 veh.	B
Ped Phasing	AM	D	1.02	E	0.69	6 veh	B
	PM	E	1.09	F	1.54	12 veh	B
Ped Phasing and RTL	AM	D	1.02	D	0.69	4 veh.	B
	PM	C	0.97	D	0.73	4 veh.	B

LOS = Level of Service; V/C = volume to capacity ratio; 95th Queue = 95th percentile queue; RTL = Right Turn Lane

Future conditions analysis of the year 2043 indicate reduced overall operating conditions at the Stowe Street /VT 100 intersection in terms of level of service during the morning from LOS C to LOS D due to traffic volume growth and the addition of planned pedestrian accommodation requiring a separate phase. (Of course, pedestrian accommodation is a real improvement to the traffic signal operations.) During the evening peak hours the overall reduction is greater as LOS E is expected.

For the purpose of this report, the benefit of a westbound right turn lane was analyzed. The westbound approach experiences queuing today that extends beyond Lincoln Street during peak periods. Future traffic growth and the addition of the pedestrian phasing will exacerbate this queuing. A right turn lane that would

Reference: **Waterbury Stowe St Bridge 36**

extend over Bridge 36 would mitigate both the future growth and pedestrian phasing impacts on the westbound approach.

Stantec Consulting Services Inc.

Dave DeBaie credentials
Senior Traffic Engineer

Phone: (603) 206-7533
Fax: (603) 669-7636
dave.debaie@stantec.com

Attachment: Attachment

c. C.C.

Stantec

APPENDIX

DHV CALCULATIONS

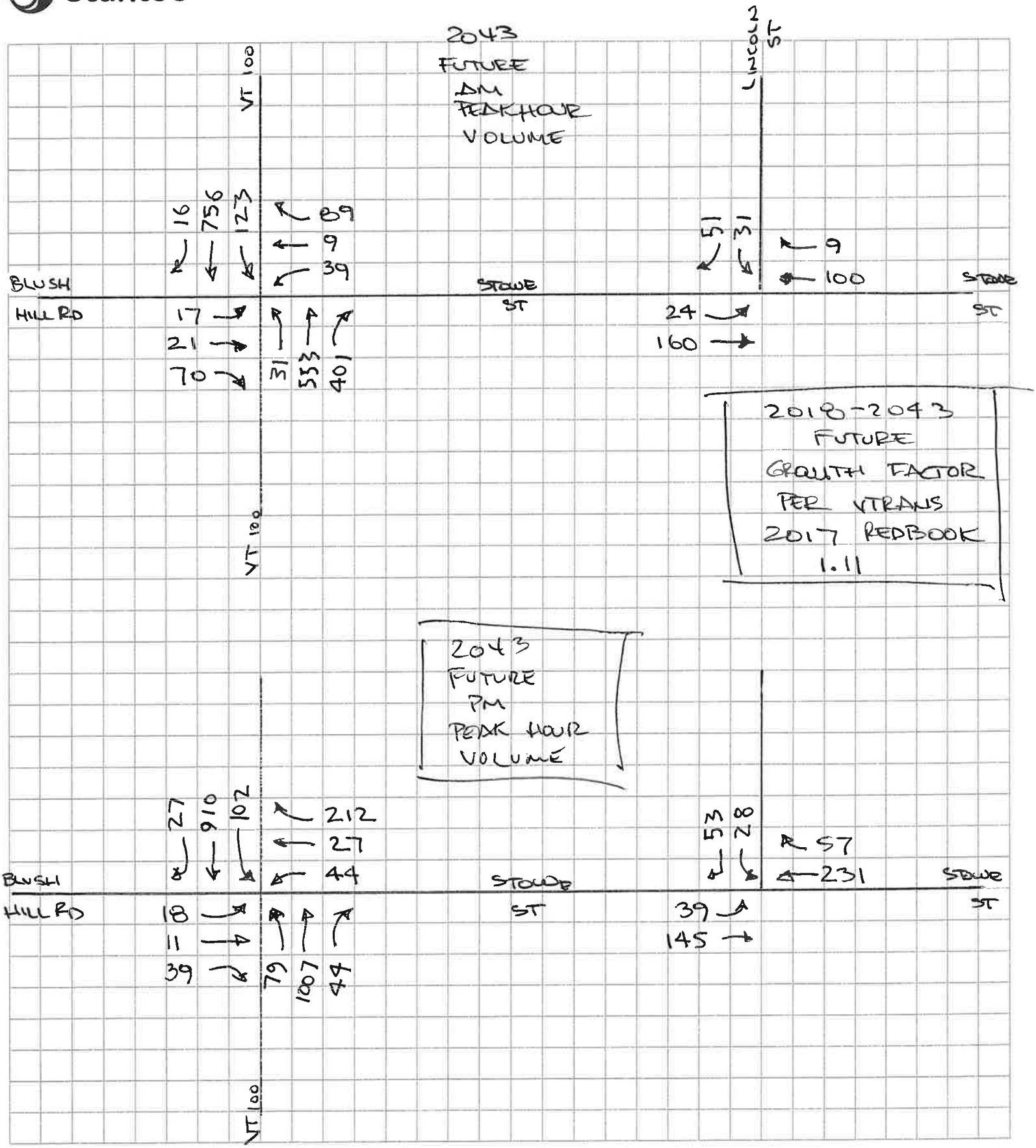
CRASH REVIEW

CAPACITY ANALYSIS

Designed by:

Checked by:

Stantec



195311625 - BRIDGE 36 FEAS

STOWE ST - WATERBURY

2043 VOLUMES

DHV

Designed by: D. DEBAIE

Checked by:

20-YEAR AADT GROWTH FACTORS

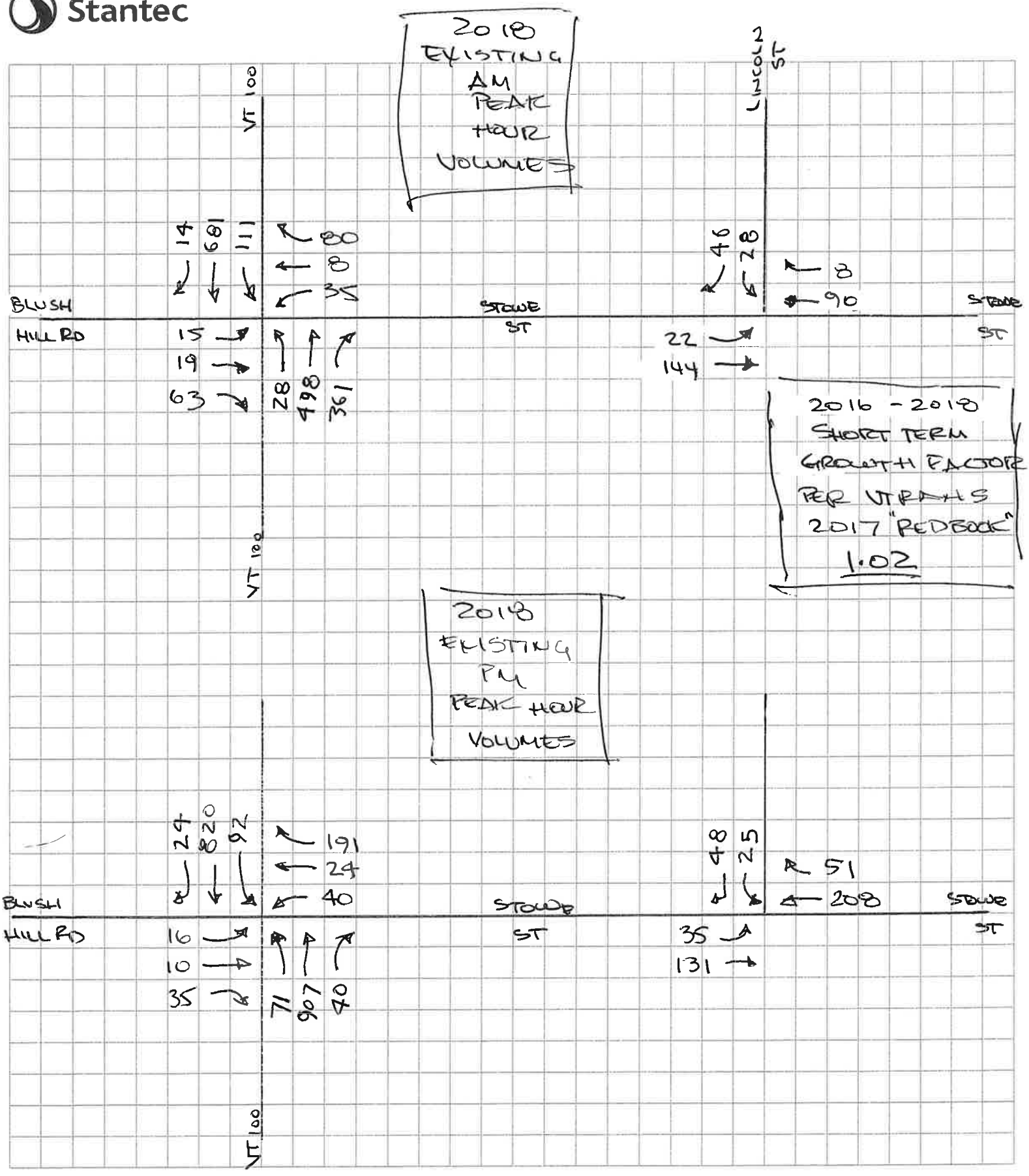
The factors in the table below may be used to project current year AADTs to a future year. They are applicable on all routes statewide.

The factors are based on a 2017 to 2037 20-year AADT growth factor of 1.09 which was developed from Vermont population and labor statistics.

	FROM CURRENT YEAR		
TO FUTURE YEAR	2017	2018	2019
2017	1.00		
2018	1.00	1.00	
2019	1.01	1.00	1.00
2020	1.01	1.01	1.00
2021	1.02	1.01	1.01
2022	1.02	1.02	1.01
2023	1.03	1.02	1.02
2024	1.03	1.03	1.02
2025	1.04	1.03	1.03
2026	1.04	1.04	1.03
2027	1.05	1.04	1.04
2028	1.05	1.05	1.04
2029	1.05	1.05	1.05
2030	1.06	1.05	1.05
2031	1.06	1.06	1.05
2032	1.07	1.06	1.06
2033	1.07	1.07	1.06
2034	1.08	1.07	1.07
2035	1.08	1.08	1.07
2036	1.09	1.08	1.08
2037	1.09	1.09	1.08
2038	1.09	1.09	1.09
2039	1.10	1.09	1.09
2040	1.10	1.10	1.09
2041	1.11	1.10	1.10
2042	1.11	1.11	1.10
2043	1.12	1.11	1.11

25 YEARS GROWTH FACTOR (2018 - 2043)

Stantec



19531162S - BRIDGE 36 FEAS

STOWE ST - WATERBURY

2018 VOLUMES (DHV)

Designed by: D. DEBALE

Checked by:

ESTIMATING DESIGN HOUR VOLUMES

To determine the Design Hour Volume (DHV), normally the 30th highest hourly volume of the year, consider using one of the methods described below. No one method fits every location, so it can be helpful to estimate the DHV using several methods and then compare the results with each other and with any available raw hourly data to gauge whether the value is likely in the neighborhood of the 30th highest hour of the year.

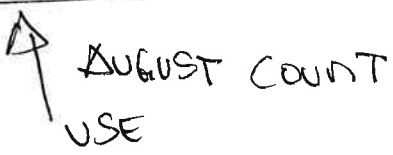
1. If the project is located in the vicinity of a VTrans Continuous Traffic Counter (CTC), apply the %K value from a VTrans Continuous Traffic Counter to the AADT. The %K values are listed on the CTC Summary page of the Redbook.

2. For projects not located near a CTC site, use the DHV Chart on the following pages to select the predicted DHV from an AADT based on the seasonal factor group. The seasonal factor groups are defined at the beginning of the Redbook. For any particular traffic counter, the seasonal factor group (SF Group) is shown in the VTrans Traffic Data Management System. Refer to the VTrans Traffic Data webpage for a link to the system and guidance on navigating the system.

3. If VTrans has conducted a short-term count in the project area, consider using the #1 high hour of the count as the DHV. This is the value that appears in the VTrans Traffic Data Management System's DHV-30 field for count locations not designated as permanent. (This value is only shown for counts done since 2015.) The highest hour may or may not be a reasonable DHV estimate depending on when the short-count was done.

   For Locations designated as Permanent (Continuous Traffic Counters), the DHV-30 value is the 30th highest hourly volume recorded for the year. This should agree with the DHV listed in the Redbook. However, if the counter did not run for most of an entire year, the DHV will not be in the Redbook and the DHV-30 value may or may not be a good DHV estimate, depending on when the counter was running.

4. Depending on when the count was done, the peak hour volume from a turning movement count may be a reasonable DHV estimate.



2012 TO 2017 GROWTH FACTORS

The 5-year growth factors shown in the tables below are based on AADTs from VTrans Continuous Traffic Counters (CTC). Each CTC is assigned to a Growth Factor Group and the factors for each group are calculated based on the average ratio of the AADT to the prior year AADT. Due to rounding, the Grown AADTs shown in MS2 may not agree exactly with AADTs calculated using the factors below.

Growth Factor Group 1: Rural
- This is the default group if a location does not fit another group -

To \ From	2012	2013	2014	2015	2016
2013	1.01				
2014	1.01	1.00			
2015	1.06	1.05	1.05		
2016	1.08	1.07	1.07	1.02	
2017	1.09	1.08	1.08	1.03	1.01

Growth Factor Group 2: Urban
- For locations within a designated federal aid urban (FAU) area -

To \ From	2012	2013	2014	2015	2016
2013	1.01				
2014	1.00	1.00			
2015	1.02	1.01	1.01		
2016	1.03	1.02	1.02	1.01	
2017	1.03	1.02	1.02	1.01	1.00

USE 1.02

Growth Factor Group 3: Interstate
- For locations on I-89, I-91 or I-93 -

To \ From	2012	2013	2014	2015	2016
2013	1.01				
2014	1.02	1.02			
2015	1.07	1.06	1.04		
2016	1.09	1.08	1.06	1.02	
2017	1.11	1.10	1.08	1.04	1.02

Growth Factor Group 4: Ski
- For locations on ski access roads -

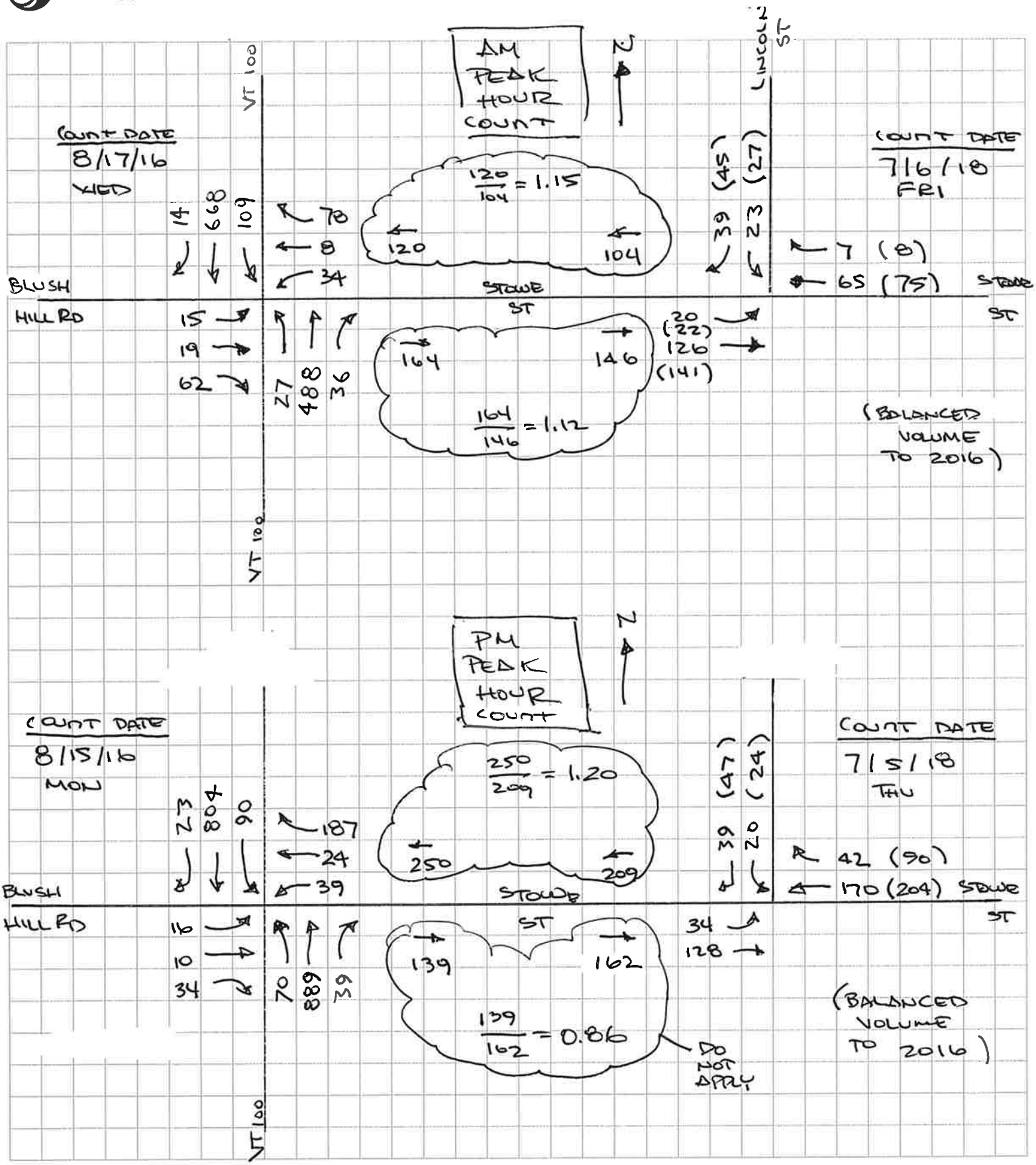
To \ From	2012	2013	2014	2015	2016
2013	1.05				
2014	1.04	0.99			
2015	1.08	1.04	1.05		
2016	1.01	0.96	0.97	0.93	
2017	1.08	1.03	1.04	1.00	1.07

Example: Project the 2012 AADT at D053 on I-89 to Year 2017
2012 AADT = 29,300
GF_3(2012 → 2017) = 1.11
2017 AADT = 29,300 x 1.11 = 32,523
Round to the nearest hundred = 32,500

FOR 2016 TO 2018

USE 1.02 FACTOR

Stantec



19531162S - BRIDGE 36 FEAS — COUNT DATA & BALANCING FACTORS

STOWE ST - WATERBURY — 2016 VOLUMES

Designed by: D. DeBaie

Checked by:

