

**STATE OF VERMONT
AGENCY OF TRANSPORTATION**

**Scoping Report
FOR
Elmore STP CULV(64)**

VT ROUTE 12, BRIDGE 90 OVER UNNAMED BROOK

May 28, 2020



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I. Site Information

Bridge 90 is a State-owned bridge located on VT Route 12 in the Town of Elmore approximately 11.0 miles south of the junction with VT Route 15A. The bridge is at a large skew to the roadway and is located under an average of 18 feet of fill. 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	Major Collector
Bridge Type	Corrugated Galvanized Metal Plate Pipe (CGMPP)
Culvert Span	6 feet
Culvert Length	208 feet
Fill Over Culvert	18 feet
Year Built	1964
Ownership	State of Vermont

Need

Bridge 90 carries VT Route 12 across an Unnamed Brook. The following is a list of deficiencies of Bridge 90 and VT Route 12 in this location:

1. The culvert is in serious condition. There is heavy rust scaling and holes throughout the invert. The pipe has buckled under the roadway and cracks have formed.
2. The existing culvert does not meet the calculated or measured bank full width and does not meet the minimum hydraulic standard.

Traffic

A traffic study of this site was performed by the Vermont Agency of Transportation. The traffic volumes are projected for the years 2023 and 2043.

TRAFFIC DATA	2023	2043
AADT	1,100	1,200
DHV	170	180
ADTT	55	95
%T	4.6	7.0
%D	62	62

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 1,200, a DHV of 180, and a design speed of 50 mph for a Major Collector.

Design Criteria	Source	Existing Condition	Minimum Standard	Comment
Approach Lane and Shoulder Widths	VSS Table 5.3	11'4" (30')	11'3" (28')	
Bridge Lane and Shoulder Widths	VSS Section 5.7	11'4" (30')	11'3" (28') ¹	
Clear Zone Distance	VSS Table 5.5	No Issues Noted	16' fill / 10' cut (1:3 slope), 12' cut (1:4 slope)	
Banking	VSS Section 5.13	Normal Crown	8% (max)	
Speed		50 mph (Posted)	50 mph (design)	
Horizontal Alignment	AASHTO Green Book Table 3-10b	R = ∞	R _{min} = 8,150' @ NC	
Vertical Grade	VSS Table 5.6	-5.8% (max)	6% (max) for level terrain	
K Values for Vertical Curves	VSS Table 5.1	K _{sag} = 74, K _{crest} = 90	110 crest / 90 sag	Substandard
Vertical Clearance	VSS Section 5.8	No Issues Noted	14'-3" (min)	
Stopping Sight Distance	VSS Table 5.1	346'	400'	Substandard
Bicycle/Pedestrian Criteria	VSS Table 5.8	3' shoulder	3' Shoulder	
Hydraulics	VTrans Hydraulics Section	HW/D = 1.46 Clearspan: 6'	HW/D < 1.2 Bank Full Width: 23'	Substandard
Structural Capacity	SM, Ch. 3.4.1	Structurally Deficient	Design Live Load: HL-93	Substandard

Inspection Report Summary

Culvert Rating 3 Serious
Channel Rating 4 Poor

12/5/2018 – Structure is in poor condition with heavy rust scaling and holes through out invert and haunches. The center of the pipe is buckling, and cracks have formed. Structure should be replaced. ~ABC/JAS

12/28/2017 – Structure is in poor condition. There is distortion and signs of buckling. Pipe is in need or replacement or repair. Cracking and holes present throughout structure. A liner wouldn't work due to condition of culvert. Some debris is present at inlet and should be removed. ~MC/MJ

11/23/2016 - The culvert is in poor condition. There is distortion and signs of buckling, the culvert needs to be replaced soon. With the deflection and distortion along the culvert a liner wouldn't work in this location any longer. ~JAS

¹The minimum typical section required for safety and service is 10'/2' per Table 5.3 of the Vermont State Standards. A 3-foot shoulder is required per Table 5.8 of the Vermont State Standards to accommodate shared use of the roadway by bicycles. Additionally, a minimum paved width of 28' is required for winter maintenance activities per VTrans Highway Safety & Design Engineering Guidance HSDEI 11-004.

11/10/2015 – Poor condition & has been for years now with no repairs, pipe deterioration has advanced, and crushing has started with cracking along barrel and large holes. Abrupt failure is possible. Repairs are needed. ~MJK/SP

11/20/2014 – There are scattered large perforations throughout along the invert. This has led to ex-filtration of soils and squashing of the center area of the pipe. The sides have bowed out and the top of the pipe has dropped 4"(+/-). This structure should be replaced in the near future. ~JWW/JDM

Hydraulics

The existing structure does not meet the current hydraulic standard of the VTrans hydraulic manual. The existing 6-foot diameter culvert provides a Headwater to Depth ratio (HW/D) of 1.46 during the design storm event. Per the current standards, a culvert with a diameter greater than 60-inches should provide a maximum HW/D of 1.2 during the design storm event. Additionally, the existing structure constricts the channel width, as it does not meet the 23-foot field measured bankfull width. The VTrans Hydraulics Section has made several recommendations for a replacement structure; these options are outlined in the preliminary hydraulics report in Appendix D. Regardless of the recommendation, Aquatic Organism Passage is required and will need to be incorporated into the design and construction of the project.

Utilities

The existing utilities are shown on the Existing Conditions Layout Sheet, and are as follows:

Municipal Utilities

- There are no municipal utilities within the project area.

Public Utilities

Underground:

- There are no buried utilities within the project area.

Aerial:

- There are no aerial utilities within the project area.

It is anticipated that a utility relocation will not be required for the project.

Right-Of-Way

The existing Right-of-Way is plotted on the Existing Conditions Layout Sheet. It is anticipated that additional Right-of-Way will not be required.

Environmental and Cultural Resources

The environmental resources present at this project are shown on the Existing Conditions Layout Sheet, and are as follows:

Biological:

Wetlands/Floodplains

There are no mapped wetlands within the project area.

Rare, Threatened, and Endangered Species

There are no occurrences of R/T/E species within the project vicinity.

The USFWS IPaC mapping indicates that the project area is within the Northern Long Eared Bat's (NLEB's) habitat range. The NLEB is a federally listed threatened species. Suitable habitats for NLEB's per guidance from USFWS are: trees ≥ 3 inches in diameter that have holes, crevices, cracks or peeling bark. During a site visit by the VTrans Environmental Section, trees that fit this description on both sides of the road were identified. As the project moves forward, additional investigation is warranted to avoid impacts to potential roosting habitat.

Wildlife Habitat

Vt. Fish and Wildlife identifies the study area as a Highest Priority surface water and riparian area in the Vt. Conservation Design Community and Species Scale Components. The landscape adjacent to the stream west of the crossing structure is currently grazed by livestock but is still generally forest or shrub dominated alder swamp for a distance of at least 75-feet from the streambank. North and east of the crossing structure, the forested area narrows to 10-30 feet in width due to existing residential development. Residential development southeast of the structure is slightly further from the streambank, with approximately 30-40 feet of forested/shrub wetland area adjacent to the banks. This shrub/forest band on both sides of the structure is the only forested connectivity habitat within at least a mile and likely provides an important corridor for aquatic organism and mammal passage from the forest lands east of the structure to extensive forest, wetlands and Elmore Lake to the west of the structure. The current structure is undersized and does not provide a natural bed substrate to benefit aquatic organism passage, nor does it include bank features which would facilitate terrestrial connectivity. Structure design should consider the passage requirements of both aquatic and terrestrial species moving east/west within the riparian corridor.

Agricultural Soils

The agricultural soils assessment involved a remote review of the NRCS County Soil Survey for the Project area. Primary agricultural soils were identified throughout the Project area. Primary soil types present include Tunbridge- Lyman fine sandy loam (Statewide).

Hazardous Materials:

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

Historic:

Bridge 90 is not historic and there are no historic resources in the project area. One 4(f) resource was identified: the CC Putnam State Forest, which lies on the northeastern side of VT Route 12 within the survey area. Provided all project work is completed within the state-owned right-of-way, a Section 4(f) review will not be needed for the project.

Archeological:

There are no areas of archaeological sensitivity within the project area.

Stormwater:

There are no stormwater concerns for this project.

II. Safety

There have been no recorded crashes within the project area in the last five-year period.

III. Alternatives Discussion

No Action

This alternative is not recommended. The culvert is in serious condition and will continue to deteriorate if no action is taken. Additionally, there is a large drop at the outlet of the culvert making it impossible to pass fish. Something will have to be done to improve this culvert in the near future. In the interest of safety to the traveling public, the No Action alternative is not recommended. No cost estimate has been provided for this alternative since there are no immediate costs.

Rehabilitation

Crushing of the pipe has occurred with cracking and large perforations along the barrel. Additionally, the pipe is significantly undersized for hydraulics and has a history of debris jams. Due to the amount of deterioration and deformation in the pipe, along with the substandard hydraulic condition, rehabilitation options are not being considered.

Culvert Replacement with a New Buried Structure Using Open Cut

This option involves removing the existing Corrugated Galvanized Metal Plate Pipe and replacing it with a new precast structure having a waterway opening of at least 138 square feet and a span of 23 feet. Since there is approximately 18 feet of fill above the existing culvert, there would be a considerable amount of earthwork. Any new structure should have flared wingwalls at the inlet and outlet to make a smooth transition between the channel and the culvert. The various considerations under this option include: the roadway width, structure type, and culvert size, length, and skew.

a. Roadway Width

The existing roadway currently has 11-foot-wide lanes and 4-foot-wide shoulders, which meets the minimum standard of 28 feet as set forth in the Vermont State Standards. Since a new 75+ year structure is being proposed, the roadway geometry should meet the minimum standards and match the existing corridor. A 30-foot width roadway will be proposed through the project area to match the existing conditions.

b. Structure Type

The most common structure types for the recommended hydraulic opening are a 3-sided open bottom concrete structure, or a structural plate arch. A plate arch is not recommended at this site, since it would have a reduced design life compared to a reinforced concrete structure.

A 4-sided concrete box culvert will not be considered as the required span is outside of the preferred limits for a precast box.

If an arch or frame is used, it should be founded either on bedrock or 6' minimum below the channel bottom, and full depth headwalls used.

The Preliminary Geotechnical Report indicates that the site consists of extensive amounts of gravel deposits, cobbles, and boulders within the streambed and along the embankments upstream and downstream of the culvert with some possible bedrock outcroppings. Borings should be requested early on in design to verify the in-situ condition and determine the appropriate substructure type.

c. Culvert Size, Length and Skew

The existing culvert has a span of 6 feet, which constricts the natural channel width. Additionally, the waterway opening does not meet the minimum hydraulic standard. If a new structure is chosen, the VTrans Hydraulics section has recommended a structure with a 23-foot-wide and 6-foot-high inside opening, with E-Stone, Type III placed for a natural stone bottom. When the culvert was constructed in 1964, the stream was re-aligned to straighten the flow through the new 200-foot culvert. This created a large skew between the channel and roadway. It would be advantageous from a design standpoint to re-stabilize the stream back to its natural state prior to the placement of the culvert. By bringing the stream back to a more natural state, the skew of the channel to the roadway is reduced resulting in a shorter culvert length. In order to accommodate a 30-foot-wide roadway with the stream brought back to its natural state, the proposed barrel length will be approximately 125 feet long. The culvert would have a skew of approximately 45 degrees to the roadway.

d. Maintenance of Traffic

Either an off-site detour, phased construction, or a temporary bridge would be appropriate measures for traffic control at this site.

Advantages: This alternative would address the structural deficiencies of the existing bridge, with a brand-new culvert with a 75-year design life. This option would meet the minimum hydraulic standards and provide adequate AOP as well as address on-going issues with debris blockage. This option would have minimal future maintenance costs.

Disadvantages: This option has the highest upfront costs.

New Culvert using Trenchless Technology

This option would replace the existing culvert with a brand new culvert installed adjacent to the existing pipe. The new pipe would be installed using one of several trenchless technologies while traffic maintained on the road above. Although conventional jack-and-bore or pipe ramming methods would be likely to succeed on this project, the pipe size required to meet bank full width requirements would not be practical. Pipes as large as 12' diameter have been installed using

trenchless technology, but the equipment and expertise for even this size project may be unavailable or prohibitively expensive in Vermont. Additionally, the preliminary geotechnical report has indicated that there are most likely boulders present, which could make trenchless technologies more costly. Trenchless techniques are generally more cost effective with 60-inch diameter pipes and smaller, with pipes being driven into favorable soil conditions.

A new culvert using trenchless technology could also include the installation of two new pipes next to each other. A double barrel culvert would meet the minimum waterway opening; however, a dual culvert installation is not favored hydraulically. It is not efficient, creates additional turbulence, is more prone to debris clogging, and causes more impacts when directing the stream into the second pipe.

This option would not be favorable for wildlife or Aquatic Organism Passage. Due to the size of the required structure, trenchless methods are not being considered further.

Advantages: This solution would provide for a typical service life for culverts of at least 60 years, depending on material selection. Traffic would be maintained through the work area with minor impacts.

Disadvantages: The location of the culvert and a small length of the stream on each end would be slightly modified, to direct flow into both the new and existing pipe. This alternative has higher initial costs than pipe rehabilitation and slightly higher temporary impacts to resources.

Maintenance of Traffic: For this alternative, traffic would be maintained as normal flow through the work zone with minor impacts due to construction vehicles entering and leaving the site.

Culvert Replacement with a New Bridge (Integral Abutment or Spread Footings)

This alternative would replace the existing culvert with a new integral abutment bridge at the existing location. The various considerations under this option include: the stream alignment, bridge width and length, skew, superstructure type and substructure type.

a. Stream Alignment

When the culvert was constructed in 1964, the stream was re-aligned to straighten the flow through the new 200-foot culvert. This created a large skew between the channel and roadway. It would be advantageous from a design standpoint to re-stabilize the stream back to its natural state prior to the placement of the culvert. By bridging the stream back to a more natural state, the skew of the channel to the roadway is reduced.

b. Bridge Width

The existing lane widths and shoulders on VT Route 12 over the culvert are 11-foot-wide and 4-foot-wide respectively; this meets the minimum standard as set forth in the Vermont State Standards. Since a new 75+ year bridge is being proposed, the bridge geometry should meet the minimum standards. A 30-foot rail-to-rail distance is proposed over the bridge to match the corridor.

c. Bridge Length and Skew

The existing culvert has a 6-foot span. The required bankfull width is 23-feet and the brook as well as the culvert are at a skew of 55-degrees to the roadway. In order to meet the minimum bankfull width requirements with the maximum 20-degree skew preferred for integral abutments, the bridge would have an 80-foot span based on the layout procedures for integral abutment bridges. If the site is not conducive to an integral abutment, a skew of 30 degrees with an approximate 60-foot span bridge would be recommended.

d. Superstructure Type

If the bridge is closed during construction, a precast structure would be the preferred choice, due to decreased construction time. The possible 80-foot length bridge types that are most commonly used in Vermont are box beams with a structural overlay, and steel beams with a composite concrete deck (Precast Bridge Units). If VT Route 12 through the project area is to remain open during construction, then a cast-in-place deck on steel beams would be recommended as this type of superstructure is more cost efficient than precast superstructure types. The superstructure depth is not critical for hydraulics; therefore, the beam depth is not a controlling factor in choosing a superstructure type.

e. Substructure Type

The project site was observed to have a high frequency of gravel, cobbles, and boulders with possible bedrock outcroppings. There was little subsurface information obtained from nearby water wells and record plans. Borings should be taken at the project site, to determine if the subsurface is conducive for an integral abutment at this location. This type of substructure would provide the best scour protection. If it is determined that driving piles will be difficult, then the substructure should be reinforced concrete abutments on spread footings. Any rapid construction alternative should have sufficient subsurface information to verify the in-situ conditions. In order to reduce construction time, precast abutment components may be used where possible. The preliminary geotechnical report can be found in the Appendix.

f. Maintenance of Traffic:

Either a temporary bridge, phased construction, or an offsite detour could be utilized for traffic control.

IV. Maintenance of Traffic

The Vermont Agency of Transportation has created an 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 helps 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 early. The Agency will consider the closure option on most 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. Accelerated Construction should provide enhanced safety for the workers and the travelling 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 an official, signed State detour. There are two detours that could be used if the bridge is closed during construction. The two potential State-signed detours are as follows:

1. VT Route 12, to VT Route 100, and US Route 2, back to VT Route 12 (61 miles end-to-end)
2. VT Route 12, to US Route 2, VT Route 14, and VT Route 15, back to VT Route 12 (66 miles end-to-end)

There are no local bypass routes available. Access to driveways and town highways would be maintained. A map of the detour routes can be found in the appendix.

Advantages: Utilizing 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 amount of 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 the travelling public will be improved by removing traffic from the construction site.

Disadvantages: Traffic flow would not be maintained through the project corridor during construction.

Option 2: Phased Construction

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

While the time required to develop a phased construction project would remain the same, the time required to complete a phased construction project increases because some of the construction tasks must be performed multiple times. In addition to the increased design and construction costs mentioned above, the costs also increase for phased construction because of the inconvenience of working around traffic and the effort involved in coordinating the joints between the phases. Another negative aspect of phased construction is the decreased safety of the workers and vehicular traffic, which is caused by increasing the proximity and extending the duration that workers and moving vehicles are operating in the same confined space. Phased construction is usually considered when the benefits include reduced impacts to resources and decreased costs and development time by not requiring the purchase of additional ROW.

Based on the current traffic volumes, it is acceptable to close one lane of traffic, and maintain one lane of traffic, both ways, with a traffic signal. There is approximately 20 feet of vertical fill over the existing culvert; it would be complicated to hold back this amount of fill for phased construction making this option more expensive.

Option 3: Temporary Roadway

From a constructability standpoint, a temporary roadway over the existing culvert ends could be placed either upstream or downstream of the existing structure. The culvert is located in a heavily wooded area, and a temporary roadway off either side would require a significant amount of tree clearing and fill. On the upstream side of the culvert, there are bedrock outcrops that the temporary roadway would need to avoid.

Additional costs would be incurred to construct a temporary roadway over the existing culvert, including the cost of fill and sheet piles, installation and removal of the temporary roadway and restoration of the disturbed area.

If a temporary roadway is chosen as the preferred method of traffic control, it should be a two-way bridge to accommodate the traffic volumes along with the long temporary roadway approaches that would be required at this site. The bridge is surrounded by wooded areas, both upstream and downstream. A number of trees would need to be cut down for this temporary condition. See the Temporary Roadway Layout Sheet in the Appendix.

Advantages: Traffic flow can be maintained along the VT Route 12 corridor.

Disadvantages: This option would require a significant amount of tree clearing. There would be decreased safety to the workers and to vehicular traffic, because of cars driving near the construction site, and construction vehicles entering and exiting the construction site. This traffic control option would be more costly, and time consuming than an offsite detour.

V. Alternatives Summary

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

- Alternative 1a: New Precast 3-Sided Structure (open cut) with Traffic Maintained on Offsite Detour
- Alternative 1b: New Precast 3-Sided Structure (open cut) with Traffic Maintained with Phased Construction
- Alternative 1c: New Precast 3-Sided Structure (open cut) with Traffic Maintained on a Temporary Roadway
- Alternative 2a: New integral abutment bridge with Traffic Maintained on Offsite Detour
- Alternative 2b: New integral abutment bridge with Traffic Maintained with Phased Construction
- Alternative 2c: New integral abutment bridge with Traffic Maintained on a Temporary Roadway over the existing structure

A cost evaluation for each of the alternatives is shown below.

VI. Cost Matrix²

Elmore STP CULV(64)		Do Nothing	Alternative 1			Alternative 2		
			3-Sided Concrete Structure			New Bridge		
			a. Offsite Detour	b. Phased Construction	c. Temporary Roadway	a. Offsite Detour	b. Phased Construction	c. Temporary Roadway
COST	Bridge Cost	\$0	1,293,829	1,617,286	1,406,336	1,085,300	1,356,600	1,085,300
	Removal of Structure	\$0	124,800	143,520	124,800	12,600	14,490	12,600
	Roadway	\$0	267,759	418,374	291,042	254,000	396,000	254,000
	Maintenance of Traffic	\$0	164,300	271,600	451,373	164,300	271,600	451,373
	Construction Costs	\$0	1,850,688	2,450,780	2,273,552	1,516,200	2,038,690	1,803,273
	Construction Engineering & Contingencies	\$0	462,672	612,695	568,388	348,726	611,607	450,818
	Accelerated Premium	\$0	0	0	0	0	0	0
	Total Construction Costs w CEC	\$0	2,313,360	3,063,475	2,841,939	1,864,926	2,650,297	2,254,092
	Preliminary Engineering ³	\$0	370,138	490,156	454,710	227,430	407,738	360,655
	Right of Way	\$0	0	0	0	0	0	0
	Total Project Costs	\$0	2,683,498	3,553,631	3,296,650	2,092,356	3,058,035	2,614,746
	Annualized Costs	\$0	35,780	47,382	43,955	27,898	40,774	34,863
TOWN SHARE		No Local Share						
TOWN %		No Local Share						
SCHEDULEING	Project Development Duration ⁴	N/A	2 years	2 years	2 years	2 years	2 years	2 years
	Construction Duration	N/A	6 months	8 months	8 months	6 months	8 months	8 months
	Closure Duration (If Applicable)	N/A	14 Days	N/A	N/A	30 Days	N/A	N/A
ENGINEERING	Typical Section - Roadway (feet)	30'	30'	30'	30'	30'	30'	30'
	Typical Section - Bridge (feet)	11' ¹ / ₄ ' (30')	11' ¹ / ₄ ' (30')	11' ¹ / ₄ ' (30')	11' ¹ / ₄ ' (30')	11' ¹ / ₄ ' (30')	11' ¹ / ₄ ' (30')	11' ¹ / ₄ ' (30')
	Geometric Design Criteria	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard
	Traffic Safety	Structurally Deficient Culvert	Improved	Improved	Improved	Improved	Improved	Improved
	Alignment Change	N/A	No Change	No Change	No Change	No Change	No Change	No Change
	Bicycle Access	Meets Minimum Standard	No Change	No Change	No Change	No Change	No Change	No Change
	Pedestrian Access	N/A	No Change	No Change	No Change	No Change	No Change	No Change
	Hydraulics	Hydraulically Substandard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard
	Utilities	No Change	No Change	No Change	No Change	No Change	No Change	No Change
OTHER	ROW Acquisition	No	No	No	No	No	No	No
	Road Closure	No	Yes	No	No	Yes	No	No
	Design Life (years)	<10	75	75	75	75	75	75

² Costs are estimates only, used for comparison purposes.

³ Preliminary Engineering costs are estimated starting from the end of the Project Definition Phase.

⁴ Project Development Durations are starting from the end of the Project Definition Phase.

VII. Conclusion

Alternative 2b or 2c is recommended; to replace the existing culvert with a new bridge while one lane of alternating traffic is maintained during construction.

Structure:

The existing culvert is 55 years old and has reached the end of its anticipated design life. Additionally, the current culvert is in serious condition and does not meet the minimum hydraulic standard for waterway area or bank full width and a replacement is warranted as such.

Due to the amount of fill over the existing culvert along with the required length of a new buried structure, a new bridge is more cost effective than a new buried structure.

The new bridge will have a rail-to-rail width of 30-feet, to match the existing conditions and meet the minimum standards as set forth in the Vermont State Standards. A bridge span of 80-feet is recommended based on the required clear span and integral abutment bridge layout procedures. If the site is not conducive to an integral abutment bridge, the span length may be reduced. The new structure will meet the minimum hydraulics standards and will also satisfy Aquatic Organism Passage (AOP) needs.

