Exhibit VGS-AG-017

STATE OF VERMONT
PUBLIC UTILITIES COMMISSION

Investigation Pursuant to 30 V.S.A. §§ 30 and 309 regarding the alleged failure of Vermont Gas Systems, Inc. to comply with the Certificate of Public Good in Docket 7970	)	Case No. 17-3550-INV

INTERVENORS' SUMMARY OF THE EVIDENCE FOR INDEPENDENT INVESTIGATOR WILLIAM BYRD, PE (annotated with attachments)[1]

1. WHAT ONE SET OF PHOTOGRAPHS AND VIDEO REVEAL ABOUT THE ENTIRE ANGP

PHMSA regulation 192.303 requires that **every pipeline "be constructed in accordance with comprehensive written specifications or standards."** This requirement has two components – the gas company must develop comprehensive written specifications or standards, and the pipeline must be constructed in accordance with those written specifications.

VGS filed detailed exhibits with the PUC in order to obtain approval. Later plans, never submitted to the PUC (see, e.g., the 6-30-16 Modification Bulletin Trans-14, discussed below) **[6-30-16 MODIFICATION BULLETIN TRANS-14 IS SUPPLEMENTAL ATTACHMENT #1]** removed certain requirements, but other requirements remained unchanged, including:

► Two methods of construction were authorized, the **trench method** (involving 6" of sand beneath the pipeline, 12" of sand on top of the pipeline, and screened and inspected backfill above the sand) and **Horizontal Directional Drilling.**

[1] This summary memorandum is unchanged from what was delivered to Mr. Byrd and filed with the Commission in February, except for the material in boldface brackets, **[THUS]** to direct the reader to each exhibit attached to the memorandum. The "Appendix" is the Appendix that was filed with the Motion to Broaden Scope on February 28, 2018. The "Supplemental Attachments" constitute a second Appendix containing documents cited in the summary memo, being filed and served on all parties along with this annotated summary.

► **Removal of all water** from the trenches was required. "promptly and continuously throughout the progress of the work." The contractor "shall keep the excavation dry at all times until the work is completed and excavation is backfilled…" (¶ 3.4)

► **Shoring and bracing of trench walls was required** where sloping was not possible because of space limitations or stability of material excavated. (¶ 3.3)

► "**The bottom of trench shall be accurately graded** to provide a uniform level of padding/bedding…". (¶ 3.3)

► Specifications mandated compliance with both PHMSA regulations requiring a minimum **3 feet of cover,** and with the **PUC Order requiring 4 feet within the VELCO Right of Way.**

► All **backfill was required to be compacted**, (the PUC-filed plans required 90% compaction within the VELCO ROW). (¶ 3.5) Load-bearing calculations for heavy equipment accessing the VELCO high voltage line were based upon **API RP 1102, which assumes compacted backfill**. American Petroleum Institute ("API") Recommended Practice ("RP") 1102, "Steel Pipelines Crossing Railroads and Highways" (7th ed. 2007). **[API 1102 IS FOUND AT APPENDIX PAGES 287-346.]** The VELCO MOU also was based upon the same API RP 1102 load-bearing calculations, which assume compaction of backfill. *May 25, 2016 Mott MacDonald Report.*

PUC Finding 264 **(**Docket 7970 12/23/13 Order) accepted VGS's commitment to **a** Quality Assurance program that would include "lowering of the pipeline into the ditch, padding and backfilling." Intrinsic to any QA plan is inspection and documentation.

Photograph #4 [SUPPLEMENTAL ATTACHMENT #2.], taken by VGS's contractor, VHB, depicts the pipeline in Clay Plains Swamp in New Haven. It is dated September 15 and 16, 2016.

But that photo does not show what really happened. Before the pipe could be covered, the wetlands around it poured water into it. **Mr. Shelton's photographs, video and affidavit** show the condition the pipe was in when it was buried. His photographs and video were taken in the exact same location as Photograph #4, as shown by the trees along the trench, the cattails across from the trees, and the double ridge of mountains in the background. **[See SUPPLEMENTAL ATTACHMENTS #3A, 3B, 4 AND 5, FROM MR. SHELTON]. Mr. Bubolz' deposition [APPENDIX PAGES 742-879]** describes what these photos show. The trench became flooded with water and

the walls collapsed. One excavator, even though it was on mats, slid into the wetland and could not get out. Other equipment had to be brought in to remove it. It became impossible to achieve 4 feet of burial within the VELCO ROW; they could not even attain 3 feet. As a result, according to Mr. Bubolz, a Michels foreman, VGS employed a third method, the "sink in swamp" method. It was, according to Mr. Bubolz, a method unlike the two methods in the written specifications (open trench construction and HDD). The new method consisted of digging trenches on either side of the pipeline and relying on the weight of the pipeline to squeeze soils out from beneath it. No sand or other select backfill was placed beneath the pipe. No excavation of a level area, and no inspection of that level area before placement of the pipeline on it, occurred. No inspection was conducted for rocks or soil clods over 3 inches long or 6 inches long in the backfill (other than the backhoe operators' observations from the seats of their equipment). No compaction of backfilling occurred, and soon after construction the ground subsided over the pipeline resulting in a depression that filled with water, so that this portion of the pipeline is now underwater.[2] The company and its contractors made this method up as they went along. Nothing was in writing. This unwritten method was used for a 2500-foot long area New Haven witnessed by Mr. Bubolz. It also occurred further south, in another roughly 1300-foot long stretch, according to Mr. Bubolz. If the walls of the trench had been shored up by sheeting, all of this could have been avoided, but VGS refused to authorize use of sheeting. *Bubolz Deposition* pp. 28, 31-32, 42-43, 47-48, 62, 78, 102, 110-111, 113-114, 122, 133 **[APPENDIX PP.742-879]**.

[2] A photograph taken by Mr. Bubolz shows the depression. It had filled with water by the time he took the photograph 8 weeks after the construction. [**MR. BUBOLZ'S PHOTOGRAPHS ARE FOUND AT APPENDIX PP.880-890.]**

The unwritten sink-in-swamp method was not restricted to the 2500-foot long area and the 1300-foot long area described by Mr. Bubolz; it was used "several" times, in both Monkton and New Haven. *G.C. Morris email to David Berger 9/8/17; G.C. Morris email to James Porter, August 7, 2017.* **[APPENDIX PP.200-202 -- DPS ENGINEER REPORTS VGS HAS INFORMED HIM THAT THE PIPELINE WAS INSTALLED IN SEVERAL SWAMPY AREAS BY "EXCAVATION OF SOFT MATERIAL ADJACENT TO THE PIPELINE ALLOWING PIPE TO SINK-IN TO POSITION BY DISPLACEMENT OF GROUND BENEATH IT."; APPENDIX PP.147-28 – DPS ENGINEER REPORTS "SINK-IN SWAMP METHOD" USED IN BOTH NEW HAVEN AND MONKTON]**

In sum, the photographs and video taken by a single citizen, and the resulting deposition, reveal:

► Contrary to PHMSA regulation 192.303, the **pipeline was not "constructed in accordance with comprehensive written specifications or standards." A third, unwritten, method was followed.**

► **No record** was created by VGS or any of its contractors of **where** the unwritten method was used. Mr. Shelton's photographs and Mr. Bubolz's deposition a year later – which resulted from Mr. Shelton's photographs – are the only record.

► No record was created by VGS or any of its contractors of **who authorized** use of the unwritten **method,** who at VGS **accepted this work** and paid for it under the contract, or **why VGS authorized or accepted this work.**

► **Water was not removed** from the trenches "promptly and continuously throughout the progress of the work." The contractor did not "keep the excavation dry at all times until the work is completed and excavation is backfilled…" (¶ 3.4)

► **Shoring and bracing of trench walls did not occur** where sloping was not possible because of space limitations or stability of material excavated. (¶ 3.3)

► "**The bottom of trench" was not "accurately graded** to provide a uniform level of padding/bedding…". (¶ 3.3)

► Although VGS claims it achieved **3 feet of cover** within 24 hours of Mr. Shelton's photographs and video, this was impossible. See Mr. Shelton's affidavit.

► **Backfill was not compacted, to 90% or any other %.** Yet all load-bearing calculations for heavy equipment accessing the VELCO high-voltage line were based upon **API RP 1102, which assumes compacted backfill**.

A QA process – if one existed – would have found and documented these many departures from written specifications. But there is no such record. Without Mr. Shelton's photographs and video, the substantial departure from PHMSA regulations and written specifications that Mr. Bubolz later described would never have come to light. Clearly, there was no functioning QA process.

The absence of a functioning QA process throws into question many other critical safety requirements, because --like the departures which Mr. Shelton uncovered -- there is no affirmative record of compliance with these either. These are addressed in some of the following sections.

2. **VIOLATION 1: UNINSPECTED REPAIRS OF DAMAGED CORROSION PROTECTION COATINGS, AND KNOWN DAMAGED COATINGS, WERE BURIED IN MANY LOCATIONS.**

Intervenors have referred to damaged coatings as Violation 1 in their PUC filings. Damaged or defective coatings are the single most common pipeline construction problem, according to the federal agency in charge of pipeline safety, the Pipeline and Hazardous Material Safety Administration, "PHMSA." PHMSA Pipeline Construction; FAQs, Question 2[3] **[APPENDIX PP.001-004]**.

Good coatings are "necessary" as one of two "layers of protection" against corrosion, according to PHMSA. The "cathodic protection" or "CP" system by itself does not suffice, because "the CP system is not always enough. There may be issues that reduce the effectiveness of CP, such as shielding. There may be problems with the CP system that go undetected for some period." And, critically, just a few months of corrosion can doom a pipeline: "Experience has

[3] https://primis.phmsa.dot.gov/construction/faqs.html.

shown that corrosion can do significant damage to a pipeline if CP is not adequate, even for a period of a few months." Therefore, it is "necessary to assure that pipeline coating is good to provide continued assurance of protection against corrosion even if CP problems occur." PHMSA Pipeline Construction; FAQs, Question 4. **[APPENDIX PP.001-004]**.

Later inspections, after the pipeline is buried, cannot substitute for quality assurance during construction. PHMSA Pipeline Construction; FAQs, Questions 2 and 7, **[APPENDIX PP.001-004]**.

A problem commonly found by PHMSA is "field-applied coatings have been identified as inadequate." PHMSA Pipeline Construction; FAQs, Question 12. "Unrepaired coating defects at lowering" is one of the typical problems found by PHMSA inspectors. **[APPENDIX PP.001-004]**. PHMSA Pipeline Construction: Miscellaneous[4]. **[APPENDIX PP.005-006]**. Poorly qualified construction personnel, poorly qualified inspectors, improper procedures, failure to follow procedures and lack of procedures are the most common problems that State pipeline inspectors have found. PHMSA Pipeline Construction; FAQs, Question 20. **[APPENDIX PP.001-004]**.

Finding 120 of the Commission's order in Docket 7970 addressed the potentially horrendous impacts of pipeline failure: "The impact radius, or the area subject to catastrophic harm to both property and person, caused by a catastrophic breach of the transmission pipeline as designed by VGS is approximately 320 feet." After finding that property and persons could suffer catastrophic harm within 320 feet of the pipeline, the Commission decided to approve of the project without a setback requirement of 320 feet. It did so for two reasons.

[4] https://primis.phmsa.dot.gov/construction/issuemiscellaneous.html

One reason was that a setback of that distance is not feasible. (Finding 277). The second reason was the company's "demonstrated commitment" to safety. "Vermont Gas has provided ample evidence that its design for the Project meets or exceeds all applicable federal and state standards and that the Company will implement robust operational and monitoring controls." ("Discussion" following Finding 284).

Quality assurance was one of the principal standards and controls the Commission relied upon – and in particular, **quality assurance with regard to coatings**. Finding 264 of the Commission's order in Docket No. 7970 stated that the pipeline would be constructed under a quality assurance plan that addresses "pipe inspection… applying and testing field-applied coating, lowering of the pipeline into the ditch, padding and backfilling…" Finding 265 stated that the company "will have a quality assurance inspection and testing program for the pipe coating that will cover the surface quality of the bare pipe, surface cleanliness and chlorides, blast cleaning, application temperature control, adhesion, cathodic disbondment, moisture permeation, bending, coating thickness, holiday detection and repair."

The facts found in the company's documents reveal widespread, open violation of this commitment, because **the records of inspection are either nonexistent or affirmatively show lack of inspection. [APPENDIX PP. 7-20, 25, 26, 188-190, 197-203]**

Defective coatings were found on pipe and on the canusa sleeves that cover welds. Then it was discovered that the patch kits used to repair the pipeline themselves were defective, so canusa sleeves had to be placed over the patch kits as well – but some batches of the canusa sleeves

themselves had defective coatings. All of this had to be repaired in the field by Over & Under and then Michels' employees.

Their work was often uninspected. Discovery response 1-114.1 **[APPENDIX PP.7-20]**, consists of "Inspection Reports." The following entry (with slight variations) **appears on 45 different days:**

> **There are several coating crews now so I am unable to observe/report on all coating/sleeves. All reports turned in are a spot check status as I overlook 3 to 5 different crews depending on the day**.

Coatings are essential to public safety. One inspector was covering 3 to 5 coating crews. He was performing only "spot checks." The inspector complained of inability to inspect on 45 different occasions. This is the polar opposite of QA.

The company's response to the Department when Department engineer Morris raised these concerns was to dismiss them as unnecessarily protective. Yes, there was only one inspector for three coating crews, the company wrote in its formal QA report but "There is no requirement, either contractual or statutory" to having a coating report for each coating application..." **[APPENDIX P.25]**

Sixty-six canusa sleeves from batches that were found to be defective had been buried before the defect was discovered. Testing by the manufacturer showed that the coating failure was occurring but that it did not reach the inner-most coating. The 66 sleeves were left in the ground. Christopher LaForce, March 2, 2017, Report on Canusa Shrink Sleeve Peel Tests. **[APPENDIX PP.188-190]**

It turned out that the sleeves left in the ground (also known as wraps) were not adequate. An in-line investigation of another pipeline revealed "significant pipe degradation (resultant from the wrap)." The Department's engineer asked the Department's pipeline expert, Mr. Berger, for his advice. He responded that he possessed confidential information about canusa sleeve failure and could not answer the question. August 30, 2017 Morris/Berger emails. **[APPENDIX P.197]**

Eight hundred feet of the ANGP also was buried with backfill that, according to "a variety" of witnesses, had "broken glass… chunks of metal and other household garbage/trash" mixed in with the backfill. These could compromise coatings. The company did not find and remove the glass, metal and other garbage during the two attempts it made to excavate the pipeline. The company stopped looking. Finding the glass, metal and garbage was unnecessary, the company stated, because the CP system would be placed into operation "at the gas-up of the pipeline" and because there would be a direct assessment survey. 10/19/15 Corrective/Preventative Action Plan. **[APPENDIX PP.198-199]**

There is no record of how many times repaired but uninspected pipeline or sleeve was buried, but the inspectors' notes, the QA report, and Department documents reveal this was a common occurrence. The company's QA report acknowledges there were 340 weld sleeves that lacked adequate records of repair. **[APPENDIX P.26]** An email from the Department's engineer to the Department's expert, Mr. Berger refers to the problems that required repair on the pipes (not the sleeves over the welds) as occurring at "multiple locations" on the ANGP of an "unknown number." **[APPENDIX PP.200-202]** There is no usable record of where those locations are**.** Neither

station number nor GPS data were created to record where repaired-but-uninspected pipe or sleeves have been buried.