Stantec

Peak Hour Data for Intersection

Int ID: 31218805
Community: WATERBURY
Road 1: VT-100
Road 2: STOWE ST

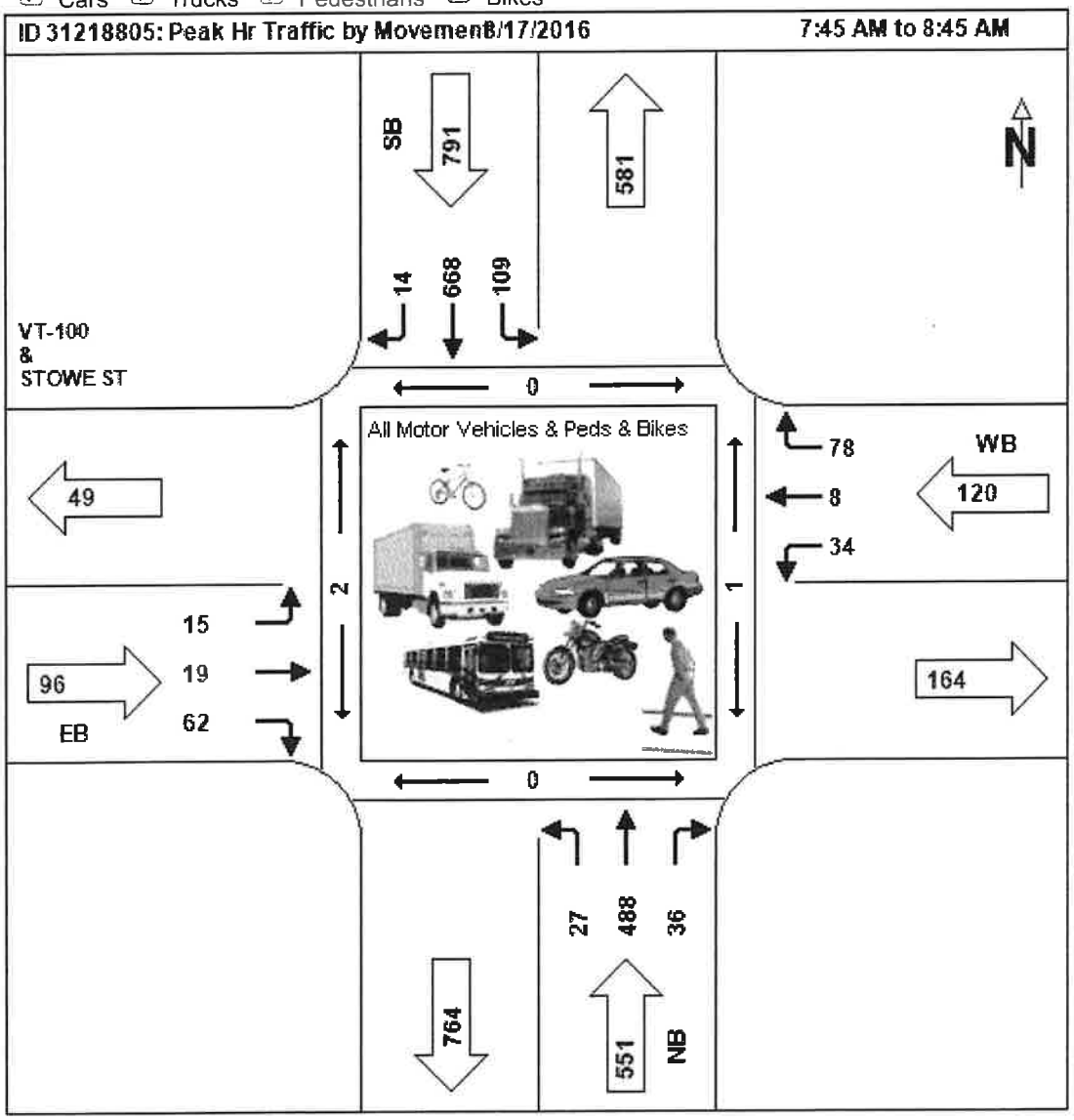
Corridor: Test
Road 3: VT-100
Road 4: BLUSH HILL RD

|<< | < | > | >>| 1-7 of 7

AM Peak Hour
08/17/2016

Start Time	NB Left	NB Thru	NB Right	NB Ped	NB App Total	EB Left	EB Thru	EB Right	EB Ped	EB App Total	SB Left	SB Thru	SB Right	SB Ped	SB App Total	WB Left	WB Thru	WB Right	WB Ped	WB App Total	Int Total
7:45 AM	7	118	8	0	133	4	5	24	0	33	25	173	2	0	200	9	2	19	0	30	396
8:00 AM	10	134	14	1	158	5	4	16	0	25	31	174	6	0	211	11	0	20	0	31	425
8:15 AM	4	115	7	0	126	5	6	8	0	19	28	151	1	2	180	7	1	23	0	31	356
8:30 AM	6	121	7	0	134	1	4	14	0	19	25	170	5	0	200	7	5	16	0	28	381
Total	27	488	36	1	551	15	19	62	0	96	109	668	14	2	791	34	8	78	0	120	1558
PHF	0.68	0.91	0.64		0.87	0.75	0.79	0.65		0.73	0.88	0.96	0.58		0.94	0.77	0.40	0.85		0.97	
HV %	7	9	3		8.5	0	0	2		1.0	1	4	7		3.7	6	0	5		5.0	

☑ Cars ☑ Trucks ☑ Pedestrians ☑ Bikes



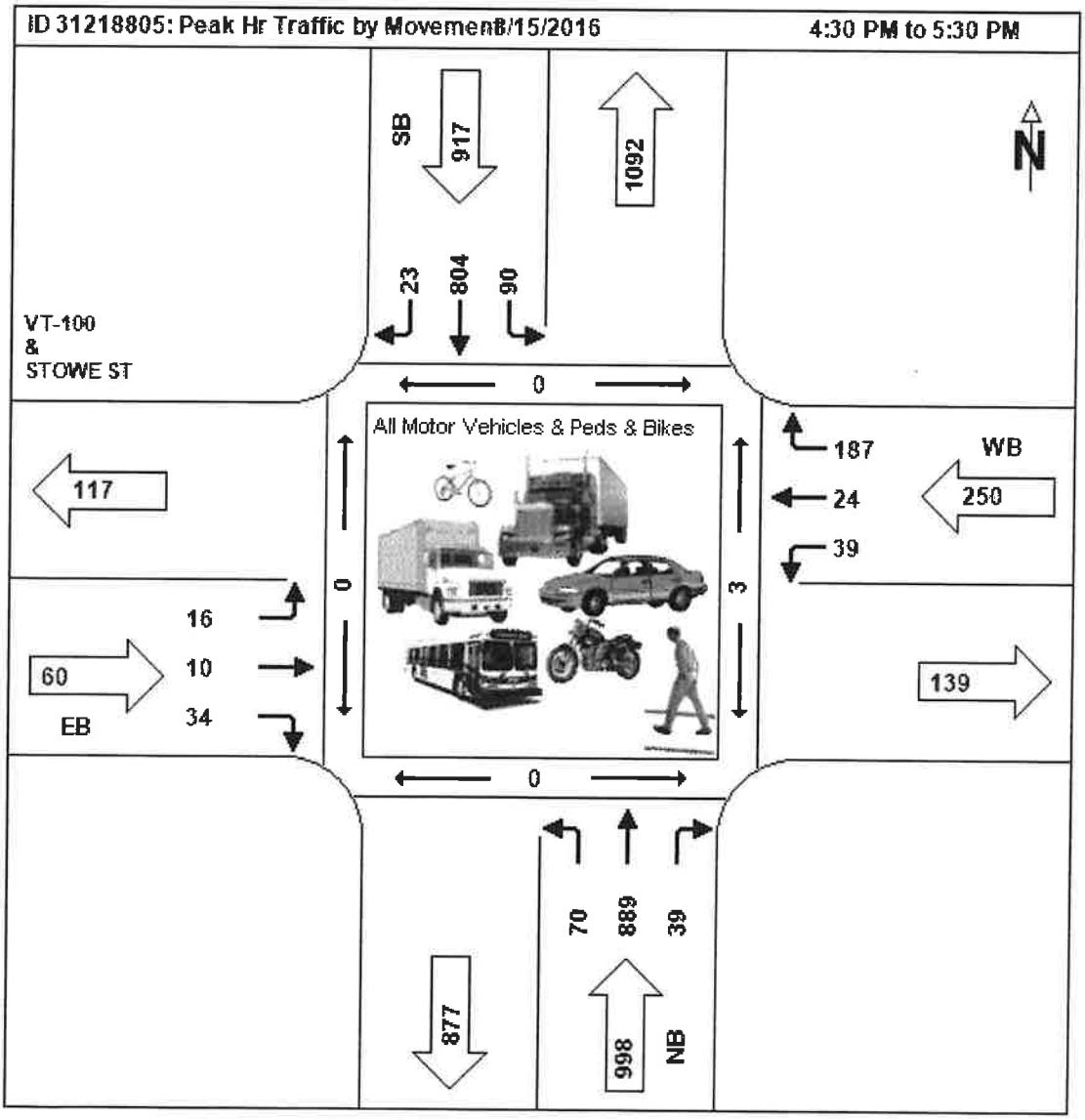
Designed by: Checked by:

Stantec

PM Peak Hour
08/15/2016

Start Time	NB Left	NB Thru	NB Right	NB Ped	NB App Total	EB Left	EB Thru	EB Right	EB Ped	EB App Total	SB Left	SB Thru	SB Right	SB Ped	SB App Total	WB Left	WB Thru	WB Right	WB Ped	WB App Total	Int Total
4:30 PM	12	221	8	0	241	4	1	8	0	13	16	185	5	0	206	8	4	47	0	59	519
4:45 PM	20	211	7	0	238	4	2	12	0	18	23	195	7	0	225	10	10	69	0	89	570
5:00 PM	20	223	11	1	254	4	3	9	0	16	25	207	6	0	238	11	7	47	0	65	573
5:15 PM	18	234	13	2	265	4	4	5	0	13	26	217	5	0	248	10	3	24	0	37	563
Total	70	889	39	3	998	16	10	34	0	60	90	804	23	0	917	39	24	187	0	250	2225
PHF	0.88	0.95	0.75		0.94	1.00	0.63	0.71		0.83	0.87	0.93	0.82		0.92	0.89	0.60	0.68		0.70	
HV %	3	3	8			0	0	3			1	3	0			8	0	0			

☑ Cars ☑ Trucks ☑ Pedestrians ☑ Bikes

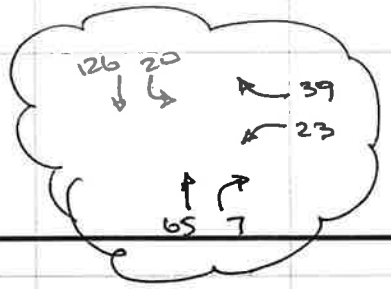


Designed by: Checked by:

Name: Justin LaPerle
Date: 7-6-18

Day of Week: Friday - July 4th Week
Weather: 72 - Rain

	Stowe St		Stowe St		Lincoln St	
	Away from I-30 Soutbound		Towards I-93 Northbound		Westbound	
15 Min Begins	Thru	Left	Thru	Right	Left	Right
7:30 AM	24	4	19 +T	1	3	15
7:45 AM	26	7	16	1	7 +B+B	7
8:00 AM	30 +T	2	21	2	7	7 +B
8:15 AM	35	6 +B	17	2 +B	4	7 +B+B
	126	20	65	7	23	39



AM

Enter tick mark for cars, "B" for bus and "T" for truck.

Name: Justin LaPerle
Date: 7-5-13

Day of Week: Thursday - July 4th
Weather: 94° Partly Cloudy

	Stowe St		Stowe St		Lincoln St	
	Soutbound		Northbound		Westbound	
15 Min Begins	Thru	Left	Thru	Right	Left	Right
4:30 PM	41 + B B	13 + B B	34	12	4	14
4:45 PM	41	7	53 B Bikes x2	17 B	4	12 + T + B T B
5:00 PM	32	6	56 + B + Bikes Pedal x2 bike B	7	9	5
5:15 PM	25 + Bikes 5 Bikes	6 + B B	26	6	3	6
	128	34	170	42	20	39
		PM	128 34 39 20 170 42			

Enter tick mark for cars, "B" for bus and "T" for truck.

CRASH RATE WORKSHEET

CITY/TOWN : Waterbury COUNT DATE : 8/15/2016

UNSIGNALIZED : X SIGNALIZED : Yes

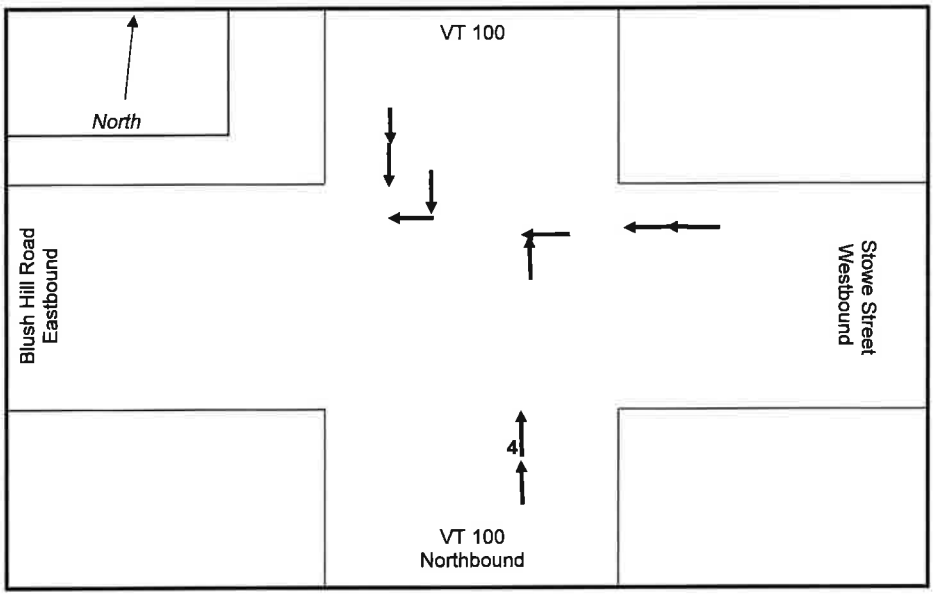
~ INTERSECTION DATA ~

MAJOR STREET : VT 100

MINOR STREET(S) : Stowe Street

Blush Hill Drive

COLLISION DIAGRAM
(Label Approaches)



Peak Hour Volumes

APPROACH :	1	2	3	4	5	Total Entering Vehicles
DIRECTION :	NB	SB	EB	WB		
VOLUMES (PM) :	1,130	1,039	68	283		2,520

" K " FACTOR : 0.110 APPROACH ADT : 22,909 **ADT** = TOTAL VOL/"K" FACT.

TOTAL # OF CRASHES : 8 # OF YEARS : 5 AVERAGE # OF CRASHES (**A**) : 1.60

CRASH RATE CALCULATION : 0.191 RATE = $\frac{(A * 1{,}000{,}000)}{(ADT * 365)}$

Comments : Most crashes were rear end type when weather was clear; two others occurred during snow. Six of crashes occurred in 2012, and two others in 2013; none since that then.

Waterbury Vermont Bridge 36 Feasibility Study 195311625 7/6/2018	VT 100 at Stowe Street	Stantec **Stantec Consulting Services Inc.** 55 Green Mountain Drive. South Burlington, VT U.S.A. 05403 Tel. 802.864.0223 Fax. 802.864.0165 www.stantec.com

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

WHERE Year of Crash >= 2012 AND Year of Crash <= 2016 AND City Code is Waterbury AND Route Codes is 1000

*	Reporting Agency/ Incident No.	City/Town	Mile Marker	Crash Date	Time	Weather	Contributing Circumstances	Direction of Collision	Number Of Injuries	Number Of Fatalities	Number Of Untimely Deaths	Direction	Road Group
Route: VT-100													
	VT0120400/12WB01104	Waterbury	0.00	12/16/2012	11:08	[No Weather]	Driving too fast for conditions, Followed too closely, No improper driving	[No Direction of Collision]	0	0	0	S	SH
	VT0120400/15WB00152	Waterbury	0.20	02/11/2015	11:40	Clear		Rear End	1	0	0	N	SH
	VT0120400/13WB00479	Waterbury	0.37	06/28/2013	18:09	Clear	Driving too fast for conditions, No improper driving	Rear End	0	0	0	N	SH
	VTVSP1200/14A300982	Waterbury	0.52	03/02/2014	10:35	Snow	Failed to yield right of way, No improper driving	Left Turn and Thru, Angle Broadside –>v–	0	0	0	W, N	SH
	VT0120400/12WB00089	Waterbury	0.67	01/26/2012	10:11	Clear	Followed too closely	Rear End	0	0	0	W	SH
	VT0120400/12WB00156	Waterbury	0.67	02/23/2012	08:36	Clear	Followed too closely, Inattention, No improper driving	Rear End	0	0	0	S	SH
	VT0120400/12WB00162	Waterbury	0.67	02/24/2012	17:53	Snow	Driving too fast for conditions, No improper driving	Other - Explain in Narrative	0	0	0	W, N	SH
	VTVSP1200/12A304103	Waterbury	0.67	09/15/2012	14:20	Clear	Driving too fast for conditions, No improper driving	Rear End	0	0	0	N	SH
	VT0120400/13WB00514	Waterbury	0.67	07/05/2013	16:04	Clear	Followed too closely, No improper driving	Rear End	0	0	0	N	SH
	VT0120400/13WB00648	Waterbury	0.67	08/24/2013	17:14	Clear	Followed too closely, No improper driving	Rear End	0	0	0	N	SH
	VT0120400/12WB00173	Waterbury	0.68	02/28/2012	08:53	Snow	Failure to keep in proper lane, No improper driving	Opp Direction Sideswipe	0	0	0	S, W	SH
	VT0120400/12WB00177	Waterbury	0.68	02/29/2012	16:56	Clear	Inattention, Distracted, No improper driving	Rear End	0	0	0	N	SH
	VTVSP1200/16A302669	Waterbury	0.80	06/27/2016	15:39	Clear	Other improper action, Other Outside Vehicle	Head On	0	0	0	E, P	SH State Owned
	VT0120400/12WB00006	Waterbury	0.83	01/02/2012	19:18	Snow	Followed too closely	Rear End	0	0	0	N	SH
	VT0120400/13WB00066	Waterbury	0.85	01/28/2013	15:05	Snow		Rear End	0	0	0	N	SH
	VT0120400/14WB00521	Waterbury	0.89	07/07/2014	14:20	Cloudy	Inattention, No improper driving	Rear End	0	0	0	N	SH
	VT0120400/14WB00139	Waterbury	1.03	02/28/2014	16:47	[No Weather]	Followed too closely, Technology Related Distraction, No improper driving	Rear End	0	0	0	S	SH
	VTVSP1200/14A302592	Waterbury	1.03	06/19/2014	10:32	Cloudy	Driving too fast for conditions, No improper driving	Rear End	1	0	0	S	SH
	VT0120400/12WB00736	Waterbury	1.12	06/22/2012	18:57	Clear	Failed to yield right of way, Visibility obstructed, No improper driving	Left Turn and Thru, Angle Broadside –>v–	0	0	0	N	SH
	VTVSP1200/15A303658	Waterbury	1.53	07/30/2015	18:13	Rain	Failure to keep in proper lane	Single Vehicle Crash	0	0	0	S	SH
	VTVSP1200/16A303148	Waterbury	1.63	07/28/2016	15:40	[No Weather]		[No Direction of Collision]	0	0	0		SH State Owned
	VTVSP1200/13A300464	Waterbury	1.64	02/02/2013	02:20	[No Weather]		[No Direction of Collision]	0	0	0		SH
	VTVSP1200/13A300752	Waterbury	1.64	02/20/2013	16:35	Snow	Failed to yield right of way, No improper driving	No Turns, Thru moves only, Broadside ^<	0	0	0	S, N	SH
	VTVSP1200/13A301267	Waterbury	1.64	03/28/2013	16:47	Clear	Failed to yield right of way, No improper driving	Left Turn and Thru, Broadside v<–	1	0	0	S, N, W	SH

