STATE OF VERMONT
AGENCY OF TRANSPORTATION

Scoping Report

FOR

Plymouth BF 013-3(13)

VT ROUTE 100, CULVERT 115 OVER RESERVOIR BROOK

June 15, 2017

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I. Site Information

Culvert 115 is a state-owned bridge located on VT Route 100 in the town of Plymouth. The project site is located in a rural area. The culvert is approximately 1.4 miles south of the intersection of VT Route 100 and US Route 4 in Bridgewater, VT, at mile marker 9.34. The site is adjacent to the Markowski gravel pit. The culvert is at a skew of 43º to the roadway, and has an average cover of 5 feet. The existing conditions were gathered from a combination of a Site Visit, the Inspection Report, the Route Log and the existing survey. See correspondence in the Appendix for more detailed information.

Roadway Classification	Minor Arterial (State Highway)
Culvert Type	Corrugated Galvanized Metal Plate Pipe
Culvert Span	8 feet
Culvert Length	80 feet
Skew	43º
Year Built	1971
Ownership	State of Vermont
Maintenance District	3

Need

Culvert 115 carries VT Route 100 over the Reservoir Brook. The following is a list of deficiencies of Culvert 115 in this location:

1. This culvert has a rating of 4 “Poor”: there is deterioration in the form of large perforations throughout the entire length, along the water line.
2. The existing culvert does not meet hydraulic standards.
3. Approach and bridge lane and shoulder widths are substandard.

Traffic

The Vermont Agency of Transportation performed a traffic study of this site. The traffic volumes are projected for the years 2018 and 2038.

TRAFFIC DATA	2018	2038
AADT	920	940
DHV	130	130
ADTT	65	110
%T	7.4	11.7
%D	51	51

Design Criteria

The design standards for this bridge project are the Vermont State Standards, dated October 22, 1997. Minimum standards are based on an ADT of 940, a DHV of 130, and a design speed of 50mph for a Minor Arterial.

Design Criteria	Source	Existing Condition	Minimum Standard	Comment
Approach Lane and Shoulder Widths	VSS Table 4.3	11'/3' (28')	11'/4' (30')	Substandard
Bridge Lane and Shoulder Widths	VSS Section 4.7	11'/3' (28')	11'/4' (30')	Substandard
Clear Zone Distance	VSS Table 4.4	Shielded with W-beam guardrail	16' fill / 10' cut (1:3) 12' cut (1:4) Shielded 4'9"	Meets Standard
Banking	VSS Section 5.13	Varies, 3-8%	8% (max)	
Speed		50 mph	50 mph (Design)	
Horizontal Alignment	AASHTO Green Book Table 3-10b	R = 818.5'	R_{min} = 758' @ e = 8%	
Vertical Grade	VSS Table 4.5	4.2%	5% (max) for rolling terrain	
K Values for Vertical Curves	VSS Table 4.1	Bridge is on a tangent	110 crest / 90 sag	
Vertical Clearance	VSS Section 4.8	No Issues Noted	14'3" (min)	
Stopping Sight Distance	VSS Table 4.1	270' around the curve	400'	
Bicycle/Pedestrian Criteria	VSS Table 4.7	3' Shoulder	3' Shoulder	
Bridge Railing	Structures Design Manual Section 13	TL-3	TL-3	
Hydraulics	VTrans Hydraulics Section	Q50 storm event headwater is 1.4X diameter, and bankfull requirement is not met	Pass Q_{50} storm event without headwater exceeding 1.2X diameter	Substandard
Structural Capacity	SM, CH. 3.4.1	Unknown	Design Live Load: HL-93	

Inspection Report Summary

Culvert Rating 4 Poor
Channel Rating 6 Satisfactory

12/3/2013 – The invert has extensive deterioration with large holes scattered along the water line. A concrete invert should be installed in the near future. JWW/JDM

10/18/12 – Poor Condition. There are large 2+ holes numerous throughout the pipe at about 2' up the pipe from the bottom of invert…1' of undermining is occurring at outlet end. JM MK

11/08/11 – Poor condition, deterioration has progressed and a liner is needed or full replacement. MJK & JM

09/01/2011 – Multi plate pipe. Large wash out behind the cradle headwall at the inlet end in the north shoulder from hurricane Irene. These areas need to be repaired. DCP & FRE

06/30/2009 – Culvert should be evaluated for a possible sleeve and rocks and debris should be removed from the inlet. FRE

Hydraulics

The existing structure is not hydraulically adequate. The existing structure does not meet the current standards of the VTrans Hydraulic Manual or the state stream equilibrium standards for bankfull width. The culvert constricts the channel width, increasing potential for debris blockage, scour and erosion. There is a drop at the outlet with water undermining at that location. Hydraulics has recommended that the culvert be fully replaced and has recommended several options for a replacement. These options include a bridge with a clear span of 20' and clear height of 7', a high metal arch with a width of 20' and height of 8.3', or any similar structure that provides a clear span of 20' and a waterway area of 125 square feet or more. These options are outlined in detail in the preliminary hydraulics report in Appendix E.

Utilities

The existing utilities are as follows:

Municipal Utilities

- The Town of Plymouth does not have any utilities in the vicinity of this bridge.

Public Utilities

Aerial:

- There are 2 communication lines owned by Vermont Telephone Company (VTEL) and Comcast and an aerial three phase electric line (owned by Green Mountain Power) parallel to VT Route 100 on the western side. The Green Mountain Power electric line crosses RT 100 approximately 325 feet south of the culvert.
- There is a three phase electric line (to a service pole) that crosses RT 100 close to the culvert outlet; this could affect construction.

Private Utilities

Underground:

- There is a water pipeline owned by Killington LTD that crosses RT 100 immediately north of the culvert, around the outlet end of the culvert, and continues parallel to RT 100. This pipe also has underground electric for heat tracing in the exposed areas around the culvert.

Right-of-Way

The existing Right-of-Way is plotted on the Layout Sheet, and is approximately 120 feet wide. It is anticipated that minor additional ROW will be necessary to facilitate installation of wingwalls.

Resources

Biological

Wetlands/Floodplains

Culvert 115 is located on Reservoir Brook. There are no wetlands present within the scoping area.

Wildlife Connectivity

This culvert falls within the Network of Connected Lands, between two large habitat blocks. Therefore, wildlife connectivity should be considered.

Fisheries

Currently this structure is considered "impassable" for aquatic organism passage. Currently all downstream structures allow for at least partial passage to the Ottauquechee River. It is recommended that a structure is built that allows for AOP.

Species/Habitat of Special Concern

The Northern Long Eared Bat was recently listed by the US Fish & Wildlife Service as threatened, and by the Vermont Fish and Wildlife Department as endangered in Vermont. Guidance surrounding this listing indicates that all trees greater than 3" in diameter and that have cracks, crevices, holes and peeling bark are suitable habitat for the Northern Long Eared bats. A habitat assessment will be necessary prior to any necessary tree clearing. This requirement is withheld if the trees are cleared from November 1st through April 15th. There are no further mapped rare, threatened, or endangered species within the project scope.

Agricultural Soils

Soil within the site is mapped as Berkshire-Tumbridge complex, which is not a prime or statewide significant soil.

Hazardous Materials

According to the Vermont Agency of Natural Resources (VANR) Vermont Hazardous Sites List, there are no known active hazardous sites in the project area.

Historic

No historically significant resources have been identified at the site.

Archeological

The VTrans Archaeology Officer conducted a resource identification on 12-5-15 and found no areas of archaeological sensitivity in the vicinity.

Stormwater

There are no stormwater concerns for this project.

Safety

The project area is not in a high crash location. There has been only one reported crash in the last 5-year period ending 12/31/14.

Bike and Pedestrian Usage

VT Route 100 is a moderate bicycle use priority roadway. Pedestrian usage will not be maintained through a closure. The detour is made up of moderate and high bicycle use priority roadways on which bicycle traffic can be maintained.

II. Alternatives Discussion

A. Structure Alternatives

The existing shoulder widths at the culvert location does not meet standards in terms of roadway geometry.

No Action

This alternative would involve leaving the culvert in its current condition. Given that the inspection rating on this culvert is poor, the culvert should not be left in its current condition. The culvert, in its current state, has a limited service life under 10 years, and out of interest of safety to the traveling public, this alternative will not be further considered.

Rehabilitation

According to the Preliminary Hydraulic Report, found in Appendix D, the hydraulic standard of the VTrans Hydraulic Manual is not met. The culvert additionally does not meet the state stream equilibrium standards for bankfull width (span length). VT 100 is a minor arterial, therefore, using a design storm with a 2% Annual Exceedance Probability, the headwater depth is 10.9' and the headwater to depth ratio is 1.4. The water level overtops the roadway below the 1% AEP. Therefore, the existing culvert is not adequate for the stream. Rehabilitation is not recommended because insertion of any kind of liner would further decrease the hydraulic area of an already hydraulically inadequate culvert. Rehabilitation will not be further considered.

Structure Replacement Using Open Cut – New Buried Structure with Natural Streambed

This option involves removing the existing corrugated metal plate pipe, and replacing it with a new buried structure having a waterway opening of at least 20-foot clear span and 7-foot clear height. Because there is an average of 5 feet of fill above the existing culvert, there would not have to be a large amount of earthwork, making this a good site for a new precast buried structure. Any new structure should have flared wingwalls to ease the transition from stream to structure channel at the inlet and outlet. The various considerations under this option include the roadway width, structure type, culvert length and skew, and roadway alignment.

a. Roadway Width

The current roadway width is 28 feet. In compliance with minimum Vermont State Standards, a roadway width of 30 feet will be proposed through the project area. This would meet the design standards by providing an 11' lane/4' shoulder roadway. Striping to match the current lane widths would be proposed.

b. Structure Type

Per the hydraulics report, the replacement structure could be a metal arch, a precast Conspan-type arch, three-sided precast concrete rigid frame, or any other shape meeting the waterway requirements. If stone fill is needed to protect the footings or any type of abutment wall, a wider structure should be considered to account for the stone fill. Any new channel bottom will need to be built using streambed stone type E3 through the new structure. Based on the geotechnical investigation, spread footings on soil or rock is a feasible foundation option based on the varying depth of bedrock from 15 to 20 feet. Based on the location of shallow bedrock, a three-sided structure is preferable to ease construction, and provides a natural streambed.

Alternative 1: Precast Concrete Three-Sided Rigid Frame or ConSpan Concrete Arch

A precast concrete three-sided box/arch is the first option for an open-bottom structure. This structure would have a clear span of 20 feet and a clear height of 7 feet from the streambed. The Preliminary Geotechnical Report revealed exposed bedrock in the river bed. This structure will also resist scour with footings founded on bedrock. A concrete structure will better resist abrasion from particulate flow.

Alternative 2: Metal Arch

A metal arch is another option for increasing the hydraulic capacity of the culvert, as well as the bankfull width. The proposed metal arch would have a minimum clear height of 8.3 feet and available waterway area of 125 square feet. For any three-sided structure, the stream bed will be excavated down to bedrock, and spread footings will be installed to resist scour. If a metal arch is chosen, it is suggested that concrete pedestals are used up to the height of ordinary high water to resist abrasion.

c. Culvert Size, Length, and Skew

The existing culvert has a span of 8 feet, which constricts the natural channel width. Regardless of the structure chosen, hydraulics has recommended a minimum of 125 sq. ft. of waterway area. The culvert will match the existing skew of the channel. Any replacement structure will have an approximate 90-foot length.

d. Roadway Alignment

The existing horizontal alignment meets the minimum standard. Additionally, the vertical alignment meets current geometric standards. As such, both the horizontal and vertical alignment will remain unchanged.

Structure Replacement Using Open Cut – New Four-Sided Structure

This option involves removing the existing corrugated metal plate pipe, and replacing it with a new buried structure having a waterway opening of at least 20 feet wide and 7 feet high. It would be difficult to accommodate the proper height and area of flow without excavating into bedrock to bury the bottom side of the structure. Installing a four-sided box in this site is plausible; however, it poses more risk than a three-sided structure because of the level of bedrock approximately 15 feet below the surface. The exposed bedrock in the streambed could interfere with the necessary

excavation for the precast four-sided box. This would produce high construction costs and longer construction lengths, and therefore a four-sided concrete box will not be further considered.

Structure Replacement Using Open Cut – New Bridge

This option involves removing the existing corrugated metal plate pipe, and replacing it with a new bridge having a waterway opening of at least 20 feet wide and 7 feet high. Any new structure should have flared wingwalls at the inlet and outlet to make a smooth transition between the stream and structure channel, and prevent scour of the stream banks. The various considerations under this option include: the roadway width, structure type, length and skew, and roadway alignment.

a. Roadway Width

The current roadway width is 28 feet. In compliance with minimum Vermont State Standards, a roadway width of 30 feet will be proposed through the project area. This would meet the design standards by providing an 11' lane/4' shoulder roadway. Striping to match the current lane widths would be proposed.

b. Bridge Length and Skew

Hydraulics has recommended a bridge with a minimum clear span of 20' and a minimum clear height of 7'. The bridge could be built to match the skew of the channel at 45º, however, large skew bridges are difficult and expensive to install, and the skew should be limited as much as possible. A skew of 0º would require a much longer span, and rerouting the stream. Therefore, a skew of 20º will be considered. The bridge length must encompass the required clear span of at least 20' perpendicular to the river, which is accomplished with a 50-foot span bridge.

c. Structure Type

If a new bridge is installed, the bottom of abutment footings should be at least 6 feet below the channel bottom, to ledge, or moved further away from the stream to prevent undermining and scour. A prefabricated structure will be the preferred choice at this site, due to decreased construction time.

Alternative 3: Integral Abutment with Piles

Integral Abutment Bridges require a minimum of 16 feet of pile length from the bottom of the abutment. There is exposed bedrock in the streambed, and there is shallow bedrock in the locations of the proposed abutments. The minimum length will be unattainable unless there is pre-excavation of the pile locations which increase construction costs and durations.

Alternative 4: Vertical Abutment with Spread Footings

At this site, excavation will occur down to bedrock, which will be cleaned and then made level with cast-in-place concrete subfootings. Spread footings will then be installed on the leveled surface. This bridge type is economical because it does not require excavating any bedrock, and is not dependent on the specific location of bedrock. Because the foundation is formed directly on bedrock, there is very low risk of scour, and therefore the service life of the bridge is increased.

d. Roadway Alignment

The existing horizontal alignment meets the minimum standard. Additionally, the vertical alignment meets current geometric standards. As such, both the horizontal and vertical alignment will remain unchanged.

B. Maintenance of Traffic

The Vermont Agency of Transportation created an Accelerated Bridge Program in 2012, which focuses on expedited delivery of construction plans, permitting, and Right-of-Way, as well as accelerated 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 accelerated construction techniques and incentives to contractors to complete projects early. The Agency will consider the closure option on projects where rapid reconstruction or rehabilitation is feasible. The use of prefabricated elements and systems for new bridges will also expedite construction schedules. This can apply to decks, superstructures, and substructures. Accelerated Bridge Construction should provide enhanced safety for workers and the traveling public while maintaining project quality. The following options have been considered:

Option 1: Off-Site Detour

This option would close the bridge and reroute traffic onto VT Route 100A east of Plymouth and through Bridgewater, then onto VT Route 4, and back to VT Route 100 in West Bridgewater. This detour features the following, assuming no delays:

Thru Distance:	5.4 miles	7 minutes
Detour Distance:	12.6 miles	17 minutes
Added Distance for Thru Traffic:	7.2 miles	10 minutes
End to End Distance:	18 miles	24 minutes

There are no local bypass routes to see an increase in traffic. Access to driveways would be maintained on VT Route 100. There is no interference with emergency response because Regional Ambulance Services in Rutland is located Northwest of the culvert, Woodstock Ambulance Department is located Northeast of the culvert, and Ludlow Town & Village Ambulance is located South of the culvert. All services are equidistant to the residences located around the closure. Additionally, Rutland Regional Medical Center (northwest), Springfield Hospital Emergency Department (southeast) and Mount Ascutney Hospital and Health Center (east) are available hospitals in close proximity to Plymouth. Access for Bridgewater and Ludlow citizens will remain the same. Therefore, a closure will not greatly affect the emergency response safety of the Plymouth citizens. VT 100 is considered a scenic byway, and the shortened construction allowed by full closure would limit interference with the traveling, sightseeing public.