When the culvert was constructed, the stream was re-aligned to straighten the flow through the new 200-foot culvert. This created a large skew between the channel and roadway. It would be advantageous from a design standpoint to re-stabilize the stream back to its natural state prior to the placement of the culvert. By bridging the stream back to a more natural state, the skew of the channel to the roadway is reduced resulting in a shorter structure.

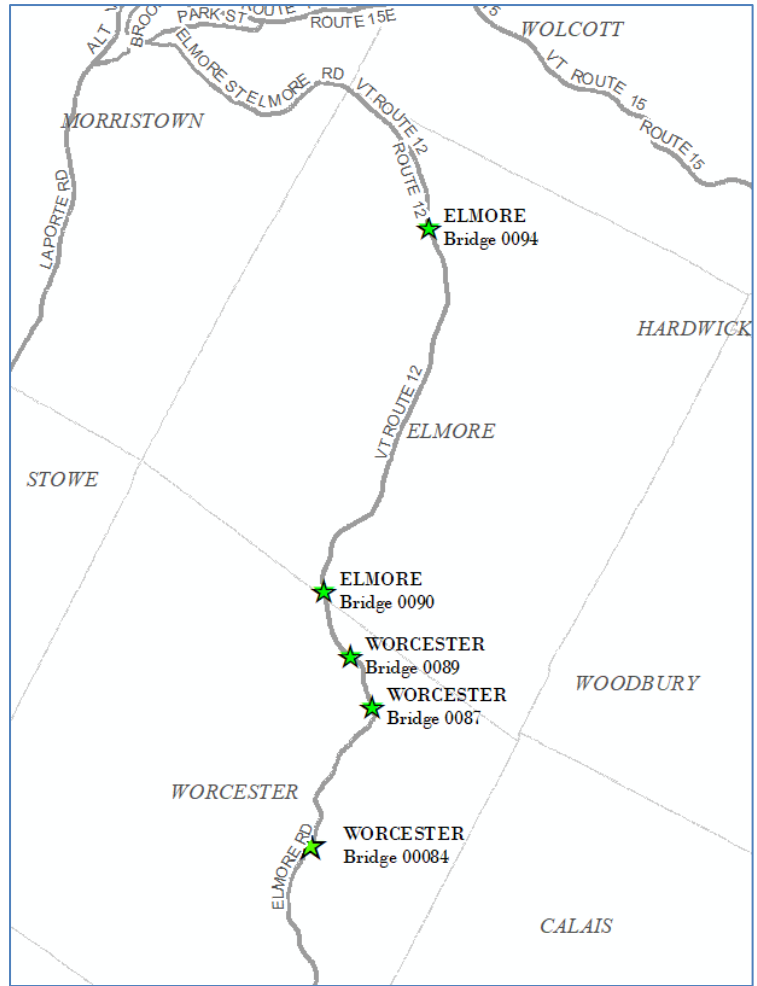
Traffic Control:

The regional detour routes available have an end-to-end distance of approximately 60 miles, with no local bypass routes available. This distance is considered relatively long for a detour route, and as such, traffic should be maintained through the project area. The recommended method of traffic control is to either construct a temporary roadway to one side of the existing roadway over the existing culvert in the roadway slope area or to construct the new bridge in phases. Phased construction would require the roadway through the project area to be widened slightly during construction. A new bridge would be constructed on the existing alignment and the culvert, additional fill, and temporary roadway would be removed.

Coordination with other projects:

There are several projects in the State Highway Bridge Program within the project area that are currently in the scoping phase of project development. The projects are as follows:

- ELMORE BF 0241(55) 19B212, VT Route 12, Bridge 94 over unnamed brook.
- ELMORE STP CULV(64) 18B003, VT Route 12, Bridge 90 over unnamed brook.
- WORCESTER BF 0241(56) 19B213, VT Route 12, Bridge 87 over Hardwood brook.
- WORCESTER BF 0241(57) 19B214, VT Route 12, Bridge 89 over North brook.
- WORCESTER BF 0241(59) 86E053, VT Route 12, Bridge 84 over the north branch of Winooski river



Consideration should be given to bundling these projects for design and/or construction.

VIII. Appendices

- Appendix A: Site Pictures
- Appendix B: Town Map
- Appendix C: Bridge Inspection Report
- Appendix D: Hydraulics Memo
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- Appendix G: Natural Resources Memo
- Appendix H: Archeology Memo
- Appendix I: Historic Memo
- Appendix J: Community Input
- Appendix K: Operations Input
- Appendix L: Crash Data
- Appendix M: Detour Routes
- Appendix N: Plans

Appendix A: Site Pictures



Picture 1: Looking North on VT Route 12 over Bridge 90



Picture 2: Looking South VT Route 12 over Bridge 90



Picture 3: Culvert Outlet



Picture 4: Culvert Inlet



Picture 5: Culvert Barrel

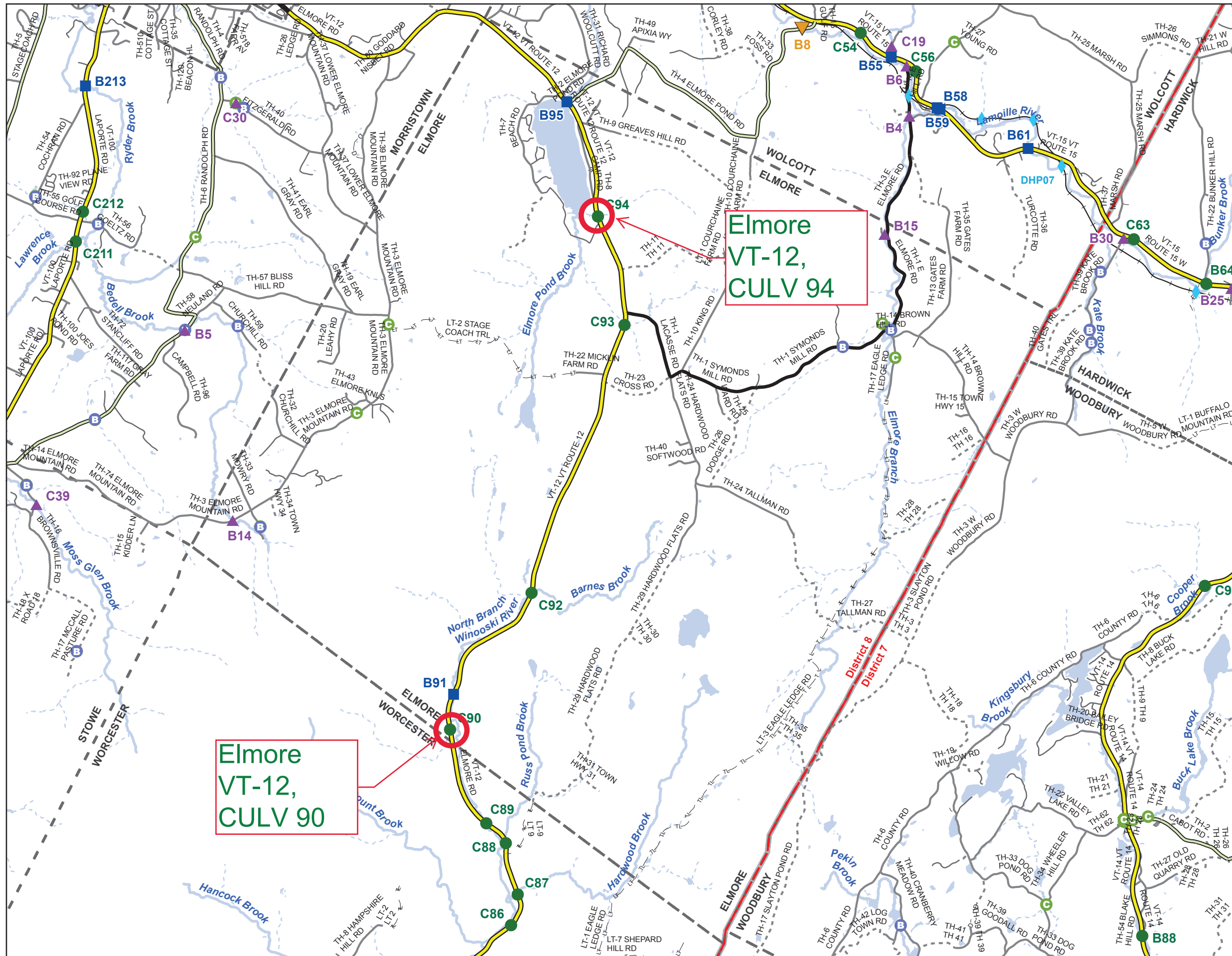


Picture 6: Perforations in Culvert Invert



Picture 7: Looking Upstream

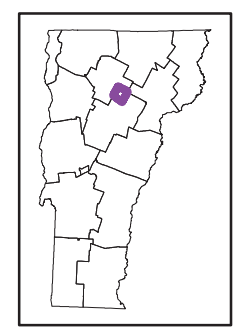
Appendix B: Town Map



- Scale: 1:58,110
- ★ INTERSTATE
 - STATE LONG
 - STATE SHORT
 - ▲ TOWN LONG
 - ▼ FAS/FAU
 - ◆ BIKE PATH
 - INTERSTATE
 - STATE HIGHWAY
 - CLASS 1
 - CLASS 2
 - CLASS 3
 - CLASS 4
 - - - LEGAL TRAIL
 - PRIVATE
 - - - DISCONTINUED
 - FAS/FAU HWY
 - [] MAINTENANCE DISTRICT
 - [] POLITICAL BOUNDARY
 - [] VTRANS REGION BOUNDARY
 - NAMED RIVER-STREAM
 - - - UNNAMED RIVER-STREAM
 - B Point from Local Bridge Data *
 - C Point from Local Culvert Data *

* Points are from local town bridge and culvert inventories. Some points may overlap where VTrans has also conducted an inventory on the Town highway.
Data source: VOBGIT aka VTCulverts

Produced by:
Mapping Section
Division of Policy, Planning and
Intermodal Development
Vermont Agency of Transportation
May 2017



ELMORE
COUNTY-TOWN CODE: 0804-0
LAMOILLE COUNTY
DISTRICT # 8
District Long Name: St. Albans District
VTrans Four Region: Northwest

This map was funded in part through grants from the Federal Highway Administration, U.S. Department of Transportation. The representation of the authors expressed herein do not necessarily state or reflect those of the U. S. Department of Transportation.

Appendix C: Bridge Inspection Report

STRUCTURE INSPECTION, INVENTORY and APPRAISAL SHEET

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

Inspection Report for **ELMORE**

bridge no.: 0090

District: 8

Located on: VT12 over **BROOK**

approximately 11.0 MIS JCT VT 15A

Maintained By: STATE

CONDITION

Deck Rating: N NOT APPLICABLE
Superstructure Rating: N NOT APPLICABLE
Substructure Rating: N NOT APPLICABLE
Channel Rating: 4 POOR
Culvert Rating: 3 SERIOUS
Federal Str. Number: 300241009008041

AGE and SERVICE

Year Built: 1964 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): 4
ADT: 1000 Year of ADT: 1996

GEOMETRIC DATA

Length of Maximum Span (ft): 6
Structure Length (ft): 6
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): 30
Skew: 55
Bridge Median: 0 NO MEDIAN
Feature Under: FEATURE NOT A HIGHWAY OR RAILROAD
Min Vertical Underclr (ft): 06 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): 208
Average Cover Over Culvert (ft): 18
Waterway Area Through Culvert (sq.ft.): 220
Wingwall/Headwall Rating: 6 SATISFACTORY CONDITION

APPRAISAL

Appr. Rdwy. Alignment: 8 EQUAL TO DESIRABLE CRITERIA

INSPECTION

Inspection Date: 122018 Inspection Frequency (months): 12

INSPECTION SUMMARY and NEEDS

12/5/2018 - Structure is in poor condition with heavy rust scaling and holes through out invert and haunches. Center of pipe is buckling and cracks have formed. Structure should be replaced. - ABC/JAS

12/28/17- Structure is in poor condition. There is distortion and signs of buckling. Pipe is in need or replacement or repair. Cracking and holes present through out structure. A liner wouldn't work due to condition of culvert. Some debris is present at inlet and should be removed. MC/MJ

11/23/2016 - The culvert is in poor condition. There is distortion and signs of buckling, the culvert needs to be replaced soon. With the deflection and distortion along the culvert a liner wouldn't work in this location any longer. JAS

11/10/15 Poor condition & has been for years now with no repairs, pipe deterioration has advanced and crushing has started with cracking along barrel and large holes. Abrupt failure is possible. Repairs are needed. MJK SP

11/20/2014 There are scattered large perforations throughout along the invert. This has led to ex-filtration of soils and squashing of the center area of the pipe. The sides have bowed out and the top of the pipe has dropped 4" +/- This structure should be replaced in the near future. JWW/JDM

Appendix D: Hydraulics Memo

**State of Vermont
Structures and Hydraulics Section**

One National Life Drive
Montpelier, Vermont 05633-5001
vtrans.vermont.gov

[phone] 802-371-7326
[fax] 802-828-3566
[ttd] 800-253-0191

Agency of Transportation

TO: Laura Stone, Structures, Scoping Engineer

CC: Nick Wark, Hydraulics Engineer

FROM: Jeff DeGraff, Hydraulics Project Engineer

DATE: February 5, 2020

SUBJECT: Elmore STP CULV(64) pin #18b003
Elmore, VT-12 Br90, over Unnamed Brook
Site location: MM 0.154
Coordinates: [44.454275, -72.546967](#)

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

On 12/11/19 we met with ANR at the site. In an email on 12/12/19 they indicated a minimum span of 23-feet should be used to span bankfull width (BFW).

VT-12 is a Rural – Major Collector.

The Design Storm Flow is 2% AEP (Q50).

The following was analyzed:

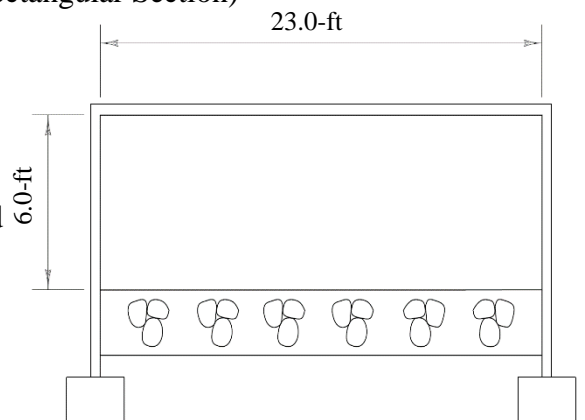
Existing Conditions: 6-foot Diameter Steel CGMPP

- Provides a Headwater to Depth ratio (HW/D) of 1.46 during the design storm event
- The existing culvert does not meet the current hydraulic standards

Option 1: Bridge (3-Sided) 23-foot span x 6.0-foot clear height (Rectangular Section)

There is approximately 2.7-feet of freeboard at the design AEP, providing a minimum waterway area of 138 sq. ft.

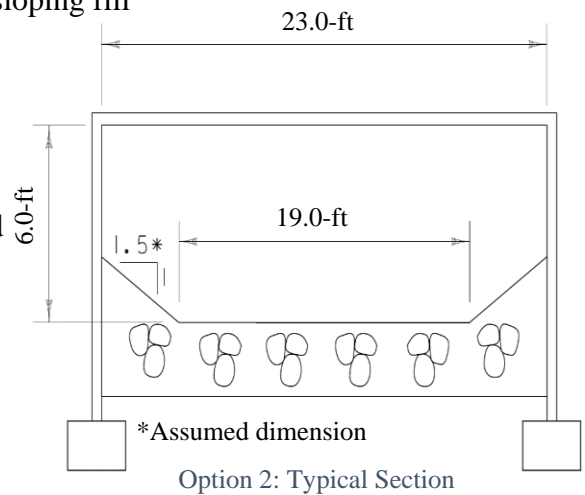
- E-Stone, Type III will need to be used to build the channel through this structure
- Stone Fill, Type III shall be used to protect any disturbed channel banks or roadway slopes at the structure's inlet and outlet
- Does not increase the 100-year base flood elevations
- Assumes no changes to the existing structure alignment/skew



Option 1: Typical Section

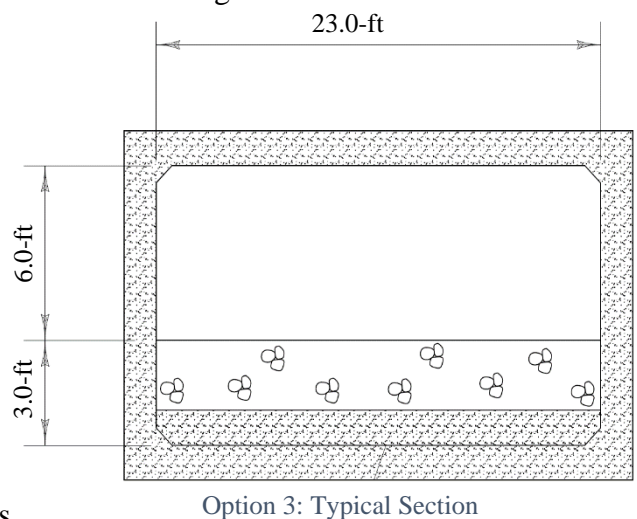
Option 2: Bridge (3-Sided) 23-foot span x 6.0-foot clear height w/sloping fill

- There is approximately 2.7-feet of freeboard at the design AEP, providing a minimum waterway area of 131 sq. ft \pm .
- E-Stone, Type III will need to be used to build the channel through this structure
- Stone Fill, Type III shall be used to protect any disturbed channel banks or roadway slopes at the structure's inlet and outlet
- Does not increase the 100-year base flood elevations
- Assumes no changes to the existing structure alignment/skew



Option 3: Four-Sided Concrete Box (closed bottom) 23-foot span x 9.0-foot height

- The structure invert shall be buried 3-feet resulting in a minimum clear height of 6 feet above the streambed, providing a minimum waterway area of 138 sq. ft.
- There is approximately 2.7-feet of freeboard at the design AEP
- E-Stone, Type III will need to be used to build the channel through this structure
- Stone Fill, Type III shall be used to protect any disturbed channel banks or roadway slopes at the structure's inlet and outlet
- Bed retention sills should be added in the bottom of the structure. Sills should be 12 inches high at the edges of the box and 6 inches high in the center, creating a V-shape across the full width of the box. Sills should be spaced no more than 8 feet apart throughout the structure with one sill placed at both the inlet and the outlet
- Does not increase the 100-year base flood elevations
- Assumes no changes to the existing structure alignment/skew



Based on field observation, there appears to be a moderate to high debris load. This warrants additional freeboard. The current options have 1.7' \pm of freeboard above what is typically required. If this creates design issues let us know and we can discuss the risk of debris at the site

Subsurface investigation has not been performed but a preliminary scour analysis has indicated 3-ft of scour assuming a grain size of 5 mm. For the purposes of this study, the bottom of abutment footings should be at least 6 feet below the channel bottom, or to ledge. An updated/detailed scour analysis will be performed during the final hydraulics phase.

If Option 3 is not constructible, a shorter span structure may be hydraulically adequate. Further coordination with ANR will be necessary if this option is chosen.

Other similar sized structures could be considered for this site. If another alternative is considered, coordinate with the Hydraulics Unit to perform additional analyses.

Please contact us with any questions, or to check substructure configuration scenarios.

Appendix E: Preliminary Geotechnical Information

To: Nick Wark, P.E., P.I.I.T. Program Manager
SPM CEE

From: Stephen Madden, Geotechnical Engineer, via Callie Ewald, P.E., Geotechnical Engineering Manager

Date: September 19th, 2019

Subject: Elmore STP CULV(64) Preliminary Geotechnical Information

1.0 INTRODUCTION

As requested, we have completed our preliminary geotechnical investigation of Bridge No. 90 on VT Route 12 over an unnamed brook in the Town of Elmore, VT. Bridge No. 90 is located approximately 11.0 miles south of the junction of VT Route 12 with VT Route 15A. The subject project consists of replacing or rehabilitating the existing corrugated galvanized metal plate pipe culvert. The project is currently in the scoping phase. 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 Vermont Agency of Natural Resources (ANR), published surficial and bedrock geologic maps, and observations made during a site visit.

2.0 SUBSURFACE INFORMATION

2.1 Published Geologic Data

Mapping conducted in 1970 for the Surficial Geologic Map of Vermont shows that the project area consists of glacial till deposits (Doll, 1970).

According to the 2011 Bedrock Map of Vermont, published by the USGS and State of Vermont, the project site is underlain with granofels and quartzite of the Moretown Formation, and is close to the boundary with phyllite of the Stowe Formation (Ratliffe, et. al, 2011).

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 no nearby projects within a 0.5-mile radius of the project site.

2.2 Water Well Logs

The Vermont ANR documents and publishes all water wells that are drilled for residential or commercial purposes. Published online, these logs may provide general characteristics of the soil strata and depth to bedrock in the area. The closest recorded water well is located approximately 0.86 miles north of the culvert location and the well report listed a depth to bedrock of approximately 60 feet.

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 1.0-mile radius and no impact from other hazardous waste sites is anticipated.

2.4 Record Plans

Record plans from the culvert construction, dated August 1962, were reviewed as part of this investigation and included layout, profile, and culvert detail sheets. The culvert detail sheet indicates the elevations of the concrete footings at the inlet and outlet of the culvert, and a note on the culvert detail sheet states that the pipe was bedded on native material or up to 12 inches of gravel backfill. The plans did not include any subsurface information.

3.0 FIELD OBSERVATIONS

A preliminary site visit was conducted on September 12th, 2019 to identify possible obstructions inhibiting boring operations and to make any other pertinent observations about the project. No overhead utilities were visible in the vicinity of the site. There were extensive amounts of gravel deposits, cobbles, and boulders within the streambed and along the embankments upstream and downstream of the culvert and some possible bedrock outcroppings, as seen in Figures 3.1 through 3.3. Riprap was visible directly adjacent to the culvert inlet and outlet.



Figure 3.1: Facing upstream; note high frequency of gravel, cobbles, and boulders within streambed and possible bedrock outcroppings.



Figure 3.2: *Facing upstream; note high frequency of gravel, cobbles, and boulders within streambed and possible bedrock outcroppings.*



Figure 3.3: *Facing downstream; note high frequency of gravel, cobbles, and boulders within streambed and possible bedrock outcroppings.*

4.0 RECOMMENDATIONS

4.1 Preliminary Foundation Alternatives

Based on the information reviewed during this investigation, if a full culvert replacement option is chosen as the preferred alternative foundation options for a replacement structure include the following:

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

4.2 Proposed Subsurface Investigation

If a full replacement of the culvert is chosen as the preferred alternative we recommend a minimum of two borings be advanced, one each at the inlet and outlet of the culvert, in order to more fully assess the subsurface conditions at the site including, but not limited to, the soil properties, depth to and characteristics of bedrock, and groundwater conditions. If shallow bedrock is encountered during drilling operations, as may be likely here, additional borings will likely be required to profile the bedrock elevation across the footprint of the proposed structure. Given the steep slopes adjacent to the roadway on both the inlet and outlet sides of the culvert the Geotechnical Sections drilling equipment would likely be restricted to drilling from the roadway and borings would need to be advanced from within the travel lanes and shoulders of VT Route 12. Hand steel probes could be performed across the footprint of the box and wing walls to supplement boring information if shallow bedrock is encountered.

5.0 CLOSING

When a design alternative as well as a preliminary alignment has been chosen, the Geotechnical Engineering Section can assist in designing 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.

6.0 REFERENCES

Doll, C. G., 1970, Surficial Geologic Map of Vermont, Vermont Geological Survey, Montpelier, VT.

Ratcliffe, N. M., Stanley, R. S., Gale, M. H., Thompson, P. J., Walsh, G. J., 2011, Bedrock Geologic Map of Vermont, Vermont Geological Survey, Montpelier, VT.