The CP system that the company repeatedly stated would mitigate the failure to inspect coatings and the known coating defects in fact was not placed into commission "at time of gas-up." The pipeline was gassed up on April 12, 2017. In August of 2017, VGS expert Adam Gero wrote that "VGS is still working on the finalization of the CP." He wrote that he expected completion of the CP system in the "mid-fall" of 2017. **[APPENDIX P.203]** As noted above, PHMSA states that "Experience has shown that corrosion can do significant damage to a pipeline if CP is not adequate, even for a period of a few months." PHMSA Pipeline Construction; FAQs, Question 4.

The public is now in precisely the situation that, according to PHMSA, should never have happened. There was no inspection of 2/3 to 3/5 of the repaired pipe coatings and repaired canusa sleeve coatings (there was one inspector for 3 to 5 coating crews). Only by excavating and inspecting the entire pipeline can inspections determine if the coatings of the pipeline and of the sleeves are adequate.

Condition 2 of the PUC's CPG required construction to conform to the filed testimony and plans. The filed testimony and plans committed VGS to an aggressive QA program. That did not occur. The PUC CPG was violated. The violation places the safety of the public at risk. The ANGP should not continue in operation until these inspections have been completed.

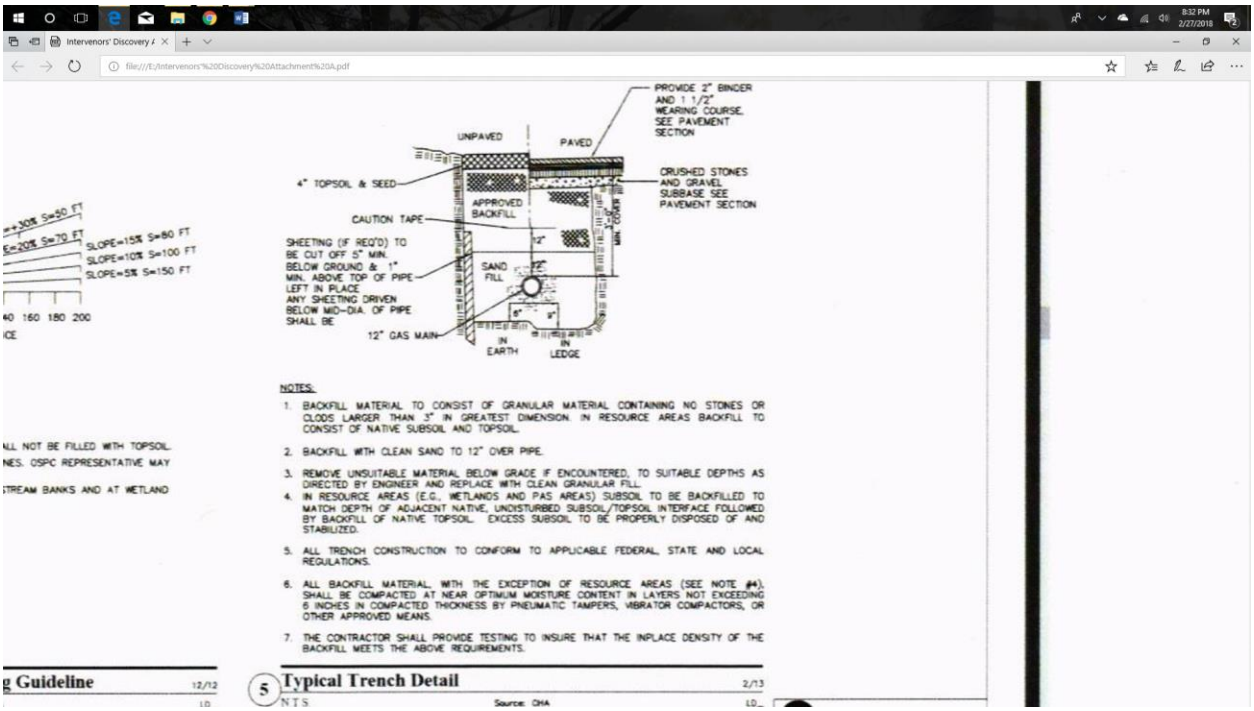
3. **VIOLATIONS 2(A)-(F). CLEAN SAND WAS NOT PLACED UNDER AND OVER THE PIPE.**

The Board's December 23, 2013 Certificate of Public Good stated, in paragraph 2:

> Construction of the proposed Project shall be in accordance with plans and evidence as submitted in this proceeding. Any material deviation from these plans or a substantial change to the Project must be approved by the Board. Failure to obtain advance approval from the Board for a material deviation from the approved plans or a substantial change to the Project may result in the assessment of a penalty pursuant to 30 V.S.A. §§ 30 and 247.

Paragraph 2 makes explicit that "Construction of the proposed Project shall be in accordance with plans and evidence as submitted in this proceeding." Paragraph 2 does not state that VGS must comply with only those parts of its plans and evidence summarized in the Board's lengthy order which explained the basis for the Certificate. Paragraph 2 also makes clear that approval to materially deviate from the plans and evidence must be sought and obtained in advance. It states that VGS must obtain "advance approval" of any "material change from," or any "substantial change to" the project from the plans and evidence submitted to the Board during the course of the proceedings. Paragraph 2 states that failure to obtain "advance approval" may result in penalties under 30 V.S.A. §§ 30 and 247. Section 247 imposes criminal penalties, including a jail sentence.

The trench detail plans submitted to the Commission prior to issuance of the CPG are set forth in Discovery Attachment A **[APPENDIX P.207]**and Answer to Request to Discovery Question 1-12 (Agreeing that Attachment A was the trench construction detail plan submitted to the Commission to obtain the CPG.) **[APPENDIX P.208]** The details from Attachment A are reproduced here:



The diagram shows the pipe entirely surrounded by "SAND FILL." It shows a minimum depth of sand fill of 6" on earth trench bottom and 9" on ledge trench bottom. It shows 12" of SAND FILL above the pipe. Above the SAND FILL its shows "APPROVED BACKFILL."

Note 1 states: "BACKFILL MATERIAL TO CONSIST OF GRANULAR MATERIAL CONTAINING NO STONES OR CLODS LARGER THAN 3" IN GREATEST DIMENSION. IN RESOURCE AREAS BACKFILL TO CONSIST OF NATIVE SUBSOIL AND TOPSOIL."

Note 2 states: "BACKFILL WITH CLEAN SAND TO 12" OVER PIPE."

Note 6 states: "ALL BACKFILL MATERIAL, WITH THE EXCEPTION OF RESOURCES AREAS (SEE NOTE #4) SHALL BE COMPACTED AT NEAR OPTIMUM MOISTURE CONTENT TO LAYERS NOT EXCEEDING 6 INCHES IN COMPACTED

THICKNESS BY PNEUMATIC TAMPERS, VIBRATOR COMPACTORS, OR OTHER APPROVED MEANS."

Note 7 states: "THE CONTRACTOR SHALL PROVIDE TESTING TO INSURE THAT THE INPLACE DENSITY OF THE BACKFILL MEETS THE ABOVE REQUIREMENTS."

As noted above, Finding 264 of the Commission's order in Docket No. 7970 stated that the pipeline would be constructed under a quality assurance plan that addresses "pipe inspection… applying and testing field-applied coating, lowering of the pipeline into the ditch, **padding and backfilling**…" (Emphasis added.) Finding 270 stated that the company "**will only use suitable backfill** material that will not shield the cathodic protection system or cause coating damage to the pipeline." (Emphasis added.) The Certificate of Public Good stated, in paragraph 2 that "Construction of the proposed Project shall be in accordance with plans and evidence as submitted in this proceeding." Discovery Attachment A is the only plan submitted by the company to the Commission showing what that "padding" and "suitable backfill" would consist of – 6 to 9 inches of clean sand under the pipe, 12 inches of clean sand over the pipe and approved backfill on top of that.

The purposes of requiring clean sand or other select backfill under the pipe are not just to avoid abrading the pipe coating and to provide support to withstand loading. A third, important purpose, is to prevent corrosion. The varying oxygen and moisture of native soils can accelerate corrosion, and nongranular objects can "shield" the pipeline and thereby render CP ineffective. The company did not understand this until the Department explained this to the company in June

of 2016. David Berger email to John McCauley June 20, 2016; John St. Hilaire email to GC Morris, July 1, 2016. **[APPENDIX PP.209-213]**

Violation 2(a). Neither clean sand nor any other fill was placed under the pipe in numerous locations in 2014 and 2016.

The company's written specifications for its contractors in 2014 explicitly authorized the contractors to lay the coated pipe directly on trench bottom. VGS Answers to Discovery Requests 1-85 through 1-96, and Discovery Requests Attachments D and E. **[APPENDIX PP.214-230]**

Contractors complied with the company's new specifications by laying the pipe directly on trench bottom. No fill of any kind -- much less clean sand - was placed under the pipe in numerous locations in 2014. **[APPENDIX PP.231-233]**

The company lacks a complete record of where this occurred. Discovery Attachment 84.3a., the December 21, 2015 QA Report, states "There was concern as to whether proper backfill was used in all areas where construction occurred in 2014. We are uncertain of specific locations were improper backfill may have been used." **[APPENDIX PP.24-26]** However, at least 4,200 feet of pipeline was installed in this manner, from station 240+26 to station 279+75 and from station 564+24 to station 567+84. Adam Gero Memorandum "Addison Natural Gas Project Pipe Laid on Trench Bottom," June 6, 2017. **[APPENDIX PP.231-233]**

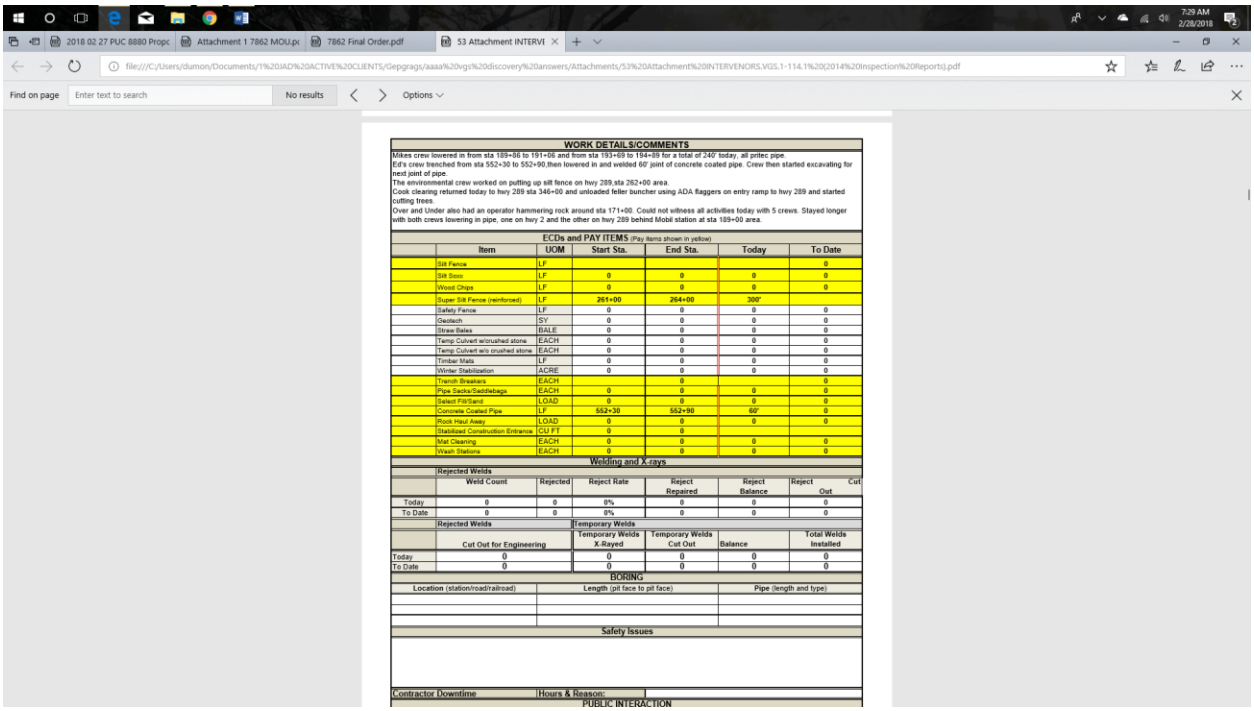
On June 16, 2016, Vermont's inspector found ongoing construction in which pipe again was being laid directly on trench bottom. "At kickoff Williston station observed pipe laid directly on trench bottom…" And on July 8, 2016, Mr. McCauley wrote: "Observing backfilling at Williston substation. Once again noted pipe directly on bottom of ditch." The company argued to Mr. McCauley that this was entirely proper. McCauley Excerpts. **[APPENDIX PP.245-246]**

In July 1, 2016, the company agreed not to lay pipe without use of select fill beneath it. John St. Hilaire email to GC Morris, July 1, 2016. **[APPENDIX PP.212-213; SEE ALSO APPENDIX PP. 231-232, SHOWING CORRECT DATE OF AGREEMENT TO CEASE LAYING PIPE ON TRENCH BOTTOM WAS JULY 7, 2016]**

Nonetheless, in September of 2016, the company yet again laid pipe without sand or any other select fill beneath it, in wetlands in New Haven and Monkton (see #5 below). The Department's engineer, Mr. Morris, described this as a repeat of the earlier violations. G.C. Morris email to David Berger 9/8/17. **[APPENDIX PP.200-202]** Mr. Morris' email makes clear that the failure to use sand or other select fill beneath the pipe was not restricted to the Red Maple/Green Ash swamp in New Haven – he said this had occurred "several" times, and in an August 7, 2017 email he wrote this had occurred in both Monkton and New Haven. G.C. Morris email to James Porter, August 7, 2017. **[APPENDIX PP.247-248]**

Violation 2(b). In 2014, in those locations where the pipe was not placed directly on trench bottom, there is no record that clean sand or other select fill was placed under and over the pipeline.

The company's daily inspection records in 2014 contained columns for stating the number of loads of "select fill/sand" used in each location. These records reveal that all of the pipeline construction which occurred in 2014 lacked sand or substitute select fill; if sand or substitute select fill in fact was used, there is no record of its use. The daily records state "0" in this category every day. The following, from September 9, 2014, by Inspector J.R. Kelch **[APPENDIX P.250]**, is a typical example:



WORK DETAILS/COMMENTS

Mikes crew lowered in from sta 189+86 to 191+06 and from sta 193+69 to 194+89 for a total of 240' today, all pritec pipe.
Ed's crew trenched from sta 552+30 to 552+90,then lowered in and welded 60' joint of concrete coated pipe. Crew then started excavating for next joint of pipe.
The environmental crew worked on putting up silt fence on hwy 289,sta 262+00 area.
Cook clearing returned today to hwy 289 sta 346+00 and unloaded feller buncher using ADA flaggers on entry ramp to hwy 289 and started cutting trees.
Over and Under also had an operator hammering rock around sta 171+00. Could not witness all activities today with 5 crews. Stayed longer with both crews lowering in pipe, one on hwy 2 and the other on hwy 289 behind Mobil station at sta 189+00 area.