Advantages: Using an off-site detour would eliminate the need to use a temporary bridge or phase construction to maintain traffic. This would decrease the cost and time required to construct a project in this location. The impacts and amount of temporary rights required to construct a project in this

location would also be reduced for this option. The safety of both construction workers and travelling public would be improved by removing traffic from the construction site.

Disadvantages: Traffic flow would not be maintained through the project corridor during construction, which would increase the length of commute for most travelers.

Option 2: Temporary Bridge

A temporary bridge would allow traffic to be maintained through the project corridor during construction. Initial investigations indicate that the site conditions including proximity of the river to Route 100 and the banking grade will not allow for construction of a cost-effective temporary bridge upstream or downstream of the existing structure. This option will not be further evaluated.

Option 3: Phased Construction

Phased construction is the maintenance of one lane of alternating traffic on the existing bridge while building one lane at a time of the proposed structure. This keeps the roadway open during construction, while having minimal impacts to resources and adjacent property owners.

Based on traffic volumes and the existing roadway width, it would be reasonable to close one lane of traffic, and maintain one lane of alternating traffic, with traffic signals. Given the shallow depth to bedrock as noted in the geotechnical investigation, sheet piles alone would not be able to obtain sufficient embedment depth to retain the anticipated excavation. A general approximation is to assume 2/3 of the pile length needs to be embedded into order to support a 1/3 cut. If the embedment cannot be achieved then other means such as bracing, soil nails, and tie backs would need to be used to adequately support the sheet piles.

Advantages: Traffic is maintained through the project corridor with only a small impact on travel time.

Disadvantages: Traffic is maintained close to the construction site, which jeopardizes the safety of the workers and travelers. The construction time will be increased due to space, safety limitations, and complications of constructing on bedrock. Travel time through the corridor is delayed.

III. Alternatives Summary

Based on the existing site conditions, culvert condition, and recommendations from hydraulics and others, the following alternatives are offered:

Alternative 1a: Precast Concrete Box with Traffic Maintained by Detour
Alternative 1b: Precast Concrete Box with Traffic Maintained by Phased Construction
Alternative 2a: Metal Arch with Traffic Maintained by Detour
Alternative 2b: Metal Arch with Traffic Maintained by Phased Construction
Alternative 3a: Integral Abutment Bridge with Traffic Maintained by Detour
Alternative 3b: Integral Abutment Bridge with Traffic Maintained by Phased Construction
Alternative 4a: Vertical Abutment Bridge with Traffic Maintained by Detour
Alternative 4b: Vertical Abutment Bridge with Traffic Maintained by Phased Construction

IV. Cost Matrix

Plymouth BF 013-3(13)		Do Nothing	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
			3-Sided Box Detour	3-Sided Box Phasing	Metal Arch Detour	Metal Arch Phasing	Integral Abutment Detour	Integral Abutment Phasing	Vertical Abutment Detour	Vertical Phasing
COST[1]	Bridge Cost	$0	$771,000	$963,000	$416,000	$520,000	$917,000	$1,146,000	$549,000	$686,000
	Removal of Structure	$0	$20,000	$25,000	$20,000	$25,000	$20,000	$25,000	$20,000	$25,000
	Roadway	$0	$249,000	$311,000	$213,000	$266,000	$263,000	$329,000	$226,000	$283,000
	Maintenance of Traffic	$0	$40,000	$150,000	$40,000	$150,000	$40,000	$150,000	$40,000	$150,000
	Construction Costs	$0	$1,080,000	$1,449,000	$689,000	$961,000	$1,240,000	$1,650,000	$835,000	$1,144,000
	Construction Engineering + Contingencies	$0	$324,000	$434,700	$206,700	$288,300	$372,000	$495,000	$250,500	$343,200
	Total Construction Costs w CEC	$0	$1,404,000	$1,883,700	$895,700	$1,249,300	$1,612,000	$2,145,000	$1,085,500	$1,487,200
	Preliminary Engineering[2]	$0	$270,000	$362,300	$172,300	$240,300	$310,000	$412,500	$208,800	$286,000
	Right of Way	$0	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000
	Total Project Costs	$0	$1,694,000	$2,266,000	$1,088,000	$1,509,600	$1,942,000	$2,577,500	$1,314,300	$1,793,200
SCHEDULING	Project Development Duration[3]	N/A	2 years	2 years	2 years	2 years	2 years	2 years	2 years	2 years
	Construction Duration	N/A	3 months	8 months	3 months	8 months	3 months	8 months	6 months	8 months
	Closure Duration (If Applicable)	N/A	3 weeks	N/A	3 weeks	N/A	3 weeks	N/A	6 weeks	N/A
ENGINEERING	Typical Section - Roadway	4-11-11-4	4-11-11-4	4-11-11-4	4-11-11-4	4-11-11-4	4-11-11-4	4-11-11-4	4-11-11-4	4-11-11-4
	Typical Section - Bridge	4-11-11-4	4-11-11-4	4-11-11-4	4-11-11-4	4-11-11-4	4-11-11-4	4-11-11-4	4-11-11-4	4-11-11-4
	Geometric Design Criteria	No Change	Meets Criteria	Meets Criteria	Meets Criteria	Meets Criteria	Meets Criteria	Meets Criteria	Meets Criteria	Meets Criteria
	Traffic Safety	No Change	Improved	Improved	Improved	Improved	Improved	Improved	Improved	Improved
	Alignment Change	No	No	No	No	No	No	No	No	No
	Bicycle Access	No Change	Improved	Improved	Improved	Improved	Improved	Improved	Improved	Improved
	Hydraulic Performance	Substandard	Meets Standard	Meets Standard	Meets Standard	Meets Standard	Meets Standard	Meets Standard	Meets Standard	Meets Standard
	Pedestrian Access	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change
	Utility	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change
OTHER	ROW Acquisition	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Road Closure	No	Yes	No	Yes	No	Yes	No	Yes	No
	Design Life	<10 years	75 years	75 years	75 years	75 years	100 years	100 years	100 years	100 years

[1] Costs are estimates only, used for comparison purposes.
[2] Preliminary Engineering costs are estimated starting from the end of the Project Definition Phase.
[3] Project Development Durations are starting from the end of the Project Definition Phase.

V. Conclusion

Alternative 2a is recommended; to replace the existing culvert with a new metal arch concrete pedestal combination structure, while maintaining traffic on an offsite detour.

Structure:
Because the existing structure is hydraulically inadequate and rated "Poor", it is reasonable to assume that a replacement is necessary. The cost of a metal arch with concrete pedestals is lower than a new precast concrete structure and a vertical abutment bridge, and therefore a metal arch is recommended. This alternative offers the lowest up front cost as well as the lowest annualized cost for its life expectancy.

The new arch will have a 20' span and 6'-4" height, and will be founded on concrete pedestals founded on bedrock. The arch will match the channel at a 45-degree skew to the roadway. The new structure will be AOP compliant.

Traffic Control:
The recommended method of traffic control is to close the road for three weeks, and maintain traffic on an offsite detour. The detour for this project location would add approximately 7.2 miles to the through route, and have an end-to-end distance of 18 miles. The option to close the road is the least expensive and safest option. The closure duration may be shortened once final design has been completed but due to the presence of shallow bedrock a slightly conservative construction schedule has been assumed.

VI. Appendices

Appendix A: Site Pictures

Picture 1: Bridge 115 – Looking South, Typical Top of Deck

Picture 2: Bridge 115 – Looking North, Typical Deck

Picture 3: Looking Upstream from Culvert Inlet

Picture 4: Inlet of Culvert, Stream Bed Steps Down into Culvert

Picture 5: Holes Forming on Invert

Picture 6: Outlet of Culvert, Water Pipe in Foreground

Picture 7: Outlet of Culvert, Exposed Bedrock in Streambed on Left

Appendix B: Town Map

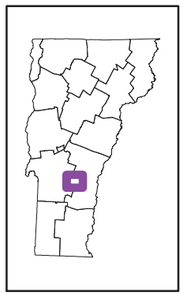
PLYMOUTH VT 100, CULV 115

Scale 1:59,695

N

- INTERSTATE
- STATE LONG
- STATE SHORT
- TOWN LONG
- FAS/FAU
- INTERSTATE
- STATE HIGHWAY
- CLASS 1
- CLASS 2
- CLASS 3
- CLASS 4
- LEGAL TRAIL
- PRIVATE
- DISCONTINUED
- DISTRICT
- POLITICAL BOUNDARY
- NAMED RIVERS-STREAMS
- UNNAMED RIVERS-STREAMS
- VOBCIT Bridge Data
- VOBCIT Culvert Data

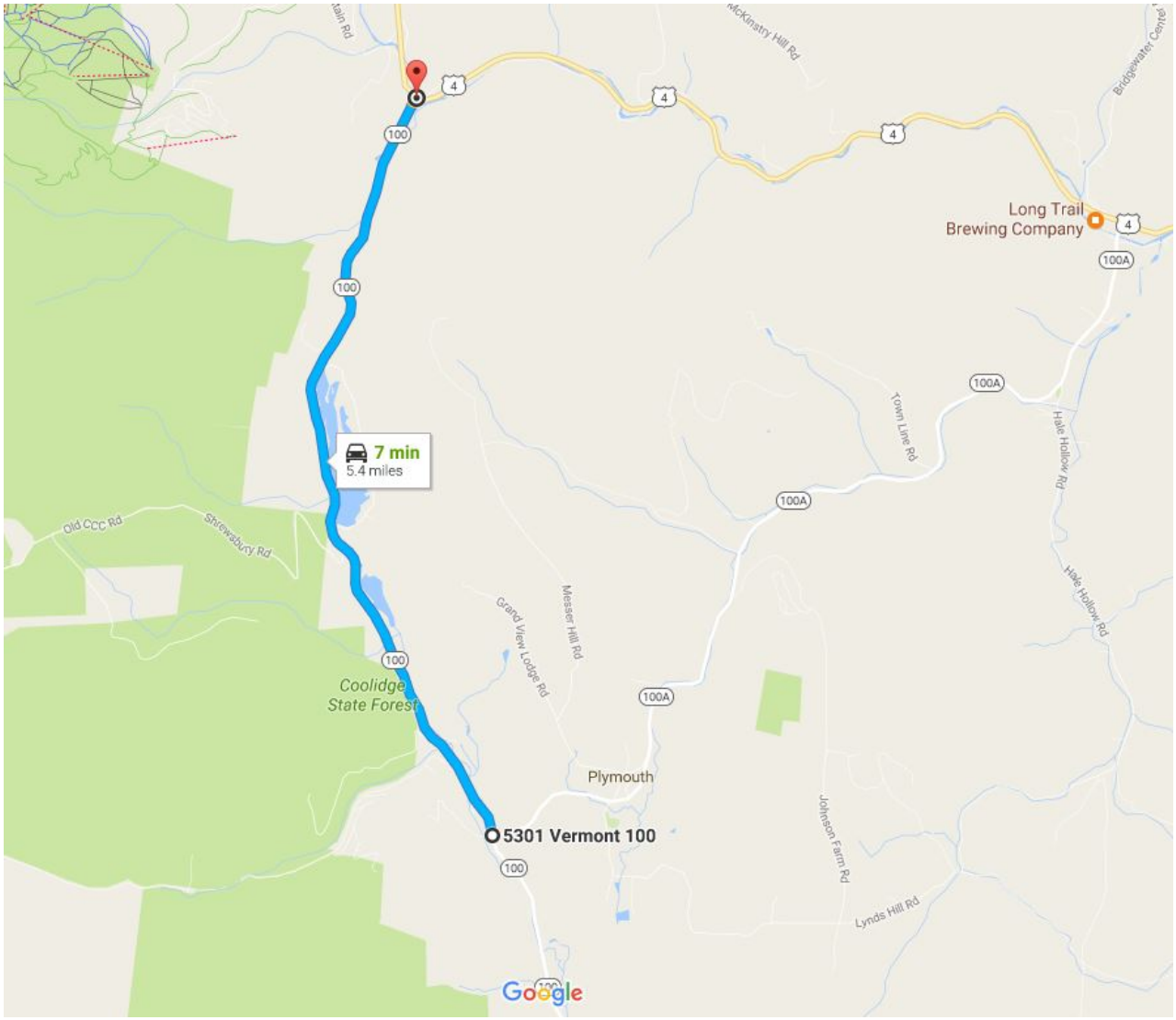
Produced by:
Mapping Unit
Vermont Agency of Transportation
June 2014



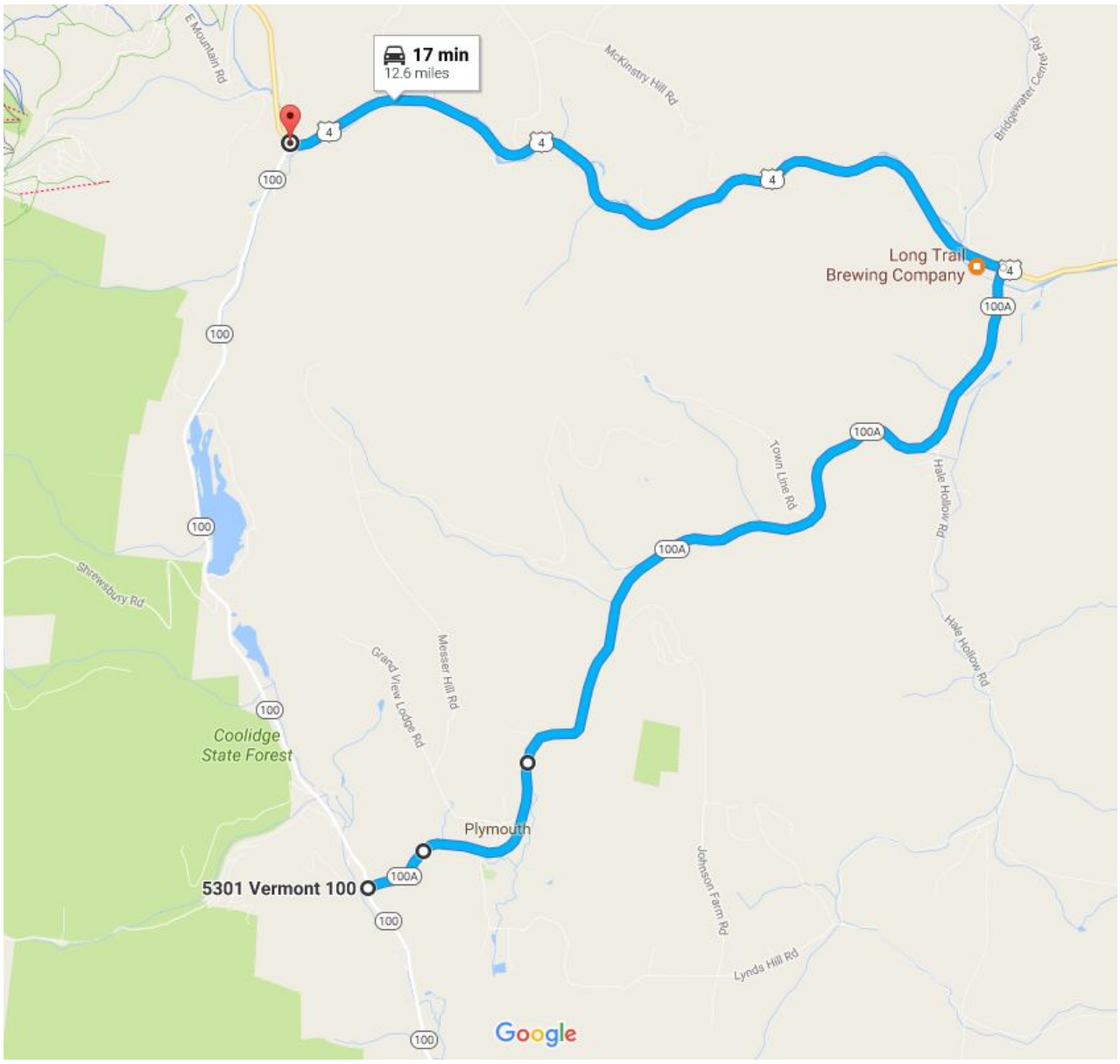
PLYMOUTH
WINDSOR COUNTY
DISTRICT # 3

Appendix C: Detour Map

Original Route



Detour Route



Appendix D: Bridge Inspection Report

STRUCTURE INSPECTION, INVENTORY and APPRAISAL SHEET

Vermont Agency of Transportation ~ Structures Section ~ Bridge Management and Inspection Unit