Vermont Agency of Natural Resources Department of Environmental Conservation, Natural Resources Atlas, www.anr.vermont.gov/maps/nr-atlas%20, accessed 9/17/2019.

cc: Laura Stone, P.E., P.I.I.T. Project Engineer
Electronic Read File/MG
Project File/CEE
SPM

Appendix F: Resource ID Completion Memo



OFFICE MEMORANDUM
AOT - PDB - ENVIRONMENTAL SECTION

RESOURCE IDENTIFICATION COMPLETION MEMO

TO: Laura Stone, Project Manager
FROM: Jeff Ramsey, Environmental Specialist Supervisor
DATE: 11/13/19
Project: Elmore STP CULV (64)

ENVIRONMENTAL RESOURCES:

Archaeological Site:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	See Archaeological Resource ID Memo
Historic/Historic District:	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	See Historic Resource ID Memo
Wetlands:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	See Natural Resource Assessment Report
Agricultural Land:	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	See Natural Resource Assessment Report
Fish & Wildlife Habitat:	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	See Natural Resource Assessment Report
Wildlife Habitat Connectivity:	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	See Natural Resource Assessment Report
Endangered Species:	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	See Natural Resource Assessment Report
Stormwater:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	
6(f) Property:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	
Hazardous Waste/ ANR Urban Background Soils:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	
USDA-Forest Service Lands:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	
Scenic Highway/ Byway:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	
Act 250 Permits:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	
FEMA Floodplains:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	
Flood Hazard Area/ River Corridor:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	
US Coast Guard:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	
Lakes and Ponds: 303D List/ Class A Water/ Outstanding Resource Water:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	
Surface and Ground Water (SPA) Source Protection Area:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	
Groundwater Classification:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	
Public Water Sources/ Private Wells:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	
Other:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	

cc:
 Project File

Appendix G: Natural Resources Memo

**Natural Resources Assessment Report for
Vermont Agency of Transportation
Elmore STP CULV (64)**

Elmore, Vermont

*Prepared by:
Arrowwood Environmental, LLC*

October 18, 2019



ARROWWOOD ENVIRONMENTAL

950 BERT WHITE ROAD
HUNTINGTON, VT 05462
(802) 434-7276 FAX: (802) 329-2253

**Natural Resources Assessment Report for
Vermont Agency of Transportation
Elmore STP CULV (64)**

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I. Introduction and Project Description	2
II. Site Characterization	2
III. Wetlands	2
IV. Rare, Threatened and Endangered Species.....	3
V. Non-Native Invasive Species (NNIS)	4
VI. Streams	4
VII. Wildlife Habitat and Habitat Connectivity	4
VIII. Agricultural Soils	6

Appendices

- Appendix 1: Photo Log
- Appendix 2: Resource Map
- Appendix 3: Plant Species List
- Appendix 4: Stream Summary Forms

Natural Resources Assessment Report for Vermont Agency of Transportation Elmore STP CULV (64)

I. Introduction and Project Description

Arrowwood Environmental, LLC (AE) was retained by the Vermont Agency of Transportation to perform a natural resources assessment for the proposed Culvert 90 project between mile marker 0.2 and 0.1 along Route 12 in Elmore, Vermont. The study area for the assessment is shown on the Resource Map in Appendix 2.

The assessment consisted of a remote landscape analysis of the study area as well as a field assessment. The field assessment was conducted on September 16, 2019. This Natural Resource Assessment Report summarizes the results of the remote analysis and field assessment.

II. Site Characterization

Ecologically the site is within the Northern Green Mountains biophysical region of the state (Thompson and Sorenson, 2000). The study area is located at approximately 1000 feet above mean sea level according to U.S. Geologic Survey (“USGS”) topographic data. The mapped bedrock that is underlying the site is granofels and quartzite from the Moretown Formation. (Ratcliffe et al. 2011). The soils are primarily mapped as Tunbridge-Lyman fine sandy loams with a small area of Adams loamy fine sand in the northeast study area (NRCS Soil Survey). The surrounding landscape is dominated by forest land.

Much of the study area consists of mowed roadside dominated by herbaceous vegetation. The upland forests in the study area consist of Hemlock-Northern Hardwood forests and Northern Hardwood Forests.

III. Wetlands

The wetland assessment involved both a remote review of available maps (including Vermont Significant Wetland Inventory Maps and the NRCS Soil Survey) and a field inventory component

conducted on September 16, 2019. The protocols put forth in the USACE's *Corp of Engineers Wetlands Delineation Manual* (2009 Regional Supplement for the Northcentral and Northeast Region) were employed for delineating wetlands as is the standard practice in Vermont. No wetlands were mapped within the study area. A mapped Class 2 wetland is located to the north and east of the project area and was not found to extend into the study area.

IV. Rare, Threatened and Endangered Species

The RTE species review involved both a remote review of available digital maps for the study area as well as a field survey. AE reviewed digital orthophotography, the NRCS Soil Survey, the 2011 Bedrock Geologic Map of Vermont and the Wildlife Natural Heritage Inventory (NHI) Rare, Threatened and Endangered Species digital database.

In reviewing the NHI digital database, there are no records or occurrences of RTE plant or animal species in or directly adjacent to the study area.

Plant Species

An inventory for RTE and uncommon plant species was undertaken in the study area on September 16, 2019. A complete list of plants documented during that inventory is presented in Appendix 3. No RTE or uncommon plant species were identified during the inventory of the study area.

Animal Species

The Northern Long Eared Bat (*Myotis septentrionalis*, MYSE) became a federally listed endangered species in May of 2015. The State of Vermont has determined that project clearing greater than 1% of the total forested area within a 1 square mile radius of a project triggers greater review for habitat loss for this endangered species. Although the specific details of the proposed project at this location are unknown, it is located in an extensively forested environment with approximately 1850 acres of forest within a 1 mile radius. The Project would require more than 18.5 acres of clearing before reaching the 1% threshold triggering MYSE related restrictions or further review.

The study area was reviewed for the presence of trees that may provide potential summer roost habitat for MYSE. Thirteen trees with features that could support MYSE roosting were documented within the study area during the field investigation. Although project clearing is unlikely to trigger

MYSE related restrictions or further review, the preservation of these potential roost trees would help insure avoidance of any impacts to MYSE.

No other RTE animal species are documented nearby or are expected to be impacted by the proposed project.

V. Non-Native Invasive Species (NNIS)

A non-native invasive plant species is considered to be a species which has become established outside of its native range and grows aggressively enough to threaten native ecological communities. For the purposes of this study, a NNIS plant is any species listed as a Class A or Class B noxious weed by the Vermont Noxious Weed Quarantine Rule or a plant on the Vermont Invasive Exotic Plant Committee Watch List. An inventory for non-native invasive plant species was conducted on September 16, 2019. No NNIS plant species were documented during the inventory of the study area.

VI. Streams

The stream assessment involved both a remote review of the USGS topographic map, Vermont Hydrography Dataset (streams, rivers, and waterbodies), LiDAR derived elevation data, and field investigation on September 16, 2019. One stream was mapped in the study area and is summarized below. A stream data form is provided in Appendix 4.

Unnamed Tributary to North Branch Winooski River: The project structure (Culvert 90) crosses an unnamed tributary stream to North Branch Winooski River. The perennial stream is a step pool system with estimated bankfull depth of 25'-30' and boulder, cobble and coarse gravel substrate. The tributary's confluence with the North Branch is approximately 380' to the north of the crossing. The undersized culvert has a perched outlet and there is a scour pool present.

VII. Wildlife Habitat and Habitat Connectivity

The wildlife habitat assessment involved both a remote review of available digital maps for the study area and a field inventory component. A remote review of available digital databases was

conducted to identify potentially necessary wildlife habitat within the study area and within the vicinity of the study area.

There are no mapped Vt. Fish and Wildlife deer winter habitats in the study area and field investigation confirmed the absence of deer wintering areas or significant deer activity within the study area. A moose crossing road sign has been installed to the south of Culvert 90. No sign of moose activity was noted, however numerous moose collisions have been documented in the vicinity of the study area.

Vt. Fish and Wildlife identifies the study area as a Highest Priority wildlife crossing and Highest Priority surface water and riparian area in the Vt. Conservation Design Community and Species Scale Components. The forest surrounding the study area is largely unfragmented with varying cover types and large areas of protected land in the adjacent Putnam State Forest. The roadway cuts tightly through the surrounding forest with some elevation changes between road edge and forest, but no significant barriers to habitat connectivity. The current structure is significantly undersized and perched at the outlet and does not provide a natural bed substrate supportive of organism passage. The structure may provide enough dry edge to be used during low flows by wildlife passing under the road, but the scour pool and drop at the outlet creates an obstruction to movement. Structure design should consider the passage requirements of both aquatic and terrestrial species moving east/west within the riparian corridor.

The presence of historically documented wildlife activity in or near the study area indicates an increased likelihood of an active wildlife corridor in the area. While large megafauna like moose are important on the Vermont landscape, particularly in this region, their proximity to traveled roads causes conflicts resulting in risk to the traveling public and moose alike. Depending on the project scope, design elements to enhance driver visibility and encourage caution while still providing opportunities for moose and other wildlife to pass from one side of the road to the other may be in order. Such elements should be explored in partnership with Vt. Department of Fish and Wildlife.

Concentrated amphibian crossing areas occur when different amphibian habitat features are separated from each other by roads. Typical habitat features include wetland/vernal pool breeding

habitats and upland habitats, or, in some cases, different wetland feeding habitats. Movement typically occurs on warm rainy nights in the spring and early summer. Depending on surrounding land-use and the position of the different habitat features, this amphibian movement can be concentrated and involve hundreds or thousands of individuals. When this concentrated movement occurs across a busy road, mass mortality of amphibians can occur. While minor amphibian movement can occur scattered across the landscape, this movement rarely results in mass amphibian mortality or traffic difficulties. For this reason, it is the concentrated amphibian crossing areas that are of a concern.

There are no wetlands or vernal pools in the project study area or vicinity that would likely result in concentrated amphibian crossing areas.

Stream salamanders are likely present in the study area along the tributary stream to the North Branch. Based on the habitats present, these species likely include spring salamanders (*Gyrinophilus porphyriticus*), northern dusky salamanders (*Desmognathus fuscus*) and northern two-lined salamanders (*Eurycea bislineata*). For these species only limited movement occurs outside of the stream corridor and mass migrations do not occur. Since these species rarely cross roads, they do not pose a management concern as concentrated amphibian crossing areas. However, since they do migrate within the stream corridor, management for these species at road crossings is best achieved by adhering to the AOP Guidelines for culvert and bridge construction.

VIII. Agricultural Soils

The agricultural soils assessment involved a remote review of the NRCS County Soil Survey for the Project area. Primary agricultural soils were identified throughout the Project area and presented on the Resource Map in Appendix 2. Primary soil types present include Tunbridge-Lyman fine sandy loam (Statewide).

Appendix 1

Photo Log



Culvert 90 Inlet
September 16, 2019



Culvert 90 Outlet
September 16, 2019



Moose Crossing Sign South of
Culvert 90
September 16, 2019



Potential Bat Roost Tree
September 16, 2019

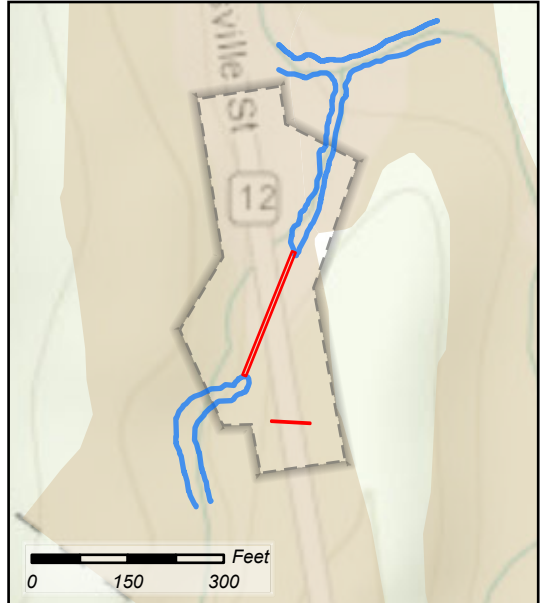
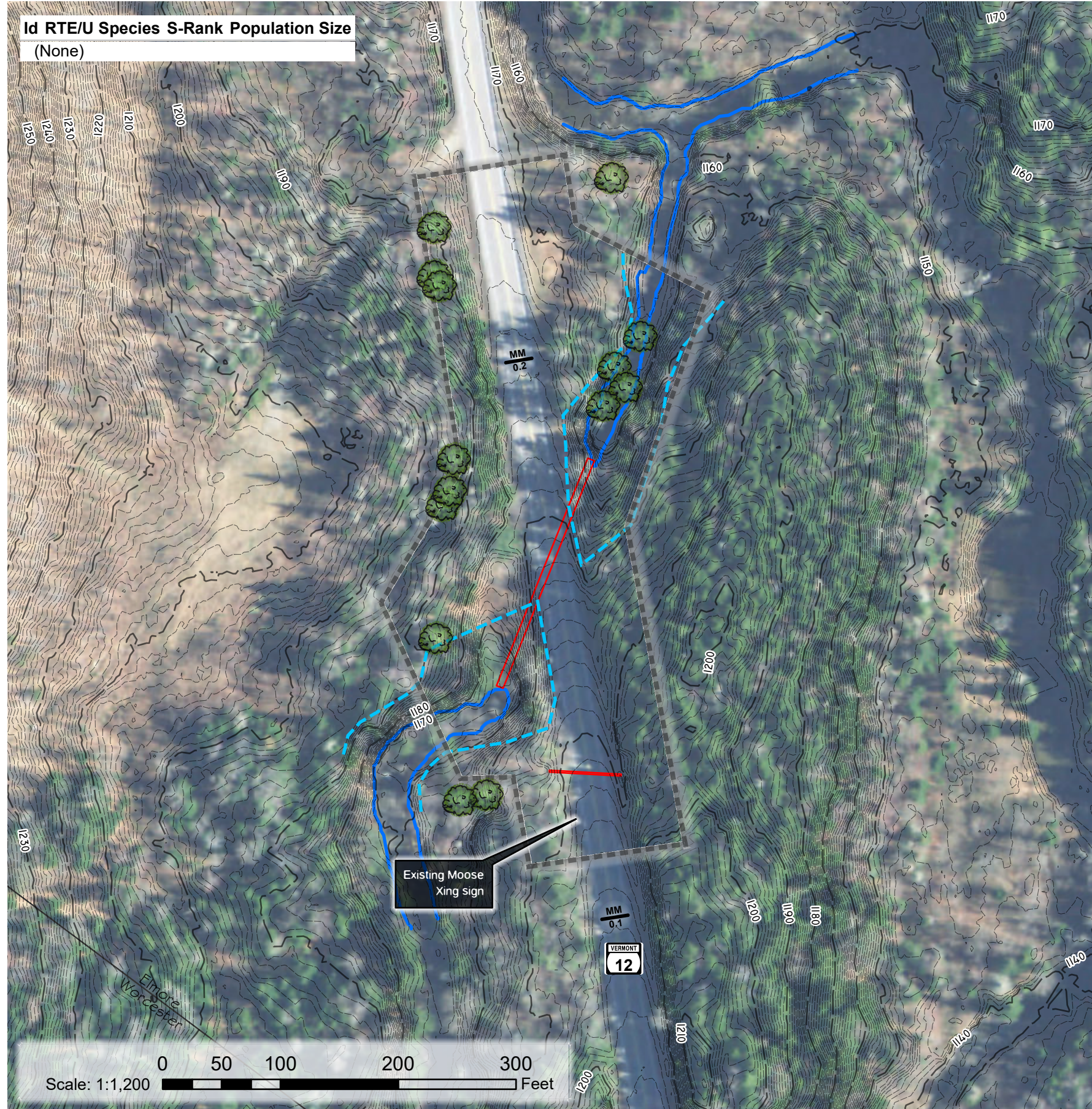


Unnamed Tributary Downstream
of Culvert 90
September 16, 2019

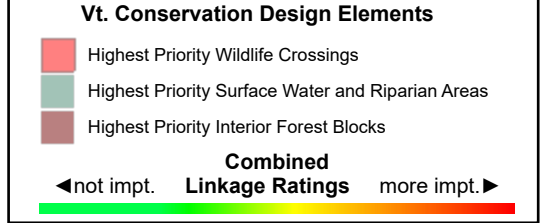
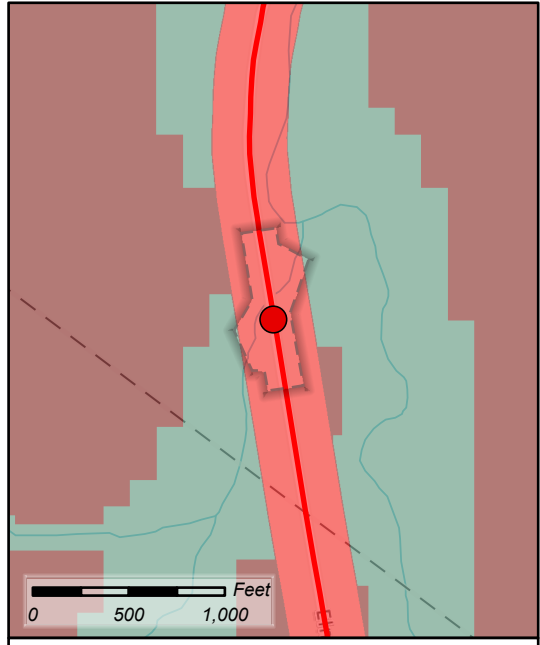
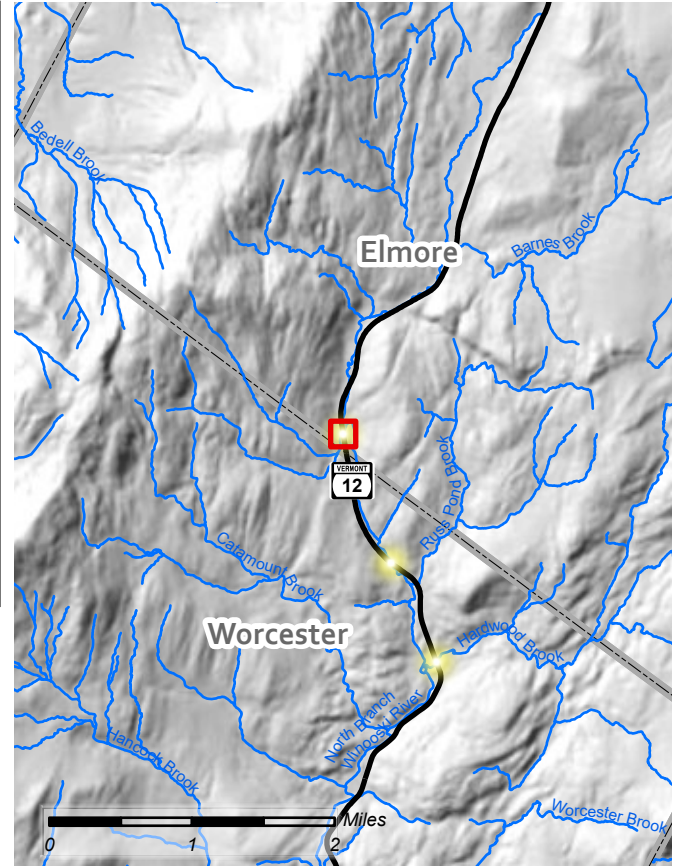
Appendix 2

Resource Map

Id RTE/U Species S-Rank Population Size
(None)



Non-native Invasive Species (NNIS) ●
Prime Ag Soils: ■ **Statewide Ag Soils:** ■
NNIS Populations at this Site
 NNIS ID Species
 (None)



- Mile Markers (VCGI)
- ▭ Study Area
- ▭ Structures
- ▭ Wetlands
- Stream or Edge of Water
- - - Stream Top-of-Bank
- ▭ RTE Plant: S1
- ▭ Uncommon Plant: S3
- Potential Bat Tree

NOTES: INFORMATION PROVIDED BASED ON REMOTE AND FIELD ASSESSMENT BY ARROWWOOD ENVIRONMENTAL, 2019. WETLANDS FIELD DELINEATED, FLAGGED AND FLAGS LOCATED WITH SUB-METER GRADE GPS BY ARROWWOOD ENVIRONMENTAL. STREAMS, TOP-OF BANK, PLANT POPULATIONS, WILDLIFE FEATURES, AND STRUCTURE LOCATIONS FROM SUB-METER GRADE GPS, FIELDNOTES, AND ANALYSIS OF AERIAL IMAGERY AND HIGH-RESOLUTION LIDAR TOPOGRAPHIC DATA.

OTHER DATA FROM VCGI, VT AGENCY OF NATURAL RESOURCES. CONTOUR INTERVAL 1' DERIVED FROM LIDAR-BASED ELEVATION MODELS PROVIDED BY VCGI. MILE MARKERS FROM VCGI LAYER TITLED: "VT_MILE_POINTS_110MILE". BACKGROUND IMAGERY- VCGI 2018.