STOWE STREET MILE MARKER 0.69

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

VTrans Office of Highway Safety
Data Unit

SUMMARY STATEWIDE AVERAGE CRASH RATES
2012-2016

SECTIONS

Functional Classification	Rate (Crashes/MVM *)
Rural:	
1 Interstate	1.8289
2 Principal Arterial	1.1393
6 Minor Arterial	1.2485
7 Major Collector	1.1938
8 Minor Collector	1.3991
9 Local	1.4298
Urban:	
11 Interstate	5.9573
12 Other Freeways and Expressways	3.8558
14 Principal Arterial	5.1796
16 Minor Arterial	3.7627
17 Urban Collector	3.0806
19 Local	2.6200

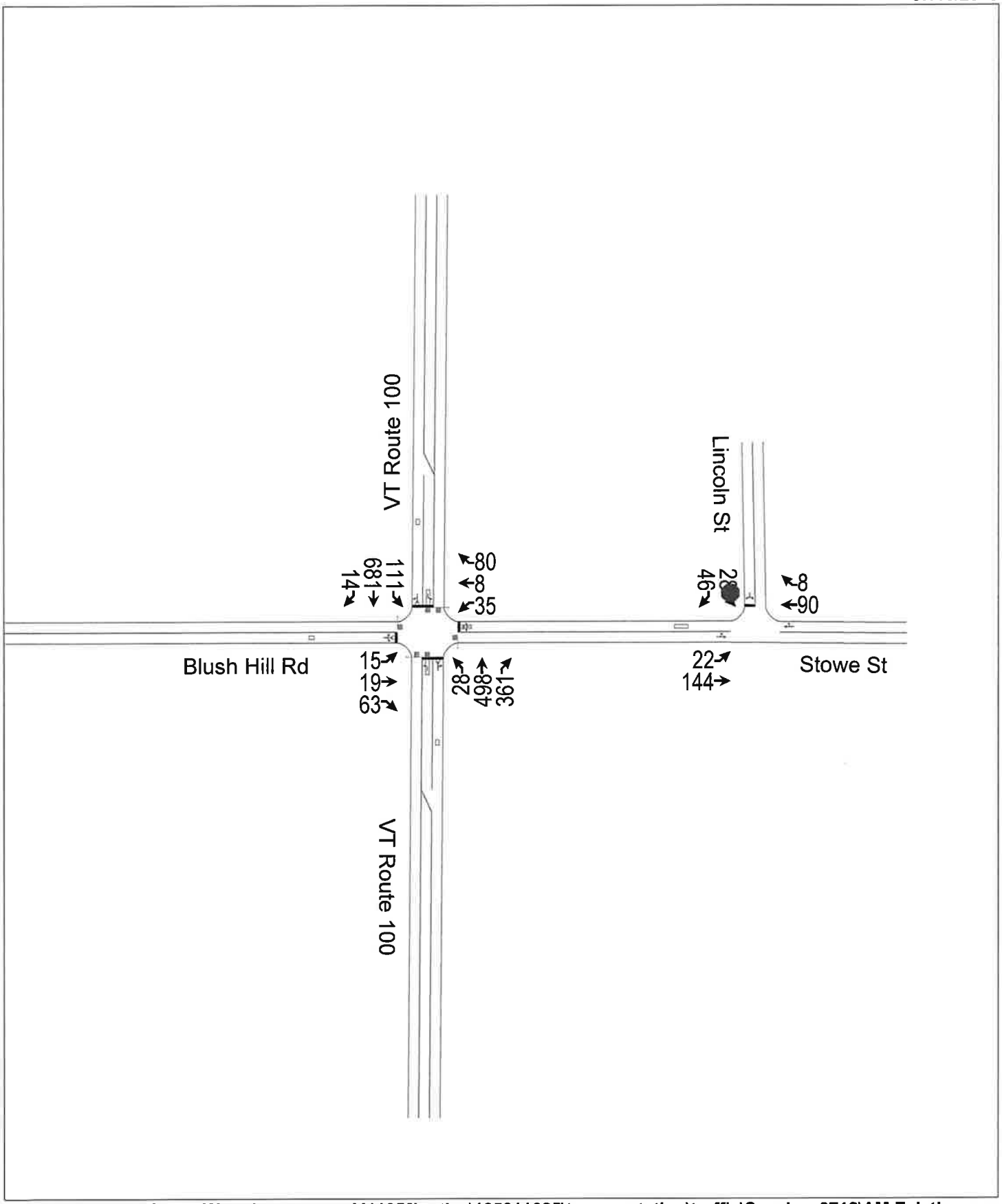
INTERSECTIONS

	Rate (Crashes/MV **)	# Occurrences
Interstate, Rural (r)/Minor Arterial (r)	6.762	1
Interstate, Urban (u)/Minor Arterial (u)	9.792	1
Principal Arterial (r)/ Minor Arterial (r)	0.511	16
Principal Arterial (r)/Major Collector (r)	0.432	60
Freeway/Expressway (u)/Principal Arterial (u)	0.680	3
Principal Arterial (u)/Urban Collector (u)	0.517	114
Freeway/Expressway (u)/Minor Arterial (u)	0.528	10
Principal Arterial (u)/Minor Arterial (u)	0.919	51
Freeway/Expressway (u)/Urban Collector	0.052	3
Principal Arterial (u)	0.572	46
Major Collector (r)	0.434	238
Minor Arterial (u)	0.450	68
Minor Arterial (u)/Urban Collector (u)	0.512	109
Minor Arterial (r)/Major Collector (r)	0.616	151
Principal Arterial (r)	0.381	19
Urban Collector (u)	0.416	148
Minor Arterial (r)	0.366	60
Major Collector (r)/Non-Federal Aid Collectors (r)	0.760	6
Minor Arterial (r)/Non-Federal Aid Collectors (r)	0.693	2
Freeway/Expressway (u)	0.116	10
Non-Federal Aid Collectors (r)	0.275	1

* Crashes per Million Vehicle Miles.
** Crashes per Million Vehicles.

NOTES:
(r) = Rural
(u) = Urban

Z:\Highways\OHS\HighwaySafetyDataUnit\Crash\High Crash Location\2012-2016 HCL Files


VT Route 100
Lincoln St
Blush Hill Rd
Stowe St
VT Route 100
14
681
111
80
8
35
46
28
8
90
15
19
63
28
498
361
22
144

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	19	63	35	8	80	28	498	361	111	681	14
Future Volume (vph)	15	19	63	35	8	80	28	498	361	111	681	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-10%			8%			0%			0%	
Total Lost time (s)		6.1			6.1		6.1	6.1		6.1	6.1	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.91			0.91		1.00	0.94		1.00	1.00	
Flt Protected		0.99			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1789			1562		1656	1633		1736	1821	
Flt Permitted		0.90			0.81		0.29	1.00		0.12	1.00	
Satd. Flow (perm)		1631			1282		501	1633		212	1821	
Peak-hour factor, PHF	0.73	0.73	0.73	0.97	0.97	0.97	0.87	0.87	0.87	0.94	0.94	0.94
Adj. Flow (vph)	21	26	86	36	8	82	32	572	415	118	724	15
RTOR Reduction (vph)	0	76	0	0	73	0	0	27	0	0	1	0
Lane Group Flow (vph)	0	57	0	0	53	0	32	960	0	118	738	0
Heavy Vehicles (%)	1%	1%	1%	5%	5%	5%	9%	9%	9%	4%	4%	4%
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		9.3			9.3		58.8	55.3		62.0	56.9	
Effective Green, g (s)		9.3			9.3		58.8	55.3		62.0	56.9	
Actuated g/C Ratio		0.11			0.11		0.67	0.63		0.70	0.65	
Clearance Time (s)		6.1			6.1		6.1	6.1		6.1	6.1	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		172			135		380	1026		237	1177	
v/s Ratio Prot							0.00	c0.59		c0.03	0.41	
v/s Ratio Perm		0.03			c0.04		0.05			0.32		
v/c Ratio		0.33			0.39		0.08	0.94		0.50	0.63	
Uniform Delay, d1		36.5			36.7		6.1	14.7		13.1	9.2	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		1.1			1.9		0.1	16.3		1.6	2.5	
Delay (s)		37.6			38.6		6.2	31.0		14.7	11.8	
Level of Service		D			D		A	C		B	B	
Approach Delay (s)		37.6			38.6			30.2			12.2	
Approach LOS		D			D			C			B	

Intersection Summary			
HCM 2000 Control Delay	23.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	88.0	Sum of lost time (s)	18.3
Intersection Capacity Utilization	82.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	133	126	32	987	118	739
v/c Ratio	0.54	0.61	0.08	0.92	0.46	0.60
Control Delay	24.0	28.4	3.6	29.5	10.7	12.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.0	28.4	3.6	29.5	10.7	12.0
Queue Length 50th (ft)	25	23	3	438	13	230
Queue Length 95th (ft)	53	78	10	#734	35	377
Internal Link Dist (ft)	602	95		470		414
Turn Bay Length (ft)			150		150	
Base Capacity (vph)	276	230	427	1076	259	1228
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.48	0.55	0.07	0.92	0.46	0.60

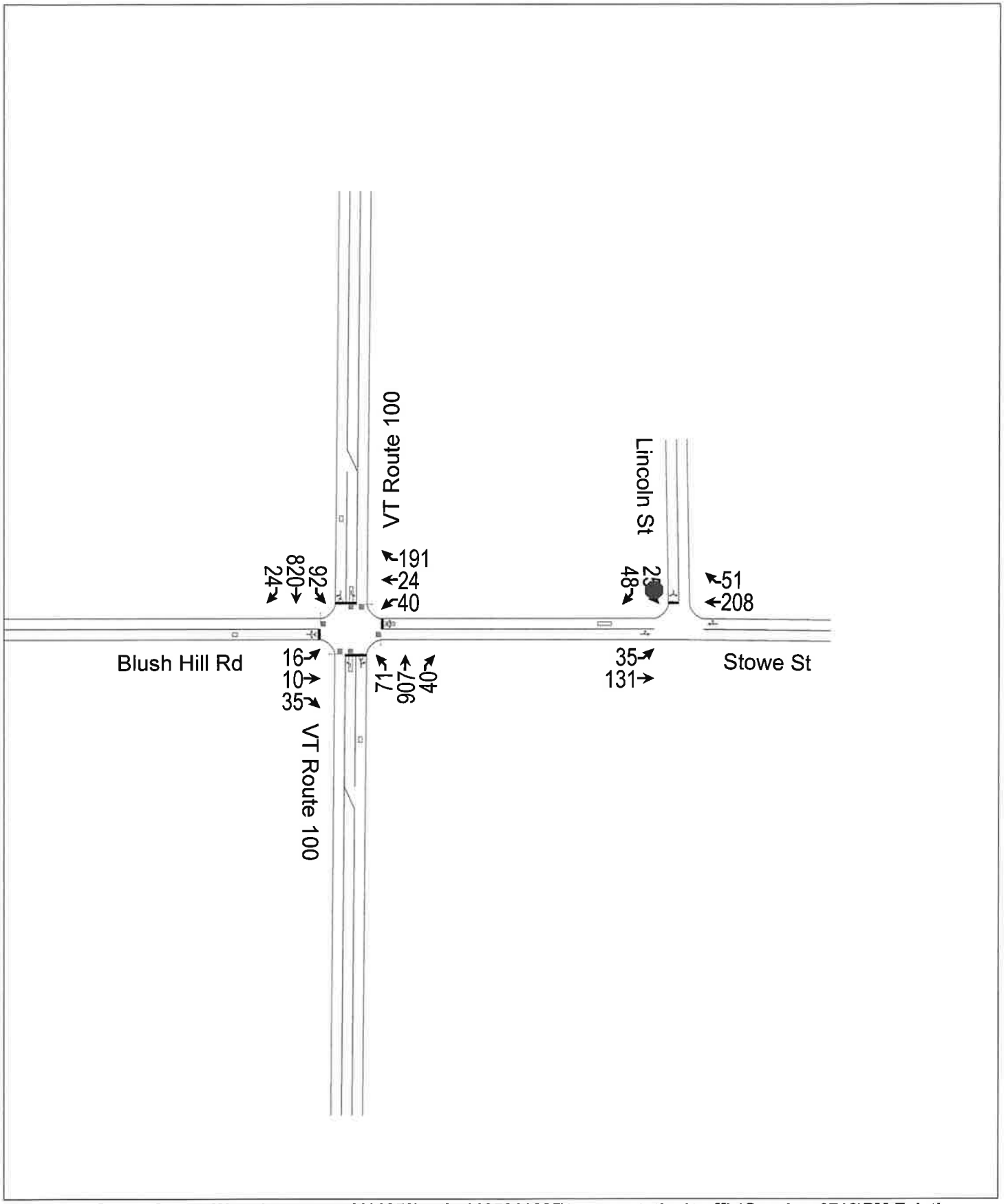
Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	22	144	90	8	28	46
Future Volume (Veh/h)	22	144	90	8	28	46
Sign Control		Free	Free		Stop	
Grade		5%	-5%		0%	
Peak Hour Factor	0.85	0.85	0.78	0.78	0.86	0.86
Hourly flow rate (vph)	26	169	115	10	33	53
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		175				
pX, platoon unblocked						
vC, conflicting volume	125				341	120
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	125				341	120
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				95	94
cM capacity (veh/h)	1462				645	934

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	195	125	86
Volume Left	26	0	33
Volume Right	0	10	53
cSH	1462	1700	797
Volume to Capacity	0.02	0.07	0.11
Queue Length 95th (ft)	1	0	9
Control Delay (s)	1.1	0.0	10.1
Lane LOS	A		B
Approach Delay (s)	1.1	0.0	10.1
Approach LOS			B

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	26.5%	ICU Level of Service	A
Analysis Period (min)	15		


VT Route 100
Lincoln St
191
24
40
92
820
24
48
25
51
208
Blush Hill Rd
16
10
35
71
907
40
35
131
Stowe St
VT Route 100

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	16	10	35	40	24	191	71	907	40	92	820	24
Future Volume (vph)	16	10	35	40	24	191	71	907	40	92	820	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-10%			8%			0%			0%	
Total Lost time (s)		6.1			6.1		6.1	6.1		6.1	6.1	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.92			0.90		1.00	0.99		1.00	1.00	
Flt Protected		0.99			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1798			1610		1752	1833		1752	1837	
Flt Permitted		0.60			0.94		0.16	1.00		0.10	1.00	
Satd. Flow (perm)		1099			1526		289	1833		188	1837	
Peak-hour factor, PHF	0.83	0.83	0.83	0.70	0.70	0.70	0.94	0.94	0.94	0.92	0.92	0.92
Adj. Flow (vph)	19	12	42	57	34	273	76	965	43	100	891	26
RTOR Reduction (vph)	0	36	0	0	113	0	0	1	0	0	1	0
Lane Group Flow (vph)	0	37	0	0	251	0	76	1007	0	100	916	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	3%	3%	3%	3%	3%	3%
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		12.9			12.9		64.8	60.1		64.8	60.1	
Effective Green, g (s)		12.9			12.9		64.8	60.1		64.8	60.1	
Actuated g/C Ratio		0.13			0.13		0.67	0.63		0.67	0.63	
Clearance Time (s)		6.1			6.1		6.1	6.1		6.1	6.1	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		147			205		266	1147		203	1150	
v/s Ratio Prot							0.01	c0.55		c0.02	0.50	
v/s Ratio Perm		0.03			c0.16		0.18			0.31		
v/c Ratio		0.25			1.23		0.29	0.88		0.49	0.80	
Uniform Delay, d1		37.2			41.5		11.1	14.9		15.3	13.4	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.9			137.3		0.6	9.6		1.9	5.8	
Delay (s)		38.1			178.9		11.7	24.5		17.2	19.1	
Level of Service		D			F		B	C		B	B	
Approach Delay (s)		38.1			178.9			23.6			19.0	
Approach LOS		D			F			C			B	

Intersection Summary

HCM 2000 Control Delay	44.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	96.0	Sum of lost time (s)	18.3
Intersection Capacity Utilization	88.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

3: VT Route 100 & Blush Hill Rd/Stowe St

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	73	364	76	1008	100	917
v/c Ratio	0.40	1.15	0.26	0.86	0.44	0.78
Control Delay	26.6	123.2	6.0	24.5	11.5	19.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.6	123.2	6.0	24.5	11.5	19.5
Queue Length 50th (ft)	17	~189	11	482	14	394
Queue Length 95th (ft)	53	#221	22	#808	31	592
Internal Link Dist (ft)	602	95		470		414
Turn Bay Length (ft)			150		150	
Base Capacity (vph)	183	317	289	1172	225	1174
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.40	1.15	0.26	0.86	0.44	0.78

Intersection Summary

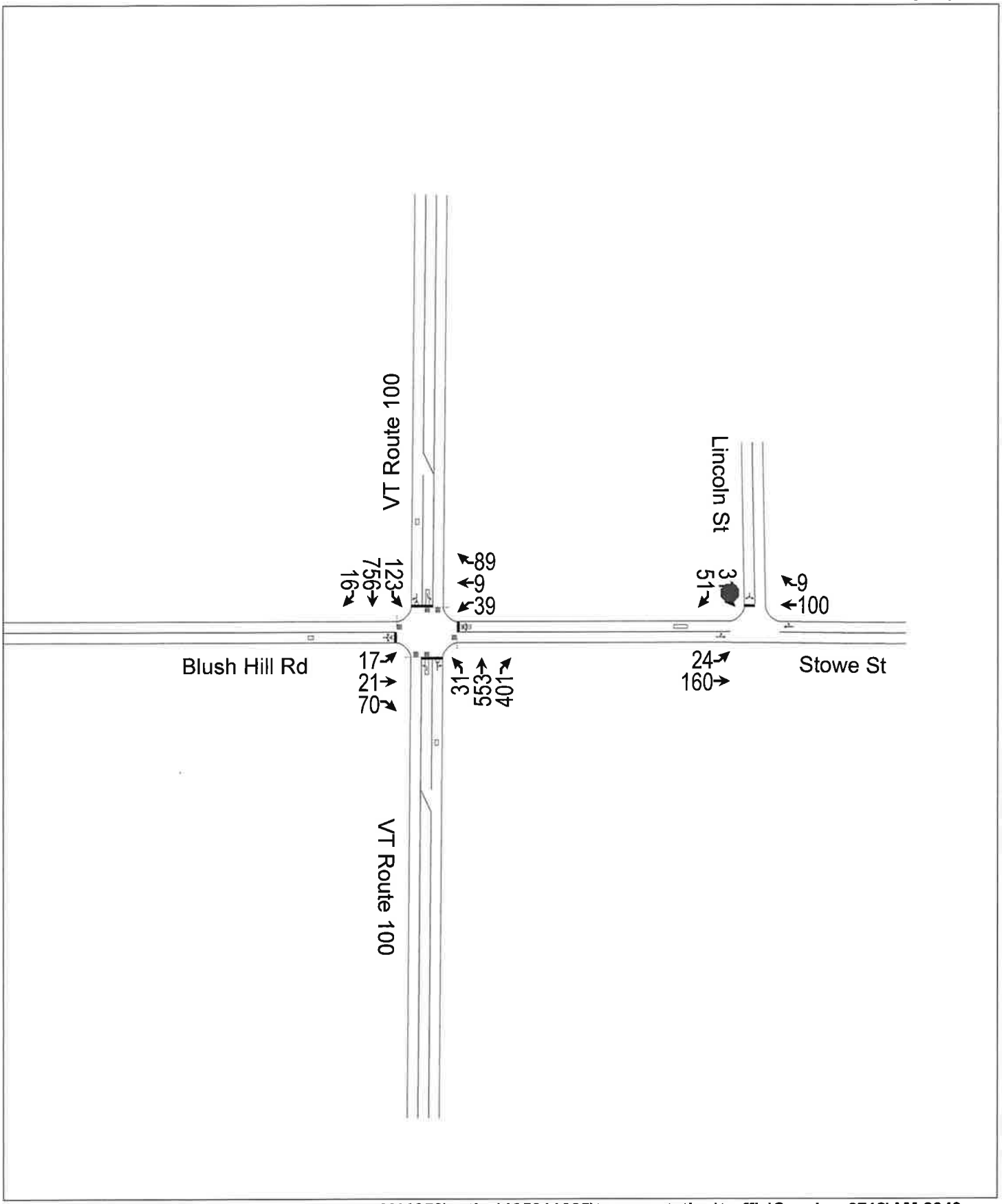
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	35	131	208	51	25	48
Future Volume (Veh/h)	35	131	208	51	25	48
Sign Control		Free	Free		Stop	
Grade		5%	-5%		0%	
Peak Hour Factor	0.72	0.72	0.76	0.76	0.82	0.82
Hourly flow rate (vph)	49	182	274	67	30	59
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		175				
pX, platoon unblocked					0.99	
vC, conflicting volume	341				588	308
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	341				575	308
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				93	92
cM capacity (veh/h)	1224				456	735