Inspection Report for PLYMOUTH **bridge no.:** 0115 **District:** 3

Located on: VT100 **over** RESERVOIR BROOK **approximately** 1.4 MI S JCT US 4 **Maintained By:** STATE

CONDITION

Deck Rating: N NOT APPLICABLE

Superstructure Rating: N NOT APPLICABLE

Substructure Rating: N NOT APPLICABLE

Channel Rating: 6 SATISFACTORY

Culvert Rating: 4 POOR

Federal Str. Number: 300013011514121

AGE and SERVICE

Year Built: 1971 **Year Reconstructed:** ____

Type of Service On: 1 HIGHWAY

Type of Service Under: 5 WATERWAY

Lanes On the Structure: 02

Lanes Under the Structure: 00

Bypass, Detour Length (miles): 8

ADT: 980 **Year of ADT:** 1996

GEOMETRIC DATA

Length of Maximum Span (ft): 8

Structure Length (ft): 8

Lt Curb/Sidewalk Width (ft): 0

Rt Curb/Sidewalk Width (ft): 0

Bridge Rdwy Width Curb-to-Curb (ft): 0

Deck Width Out-to-Out (ft): 0

Appr. Roadway Width (ft): 28

Skew: 40

Bridge Median: 0 NO MEDIAN

Feature Under: FEATURE NOT A HIGHWAY OR RAILROAD

Min Vertical Underclr (ft): 08 FT 00 IN

STRUCTURE TYPE and MATERIALS

Bridge Type: CGMPP

Number of Main Spans: 1

Kind of Material and/or Design: 3 STEEL

Deck Structure Type: N NOT APPLICABLE

Type of Wearing Surface: N NOT APPLICABLE

Type of Membrane: N NOT APPLICABLE

Deck Protection: N NOT APPLICABLE

CULVERT GEOMETRIC DATA and INDICATORS

Culvert Barrel Length (ft): 80

Average Cover Over Culvert (ft): 05

Waterway Area Through Culvert (sq.ft.): 50

Culvert Wing/Header Rating: 6 SATISFACTORY CONDITION

Steel Culvert Corrosion Indicator: 2 PERFORATIONS > 2" THROUGHOUT, CULVERT

Multi Plate Culvert Bolt Line Crack Indicator: 0 NO BOLT LINE CRACKS PRESENT

APPRAISAL

Appr. Rdwy. Alignment: 8 EQUAL TO DESIRABLE CRITERIA

INSPECTION

Inspection Date: 122014 **Inspection Frequency (months):** 12

INSPECTION SUMMARY and NEEDS

11/19/2014 The invert has extensive section loss w/ scattered large perforations throughout. This structure would be a good candidate for a concrete invert. JWW/JDM

12/3/2013 The invert has extensive deterioration with large holes scattered along the water line. A concrete invert should be installed in the near future. JWW/JDM

Poor condition. there are large 2+ holes numerous throughout the pipe at about 2' up the pipe from bottom of invert.. 1' of undermining is occurring at outlet end JM MK 10/18/12

11/08/11 Poor condition , deterioration has progressed and a liner is needed or full replacement. MJK & JM

Appendix E: Preliminary Hydraulics Memo

VT AGENCY OF TRANSPORTATION PROGRAM DEVELOPMENT DIVISION

HYDRAULICS UNIT

TO: Jennifer Fitch, Structures Project Manager

FROM: Leslie Russell, P.E., Hydraulics Project Manager

DATE: 17 March 2016

SUBJECT: Plymouth BF 013-3(13) VT 100 BR 115 over Reservoir Brook
Preliminary Hydraulics

We have completed our preliminary hydraulic study for the above referenced site, and offer the following information for your use:

Existing Conditions

The existing structure is an 8' corrugated galvanized metal plate pipe that provides 50.3 sq. ft. of waterway opening. The pipe is 80' long and was built in 1971.

VT 100 is a minor collector, so the design storm is the 2% AEP.

The pipe is in poor condition with large holes scattered along the waterline. There is a drop at the outlet with water undermining here.

Our calculations, field observations and measurements indicate the existing structure does not meet the current standards of the VTrans Hydraulic Manual nor does it meet state stream equilibrium standards for bankfull width (span length). The existing structure constricts the channel width, resulting in an increased potential for debris blockage. The headwater depth at 2% AEP = 10.9' (hw/d = 1.4) and water overtops the roadway below the 1% AEP.

Liner Comments

Since the existing pipe is not hydraulically adequate, no liner is recommended for this pipe.

Replacement Recommendations

In sizing a new structure we attempt to select structures that meet both the current VTrans hydraulic standards, state environmental standards with regard to span length and opening height, and allow for roadway grade and other site constraints.

Based on the above considerations and the information available, we recommend any of the following structures as a replacement at this site:

1. A bridge with a 20' clear span and a rise of 7'. This structure will provide 140 sq. ft. of waterway area. It results in a headwater depth of 5.0' at 2% AEP and 5.7' at 1% AEP. A new channel bottom will need to be built with E-stone type E3 through the new structure.

2. A 20' wide by 8.3' high metal arch. This structure will provide 124 sq. ft. of waterway area. It results in a headwater depth of 5.4' at 2% AEP and 6.0' at 1% AEP. A new channel bottom will need to be built using E-stone type E3 through the new structure. A precast Conspan-type arch that is 20' wide by 7' high will also work.

3. Any similar structure with a minimum clear span of at least 20’ and at least 125 sq. ft. of waterway area, that fits the site conditions, could be considered. **If stone fill is needed to protect the footings or any type of abutment wall, a wider structure should be considered to account for the stone fill.**

General Comments

We will need to calculate scour at final hydraulics. Chances are the 6’ minimum depth below channel bottom will be required for bottom of footings.

If a new bridge is installed, the bottom of abutment footings should be at least six feet below the channel bottom, or to ledge, to prevent undermining. Abutments on piles should be designed to be free standing for a scour depth at least 6’ below channel bottom.

If the open bottom arch option is installed, we recommend full height concrete headwalls be constructed at the inlet and outlet. The bottom of abutment footings under the arch should be at least six feet below the channel bottom, or to ledge, to prevent undermining. We recommend a minimum cover of 3’ over all metal arch structures. Pipe manufactures can provide specific recommendations for minimum and maximum fill heights and required pipe thickness. All structures are required to handle public highway loading.

It is always desirable for a new structure of this size to have flared wingwalls at the inlet and outlet, to smoothly transition flow through the structure, and to protect the structure and roadway approaches from erosion. The wingwalls should match into the channel banks. Any new structure should be properly aligned with the channel, and constructed on a grade that matches the channel. A new structure should span the natural channel width.

Stone Fill, Type IV should be used to protect any disturbed channel banks or roadway slopes at the structure’s inlet and outlet, up to a height of at least one-foot above the top of the opening. The stone fill should not constrict the channel or structure opening.

Please contact us if you have any questions or if we may be of further assistance.

LGR

cc: Hydraulics Project File via NJW

Appendix F: Preliminary Geotechnical Report

AGENCY OF TRANSPORTATION **OFFICE MEMORANDUM**

To: Jennifer Fitch, P.E., Structures Project Manager

END

From: Eric Denardo, Geotechnical Engineer, via Callie Ewald, P.E., Senior Geotechnical Engineer

CEE

Date: December 4, 2015

Subject: Plymouth BF 013-3(13) Preliminary Geotechnical Information

1.0 INTRODUCTION

We have completed our preliminary geotechnical investigation for the replacement of Bridge No. 115 on Vermont Route 100 over the Reservoir Brook in the town of Plymouth, VT. Bridge No. 115 is located approximately 1.4 miles south of the junction with US Route 4 adjacent to the Markowski gravel pit. The subject project consists of replacing or repairing the existing corrugated galvanized metal plate pipe (CGMPP) culvert. This review included the examination of as-built record plans, historical in-house bridge boring files, water well logs and hazardous site information on-file at the Agency of Natural Resources, USDA Natural Resources Conservation soil survey records, published surficial and bedrock geologic maps, and observations made during a site visit.

2.0 SUBSURFACE INFORMATION

2.1 Previous Projects

Record plans were available for this project from the construction in 1971. The plans included details of the existing culvert elevation; however the plans did not contain soil or foundation information.

The Geotechnical Engineering Section maintains a GIS based historical record of subsurface investigations, which contains electronic records for the majority of borings completed in the past 10 years. An exploration of this database revealed three nearby projects within a 3.5 mile radius. For projects approximately 2.2 to 3.5 miles away, boring logs indicated sand, silt, and gravel mixtures with bedrock encountered at depths as shallow as 45 feet and deeper than 111 feet.

2.2 Water Well Logs

The Agency of Natural Resources (ANR) documents and publishes all water wells that are drilled for residential or commercial purposes. Published online, these logs can be used to determine general characteristics of the soil strata in the area. The soil description given on the logs is done in the field, by unknown personnel, and as such, should only be used as an approximation. Figure 1 contains the subject project as well as surrounding well locations found using the ANR Natural Resources Atlas. Four water wells within an approximate 2300 foot radius of the project were used to get an estimate of the depth to

bedrock likely to be encountered for Bridge No. 115 and are highlighted below with red boxes.

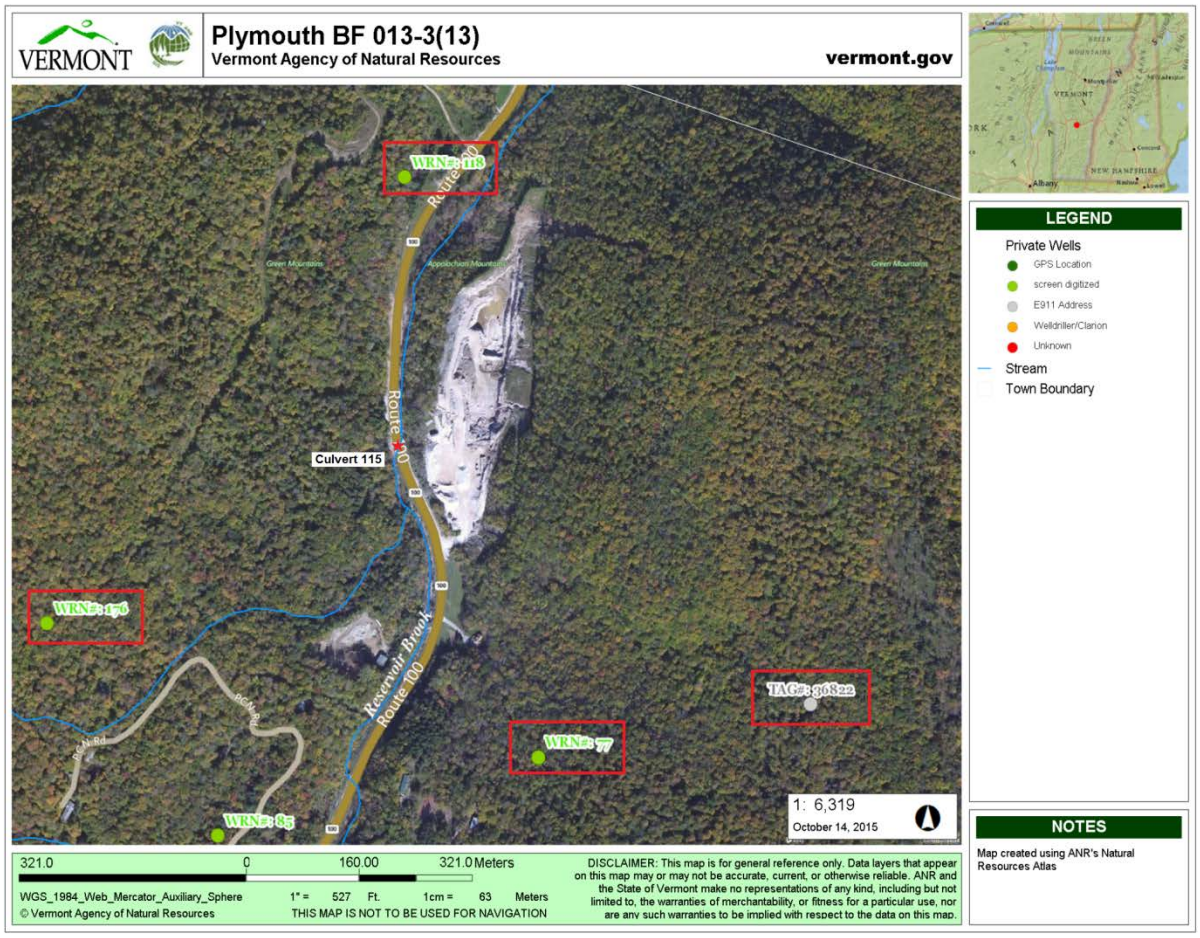


Figure 1. Highlighted Well Locations near Subject Project

Table 1 lists the well sites used in gathering the surrounding information. Wells are listed with the distance from the bridge project, depth to bedrock, and overburden material encountered.

Table 1. Depths to Bedrock of Surrounding Wells

Well ID	Approx. Distance From Project (feet)	Approx. Depth To Bedrock (feet)	Overburden Material
118	1280	Not Reported	Gravel, Sand, Clay, and Boulders
176	1880	4	Topsoil
77	1600	Not Reported	Sand and Gravel
36822	2300	90	Sand, Gravel, and Boulders

2.3 Hazardous Materials and Underground Storage Tanks

The ANR Natural Resource Atlas also maps the location and information of known hazardous waste sites and underground storage tanks. The location of this project is not on the Hazardous Site List. No underground storage tanks are located within a 1 mile radius and no impact from other hazardous waste sites is anticipated.

2.4 USDA Soil Survey

The United States Department of Agriculture Natural Resources Conservation Service maintains an online surficial geology map of the United States. According to the Web Soil Survey, the stratum directly underlying the project site consists of well drained Berkshire-Tunbridge Complex with depth to bedrock of more than 80 inches, and depth to groundwater of more than 80 inches.

2.5 Geologic Maps of Vermont

Mapping conducted in 1970 for the Surficial Geologic map of Vermont shows that the project area consists of glaciofluvial kame moraine.

According to the 2011 Bedrock Map of Vermont, published by the USGS and State of Vermont, the project site is underlain with Magnetite Biotite and Feldspathic Quartzite.

3.0 BRIDGE INSPECTION

An inspection of the culvert was done in November of 2014 by the Bridge Inspection unit. This inspection recommended a concrete invert replacement due to the extensive section loss and perforations of the culvert.