Appendix 3

Plant Species List

**Rare, Threatened and Endangered Plant Inventory**

Report Date: 10/15/2019

Project Name Vtrans Elmore STP CULV (64)

Botanist Michael Lew-Smith

Survey Date 9/16/2019

Description

Plant List

**note: plants with no listed S-Ranks are considered common in Vermont.*

Plant Name	Common Name	S-Rank*	T/E	Plant Family
<i>Maianthemum canadense</i>	Canada mayflower			Amaryllidaceae
<i>Daucus carota</i>	Queen Anne's lace			Apiaceae
<i>Apocynum cannabinum</i>	Indian hemp			Apocynaceae
<i>Arisaema triphyllum</i>	Jack-in-the-pulpit			Araceae
<i>Aralia nudicaulis</i>	wild sarsaparilla			Araliaceae
<i>Ambrosia artemisiifolia</i>	common ragweed			Asteraceae
<i>Cichorium intybus</i>	chicory			Asteraceae
<i>Doellingeria umbellata</i>	tall white aster			Asteraceae
<i>Erigeron annuus</i>	white daisy-fleabane			Asteraceae
<i>Erigeron canadensis</i>	horseweed			Asteraceae
<i>Euthamia graminifolia</i>	grass-leaved goldenrod			Asteraceae
<i>Leucanthemum vulgare</i>	common daisy			Asteraceae
<i>Pilosella aurantiaca</i>	orange hawkweed			Asteraceae
<i>Pilosella piloselloides</i>	glaucous king-devil			Asteraceae
<i>Pseudognaphalium obtusifolium</i>	common everlasting			Asteraceae
<i>Rudbeckia hirta</i>	black-eyed Susan			Asteraceae
<i>Solidago flexicaulis</i>	zig-zag goldenrod			Asteraceae
<i>Solidago gigantea</i>	large goldenrod			Asteraceae
<i>Solidago rugosa</i>	rough-leaved goldenrod			Asteraceae
<i>Sonchus arvensis</i>	sow thistle			Asteraceae
<i>Symphyotrichum lateriflorum</i>	calico aster			Asteraceae
<i>Symphyotrichum puniceum</i>	red-stemmed aster			Asteraceae
<i>Taraxacum officinale</i>	common dandelion			Asteraceae
<i>Tussilago farfara</i>	colt's-foot			Asteraceae
<i>Athyrium filix-femina</i>	lady fern			Athyriaceae
<i>Impatiens capensis</i>	common jewelweed			Balsaminaceae
<i>Alnus incana</i>	gray alder			Betulaceae
<i>Betula alleghaniensis</i>	yellow birch			Betulaceae
<i>Corylus cornuta</i>	beaked hazelnut			Betulaceae



Rare, Threatened and Endangered Plant Inventory

Report Date: 10/15/2019

Plant Name	Common Name	S-Rank*	T/E	Plant Family
<i>Silene vulgaris</i>	common bladder campion			Caryophyllaceae
<i>Convolvulus arvensis</i>	field bindweed			Convolvulaceae
<i>Cornus alternifolia</i>	alternate-leaved dogwood			Cornaceae
<i>Carex gracillima</i>	slender sedge			Cyperaceae
<i>Carex gynandra</i>	gynandrous sedge			Cyperaceae
<i>Carex scoparia</i>	broom sedge			Cyperaceae
<i>Carex cf torta</i>	twisted sedge			Cyperaceae
<i>Gymnocarpium dryopteris</i>	oak fern			Cystopteridaceae
<i>Pteridium aquilinum</i>	bracken			Dennstaedtiaceae
<i>Dryopteris carthusiana</i>	spinulose woodfern			Dryopteridaceae
<i>Dryopteris intermedia</i>	intermediate woodfern			Dryopteridaceae
<i>Polystichum braunii</i>	Braun's holly fern			Dryopteridaceae
<i>Vaccinium angustifolium</i>	low sweet blueberry			Ericaceae
<i>Lathyrus sylvestris</i>	flat pea			Fabaceae
<i>Medicago lupulina</i>	black medick			Fabaceae
<i>Trifolium arvense</i>	rabbit's-foot clover			Fabaceae
<i>Fagus grandifolia</i>	American beech			Fagaceae
<i>Hypericum cf boreale</i>	northern St. John's-wort			Hypericaceae
<i>Hypericum canadense</i>	Canada St. John's-wort			Hypericaceae
<i>Juncus tenuis</i>	path rush			Juncaceae
<i>Galeopsis tetrahit</i>	dead hemp-nettle			Lamiaceae
<i>Prunella vulgaris</i>	self-heal			Lamiaceae
<i>Tilia americana</i>	basswood			Malvaceae
<i>Trillium erectum</i>	red trillium			Melanthiaceae
<i>Fraxinus americana</i>	white ash			Oleaceae
<i>Circaea alpina</i>	dwarf enchanter's nightshade			Onagraceae
<i>Epilobium coloratum</i>	cinnamon willow-herb			Onagraceae
<i>Oenothera biennis</i>	common evening primrose			Onagraceae
<i>Onoclea sensibilis</i>	sensitive fern			Onocleaceae
<i>Epipactis helleborine</i>	helleborine			Orchidaceae
<i>Osmunda claytoniana</i>	interrupted fern			Osmundaceae
<i>Oxalis montana</i>	wood-sorrel			Oxalidaceae
<i>Oxalis stricta</i>	tall yellow wood-sorrel			Oxalidaceae
<i>Abies balsamea</i>	balsam fir			Pinaceae
<i>Picea rubens</i>	red spruce			Pinaceae



Rare, Threatened and Endangered Plant Inventory

Report Date: 10/15/2019

Plant Name	Common Name	S-Rank*	T/E	Plant Family
<i>Plantago lanceolata</i>	buckhorn plantain			Plantaginaceae
<i>Plantago major</i>	plantain			Plantaginaceae
<i>Veronica officinalis</i>	common speedwell			Plantaginaceae
<i>Agrostis capillaris</i>	colonial bent			Poaceae
<i>Agrostis gigantea</i>	red-top			Poaceae
<i>Agrostis perennans</i>	autumn bent			Poaceae
<i>Anthoxanthum odoratum</i>	sweet vernal grass			Poaceae
<i>Brachelytrum aristosum</i>	bearded shorthusk			Poaceae
<i>Dactylis glomerata</i>	orchard grass			Poaceae
<i>Danthonia compressa</i>	flat-stemmed oat-grass			Poaceae
<i>Digitaria ischaemum</i>	smooth crabgrass			Poaceae
<i>Elymus repens</i>	witch grass			Poaceae
<i>Glyceria striata</i>	fowl manna grass			Poaceae
<i>Oryzopsis asperifolia</i>	mountain rice-grass			Poaceae
<i>Panicum capillare</i>	old witch-grass			Poaceae
<i>Panicum dichotomiflorum</i>	smooth witch grass			Poaceae
<i>Poa annua</i>	annual bluegrass			Poaceae
<i>Poa pratensis</i>	Kentucky bluegrass			Poaceae
<i>Poa trivialis</i>	rough bluegrass			Poaceae
<i>Schedonorus pratensis</i>	meadow fescue			Poaceae
<i>Lysimachia borealis</i>	starflower			Primulaceae
<i>Lysimachia nummularia</i>	moneywort			Primulaceae
<i>Ranunculus acris</i>	common buttercup			Ranunculaceae
<i>Ranunculus recurvatus</i>	hooked crowfoot			Ranunculaceae
<i>Ranunculus repens</i>	creeping buttercup			Ranunculaceae
<i>Thalictrum pubescens</i>	tall meadow-rue			Ranunculaceae
<i>Agrimonia striata</i>	roadside agrimony			Rosaceae
<i>Amelanchier sp.</i>	shadbush			Rosaceae
<i>Fragaria vesca</i>	wood strawberry			Rosaceae
<i>Geum canadense</i>	white avens			Rosaceae
<i>Geum sp.</i>	avens			Rosaceae
<i>Malus pumila</i>	wild apple			Rosaceae
<i>Potentilla simplex</i>	old-field cinquefoil			Rosaceae
<i>Prunus serotina</i>	black cherry			Rosaceae
<i>Prunus virginiana</i>	choke cherry			Rosaceae

**Rare, Threatened and Endangered Plant Inventory**

Report Date: 10/15/2019

Plant Name	Common Name	S-Rank*	T/E	Plant Family
<i>Rubus allegheniensis</i>	common highbush blackberry			Rosaceae
<i>Rubus idaeus</i>	red raspberry			Rosaceae
<i>Rubus pubescens</i>	dwarf raspberry			Rosaceae
<i>Spiraea alba</i>	meadowsweet			Rosaceae
<i>Galium mollugo</i>	common bedstraw			Rubiaceae
<i>Galium tinctorium</i>	southern three-lobed bedstraw			Rubiaceae
<i>Populus balsamifera</i>	balsam poplar			Salicaceae
<i>Populus tremuloides</i>	quaking aspen			Salicaceae
<i>Salix eriocephala</i>	wand willow			Salicaceae
<i>Acer pensylvanicum</i>	striped maple			Sapindaceae
<i>Acer rubrum</i>	red maple			Sapindaceae
<i>Acer saccharum</i>	sugar maple			Sapindaceae
<i>Acer spicatum</i>	mountain maple			Sapindaceae
<i>Chrysosplenium americanum</i>	water carpet			Saxifragaceae
<i>Tiarella cordifolia</i>	foam flower			Saxifragaceae
<i>Parathelypteris noveboracensis</i>	New York fern			Thelypteridaceae
<i>Phegopteris connectilis</i>	long beech fern			Thelypteridaceae
<i>Ulmus americana</i>	American elm			Ulmaceae
<i>Parthenocissus quinquefolia</i>	woodbine			Vitaceae

Appendix 4

Stream Summary Forms



ARROWWOOD ENVIRONMENTAL
 950 BERT WHITE ROAD
 HUNTINGTON, VT 05462
 (802) 434-7276 FAX: (802) 329-2259



Streams: Existing Condition Summary

October 18, 2019

Project: Elmore STP CULV (64)

Stream ID:	Unnamed Tributary to North Branch Winooski River		
Date(s) Observed:	9/16/19		
Survey Type:	Rapid		
Field Observations			
Observation Location:	LAT	44.45113	LONG -72.546847
Stream Type (typical):	Cascade <input type="checkbox"/> Step-Pool <input checked="" type="checkbox"/> Riffle-pool <input type="checkbox"/> Plane Bed <input type="checkbox"/> Ripple-dune <input type="checkbox"/> Braided <input type="checkbox"/>		
Dominant Sediment Size:	Bedrock <input type="checkbox"/> Boulder <input checked="" type="checkbox"/> Cobble <input checked="" type="checkbox"/> C-Gravel <input checked="" type="checkbox"/> F-Gravel <input type="checkbox"/> Silt/Sand <input type="checkbox"/>		
Average Bankfull Width:	Estimated <input checked="" type="checkbox"/> Measured <input type="checkbox"/>	~25' to 30'	
Flow Conditions:	Flowing <input checked="" type="checkbox"/> Pools <input type="checkbox"/> Damp <input type="checkbox"/> Dry <input type="checkbox"/> Prelim* <input type="checkbox"/> Perennial <input checked="" type="checkbox"/> Intermittent <input type="checkbox"/>		
Slope/Confinement:	Not measured		
Field Comments:	Confluence with North Branch is approximately 380ft to the north of the project area. The undersized culvert has a perched outlet and there is a scour pool present.		
Other Data			
Watershed Size:	~2 square miles (ANR Atlas)		
Approx. Elevation:	~1000ft		

**preliminary assessment of flow regime based on field observations and professional judgement*

Photos	
 <p>Looking upstream of culvert</p>	 <p>Downstream looking upstream to perched culvert outlet</p>
Photo Date: 9/16/19	Photo Date: 9/16/19



LEGEND

- DFIRM X-Sections
- DFIRM - Letter of Map Revisio
- DFIRM Panels
- DFIRM Floodways
- Flood Hazard Areas (Only FEM)
 - AE (1-percent annual chance flood)
 - 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.
- Roads
 - Interstate
 - Principal Arterial
 - Minor Arterial
 - Major Collector
 - Minor Collector
 - Local
 - Not part of function Classification S
- Waterbody
- Stream
- Town Boundary

1: 5,379
August 21, 2019



273.0 0 136.00 273.0 Meters
 WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 448 Ft. 1cm = 54 Meters
 © Vermont Agency of Natural Resources THIS MAP IS NOT TO BE USED FOR NAVIGATION

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

NOTES

Map created using ANR's Natural Resources Atlas



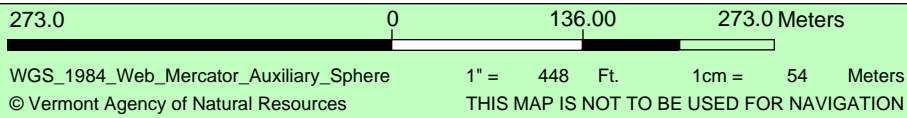
LEGEND

- Landfills**
 - OPERATING
 - CLOSED
- Land Use Restrictions**
 - Class IV GW Reclass
 - Class VI GW Reclass
 - Deed Restriction
 - Easement
 - Land Record Notice
 - Other
- Hazardous Site
- Hazardous Waste Generators
- Brownfields
- Salvage Yard
- Aboveground Storage Tank
- Underground Storage Tank (w/)
- Dry Cleaner
- Urban Soil Background Areas
- Roads**
 - Interstate
 - Principal Arterial
 - Minor Arterial
 - Major Collector
 - Minor Collector
 - Local
 - Not part of function Classification S
- Waterbody

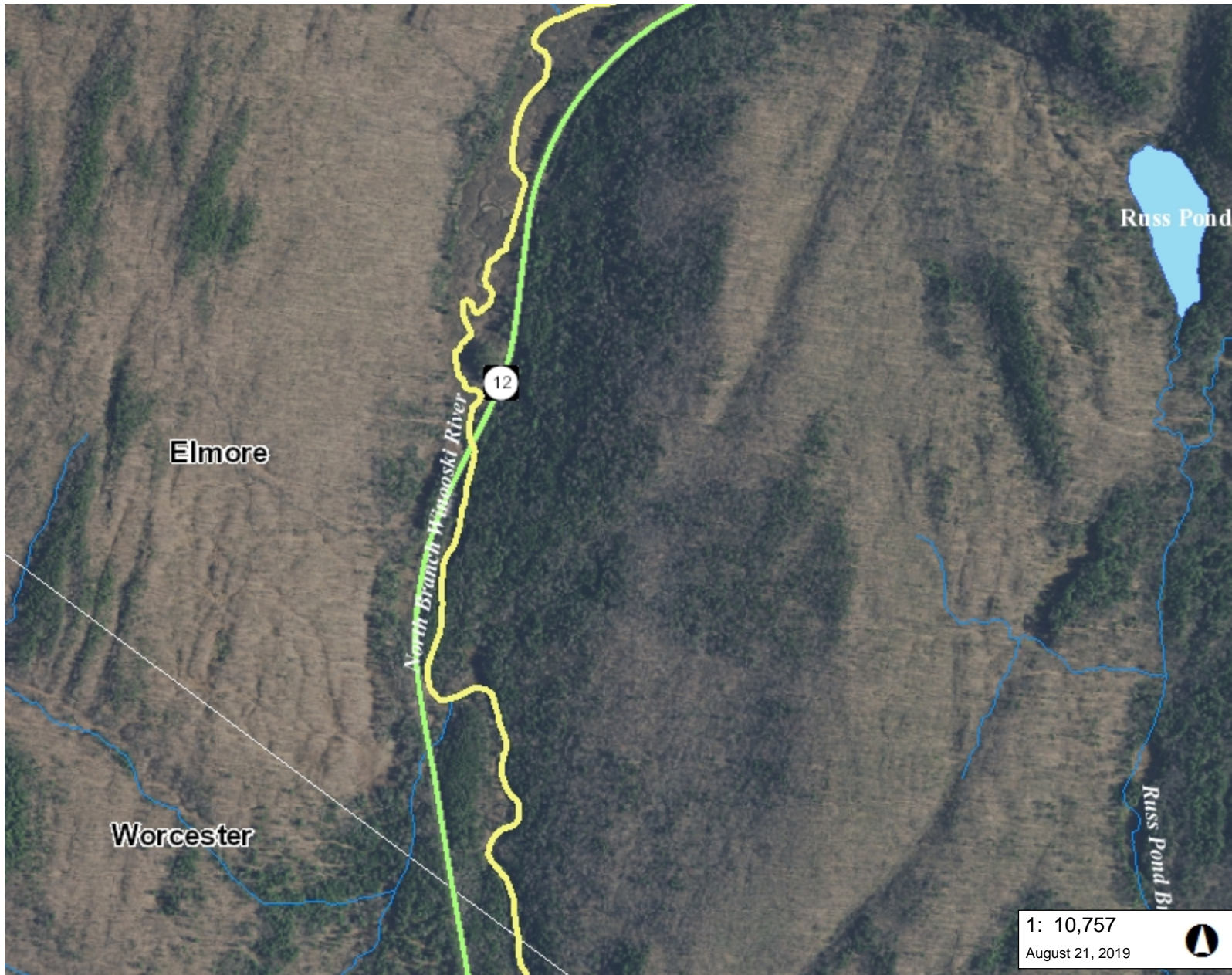
1: 5,379
August 21, 2019

NOTES

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LEGEND

- 303(d) List of Impaired Stream
- Designated ORW (Streams an
- Prospective ORW (Streams an
- Prospective ORW (Lakes and
- Green Mountain National Fore
- Act250 Permits **INCOMPLET

Roads

- Interstate
- Principal Arterial
- Minor Arterial
- Major Collector
- Minor Collector
- Local
- Not part of function Classification S

- Waterbody
- Stream
- Town Boundary

1: 10,757
August 21, 2019

546.0 0 273.00 546.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 896 Ft. 1cm = 108 Meters

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NOTES

Map created using ANR's Natural Resources Atlas



1: 5,379
August 21, 2019

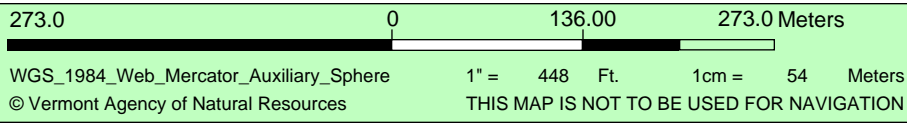


LEGEND

- Private Wells**
 - Incorrectly Located
 - GPS Located
 - Screen Digitized
 - E911 Address Matched
 - Welldriller/Clarion
 - Unknown Location Method
- Public Water Sources**
 - Active
 - Proposed
 - Inactive
- Surface Water SPA**
 - Active
 - Inactive
- Ground Water SPA**
 - Active
 - Proposed
 - Inactive
- Roads**
 - Interstate
 - Principal Arterial
 - Minor Arterial
 - Major Collector
 - Minor Collector
 - Local
 - Not part of function Classification S
- Waterbody**
 -

NOTES

Map created using ANR's Natural Resources Atlas



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Appendix H: Archeology Memo

Jeannine Russell
VTrans Archaeology Officer
State of Vermont
Environmental Section
One National Life Drive
Montpelier, VT 05633-5001
802-477-3460 phone
Jeannine.russell@vermont.gov

Agency of Transportation

To: Jeff Ramsey, Environmental Specialist Supervisor

From: Jeannine Russell, VTrans Archaeology Officer via Timothy Quesnell, Archaeology Technical Apprentice II

Date: September 20, 2019

Subject: Elmore STP CULV(64) – Archaeological Resource ID

VTrans proposes a culvert replacement project in the town of Elmore located along VT Route 12. The project boundaries are not yet defined for the proposed project. A circle with the culvert sitting at the center has been used for a stand in project area on the map provided. The culvert in question is located 0.15 miles north of the Elmore-Worcester town border.

Route 12 runs north/south through a forested area, while a stream runs northeastward underneath the road and through the culvert. The stream exits into the north branch of the Winooski River. The lowest elevation of the project area is 1200ft. To the west of the road lies a small forested plateau, followed by steep forested slopes. To the east of the road sits a small steep ridge. There are no known archaeology sites within a mile of the culvert.

The VTrans Archaeology Officer and Archaeology Technician conducted background research and a desk review. This included a review of information available on the Online Resource Center (ORC), the Agency of Natural Resources interactive map and the VDHP environmental sensitivity predictive model. Using the parameters given by the model, the project interacting with an intermittent stream, in addition to its proximity to nearby wetlands (45m away), and stream/river confluence (88m away) would give the location a score of 32. However, by accounting for the excessive slope in the project area, the total score negates to 0.

Figure 2: ARA Map

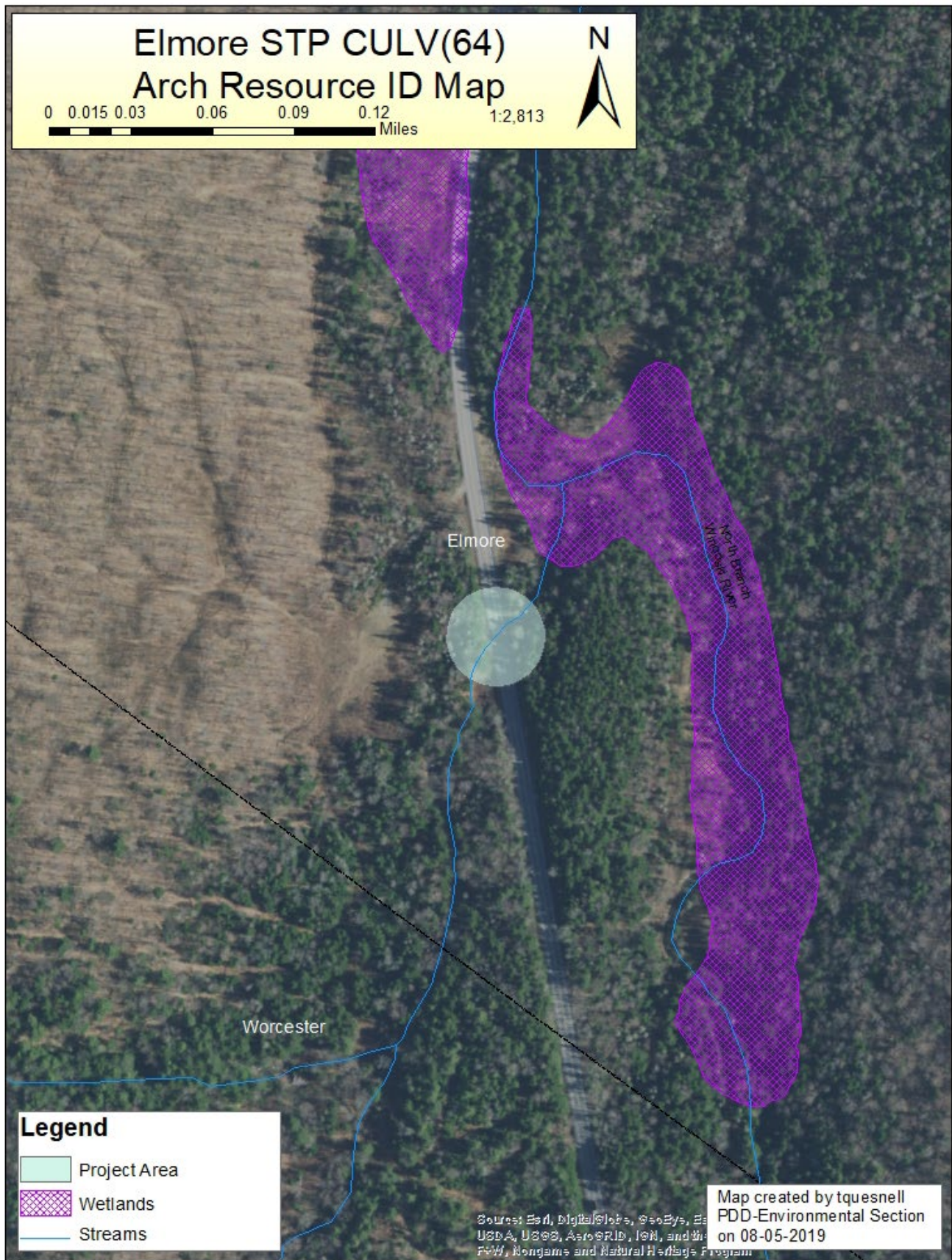


Figure 3: Aerial image using Google Earth



Figure 4: View from the road facing east



Figure 5: View from the road facing north



Figure 6: View from the road facing south



Figure 7: View from the road facing west



Appendix I: Historic Memo

State of Vermont

Agency of Transportation

Gabrielle Fernandez
AOT Technical Apprentice IV
Gabrielle.Fernandez@vermont.gov
(802) 793-3738

Project Delivery Bureau - Environmental Section
One National Life Drive
Montpelier, VT 05633-5001
vtrans.vermont.gov

Historic Resources Identification Memo

To: Jeff Ramsey, AOT Environmental Specialist
CC: Jeannine Russell, AOT Archaeology Officer
Reviewer: Judith Ehrlich, AOT Historic Preservation Officer

Date: November 13, 2019

Subject: Elmore STP CULV(64) 18B003

Hello Jeff,

I have completed the Resource Identification for Elmore STP CULV(64). At this time, one resource over fifty years of age was identified within the possible project area: culvert 90 in Elmore. One 4(f) resource was identified: the CC Putnam State Forest, which lies on the northeastern side of VT-12 within the survey area.

This Resource Identification effort is being undertaken to provide information to the VTrans designers working on a proposed improvement project. Toward that end, VTrans Cultural Resources staff have identified potential resources within a broad preliminary Area of Potential Effect to ensure the designers are aware of all cultural resources that could possibly be affected by a project. Once the project is defined at the Conceptual Design phase, Cultural Resources staff will be able to determine a formal Area of Potential Effect for purposes of Section 106 and 22 VSA § 14.

This Resource ID is being undertaken to identify cultural resources within a survey area that could possibly be impacted by a VTrans project on culvert 90 in Elmore (Figure 1). Once the project has been formally developed at the Conceptual Design phase, VTrans Cultural Resources staff will be able to determine a formal Area of Potential Effect for purposes of Section 106 and Section 4(f) responsibilities.

Culvert 90 is a metal culvert over a small brook on VT 12 in Elmore, adjacent to the 4(f) resource, the CC Putnam State Forest. Built in 1964, this culvert meets the 50-year criteria for eligibility for the National Register (Figure 2). However, because of the condition of the culvert and the fact that it displays common materials, design, and construction, VTrans has determined that is not historic as it

does not possess any qualities of significance necessary for inclusion in the National Register of Historic Places individually or as a contributing resource to an existing or potential historic district under any applicable evaluation criteria.