ECDs and PAY ITEMS (Pay items shown in yellow)

	Item	UOM	Start Sta.	End Sta.	Today	To Date
	Silt Fence	LF				0
	Silt Sonx	LF	0	0	0	0
	Wood Chips	LF	0	0	0	0
	Super Silt Fence (reinforced)	LF	261+00	264+00	300'	
	Safety Fence	LF	0	0	0	0
	Geotech	SY	0	0	0	0
	Straw Bales	BALE	0	0	0	0
	Temp Culvert w/crushed stone	EACH	0	0	0	0
	Temp Culvert w/o crushed stone	EACH	0	0	0	0
	Timber Mats	LF	0	0	0	0
	Winter Stabilization	ACRE	0	0	0	0
	Trench Breakers	EACH		0		0
	Pipe Sacks/Saddlebags	EACH	0	0	0	0
	Select Fill/Sand	LOAD	0	0	0	0
	Concrete Coated Pipe	LF	552+30	552+90	60'	0
	Rock Haul Away	LOAD	0	0	0	0
	Stabilized Construction Entrance	CU FT	0	0		
	Mat Cleaning	EACH	0	0	0	0
	Wash Stations	EACH	0	0	0	0

Welding and X-rays

Rejected Welds

	Weld Count	Rejected	Reject Rate	Reject Repaired	Reject Balance	Reject Cut Out
Today	0	0	0%	0	0	0
To Date	0	0	0%	0	0	0

Rejected Welds | **Temporary Welds**

	Cut Out for Engineering	Temporary Welds X-Rayed	Temporary Welds Cut Out	Balance	Total Welds Installed
Today	0	0	0	0	0
To Date	0	0	0	0	0

BORING

Location (station/road/railroad)	Length (pit face to pit face)	Pipe (length and type)

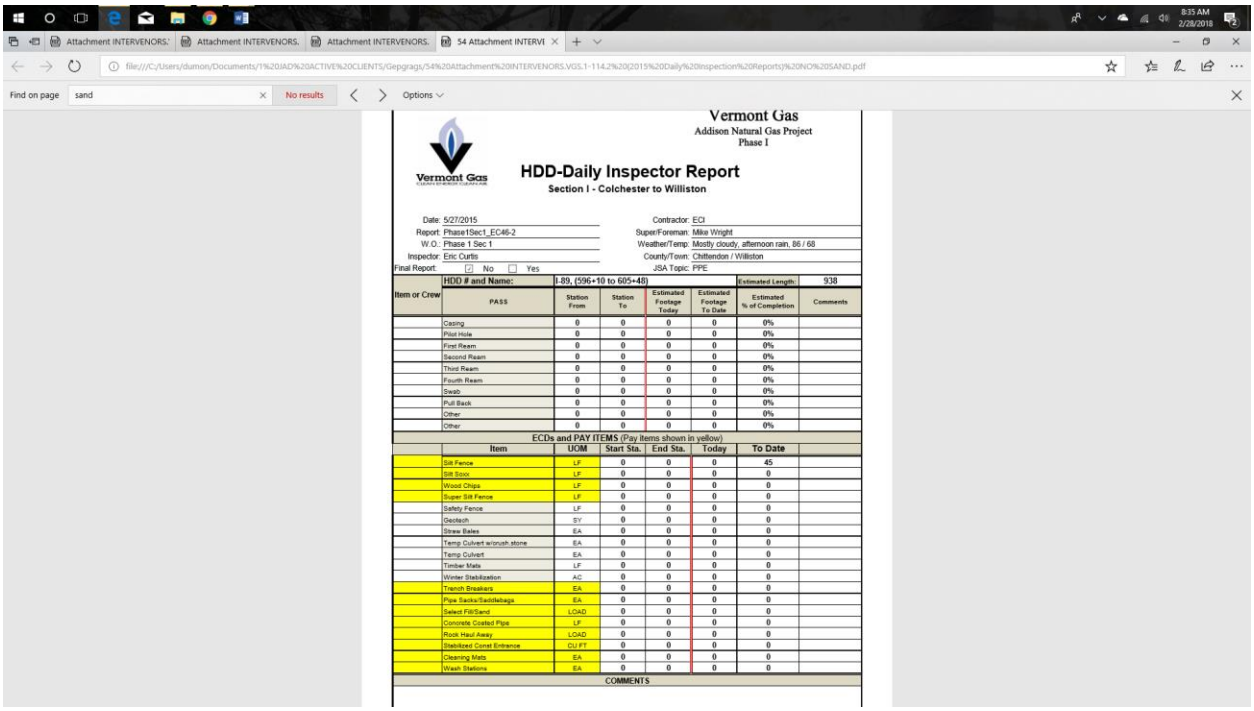
Safety Issues

Contractor Downtime | Hours & Reason:

PUBLIC INTERACTION

Violation 2(c). In 2015, there is no record of sand or substitute select fill under and over the pipeline.

By 2015, the company's contractor specifications had been changed to require that backfill be placed under the pipe but left it to the contractor to decide not to use clean sand if the contractor believed other materials were adequate. Records for 2015, however, do not indicate that any sections of the pipeline received clean sand or received substitutes. The inspection reports for some of the year contain a column for indicating if "select fill/sand" was used. They are uniformly marked "0." The May 27, 2017 report **[APPENDIX P.252]** , for example, is copied here:



Vermont Gas
Addison Natural Gas Project
Phase I

HDD-Daily Inspector Report
Section I - Colchester to Williston

Date: 5/27/2015 | Contractor: ECI
Report: Phase1Sect_EC46-2 | Super/Foreman: Mike Wright
W.O.: Phase 1 Sec 1 | Weather/Temp: Mostly cloudy, afternoon rain, 86 / 68
Inspector: Eric Curtis | County/Town: Chittendon / Williston
Final Report: ☑ No ☐ Yes | JSA Topic: PPE

Item or Crew	HDD # and Name:	I-89, (596+10 to 605+48)				Estimated Length:	938
	PASS	Station From	Station To	Estimated Footage Today	Estimated Footage To Date	Estimated % of Completion	Comments
	Casing	0	0	0	0	0%	
	Pilot Hole	0	0	0	0	0%	
	First Ream	0	0	0	0	0%	
	Second Ream	0	0	0	0	0%	
	Third Ream	0	0	0	0	0%	
	Fourth Ream	0	0	0	0	0%	
	Swab	0	0	0	0	0%	
	Pull Back	0	0	0	0	0%	
	Other	0	0	0	0	0%	
	Other	0	0	0	0	0%	

ECDs and PAY ITEMS (Pay items shown in yellow)

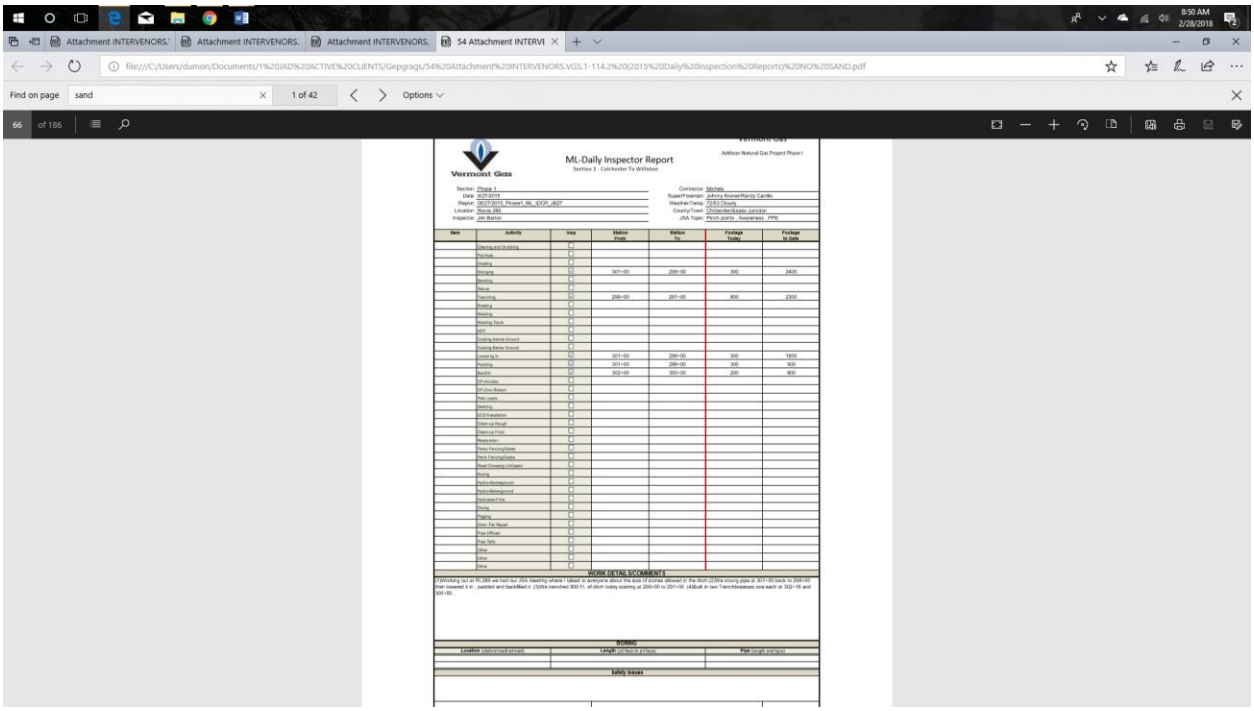
Item	UOM	Start Sta.	End Sta.	Today	To Date	
Silt Fence	LF	0	0	0	45	
Silt Sooc	LF	0	0	0	0	
Wood Chips	LF	0	0	0	0	
Super Silt Fence	LF	0	0	0	0	
Safety Fence	LF	0	0	0	0	
Geotech	SY	0	0	0	0	
Straw Bales	EA	0	0	0	0	
Temp Culvert w/crush stone	EA	0	0	0	0	
Temp Culvert	EA	0	0	0	0	
Timber Mats	LF	0	0	0	0	
Winter Stabilization	AC	0	0	0	0	
Trench Breakers	EA	0	0	0	0	
Pipe Sacks/Saddlebags	EA	0	0	0	0	
Select Fill/Sand	LOAD	0	0	0	0	
Concrete Coated Pipe	LF	0	0	0	0	
Rock Haul Away	LOAD	0	0	0	0	
Stabilized Const Entrance	CU FT	0	0	0	0	
Cleaning Mats	EA	0	0	0	0	
Wash Stations	EA	0	0	0	0	

COMMENTS

If sand was used, or a substitute for sand was used, there is no record of where either was used, or what the substitute was.

Violation 2(d). In late 2015 and 2016, the company ceased recording whether select backfill of any kind was being used.

The inspection reports for late 2015 and 2016 contained no place to record whether sand or select fill was used. The report of August 27, 2015 **[APPENDIX PP.254-256]** , for example states that the crew discussed the size of stones allowed in the ditch and that pipe was laid down, padded and backfilled, but there is no mention of sand or select fill:



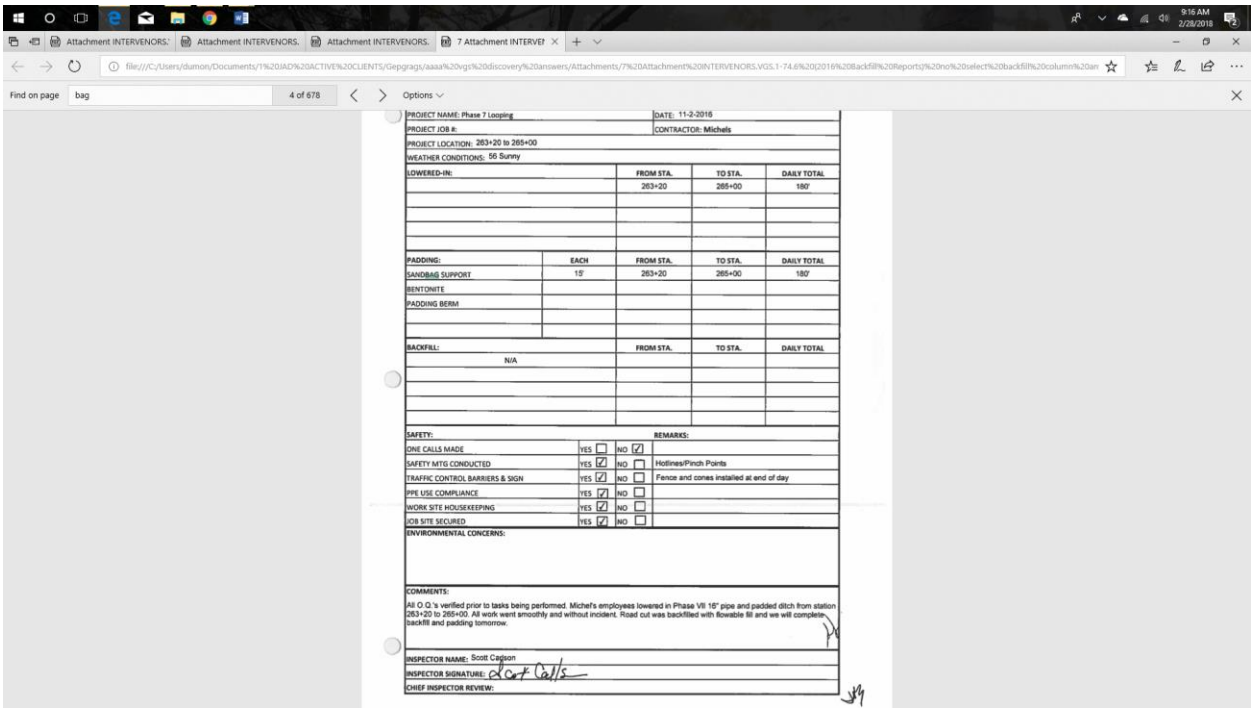
Violation 2(e). In 2016, other records show a very small amount of sand was used, and in many areas neither clean sand nor a substitute was used.

By construction season in 2016, VGS had explicitly changed its construction plans to match its practices. See 6-30-16 Modification Bulletin Trans-14. **[SUPPLEMENTAL ATTACHMENT #1]** But this change was never presented to or approved of by the Commission.

Sand-purchase invoices show that only 350 cubic yards of screened sand were purchased in all of 2016. (The purchases for sand to place into sandbags is not included.) This would provide select backfill for about 2000 feet of pipeline. Sand Purchase Invoices **[APPENDIX PP.257-282]**

Other records show that the pipeline was constructed on sandbags spaced 15 feet apart with no sand or select fill between the sandbags. Either the gaps between sandbags were left empty or regular backfill was used. What follows is one example. It is a daily report for November 2, 2016,

[APPENDIX PP.283-285] by Inspector Scott Carlson. It states that the pipeline was lowered down onto sandbags spaced 15 feet apart, with no fill between the sandbags. The sandbags are the "padding" cited in the narrative.