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	231	341	89
Volume Left	49	0	30
Volume Right	0	67	59
cSH	1224	1700	609
Volume to Capacity	0.04	0.20	0.15
Queue Length 95th (ft)	3	0	13
Control Delay (s)	2.0	0.0	11.9
Lane LOS	A		B
Approach Delay (s)	2.0	0.0	11.9
Approach LOS			B

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	37.2%	ICU Level of Service	A
Analysis Period (min)	15		


VT Route 100
Lincoln St
Blush Hill Rd
Stowe St
VT Route 100
16
756
123
89
9
39
17
21
70
31
553
401
31
51
9
100
24
160

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	17	21	70	39	9	89	31	553	401	123	756	16
Future Volume (vph)	17	21	70	39	9	89	31	553	401	123	756	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-10%			8%			0%			0%	
Total Lost time (s)		6.1			6.1		6.1	6.1		6.1	6.1	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.91			0.91		1.00	0.94		1.00	1.00	
Flt Protected		0.99			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1788			1562		1656	1633		1736	1821	
Flt Permitted		0.89			0.77		0.24	1.00		0.07	1.00	
Satd. Flow (perm)		1596			1219		424	1633		129	1821	
Peak-hour factor, PHF	0.73	0.73	0.73	0.97	0.97	0.97	0.87	0.87	0.87	0.94	0.94	0.94
Adj. Flow (vph)	23	29	96	40	9	92	36	636	461	131	804	17
RTOR Reduction (vph)	0	77	0	0	79	0	0	29	0	0	1	0
Lane Group Flow (vph)	0	71	0	0	62	0	36	1068	0	131	820	0
Heavy Vehicles (%)	1%	1%	1%	5%	5%	5%	9%	9%	9%	4%	4%	4%
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		9.4			9.4		57.3	53.8		63.3	56.8	
Effective Green, g (s)		9.4			9.4		57.3	53.8		63.3	56.8	
Actuated g/C Ratio		0.11			0.11		0.65	0.61		0.72	0.65	
Clearance Time (s)		6.1			6.1		6.1	6.1		6.1	6.1	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		170			130		325	998		211	1175	
v/s Ratio Prot							0.00	c0.65		c0.05	c0.45	
v/s Ratio Perm		0.04			c0.05		0.07			0.40		
v/c Ratio		0.42			0.48		0.11	1.07		0.62	0.70	
Uniform Delay, d1		36.7			37.0		7.2	17.1		20.3	10.1	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		1.7			2.8		0.2	49.3		5.6	3.5	
Delay (s)		38.4			39.8		7.4	66.4		25.9	13.5	
Level of Service		D			D		A	E		C	B	
Approach Delay (s)		38.4			39.8			64.5			15.2	
Approach LOS		D			D			E			B	

Intersection Summary			
HCM 2000 Control Delay	41.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	88.0	Sum of lost time (s)	18.3
Intersection Capacity Utilization	89.6%	ICU Level of Service	E
Analysis Period (min)	15		

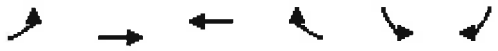
c Critical Lane Group

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	148	141	36	1097	131	821
v/c Ratio	0.60	0.67	0.10	1.07	0.63	0.67
Control Delay	27.6	32.9	3.8	67.0	28.6	13.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.6	32.9	3.8	67.0	28.6	13.8
Queue Length 50th (ft)	33	28	4	~675	21	286
Queue Length 95th (ft)	61	#99	11	#866	#105	458
Internal Link Dist (ft)	602	95		470		414
Turn Bay Length (ft)			150		150	
Base Capacity (vph)	273	228	370	1027	209	1224
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.62	0.10	1.07	0.63	0.67

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

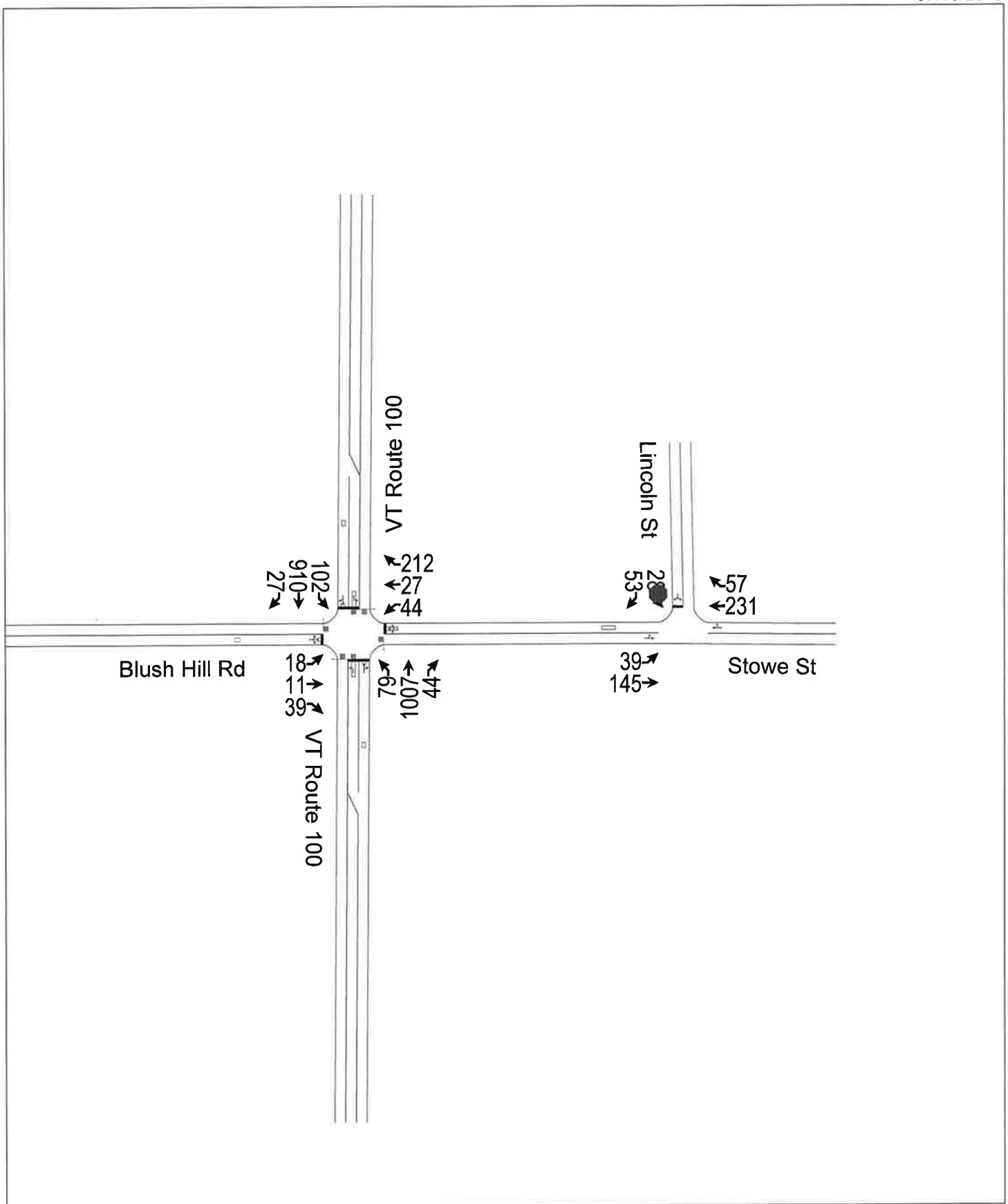
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	24	160	100	9	31	51
Future Volume (Veh/h)	24	160	100	9	31	51
Sign Control		Free	Free		Stop	
Grade		5%	-5%		0%	
Peak Hour Factor	0.85	0.85	0.78	0.78	0.86	0.86
Hourly flow rate (vph)	28	188	128	12	36	59
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		175				
pX, platoon unblocked						
vC, conflicting volume	140				378	134
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	140				378	134
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				94	94
cM capacity (veh/h)	1443				614	918

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	216	140	95
Volume Left	28	0	36
Volume Right	0	12	59
cSH	1443	1700	773
Volume to Capacity	0.02	0.08	0.12
Queue Length 95th (ft)	1	0	10
Control Delay (s)	1.1	0.0	10.3
Lane LOS	A		B
Approach Delay (s)	1.1	0.0	10.3
Approach LOS			B

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	27.9%	ICU Level of Service	A
Analysis Period (min)	15		


VT Route 100
Lincoln St
Blush Hill Rd
Stowe St
VT Route 100
102
910
27
212
27
44
28
53
57
231
18
11
39
79
1007
44
39
145

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	18	11	39	44	27	212	79	1007	44	102	910	27
Future Volume (vph)	18	11	39	44	27	212	79	1007	44	102	910	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-10%			8%			0%			0%	
Total Lost time (s)		6.1			6.1		6.1	6.1		6.1	6.1	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.92			0.90		1.00	0.99		1.00	1.00	
Flt Protected		0.99			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1798			1611		1752	1833		1752	1837	
Flt Permitted		0.58			0.94		0.10	1.00		0.07	1.00	
Satd. Flow (perm)		1051			1526		181	1833		123	1837	
Peak-hour factor, PHF	0.83	0.83	0.83	0.70	0.70	0.70	0.94	0.94	0.94	0.92	0.92	0.92
Adj. Flow (vph)	22	13	47	63	39	303	84	1071	47	111	989	29
RTOR Reduction (vph)	0	41	0	0	112	0	0	2	0	0	1	0
Lane Group Flow (vph)	0	41	0	0	293	0	84	1116	0	111	1017	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	3%	3%	3%	3%	3%	3%
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		12.9			12.9		63.6	58.9		66.0	60.1	
Effective Green, g (s)		12.9			12.9		63.6	58.9		66.0	60.1	
Actuated g/C Ratio		0.13			0.13		0.66	0.61		0.69	0.63	
Clearance Time (s)		6.1			6.1		6.1	6.1		6.1	6.1	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		141			205		196	1124		184	1150	
v/s Ratio Prot							0.02	c0.61		c0.04	0.55	
v/s Ratio Perm		0.04			c0.19		0.26			0.38		
v/c Ratio		0.29			1.43		0.43	0.99		0.60	0.88	
Uniform Delay, d1		37.4			41.5		15.3	18.4		22.4	15.0	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		1.2			219.6		1.5	25.3		5.5	10.0	
Delay (s)		38.6			261.2		16.8	43.6		27.9	25.1	
Level of Service		D			F		B	D		C	C	
Approach Delay (s)		38.6			261.2			41.8			25.3	
Approach LOS		D			F			D			C	

Intersection Summary

HCM 2000 Control Delay	66.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	96.0	Sum of lost time (s)	18.3
Intersection Capacity Utilization	96.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

3: VT Route 100 & Blush Hill Rd/Stowe St

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	82	405	84	1118	111	1018
v/c Ratio	0.45	1.28	0.39	0.99	0.60	0.87
Control Delay	27.9	174.4	9.4	45.0	27.4	25.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.9	174.4	9.4	45.0	27.4	25.1
Queue Length 50th (ft)	19	~243	12	617	16	492
Queue Length 95th (ft)	58	#271	23	#959	#81	#821
Internal Link Dist (ft)	602	95		470		414
Turn Bay Length (ft)			150		150	
Base Capacity (vph)	182	316	218	1126	185	1174
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.45	1.28	0.39	0.99	0.60	0.87

Intersection Summary

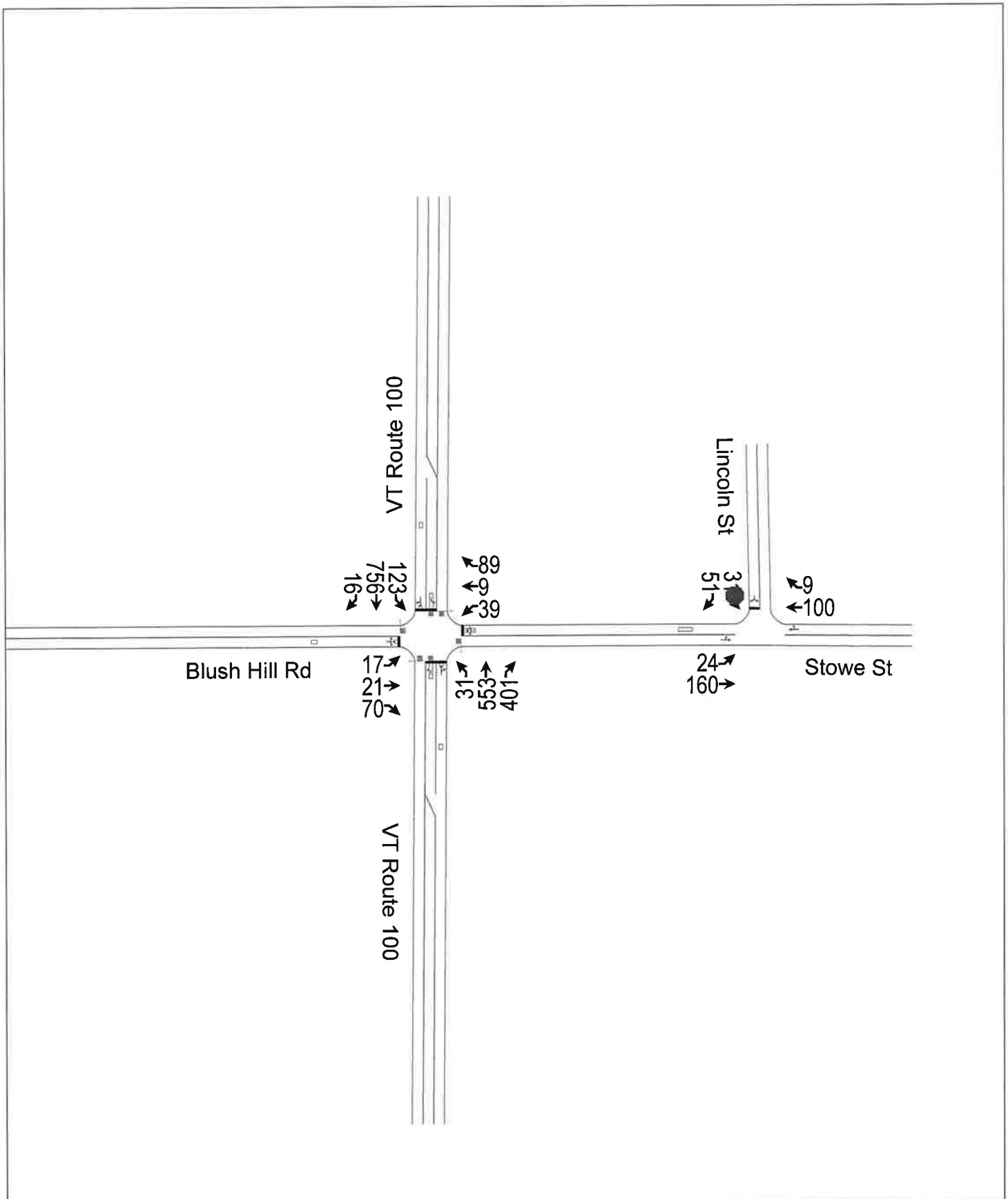
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	39	145	231	57	28	53
Future Volume (Veh/h)	39	145	231	57	28	53
Sign Control		Free	Free		Stop	
Grade		5%	-5%		0%	
Peak Hour Factor	0.72	0.72	0.76	0.76	0.82	0.82
Hourly flow rate (vph)	54	201	304	75	34	65
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		175				
pX, platoon unblocked					0.98	
vC, conflicting volume	379				650	342
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	379				636	342
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				92	91
cM capacity (veh/h)	1185				416	703

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	255	379	99
Volume Left	54	0	34
Volume Right	0	75	65
cSH	1185	1700	569
Volume to Capacity	0.05	0.22	0.17
Queue Length 95th (ft)	4	0	16
Control Delay (s)	2.1	0.0	12.7
Lane LOS	A		B
Approach Delay (s)	2.1	0.0	12.7
Approach LOS			B

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	40.2%	ICU Level of Service	A
Analysis Period (min)	15		

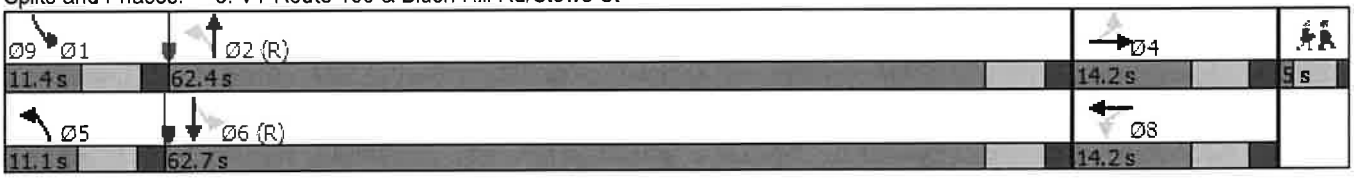

VT Route 100
Lincoln St
Blush Hill Rd
Stowe St
VT Route 100
16
756
123
89
9
39
17
21
70
31
553
401
51
9
100
24
160

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	Ø9
Lane Configurations									
Traffic Volume (vph)	17	21	39	9	31	553	123	756	
Future Volume (vph)	17	21	39	9	31	553	123	756	
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	pm+pt	NA	
Protected Phases		4		8	5	2	1	6	9
Permitted Phases	4		8		2		6		
Detector Phase	4	4	8	8	5	2	1	6	
Switch Phase									
Minimum Initial (s)	8.0	8.0	8.0	8.0	5.0	8.0	5.0	8.0	1.0
Minimum Split (s)	14.1	14.1	14.1	14.1	11.1	14.1	11.1	14.1	5.0
Total Split (s)	14.2	14.2	14.2	14.2	11.1	62.4	11.4	62.7	5.0
Total Split (%)	15.3%	15.3%	15.3%	15.3%	11.9%	67.1%	12.3%	67.4%	5%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		6.1		6.1	6.1	6.1	6.1	6.1	
Lead/Lag					Lead	Lag	Lead	Lag	
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	
Recall Mode	None	None	None	None	None	C-Max	None	C-Max	None
Act Effct Green (s)		8.1		8.1	63.7	58.0	69.5	64.6	
Actuated g/C Ratio		0.09		0.09	0.68	0.62	0.75	0.69	
v/c Ratio		0.72		0.82	0.09	1.05	0.60	0.65	
Control Delay		41.7		56.6	3.7	60.8	28.2	12.6	
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay		41.7		56.6	3.7	60.8	28.2	12.6	
LOS		D		E	A	E	C	B	
Approach Delay		41.7		56.6		59.0		14.7	
Approach LOS		D		E		E		B	