As noted above, the CC Putnam State Forest is a 4(f) resource. Provided all project work is completed within the state-owned right-of-way, a Section 4(f) review will not be needed for the project.

Please do not hesitate to contact me should you have any questions.

Attachments:

- Map
- Photos

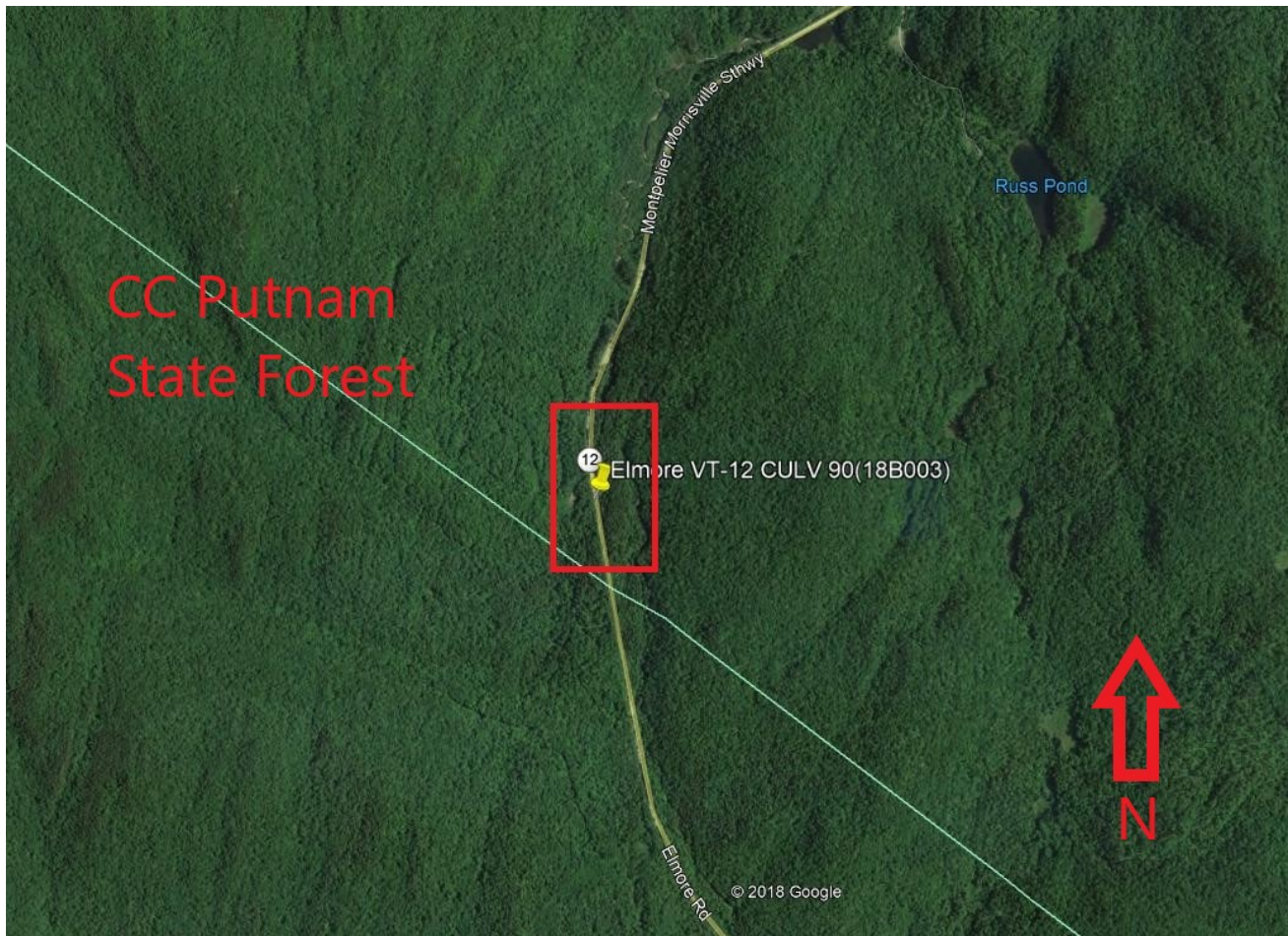


Figure 1: Google Earth view of the approximate survey area for Elmore STP CULV(64).



Figure 2: Culvert 90 in Elmore on VT-12.



Figure 3: Google Earth view of culvert 90 and the survey area.

Appendix J: Community Input

Local & Regional Input Questionnaire

Project Summary

This project, STP CULV(64), focuses on **culvert 90 on VT Route 12 in Elmore, Vermont**. The culvert is deteriorating and is in need of either a major maintenance action or replacement. Potential options being considered for this project include a new liner applied to the interior of the existing culvert pipe, removal of the existing pipe and replacement with a new culvert placed in the same location, or removal of the existing pipe and replacement in a new location. It is possible that VTrans will recommend a road closure and detour traffic away from the project site for the duration of the work. Efforts will be made to limit the detour to State roads.

Community Considerations

1. Are there regularly 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 culvert is closed during construction? Examples include annual bike races, festivals, parades, cultural events, weekly farmers market, concerts, etc. that could be impacted? If yes, please provide approximate date, location and event organizers' contact info.
No regular events. Bike Tours and ad hoc groups can be expected during spring, summer and autumn. This culvert, located on the town/county boundary between Elmore, Lamoille Cty and Worcester, Washington Cty is in a remote wilderness area where radio and cell coverage is erratic to unavailable. Expect wildlife.
2. Is there a "slow season" or period of time from May through October where traffic is less or no events are scheduled? **No predictable slow season exists. VT Route 12 is the single major commercial route between Montpelier, Elmore and Morristown. Expect high volumes of AM and PM commuter plus steady commercial traffic.**
3. Please describe the location of the Town garage, emergency responders (fire, police, ambulance) and emergency response routes that might be affected by the closure of the culvert, one-way traffic, or lane closures and provide contact information (names, address, email addresses, and phone numbers). **NOT a FACTOR as both Worcester and Elmore facilities are 6+/- miles distance N & S.**
4. Are there businesses (including agricultural operations and industrial parks) or delivery services (fuel or goods) that would be adversely impacted either by a detour or due to work zone proximity? **No major business or industrial areas. No detours are available. Expect transient gravel, log, delivery and tradesman trucks.**
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? **Not applicable.**
6. What other municipal operations could be adversely affected by a road/culvert closure or detour? **No adverse operations affect. No detour available.**

Local & Regional Input Questionnaire

7. Are there any town highways that might be adversely impacted by traffic bypassing the construction on other local roads? Please indicate which roads may be affected and their condition (paved/unpaved, narrow, weight-limited structures, etc), including those that may be or go into other towns. **No. There are no direct alternatives to this route between Morrisville and Montpelier.**
8. Is there a local business association, chamber of commerce, regional development corporation, or other downtown group that we should be working with? If known, please provide name, organization, email, and phone number. **NO**
9. Are there any public transit services or stops that use the culvert or transit routes in the vicinity that may be affected if they become the detour route? **NO**

Schools Where are the schools in your community and what are their yearly schedules (example: first week in September to third week in June)? **Not a factor**

1. Is this project on specific routes that school buses or students use to walk to and from school? **NO**
2. Are there recreational facilities associated with the schools nearby (other than at the school)? **NO**

Pedestrians and Bicyclists

1. What is the current level of bicycle and pedestrian use on the culvert? **Steady individual and occasional group bicycle traffic, Scant Pedestrian traffic. Occasional roller skiers.**
2. Are the current lane and shoulder widths adequate for pedestrian and bicycle use? **YES**
3. Does the community feel there is a need for a sidewalk or bike lane on the culvert? **NO**
4. Is pedestrian and bicycle traffic heavy enough that it should be accommodated during construction? **YES**
5. Does the Town have plans to construct either pedestrian or bicycle facilities leading up to the culvert? Please provide any planning documents demonstrating this (scoping study, master plan, corridor study, town or regional plan). **NO**
6. In the vicinity of the culvert, 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 much of the forest is conserved or privately held.**

Design Considerations

1. Are there any concerns with the alignment of the existing culvert? For example, if the culvert is located on a curve, has this created any problems that we should be aware of? **NO physical issues. Route 12 Speeding is endemic.**
2. Are there any concerns with the width of the existing culvert? **NO**

Local & Regional Input Questionnaire

3. Are there any special aesthetic considerations we should be aware of? **NO man made or geologic rarities. Area is in significant regional wildlife corridor.**
4. Does the location have a history of flooding? If yes, please explain. **NO. No flooding observed at peak water during Halloween Storm 2019.**
5. Are there any known Hazardous Material Sites near the project site? **NO. Long Rumored abandoned Franz Kroznik mine over 200 years ago.**
6. Are there any known historic, archeological and/or other environmental resource issues near the project site? **NO. No known AER survey conducted.**
7. Are there any utilities (water, sewer, communications, power) attached to the existing culvert? Please provide any available documentation. **NO. Occasional vagrant utilization reported.**
8. Are there any existing, pending, or planned municipal utility projects (communications, lighting, drainage, water, wastewater, etc.) near the project that should be considered? **NO**
9. Are there any other issues that are important for us to understand and consider? **NO**

Land Use & Zoning

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

1. Are there any existing, pending or planned development proposal that would impact future transportation patterns near the culvert? If so, please explain. **NO**
2. Is there any planned expansion of public transit or intercity transit service in the project area? Please provide the name and contact information for the relevant public transit provider. **NO**

Communications

1. Please identify any local communication outlets that are available for us to use in communicating with the local population. Include weekly or daily newspapers, blogs, radio, public access TV, Facebook, Front Page Forum, etc. Also include any unconventional means such as local low-power FM. **WDEV, WSKI, Times Argus, News & Citizen, FPF**
2. Other than people/organizations already referenced in this questionnaire, are there any others who should be kept in the loop as the project moves forward? **NO**

Appendix K: Operations Input

Culvert Scoping Project STP CULV(64) Operations Input Questionnaire

The Structures Section has begun the scoping process for STP CULV(64), VT Route 12, Culvert 90, in the town of Elmore, over an unnamed brook. This is a culvert constructed in 1964. The Structure Inspection, Inventory, and Appraisal Sheet (attached) rates the culvert as a 3 (Serious), and the channel as a 4 (poor). 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. What are your thoughts on the general condition of this culvert and the general maintenance effort required to keep it in service?
Poor should be replaced hasn't posed any maintenance problems yet
2. What are your comments on the current geometry and alignment of the road over the culvert (curve, sag, banking, sight distance)?
Good
3. Do you feel that the posted speed limit is appropriate?
Yes
4. Is the current roadway width adequate for winter maintenance including snow plowing?
Its adequate but an extra couple of feet on the west side would improve plowing and salt efficiency
5. Is the guardrail constantly in need of repair or replacement? What type of railing works best for your district? (We are recommending more and more box beam guardrail on our culverts because of crash-worthiness and compatibility with accelerated projects).
No the current W beam works and is fairly new and in good condition
6. Are you aware of any unpermitted driveways within close proximity to the culvert? We frequently encounter driveways that prevent us from meeting railing and safety standards.
No but a new I believe to be a state nature trail is currently being built on the east end
7. 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.
The new nature trail that's currently being built and the surrounding area is a state park called the Worcester block
8. Do you find that extra effort is required to keep the slopes and river banks around the culvert in a stable condition? Is there frequent flood damage that requires repair?
The slope on the west end is steep and has minor washing but no large repairs in memory

Culvert Scoping Project STP CULV(64) Operations Input Questionnaire

9. Does this culvert seem to catch an unusual amount of debris from the waterway?
Yes mostly due to the shape of the stream bed and the amount of decayed wood that seems to come from that area

10. Are you familiar with traffic volumes in the area of this project?
Low

11. Do you think a closure with off-site detour and accelerated construction would be appropriate?
Do you have any opinion about a possible detour route, assuming that we use State route for State projects and any route for Town projects? Are there locations on a potential detour that are already congested that we should consider avoiding?
Yes I would recommend a short term full closer

12. Please describe any larger projects that you have completed that may not be reflected on the attached Appraisal sheet, such as railing replacement with new type, steel coating, etc.
None

13. Are there any drainage issues that we should address on this project?
No

14. Are you aware of any complaints that the public has about issues that we can address on this project?
No

15. Is there anything else we should be aware of?
State park "Worcester block" and the new nature trail

Appendix L: Crash Data

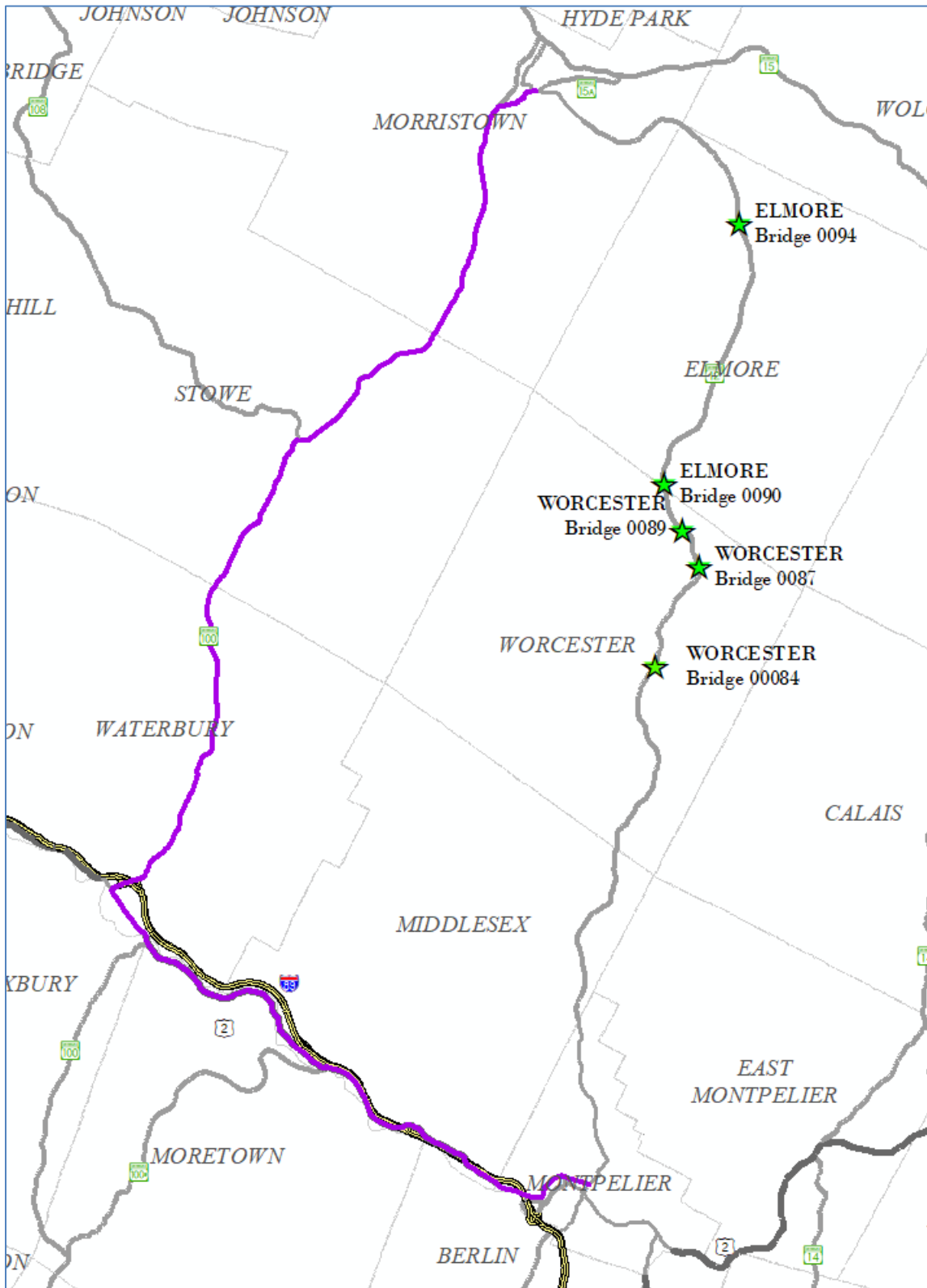
General Yearly Summaries - Crash Listing: State Highways and All Federal Aid Highway Systems

WHERE Year of Crash >= 2012 AND Year of Crash <= 2016

* 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
VTVSP1200/13A303188	Worcester	2.39	08/04/2013	12:43	Clear	Failed to yield right of way, No improper driving	Left Turn and Thru, Angle Broadside -->v--	1	0	0	N, S	SH Owned
VTVSP1200/16A304476	Worcester	2.68	10/18/2016	10:20	Clear	Driving too fast for conditions	Single Vehicle Crash	1	0	0	S	SH State Owned
VTVSP1200/15A305585	Worcester	2.87	11/19/2015	14:17	Rain	Fatigued, asleep, Failure to keep in proper lane	Single Vehicle Crash	0	0	0	S	SH
VTVSP1200/15A301256	Worcester	2.99	03/15/2015	11:45	[No Weather]		[No Direction of Collision]	0	0	0		SH
VTVSP1200/13A304653	Worcester	3.16	11/05/2013	07:19	Cloudy	Failure to keep in proper lane, Inattention	Single Vehicle Crash	0	0	0	S	SH
VTVSP1200/15A305109	Worcester	3.87	10/18/2015	20:07	[No Weather]		[No Direction of Collision]	0	0	0		SH
VTVSP1200/16A305468	Worcester	6.20	12/16/2016	06:30	Clear	Driving too fast for conditions, Under the influence of medication/drugs/alcohol, No improper driving	Head On	2	0	0	S, N	SH State Owned
VTVSP1200/16A305156	Worcester	6.23	11/29/2016	07:36	[No Weather]		[No Direction of Collision]	0	0	0		SH State Owned
VTVSP1200/12A302163	Worcester	6.73	05/25/2012	18:00	Clear	Failure to keep in proper lane	Single Vehicle Crash	1	0	0	N	SH
VTVSP1200/12A301994	Worcester	UNK	05/14/2012	07:25	Rain	Other improper action	Rear End	2	0	0	N	SH
VTVSP1200/13A300873	Worcester	UNK	02/27/2013	21:00	[No Weather]		[No Direction of Collision]	0	0	0		SH
VTVSP1200/13A301934	Worcester	UNK	05/16/2013	20:50	Cloudy	No improper driving	Single Vehicle Crash	2	0	0	S	SH
VTVSP1200/14A301410	Worcester	UNK	03/30/2014	01:00	Sleet, Hail (Freezing Rain or Drizzle)	Fatigued, asleep, Failure to keep in proper lane	Single Vehicle Crash	1	0	0	N	SH
VTVSP0100/16A101604	Elmore	1.79	04/02/2016	21:51	Cloudy	Under the influence of medication/drugs/alcohol, Exceeded authorized speed limit	Single Vehicle Crash	1	0	0	S	SH State Owned
VTVSP0100/12A103503	Elmore	3.52	09/08/2012	19:12	Rain	Under the influence of medication/drugs/alcohol	Single Vehicle Crash	1	0	0	N	SH
VTVSP0100/14A105918	Elmore	4.65	12/26/2014	14:38	Clear	Swerving or avoiding due to wind, slippery surface, vehicle, object, non-motorist in roadway etc, No improper driving	Same Direction Sideswipe	0	0	0	N	SH
VTVSP0100/15A100413	Elmore	4.66	01/25/2015	07:06	[No Weather]		[No Direction of Collision]	0	0	0		SH
VTVSP0100/16A106536	Elmore	4.66	12/22/2016	21:50	[No Weather]		[No Direction of Collision]	0	0	0		SH State Owned
VTVSP0100/16A103497	Elmore	4.90	07/14/2016	13:26	[No Weather]		[No Direction of Collision]	0	0	0		SH State Owned
VTVSP0100/16A106388	Elmore	4.96	12/15/2016	17:39	[No Weather]		[No Direction of Collision]	0	0	0		SH State Owned
VTVSP0100/15A100804	Elmore	5.07	02/11/2015	10:27	[No Weather]		[No Direction of Collision]	0	0	0		SH
VTVSP0100/15A105765	Elmore	5.11	11/10/2015	17:40	Cloudy	No improper driving	Single Vehicle Crash	0	0	0	N	SH

*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.

Appendix M: Detour Routes



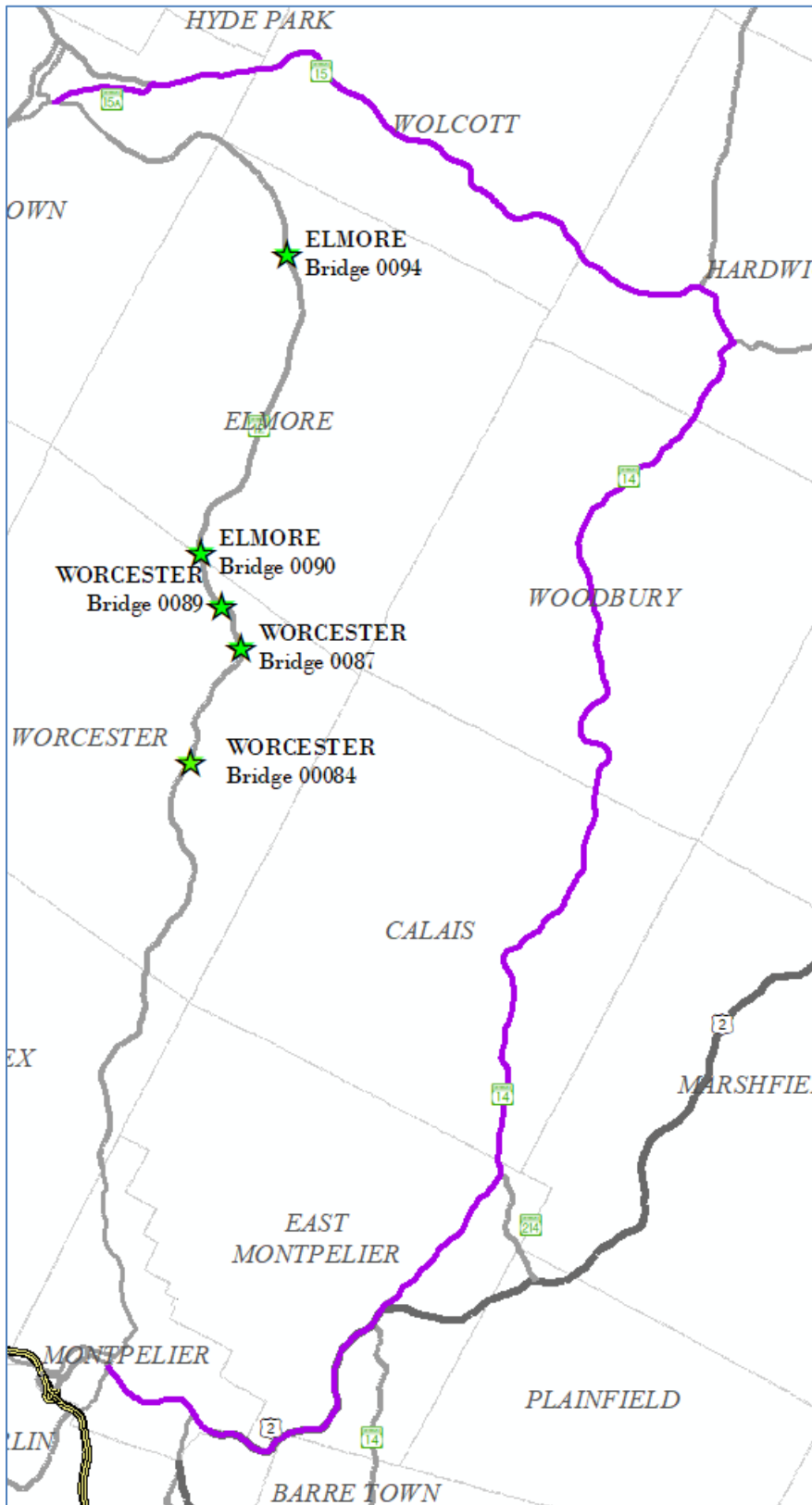
Regional Detour Route 1: VT Route 12, to VT Route 100, and US Route 2, back to VT Route 12