PROJECT NAME: Phase 7 Looping — DATE: 11-2-2016
PROJECT JOB #: — CONTRACTOR: Michels
PROJECT LOCATION: 263+20 to 265+00
WEATHER CONDITIONS: 56 Sunny

LOWERED-IN:	FROM STA.	TO STA.	DAILY TOTAL
	263+20	265+00	180'

PADDING:	EACH	FROM STA.	TO STA.	DAILY TOTAL
SANDBAG SUPPORT	15'	263+20	265+00	180'
BENTONITE				
PADDING BERM				

BACKFILL:	FROM STA.	TO STA.	DAILY TOTAL
N/A			

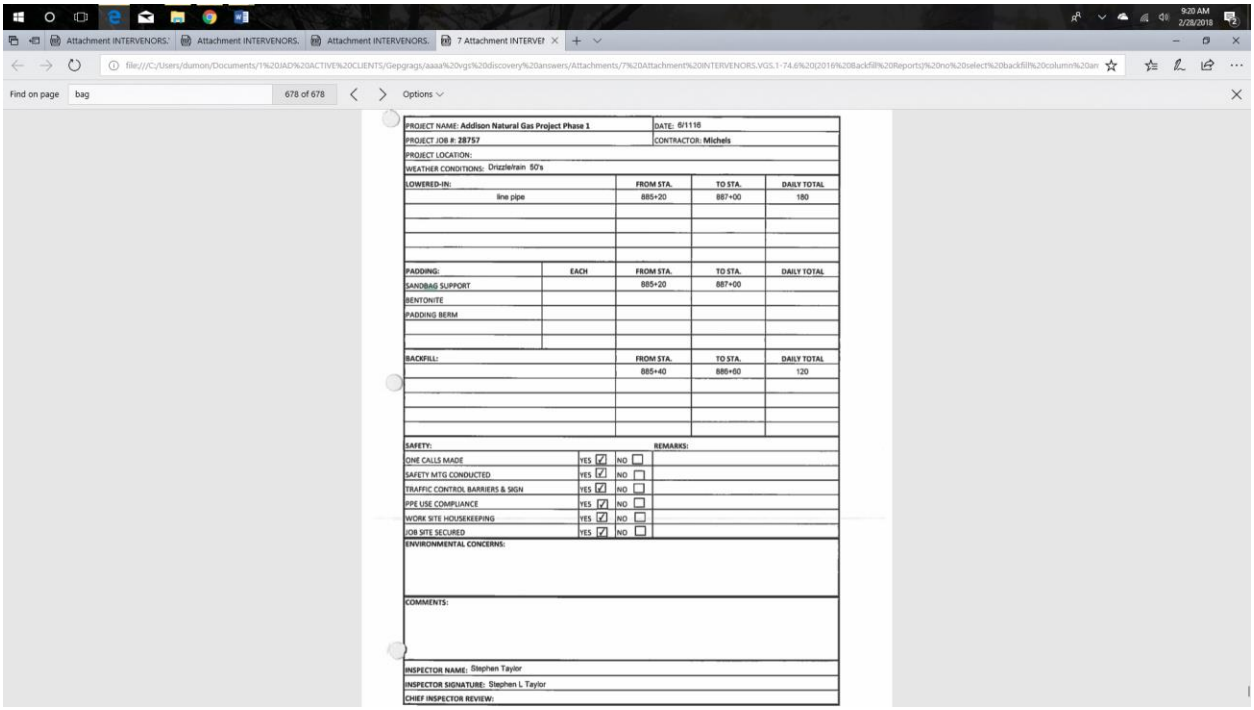
SAFETY:			REMARKS:
ONE CALLS MADE	YES ☐	NO ☑	
SAFETY MTG CONDUCTED	YES ☑	NO ☐	Hotlines/Pinch Points
TRAFFIC CONTROL BARRIERS & SIGN	YES ☑	NO ☐	Fence and cones installed at end of day
PPE USE COMPLIANCE	YES ☑	NO ☐	
WORK SITE HOUSEKEEPING	YES ☑	NO ☐	
JOB SITE SECURED	YES ☑	NO ☐	

ENVIRONMENTAL CONCERNS:

COMMENTS:
All O.Q.'s verified prior to tasks being performed. Michel's employees lowered in Phase VII 16" pipe and padded ditch from station 263+20 to 265+00. All work went smoothly and without incident. Road cut was backfilled with flowable fill and we will complete backfill and padding tomorrow.

INSPECTOR NAME: Scott Carlson
INSPECTOR SIGNATURE: Scott Carlson
CHIEF INSPECTOR REVIEW:

Other inspector reports show that the pipe was lowered onto sandbags that had some backfill added but not along the entire distance. What follows is the June 11, 2016 report by Stephen Taylor.[5]



PROJECT NAME: Addison Natural Gas Project Phase 1 | DATE: 6/1116
PROJECT JOB #: 28757 | CONTRACTOR: Michels
PROJECT LOCATION:
WEATHER CONDITIONS: Drizzle/rain 60's

LOWERED-IN:	FROM STA.	TO STA.	DAILY TOTAL
line pipe	885+20	887+00	180

PADDING:	EACH	FROM STA.	TO STA.	DAILY TOTAL
SANDBAG SUPPORT		885+20	887+00	
BENTONITE				
PADDING BERM				

BACKFILL:	FROM STA.	TO STA.	DAILY TOTAL
	885+40	886+60	120

SAFETY:			REMARKS:
ONE CALLS MADE	YES ☑	NO ☐	
SAFETY MTG CONDUCTED	YES ☑	NO ☐	
TRAFFIC CONTROL BARRIERS & SIGN	YES ☑	NO ☐	
PPE USE COMPLIANCE	YES ☑	NO ☐	
WORK SITE HOUSEKEEPING	YES ☑	NO ☐	
JOB SITE SECURED	YES ☑	NO ☐	

ENVIRONMENTAL CONCERNS:

COMMENTS:

INSPECTOR NAME: Stephen Taylor
INSPECTOR SIGNATURE: Stephen L Taylor
CHIEF INSPECTOR REVIEW:

[APPENDIX P.286]

Violation 2(f). In 2014, 2015, and 2016, the company kept no records showing that the required depth of sand or select fill was measured or inspected.

There is no documentation in 2014 or 2015 that sand or select fill was measured to a depth of 6 inches on top of soils, 9 inches on top of rock, and 12 inches above the pipe, in those locations where records show that select fill of any kind was used.

In 2016, there is no record at all of the use of sand or select fill (except the sand purchase invoices, showing purchase of 350 c.y.), so there are no records of depth.

[5] Each whole number in the station number represents 100 feet. For example, the distance from 885.00 to 886.00 is 100 feet; to 885.20 it would be 120 feet.

If contractors did measure depth, and then filled to those depths, there is no record that the contractors' measurements or depths were ever inspected. It was an honor system. It was an honor system that did not require those whose work was not being inspected to record that they were complying.

The Commission relied on the fact that "the Company will implement robust operational and monitoring controls." ("Discussion" following Finding 284). A construction process that did not require contractors to *record* compliance with construction standards, and did not require inspectors to *inspect* compliance, lacks "robust operational and monitoring controls."

The CPG was repeatedly violated by noncompliance with the plans submitted to the PUC, which required placement of the pipe on sand bedding, and covering the pipe with 12 inches of sand. If VGS believed those plans should be changed, they were obligated to obtain advance approval from the PUC.

As noted next, there was wholesale failure to inspect and record the inspection of the non-sand backfill that was used in lieu of sand. The CPG violation placed the safety of the pipeline at risk.

4. **SAFETY VIOLATIONS 3(A)-(D). SCREENING, INSPECTION, COMPACTION AND COMPACTION TESTING OF REGULAR BACKFILL DID NOT OCCUR.**

The CPG plans required that regular backfill be placed over the select backfill, and that it must be: i) screened and inspected to ensure no rocks or soil clods over 3 inches in length were present, ii) compacted in 6-inch layers; iii) compacted to 90% within the VELCO ROW, iv) tested to insure proper compaction had occurred and then v) covered with topsoil. **[APPENDIX PP.207-208]** This was all to be performed pursuant to a QA Plan, as noted above. PHMSA regulations

require not only compliance with specifications, but installation in the trench so as to protect pipe coatings and provide firm support for the pipeline. 49 CFR § 192.319.

There are no records of any backfill screening, backfill inspection, backfill layering, backfill compaction, or backfill testing -- other than the 11 tests discussed below. As a practical matter, there was no QA.

Properly compacted backfill is absolutely necessary for pipeline safety in the VELCO ROW because *load-bearing calculations were based on compacted soils*. The load-bearing calculations were from the industry standard, which is American Petroleum Institute ("API") Recommended Practice ("RP") 1102, "Steel Pipelines Crossing Railroads and Highways" (7th ed. 2007). **[APPENDIX PP.287, 326 – REQUIRING COMPACTION "TO DENSITIES CONSISTENT WITH THAT OF THE SURROUNDING SOIL."]** PHMSA relies upon API RP 1102. See, e.g., PHMSA PIPA Recommended Practice ND 13 **[APPENDIX PP.371-372]**, and PHMSA Interpretation Response #PI-75-0116 **[APPENDIX PP.373-376]** .

API RP 1102 contains the equations that were used by CHA to engineer the ANGP. Mott MacDonald Report, *supra* **[APPENDIX PP.347, 350, RELYING ON API RP 1102]**. APR RP 1102 includes the following assumptions:

§4.2.1: Uniform soil support exists for the entire length of the pipeline (i.e., not acceptable to rest pipeline on sandbags). **[APPENDIX P.299]**

§4.2.2: Voids between pipe and adjacent soil must be minimized (see §6.2.2). (Again, resting pipeline on sandbags not acceptable). **[APPENDIX P.299]**

§4.3.1: Vehicle crossings must be as near as possible to be at right angle (90 degrees) and in no event less than 30 degrees. (Emphasis added.) **[APPENDIX P.299]** (VGS and VELCO have not included this restriction in their MOU.)

§4.4: Wet soils should be avoided. Depth of cover must be 4 feet. **[APPENDIX PP.299-300, §§ 4,3,2 AND 4.4]**

§4.6.1.2: Site specific unusual situations such as "frost heave" "shrinking or swelling soils" or "local instability" must be separately considered and are not addressed by API 1102. ("Oozing" wet soils from New Haven and Monkton wetlands, as described by Mr. Bubolz, are not addressed by RP 1102.) **[APPENDIX P.301]**

§6.2.1.3. Bedding must be uniformly provided throughout. **[APPENDIX P.326]**

§6.2.2: "Backfill should be compacted sufficiently to prevent settlement detrimental to the facility to be crossed. **Backfill should be placed in layers of 12 in**. (305 mm) or less (uncompacted thickness) and **compacted thoroughly around the sides and over the pipe to densities consistent with that of the surrounding soil**. Trench soil used for backfill (or a substituted backfill material) must be capable of producing the required compaction. In addition to being properly compactable, padding and backfill must be of appropriate quality to prevent damage to pipeline and/or casing coatings." (Emphasis added.) **[APPENDIX P.326]**

There is no documentation of **compaction within the VELCO ROW or outside of the VELCO ROW for the entire ANGP**, for open land and all road crossings and driveway crossings. There exists no record that compaction, anywhere, was performed in 6-inch or even 12-inch layers as required by the filed plans and then the un-filed amended plans and API RP 1102. There is no mention of compaction in any of the inspection records. It is mentioned only in passing (*e.g.*, "compaction finished") in just a few of the hundreds of pages of work records. But API RP 1102 assumes that compaction occurs at all load-bearing locations, be they access points for VELCO heavy equipment, or driveways over which fuel trucks deliver heating oil to a home, or open fields traversed by tractors or log trucks..

There is no record that any construction contractor or the company tested backfill compaction, with two exceptions. Eight tests were done by Knight Engineering, in 2015, within the VELCO ROW. Five showed inadequate compaction. Additional testing was performed at 3

VELCO ROW sites in April of 2016. One of the 3 additional sites failed. No other tests were ever done. Therefore it is probable that much of the backfill throughout the VELCO ROW does not satisfy the 90% compaction pipeline safety requirement. The only evidence that exists is the data from the 11 sites tested by Knight Engineering. Six of the 11 sites tested failed. **[APPENDIX PP.470-471]**

Remarkably, long after much of the pipeline had been constructed within the VELCO ROW, VGS's representatives emailed to their engineers at CHA that they wanted to get rid of the 90% compaction requirement because it was "unachievable." They proposed instead that concrete-coated pipe be used near road crossings. CHA replied that the load-bearing calculations had been based on compaction, and that concrete-coating does not improve load-bearing capacity (it protects against abrasions). See 5/20/16-5/21/16 correspondence between Joey Wilson, Brendan Kearns and Michael Reagan. **[SUPPLEMENTAL ATTACHMENT #6]**

The following month, emails authored by the company's Vice President, who had been placed in charge of this project, and one of Mott MacDonald's inspectors, made painfully clear how carefully the company was ensuring that compaction was occurring. The letter post-dates the Knight Engineering testing, so the company knew it had failed 6 of the 11 tests. The company's view was that the answer was to cease the testing. Mott MacDonald Inspector Mike Reagan emailed Vice President St. Hilaire that "GC," the Department's engineer, "is back on the issue if [sic] compaction on the VELCO easement. Just a heads up, he talked to some operators today. So except [sic] a call tomorrow. I was just notified by a VELCO inspector." Mr. St. Hilaire replied: "Compaction or placing pipe on bottom of trench?" Mr. Reagan replied "Compaction the original

spec." **Mr. St. Hilaire then replied: "I thought we took that out?"** The inspector replied: **"I did to [sic] we went thru it hope CHA did it. I thought this was all s**et…" John St. Hilaire emails with Michael Reagan June 29, 2016. **[APPENDIX P.472]**

Intervenors thus far have seen no record of any testing that was done outside of the VELCO ROW -- at road crossings in residential areas, for example. The API RP 1102 standards, and calculations, apply to all road crossings, inside or outside the VELCO ROW. Every pipeline must be constructed so that so that a lumber truck, milk tanker truck, fuel delivery truck, or other fully loaded truck, does not rupture the pipeline when passing down an unpaved road or driveway that crosses a pipeline.[6]

The company's specifications to contractors also changed the screening standard from 3 inches to 6 inches in 2015. ANGP Project Directive dated 8/31/15. **[APPENDIX P.469]** The company did not consult with the Department, or inform the Commission, before changing the specifications that had been submitted to the Commission. From that date forward, backfill with rocks and clods of soil larger than 6 inches was used.

In sum, VGS violated its CPG, violated PHMSA regulations 192.303 and 192.319, constructed the ANGP without compliance with the critical assumptions upon which API RP 1102 was based, and placed public safety at risk, by: i) failing to screen and inspected to ensure no rocks or soil clods over 3 inches in length were present in backfill, ii) failing to inspect for and document compaction in 6-inch layers or 12-inch layers, and failure to compact at all in certain areas; and

[6] The standard specifications provided to contractors required 95% compaction for road crossings. API RP 1102 says the compaction must be "consistent" with adjoining soils.

iii) failure to compact to 90% or to density consistent with undisturbed soils within the VELCO ROW.

5. **VIOLATION 4. ZINC RIBBON CORROSION PROTECTION FOR HIGH RISK AREAS WAS NOT INSTALLED, OR THERE IS NO RECORD OF WHERE IT WAS INSTALLED.**

An ARK engineering report issued in 2013 required that heightened corrosion protection be utilized in 27 high-risk areas (such as wetland areas that are parallel to or cross the VELCO ROW) by installation of zinc ribbon. **[APPENDIX P.717]** This requirement was incorporated into plans provided to each contractor. PHMSA rules required that the written plans be adhered to. 49 C.F.R. §192.303. Vermont law and the CPG required compliance with PHMSA regulations. PUC Rule 6.154; CPG ¶ 3.

There is no record of installation of the zinc ribbon in the New Haven Red Maple/Green Ash wetland and from station number 889 to station number 892, in St. George.

The evidence from the deposition of the foreman from Michels, however, suggested that the zinc ribbon could not have been installed at the New Haven site. The site was extremely difficult to work in. One excavator, even though it was on mats, slid into the wetland and could not get out. Other equipment had to be brought in to remove it. Immediately after the pipe was sunk into the soils, the mats were removed and taken away. *Bubolz depo.* tr. 62, 113-114. It would have been impossible for the ditch for the zinc ribbon to be installed other than by hand-digging. This was a 2500-foot long area. *Bubolz depo* tr. 32, 102. **[APPENDIX PP.743, 773, 844, 854, 855]** Hand-digging seems unlikely.

6. **SAFETY VIOLATION 5. THE UNWRITTEN "SINK IN SWAMP" METHOD REPLACED THE TWO APPROVED METHODS OF CONSTRUCTION IN WETLANDS.**

This fifth violation is discussed above.

7. SAFETY VIOLATIONS 6(A)-(C). NO QUALITY ASSURANCE PLAN WAS ADOPTED AND IMPLEMENTED UNTIL MOST OF THE ANGP HAD BEEN COMPLETED; THE QA PLAN FAILS TO ADDRESS KNOWN SAFETY RISK AND THE CPG.

The CPG required that the company adopt and enforce a written **Quality Assurance** plan as well as a **QA plan specific to coatings**. PUC findings relied on these commitments.

Violation 6(a). In 2014, construction occurred without a QA Plan or QA review.

The company had no QA plan in 2014, when the first 11 miles were constructed -- during which time pipe was laid directly on trench bottoms, contrary to the plans submitted to the PUC the year before.