Intersection Summary

Cycle Length: 93
Actuated Cycle Length: 93
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green, Master Intersection
Natural Cycle: 120
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.05
Intersection Signal Delay: 40.0 — Intersection LOS: D
Intersection Capacity Utilization 89.6% — ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 3: VT Route 100 & Blush Hill Rd/Stowe St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	17	21	70	39	9	89	31	553	401	123	756	16
Future Volume (vph)	17	21	70	39	9	89	31	553	401	123	756	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-10%			8%			0%			0%	
Total Lost time (s)		6.1			6.1		6.1	6.1		6.1	6.1	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.91			0.91		1.00	0.94		1.00	1.00	
Flt Protected		0.99			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1788			1562		1656	1633		1736	1821	
Flt Permitted		0.86			0.72		0.27	1.00		0.06	1.00	
Satd. Flow (perm)		1552			1133		466	1633		116	1821	
Peak-hour factor, PHF	0.73	0.73	0.73	0.97	0.97	0.97	0.87	0.87	0.87	0.94	0.94	0.94
Adj. Flow (vph)	23	29	96	40	9	92	36	636	461	131	804	17
RTOR Reduction (vph)	0	71	0	0	73	0	0	26	0	0	1	0
Lane Group Flow (vph)	0	77	0	0	68	0	36	1071	0	131	820	0
Heavy Vehicles (%)	1%	1%	1%	5%	5%	5%	9%	9%	9%	4%	4%	4%
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		8.1			8.1		62.4	59.0		70.8	63.2	
Effective Green, g (s)		8.1			8.1		62.4	59.0		70.8	63.2	
Actuated g/C Ratio		0.09			0.09		0.67	0.63		0.76	0.68	
Clearance Time (s)		6.1			6.1		6.1	6.1		6.1	6.1	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		135			98		356	1035		220	1237	
v/s Ratio Prot							0.00	c0.66		c0.05	c0.45	
v/s Ratio Perm		0.05			c0.06		0.06			0.40		
v/c Ratio		0.57			0.69		0.10	1.03		0.60	0.66	
Uniform Delay, d1		40.8			41.2		6.4	17.0		22.7	8.7	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		5.4			19.1		0.1	37.4		4.3	2.8	
Delay (s)		46.2			60.4		6.5	54.4		26.9	11.5	
Level of Service		D			E		A	D		C	B	
Approach Delay (s)		46.2			60.4			52.8			13.6	
Approach LOS		D			E			D			B	

Intersection Summary			
HCM 2000 Control Delay	37.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	93.0	Sum of lost time (s)	22.3
Intersection Capacity Utilization	89.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	148	141	36	1097	131	821
v/c Ratio	0.72	0.82	0.09	1.05	0.60	0.65
Control Delay	41.7	56.6	3.7	60.8	28.2	12.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.7	56.6	3.7	60.8	28.2	12.6
Queue Length 50th (ft)	40	35	4	~695	25	272
Queue Length 95th (ft)	72	#142	12	#904	#128	471
Internal Link Dist (ft)	602	95		470		414
Turn Bay Length (ft)			150		150	
Base Capacity (vph)	206	171	391	1045	218	1266
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.72	0.82	0.09	1.05	0.60	0.65

Intersection Summary

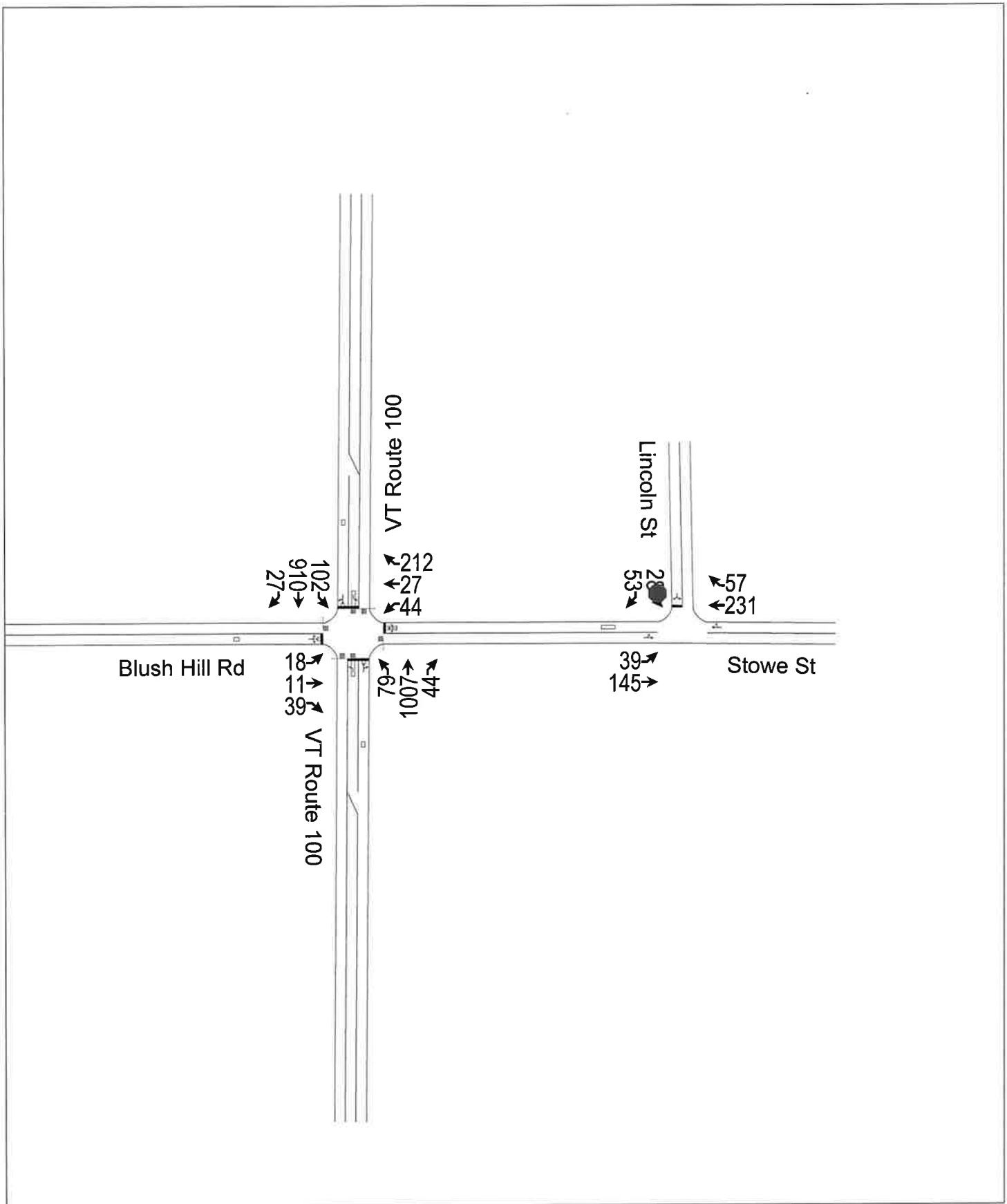
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	24	160	100	9	31	51
Future Volume (Veh/h)	24	160	100	9	31	51
Sign Control		Free	Free		Stop	
Grade		5%	-5%		0%	
Peak Hour Factor	0.85	0.85	0.78	0.78	0.86	0.86
Hourly flow rate (vph)	28	188	128	12	36	59
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		175				
pX, platoon unblocked						
vC, conflicting volume	140				378	134
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	140				378	134
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				94	94
cM capacity (veh/h)	1443				614	918

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	216	140	95
Volume Left	28	0	36
Volume Right	0	12	59
cSH	1443	1700	773
Volume to Capacity	0.02	0.08	0.12
Queue Length 95th (ft)	1	0	10
Control Delay (s)	1.1	0.0	10.3
Lane LOS	A		B
Approach Delay (s)	1.1	0.0	10.3
Approach LOS			B

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	27.9%	ICU Level of Service	A
Analysis Period (min)	15		


VT Route 100
Lincoln St
Blush Hill Rd
Stowe St
VT Route 100
102
910
27
212
27
44
28
53
57
231
18
11
39
79
1007
44
39
145

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	18	11	39	44	27	212	79	1007	44	102	910	27
Future Volume (vph)	18	11	39	44	27	212	79	1007	44	102	910	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-10%			8%			0%			0%	
Total Lost time (s)		6.1			6.1		6.1	6.1		6.1	6.1	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.92			0.90		1.00	0.99		1.00	1.00	
Flt Protected		0.99			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1798			1611		1752	1833		1752	1837	
Flt Permitted		0.57			0.94		0.10	1.00		0.06	1.00	
Satd. Flow (perm)		1038			1525		188	1833		116	1837	
Peak-hour factor, PHF	0.83	0.83	0.83	0.70	0.70	0.70	0.94	0.94	0.94	0.92	0.92	0.92
Adj. Flow (vph)	22	13	47	63	39	303	84	1071	47	111	989	29
RTOR Reduction (vph)	0	41	0	0	106	0	0	2	0	0	1	0
Lane Group Flow (vph)	0	41	0	0	299	0	84	1116	0	111	1017	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	3%	3%	3%	3%	3%	3%
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		12.9			12.9		67.7	61.6		71.9	63.7	
Effective Green, g (s)		12.9			12.9		67.7	61.6		71.9	63.7	
Actuated g/C Ratio		0.13			0.13		0.67	0.61		0.71	0.63	
Clearance Time (s)		6.1			6.1		6.1	6.1		6.1	6.1	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		132			194		220	1117		215	1158	
v/s Ratio Prot							0.02	c0.61		c0.04	0.55	
v/s Ratio Perm		0.04			c0.20		0.23			0.33		
v/c Ratio		0.31			1.54		0.38	1.00		0.52	0.88	
Uniform Delay, d1		40.0			44.0		15.3	19.7		23.2	15.4	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		1.3			268.6		1.1	26.8		2.1	9.5	
Delay (s)		41.4			312.7		16.4	46.5		25.3	25.0	
Level of Service		D			F		B	D		C	C	
Approach Delay (s)		41.4			312.7			44.4			25.0	
Approach LOS		D			F			D			C	

Intersection Summary

HCM 2000 Control Delay	75.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	101.0	Sum of lost time (s)	22.3
Intersection Capacity Utilization	96.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

3: VT Route 100 & Blush Hill Rd/Stowe St

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	82	405	84	1118	111	1018
v/c Ratio	0.47	1.35	0.35	1.00	0.52	0.86
Control Delay	30.3	204.1	8.2	47.9	21.9	25.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.3	204.1	8.2	47.9	21.9	25.3
Queue Length 50th (ft)	21	~272	12	652	17	505
Queue Length 95th (ft)	61	#296	23	#1037	72	#881
Internal Link Dist (ft)	602	95		470		414
Turn Bay Length (ft)			150		150	
Base Capacity (vph)	173	300	240	1119	215	1182
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.47	1.35	0.35	1.00	0.52	0.86

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

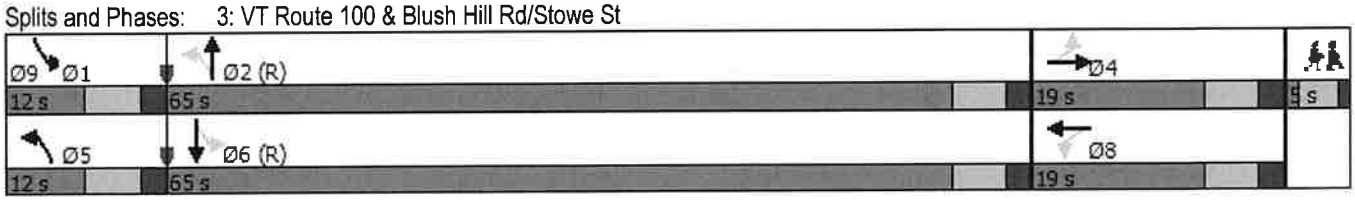
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	Ø9
Lane Configurations									
Traffic Volume (vph)	18	11	44	27	79	1007	102	910	
Future Volume (vph)	18	11	44	27	79	1007	102	910	
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	pm+pt	NA	
Protected Phases		4		8	5	2	1	6	9
Permitted Phases	4		8		2		6		
Detector Phase	4	4	8	8	5	2	1	6	
Switch Phase									
Minimum Initial (s)	8.0	8.0	8.0	8.0	5.0	8.0	5.0	8.0	1.0
Minimum Split (s)	14.1	14.1	14.1	14.1	11.1	14.1	11.1	14.1	5.0
Total Split (s)	19.0	19.0	19.0	19.0	12.0	65.0	12.0	65.0	5.0
Total Split (%)	18.8%	18.8%	18.8%	18.8%	11.9%	64.4%	11.9%	64.4%	5%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		6.1		6.1	6.1	6.1	6.1	6.1	
Lead/Lag					Lead	Lag	Lead	Lag	
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	
Recall Mode	None	None	None	None	None	C-Max	None	C-Max	None
Act Effct Green (s)		12.9		12.9	68.8	61.6	72.0	65.0	
Actuated g/C Ratio		0.13		0.13	0.68	0.61	0.71	0.64	
v/c Ratio		0.47		1.35	0.35	1.00	0.52	0.86	
Control Delay		30.3		204.1	8.2	47.9	21.9	25.3	
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay		30.3		204.1	8.2	47.9	21.9	25.3	
LOS		C		F	A	D	C	C	
Approach Delay		30.3		204.1		45.1		25.0	
Approach LOS		C		F		D		C	

Intersection Summary

Cycle Length: 101
Actuated Cycle Length: 101
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green, Master Intersection
Natural Cycle: 150
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.35
Intersection Signal Delay: 59.5
Intersection LOS: E
Intersection Capacity Utilization 96.2%
ICU Level of Service F
Analysis Period (min) 15

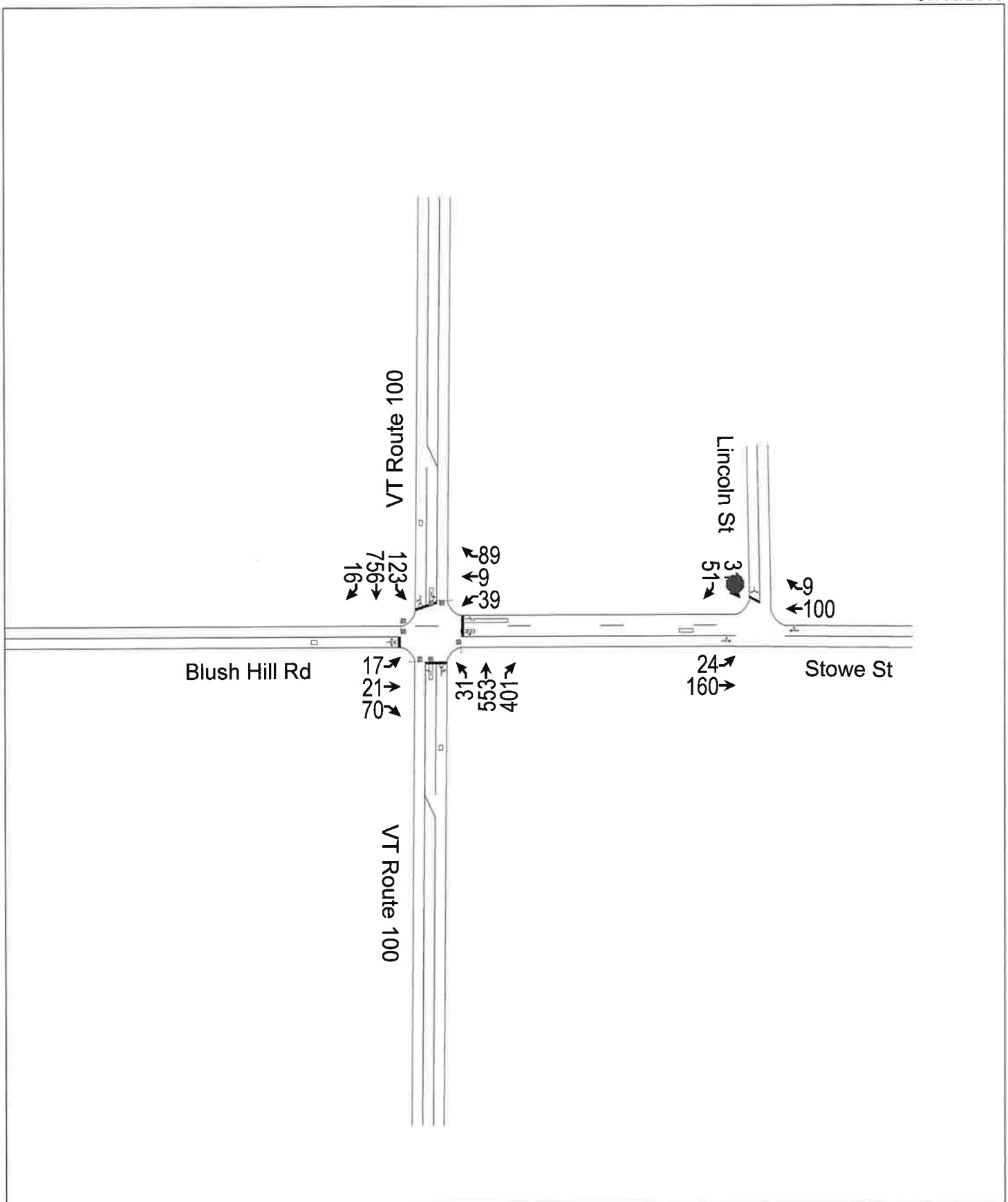
Splits and Phases: 3: VT Route 100 & Blush Hill Rd/Stowe St



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	39	145	231	57	28	53
Future Volume (Veh/h)	39	145	231	57	28	53
Sign Control		Free	Free		Stop	
Grade		5%	-5%		0%	
Peak Hour Factor	0.72	0.72	0.76	0.76	0.82	0.82
Hourly flow rate (vph)	54	201	304	75	34	65
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		175				
pX, platoon unblocked					0.98	
vC, conflicting volume	379				650	342
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	379				633	342
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				92	91
cM capacity (veh/h)	1185				416	703

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	255	379	99
Volume Left	54	0	34
Volume Right	0	75	65
cSH	1185	1700	569
Volume to Capacity	0.05	0.22	0.17
Queue Length 95th (ft)	4	0	16
Control Delay (s)	2.1	0.0	12.7
Lane LOS	A		B
Approach Delay (s)	2.1	0.0	12.7
Approach LOS			B

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	40.2%	ICU Level of Service	A
Analysis Period (min)	15		


VT Route 100
Lincoln St
Blush Hill Rd
Stowe St
VT Route 100
16
756
123
89
9
39
17
21
70
31
553
401
51
9
100
24
160