4.0 FIELD OBSERVATIONS

A preliminary site visit was conducted on October 16, 2015 to determine possible obstructions inhibiting boring operations and to make any other pertinent observations about the project. This visit revealed a large water pipe in close proximity to the outlet of the culvert, as seen in Figure 2. Overhead power lines cross Route 100 above the culvert and run over the inlet of the culvert, west of Route 100. The utility lines can be seen in Figure 3. The embankment slopes above the inlet and outlet of the culvert are steep, and this coupled with limited access for drill rigs could make boring operations at the inlet and outlet locations difficult.

Figure 2: Water pipe Northeast of the Culvert Outlet

Figure 3: Utility Lines above Culvert Inlet

Exposed bedrock was observed at the outlet of the culvert as seen in Figure 4 and denoted with the red arrows. The river bed contained cobbles and small to medium boulders, as seen in Figure 5.

Figure 4: Exposed Bedrock in Stream

Figure 5: Boulders Upstream of the Culvert

5.0 RECOMMENDATIONS

Based on this information, possible foundation options for a bridge replacement include the following:

- Precast or steel arch bridge with spread footings founded on rock or soil
- Reinforced concrete box culvert with new headwalls and wingwalls

We recommend a minimum of two borings be taken with one located at the inlet and one located at the outlet in order to more fully assess the subsurface conditions at the site including, but not limited to, the soil properties, groundwater conditions, and depth to bedrock (if applicable). If access to the inlet or outlet is restricted due to the slopes at the site, borings can be taken in the roadway. If shallow bedrock is encountered during drilling operations, additional borings will likely be required to profile the bedrock elevation across the footprint of the proposed structure.

6.0 CONCLUSION

When an alternative as well as preliminary alignment has been chosen, the Geotechnical Engineering Section can assist in determining a subsurface investigation that efficiently gathers adequate information for the alternative chosen.

If you have any questions or would like to discuss this report, please contact us by phone at (802) 828-2561, or via email at eric.denardo@vermont.gov.

cc: Project File/CEE
END

Appendix G: Natural Resources Memo

VERMONT

State of Vermont
Program Development Division
One National Life Drive
Montpelier, VT 05633-5001
www.aot.state.vt.us

Agency of Transportation

[phone] 802-279-2562
[fax] 802-828-2334
[ttd] 800-253-0191

To: Project File via environmental specialist, cc project manger

From: James Brady, VTrans Environmental Biologist

Date: October 29, 2015
Subject: Plymouth BF 013-3(13) - Natural Resource ID

I have completed my natural resource report for Plymouth BF 013-3(13), culvert 115 on VT Route 100. My evaluation has included wetlands, wildlife habitat, agricultural soils, and rare, threatened and endangered species. A site visit was performed on October 14, 2015 with James Brady and Glenn Gingras present.

Wetlands/Watercourses

This project is located on Reservoir Brook in Plymouth Vermont. Based on data from the ANR Natural Resource Atlas, this structure is considered "Impassable" for aquatic organism passage (AOP). All structures downstream allow at least partial passage to the Ottauquechee River. Designing a structure that allows for AOP is recommended at this site.

There are no wetlands present within the scoping area.

Wildlife Habitat

This culvert is located between two large habitat blocks. The block to the west is 45,489 acres and the block to the east is 8,673 acres. This culvert also falls within the Network of Connected Lands. While the local linkage score for this site is a 3, wildlife connectivity should be considered when designing this project based on its location between the habitat blocks and within the Network of Connected Lands. To the north there is a greater amount of development and to the south are several large reservoirs, all potential barriers to wildlife movement.

Rare, Threatened and Endangered Species

The Vermont Natural Resource Atlas was reviewed for the latest set of T&E species occurrences.

Recently, the Northern Long Eared bat was listed by the US Fish & Wildlife Service as threatened and the Vermont Fish and Wildlife Department as endangered throughout the entire state of Vermont. The Federal Highway Administration (FHWA) and Federal Railroad Administration (FRA) have implemented a Rangewide Programmatic Informal Consultation for Indiana Bat and Northern Long-eared Bat. The guidance indicates that all trees ≥ 3" in diameter, that exhibit: cracks, crevices, holes, and peeling bark are considered suitable habitat roost trees. If tree clearing will be required, a habitat assessment will be needed prior to cutting unless trees can be cleared from November 1st through April 15th.

There are no other mapped rare, threatened or endangered species within the projec

Agricultural Soils:

The soil within this site is mapped as Berkshire-Tunbridge complex which is not a prime or statewide significant soil.

Natural Resources Atlas

Vermont Agency of Natural Resources

vermont.gov

LEGEND

Stream Crossings

- Fully Passable
- Reduced Passage
- Impassable except for Adult Trout
- Impassable
- Bridge/Arch (Fully Passable)

Habitat Blocks

- 10 - Higher Priority
- 9
- 8
- 7
- 6
- 5
- 4
- 3
- 2
- 1 - Lower Priority
- 0

- Waterbody
- Stream
- Town Boundary

NOTES

Map created using ANR's Natural Resources Atlas

80.0 0 40.00 80.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 132 Ft. 1cm = 16 Meters

THIS MAP IS NOT TO BE USED FOR NAVIGATION

Natural Resources Atlas

Vermont Agency of Natural Resources

vermont.gov

LEGEND

Stream Crossings

- Fully Passable
- Reduced Passage
- Impassable except for Adult Trout
- Impassable
- Bridge/Arch (Fully Passable)

Habitat Blocks

- 10 - Higher Priority
- 9
- 8
- 7
- 6
- 5
- 4
- 3
- 2
- 1 - Lower Priority
- 0

- Waterbody
- Stream
- Town Boundary

NOTES

Map created using ANR's Natural Resources Atlas

1,284.0 0 642.00 1,284.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 2106 Ft. 1cm = 253 Meters

THIS MAP IS NOT TO BE USED FOR NAVIGATION

Appendix H: Historic Memo

Kyle Obenauer
Historic Preservation Specialist

Vermont Agency of Transportation

kyle.obenauer@vermont.gov
802.828.3962
www.vtrans.vermont.gov

Project Delivery Bureau - Environmental Section
One National Life Drive
Montpelier, VT 05633-5001

Historic Preservation Resource Identification Memo

To: James Brady, Environmental Specialist
Via: Judith Ehrlich, VTrans Historic Preservation Officer
Cc: Brennan Gauthier, VTrans Archaeologist
Karen Spooner, Administrative Assistant
Date: December 02, 2015

Subject: Plymouth BF 013-3(13) Resource Identification

I have completed a Resource Identification (ID) for Plymouth BF 013-3(13). Constructed in 1971, Bridge (Culvert) 115 is a metal culvert with reinforced concrete wing and headwalls located south of the Bridgewater-Plymouth town line on VT Route 100 in Plymouth, Windsor County, Vermont.

VTrans has determined Bridge 115 appears ineligible for inclusion in the National Register of Historic Places (NRHP). The replacement of this culvert will not affect historic resources; this culvert is not historically or architecturally significant.

Please, contact me with any questions. Additional background information and documentation can be provided upon request.

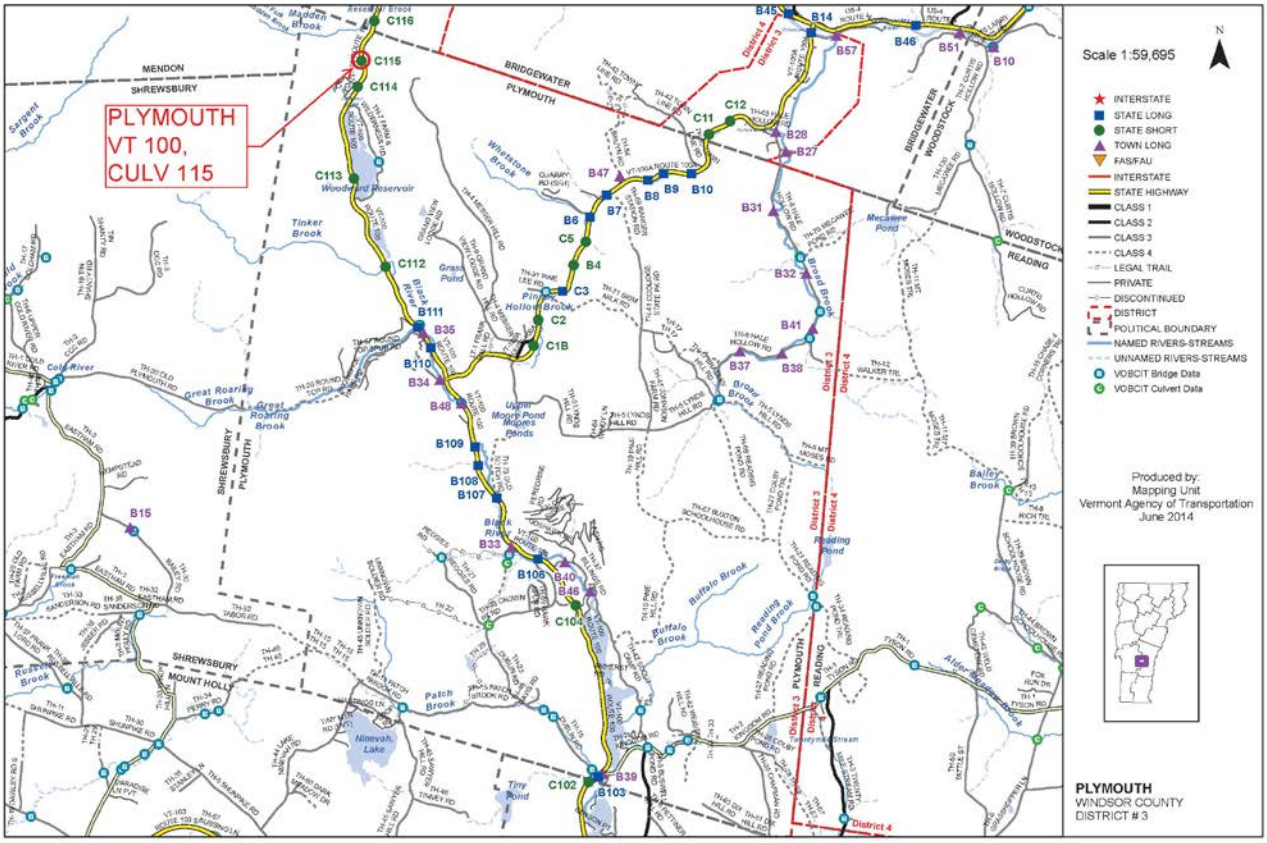


Figure 1. Map showing project APE.

Figure 2. Bridge (Culvert) 115 at right with reinforced concrete head and wing-walls.

Appendix I: Local Input

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.

   100 on 100 Relay Race usually mid- August - http://www.100on100.org/event.html
   Bike Tours - mostly from June through August
   Motorcycle Tours – mostly mid summer
   Gifford Last Mile Ride 2016 (motorcycle route possible impact) - August 19-20 , 2016
   https://www.giffordmed.org/LastMileRide
   100/200 RIDE VERMONT IN A DAY! - http://100-200.org/ - Probably mid-June
   Green Mountain Bike Club - http://www.thegmbc.com/ - View schedule for Rte 100?

   Farm and Wilderness schedules events and can have considerable traffic.

   - *In Mid- June we have approximately 200 staff arrive and many commute to offsite training locations.*
   - *The day camp opens on June 29 and we'll have an additional 40 cars twice a day.*
   - *Opening day for the overnight camps is on July 1st and we'll expect approximately 250 vehicles to visit the campus.*
   - *We have several visiting days and session pickup and drop offs throughout the summer mostly at the end of July.*
   - *Our fair is on August 13th and we expect to have over 500 cars park at the "notch resort" and they'll be bussed to F&W for the day.*
   - *The camps close on August 14th, and all parents arrive to pickup campers, expect 250 vehicles.*
   - *We run retreat programs and events in the shoulder season. Traffic varies from 50 – 200 cars to these until mid-october.*

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

   May to mid June and September 1st to mid December

   Farm and Wilderness - By November first it is mostly year-round employees commuting to the campus until the beginning of May.

3. Please describe the location of emergency responders (fire, police, ambulance) and emergency response routes. The Town Hall and emergency responders come from 68 Town Office Road on Route 100.

For F&W: "If an ambulance were called (not just first responders), they would come from Woodstock or Rutland (so up route 100 from the north end) and even possibly Ludlow."

Please see attached map.

4. Are there businesses (including agricultural operations) that would be adversely impacted either by a detour or due to work zone proximity? Markowski rock quarry just south of bridge.
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? No
6. What other municipal operations could be adversely affected by a road/bridge closure or detour?
7. Are there any town highways that might be adversely impacted by traffic bypassing the construction on another local road? VT Rte 100A would be adversely impacted.
8. Is there a local business association, chamber of commerce or other downtown group that we should be working with?

Schools

1. Where are the schools in your community and what are their schedules? Plymouth students are bused to Woodstock and Ludlow – (Killington?). The school bus uses Rte 100A.
2. Is this project on the specific routes that students use to walk to and from school? No
3. Are there recreational fields associated with the schools (other than at the school)? No

Pedestrians and Bicyclists

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

   The route 100 – 100A loop from West Bridgewater – Bridgewater – Plymouth is very popular``
2. Are the current lane and shoulder widths adequate for pedestrian and bicycle use? No, however Rte 100 is still very popular through the summer and autumn months
3. Does the community feel there is a need for a sidewalk on the bridge? No

4. Is pedestrian and bicycle traffic heavy enough that it should be accommodated during construction? Probably signs should be place at intersection of rte 100/rte 4 and 100/100A for bicycles to use 100A and Rte 4 as an alternative to rte 100. Bicycle traffic is very high.

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). No

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? No

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.

   Plymouth Town Listserv
   Front Porch Forum
   Vermont Standard
   Mountain Times
   Plymouth Town Office
   Plymouth 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? No

2. Are there any concerns with the width of the existing bridge? Maybe should be wider for bicycles.

3. Are there any special aesthetic considerations we should be aware of? No

4. Does the location have a history of flooding? If yes, please explain. No

5. Are there any known Hazardous Material Sites near the project site? No

6. Are there any known historic, archeological and/or other environmental resource issues near the project site? No

7. Are there any other comments that are important for us to consider? Design the new bridge so it can be constructed in the shortest feasible time. Avoid the need to construct between June 1st and August 15.

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. Please see attached map.

2. Is there any existing, pending or planned development proposal that would impact future transportation patterns near the bridge? If so please explain. No.

3. Is there any planned expansion of public transit service in the project area? If not known please contact your Regional Public Transit Provider. No transit on this route section.

Appendix J: Traffic

AGENCY OF TRANSPORTATION **OFFICE MEMORANDUM**

HIGHWAY DIVISION- TRAFFIC RESEARCH

TO: Jennifer Fitch, Structures Project Manager

FROM: Maureen Carr, Traffic Analysis Engineer MC
Colin Philbrook, Traffic Analysis Technician CCP

DATE: December 10, 2015

RE: Plymouth BF 013-3(13)
VT 100, BR #115

Per your request on September 24, 2015, please find complete estimated traffic data on the above project in the town of Plymouth. The data for the years 2018, 2038 and 2058 is included in the table below.

If you have any questions, or if further information is needed, please call at 522-4089.