The company did not begin to draft a QA plan until January of 2015. VGS believed it had developed a complete plan on July 2, of 2015. Excerpts from DPS Engineering Weekly Reports. **[APPENDIX PP.890-902]** The first QA review was conducted in December of 2015.

Violation 6(b). In 2015, construction continued despite DPS warnings the QA Plan lacked critical elements.

The Department's engineer warned the company on July, 21, 2015 that "critical elements" of the QA plan were still missing. Excerpts from DPS Engineering Weekly Reports. **[APPENDIX PP.890-902]** Construction continued.

Violation 6(c). The company's QA documents do not address known compaction testing failures and their consequences for public safety, or the commitments made to the Board.

The company's December 21, 2015 QA review did not address the results of the 8 sites tested by Knight Engineering in 2015, whether additional testing would be advisable, or the potential consequences of inadequate compaction in the VELCO ROW. **[APPENDIX PP.21-183]**

The QA review defended the company's placement of pipe directly on trench bottom, arguing that the company's own specifications allowed this. The QA review did not mention the warning it had been given in 2014 that this practice was unsafe, and its commitment to change the practice, or the specifications the company had submitted to the Commission in 2013 which barred this practice.

The commitment to quality assurance relied upon by the Commission was not honored.

8. VIOLATION #7 – DEPTH OF COVER IN THE NEW HAVEN SWAMP, UNDER STREAMS, IN RESIDENTIAL AREAS, AND THROUGHOUT THE ANGP

Intervenors initially requested an investigation because VGS had deliberately violated its Certificate of Public Good by burying the pipeline **less than 4 feet deep within the VELCO Right of Way** in New Haven, and then, after opening the pipeline to transmission of gas, a year after the burial, asking the Commission for retroactive approval.

Subsequently, compelling evidence demonstrated three other violations of the depth of cover commitments made to the PUC and adopted by the Commission in the CPG. The commitment to bury the pipeline **7 feet beneath all streams** has been violated throughout the length of the pipeline with the exception of 18 streams – the other 40 to 50 streams being in violation. The commitment to bury the pipeline **4 feet deep in all residential areas** has been violated in parts of the pipeline. And at **hundreds of locations** along the pipeline, the required depth of cover has been achieved not by burying the pipeline to the required depth but by **adding topsoil on top of the pipeline to a height above surrounding, natural contours,** in violation of other commitments VGS made to the Commission.

Mr. Heintz's February 28, 2013, supplemental prefiled testimony, on page 32, lines 9-12 stated: "The pipe will be covered by at least 36 inches of soil. **The pipeline will have four-feet of cover in agricultural areas, within the VELCO ROW and residential areas, and generally five-feet of cover at road crossings and seven feet of cover at open cut streams.**" **[SUPPLEMENTAL ATTACHMENT #7, MR. HEINTZ' 2/28/13 PFT]** VGS submitted detailed plans to the Commission which addressed depth of burial. These plans were submitted on February 28, 2013, and again on June 28, 2013. These plans were admitted into evidence as Mr. Nelson's testimony exhibit "Supplement JAN-9 Attachment 1 (2/28/13)" and as "Supplement JAN-9 Attachment 1 Updated EPSC Plan Set (6/28/13)." **[SUPPLEMENTAL ATTACHMENTS #8 AND #9]**

These exhibits contain "alignment sheets" for each section of the pipeline. On each alignment sheet, all streams are shown. The alignment sheets show more than 50 stream crossings. On each alignment sheet, the "construction type" for every part of the pipeline is shown. Construction types are coded. A key at the beginning of the exhibits explains each code. For streams, there are two codes, 7 and 8. Seven is for stream crossings by open cut trenching. Eight is for stream crossings by Horizontal Directional Drilling. For each construction type, specifications are set forth. For construction type 7, the specification is for **84 inches of burial beneath the bottom of the channel of each stream.** Every single stream along the pipeline, from Williston to Middlebury, according to Mr. Nelson's exhibits, was to be crossed using either construction type 7 or construction type 8. If the stream was not to be crossed using HDD, there would be 84 inches of burial beneath each stream.

Page 21 of the February 28, 2013 exhibit (and the corresponding page 6 in the June 28, 2013 exhibit) has diagrams titled "Horizontal Directional Drill (HDD) Stream Crossing – Typical Section" and titled "Open Trench Stream Crossing – Typical Section." Again, the latter typical section shows **7 feet of depth below each channel**.

These same pages also list 10 stream crossings in the HDD "typical" section and 9 streams in the open cut "typical" section. The typical section diagrams do *not* state that only the listed 10 streams will have HDD or only the listed 9 streams will have 7 feet of depth. Nowhere in either exhibit can be found any diagram, construction type, narrative or other indication that an open cut trench stream crossing would be buried to less than seven feet. All specifications for stream crossings are either HDD or **7 feet of burial.**

Mr. Nelson submitted testimony stating that, using Federal Emergency Management Agency maps, the project will require 30 floodway crossings. Petitioner Supp JAN-2 (2/28/13), p.14. **[SUPPLEMENTAL ATTACHMENT #10, MR. NELSON'S 2/28/13 PFT]]**Mr. Nelson also submitted testimony stating that the project would cross 22 streams with headwaters of greater than 1 square mile, and 26 streams with headwaters less than one square mile. Nelson PFT 2/28/13 p.23. **[SUPPLEMENTAL ATTACHMENT #10]** He later revised his testimony, stating that 21 streams with greater than 1 square mile of headwaters would be crossed. 6/28/13 PFT p.5. **[SUPPLEMENTAL ATTACHMENT #11, MR. NELSON'S 6/28/13 PFT]** He never submitted testimony limiting the 7-foot commitment to the 22 streams with headwaters greater than1 square mile. The only specifications for all streams limited the choices to HDD or 7 foot of burial. But VGS used 7 feet of cover only for 21 streams.

VGS has attempted to justify departure from the 7-foot stream crossing commitment by reliance on a document labelled ANGP-1-G-017. **[SUPPLEMENTAL ATTACHMENT #12, VGS COUNSEL BOUFFARD MEMO TO DPS COUNSEL DUGGAN DATED 6/21/17, P.3; SUPPLEMENTAL ATTACHMENT #13A AND 13B, ANGP -1-G-017 AND ANGP-1-G-015. THESE POST-CPG DOCUMENTS ADOPT A 5-FOOT DEPTH OF COVER FOR STREAMS EXCEPT FOR CERTAIN LISTED STREAMS.[7]]** These plans were created in 2015, two years after the CPG was issued. Under Condition 2 of the CPG, VGS could not make material changes to depth of cover under streams without Commission pre-approval.

And, despite Mr. Heintz's testimony, the plans prepared for contractors informed them they needed only 3 feet of cover in residential areas. See, e.g., ANGP-1-G-017 **SUPPLEMENTAL ATTACHMENT #13A AND 13B**.] VGS's commitment to 4 feet of cover in residential areas, in Mr. Heintz's testimony was never reflected in the plans it provided to contractors.

It has become clear that the pipeline is not buried to 7 feet under most streams and is not buried to 4 feet in any residential areas (except where the residential areas are within the VELCO ROW or have agricultural soils).

It has also become clear that depth of cover violations were and are rampant throughout the ANGP, not just for streams or residential areas. In Docket No. 7970, VGS expert witness John Heintz testified in his December 20, 2012, Prefiled Testimony, at page 12: "After completion of

[7] Note that ANGP-1-G-015 and ANGP-1-G-017 have been erroneously captioned by both VGS and Intervenors. The correct cites are ANGP-T-G-015 and ANGP-T-G-017.

construction, the entire ROW area will be **graded back to its previous contours** and restored consistent with the Erosion Prevention and Sediment Control Plan…" (Emphasis added.) See attached copy [**SUPPLEMENTAL ATTACHMENT #14, MR. HEINTZ' 12/20/12 PFT**.] In Docket No. 7970, Mr. Heintz testified again in his February 28, 2013, Supplemental Prefiled Testimony, at page 18: "After completion of construction, the entire ROW area will be **graded back to its previous contours** and restored consistent with the Erosion Prevention and Sediment Control Plan…" (Emphasis added.) [**SUPPLEMENTAL ATTACHMENT #7.]** In Docket No. 7970, VGS expert witness Jeffrey Nelson testified in his February 28, 2013, prefiled testimony that: environmental impact mitigation measures include "**restoration of ground topography** … following construction of the project" (p.12): there will be no undue adverse impact under criterion (b)(5) because "The primary components of the Project involve the subsurface placement of pipeline and **restoration of the landforms to pre-construction conditions**." (pp.14-15); and there will not be undue impacts from stormwater runoff because "the majority of this project involves the installation of underground infrastructure with **restoration of the ground surface to pre-construction contours** with permanent vegetative cover…" (pp.16-17). (Emphasis added.) **[SUPPLEMENTAL ATTACHMENT #10, MR. NELSON'S 2/28/13 PFT]**

As submitted to the Commission used in Docket 7970, therefore, **"depth of cover" referred to the depth between the top of the pipeline and the surface of the land once the land had been returned or restored to its previous contours.** The Commission's December 23, 2013 Certificate of Public Good stated that construction "shall be" in accordance with the evidence VGS had submitted and VGS's testimony was that the pipeline would be buried the

specified depths beneath the surface of the land, which two VGS witnesses testified would be at the same contours as existed prior to construction.

The CPG did **not** authorize burial of the pipeline to a depth that was calculated using the height of unlimited amounts of soil added on top of preexisting grade. Obviously, if this standard were to be accepted, the actual burial depth of any pipeline would become irrelevant; one would need only to add soil on top of the pipeline to meet any depth of burial standard.

The August 11, 2017 Affidavit of Mr. St. Hilaire **[SUPPLEMENTAL ATTACHMENT #15]** demonstrates that in **290 locations** the completed pipeline violated the depth of cover requirements of the CPG as VGS interprets those standards (i.e., without any standard for residential areas and without a 7-foot standard for most streams) – and that at those 290 locations, with very few exceptions, the depth of cover violations were "remedied" by **adding soil on top of the pipeline -- thereby changing the contours of the land, in violation of VGS's testimony** to the Commission. See Paragraphs 31 and 49-52 of Mr. St. Hilaire's Affidavit. When Mr. St. Hilaire uses the term "depth of cover" in his August 11, 2017 Affidavit, therefore, he is referring to the distance from the top of the pipeline to the surface of a new, heightened contour. He is not referring to the distance from the top of the pipeline to the "previous contours" of the land. See Paragraphs 31 and 49-52 of Mr. St. Hilaire's Affidavit.

Paragraphs 31 and 49-52 of Mr. St. Hilaire's Affidavit explain how this happened. According to Paragraph 31, once the pipeline was lowered into the trench, a GPS reading of a weld on its top surface was taken by Clough Harbour Associates ("CHA"), and then the trench was backfilled, "contouring the return the site as close to its original condition as practicable."

Also according to Paragraph 31, once the backfilling was completed, CHA returned to the site and took GPS readings of the soil surface. The two sets of data – the height of the top of the pipeline, and the height of the soil once backfilling and regrading to original condition were complete -- were then compared to determine compliance.

According to Paragraphs 49-52 of the Affidavit, as of November 9, 2016, CHA had informed VGS of 290 depth-of-cover violations – again, as VGS interprets those standards, without any standard for residential areas and without a 7-foot standard for most streams. According to Paragraphs 49-52, on November 11, 2016, VGS informed its contractor, Michels, of the 290 violations. And, again according to the Affidavit, by December 12, 2016, all of the 290 violations had been remedied by Michels except for the 18 at the Clay Plains Swamp.

How could inadequate burial of a 12-inch diameter, 41-mile long natural gas pipeline be rectified in 272 different locations in just 30 days? Not by reburying the pipeline to the correct depth at 272 locations. The 272 violations were remedied by "typically… adding more cover and further contouring the soil surface." St. Hilaire Affidavit Paragraph 52. That is, soil was added on top of the soil that Michels had already regraded to return it to its preexisting contours. Paragraph 31.

Many of the deviations were major – <u>over half of a foot in many cases, and sometimes as much as 1 foot or 2 feet</u>. Exhibit # 6 submitted by Mr. St. Hilaire on August 11 **[SUPPLEMENTAL ATTACHMENT #15]** demonstrate that some of the locations in which the pipeline is buried less than 4 feet are residential areas. It shows 3-foot depth in Williston near O'Neill Lane, Mountain View Road and Redmond Road.

The depth of cover violation which initially prompted this investigation continues to be remarkable for its deliberate nature and by VGS's attempts to obfuscate what occurred. Mr. Shelton is a highly experienced project manager. He began his career as a mason over 40 years ago, and for the past 30 years has worked as a masonry project manager and estimator. His experience includes project estimation and management of construction of what at the time was advertised as the largest brick building in the world -- the new offices of the National Institutes of Health. See Mr. Shelton's Supplemental Affidavit **[SUPPLEMENTAL ATTACHMENT #16]**.

The MP-4 video was taken by Mr. Shelton on his cell phone. It was taken late in the day, after all construction had ceased, on September 19, 2016 at the site of the Clay Plain Swamp that is subject to VGS's nonsubstantial change request. Mr. Shelton explains in his supplemental affidavit that the video starts by looking north toward the Hurlburt property. Then it swings around to the south. The video shows the surroundings of the pipeline. There is only one trench. The pipeline is in that trench. The trench is less than 2 feet deep and the 12-inch pipeline is lying on top of the trench. This was at the end of the day on September 19.

Mr. St. Hilaire's Affidavit, in Paragraph 45, states that construction was completed the next day, on September 20. VGS claims that the pipeline was left between 3 and 4 feet deep. For the 12-inch pipeline to be 3 feet deep, the trench would have to be at least 4 feet deep. It would have been impossible to commence and complete digging a new 4-foot deep trench, and then commence and complete installing the pipeline into the new trench, over the hundreds of yards of the Clay Plain Swamp area, all during one working day.

The "root cause" report, Exhibit 17, **[SUPPLEMENTAL ATTACHMENT #17]** also corroborates Mr. Shelton's affidavits and conflicts with Mr. St. Hilaire's conclusion. Mr. St. Hilaire's view is that when Mr. Shelton was present, the installation trench had not yet been excavated. Only a temporary trench, designed to hold the pipeline in place during excavation of the actual installation trench, must have been what his photographs portray. But Page 1 of the report states that the trench had already been dug as of September 15. On that date they tried to get to 4 feet but "were unable to." This is not a description of just excavating a temporary holding trench. Page 2 reports that installation then was completed on September 20, the day after Mr. Shelton's video was taken.

9. VIOLATION #8 – FINAL CONSTRUCTABILITY REVIEW BY AN ENGINEER

Intervenors recently received the as-built construction plans, and pre-construction plan-modifications that were stamped by Engineer Hollowood recently, apparently in 2019. Intervenors are still digesting this information and will submit a formal response shortly. **[SEE SUPPLEMENTAL ATTACHMENTS 8 & 9, THE FINAL PLANS SUBMITTED BY VGS TO THE PUC IN FEBRUARY AND JUNE OF 2013 (WHICH DO NOT LIST MR. HOLLOWELL AS A DRAFTER OR SUPERVISOR OF THE PLANS); AND ATTACHMENT #18, THE VERMONT SECRETARY OF STATE LICENSURE PAGE SHOWING MR. HOLLOWELL WAS NOT LICENSED IN VERMONT UNTIL SEPTEMBER 5, 2013].**

What is immediately apparent is that **the as-built construction plans were signed and sealed by a surveyor, not an engineer**. **[THEY ARE TOO VOLUMINOUS TO COPY AND ARE NOT ATTACHED. VGS MUST PROVIDE THESE.]** They reveal nothing about compliance with the CPG's

terms, or with engineering specifications, or with PHMSA standards, or with an engineer's professional standards.