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	17	21	70	39	9	89	31	553	401	123	756	16
Future Volume (vph)	17	21	70	39	9	89	31	553	401	123	756	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-10%			8%			0%			0%	
Total Lost time (s)		6.1			6.1	6.1	6.1	6.1		6.1	6.1	
Lane Util. Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frt		0.91			1.00	0.85	1.00	0.94		1.00	1.00	
Flt Protected		0.99			0.96	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1788			1669	1477	1656	1633		1736	1821	
Flt Permitted		0.93			0.47	1.00	0.27	1.00		0.06	1.00	
Satd. Flow (perm)		1685			825	1477	466	1633		116	1821	
Peak-hour factor, PHF	0.73	0.73	0.73	0.97	0.97	0.97	0.87	0.87	0.87	0.94	0.94	0.94
Adj. Flow (vph)	23	29	96	40	9	92	36	636	461	131	804	17
RTOR Reduction (vph)	0	71	0	0	0	76	0	26	0	0	1	0
Lane Group Flow (vph)	0	77	0	0	49	16	36	1071	0	131	820	0
Heavy Vehicles (%)	1%	1%	1%	5%	5%	5%	9%	9%	9%	4%	4%	4%
Turn Type	Perm	NA		Perm	NA	pm+ov	pm+pt	NA		pm+pt	NA	
Protected Phases		4			8	1	5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		8.1			8.1	15.7	62.4	59.0		70.8	63.2	
Effective Green, g (s)		8.1			8.1	15.7	62.4	59.0		70.8	63.2	
Actuated g/C Ratio		0.09			0.09	0.17	0.67	0.63		0.76	0.68	
Clearance Time (s)		6.1			6.1	6.1	6.1	6.1		6.1	6.1	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		146			71	346	356	1035		220	1237	
v/s Ratio Prot						0.00	0.00	c0.66		c0.05	c0.45	
v/s Ratio Perm		0.05			c0.06	0.01	0.06			0.40		
v/c Ratio		0.53			0.69	0.04	0.10	1.03		0.60	0.66	
Uniform Delay, d1		40.6			41.2	32.4	6.4	17.0		22.7	8.7	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		3.4			25.1	0.1	0.1	37.4		4.3	2.8	
Delay (s)		44.0			66.3	32.4	6.5	54.4		26.9	11.5	
Level of Service		D			E	C	A	D		C	B	
Approach Delay (s)		44.0			44.2			52.8			13.6	
Approach LOS		D			D			D			B	

Intersection Summary			
HCM 2000 Control Delay	36.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	93.0	Sum of lost time (s)	22.3
Intersection Capacity Utilization	88.7%	ICU Level of Service	E
Analysis Period (min)	15		

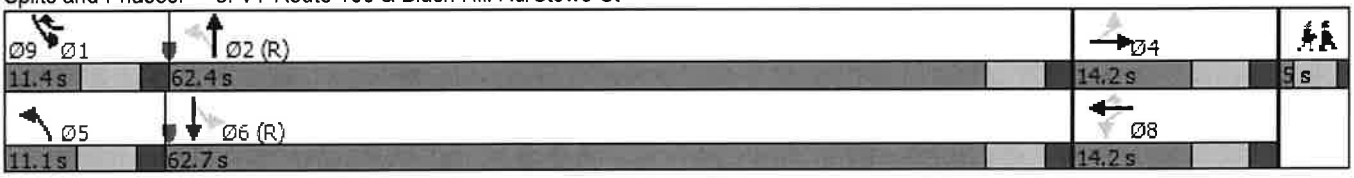
c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	Ø9
Lane Configurations										
Traffic Volume (vph)	17	21	39	9	89	31	553	123	756	
Future Volume (vph)	17	21	39	9	89	31	553	123	756	
Turn Type	Perm	NA	Perm	NA	pm+ov	pm+pt	NA	pm+pt	NA	
Protected Phases		4		8	1	5	2	1	6	9
Permitted Phases	4		8		8	2		6		
Detector Phase	4	4	8	8	1	5	2	1	6	
Switch Phase										
Minimum Initial (s)	8.0	8.0	8.0	8.0	5.0	5.0	8.0	5.0	8.0	1.0
Minimum Split (s)	14.1	14.1	14.1	14.1	11.1	11.1	14.1	11.1	14.1	5.0
Total Split (s)	14.2	14.2	14.2	14.2	11.4	11.1	62.4	11.4	62.7	5.0
Total Split (%)	15.3%	15.3%	15.3%	15.3%	12.3%	11.9%	67.1%	12.3%	67.4%	5%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		6.1		6.1	6.1	6.1	6.1	6.1	6.1	
Lead/Lag					Lead	Lead	Lag	Lead	Lag	
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	None	None	None	None	None	C-Max	None	C-Max	None
Act Effct Green (s)		8.1		8.1	20.6	63.7	58.0	69.5	64.6	
Actuated g/C Ratio		0.09		0.09	0.22	0.68	0.62	0.75	0.69	
v/c Ratio		0.68		0.69	0.23	0.09	1.05	0.60	0.65	
Control Delay		37.9		87.8	7.7	3.7	60.8	28.2	12.6	
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay		37.9		87.8	7.7	3.7	60.8	28.2	12.6	
LOS		D		F	A	A	E	C	B	
Approach Delay		37.9		35.5			59.0		14.7	
Approach LOS		D		D			E		B	

Intersection Summary

Cycle Length: 93
Actuated Cycle Length: 93
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green, Master Intersection
Natural Cycle: 110
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.05
Intersection Signal Delay: 38.5 — Intersection LOS: D
Intersection Capacity Utilization 88.7% — ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 3: VT Route 100 & Blush Hill Rd/Stowe St

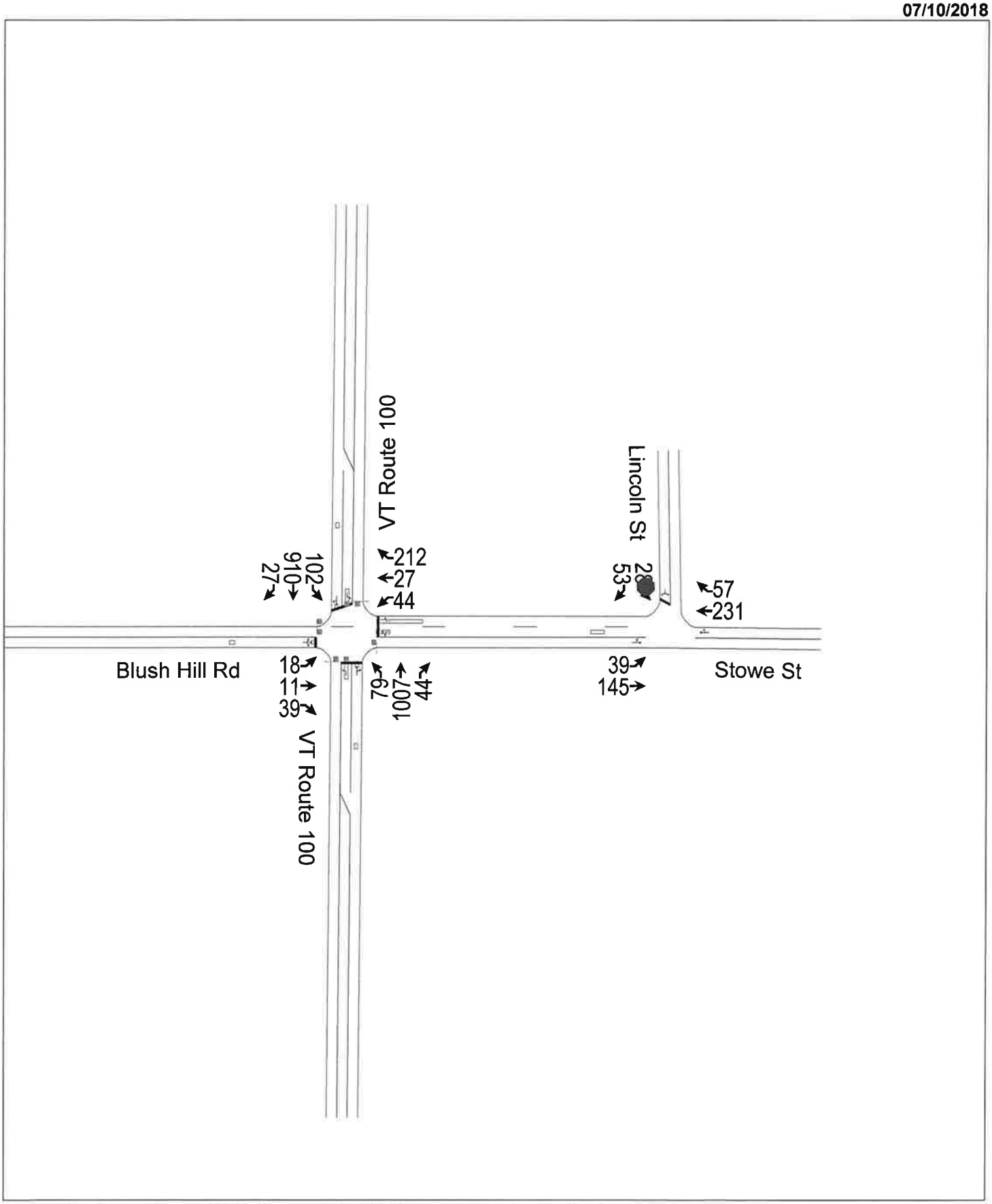


Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	148	49	92	36	1097	131	821
v/c Ratio	0.68	0.69	0.23	0.09	1.05	0.60	0.65
Control Delay	37.9	87.8	7.7	3.7	60.8	28.2	12.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.9	87.8	7.7	3.7	60.8	28.2	12.6
Queue Length 50th (ft)	40	29	0	4	~695	25	272
Queue Length 95th (ft)	72	#90	36	12	#904	#128	471
Internal Link Dist (ft)	602	95			470		414
Turn Bay Length (ft)				150		150	
Base Capacity (vph)	217	71	398	391	1045	218	1266
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.68	0.69	0.23	0.09	1.05	0.60	0.65

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.


VT Route 100
Lincoln St
Blush Hill Rd
Stowe St
VT Route 100
102
910
27
212
27
44
28
53
57
231
18
11
39
79
1007
44
39
145

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	18	11	39	44	27	212	79	1007	44	102	910	27
Future Volume (vph)	18	11	39	44	27	212	79	1007	44	102	910	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-10%			8%			0%			0%	
Total Lost time (s)		6.1			6.1	6.1	6.1	6.1		6.1	6.1	
Lane Util. Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frt		0.92			1.00	0.85	1.00	0.99		1.00	1.00	
Flt Protected		0.99			0.97	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1798			1752	1535	1752	1833		1752	1837	
Flt Permitted		0.87			0.80	1.00	0.13	1.00		0.06	1.00	
Satd. Flow (perm)		1594			1451	1535	248	1833		110	1837	
Peak-hour factor, PHF	0.83	0.83	0.83	0.70	0.70	0.70	0.94	0.94	0.94	0.92	0.92	0.92
Adj. Flow (vph)	22	13	47	63	39	303	84	1071	47	111	989	29
RTOR Reduction (vph)	0	42	0	0	0	91	0	1	0	0	1	0
Lane Group Flow (vph)	0	40	0	0	102	212	84	1117	0	111	1017	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	3%	3%	3%	3%	3%	3%
Turn Type	Perm	NA		Perm	NA	pm+ov	pm+pt	NA		pm+pt	NA	
Protected Phases		4			8	1	5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		9.7			9.7	19.1	69.6	63.6		76.4	67.0	
Effective Green, g (s)		9.7			9.7	19.1	69.6	63.6		76.4	67.0	
Actuated g/C Ratio		0.10			0.10	0.19	0.69	0.63		0.76	0.66	
Clearance Time (s)		6.1			6.1	6.1	6.1	6.1		6.1	6.1	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		153			139	382	260	1154		236	1218	
v/s Ratio Prot						c0.05	0.02	c0.61		0.04	c0.55	
v/s Ratio Perm		0.02			0.07	0.09	0.20			0.31		
v/c Ratio		0.26			0.73	0.56	0.32	0.97		0.47	0.83	
Uniform Delay, d1		42.3			44.4	37.1	12.2	17.7		22.8	12.8	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.9			18.1	1.8	0.7	19.8		1.5	6.8	
Delay (s)		43.2			62.4	38.9	12.9	37.5		24.3	19.7	
Level of Service		D			E	D	B	D		C	B	
Approach Delay (s)		43.2			44.8			35.8			20.1	
Approach LOS		D			D			D			C	

Intersection Summary

HCM 2000 Control Delay	31.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	101.0	Sum of lost time (s)	22.3
Intersection Capacity Utilization	90.7%	ICU Level of Service	E
Analysis Period (min)	15		

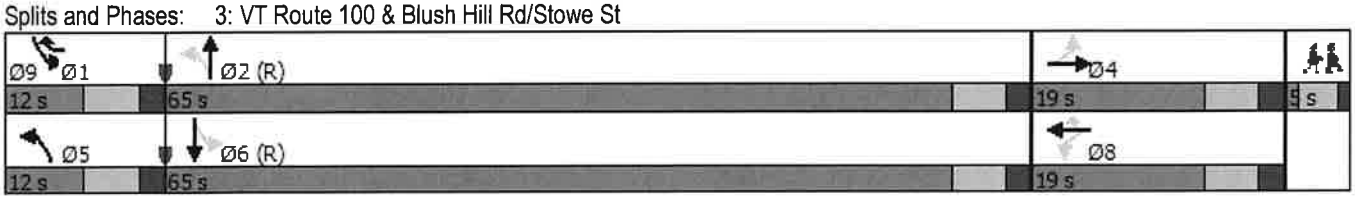
c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	Ø9
Lane Configurations										
Traffic Volume (vph)	18	11	44	27	212	79	1007	102	910	
Future Volume (vph)	18	11	44	27	212	79	1007	102	910	
Turn Type	Perm	NA	Perm	NA	pm+ov	pm+pt	NA	pm+pt	NA	
Protected Phases		4		8	1	5	2	1	6	9
Permitted Phases	4		8		8	2		6		
Detector Phase	4	4	8	8	1	5	2	1	6	
Switch Phase										
Minimum Initial (s)	8.0	8.0	8.0	8.0	5.0	5.0	8.0	5.0	8.0	1.0
Minimum Split (s)	14.1	14.1	14.1	14.1	11.1	11.1	14.1	11.1	14.1	5.0
Total Split (s)	19.0	19.0	19.0	19.0	12.0	12.0	65.0	12.0	65.0	5.0
Total Split (%)	18.8%	18.8%	18.8%	18.8%	11.9%	11.9%	64.4%	11.9%	64.4%	5%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		6.1		6.1	6.1	6.1	6.1	6.1	6.1	
Lead/Lag					Lead	Lead	Lag	Lead	Lag	
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	None	None	None	None	None	C-Max	None	C-Max	None
Act Effct Green (s)		11.3		11.3	23.9	72.0	64.9	76.7	70.6	
Actuated g/C Ratio		0.11		0.11	0.24	0.71	0.64	0.76	0.70	
v/c Ratio		0.37		0.63	0.67	0.30	0.95	0.47	0.79	
Control Delay		25.5		60.2	28.4	6.4	36.3	20.4	20.8	
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay		25.5		60.2	28.4	6.4	36.3	20.4	20.8	
LOS		C		E	C	A	D	C	C	
Approach Delay		25.5		36.4			34.2		20.8	
Approach LOS		C		D			C		C	

Intersection Summary

Cycle Length: 101
Actuated Cycle Length: 101
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green, Master Intersection
Natural Cycle: 110
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.95
Intersection Signal Delay: 28.9 — Intersection LOS: C
Intersection Capacity Utilization 90.7% — ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 3: VT Route 100 & Blush Hill Rd/Stowe St



Queues
3: VT Route 100 & Blush Hill Rd/Stowe St

Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	82	102	303	84	1118	111	1018
v/c Ratio	0.37	0.63	0.67	0.30	0.95	0.47	0.79
Control Delay	25.5	60.2	28.4	6.4	36.3	20.4	20.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.5	60.2	28.4	6.4	36.3	20.4	20.8
Queue Length 50th (ft)	21	63	108	11	642	20	497
Queue Length 95th (ft)	58	89	121	23	#1037	75	#881
Internal Link Dist (ft)	602	95			470		414
Turn Bay Length (ft)				150		150	
Base Capacity (vph)	244	185	449	283	1179	236	1285
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.55	0.67	0.30	0.95	0.47	0.79

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

TRAFFIC CONTROL SIGNAL SYSTEM, INTERSECTION (VT ROUTE 100 @ BLUSH HILL ROAD)
SEE LIST OF MAJOR EQUIPMENT, ON SHEET 182

REMOVAL OF EXISTING TRAFFIC CONTROL SIGNAL SYSTEM (VT ROUTE 100 @ BLUSH HILL ROAD)
STA. 35+50

CONSTRUCT MAST ARM POLES
STA. 34+96, 34' LT (MAP-1)
STA. 35+58, 40' RT (MAP-2)

CONSTRUCT CONTROLLER CABINET (GROUND MOUNTED)
STA. 35+50, RT

WIRED CONDUIT (2") (SCH 80 PVC)
SEE CONDUIT SCHEDULE, ON SHEET 182

ELECTRICAL CONDUIT (2") (SCH 80 PVC)
SEE CONDUIT SCHEDULE, ON SHEET 182

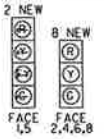
SPECIAL PROVISION (JUNCTION BOX, HEAVY DUTY)
STA. 34+62, 47' RT (JB3)
STA. 34+70, 59' RT (JB2)
STA. 34+85, 31' LT (JB4)
STA. 35+20, 85' RT (JB1)

BRACKET ARM
STA. 34+96, LT (SL-1) 12'
STA. 35+47, RT (SL-2) 12'

LUMINAIRE
STA. 34+96, LT (SL-1)
STA. 35+47, RT (SL-2)

SPECIAL PROVISION (HORIZONTAL DIRECTIONAL DRILLING) (12" CASING PIPE)
STA. 34+63, RT TO 34+85, LT (77')
STA. 34+75, RT TO 35+15, RT (45')

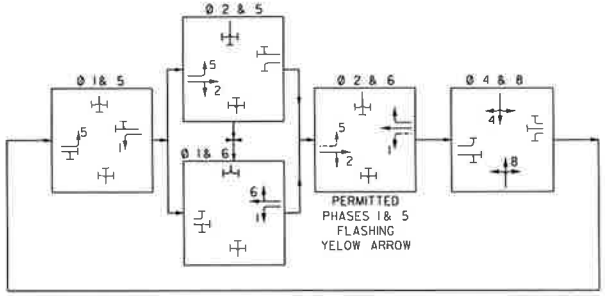
SIGNAL FACE ARRANGEMENT

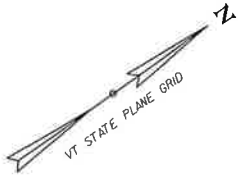


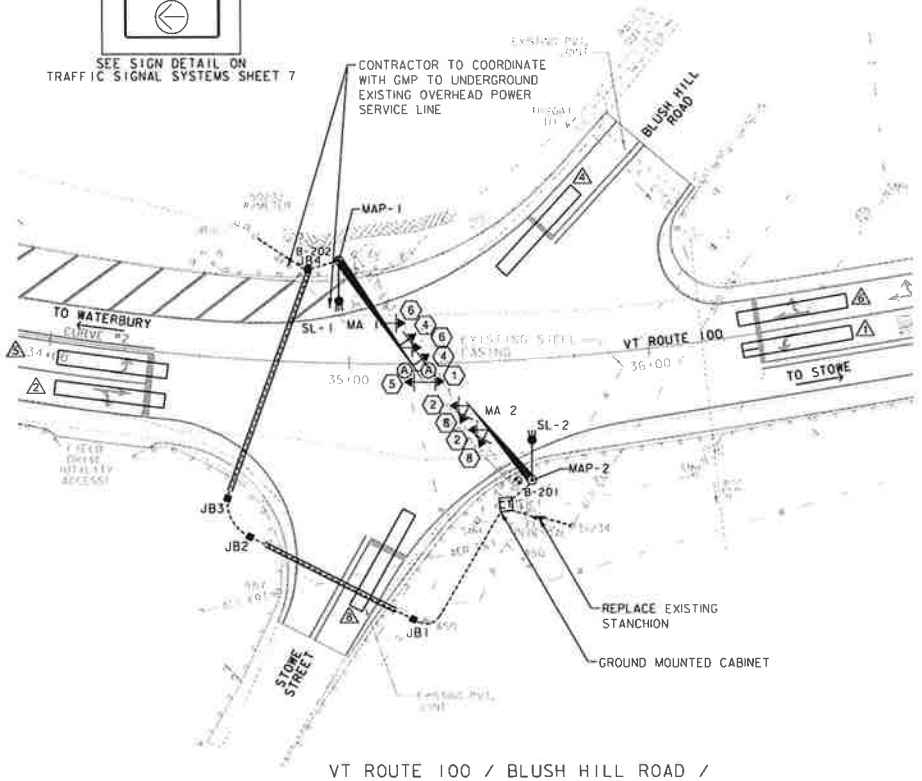
NOTE: ALL NEW 12" LED LENSES WITH 5" LOUVERED BACKPLATES, 2" RETROREFLECTIVE BORDERS AND VISORS