TRAFFIC DATA	2018	2038	2058
AADT	920	940	~
DHV	130	130	~
ADTT	65	110	~
%T	7.4	11.7	~
%D	51	51	~
FLEXIBLE ESAL	~	2018 ~ 2038 406,000	2018 ~ 2058 916,000

CC: Data Analysis Files

Vermont Agency of Transportation

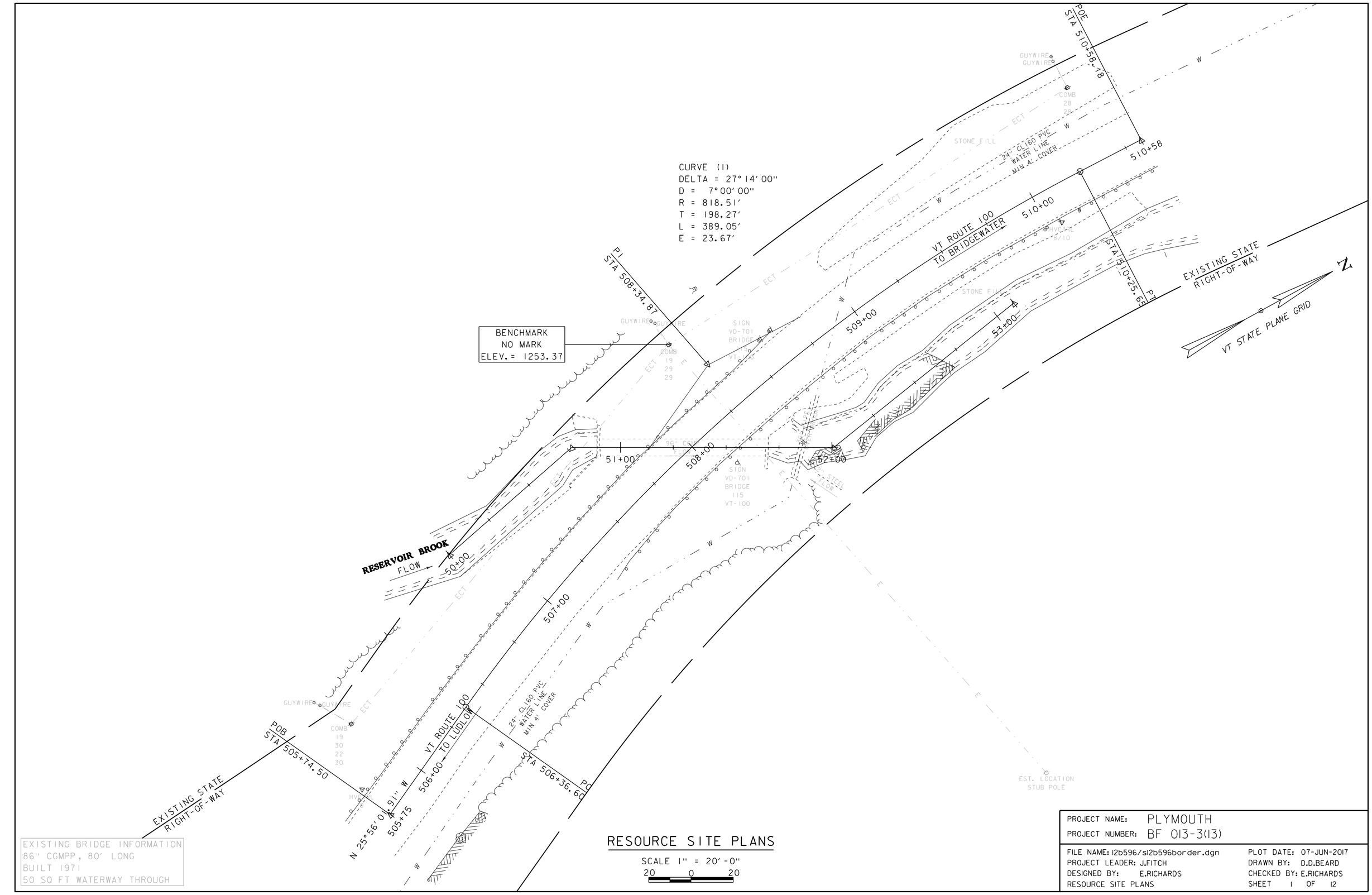
General Yearly Summaries - Crash Listing: State Highways and All Federal Aid Highway Systems

From 01/01/10 To 12/31/14 General Yearly Summaries Information

*	Reporting Agency/ Number	Town	Mile Marker	Date MM/DD/YY	Time	Weather	Contributing Circumstances	Direction Of Collision	Number Of Injuries	Number Of Fatalities	Number Of Untimely Deaths	Direction	Road Group
Route: VT-100 Continued ...													
	VT0140100/13-LL-00317	Ludlow	UNK	04/08/2013	02:25	Cloudy	Distracted	Single Vehicle Crash	1	0	0	N	SH
	VTVSP1100/13D305358	Plymouth	0.34	12/14/2013	08:30				0	0	0		SH
	VTVSP1100/14D304316	Plymouth	0.62	10/31/2014	07:13	Clear	Under the influence of medication/drugs/alcohol	Single Vehicle Crash	0	0	0	S	SH
	VT0140000/14WNC0165	Plymouth	3.73	07/30/2014	10:30	Clear		Single Vehicle Crash	0	0	0	S	SH
	VTVSP1100/13D300472	Plymouth	5.06	02/02/2013	12:31				0	0	0		SH
	VTVSP1100/13D301376	Plymouth	5.3	04/11/2013	12:14				0	0	0		SH
	VTVSP1100/13D304468	Plymouth	6.05	10/13/2013	02:20	Clear	Failure to keep in proper lane, Swerving or avoiding due to wind, slippery surface, vehicle, object, non-motorist in roadway etc	Single Vehicle Crash	0	0	0	S	SH
	VTVSP1100/10D300332	Plymouth	7.4	01/30/2010	07:21	Blowing Sand, Soil, Dirt, Snow	Driving too fast for conditions	Single Vehicle Crash	0	0	0	S	SH
	VT0140000/10WNC0038	Plymouth	7.48	04/02/2010	12:50	Cloudy		Single Vehicle Crash	0	0	0		SH
	VT0140000/14WNC0251	Plymouth	7.82	12/06/2014	07:55	Sleet, Hail (Freezing Rain or Drizzle)	Driving too fast for conditions	Single Vehicle Crash	0	0	0	N	SH
	VT0140000/13WNC0014	Plymouth	8.51	02/01/2013	17:11	Cloudy	Unknown	Single Vehicle Crash	0	0	0	S	SH
	VTVSP1100/12D301009	Plymouth	8.56	03/08/2012	15:56	Rain	Failure to keep in proper lane, Under the influence of medication/drugs/alcohol	Single Vehicle Crash	1	0	0		SH
	VTVSP1100/14D300681	Plymouth	9.18	02/18/2014	17:18				0	0	0		SH
	VT0140000/11WNC0162	Plymouth	UNK	12/29/2011	11:40	Clear	Driving too fast for conditions	Single Vehicle Crash	1	0	0	S	SH
	VTVSP1100/13D304866	Plymouth	UNK	11/10/2013	03:00	Snow	Driving too fast for conditions	Single Vehicle Crash	0	0	0	N	SH
	VTVSP1100/14D300586	Plymouth	UNK	02/13/2014	08:00				0	0	0		SH
	VT0140000/14WNC0209	Plymouth	UNK	10/03/2014	16:45	Clear	Unknown	Single Vehicle Crash	1	0	0		SH
	VT0140000/13WNC0174	Bridgewater	0.12	12/29/2013	17:14	Snow		Head On	1	0	0	N	SH
	VT0140000/14WNC0013	Bridgewater	0.43	01/11/2014	19:20	Sleet, Hail (Freezing Rain or Drizzle)	No improper driving	Single Vehicle Crash	0	0	0	S	SH
	VTVSP1100/14D301557	Bridgewater	0.69	04/24/2014	22:21				0	0	0		SH
	VTKILL006/14KP000181	Killington	0.1	03/21/2014	00:59	Snow	Failure to keep in proper lane, Driving too fast for conditions	Single Vehicle Crash	0	0	0		SH
	VTKILL006/14KP000229	Killington	0.75	04/16/2014	09:56	Clear	Exceeded authorized speed limit	Single Vehicle Crash	0	0	0	S	SH
	VTVSP0300/13C107027	Killington	0.78	12/17/2013	12:51	Snow	Failure to keep in proper lane, Driving too fast for conditions	Single Vehicle Crash	0	0	0	N	SH
	VTVSP0300/13C106922	Killington	0.85	12/13/2013	07:36	Snow	Driving too fast for conditions, Failure to keep in proper lane, No improper driving	Opp Direction Sideswipe	0	0	0	N	SH
	VTVSP0300/14C101421	Killington	0.86	03/11/2014	03:25				0	0	0		SH
	VTVSP0300/10C10573	Killington	0.87	11/19/2010	11:15	Cloudy	Failure to keep in proper lane	Single Vehicle Crash	0	0	0	N	SH
	VTVSP0300/13C103875	Killington	0.9	07/09/2013	09:03	Clear	Failure to keep in proper lane, Fatigued, asleep	Single Vehicle Crash	0	0	0	S	SH
	VTVSP0300/14C13905	Killington	1.05	07/19/2014	08:50	Cloudy	Failure to keep in proper lane, Under the influence of medication/drugs/alcohol	Single Vehicle Crash	1	0	0	S	SH

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

Appendix K: Plans

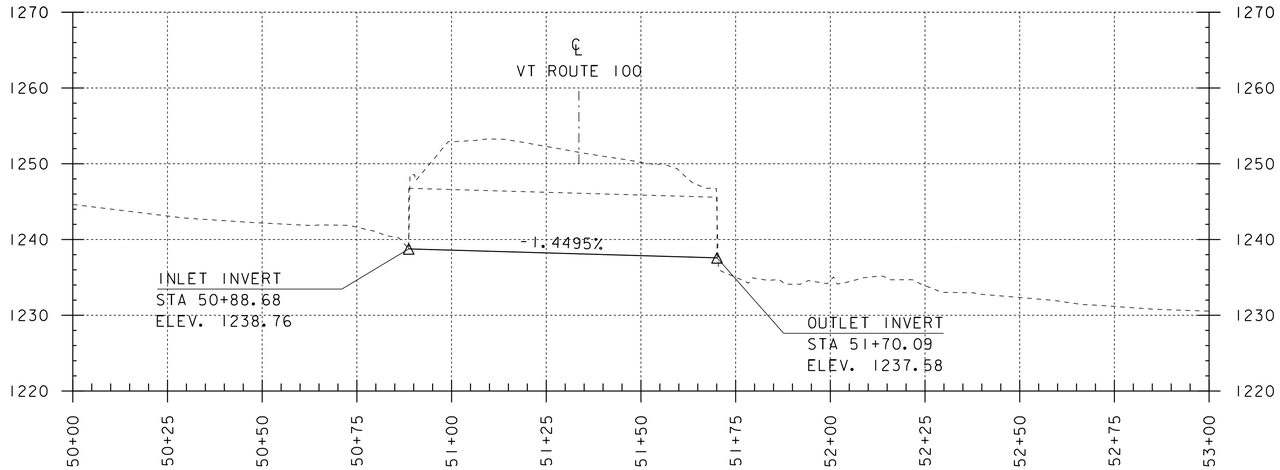


RESOURCE SITE PLANS

SCALE 1" = 20'-0"

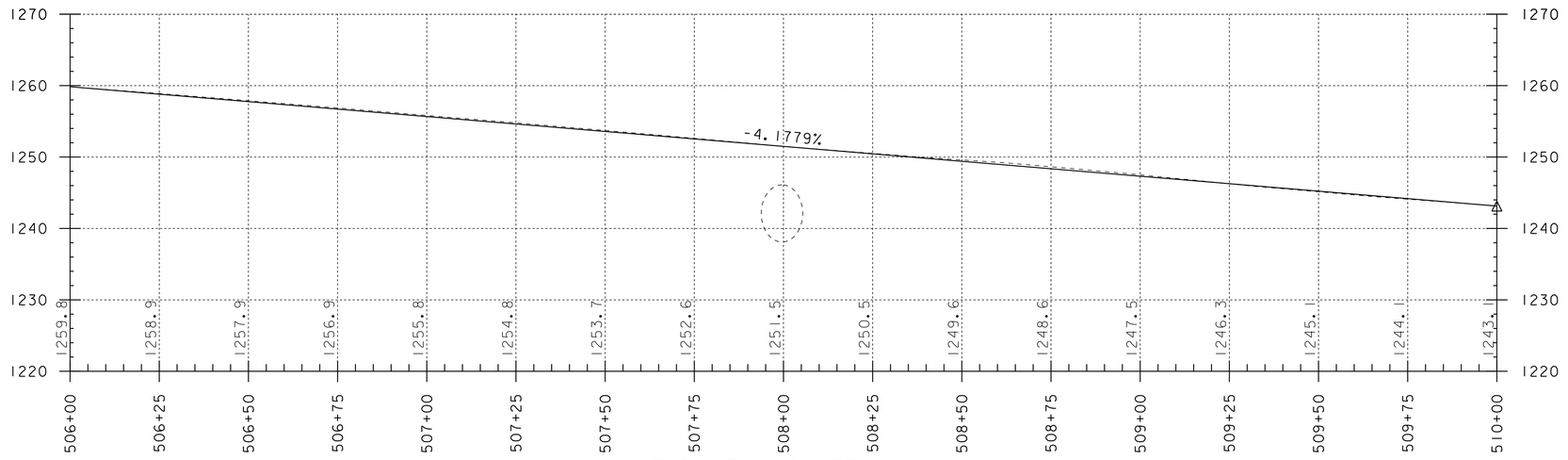
20 0 20

PROJECT NAME:	PLYMOUTH
PROJECT NUMBER:	BF 013-3(13)
FILE NAME:	I2b596/sI2b596border.dgn
PROJECT LEADER:	J.FITCH
DESIGNED BY:	E.RICHARDS
RESOURCE SITE PLANS	
PLOT DATE:	07-JUN-2017
DRAWN BY:	D.D.BEARD
CHECKED BY:	E.RICHARDS
SHEET	1 OF 12



CULVERT 115 PROFILE

SCALE: HORIZONTAL 1"=20'-0"
VERTICAL 1"=10'-0"



VT ROUTE 100 PROFILE

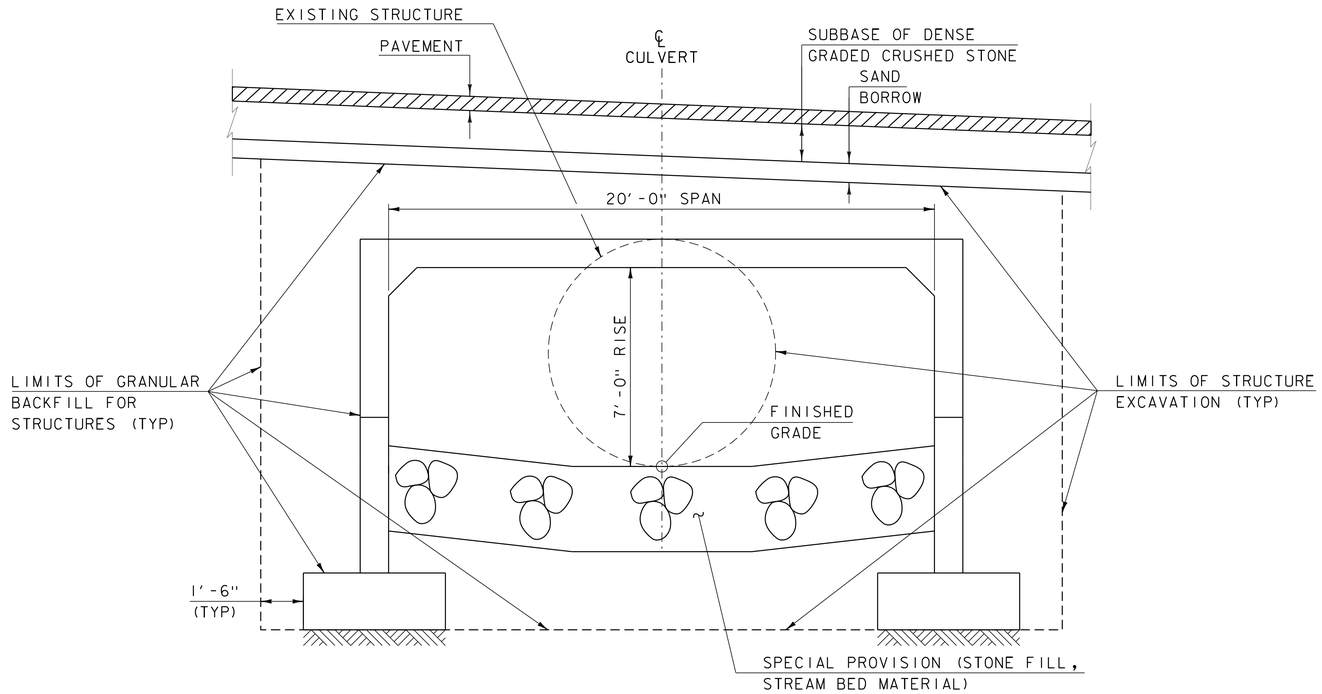
SCALE: HORIZONTAL 1"=20'-0"
VERTICAL 1"=10'-0"