What is also immediately apparent is Engineer Hollowood's signing in 2019 of several pre-construction plan modifications fails to address the key concern of the November 14, 2018 report of the National Transportation Safety Board on the pipeline failure in Lawrence, Massachusetts. The NTSB concluded that the loss of life, personal injury, and property damage caused by the Lawrence natural gas explosion would have been avoided if Massachusetts had complied with the position of the National Society of Professional Engineers that no gas pipeline construction commence until a Licensed Professional Engineer places his or her seal of approval on the final **construction** plans, including a "**comprehensive constructability review**."

The NTSB concern has not been addressed because there still has been no sign-off on the final **construction** plans and no **comprehensive constructability review**. Before the recent filing of Engineer Hollowood's seal on several of the plan-modifications, there was only one piece of paper with the signature and seal of a Licensed Professional Engineer. It was dated December 17, 2012, prior to all of the revisions. It is on the cover letter to a collection of plans submitted by James C. Colantonio, P.E., to VGS, signed and sealed by Mr. Colantonio. These initial plans, the only plans approved of by a Licensed Professional Engineer, were explicitly labelled "**Not for Construction**." **[THE COVER LETTER AND A SAMPLE PAGE ARE PROVIDED AS SUPPLEMENTAL ATTACHMENT #19A AND #19B]** Mr. Colantonio's name, seal and initials are missing from all of the subsequently revised plans, such as those labelled "For Construction." No other Licensed Professional Engineer took responsibility for, and signed off, on the "For Construction" plans.

That remains true. Mr. Colantonio signed off on plans that were not for construction. Mr. Hollowell signed off on several plan-modifications. The great bulk of the plans **for construction** have **not** yet been signed off on and no engineer, therefore, has performed a **comprehensive constructability review**. [**SEE, FOR EXAMPLE, SUPPLEMENTAL ATTACHMENT #1, 6-30-16 MODIFICATION BULLETIN TRANS-14 (DELETING THE 90%-COMPACTION-WITHIN-VELCO - ROW AND CONTINUOUS-BEDDING REQUIREMENTS, WITHOUT SIGNING OR SEALING BY AN LPE) AND APPENDIX P. 469 (AUGUST 31, 2015 PROJECT DIRECTIVE THAT CHANGED THE BACKFILL MINIMUM ROCK SIZE, WITHOUT SIGNING AND SEALING BY AN LPE).**

Date: February 27, 2019
Annotated with Attachments May 21, 2019

/s/James A. Dumont_
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STATE OF VERMONT
PUBLIC UTILITIES COMMISSION

Investigation Pursuant to 30 V.S.A. §§ 30 and 309 regarding the alleged failure of Vermont Gas Systems, Inc. to comply with the Certificate of Public Good in Docket 7970	)	Case No. 17-3550-INV

SUPPLEMENTAL APPENDIX – May 21, 2019

■ Modification Bulletin

Project Name: **Addison Natural Gas Project**

CHA Project No: **28757** **Modification Bulletin No: Trans-14**

To: **Vermont Gas Systems, Inc.**

Date: **6/30/16**

Description:

Updates have been made to the following sections of the document titled "Technical Specifications for ANGP Prepared by CHA" dated April 29, 2015:

- Section 312333-Trenching, Pipe Laying, and Backfilling

The entire revised section is contained in the Modification Bulletin and show a "***Revised 07/01/2016***" in the footer of each sheet.

Please note that all additions to the technical specifications documents are shown as ***bold and italicized.*** All deletions are shown as ~~strikethrough.~~

An updated cover sheet to the full Technical Specifications document showing the new revision date for this section will be issued at a later date after future revisions to Section 312333 are incorporated.

Attachments:

- **Section 312333-Trenching, Pipe Laying, and Backfilling**

Issued By: Brendan Kearns (CHA)
V:\Projects\ANY\K3\28757\Construction\Clarifications

SECTION 312333 - TRENCHING, PIPE LAYING AND BACKFILLING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the excavation of trenching, pipe laying, backfilling, compacting, dewatering, excavation support and disposal, as shown on the Contract Drawings, and as herein specified.

B. The Construction Management Team will determine the suitability of materials that are to be used in the work and should any materials encountered be unsatisfactory for the purpose intended, they shall be removed from the site at the Contractor's expense.

1.2 QUALITY ASSURANCE

A. Reference Standards:

1. The latest edition of the following standards, as referenced herein, shall be applicable.

a. "Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO)."

b. American Society for Testing and Materials (ASTM).

c. Vermont Agency of Transportation (VTrans) Standard Specifications

B. The Contractor shall comply with the requirements for soil erosion and sedimentation control and other requirements of governmental authorities having jurisdiction, including the State.

C. The Owner shall provide and pay for all costs in connection with an approved independent testing facility to determine conformance of soils and aggregate with the specifications, in accordance with Section "Quality Requirements."

1.3 SUBMITTALS

A. The Contractor shall submit certified gradation curves and moisture-density compaction results for each imported material. If multiple sources are utilized, information shall be submitted from each individual supplier.

B. Pipe support systems: Contractor shall submit method of pipe support system(s) to be utilized, including details on how supports will be installed.

C. Contractor shall submit details/designs for all shoring and trench boxes for excavations that exceed 20’ in depth. Details and designs shall be sealed by a registered Vermont Professional Engineer.

1.4 PROJECT REQUIREMENTS

A. Call Dig Safe at 811 before starting any excavation or verify that a Dig Safe ticket exists and is valid for the area. Contractor shall maintain Dig Safe marks and follow all Dig Safe laws. Contractor is responsible for contacting and complying with municipal and private utilities that are not members of Dig Safe. Excavate with care to avoid damage to structures and utilities - excavations shall be completed by hand if necessary. Promptly report any damages to utilities to Utility Owner and Construction Management Team, do not attempt repairs without the Utility Owners consent.

B. Notify the Construction Management Team and Owner of any unexpected subsurface condition.

C. Protect excavations by shoring, bracing, sheet piling, or by other methods, as required to ensure the stability of the excavation. Comply with VOSHA/OSHA requirements.

D. Underpin or otherwise support structures and improved surfaces adjacent to the excavation which may be damaged by the excavation. This includes service lines and existing utilities.

E. Contractor is responsible for protection of Existing Utilities:

1. Specifically, Contractor shall use extreme protection around existing 10-inch transmission main in the vicinity of the Colchester Tie-in Site. This is the primary feed for the Burlington area. Owner will locate/flag the line prior to Contractor beginning work in this area. Contractor shall take all measures necessary to protect this existing transmission main during construction. The Owner must be present for any work or excavation around the existing 10-inch transmission main.

2. Contractor will notify Owner before excavating around, or crossing, any existing natural gas distribution lines. Owner will determine if Owner should be present during any work.

3. Locate existing underground and above ground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations. Comply with OSHA requirements.

4. If necessary, coordinate interruption and/or termination of utilities with the utility companies and the Owner.

5. Provide a minimum of seven days notice to the Owner and receive written notice to proceed before interrupting any utility.

F. Demolish and completely remove from the site any existing underground utilities designated to be removed, as shown on the Drawings or as specified.

G. Repair any damaged utilities as acceptable to the Owner, Construction Management Team, and utility companies at no additional cost to the Owner.

H. Contractor shall comply with maintenance and protection requirements as approved by the authority having jurisdiction.

I. Protection of Persons and Property:

1. Barricade open excavations occurring as part of this work and post with warning lights, if required or comply with any applicable permits.

2. Operate warning lights as recommended by authorities having jurisdiction.

3. Protect structures, utilities, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by construction operations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Select Backfill/Pipe Padding:

1. ***On-site material: The use of on-site native material for select backfill/pipe padding shall be approved and inspected by the Construction Management Team. Native material shall not contain any stones that are larger than 1.5" in the longest dimension, or that contain sharp/angular pieces that may impact pipe coating integrity. Native material that consists of fractured/processed rock that has been blasted or mechanically removed cannot be utilized as select backfill material due to the angularity of the material, unless used in conjunction with Tuff-N-Nuff 11 mm Rockshield installed per the manufacturer's recommendations. A shaker bucket or screen may be used if native material is too large, given that the characteristics of the material are suitable for successful shaker bucket or screen use.***

2. Borrow Material: If native material is not acceptable, as determined by the Construction Management Team, a sand material shall be imported to the site meeting the following criteria. Alternate select backfill/pipe padding materials may be submitted by the Contractor for review and approval from Construction Management Team.

Sieve	**Percent Passing**
1-1/2"	100
½"	70 - 100
No. 4	60-100
No. 100	0-20

B. General Backfill: Native materials containing no stones or clods larger than ***6***" in the longest dimension are acceptable. If native material is not acceptable, as determined by the Construction Management Team, bank run gravel fill shall be imported to the site meeting the following criteria. General backfill area will be limited to the trench, or a maximum of 12-inches laterally from each side of the pipe. Alternative general backfill materials may be submitted by the Contractor for review and approval from Construction Management Team.

Sieve	**Percent Passing**
6"	100
No. 4	20 - 60
No. 100	0 -12
No. 200	0 - 6

PART 3 - EXECUTION

3.1 PRECONSTRUCTION MATERIAL QUALIFICATION TESTING

A. General:

1. Sufficient size samples shall be obtained from the potential borrow source to allow completion of tests listed in paragraph B below. Samples may be obtained from test borings, test pits, or from borrow pit faces provided that surficial dry or wet soil is removed to expose undisturbed earth. Tests listed below shall be performed on each sample obtained. A minimum of three (3) representative samples from each potential borrow source shall be furnished to the testing laboratory for prequalification testing.

B. Material Tests:

1. Particle Size Analysis:

a. Method: ASTM D422

b. Number of Tests: One (1) per sample; three (3) per potential source.

c. Acceptance Criteria: Gradation within specified limits.

2. Maximum Density Determination:

a. Method: ASTM D1557 - Modified Proctor

b. Number of Tests: One (1) per sample; three (3) per potential source.

3. Re-establish gradation and maximum density of fill material if source is changed during construction.

3.2 PREPARATION

A. Establish required lines, levels, contours and datum.

B. Maintain benchmarks and other elevation control points; re-establish if disturbed or destroyed, at no additional cost to the Owner.

C. Establish location and extent of existing utilities prior to commencement of excavation.

3.3 EXCAVATION

A. All excavation shall be made to such depth/width as required to provide suitable room for laying pipe and for sheeting, shoring, pumping and draining as necessary, and for removing peat, silt, or any other deleterious materials which the Construction Management Team may deem unsuitable. Hand trench excavation may be required to protect existing utilities and structures.

B. Trench excavation for pipes shall be made by open cut to accommodate the pipe or structure at the depths indicated on the Contract Drawings. Excavation shall be made to such a depth and to the width indicated on the Contract Drawings so as to allow a minimum of six (6) inches of select backfill / padding to be placed beneath and on the sides of all pipes installed unless otherwise specified on the drawings. A minimum of twelve (12) inches of select backfill/padding shall be placed above all pipes installed.

C. The bottom of the trench shall be accurately graded to provide a uniform layer of padding/bedding material, as required, for each section of pipe. Trim and shape trench bottoms and leave free of irregularities, lumps, and projections.

D. Stockpile excavated subsoil for reuse where directed or approved.

E. Over excavation/under cut: If, in the opinion of the Construction Management Team, existing material below the trench grade is unsuitable for properly placing select backfill/padding material and laying pipe, the Contractor shall excavate and remove the unsuitable material and replace the same with an approved select backfill/padding material properly compacted.

F. Stability of Excavation: Slope sides of excavations shall comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavation in safe condition until completion of backfilling.

G. Removal of materials beyond the indicated elevations, without authorization by the Construction Management Team, shall be classified as unauthorized excavation and shall be performed at no additional cost to the Owner.

H. If a trench excavation crosses a road, sidewalk, bike path, driveway, or other transportation facility, the Contractor shall arrange temporary facilities for ingress/egress of all pedestrians and vehicles. One lane of traffic shall be maintained at all times – refer to VTrans/Local permits for additional construction conditions and traffic management details.

3.4 DEWATERING

A. The Contractor shall remove all water from the excavation promptly and continuously throughout the progress of the work and shall keep the excavation dry at all times until the work is completed and excavation is backfilled or have sufficient weight to resist uplift pressures. Groundwater levels shall be depressed to a minimum of 2 feet below excavation subgrade. No pipe or structure is to be laid in water and water shall not be allowed to rise on or flow over any pipe or structure until such time as approved by the Construction Management Team.

B. Provide a suitable point of discharge from dewatering operations shall be conveyed in a non erosive manner satisfactory to the EPSC Specialist and Construction Management Team and all applicable environmental permit regulations.

C. Precautions shall be taken to protect uncompleted work from flooding during storms or from other causes. All pipe lines not stable against uplift during construction or prior to completion shall be thoroughly braced or otherwise protected to the satisfaction of the Construction Management Team.

3.5 BEDDING AND BACKFILLING

A. Contractor shall take all necessary precautions to ensure that backfill materials are kept free of all skids, stumps, welding rods, cans, bottles, trash and other deleterious debris.

B. Pipe supports may be installed in all locations prior to backfilling as an alternative to continuous pipe bedding for the entire width of the trench. However, areas around pipe shall still be padded with select backfill as shown on the contract drawings and explained in paragraph 3.3.b. above. Stacked sandbags, pipe pillows, or owner approved equal are acceptable methods. Spacing shall be per manufacturer recommendations, if a commercial product, or 15' maximum separation if sandbags.

C. Trench breakers shall be installed per construction plan details prior to backfilling operations begin.

D. All pipe trenches backfill (select backfill/padding, general backfill, subbase) shall be thoroughly compacted by mechanical means as follows:

1. Typical Cross-country areas: Thoroughly compacted by mechanical means to avoid any future trench settlement. ***Use of excavator buckets and equipment tracks is acceptable for compaction in these areas only.***

~~2. VELCO corridor: All backfill in pipe trenches in the VELCO corridor shall be compacted to a minimum of 90 percent of modified Proctor maximum dry density by installing 12-inch (maximum) loose lifts.~~

3. Existing and Proposed Road Areas (unpaved and paved): All backfill in pipe trenches in, or directly adjacent to (with 10' of edge of road surfaces – existing or proposed) road surfaces, shall be compacted to a minimum of 95 percent of modified Proctor maximum dry density. Backfill materials shall be placed with water content within plus or minus 3 percent of optimum moisture content per the modified Proctor method (ASTM D1557). Any water used for compaction shall be provided by the Contractor at their own expense. The Contractor is responsible for the repair of any trench settlement at no expense to the Owner for the period of one year after substantial completion of the project.

E. Provide uniform bearing and support for pipe in all locations, except where necessary to excavate for connections, tie-ins, and other required appurtenances. Dig no deeper, longer, or wider than needed to make the joint connection properly.

F. The bedding/padding material shall be placed to the full width of trench. The bedding material shall be placed evenly along the bottom of the trench to provide proper support of the pipe to the elevation shown on the Contract Drawings or directed by the Construction Management Team. . The backfill shall be placed on both sides of the pipe at the same time and to approximately the same elevation. Any pipe that is damaged or moved out of alignment, regardless of cause, shall be replaced or realigned at the Contractor's expense. Bedding/padding shall be thoroughly compacted by hand-tamping or mechanical means being careful not to damage the pipe. When the bedding/padding reaches one (1) foot over the top of the pipe, the entire surface shall be compacted by mechanical means.