SEE SIGN DETAIL ON TRAFFIC SIGNAL SYSTEMS SHEET 7

PHASING DIAGRAM







VT ROUTE 100 / BLUSH HILL ROAD / STOWE STREET INTERSECTION

LEGEND		
EXISTING	NEW	DESCRIPTION
○	●	UTILITY POLE
—○	—●	LUMINAIRE
○	●	LIGHT POLE
	⊗	STRAIN POLE/CANTILEVER POLE
	ET	CONTROLLER CABINET
	■	JUNCTION BOX
	◂	PEDESTRIAN SIGNAL HEAD
	▸	SIGNAL HEAD WITH LOUVERED PLATE
	----------	CONDUIT (SIGNAL)
	▭	VEHICLE DETECTION AREA
⊕	⊕	PEDESTAL POST/LIGHTING POLE
	▬	CANTILEVER
	═══	SLEEVE
	—●▸	PREEMPT OPTICAL DETECTOR
	—•	PREEMPTION STROBE
◂	◂	PEDESTRIAN PUSHBUTTON ASSEMBLY
▾▾	▾▾	POWER DROP STANCHION
+	+	L.E.D REGULATORY SIGN

NOTES:

1. FOR A LIST OF MAJOR EQUIPMENT AND CONDUIT SCHEDULE, SEE SHEET 182.
2. UNDERGROUND UTILITIES ARE APPROXIMATE AND SHALL BE VERIFIED BY THE CONTRACTOR.
3. EXISTING INTERCONNECT, DETECTION, ADAPTIVE TRAFFIC CONTROL (ATC), AND INTERNET CONNECTION SHALL BE MAINTAINED OR SALVAGED AND REUSED. PAYMENT SHALL BE UNDER CONTRACT ITEM 678.15 TRAFFIC CONTROL SIGNAL SYSTEM, INTERSECTION (VT ROUTE 100 @ BLUSH HILL ROAD)
4. EXISTING GRIDSMART 360 DEGREE CAMERA AND ASSOCIATED EQUIPMENT SHALL BE REMOVED AND SALVAGED TO VTRANS TRAFFIC SIGNAL MAINTENANCE. PAID UNDER ITEM 678.45 REMOVAL OF EXISTING TRAFFIC CONTROL SIGNAL SYSTEM (VT ROUTE 100 @ BLUSH HILL ROAD)
5. MOUNT AXIS Q6044-E PTZ DOME NETWORK CAMERA (OR APPROVED EQUAL) ON 15' EXTENSION POLE FOR OBSERVATIONAL PURPOSES. PAID UNDER 678.15 TRAFFIC CONTROL SIGNAL SYSTEM, INTERSECTION (VT ROUTE 100 @ BLUSH HILL ROAD).

0 20 40
SCALE IN FEET

Stantec

PROJECT NAME: WATERBURY-STOWE
PROJECT NUMBER: STP 2945(I)

FILE NAME: zlb342signal.dgn
PROJECT LEADER: G. EDWARDS
DESIGNED BY: T. LUTHER
TRAFFIC SIGNAL SYSTEMS SHEET 1

PLOT DATE: 9/1/2017
DRAWN BY: C. WAITE
CHECKED BY: D. DEBAIE

VT ROUTE 100 / BLUSH HILL ROAD / STOWE STREET INTERSECTION

LIST OF MAJOR EQUIPMENT		
EQUIPMENT ITEMS - 678.15 TRAFFIC CONTROL SIGNAL SYSTEM, INTERSECTION (VT ROUTE 100 @ BLUSH HILL ROAD)	QUANTITY	REMARKS
STEEL MAST ARM SIGNAL POLE (FLAT BLACK)	2	
STEEL MAST ARM (FLAT BLACK)	2	MA-1 = 50', MA-2 = 35'
POWER STANCHION WITH DISCONNECTS	1	
TRAFFIC SIGNAL CONTROLLER (NEMA TS2)	1	ECONOLITE COBALT
NEW 12-INCH LED SIGNAL HEADS (ONE-WAY 3-SECTION, VISORS, DISCONNECT HANGERS, 5 INCH LOUVERED BACKPLATES WITH 2 INCH RETRO-REFLECTIVE BORDER AND MOUNTING HARDWARE (FLAT BLACK)	8	
NEW 12-INCH LED SIGNAL HEADS (ONE-WAY 4-SECTION, VISORS, DISCONNECT HANGERS, 5 INCH LOUVERED BACKPLATES WITH 2 INCH RETRO-REFLECTIVE BORDER AND MOUNTING HARDWARE (FLAT BLACK)	2	
SIGNAL HEAD BRACKETS AND ANCILLARY EQUIPMENT	10	
NEMA P44 BASE-MOUNTED CONTROLLER CABINET WITH 15-INCH EXTENDED BASE ON A CONCRETE FOUNDATION	1	PAINTED FLAT BLACK WITH ANCILLARY EQUIPMENT, FACING AWAY FROM TRAFFIC
ELECTRICAL WIRING	560'	SEE SUMMARY THIS SHEET
MALFUNCTION MONITORING UNIT (MMU)	1	ECONOLITE MMU2-16LEDp
BIU	1	ECONOLITE BIU-64
DETECTOR BRACKET FOR MAST ARM OR POLE	6	
STOP BAR DETECTOR ASSEMBLY	4	WAVETRONIX SMARTSENSOR MATRIX
ADVANCED DETECTOR ASSEMBLY	2	WAVETRONIX SMARTSENSOR ADVANCE
DETECTION PROCESSOR (CARDS)	2	WAVETRONIX CLICK 650
DETECTION CABINET RACK	2	
360 DEGREE OBSERVATIONAL CAMERA W/ 15' EXTENSION ARM	1	360 DEGREE NETWORK CAMERA
CONTROLLER IDENTIFICATION PLAQUE	1	SEE TRAFFIC SIGNAL SYSTEM NOTES

CONTROLLER TIMING CHART									
PHASE	1	2	3	4	5	6	7	8	9
IN USE	X	X		X	X	X		X	
TRAFFIC MOVEMENT	⌜	—		⌊	⌋	—		⌊	
MIN. GREEN	5	8		8	5	8		8	
MAX 1 - GREEN (OFF)	6	64		13	6	64		13	
MAX 2 - GREEN (AM)	6	53		10	6	53		10	
MAX 3 - GREEN (PM)	6	59		12	6	59		12	
YELLOW CLEARANCE	4.1	4.1		4.1	4.1	4.1		4.1	
ALL RED CLEARANCE	2	2		2	2	2		2	
VEHICLE EXTENSION	3	3		3	3	3		3	
DELAY GREEN	0	0		0	0	0		0	
WALK									
PEDESTRIAN CLEAR									
RECALL MODE (SOFT)		X				X			

SCHEDULE PLAN			
SCHEDULE NO.	DAY PLAN	DAYS	DATES
1	1	MON, TUE, WED, THU, FRI	1-31
1	2	SAT, SUN	1-31

COORDINATION PLAN													
				SPLIT PHASES/SPLIT TIMES									
PATTERN	COS	CYCLE	OFFSET	1	2	3	4	5	6	7	8	9	
1	III	102	80	12	70	0	20	12	70	0	20	0	
2	2II	88	80	12	59	0	17	12	59	0	17	0	
3	3II	96	79	12	65	0	19	12	65	0	19	0	

DAY PLAN			
PLAN NO.	EVENT	ACTION PLAN	START TIME
1	1	254	12:00 AM
1	2	2	6:00 AM
1	3	1	9:00 AM
1	4	3	2:00 PM
1	5	1	7:00 PM
1	6	254	10:00 PM
2	1	254	12:00 AM
2	2	1	6:00 AM
2	3	3	9:00 AM
2	4	254	10:00 PM

ELECTRICAL WIRING		
	LENGTH	DESCRIPTION
MAP-1 TO MA-1	48'	DETECTION
MAP-1 TO MA-1	48'	SIGNAL HEAD
MAP-1 TO MA-1	48'	SIGNAL HEAD
MAP-1 TO MA-1	48'	SIGNAL HEAD
MAP-1 TO MA-1	48'	SIGNAL HEAD
MAP-1 TO MA-1	48'	SIGNAL HEAD
MAP-1 TO LUMINAIRE	45'	STREET LIGHTING
MAP-2 TO MA-2	36'	DETECTION
MAP-2 TO MA-2	36'	SIGNAL HEAD
MAP-2 TO MA-2	36'	SIGNAL HEAD
MAP-2 TO MA-2	36'	SIGNAL HEAD
MAP-2 TO MA-2	36'	SIGNAL HEAD
MAP-2 TO LUMINAIRE	42'	STREET LIGHTING
SUBTOTAL	555'	
ROUNDING	5'	
TOTAL	560'	(SEE NOTES BELOW)

NOTES:

1. TOTAL QUANTITY OF ELECTRICAL WIRING SHOWN IS APPROXIMATED FOR BIDDING PURPOSES. THE ACTUAL AMOUNT OF ELECTRICAL WIRING MAY VARY DUE TO FIELD CONDITIONS.
2. ELECTRICAL WIRING SHALL BE PAID UNDER ITEM 678.15 TRAFFIC CONTROL SIGNAL SYSTEM, INTERSECTION (VT ROUTE 100 @ BLUSH HILL ROAD)

CONDUIT SCHEDULE					
	WIRED CONDUIT		ELECTRICAL CONDUIT		DESCRIPTION
	2"	4"	2"	4"	
POWER TO STANCHION	40'				SERVICE
STANCHION TO CONTROLLER	20'				POWER
CONTROLLER TO JB1			55'		FUTURE USE
CONTROLLER TO JB1	70'				SIGNAL / LIGHTING
CONTROLLER TO JB1	70'				DETECTION
CONTROLLER TO MAP-2	70'				DETECTION
JB1 TO JB2			70'		FUTURE USE
JB1 TO JB2	70'				SIGNAL / LIGHTING
JB1 TO JB2	70'				DETECTION
JB2 TO JB3			20'		FUTURE USE
JB2 TO JB3	20'				SIGNAL / LIGHTING
JB2 TO JB3	20'				DETECTION
JB3 TO JB4			90'		FUTURE USE
JB3 TO JB4			90'		FUTURE USE
JB3 TO JB4	90'				SIGNAL / LIGHTING
JB3 TO JB4	90'				DETECTION
JB4 TO MAP-1			20'		FUTURE USE
JB4 TO MAP-1	20'				SIGNAL / LIGHTING
JB4 TO MAP-1	20'				DETECTION
SUBTOTAL	670'		345'		
ROUNDING	10'		5'		
TOTAL	680'		350'		

ACTION PLAN			
PLAN NO.	PATTERN	FLASH	REFERENCE
1	1	NO	MAX 1
2	2	NO	MAX 2
3	3	NO	MAX 3
4	254-FREE	NO	MAX 1

WEEKDAY PEAKS			
	HOURS		
MAX 2 - AM PEAK	6:00 AM	TO	9:00 AM
MAX 1- OFF PEAK	9:00 AM	TO	2:00 PM
	7:00 PM	TO	10:00 PM
MAX 3 - PM PEAK	2:00 PM	TO	7:00 PM
FLASH	10:00 PM	TO	6:00 AM

Stantec

PROJECT NAME: WATERBURY-STOWE
PROJECT NUMBER: STP 2945(1)

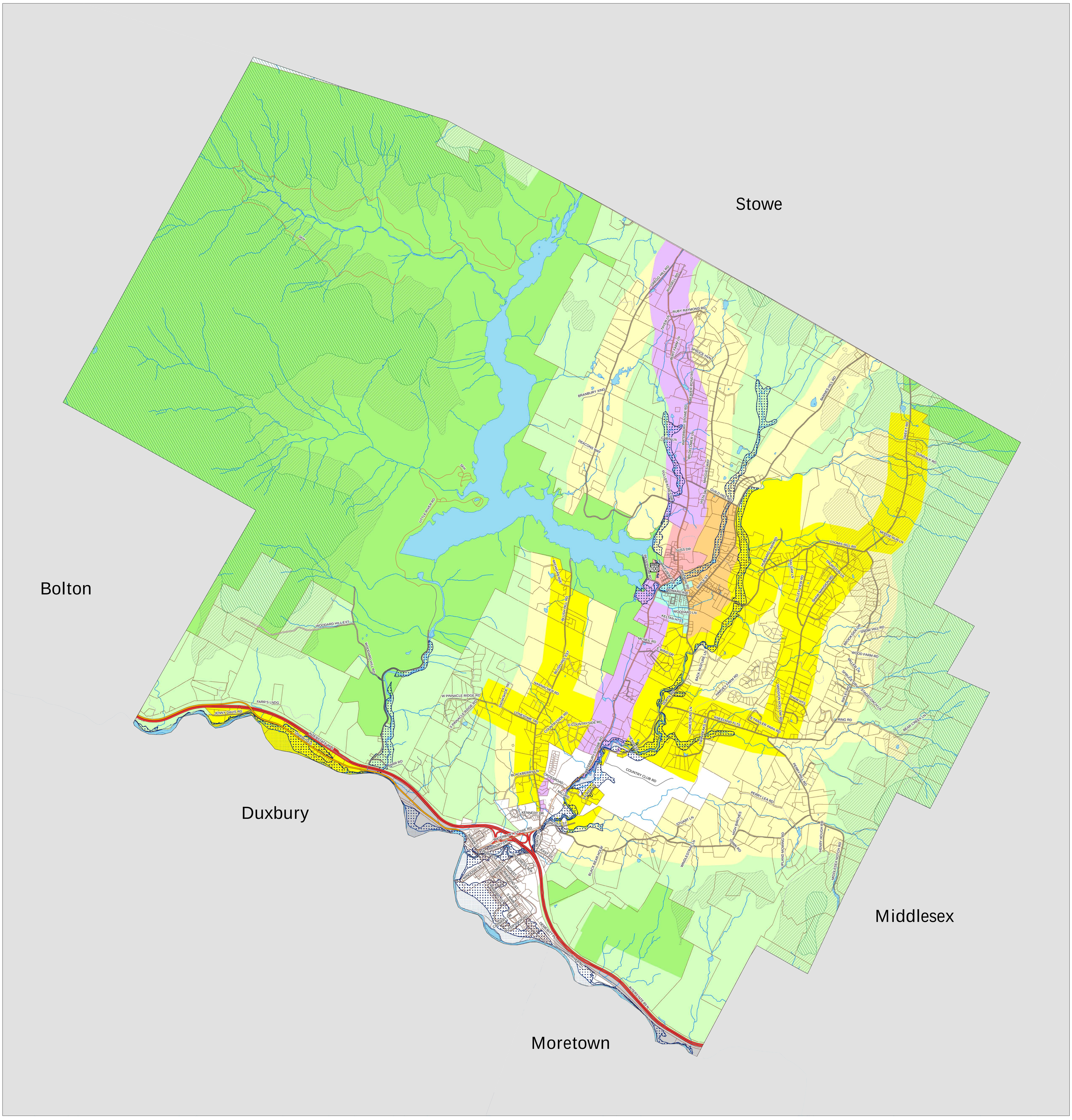
FILE NAME: z:\b342signal.dgn
PROJECT LEADER: G. EDWARDS
DESIGNED BY: T. LUTHER
TRAFFIC SIGNAL SYSTEMS SHEET 2

PLOT DATE: 9/1/2017
DRAWN BY: C. WAITE
CHECKED BY: D. DEBAIE

J. WATERBURY VILLAGE ZONING MAPS (2013)

Waterbury Village has identifying zoning areas. The project area is located in the Village Residential Zone.

Waterbury Town Zoning 2013



Town Zoning
- CONSERVATION
- INDUSTRIAL
- LOW DENSITY RESIDENTIAL
- MEDIUM DENSITY RESIDENTIAL
- ROUTE 100
- STATE FOREST (Conservation)
- TOWN COMMERCIAL
- TOWN MIXED RESIDENTIAL
- TOWN NEIGHBORHOOD COMMERCIAL

Flood Hazard Area Overlay District
- Special Flood Hazard Area 1% Chance of Annual Flood
- Flood Hazard Area Floodway

Ridgeline, Hillside, Steep Slope Overlay District
- 1200 ft
- 1500 ft
- Town Highway
- State Forest Highway
- Private and or Legal Trail
- US Highway
- Interstate
- Waterbury Parcels 2011
- Lake/River
- Streams

0 0.5 1 2 Miles

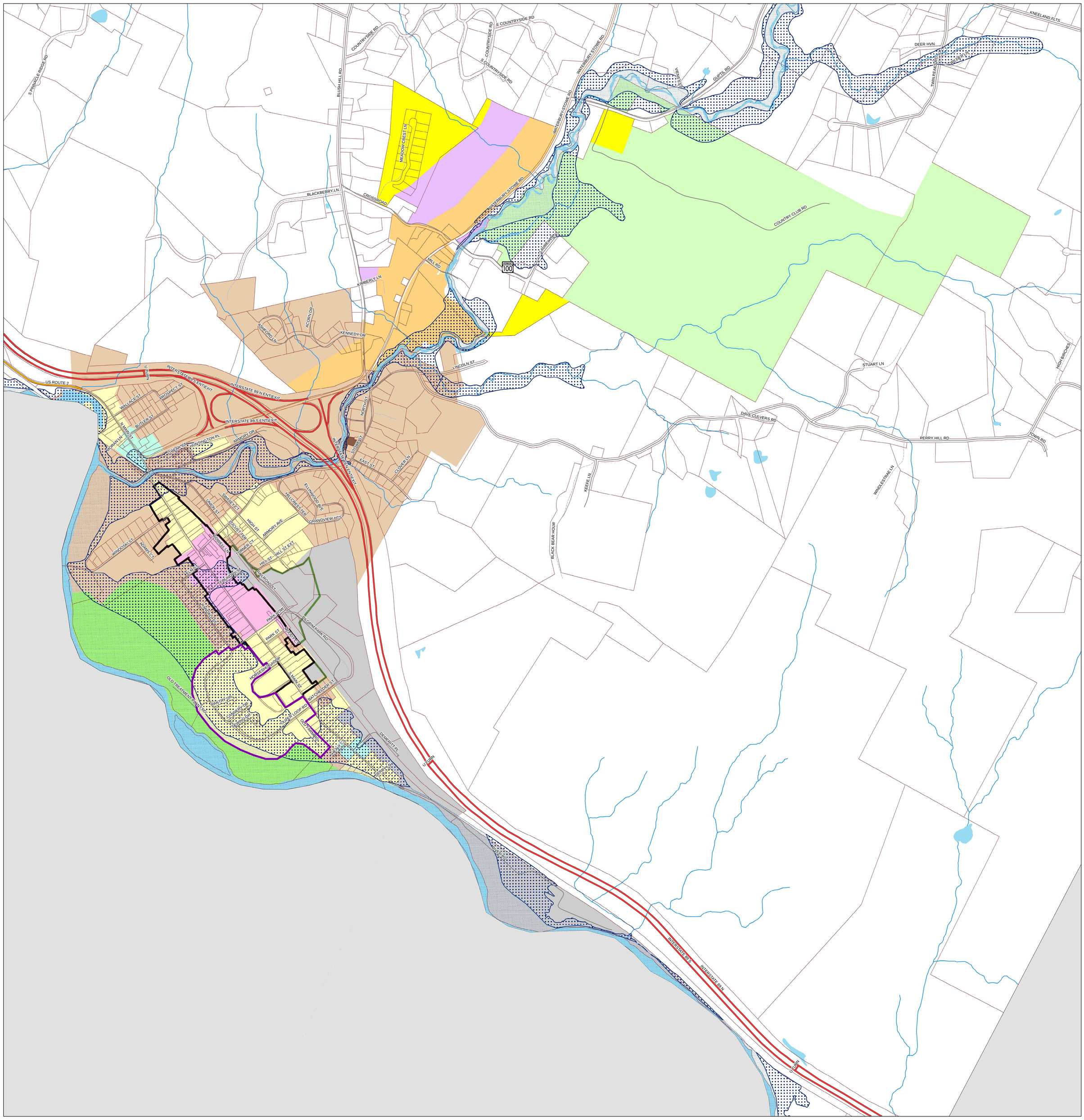
0 1 2 4 Kilometers

N

CVRPC
CENTRAL VERMONT REGIONAL PLANNING COMMISSION

Roads: VCGI/E911 2012; Railroads: VCGI 2000
Surface Water: CVRPC Surface Waters Data 1999
Zoning: CVRPC and Waterbury 2007
Preliminary NFIP: USDA, 2012.
Down Town Designated Districts: CVRPC and Waterbury, 2008.
Ridgeline/Hillside/Orverlay District: CVRPC and Waterbury.
Parcels: CVRPC and Waterbury 2011.
Created April 2006 by CVRPC Updated 2/7/13
Location:N:\Towns\Waterb\Town_Zoning_2013
Map is for planning purposes only. Data is only as accurate as the original source.