NOTE:
GRADES SHOWN TO THE NEAREST TENTH ARE EXISTING GROUND ALONG ℄
GRADES SHOWN TO THE NEAREST HUNDREDTH ARE FINISH GRADE ALONG ℄

PROJECT NAME: PLYMOUTH
PROJECT NUMBER: BF 013-3(13)

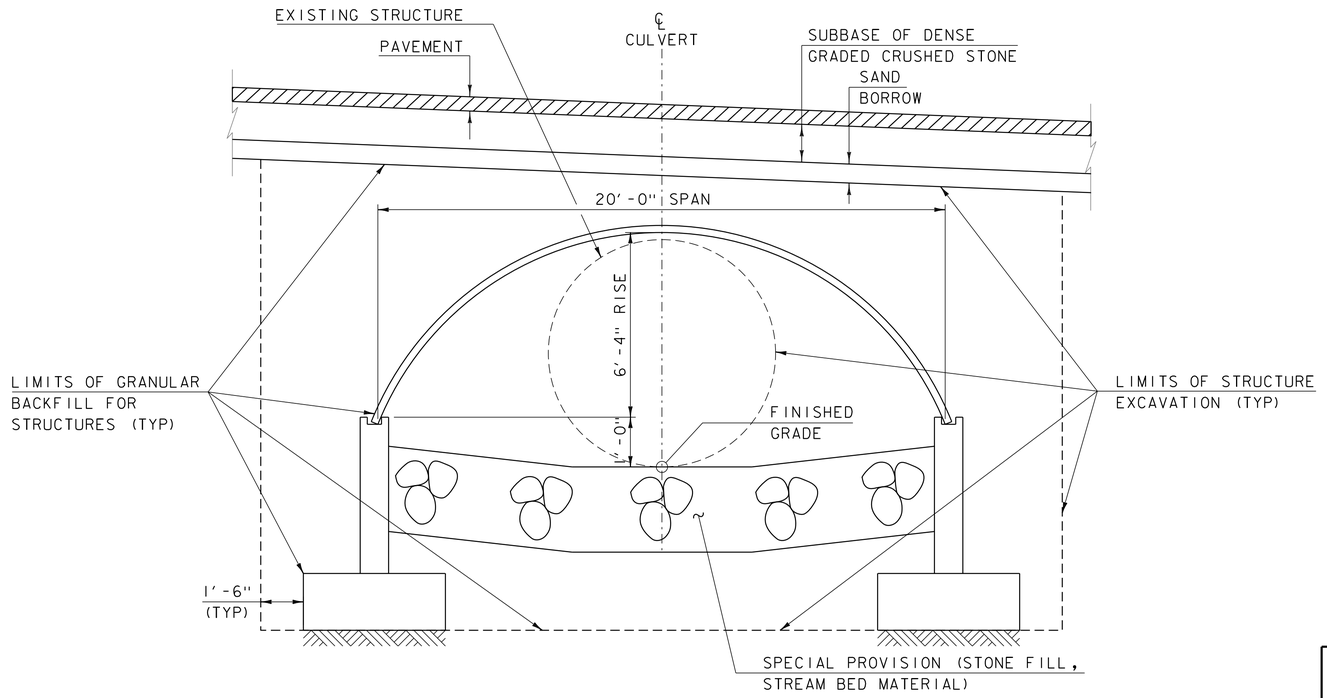
FILE NAME: 12b596/sl2b596profile.dgn
PROJECT LEADER: J.FITCH
DESIGNED BY: E.RICHARDS
EXISTING PROFILE SHEET

PLOT DATE: 07-JUN-2017
DRAWN BY: D.D.BEARD
CHECKED BY: E.RICHARDS
SHEET 2 OF 12



ALTERNATIVE #1 TYPICAL SECTION

NOT TO SCALE



ALTERNATIVE #2 TYPICAL SECTION

NOT TO SCALE

MATERIAL TOLERANCES

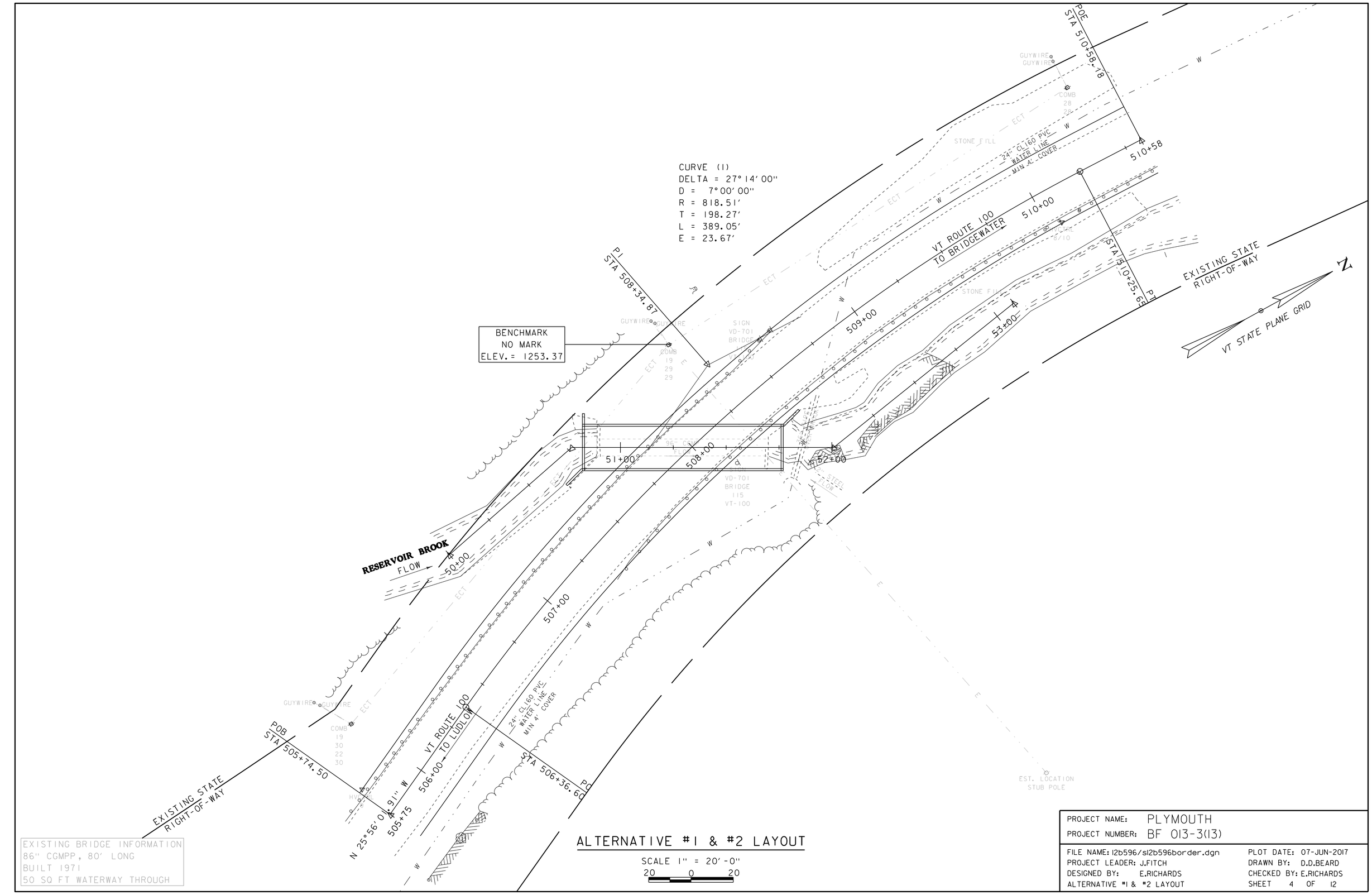
(IF USED ON PROJECT)

SURFACE	
- PAVEMENT (TOTAL THICKNESS)	+/- 1/4"
- AGGREGATE SURFACE COURSE	+/- 1/2"
SUBBASE	+/- 1"
SAND BORROW	+/- 1"

PROJECT NAME: PLYMOUTH
PROJECT NUMBER: BF 013-3(13)

FILE NAME: 12b596\s12b596typical.dgn
PROJECT LEADER: J.FITCH
DESIGNED BY: E.RICHARDS
TYPICAL SECTIONS

PLOT DATE: 07-JUN-2017
DRAWN BY: D.D.BEARD
CHECKED BY: E.RICHARDS
SHEET 3 OF 12

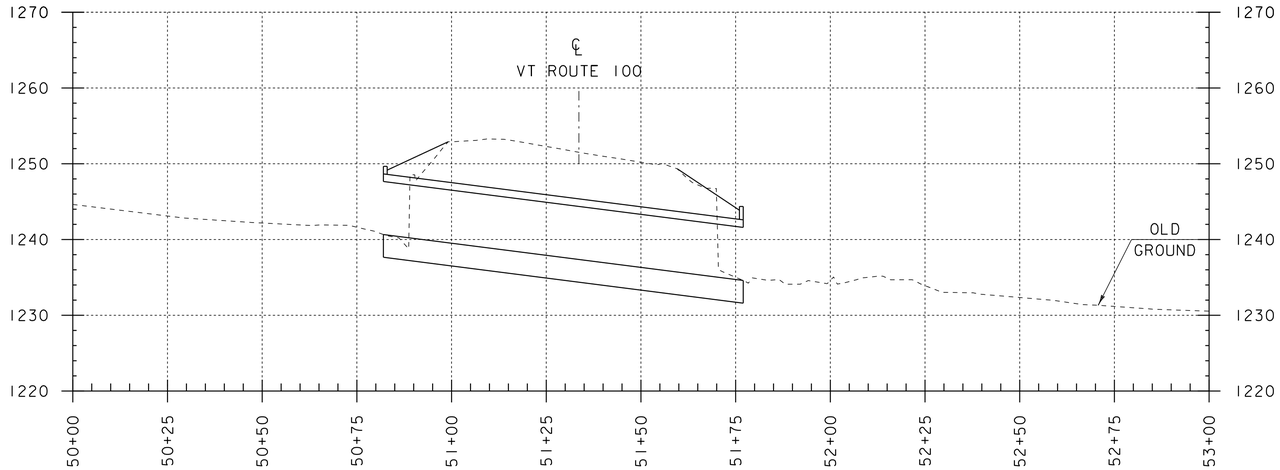


EXISTING BRIDGE INFORMATION
86" CGMPP, 80' LONG
BUILT 1971
50 SQ FT WATERWAY THROUGH

ALTERNATIVE #1 & #2 LAYOUT

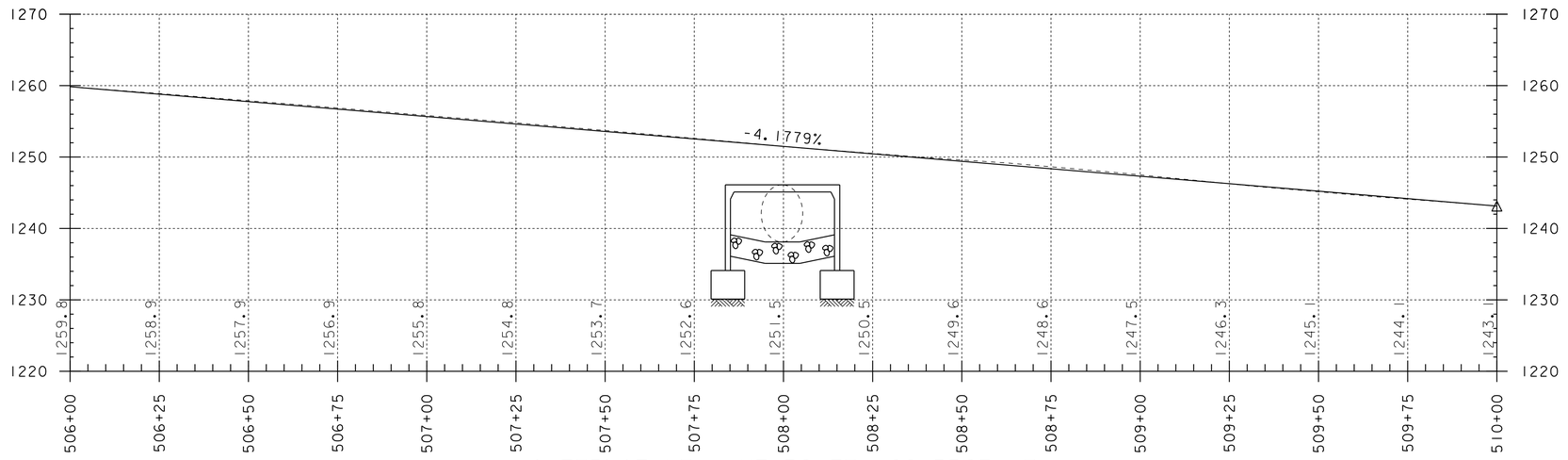
SCALE 1" = 20'-0"
20 0 20

PROJECT NAME:	PLYMOUTH
PROJECT NUMBER:	BF 013-3(13)
FILE NAME:	12b596/sl2b596border.dgn
PROJECT LEADER:	J.FITCH
DESIGNED BY:	E.RICHARDS
ALTERNATIVE #1 & #2 LAYOUT	
PLOT DATE:	07-JUN-2017
DRAWN BY:	D.D.BEARD
CHECKED BY:	E.RICHARDS
SHEET	4 OF 12



CULVERT 115 PROFILE

SCALE: HORIZONTAL 1"=20'-0"
VERTICAL 1"=10'-0"



ALTERNATIVE 1 VT ROUTE 100 PROFILE

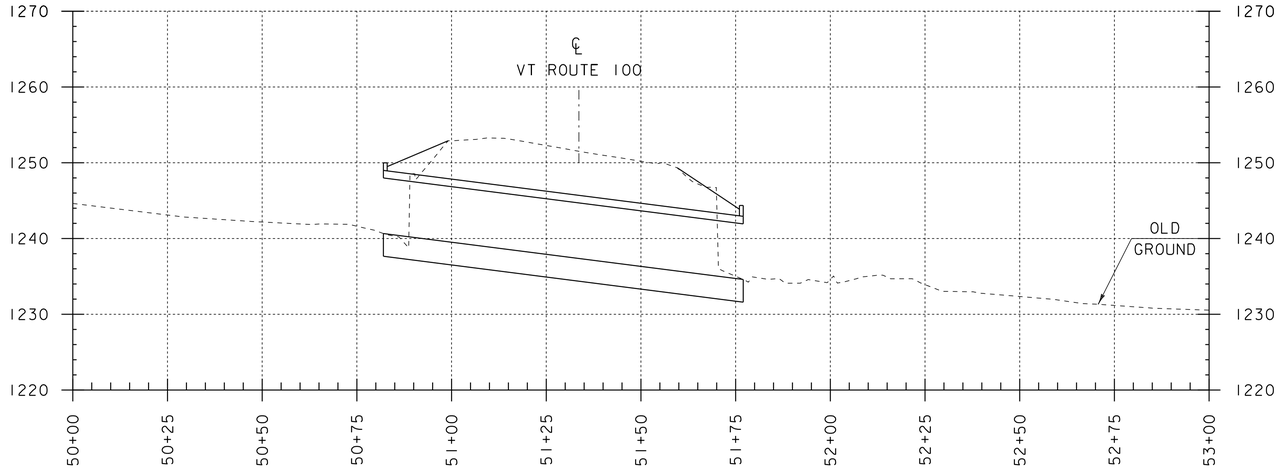
SCALE: HORIZONTAL 1"=20'-0"
VERTICAL 1"=10'-0"