Through Route: 26.2 miles

Detour Route: 30.9 miles

Added Distance: 4.7 miles

End-to-End Distance: 57.1 miles

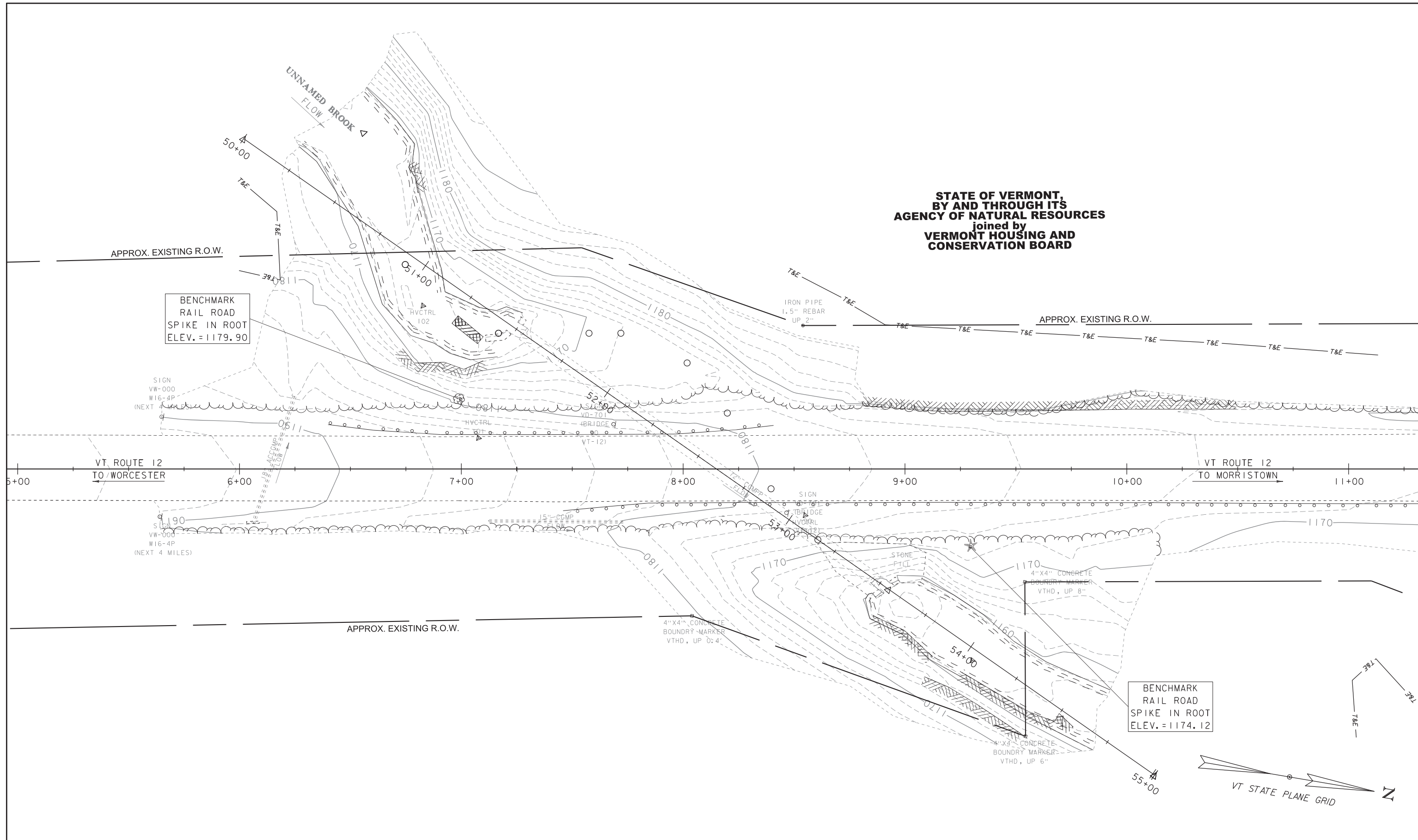


Regional Detour Route 2: VT Route 12, to US Route 2, VT Route 14, and VT Route 15, back to VT Route 12

Through Route: 26.4 miles
 Detour Route: 40.0 miles
 Added Distance: 13.6 miles
 End-to-End Distance: 66.4 miles

Appendix N: Plans

STATE OF VERMONT,
 BY AND THROUGH ITS
 AGENCY OF NATURAL RESOURCES
 joined by
 VERMONT HOUSING AND
 CONSERVATION BOARD

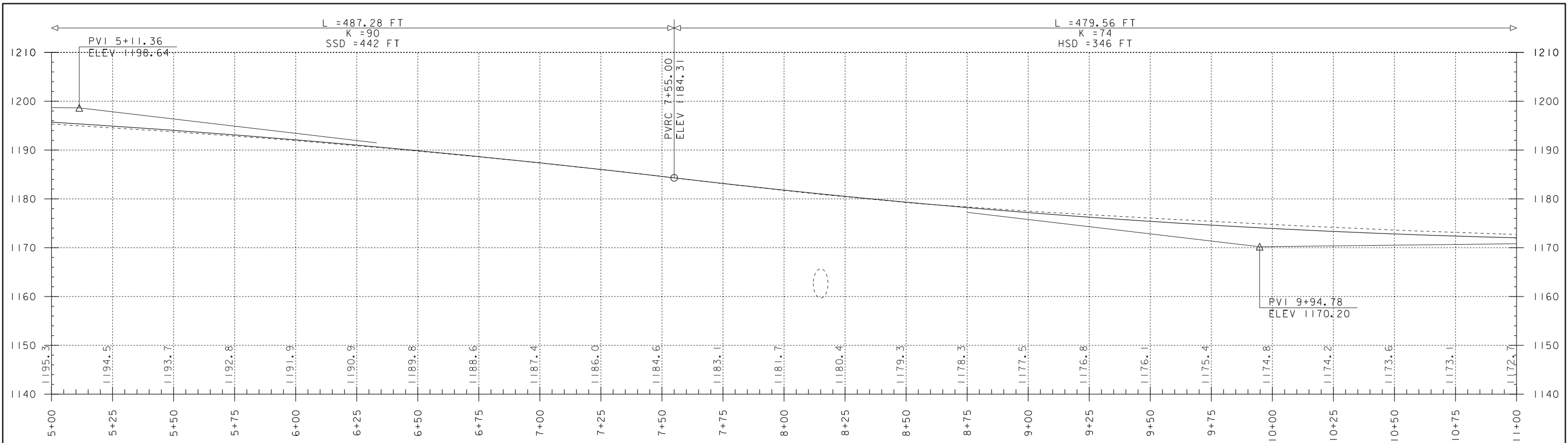


EXISTING BRIDGE INFO
 72" X 208' STEEL CGMPP
 BUILT 1964,
 18' AVERAGE COVER
 220 SQFT WATERWAY AREA

EXISTING CONDITIONS LAYOUT

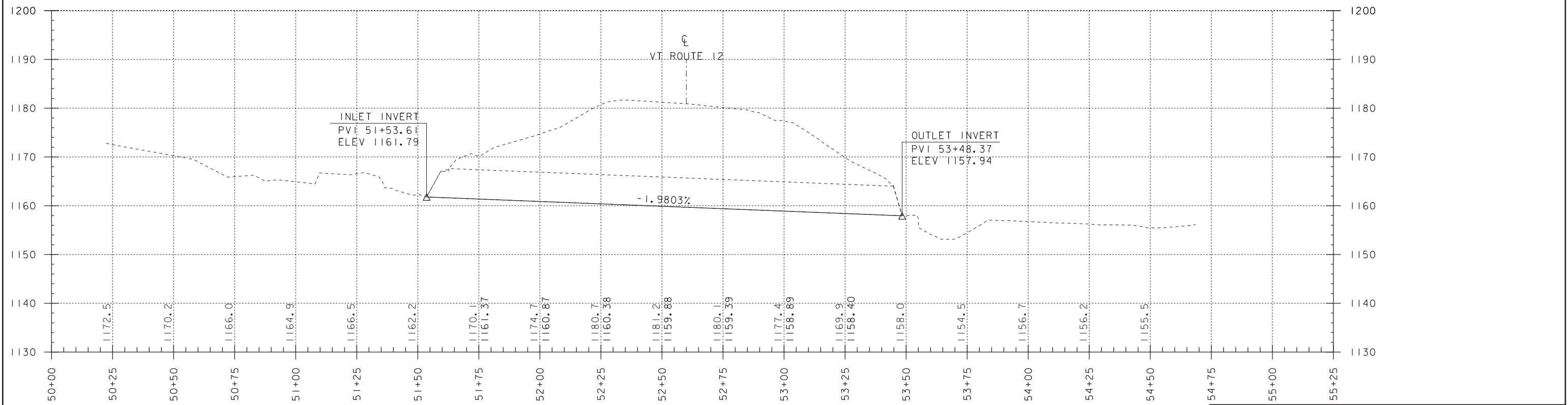
SCALE 1" = 20'-0"
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PROJECT NAME: ELMORE	PLOT DATE: 18-MAY-2020
PROJECT NUMBER: STP CULV(64)	DRAWN BY: D.D.BEARD
FILE NAME: I8b003/sl8b003border.dgn	CHECKED BY: -----
PROJECT LEADER: L.J.STONE	SHEET 1 OF 14
DESIGNED BY: -----	
EXISTING CONDITIONS LAYOUT	



VT ROUTE 12 PROFILE

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



BRIDGE 90 PROFILE

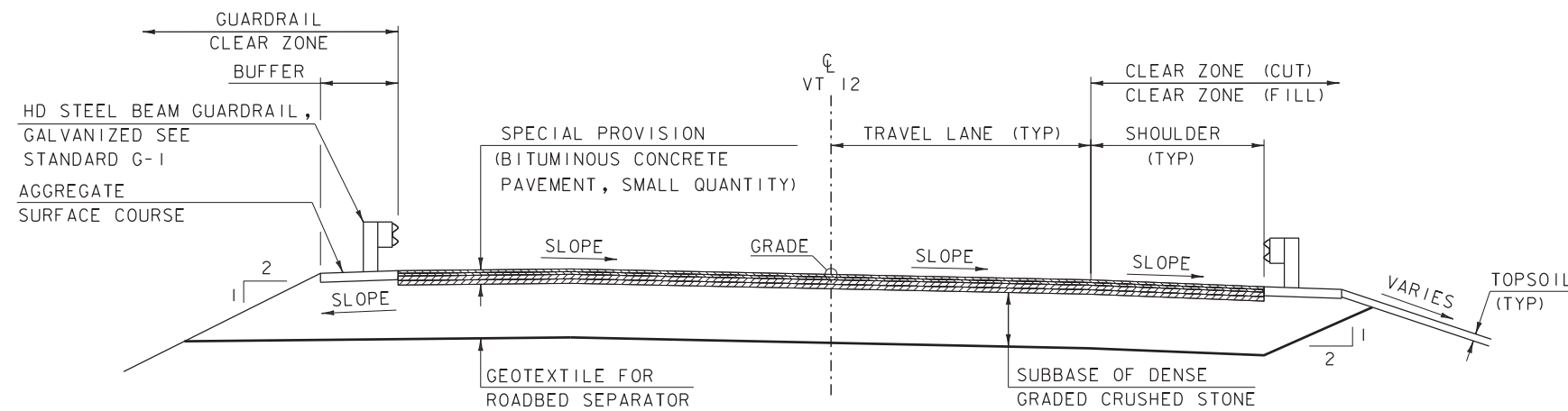
SCALE: HORIZONTAL 1"=20'-0"
VERTICAL 1"=10'-0"

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

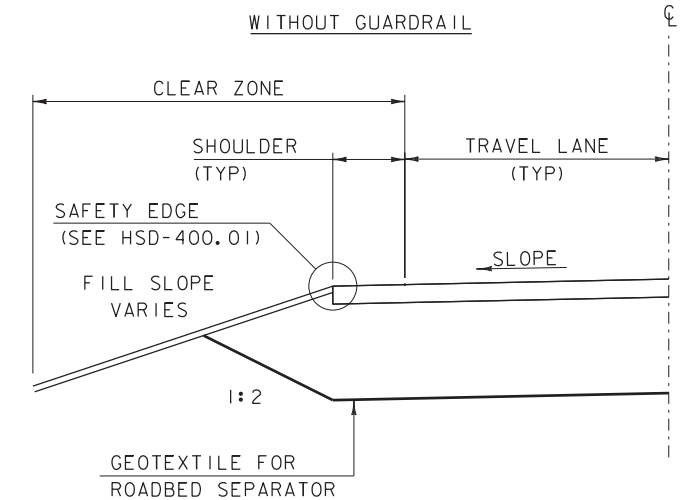
PROJECT NAME: ELMORE
PROJECT NUMBER: STP CULV(64)

FILE NAME: I8b003/sl8b003profile.dgn
PROJECT LEADER: L.J.STONE
DESIGNED BY: -----
PROFILE SHEET

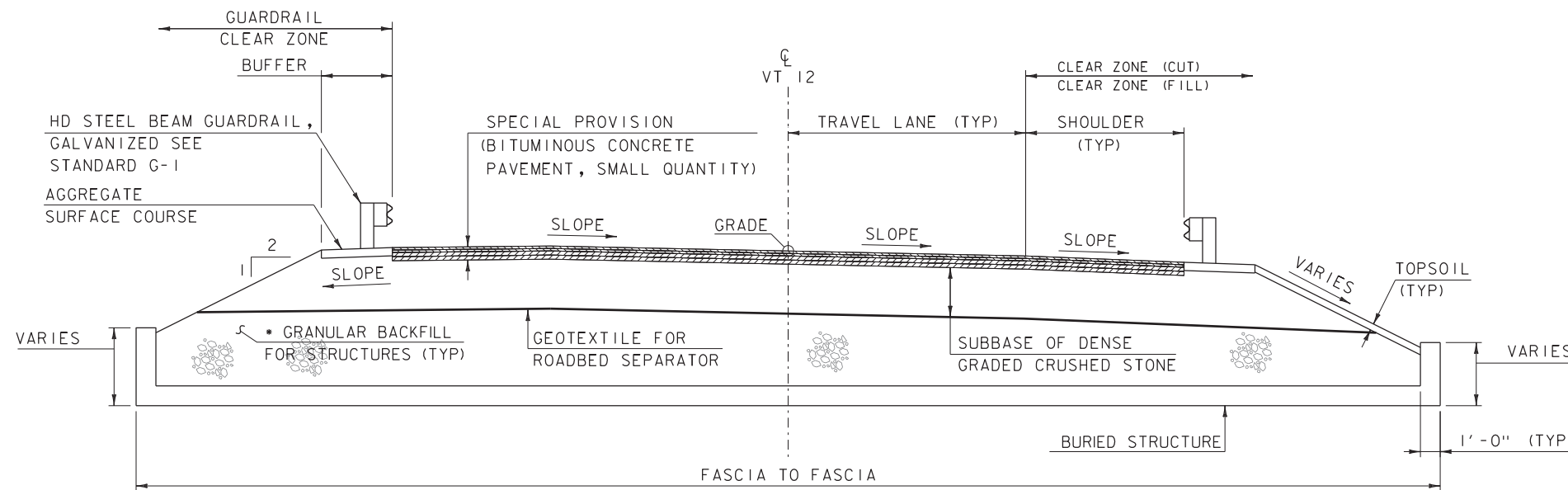
PLOT DATE: 18-MAY-2020
DRAWN BY: D.D.BEARD
CHECKED BY: -----
SHEET 2 OF 14



VT ROUTE 12 TYPICAL SECTION
SCALE: 1/4" = 1'-0"



ROADWAY TYPICAL SECTION
NOT TO SCALE



VT 12 BURIED STRUCTURE TYPICAL SECTION
SCALE: 1/4" = 1'-0"

ROAD TYPICAL INFORMATION

	LEFT		RIGHT	
	WIDTH	SLOPE	WIDTH	SLOPE
TRAVEL LANE	11'-0"	VARIES	11'-0"	VARIES
SHOULDER	4'-0"	VARIES	4'-0"	VARIES
BUFFER	3'-7"	-0.060	3'-7"	-0.060
FILL SLOPE	---	VARIES	---	VARIES
CLEAR ZONE (CUT)	10'-0"	1:3	10'-0"	1:3
CLEAR ZONE (FILL)	16'-0"	---	16'-0"	---
CLEAR ZONE (GUARDRAIL)	4'-0"	---	4'-0"	---

MATERIAL INFORMATION

	THICKNESS	TYPE
WEARING COURSE	1 1/2"	SPECIAL PROVISION (BITUMINOUS CONCRETE PAVEMENT, SMALL QUANTITY) (TYPE IVS)
BINDER COURSE	1 1/2"	SPECIAL PROVISION (BITUMINOUS CONCRETE PAVEMENT, SMALL QUANTITY) (TYPE IVS)
BASE COURSE #2	2 1/2"	SPECIAL PROVISION (BITUMINOUS CONCRETE PAVEMENT, SMALL QUANTITY) (TYPE IIS)
BASE COURSE #1	2 1/2"	SPECIAL PROVISION (BITUMINOUS CONCRETE PAVEMENT, SMALL QUANTITY) (TYPE IIS)
BUFFER	8"	AGGREGATE SURFACE COURSE
SUBBASE	24"	SUBBASE OF DENSE GRADED CRUSHED STONE
TOPSOIL	4"	TOPSOIL

TACK COAT: EMULSIFIED ASPHALT IS TO BE APPLIED AT A RATE OF 0.025 GAL/SY BETWEEN SUCCESSIVE COURSES OF PAVEMENT AND 0.080 GAL/SY ON COLD PLANED SURFACES AS DIRECTED BY THE ENGINEER.

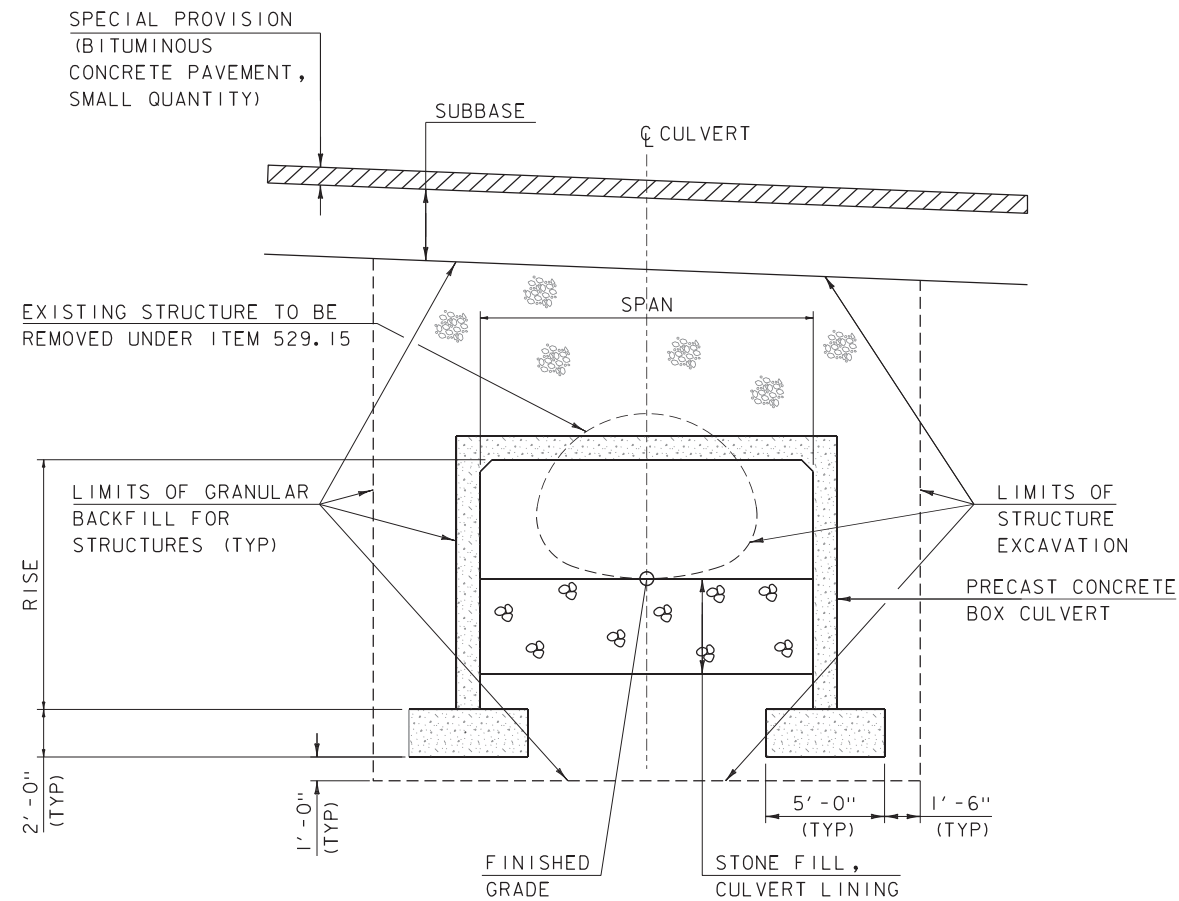
MATERIAL TOLERANCES
(IF USED ON PROJECT)

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

PROJECT NAME: ELMORE
PROJECT NUMBER: STP CULV(64)

FILE NAME: I8b003/sl8b003+yp.dgn
PROJECT LEADER: L.J.STONE
DESIGNED BY: -----
CULVERT TYPICAL SECTION SHEET 1

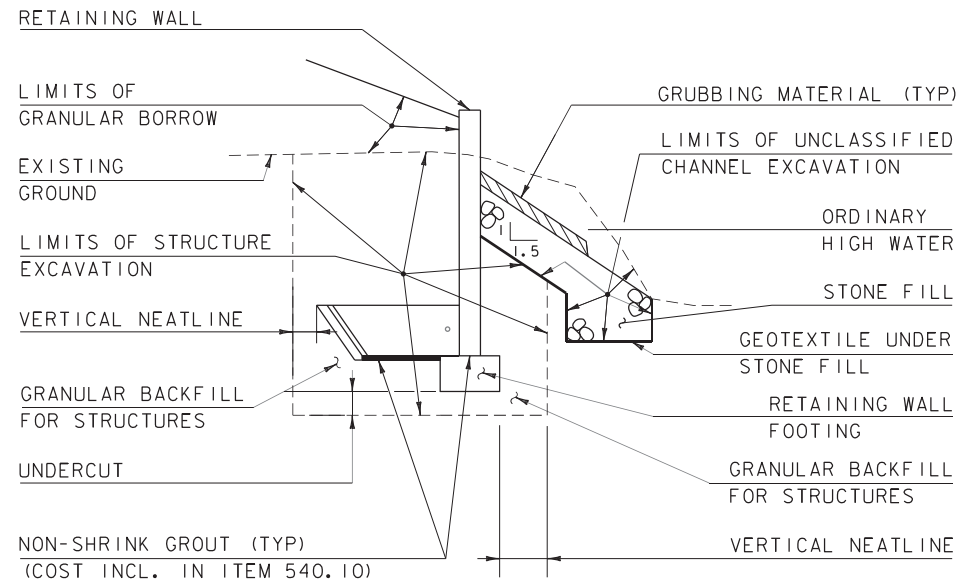
PLOT DATE: 18-MAY-2020
DRAWN BY: D.D.BEARD
CHECKED BY: -----
SHEET 3 OF 14



SPAN	23' - 0"
RISE	12' - 0"
LENGTH	200' - 0"

CULVERT TYPICAL SECTION

NOT TO SCALE

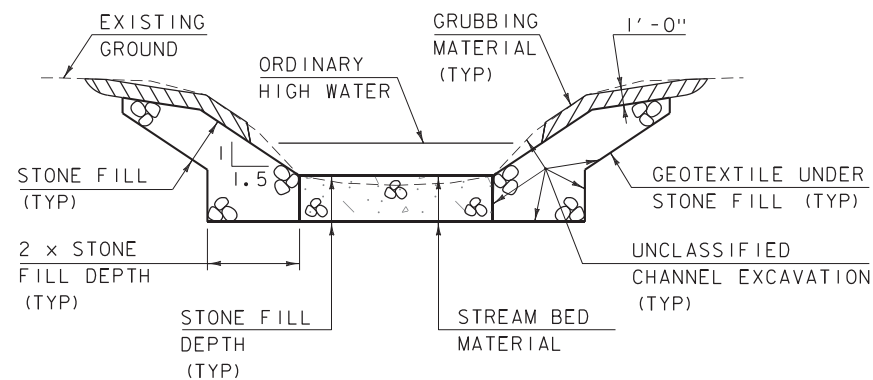


RETAINING WALL EARTHWORK TYPICAL SECTION

NOT TO SCALE

NOTE:

TOP OF RETAINING WALL FOOTING SHALL BE AT OR BELOW BOTTOM OF BOX CULVERT.