Waterbury Village Zoning 2013



VILLAGE ZONING
- CONSERVATION
- DOWNTOWN COMMERCIAL
- INDUSTRIAL
- MEDIUM DENSITY RESIDENTIAL
- MILL
- RECREATION
- ROUTE 100
- VILLAGE COMMERCIAL
- VILLAGE MIXED RESIDENTIAL
- VILLAGE NEIGHBORHOOD COMMERCIAL
- VILLAGE RESIDENTIAL

OVERLAY DISTRICTS
- Interim Campus Overlay District

FLOOD HAZARD AREA OVERLAY DISTRICT
- Special Flood Hazard Area 1% Chance of Annual Flood
- Flood Hazard Area Floodway

DOWNTOWN DESIGN REVIEW OVERLAY DISTRICT
- Historic/Commercial
- Mixed-Use

- Town Highway
- State Forest Highway
- Private and/ or Legal Trail
- US Highway
- Interstate
- Waterbury Parcels 2011
- Lake/River
- Streams

0 0.125 0.25 0.5 Miles

0 0.125 0.25 0.5 Kilometers

N W E S

CVRPC
CENTRAL VERMONT REGIONAL PLANNING COMMISSION

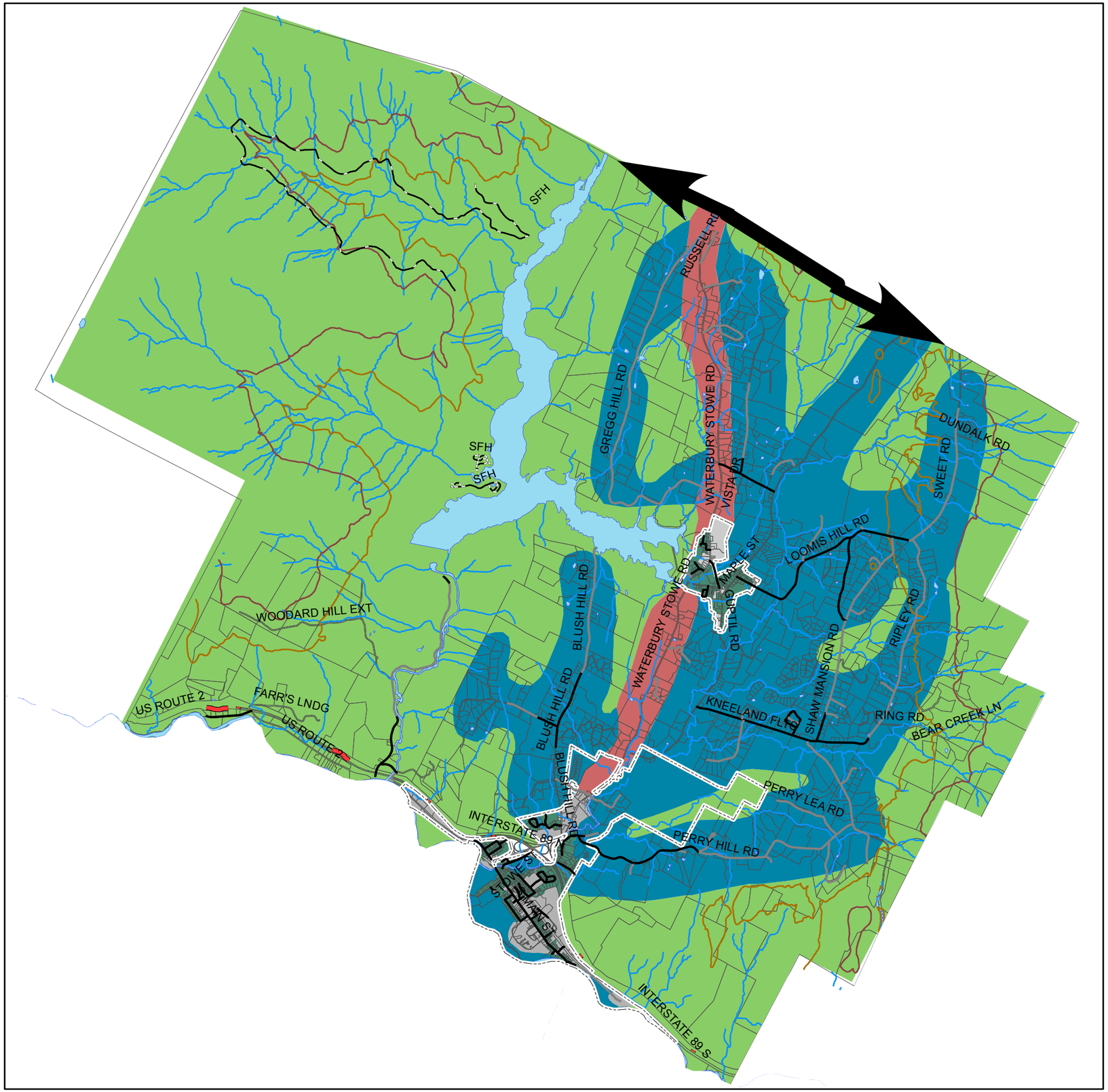
Roads: VCGI/E911 2012; Railroads: VCGI 2000
Surface Water: CVRPC Surface Waters Data 1999
Zoning: CVRPC and Waterbury 2007
Preliminary NFIP: USDA, 2012.
Down Town Designated Districts: CVRPC and Waterbury, 2008.
Parcels: CVRPC and Waterbury 2011.

Created April 2006 by CVRPC Updated 2/7/13
Location: N:\Towns\Waterb\VillageZoningMap_2013
Map is for planning purposes only. Data is only as accurate as the original source.

K. WATERBURY FUTURE LAND USE TOWN MAP (2018)

The Central Vermont Regional Planning Commission has updated the Waterbury Future Land Use Town Map. The map identifies the project area to remain in Village Resident use.

WATERBURY
Future Land Use
Town Map



Legend

Future Land Use

- Ag./Forest/Cons.
- Route 100 Corrid
- Rural Res/Ag
- Village Resident
- Mixed Use
- Growth Centers

Roads

- Paved Public Roads
- Unpaved Public Roads
- State Forest Highway
- Paved Private Roads
- Unpaved Private Roads
- Interstate

Contours

- 1200 Feet
- 1500 Feet

- Rivers, Lakes, and Ponds
- Streams
- Waterbury Parcels

← Significant Wildlife Crossing →

0 0.5 1 2 3 4 Miles

Source:
Parcels: 2015
Waterbury Town Land Use: 2002
Roads: VTrans 2017
Surface Water: VHD 2008

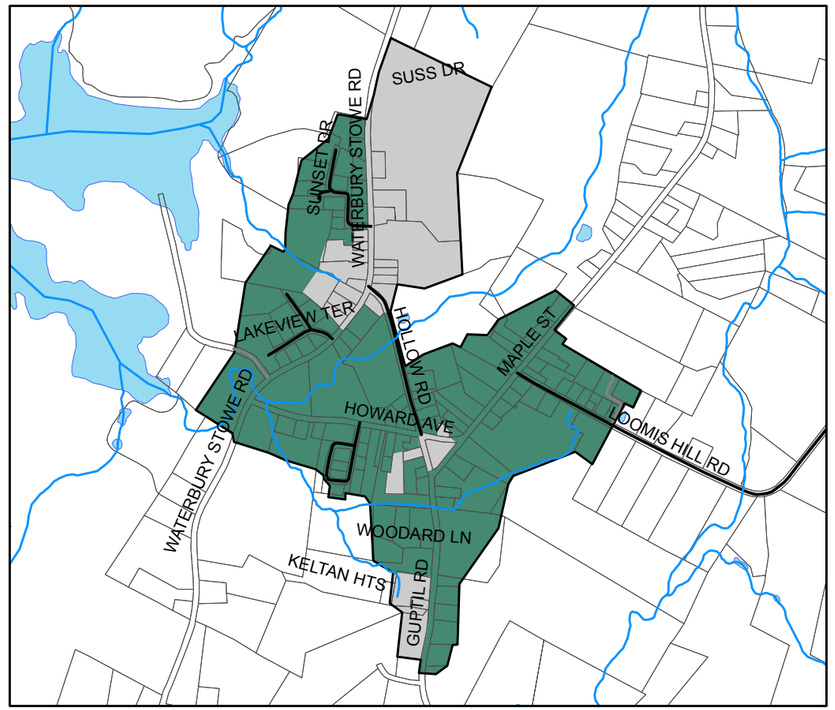
Map created 2013 by CVRPC Update 6/27/18
Path: N:\Towns\Waterb\TownPlan\Future Land Use.mxd

Data is only as accurate as the original source materials.
This map is for planning purpoes only.
This map may contain errors and or omissions.

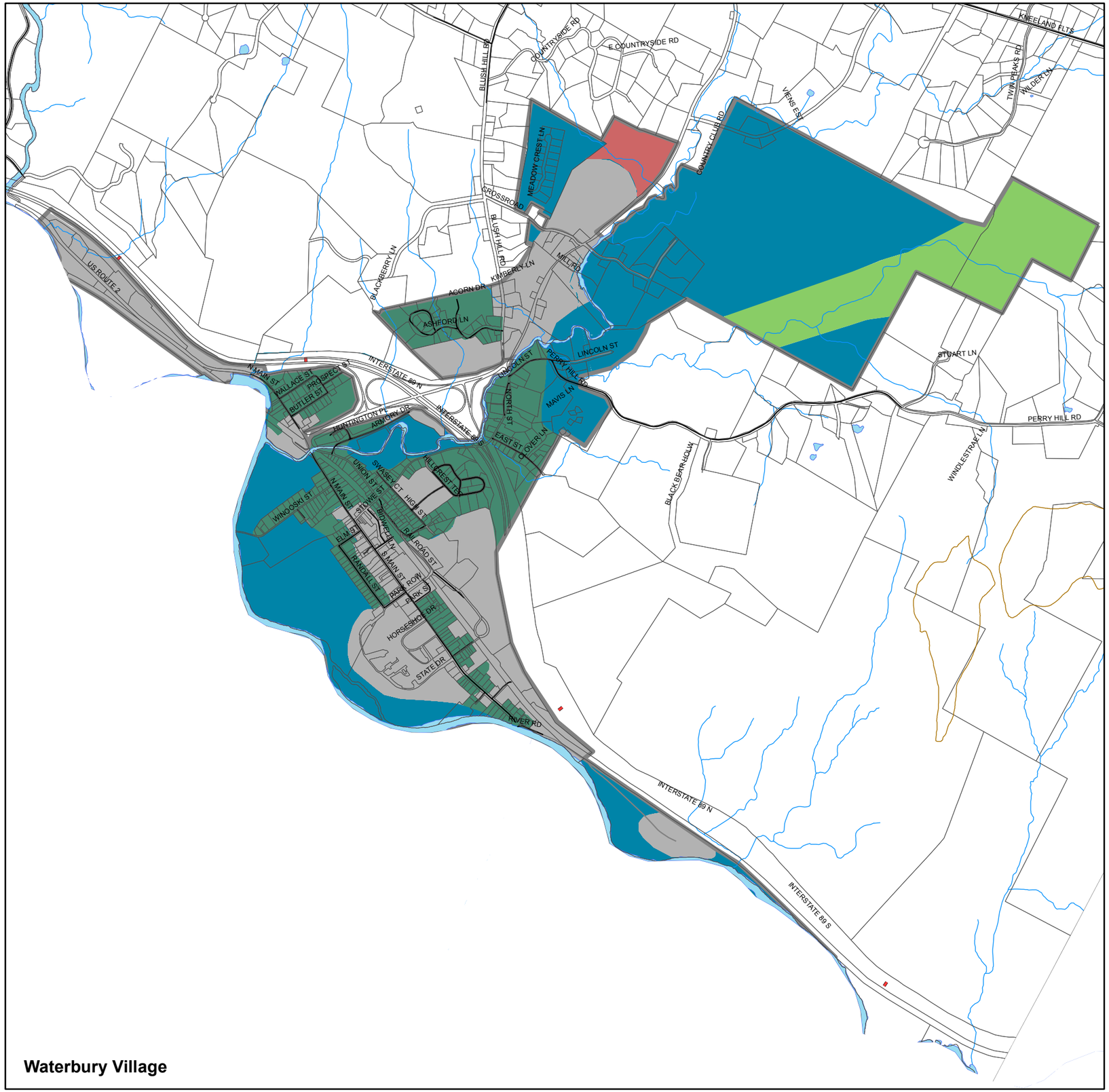
N

CVRPC
CENTRAL VERMONT REGIONAL PLANNING COMMISSION

WATERBURY
Future Land Use
Town Map



Waterbury Center



Waterbury Village

Legend

Future Land Use
- Ag./Forestry/Conservation
- Route 100 Corrid
- Rural Res/Ag
- Village Resident
- Mixed Use
- Growth Center Village Area
- Waterbury Parcels

Contours
- 1200 Feet
- 1500 Feet

Roads
- Paved Public Roads
- Unpaved Public Roads
- State Forest Highway
- Paved Private Roads
- Unpaved Private Roads
- Interstate
- Rivers, Lakes, and Ponds
- Streams

Miles
0 0.175 0.35 0.7 1.05 1.4

Source:
Parcels: Waterbury, CVRPC 2015
Waterbury Village Future Land Use: 2002
Roads: VTrans 2017
Surface Water: VHD 2008

Map created 2013 by CVRPC Update 6/27/18
Path: N:\Towns\Waterb\TownPlan\Future Land Use- village.mxd

Data is only as accurate as the original source materials.
This map is for planning purpoes only.
This map may contain errors and omissions.

N

CVRPC
CENTRAL VERMONT REGIONAL PLANNING COMMISSION

L. LOCAL CONCERNS MEETING MINUTES

A local concerns meeting was held on July 17th, 2018 to solicit input from residents regarding the need for the project and local concerns and opinions regarding the project area.

Meeting Minutes

Local Concerns Meeting

Stowe St. over Thatcher Brook – Existing Conditions Report / 195311625

Date/Time:	July 17, 2018 / Time
Place:	Steele Community Room, Waterbury, Vermont
Next Meeting:	TBD
Attendees:	See List
Absentees:	None
Distribution:	To be included in existing conditions report

The meeting was convened at 6:30 pm. Tom Knight from Stantec gave a brief presentation discussing the purpose of the project, known deficiencies, previous studies and current improvement projects and initiatives. The meeting then moved into discussion of the local concerns and public comments on the following topics:

Width / Skew / Geometry

Several Residents commented on the existing bridge being too narrow for modern uses and included the following concerns and suggestions:

- Design should consider a separated pedestrian/cycling facility in parallel to the traffic bridge.
- The current bridge has insufficient room for pedestrians and cyclists.
- Pedestrians not sufficiently protected from traffic by curb and / or guard rail.
- Insufficient width for bus turning movements.
- It was generally agreed that a right turn lane onto VT100 would help ease congestion.
- There was broad consensus that the new sidewalk or pedestrian walkway should be located on the upstream side of the bridge.

Safety

Several Residents commented regarding safety as follows:

- There was some concern expressed for the longevity of the bridge and regarding the structural safety of the bridge based on the current condition. Tom Knight explained that the bridge is monitored on a frequent basis and VTrans will notify the Town if the load carrying capacity of the bridge needs to be reduced.
- The side distance from Lincoln St. looking up and down Stowe St. is poor.
- Pedestrians and cyclist do use the route frequently, and it is felt that they would use it more frequently if they felt safer.
- Turn lanes and shoulders are poorly defined.

Meeting Minutes

- The alignment of Stowe St. with VT 100 is skewed, resulting on a very wide pavement area at the intersection with VT 100.
- Residents noted school bus stop are located just below Lincoln St. on Stowe St., and on Lincoln St. near of the intersection. They voiced concerns about the speed of vehicles on Stowe St.
- There were many residents speaking in support of traffic calming measures to reduce speed on Stowe St. below the Lincoln St. intersection.
- One resident suggested a mini traffic circle as an option for the Lincoln St./Stowe St. intersection.

Aesthetics

Several Residents commented and discussed bridge aesthetics as follows:

- The bridge is a pedestrian gateway to the Village.
- Many visitors and residents utilize the bridge for pedestrian access to downtown from Blush Hill and points North on VT 100.
- Aesthetics of this structure are important to the village.

Anticipated Changes in Development / Transportation Patterns

- Residents noted that developments on Perry Hill may increase traffic on Lincoln Street.
- Residents discussed potential for relocating the park-and-ride. Town officials noted that relocation has been studied by regional planning. The study did not locate a suitable alternate site.
- Residents suggested having the transit bus stop at the state office complex, in addition to, or in place of stopping at the park and ride.

Bridge Closure for Construction

Stantec discussed the concept of closing the bridge during construction to avoid the need for a temporary bridge and asked for input from the residents on this issue. The following issues were noted:

- Residents did not object to a reasonable closure duration because alternate routes are available.
- 6 months would be too long, 1-2 months would be tolerable.
- A temporary pedestrian bridge or shuttle system for pedestrians during the closure would be helpful. If a separate pedestrian bridge were installed as part of the permanent design, it would be nice to install it as a temporary pedestrian crossing during construction.
- Providing a temporary location for the Park and Ride would be needed.