NOTE:
GRADES SHOWN TO THE NEAREST TENTH ARE EXISTING GROUND ALONG ℄
GRADES SHOWN TO THE NEAREST HUNDREDTH ARE FINISH GRADE ALONG ℄

PROJECT NAME: PLYMOUTH
PROJECT NUMBER: BF 013-3(13)

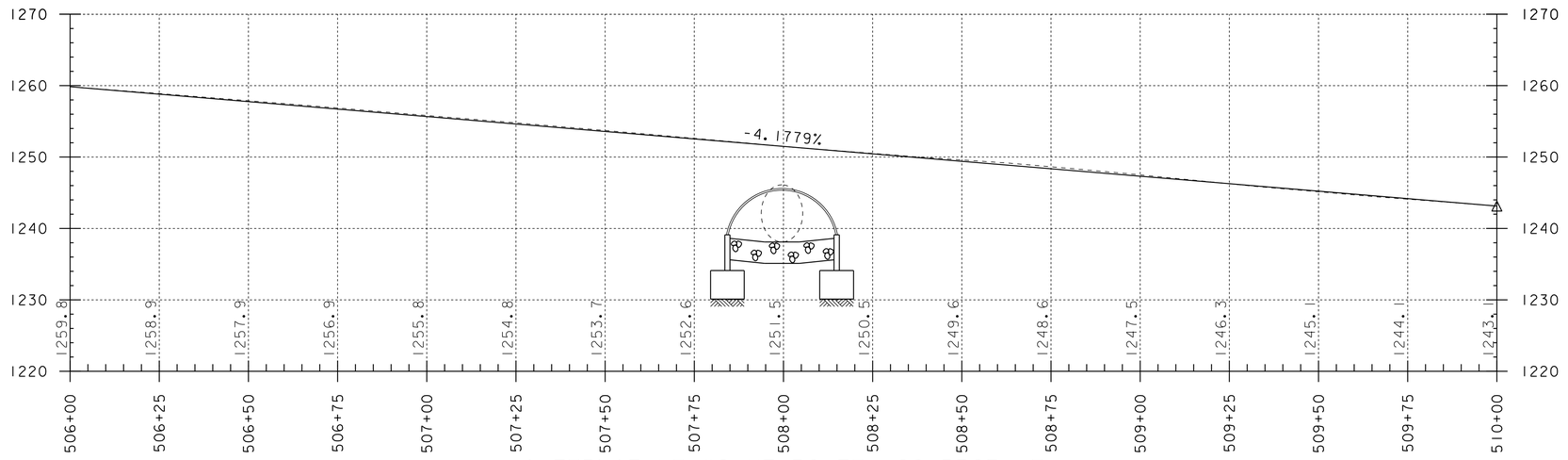
FILE NAME: 12b596/sl2b596profile.dgn
PROJECT LEADER: J.FITCH
DESIGNED BY: E.RICHARDS
ALTERNATIVE #1 PROFILE SHEET

PLOT DATE: 07-JUN-2017
DRAWN BY: D.D.BEARD
CHECKED BY: E.RICHARDS
SHEET 5 OF 12



CULVERT 115 PROFILE

SCALE: HORIZONTAL 1"=20'-0"
VERTICAL 1"=10'-0"



ALTERNATIVE #2 VT ROUTE 100 PROFILE

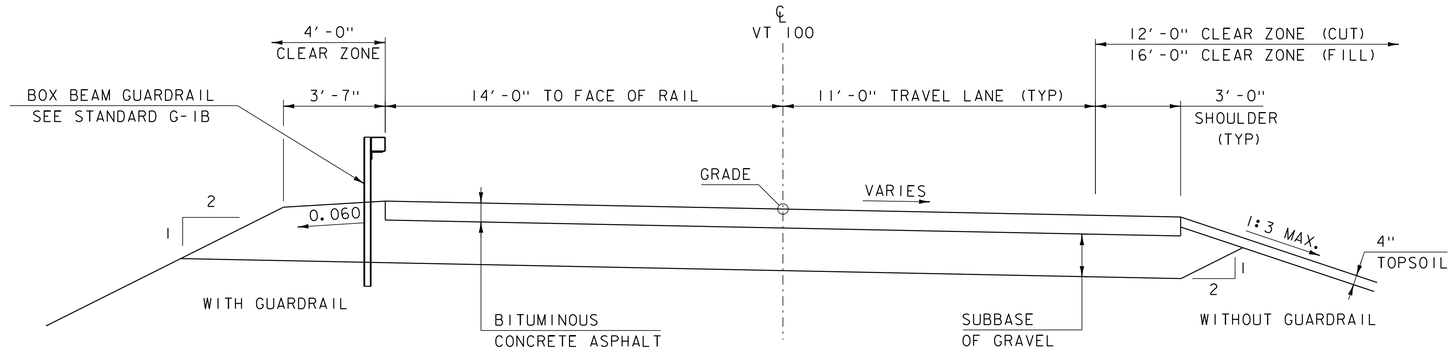
SCALE: HORIZONTAL 1"=20'-0"
VERTICAL 1"=10'-0"

NOTE:
GRADES SHOWN TO THE NEAREST TENTH ARE EXISTING GROUND ALONG ℄
GRADES SHOWN TO THE NEAREST HUNDREDTH ARE FINISH GRADE ALONG ℄

PROJECT NAME: PLYMOUTH
PROJECT NUMBER: BF 013-3(13)

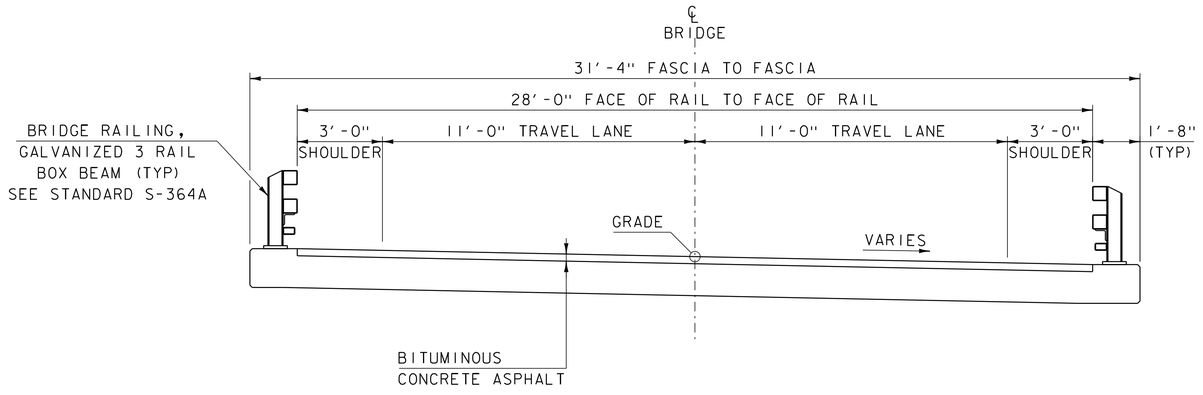
FILE NAME: 12b596/sl2b596profile.dgn
PROJECT LEADER: J.FITCH
DESIGNED BY: E.RICHARDS
ALTERNATIVE #2 PROFILE SHEET

PLOT DATE: 07-JUN-2017
DRAWN BY: D.D.BEARD
CHECKED BY: E.RICHARDS
SHEET 6 OF 12



PROPOSED VT 100 TYPICAL SECTION

SCALE 3/8" = 1'-0"



FLOW

ALTERNATIVE #3 & #4 TYPICAL SECTION

SCALE 3/8" = 1'-0"

SUPERSTRUCTURE TO BE DESIGNED LATER

MATERIAL TOLERANCES

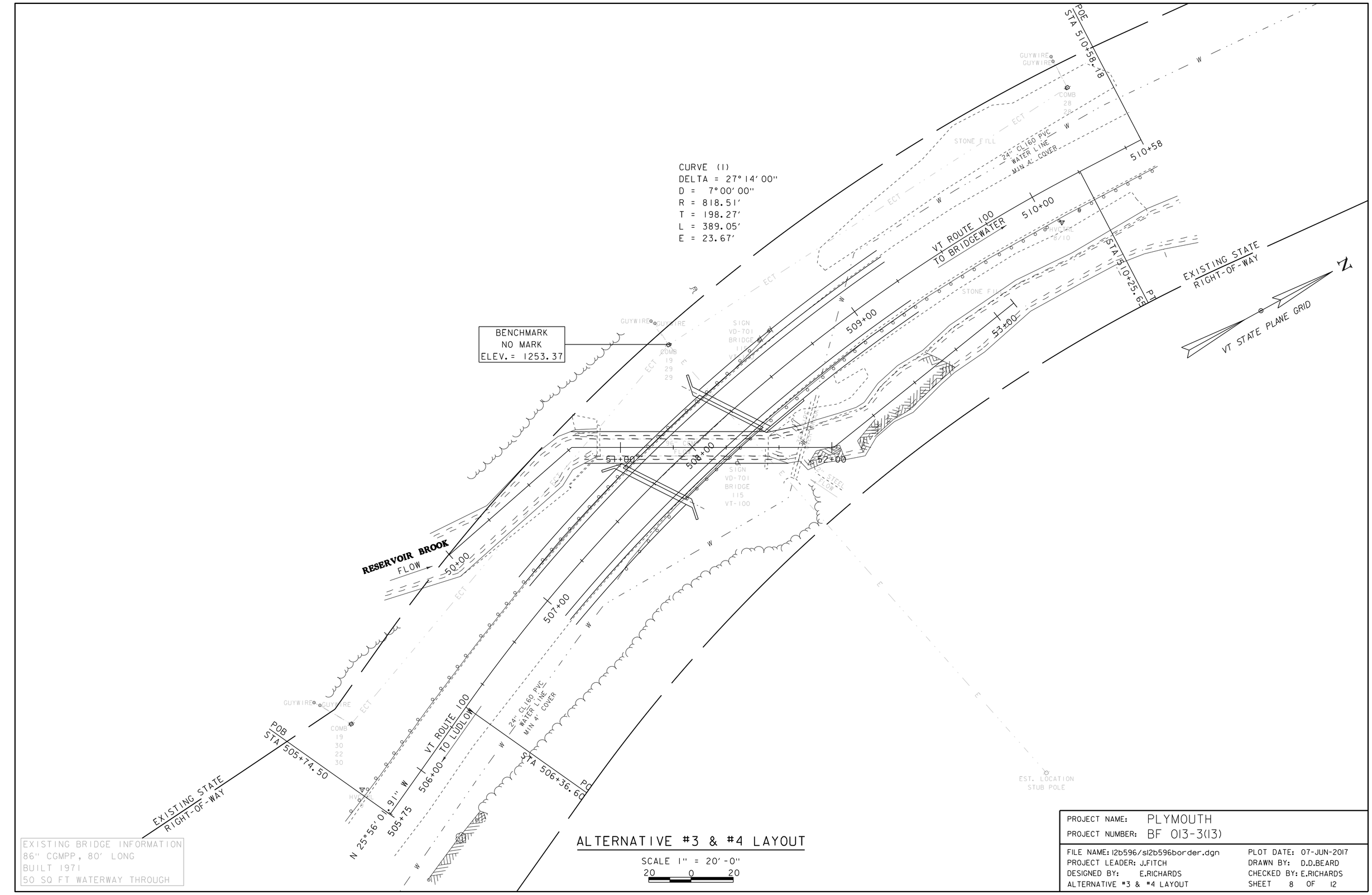
(IF USED ON PROJECT)

SURFACE	
- PAVEMENT (TOTAL THICKNESS)	+/- 1/4"
- AGGREGATE SURFACE COURSE	+/- 1/2"
SUBBASE	+/- 1"
SAND BORROW	+/- 1"

PROJECT NAME: PLYMOUTH
PROJECT NUMBER: BF 013-3(13)

FILE NAME: 12b596\s12b596typical.dgn
PROJECT LEADER: J.FITCH
DESIGNED BY: E.RICHARDS
TYPICAL SECTIONS

PLOT DATE: 07-JUN-2017
DRAWN BY: D.D.BEARD
CHECKED BY: E.RICHARDS
SHEET 7 OF 12

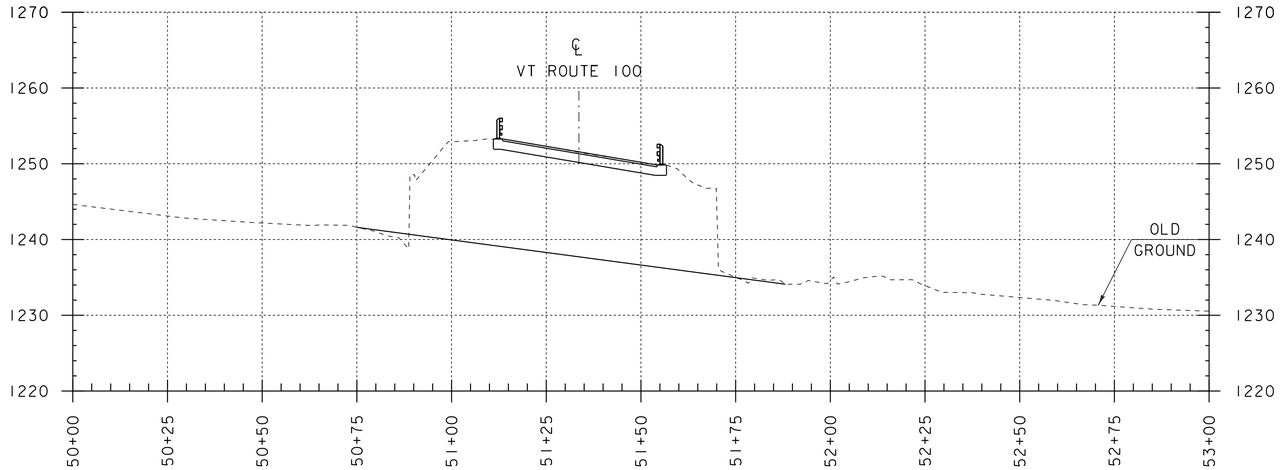


ALTERNATIVE #3 & #4 LAYOUT

SCALE 1" = 20'-0"