3.6 PIPE STRINGING & LAYING

A. Pipe shall be installed per the depth, alignment, and coating type shown on the project design plans. Depth of cover shall be measured from top of pipe to finished/final grade (after site restoration). ***Horizontal tolerance for final location of installed pipe compared to design plans/survey layout shall be +/- 1.0'. Minimum depth of cover shall be strictly adhered to (no vertical tolerance for less cover than noted on plans).***

B. Stringing

1. ~~No pipe shall be strung before the trench is excavated to full depth and accepted by the Owner to meet the requirements of this specification.~~ Pipe shall not be placed directly on the ground, but on wooden skids with proper protective padding. The skids and protective padding material shall be subject to Construction Management Team approval. Dragging, skidding or dropping the pipe is not permitted. Wooden wedges shall be used to prevent movement of each strung pipe.

2. Where possible the skid elevations shall be planned such that minor differences between grade profile and bottom of trench profile (e.g. at locations where an increased trench depth is required) can be accommodated without an additional tie-in. The distance between the trench edge and the pipe string shall be planned such that safe working space is provided. Contractor shall follow applicable OSHA/VOSHA regulations.

3. Contractor shall be responsible for proper stringing and locating of the pipe by coating type.

4. Contractor shall string the pipe in such a manner so as to cause no interference with public roads, sidewalks, or bike paths. Suitable gaps shall be left at intervals as necessary to permit the passage of livestock and/or equipment across the right-of-way and as directed by the Construction Management Team.

5. Contractor shall layout and measure the pipes such that the number of pieces required to be cut-off with less than 5 feet in length is kept to a minimum.

6. Pipe shall be strung with the use of a spreader bar and two guide lines.

C. Bending - Contractor shall make all necessary field pipe bends required in construction of the pipeline. The Contractor shall be responsible for determining the degree of the field bend necessary where a change in direction is necessary.

1. All bending shall be completed using the cold smooth method using a bending machine, approved by the Construction Management Team. Wrinkle bends will not be acceptable. Welded longitudinal pipe seams shall be right angles (neutral axis) to the direction of the bend. The Contractor shall use an internal bending mandrel to achieve smooth and undistorted bends. Padded bending shoes are required for coated pipe. Heating the pipe for bending purposes is not allowable. Prior to beginning work, Contractor shall submit and demonstrate their bending procedure, which shall conform to the recommendations of the manufacture of the bending machine. This procedure shall be approved by the Construction Management Team prior to beginning work.

2. For field cold bends, the longitudinal axis shall not be deflected more than 1-1/2 degrees in any length along the pipe access equal to the diameter of the pipe. The maximum diametrical reduction in a pipe bend shall not exceed 2-1/2% of the nominal pipe diameter. There shall be no deviation from the above requirements without prior written approval from the Construction Management Team. Individual approvals shall be obtained for each application.

3. The distance between centerline of bending points shall be such that there will be no distortion of the pipe or of the bend previously made and in no event shall be closer than seven (7) feet to the end of the joint of the pipe. When pipe is double jointed before bending, the bend shall not be closer than three (3) feet to the butt (girth) weld.

4. Bends shall not be straightened under any circumstances.

5. Pipe that is buckled, wrinkled, flattened, egged or gouged, as determined by the Construction Management Team, by bending operations shall be cut out and replaced at the sole expense of the Contractor. Hammering, the use of jacks, or other mechanical machinery to repair bucked or deformed pipe is prohibited. A buckle shall be defined as any anomaly in the contour of a bend which, when measured with a six (6) inch metal straight edge oriented on the longitudinal axis, yields a depression or void beneath the straight edge equal to, or greater than, 0.06".

6. For pipe line-up, the pipe shall be placed on skids with sufficient clearance between the bottom of the pipe and ground to accommodate the finishing weld. Pipe shall be handled in a manner to prevent damage to the pipe walls and shall be placed over or parallel to the ditch in such manner that when the pipe is lowered, the bends will rest in the ditch at the proper location. In the laying of the pipe other than seamless pipe, the longitudinal seams shall be offset by 20 degrees on adjoining pipes in the top 120 degrees of the pipe and welded sections shall be assembled and lowered into the trench so that the longitudinal seams will remain on the top 120 degrees of the pipe as laid. Exceptions shall be weld seams on side bends, which shall be located on top of the pipe, and weld seams on sag bends and over bends, which shall be located on either side of the pipe as laid.

7. Contractor shall make all necessary bends required for proper construction of the pipeline, following a trigonometric survey to establish the number and degree of bends required, to ensure that the installed pipe conforms to the contours of the excavated trench.

D. Welding – Refer to Specification 137000

E. Coating Weld Joints and Fittings – Refer to Specification 138000

F. Lowering – Prior to lowering the pipe into the trench, the Contractor shall ensure that all water, debris, skids, rocks, welding rods and other foreign or deleterious material is removed from the trench. During lowering operations coated pipe shall be handled by use of adequately spaced lowering belts or cradles, as determined to be acceptable by the Construction Management Team, but shall be a maximum of 250'. At a minimum, belts shall be equal to the outside diameter of the pipe and shall be made of material that is free of protrusions that may cause damage to the protective coating. Roller cradles shall have nylon/neoprene roller wheels. The pipe shall be lowered into the trench in a manner that will allow proportional distribution of the total weight of the pipeline to all of the lifting points to prevent undue stress or strain on the pipe and to prevent damage to the pipe coating. The pipe shall not be dropped or subjected to jarring or impact. At water crossings or any other locations which may require pulling or dragging of the pipe into place, the coated pipe shall be properly protected from damage using wood lagging or rollers. ~~Welded pipe strings shall be lowered-in within 96 hours of completion of joint coating.~~

G. Holiday Inspection – Holiday inspection ("jeeping") shall be performed on all pipe and fittings with an electronic holiday detector, supplied by the Contractor and operated in such a manner to audibly and visually detect the presence of all holidays in the coatings. Jeeping shall be completed twice (minimum) – once when on skids adjacent to trench, and again as it is lowered into the ditch. Additional jeeping may be required as determined by the Construction Management Team. Refer to Coatings, Specification 138000 for additional jeeping requirements.

H. Rock Shield – Contractor shall furnish and install Tuff N Nuff 11 mm rockshield, or Construction Management Team approved equal, on the pipeline in areas of rock trench or as otherwise directed by Construction Management Team or utility inspector.

I. Trench Breakers – Trench breakers shall be installed as defined on the project design drawings.

J. Electrolysis Test Leads – Locations for test leads are determined on the project design drawings and shall be connected prior to backfilling operations – follow Cathodic Protection Details for installation. If an electrical continuity test fails after backfilling operations, Contractor shall excavate and replace test lead at no cost to the Owner. All test lead cables shall be continuous with without splices.

K. Drainage Tile Repair – Tiles within the limit of disturbance that are damaged shall be repaired by the Contractor.

1. The replacement tile shall be installed to the gradient and alignment of the previous tile. Tile shall be supported at trench crossings as necessary in order for the tile to maintain the gradient/alignment during backfilling operations.

2. Replacement tile materials shall be new. Reusing excavated existing drain tile is not acceptable.

3. Drain tile couplings shall be utilized to splice in new drain tile. Couplings shall be installed per the manufacturer's recommendations.

4. During backfilling operations, soil adjacent to and under tiles shall be compacted to eliminate future settlement.

5. In areas where the tile alignment is parallel and directly adjacent to the pipeline alignment, the tile will be moved/offset to the side of the pipeline alignment.

6. Tile and pipeline separation shall be a minimum of 12-inches.

7. Conditions in construction line list regarding existing and future tile locations shall be adhered to by the Contractor.

8. If directed by Construction Management Team, both existing and replacement tiles shall be inspected to ensure that tiles are not plugged, crushed, mis-aligned, or otherwise damaged. If damage is found, tile shall be repaired at no cost to the Owner.

L. Warning Tape – Contractor shall install Owner provided pipeline warning tape as indicated on project design drawings.

M. Pipeline Markers – After completion of backfilling operations, Contractor shall install Owner supplied pipeline markers as directed by Construction Management Team.

3.7 BACKFILLING AROUND STRUCTURES

A. The Contractor shall not place backfill against any structure without obtaining the approval of the Construction Management Team. No dumping shall be allowed where materials would flow against or around such structures. Backfill material shall be deposited in horizontal layers not exceeding 6 inches in loose thickness or as shown on the Contract Drawings and thoroughly compacted by hand or by mechanical means to the satisfaction of the Construction Management Team.

3.8 SUSPENSION OF WORK

A. Whenever the work is suspended, excavations shall be protected and the roadways, if any, left unobstructed. Within or adjacent to private property, material shall be stored at such locations as will not unduly interfere with traffic of any nature and in no case shall materials be stored in locations which will cause damage to existing improvements.

3.9 DISPOSAL OF MATERIAL

A. Excess and unsuitable materials shall be legally disposed of by the Contractor off site at the Contractor's expense unless otherwise approved by the Owner.

3.10 FIELD QUALITY CONTROL

A. Notify the Construction Management Team at least three (3) working days in advance of all phases of excavation and backfilling operations. The contractor shall not conduct backfilling operations unless the Construction Management Team is present for inspections. Backfilling operations shall commence as soon as possible after the pipe has been lowered into trench. The amount of lowered pipe that is not backfilled shall be kept at a minimum at all times. Contractor shall not backfill trench until the Owner's as-built survey crew has completed their necessary tasks.

B. In-place density testing at road crossings and ~~VELCO corridor~~ shall be performed to ascertain the compacted density of the fill and backfill materials in accordance with the following methods:

1. In-place relative density:

a. Method: AASHTO T238, Nuclear Method

C. Perform initial density testing to verify that contractors proposed compaction effort will obtain the minimum required densities.

D. In-place density tests on trench backfills shall be provided as follows:

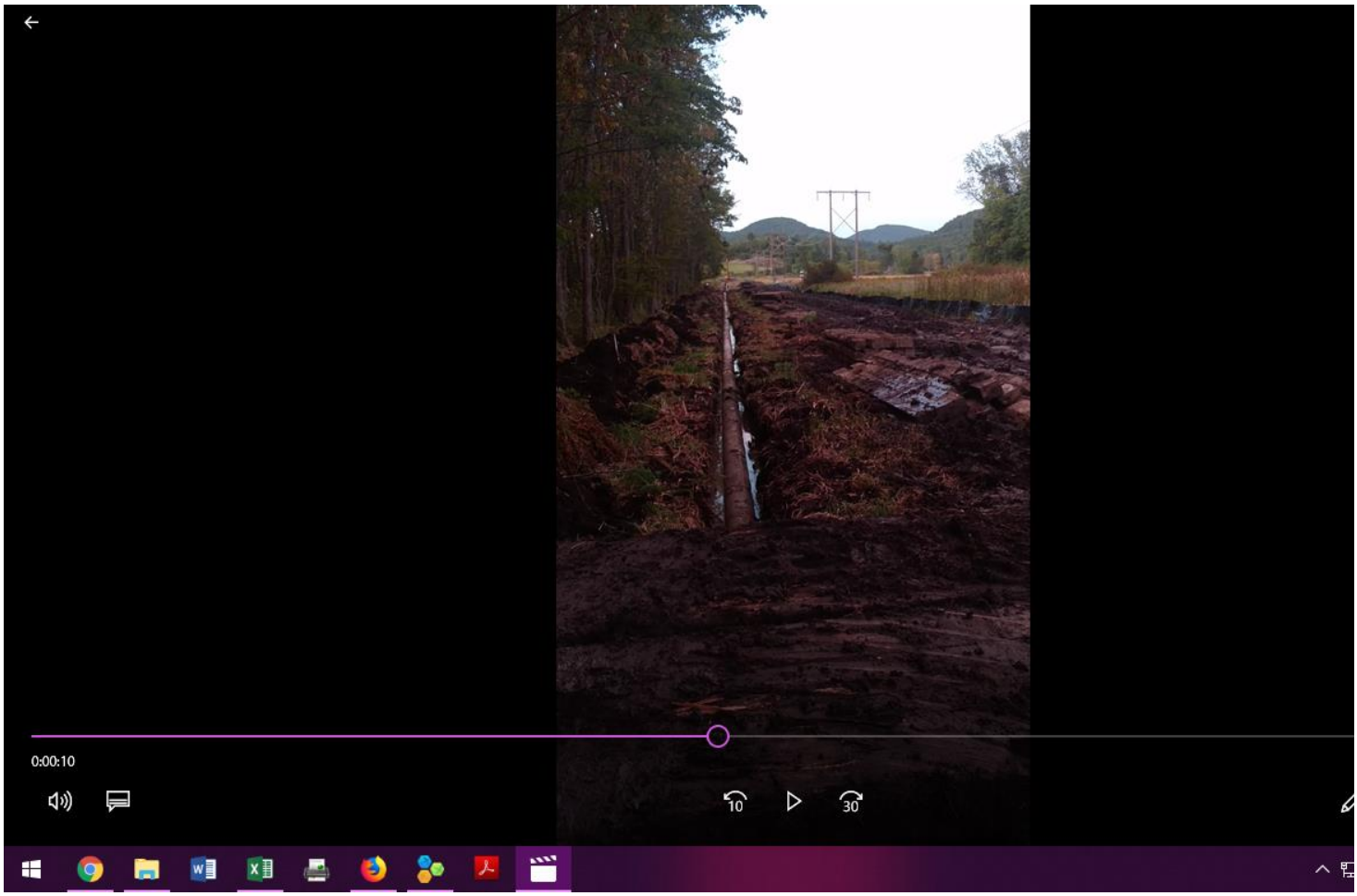
1. Open-cut road crossings: One test per lift and at least once daily.
2. Cross-country areas: Visual only – subject to Construction Management Team approval.
3. ~~VELCO corridor: Minimum of one every 500 cubic yards of fill, and not exceeding every 2 feet vertically, or once daily.~~

E. The Construction Management Team may direct additional tests to establish gradation, maximum density, and in-place density as required by working conditions.

F. Acceptance Criteria: The criteria for acceptability of in-place fill shall be both visual and in-situ dry density and moisture content. If a test fails to qualify, the fill shall be further compacted and re-tested/inspected. Subsequent test failures shall be followed by removal and replacement of the material, at no cost to the Owner. Minimum compaction of backfill materials noted in Section 3.5.D of this specification.

END OF SECTION

Photograph 4: Station 1649+00; trenching and lowering in the pipe through Clay Plains. Topsoil and subsoil are segregated and placed on timber mats. Photograph taken looking north.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Supplemental Attachment 4

Video taken at Clay Plains Swamp on September 19, 2016

Affidavit of Lawrence Shelton

I, Lawrence Shelton, upon being duly sworn, state as follows:

1. I am a resident of the town of Hinesburg, Vermont.
2. I am a user of Geprags Park and streets in Hinesburg, Vermont where VGS's pipeline is buried.
3. I enjoy the natural resources such as the wetland in Geprags Park and the wetland in New Haven. I have interest in preserving these resources. Burial of the pipeline to a depth of less than seven feet under streams jeopardizes my interests. Repeated construction in the wetlands in their communities jeopardizes my interests.
4. I was informed, and came to the site on September 18, 2016 in New Haven that VGS's 6/2/17 letter refers to and then a second time shortly afterwards.
5. I observed that the site was immediately south of the Hurlburt property.
6. I knew from talking with Mr. Hurlburt that Mr. Hurlburt's agreement with VGS required 5-foot depth of burial under his agricultural lands.
7. I observed that the pipeline south of Mr. Hurlburt's land was about 18" deep.
8. I took photographs of the pipeline south of Mr. Hurlburt's land, after the trench had been completed, the pipe had been installed, and prior to filling. The photographs show the pipeline about one hundred yards south of the Hurlburt property line. They show the pipeline at about 18" deep. The photographs are labeled "Monkton" but they are located in New Haven
9. I was informed by Mr. Hurlburt that he had observed, and had complained to VGS, that the pipeline crossing his land had not been buried 5 feet deep; it had been buried only 4 feet deep.
10. Protect Geprags, a group of which I am a member, submitted my photographs, showing approximately 18" depth of burial, to PHMSA in October of 2016, and sought an investigation of a number of issues.
11. PHMSA subsequently shared my information regarding the burial of the pipeline with VGS.
12. In the public meeting held on February 22, 2017, I shared directly with the Department and with VGS my concerns about depth of pipe burial in New Haven.
13. On March 3, 2017, I and the Department's gas engineer, Mr. GC Morris, visited the New Haven site.
14. During the visit and prior to the visit, according to Mr. Morris he had been on the telephone with a VGS engineer to discuss the site.
15. Mr. Morris and I found a marker, created by VGS, or VGS's contractor, directly over the buried pipeline. The wooden marker indicated that the pipeline was buried 3.5 feet at that location. See the attached photograph of stake "1645+26," stating "DEPTH 3.5." Mr. Morris told me the 3.5 stood for 3.5 feet.
16. During that visit, Mr. Morris told me that the pipeline that I had observed in September had been reburied by VGS to a deeper depth.
17. During that visit, Mr. Morris told me that VGS used an excavator to press down on the pipe with enough force to push it down through the soil.