TYPICAL CHANNEL SECTION

(NOT TO SCALE)

- 1) WHENEVER CHANNEL SLOPE INTERSECTS ROADWAY SUBBASE, GRUBBING MATERIAL SHALL BEGIN AT THE BOTTOM OF SUBBASE.
- 2) THE CONTRACTOR SHALL CREATE A LOW FLOW CHANNEL IN THE STREAM BED MATERIAL AS DIRECTED BY THE ENGINEER.
- 3) GRUBBING MATERIAL SHALL BE PLACED UNDERNEATH STRUCTURES WHERE THERE IS MORE THAN 6 FEET VERTICALLY FROM ORDINARY HIGH WATER (OHW) TO THE BOTTOM OF SUPERSTRUCTURE AND MORE THAN 6 FEET HORIZONTALLY FROM OHW LINE TO FRONT FACE OF ABUTMENT. THIS MATERIAL SHALL START JUST ABOVE THE OHW ELEVATION AND TERMINATE 3 FEET HORIZONTALLY FROM THE FRONT FACE OF THE ABUTMENT. THIS MATERIAL SHALL NOT BE PLACED UNDERNEATH DOWNSPOUTS. SEE THE CHANNEL SECTIONS FOR ADDITIONAL DETAILING.

MATERIAL INFORMATION

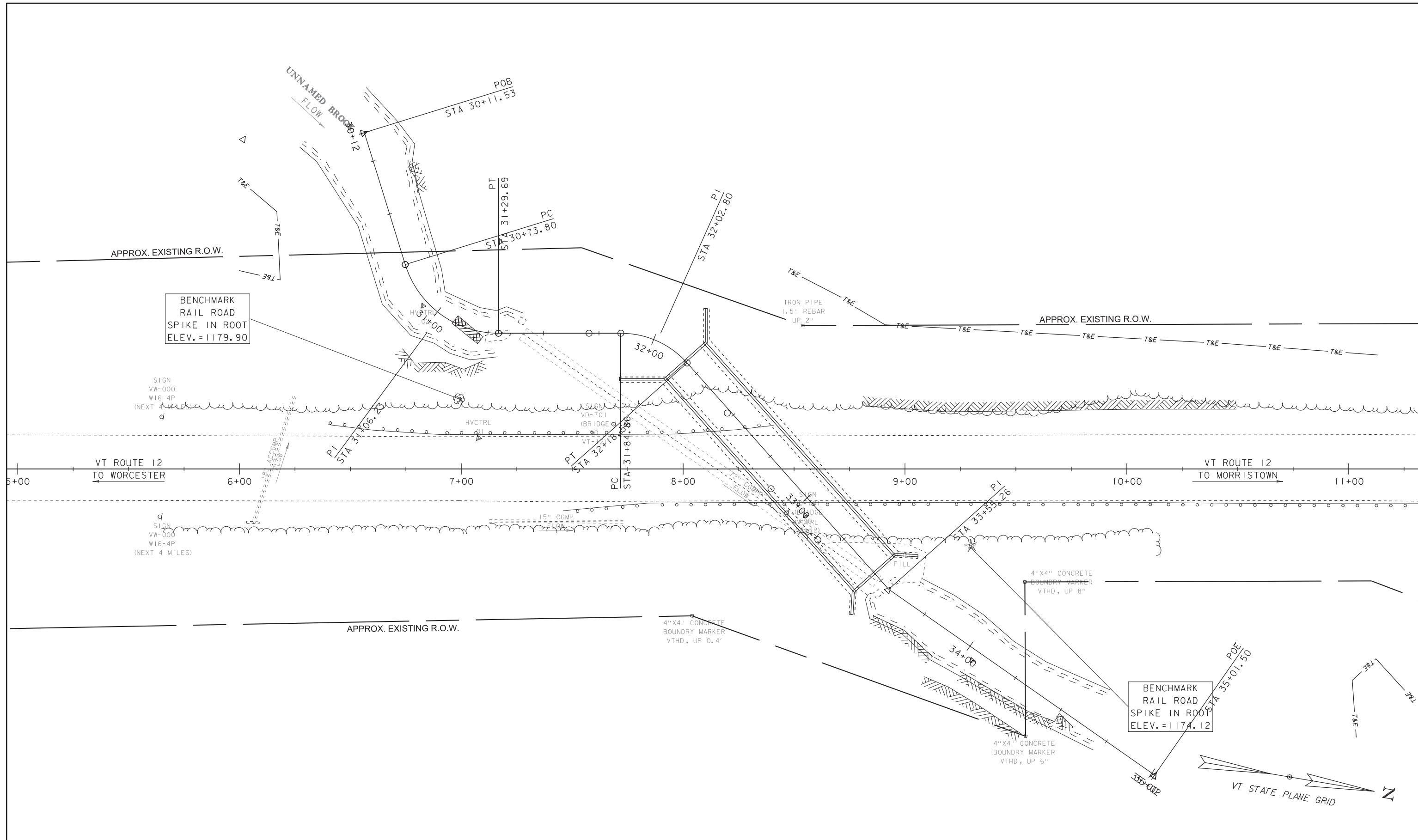
	THICKNESS	TYPE
STONE FILL	3'-0"	TYPE III
STONE FILL, CULVERT LINING	3'-0"	E-STONE TYPE III
STONE FILL, STREAM BED MATERIAL	3'-0"	E-STONE TYPE III

RETAINING WALL - ASSUMED DIMENSIONS

LEVELING PAD	
WIDTH	DIMENSION
WIDTH	2' - 6"
TOE	0' - 9"
HEEL	0' - 9"
THICKNESS	1' - 0"
UNDERCUT	1' - 0"
WALL	
THICKNESS	1' - 0"
HEIGHT	VARIES
EXCAVATION LIMITS	
VERTICAL NEATLINE	1' - 6"
UNDERCUT	1' - 0"

PROJECT NAME: ELMORE
PROJECT NUMBER: STP CULV(64)

FILE NAME: I8b003/sl8b003+yp.dgn PLOT DATE: 18-MAY-2020
PROJECT LEADER: L.J.STONE DRAWN BY: D.D.BEARD
DESIGNED BY: ----- CHECKED BY: -----
CULVERT TYPICAL SECTION SHEET 2 SHEET 4 OF 14

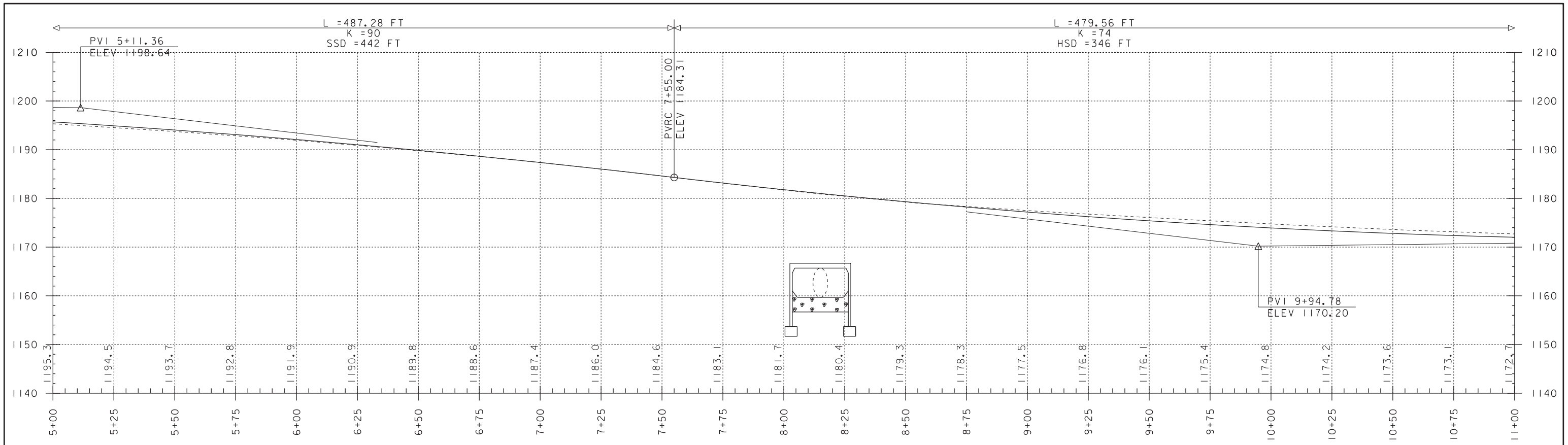


EXISTING BRIDGE INFO
 72" X 208' STEEL CGMPP
 BUILT 1964,
 18' AVERAGE COVER
 220 SQFT WATERWAY AREA

NEW 3-SIDED CULVERT LAYOUT

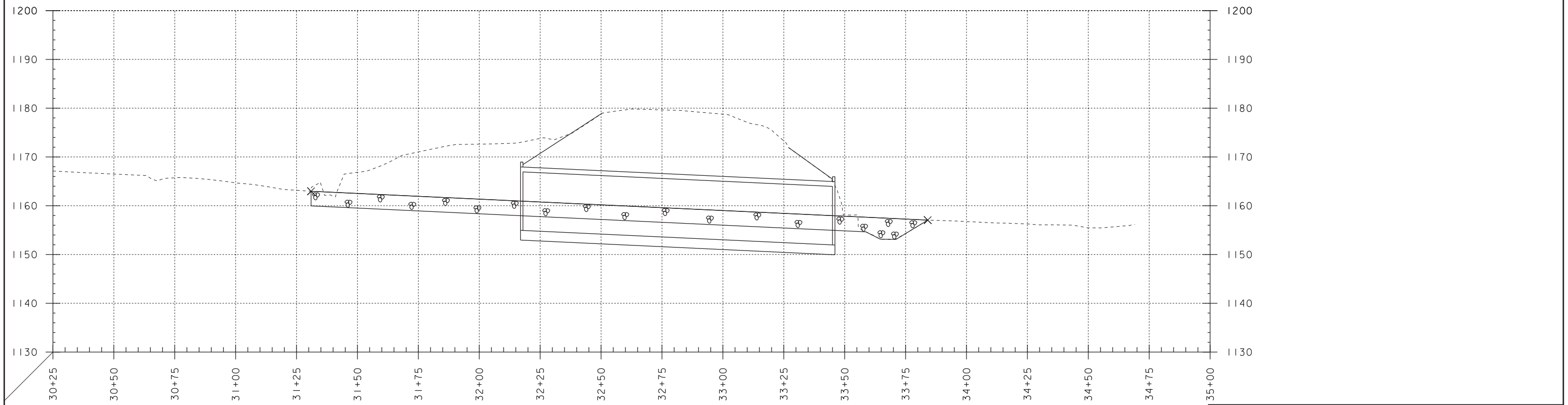
SCALE 1" = 20'-0"
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PROJECT NAME: ELMORE	PLOT DATE: 18-MAY-2020
PROJECT NUMBER: STP CULV(64)	DRAWN BY: D.D.BEARD
FILE NAME: I8b003/sI8b003border.dgn	CHECKED BY: -----
PROJECT LEADER: L.J.STONE	SHEET 5 OF 14
DESIGNED BY: -----	
NEW 3-SIDED CULVERT LAYOUT	



VT ROUTE 12 PROFILE

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

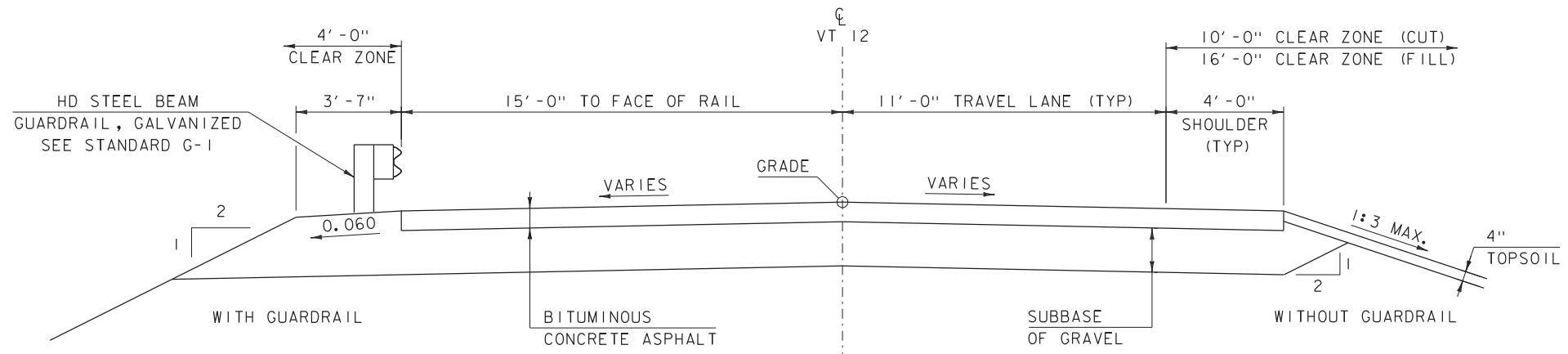


BRIDGE 90 3-SIDED CULVERT PROFILE

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

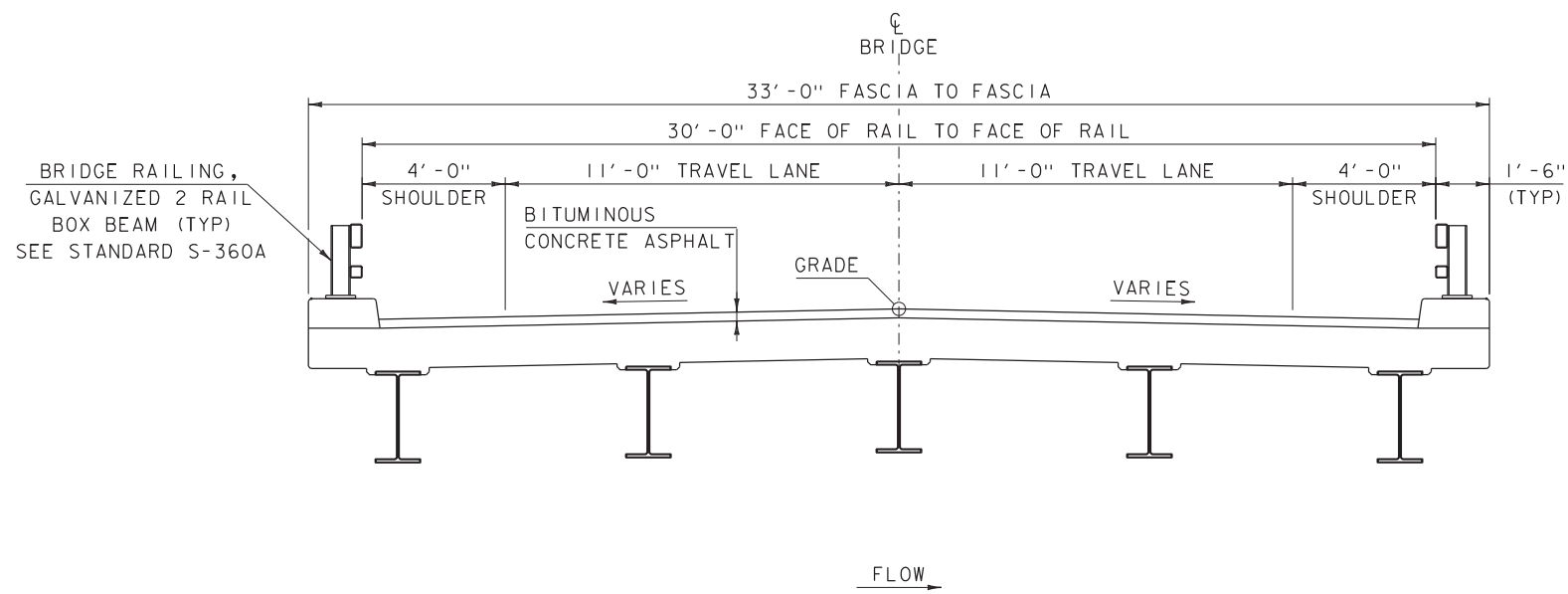
NOTE:
 GRADES SHOWN TO THE NEAREST TENTH ARE EXISTING GROUND ALONG ϵ
 GRADES SHOWN TO THE NEAREST HUNDRETH ARE FINISH GRADE ALONG ϵ

PROJECT NAME: ELMORE	PLOT DATE: 18-MAY-2020
PROJECT NUMBER: STP CULV(64)	DRAWN BY: D.D.BEARD
FILE NAME: I8b003/sl8b003profile.dgn	CHECKED BY: -----
PROJECT LEADER: L.J.STONE	SHEET 6 OF 14
DESIGNED BY: -----	
NEW 3-SIDED CULVERT PROFILE SHEET	



PROPOSED VT ROUTE 12 TYPICAL SECTION

SCALE 3/8" = 1'-0"



BRIDGE 90 PROPOSED TYPICAL SECTION

SCALE 3/8" = 1'-0"

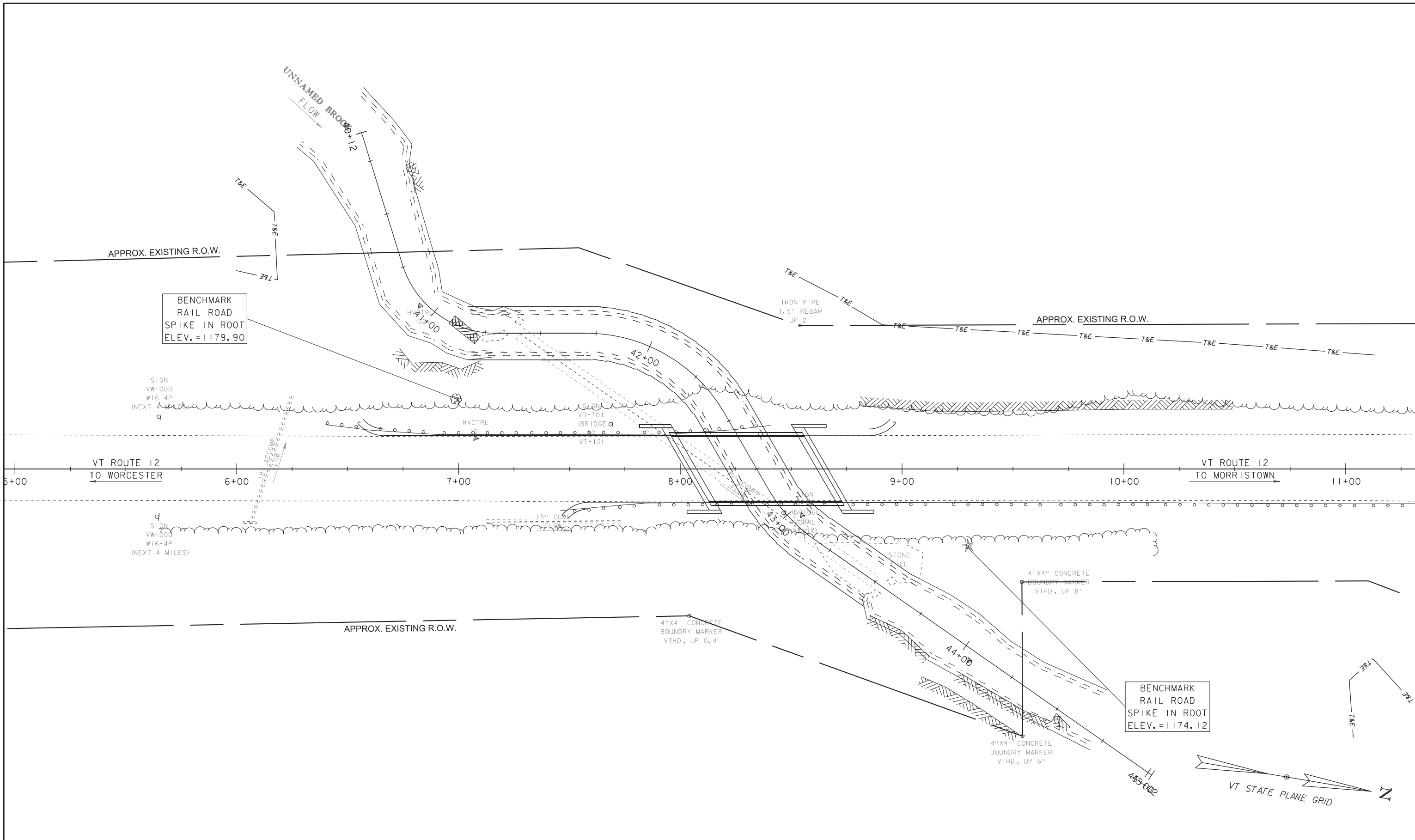
MATERIAL TOLERANCES
(IF USED ON PROJECT)

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

PROJECT NAME: ELMORE
PROJECT NUMBER: STP CULV(64)