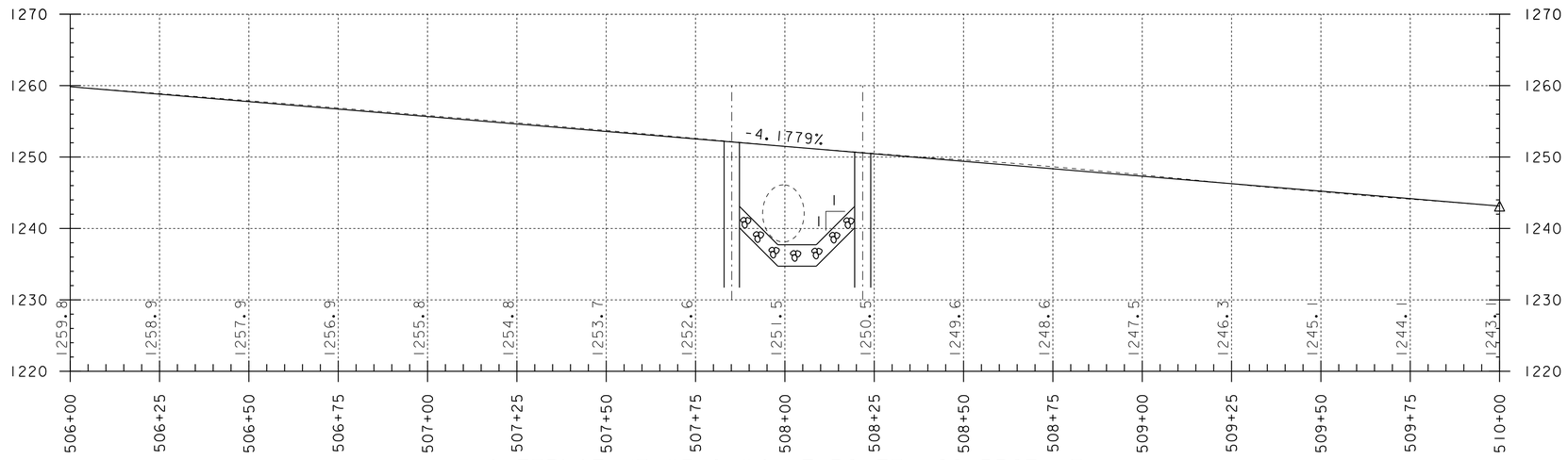
20 0 20

PROJECT NAME:	PLYMOUTH
PROJECT NUMBER:	BF 013-3(13)
FILE NAME:	I2b596/sI2b596border.dgn
PROJECT LEADER:	J.FITCH
DESIGNED BY:	E.RICHARDS
ALTERNATIVE #3 & #4 LAYOUT	
PLOT DATE:	07-JUN-2017
DRAWN BY:	D.D.BEARD
CHECKED BY:	E.RICHARDS
SHEET	8 OF 12



CULVERT 115 PROFILE

SCALE: HORIZONTAL 1"=20'-0"
VERTICAL 1"=10'-0"



ALTERNATIVE #3 & #4 VT ROUTE 100 PROFILE

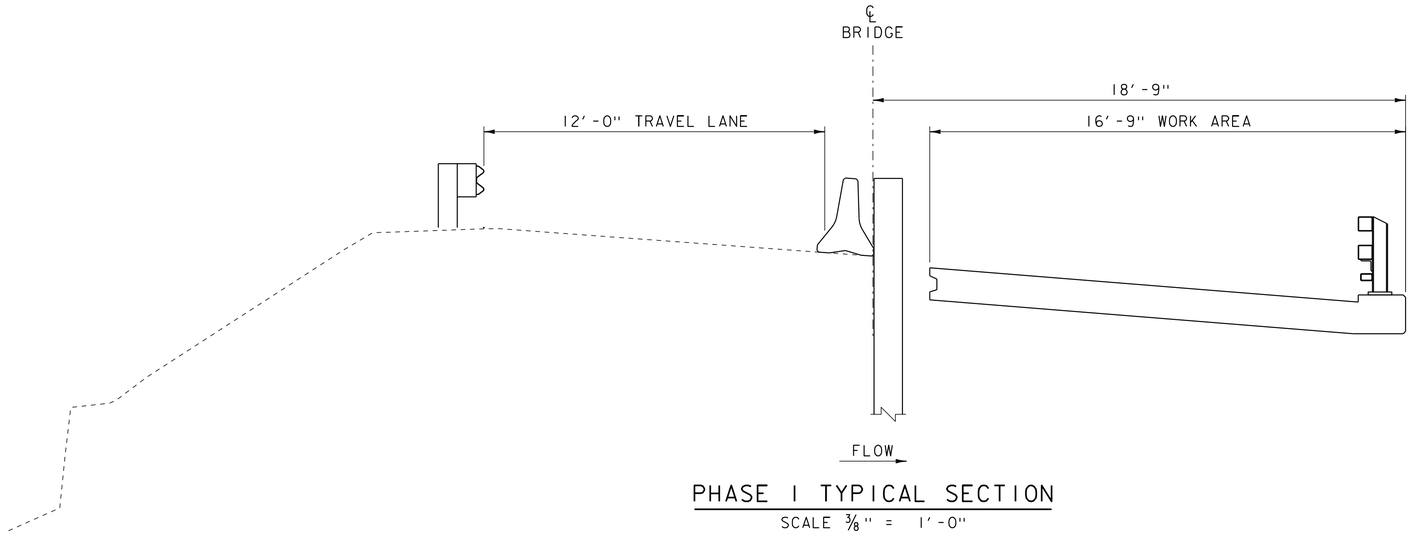
SCALE: HORIZONTAL 1"=20'-0"
VERTICAL 1"=10'-0"
SUPERSTRUCTURE AND SUBSTRUCTURE
TO BE DESIGNED LATER

NOTE:
GRADES SHOWN TO THE NEAREST
TENTH ARE EXISTING GROUND ALONG ℄
GRADES SHOWN TO THE NEAREST
HUNDREDTH ARE FINISH GRADE ALONG ℄

PROJECT NAME: PLYMOUTH
PROJECT NUMBER: BF 013-3(13)

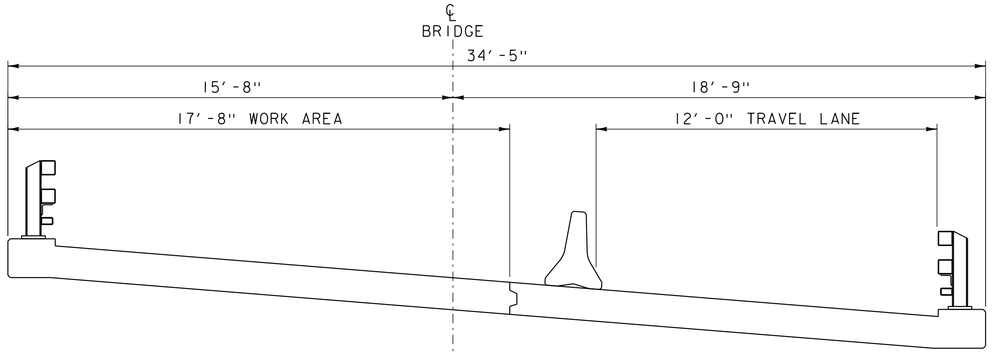
FILE NAME: 12b596/sl2b596profile.dgn
PROJECT LEADER: J.FITCH
DESIGNED BY: E.RICHARDS
ALTERNATIVE #3 & #4 PROFILE SHEET

PLOT DATE: 07-JUN-2017
DRAWN BY: D.D.BEARD
CHECKED BY: E.RICHARDS
SHEET 9 OF 12



PHASE 1 TYPICAL SECTION

SCALE 3/8″ = 1′-0″

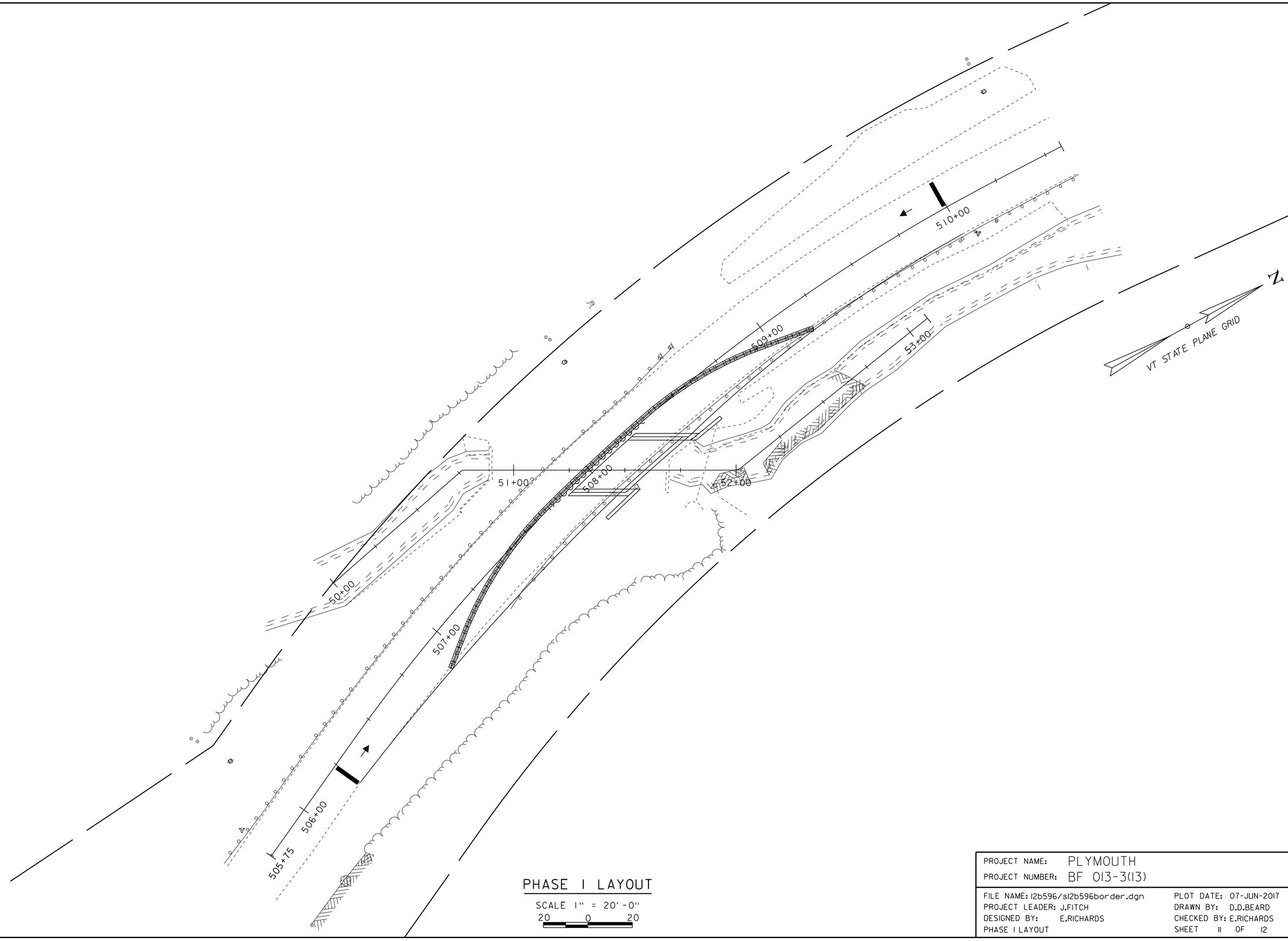


FLOW

PHASE 2 TYPICAL SECTION

SCALE 3/8″ = 1′-0″

PROJECT NAME:	PLYMOUTH
PROJECT NUMBER:	BF 013-3(13)
FILE NAME: 12b596\s12b596phasing.dgn	PLOT DATE: 07-JUN-2017
PROJECT LEADER: J.FITCH	DRAWN BY: D.D.BEARD
DESIGNED BY: E.RICHARDS	CHECKED BY: E.RICHARDS
BRIDGE PHASING TYPICAL SECTIONS	SHEET 10 OF 12



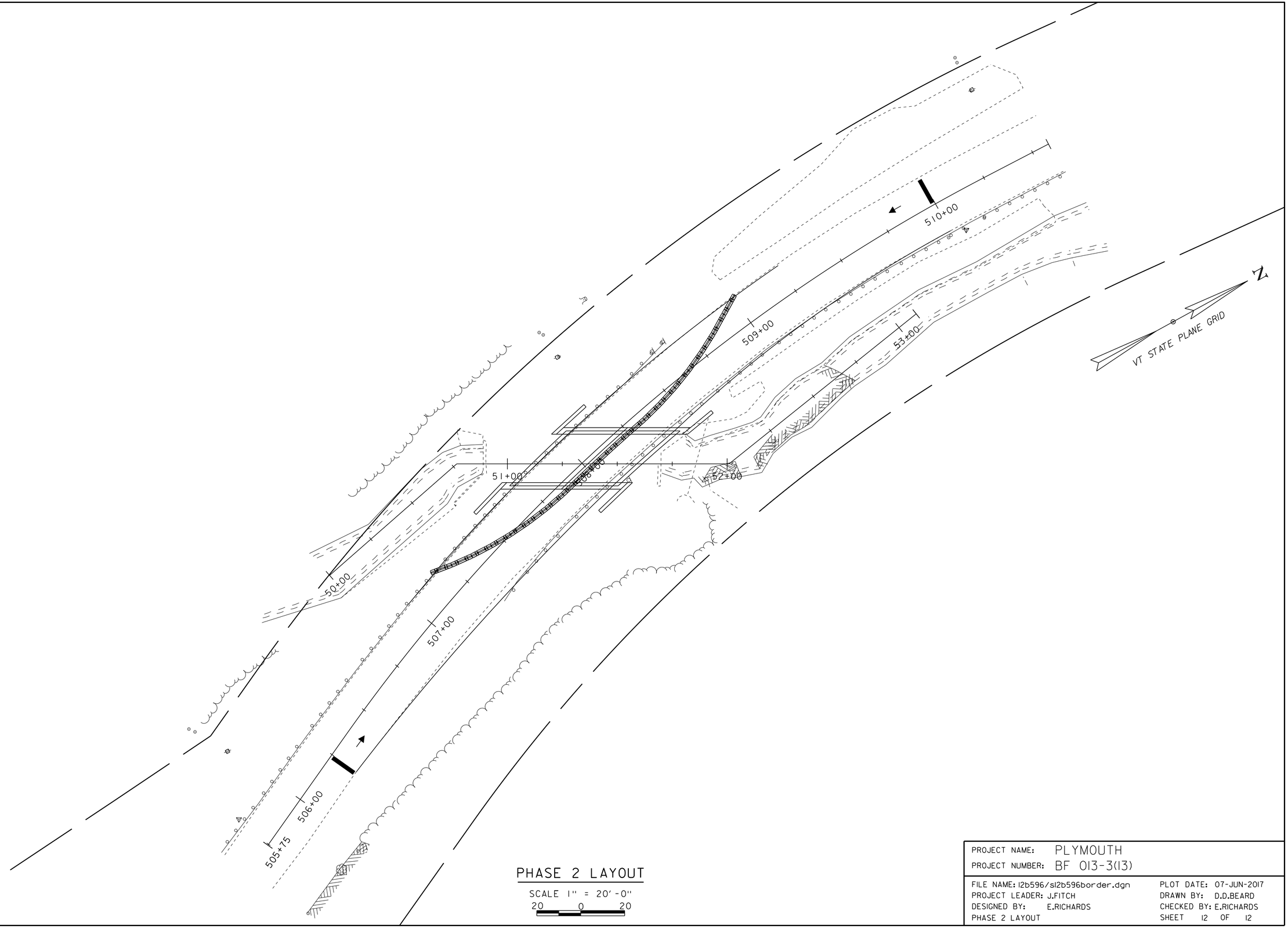
PHASE I LAYOUT

SCALE 1" = 20'-0"

20 0 20

PROJECT NAME:	PLYMOUTH
PROJECT NUMBER:	BF 013-3(13)

FILE NAME: I2b596/sI2b596border.dgn	PLOT DATE: 07-JUN-2017
PROJECT LEADER: J.FITCH	DRAWN BY: D.D.BEARD
DESIGNED BY: E.RICHARDS	CHECKED BY: E.RICHARDS
PHASE I LAYOUT	SHEET II OF I2



PHASE 2 LAYOUT

SCALE 1" = 20'-0"

20 0 20

PROJECT NAME:	PLYMOUTH
PROJECT NUMBER:	BF 013-3(13)
FILE NAME:	I2b596/sI2b596border.dgn
PROJECT LEADER:	J.FITCH
DESIGNED BY:	E.RICHARDS
PHASE 2 LAYOUT	
PLOT DATE:	07-JUN-2017
DRAWN BY:	D.D.BEARD
CHECKED BY:	E.RICHARDS
SHEET	12 OF 12