FILE NAME: I8b003/sl8b003+yp.dgn
PROJECT LEADER: L.J.STONE
DESIGNED BY: -----
NEW BRIDGE TYPICAL SECTION

PLOT DATE: 18-MAY-2020
DRAWN BY: D.D.BEARD
CHECKED BY: -----
SHEET 7 OF 14

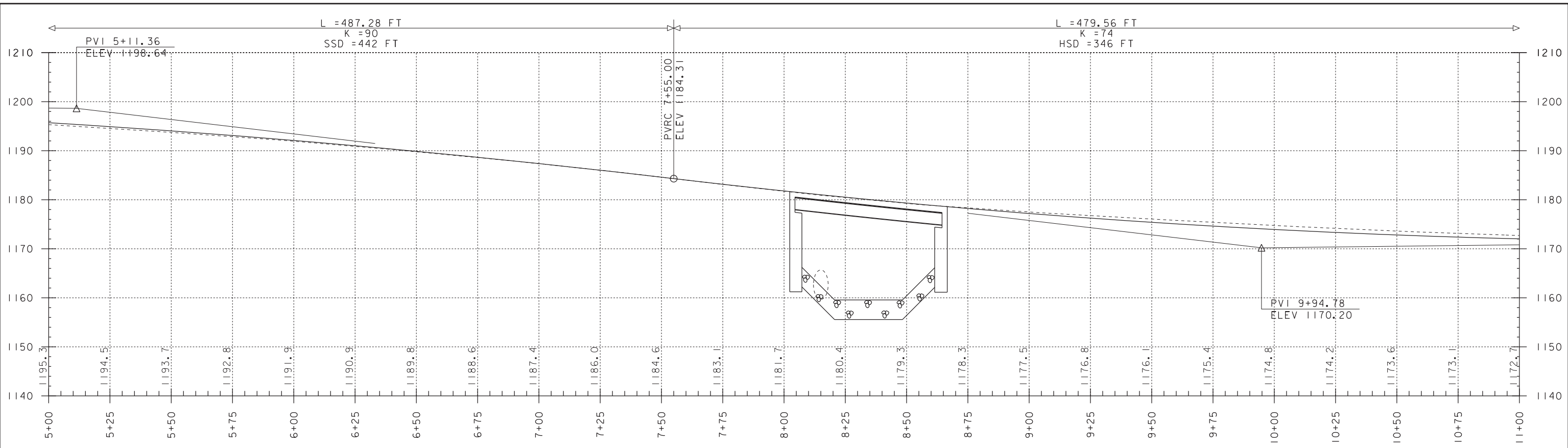


EXISTING BRIDGE INFO
 72" X 208' STEEL CGMPP
 BUILT 1964,
 18' AVERAGE COVER
 220 SQFT WATERWAY AREA

REESTABLISHED STREAM LAYOUT

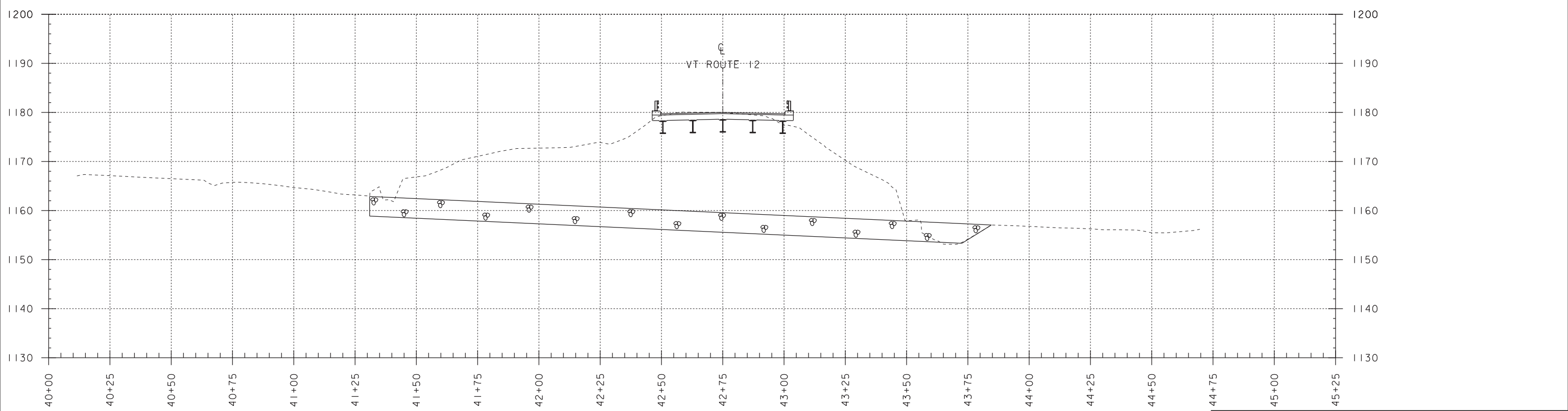
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PROJECT NAME: ELMORE	
PROJECT NUMBER: STP CULV(64)	
FILE NAME: I8b003/sl8b003border.dgn	PLOT DATE: 18-MAY-2020
PROJECT LEADER: L.J.STONE	DRAWN BY: D.D.BEARD
DESIGNED BY: -----	CHECKED BY: -----
RELOCATED STREAM LAYOUT	SHEET 8 OF 14



VT ROUTE 12 PROFILE

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

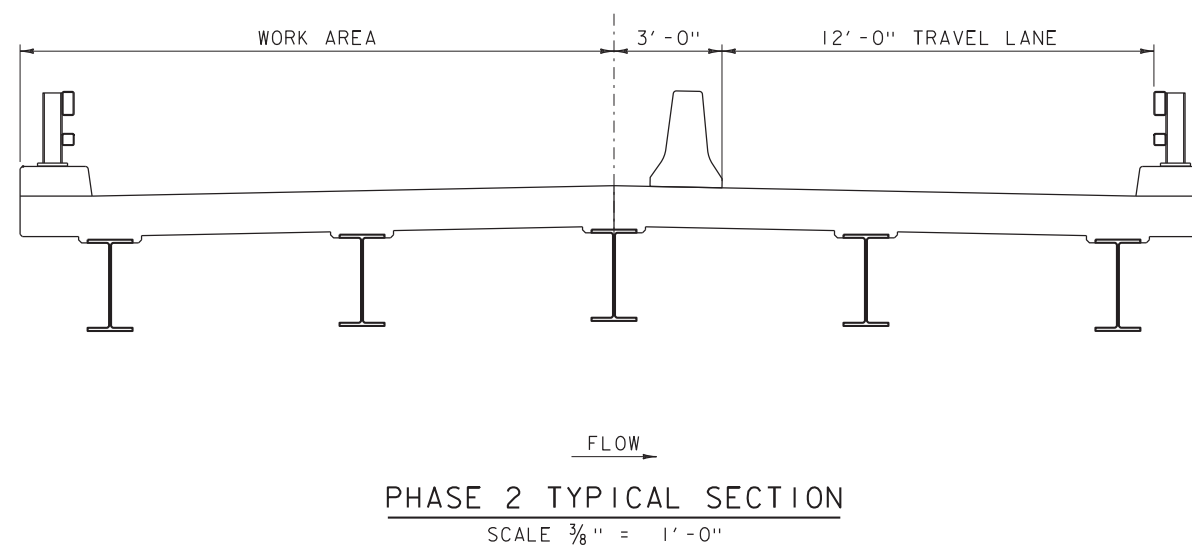
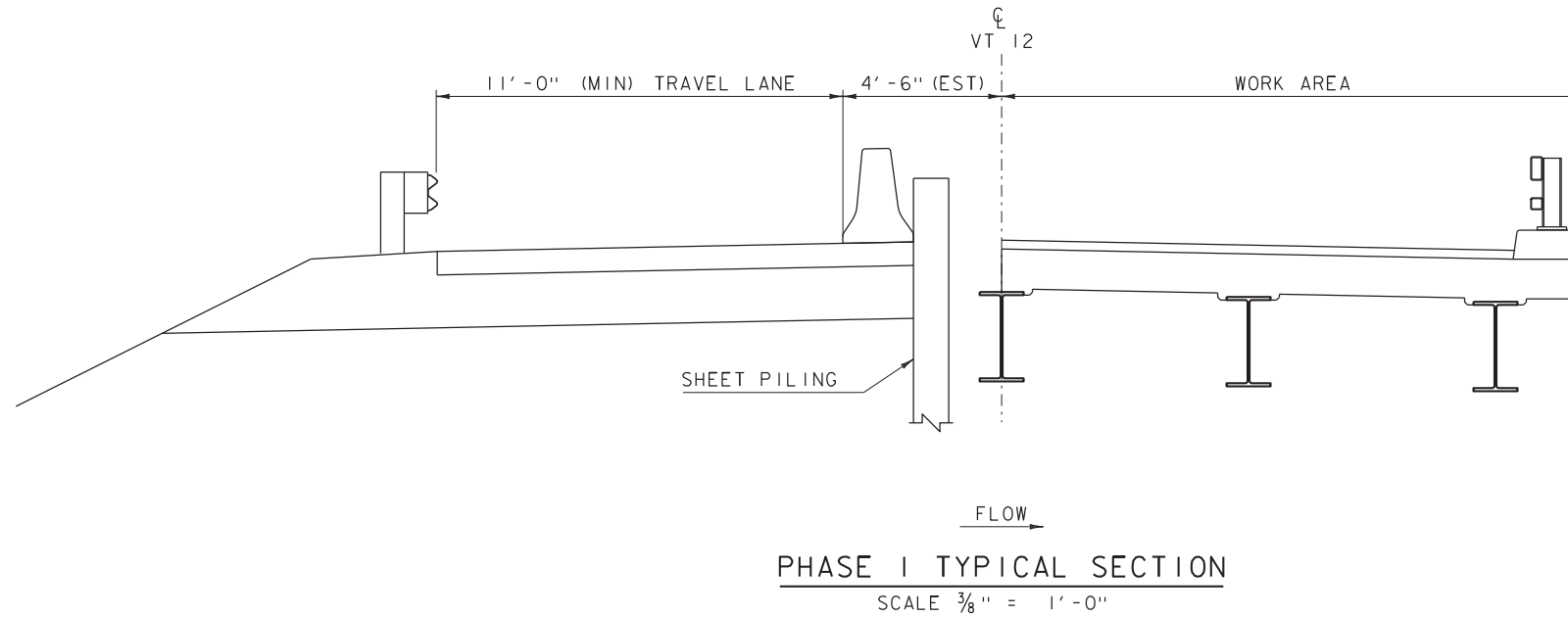


STREAM RELOCATION PROFILE

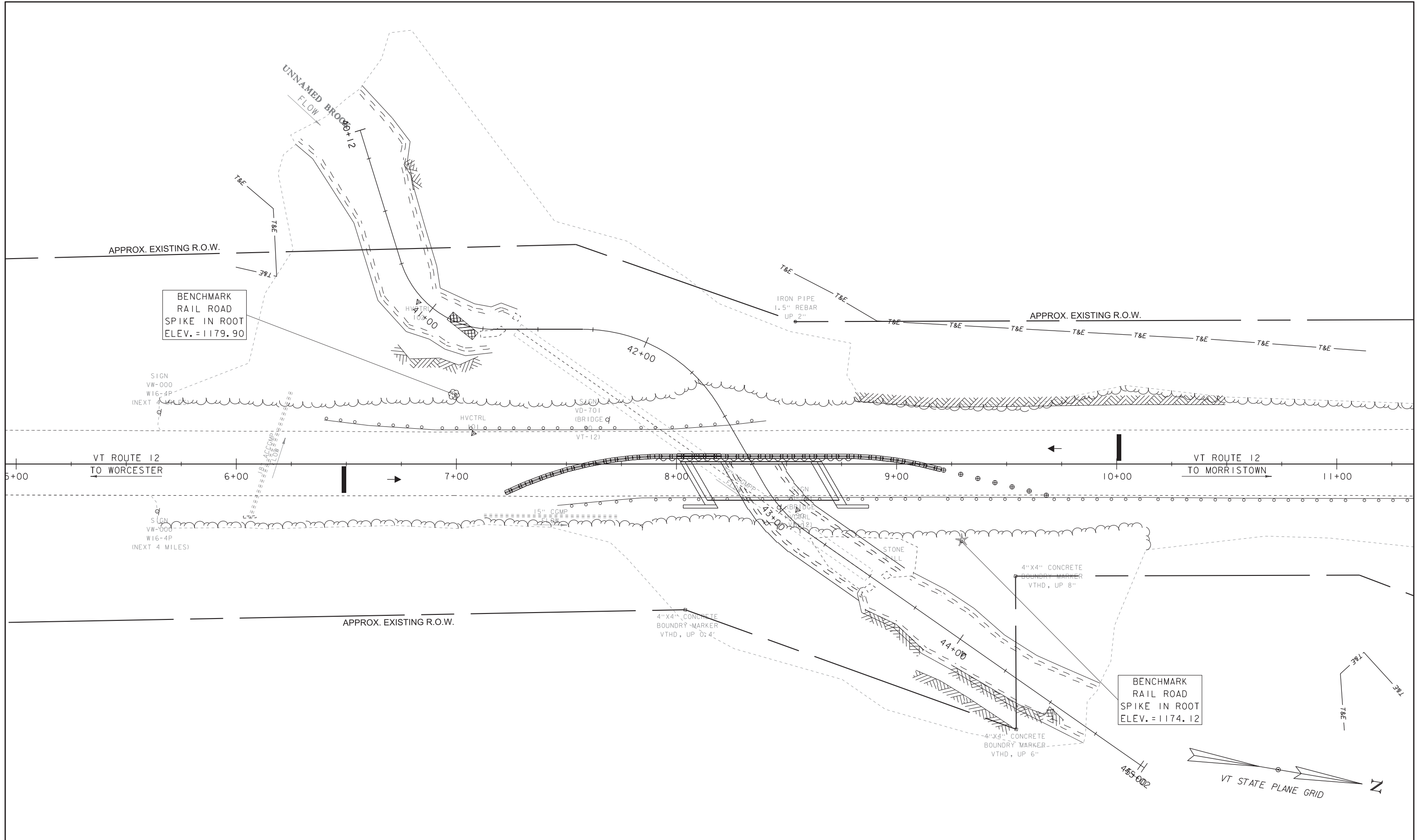
SCALE: HORIZONTAL 1"=20'-0"
 VERTICAL 1"=10'-0"

NOTE:
 GRADES SHOWN TO THE NEAREST TENTH ARE EXISTING GROUND ALONG ϕ
 GRADES SHOWN TO THE NEAREST HUNDRETH ARE FINISH GRADE ALONG ϕ

PROJECT NAME:	ELMORE	PLOT DATE:	18-MAY-2020
PROJECT NUMBER:	STP CULV(64)	DRAWN BY:	D.D.BEARD
FILE NAME:	I8b003/sl8b003profile.dgn	CHECKED BY:	-----
PROJECT LEADER:	L.J.STONE	SHEET	9 OF 14
DESIGNED BY:	-----		
STREAM RELOCATION PROFILE SHEET			



PROJECT NAME: ELMORE	PLOT DATE: 18-MAY-2020
PROJECT NUMBER: STP CULV(64)	DRAWN BY: D.D.BEARD
FILE NAME: I8b003/sl8b003+yp.dgn	CHECKED BY: -----
PROJECT LEADER: L.J.STONE	SHEET 10 OF 14
DESIGNED BY: -----	
PHASING TYPICAL SECTION	

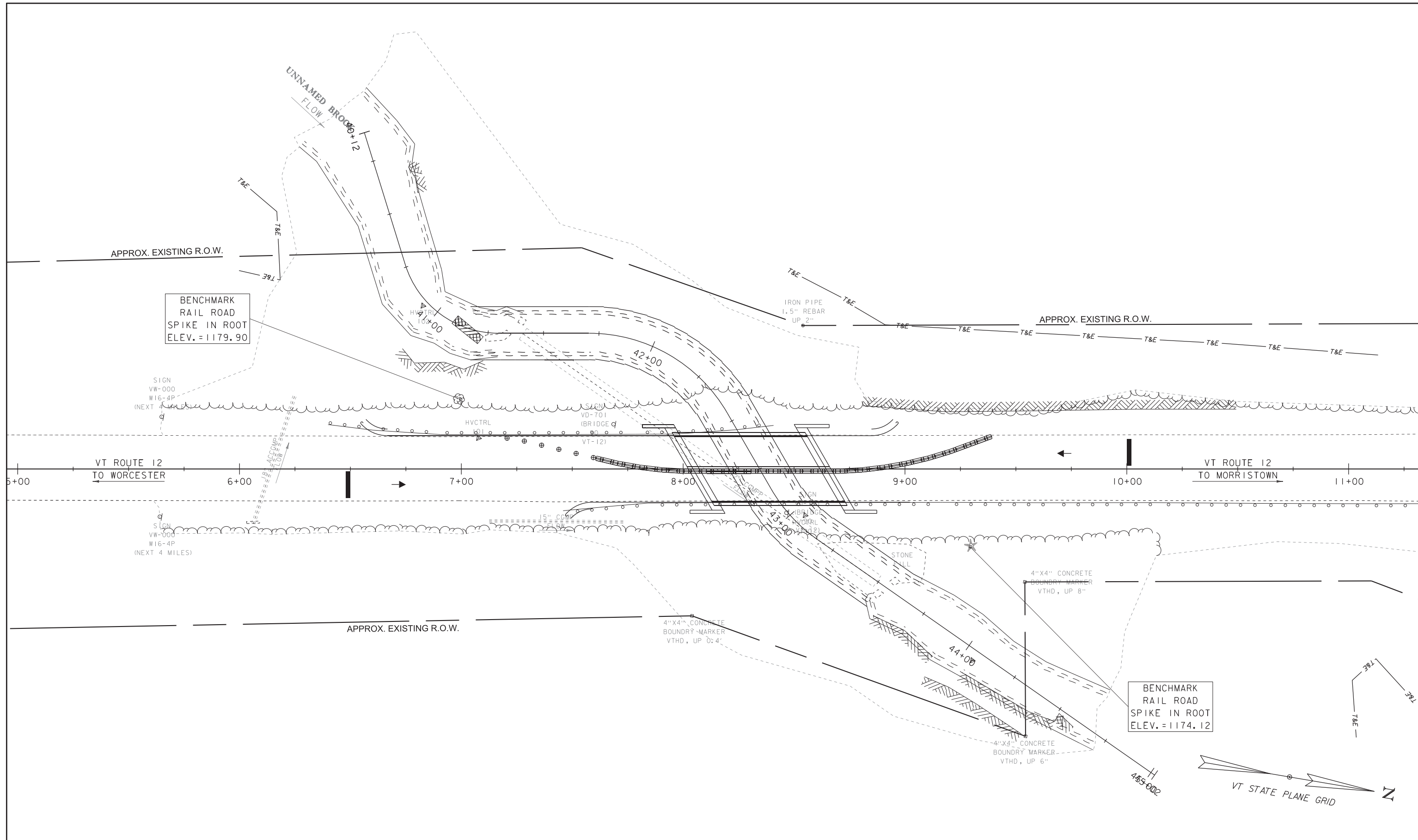


EXISTING BRIDGE INFO
 72" X 208' STEEL CGMPP
 BUILT 1964,
 18' AVERAGE COVER
 220 SQFT WATERWAY AREA

PHASE I LAYOUT

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

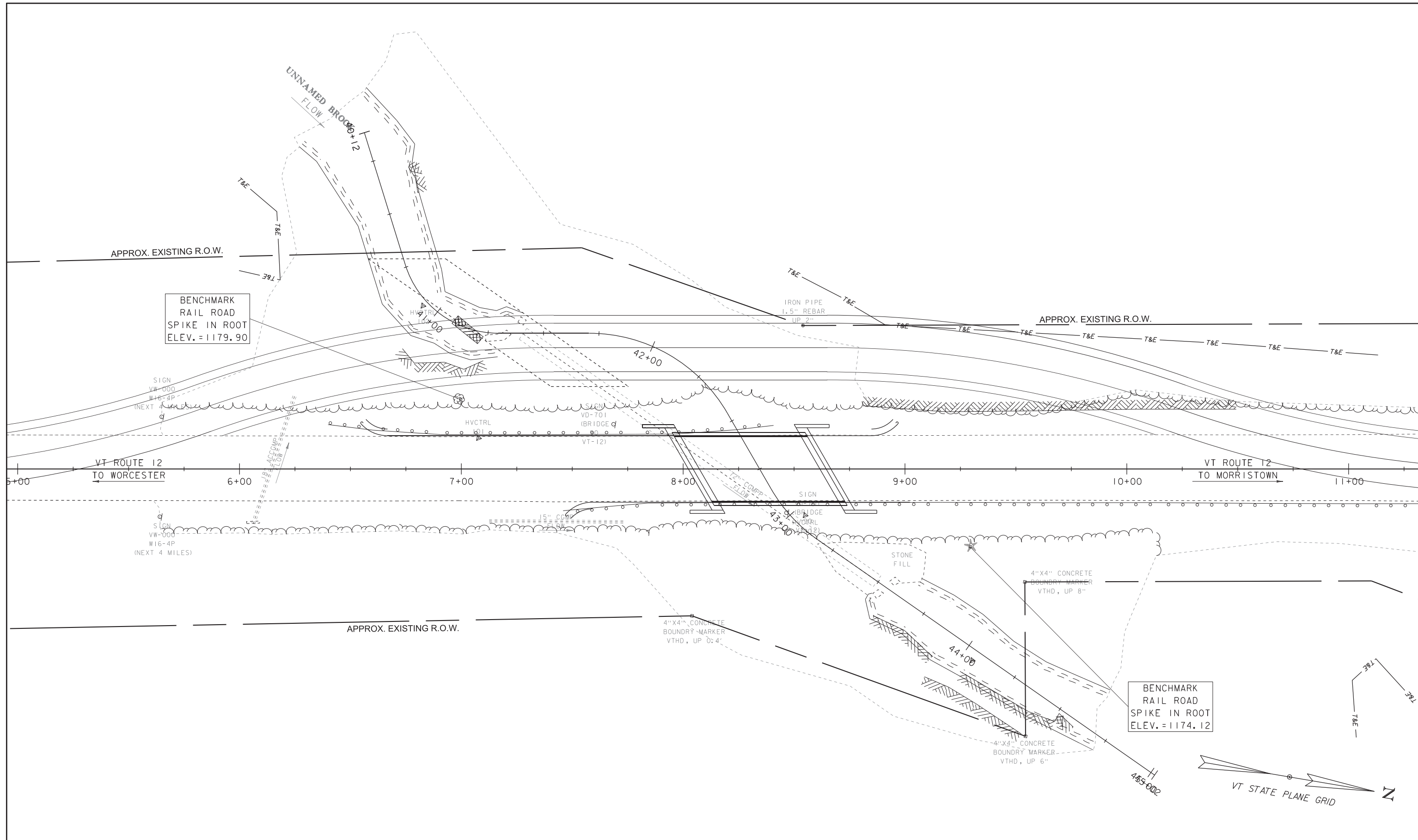
PROJECT NAME: ELMORE	PLOT DATE: 18-MAY-2020
PROJECT NUMBER: STP CULV(64)	DRAWN BY: D.D.BEARD
FILE NAME: I8b003/sI8b003Tcborder.dgn	CHECKED BY: -----
PROJECT LEADER: L.J.STONE	SHEET 11 OF 14
DESIGNED BY: -----	
PHASE I LAYOUT	



EXISTING BRIDGE INFO
 72" X 208' STEEL CGMPP
 BUILT 1964,
 18' AVERAGE COVER
 220 SQFT WATERWAY AREA

PHASE 2 LAYOUT
 SCALE 1" = 20'-0"
 20 0 20

PROJECT NAME: ELMORE	PLOT DATE: 18-MAY-2020
PROJECT NUMBER: STP CULV(64)	DRAWN BY: D.D.BEARD
FILE NAME: I8b003/sl8b003Tcborder.dgn	CHECKED BY: -----
PROJECT LEADER: L.J.STONE	SHEET 12 OF 14
DESIGNED BY: -----	
PHASE 2 LAYOUT	



BENCHMARK
RAIL ROAD
SPIKE IN ROOT
ELEV. = 1179.90

SIGN
VW-000
W16-4P
(NEXT 4 MILES)

VT ROUTE 12
TO WORCESTER

VT ROUTE 12
TO MORRISTOWN

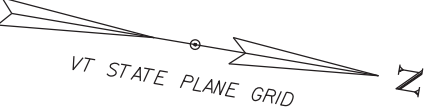
SIGN
VW-000
W16-4P
(NEXT 4 MILES)

4"X4" CONCRETE
BOUNDRY MARKER
VTHD, UP 0'.4'

4"X4" CONCRETE
BOUNDRY MARKER
VTHD, UP 8"

4"X4" CONCRETE
BOUNDRY MARKER
VTHD, UP 6"

BENCHMARK
RAIL ROAD
SPIKE IN ROOT
ELEV. = 1174.12



EXISTING BRIDGE INFO
72" X 208' STEEL CGMPP
BUILT 1964,
18' AVERAGE COVER
220 SQFT WATERWAY AREA

UPSTREAM TEMPORARY ROADWAY LAYOUT

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

NOTE: TOE OF SLOPE NOT DETERMINED

PROJECT NAME: ELMORE	PLOT DATE: 18-MAY-2020
PROJECT NUMBER: STP CULV(64)	DRAWN BY: D.D.BEARD
FILE NAME: I8b003/sl8b003TCborder.dgn	CHECKED BY: -----
PROJECT LEADER: L.J.STONE	SHEET 13 OF 14
DESIGNED BY: -----	
UPSTREAM TEMPORARY ROADWAY LAYOUT	