18. The only apparent source of Mr. Morris' information was VGS, since Mr. Morris made clear he had not been present.

19. This is the area in which the excavator had been mired. The area is a wetland. The soils are very wet.

Lawrence Shelton

On the 22nd day of June, 2017, Lawrence Shelton appeared before me and he subscribed and swore to the truth of this affidavit.

Notary Public

My Commission Expires: 2/10/19

From: Reagan, Michael J <Michael.Reagan@mottmac.com>
Sent: Friday, May 20, 2016 12:02 PM
To: Kearns, Brendan; Joey Wilson; John Stamatov (US - Advisory); John St.Hilaire
Cc: michael.reagan@hatchmott.com; Chris LeForce; Billingsley, Tyler
Subject: RE: VELCO Compaction

This is what we are trying to get changed with VELCO- and not go with the 90% compaction rate- as it is at times unachievable on the pipeline installation-

Mike

From: Kearns, Brendan [mailto:BKearns@chacompanies.com]
Sent: Friday, May 20, 2016 11:58 AM
To: Joey Wilson; John Stamatov (US - Advisory); John St.Hilaire
Cc: michael.reagan@hatchmott.com; Chris LeForce; Billingsley, Tyler
Subject: RE: VELCO Compaction

Hi All,

Please note:

1) In order to document that the installed pipe will meet the VELCO loading requirements, nuclear density tests are required to confirm that the backfill meets the specified compaction of 90% requirements. It is recommended that you confirm with VELCO what documentation they will be requesting to support the installation within their ROW. If you do not achieve 90% compaction, you will not achieve the HS-20+15% loading requirement.
2) The use of concrete coating does not increase the loading capacity of the pipe, the coating is used to protect the pipe from damage. Just adding concrete coating will not achieve the HS-20+15% loading requirement.
3) Changing the minimum depth to 5' inside these areas will require us to re-do the depth of cover table. Please let me and Chris know when this is finalized so we can get started on editing. The revised sheets will be sent to the VGS CM team upon completion via Modification Bulletin.
4) Overall, if the contractor does not perform what the VELCO letter (dated November 7, 2014) says and what is in the technical specifications, you will not achieve the loading requirements laid out in the MOU. With that being said, it is good that this supplemental agreement does not mention a loading requirement.

Thanks,
Brendan

From: Joey Wilson [mailto:jwilson@wce-co.com]
Sent: Friday, May 20, 2016 11:27 AM
To: John Stamatov (US - Advisory) <john.r.stamatov@pwc.com>; John St.Hilaire <jsthilaire@vermontgas.com>
Cc: michael.reagan@hatchmott.com; Kearns, Brendan <BKearns@chacompanies.com>; Chris LeForce <CLeForce@vermontgas.com>
Subject: RE: VELCO Compaction

For your use.
Mike and I don't see the need to attach the excel sheet just sent out. Just keep to a simple plan.

Joey

From: Joey Wilson [mailto:jwilson@wce-co.com]
Sent: Friday, May 20, 2016 10:09 AM
To: John Stamatov (US - Advisory) (john.r.stamatov@pwc.com); John St.Hilaire (jsthilaire@vermontgas.com)
Cc: michael.reagan@hatchmott.com; Joey Wilson; patrick.daley@us.pwc.com; Kearns, Brendan; Chris LeForce (CLeForce@vermontgas.com)
Subject: VELCO Compaction

Here is what Mike and I came up with for suggested compaction requirements.

- At all VELCO access road crossings, VGS will either install concrete coated pipe within 10' either side of the road or will test the material to ensure the 90% compaction requirement is adhered to. In the event that concrete coated pipe is not available or can't be used, and the in-situ material cannot be re-compacted to 90%, flowable fill will be installed within 10' of the crossing.
- When running parallel to the VELCO ROW, VGS will use Best Management Practices for pipe compaction, and will install the pipe such that it has a minimum of 5' of cover in lieu of 4' in the current specification. Best Management Practices include verification of the existing material for suable backfill and compacting via a standard excavator bucket.
- VGS is required to uphold all permit conditions, including tilling and subsoiling while working and backfilling in ag fields, and not replacing wetland material with non-native soils. These permit conditions will not allow for excessive compaction.

STATE OF VERMONT
PUBLIC SERVICE BOARD

Petition of Vermont Gas Systems, Inc., requesting a Certificate of Public Good pursuant to 30 V.S.A. § 248, authorizing the construction of the **"Addison Natural Gas Project"** consisting of approximately 43 miles of new natural gas transmission pipeline in Chittenden and Addison Counties, approximately 5 miles of new distribution mainlines in Addison County, together with three new gate stations in Williston, New Haven, and Middlebury, Vermont	Docket No. 7970

2-28-13 SUPPLEMENTAL PREFILED TESTIMONY OF JOHN HEINTZ ON BEHALF OF VERMONT GAS SYSTEMS, INC.

February 28, 2013

Mr. Heintz is the Project Manager for the Addison Natural Gas Project. His supplemental testimony describes the revised Project design, construction and schedule and provides an estimate of the Project costs. Mr. Heintz also describes construction-related impacts with respect to noise, water supply, waste disposal and transportation.

TABLE OF CONTENTS

2/28/13 EXHIBITS

Exhibit Petitioner Supp. JH-14 (2/28/13)	Impact Minimization/Avoidance, Pipeline Reroutes and Alignment Shifts
Exhibit Petitioner Supp. JH-15 (2/28/13)	Impact Minimization/Avoidance, Through Horizontal Directional Drill (HDD)
Exhibit Petitioner Supp. JH-16 (2/28/13)	Impact Minimization/Avoidance, Through Right-of-Way Narrowing

STATE OF VERMONT
PUBLIC SERVICE BOARD

Petition of Vermont Gas Systems, Inc., requesting a Certificate of Public Good pursuant to 30 V.S.A. § 248, authorizing the construction of the **"Addison Natural Gas Project"** consisting of approximately 43 miles of new natural gas transmission pipeline in Chittenden and Addison Counties, approximately 5 miles of new distribution mainlines in Addison County, together with three new gate stations in Williston, New Haven, and Middlebury, Vermont	Docket No. 7970

2-28-13 SUPPLEMENTAL PREFILED TESTIMONY OF
JOHN HEINTZ
ON BEHALF OF
VERMONT GAS SYSTEMS, INC.

1. Introduction

Q1. Please state your name, occupation, and business address.

A1. My name is John Heintz. I am the President of International Engineering and Development Corporation and have been retained by Clough Harbour & Associates ("CHA") to serve as Project Manager of the Vermont Gas Systems, Inc. ("Vermont Gas" or "VGS" or the "Company") Addison Natural Gas Project ("Project" or "ANGP"). My business address is 2812 Shipping Ave, Miami, FL 33133.

Q2. What is the purpose of your testimony?

A2. My testimony and exhibits provide a detailed description of the revised Project layout and engineering design, including the refinements and modifications undertaken since the December 20, 2012 initial filing in this proceeding, referenced herein as either the

"December 20 Proposal" or the "Initial Proposal". The result of these revisions is referred to here and in other witnesses' testimony as the "2/28/13 Alignment."

My testimony also describes the equipment specifications and the pipeline construction process that will be involved in building the Project. I also provide an updated Project cost estimate. Finally, for ease of reference, I am also restating and including those portions of my original testimony that are not changed.

2. Revised Project Description

Q3. Please describe the revised Project.

A3. The Project includes the following principal components:

(1) Approximately 41.2 miles of new 12-inch transmission pipeline, extending from a new tie-in to be located at Vermont Gas's existing 10-inch mainline north of Severance Road in Colchester ("Colchester Tie-In"), Vermont, to the intersection of U.S. Route 7 and Exchange Street in Middlebury, Vermont (the "Transmission Mainline"). The initial Project contained 43 miles of 12-inch transmission.

(2) Approximately 5.1 miles of new six-inch distribution mainlines ("Distribution Mainlines") that will extend distribution service to Vergennes (3.73 miles) and Middlebury (1.35 mile). The initial Project contained 4.8 miles of six-inch distribution mainlines; and

(3) Three new pressure regulation stations ("Stations" or "Gate Stations"), one located near Route 2 in Williston to reinforce the existing distribution system, one off Plank Road in New Haven, and the third north of the intersection of U.S. Route 7 and Exchange Street in Middlebury. The number of gate stations is unchanged, however this 2/28/13 Alignment reflects modified locations and configurations in response to community feedback as discussed below.

The Transmission Mainline is approximately 41.2 miles in length from the point of interconnection in Colchester to the terminus at the new Route 7 Gate Station in Middlebury. As with the initial proposal, the line will pass through the towns of Colchester, Essex, Williston, St. George, Hinesburg, Monkton, New Haven and Middlebury.

The Distribution Mainline to Vergennes will extend from a new Plank Road Gate Station in New Haven, running along Plank Road 3.7 miles through the towns of New Haven, Ferrisburgh and Waltham, to the intersection of Route 7 in Waltham, just east of Vergennes. The Middlebury Distribution Mainline will extend from the new Route 7 Gate Station in Middlebury to the Middlebury industrial park on Exchange Street.

2.1 Transmission Mainline from Colchester to Middlebury

Q4. Please describe the Transmission Mainline and the proposed alignment changes.

A4. A one page map with the revised 2/28/13 Alignment is included as Exhibit Petitioner Supp. JH-2 (2/28/13). Detailed engineering plan sheets of the 2/28/13 Alignment Transmission Mainline with design details are included as Exhibit Petitioner Supp. JH-3 (2/28/13). There have been a number of revisions to VGS' proposed transmission pipeline alignment from the Petition submitted to the Board on December 20, 2012 (the "Initial Proposal") to the 2/28/13 Alignment. These revisions have been developed in response to stakeholder comments.

In addition to the summary of alignment changes from the Initial Proposal to the 2/28/13 Alignment, the following adjustments occurred throughout the alignment:

- An approximate one to five foot shift of the pipeline alignment where it parallels the VELCO corridor due to improved Right-Of-Way information;
- The three Stations have been moved;
- and the Mainline Valve locations have shifted along the proposed pipeline relative to the new Transmission pipeline length and Station locations.

Below is a list of specific locations with alignment changes, with reference to specific Exhibit Petitioner Supplement JH-3 (2/28/13) plan sheets. It should be noted that with the exception of the gate stations described above and those locations where the pipeline has been moved from road rights-of-way to adjacent to or within the VELCO corridor in Hinesburg, Monkton and New Haven, most of the adjustments listed below are minor alignment adjustments generally within the same vicinity:

- ANGP-T-C-001 Specification of the dewatering area west of Colchester Tie-In
- ANGP-T-C-005 - Change in additional temporary work space (ATWS) areas near MP 2.2 (Route 2A)
- ANGP-T-C-018 - Transmission Mainline alignment change at MP 8.6 to avoid VELCO infrastructure (500 feet)
- ANGP-T-C-021 - Transmission Mainline alignment change at Allen Brook/Route 2 crossing (MP 10.3) and addition of an ATWS south of Route 2 (1,100 feet) for Horizontal Directional Drilling (HDD) purposes
- ANGP-T-C-021& 022 - Williston gate station (MP-10.45) moved to the east 300 feet along Transmission Mainline
- ANGP-T-C-023B - Alignment change at I-89 crossing to Hurricane Lane (MP 11.4) and concurrent pullback area shift (1,400 feet)
- ANGP-T-C-027 & 028 – Transmission Mainline alignment shift further east of VELCO (K-23) ROW (MP 13.5) north of Williston Switching Station (600 feet)
- ANGP-T-C-028 – Transmission Mainline alignment shift from west to east side of VELCO K-43 ROW from MP 13.84 to MP 14.25 (2,200 feet)
- ANGP-T-C-031 & 032 – Transmission Mainline alignment shift into VELCO K-43 ROW at MP 15.6 (1,500 feet)
- ANGP-T-C-034 & 035 – Transmission Mainline re-alignment along Route 116 to Route 2A Crossing (MP 16.9) (1,700 feet)

- ANGP-T-C-036 – Transmission Mainline alignment shift toward VELCO K-43 ROW (MP 17.35) (700 feet)
- ANGP-T-C-041 - 049 – Transmission Mainlinealignment change from along Charlotte/Baldwin Rd to VELCO K-43 ROW and parallel VELCO line (MP 19.8 to 24) (22,200 feet)
- ANGP-T-C-050 - 052 – Transmission Mainline alignment change from VELCO K-43 ROW to (MP 24 to MP 24.9), crossing Rotax Rd. (4,800 feet)
- ANGP-T-C-053 – 061A – Transmission Mainline alignment change from along Monkton Rd to continuing to follow VELCO K-43 ROW, with HDD under Monkton Swamp and with access from Split Rock Rd, to Old Stage Rd (MP 25.75 to MP 28.9) (16,600 feet)
- ANGP-T-C-063 - 068 – Transmission Mainline alignment change from along Old Stage Rd/Parks-Hurlburt Rd/North St (MP 29.65) to west side of VELCO K-43 ROW to Plank Rd (MP 32.4) (14,500 feet)
- ANGP-T-C-068 - Plank Rd gate station moved from east of North St/Plank Rd intersection to west side of VELCO K-43 ROW at MP 32.5
- ANGP-T-C-072 –Transmission Mainline alignment shift from west side of VELCO K-64 ROW to cross Route 17 (Main St) and parallel New Haven Substation access (MP 34.6 – MP-35.1)) (2,640 feet)
- ANGP-T-C-074 – Transmission Mainline alignment change under VELCO K-64 ROW and crossing Town Hill Rd (MP 35.6) (1,050 feet)

- ANGP-T-C-083A - 085 – Transmission Mainline alignment change from east side of Route 7 at River Rd intersection to west side with ATWS on north west corner of Belden Falls Rd/Route 7 intersection (MP 40.3 to 41.2 end of ANGP transmission mainline) (4,800 feet)
- ANGP-T-C-085 - Middlebury gate station moved from south of Exchange St/Route 7 intersection, ~0.5 miles north
- ANGP-T-C-085 - Change from Transmission to Distribution Mainline from end of ANGP at Middlebury Gate Station (MP 41.2) along west side of Route 7 to Exchange St/Route 7 intersection (2,400 feet)

At the point of interconnection with the existing VGS transmission system in Colchester, the Colchester Tie-In will be reconfigured with an approximately 35-foot by 85-foot fenced-in yard to enclose the valve and an area for utilizing a pipeline in-line cleaning or inspection tool or "PIG" launcher. This is a slightly larger footprint to better accommodate the necessary infrastructure. A PIG is a tool used in the industry to clean the pipe or to inspect the integrity of the pipeline walls for things such as defects or corrosion. It moves down the pipeline by the force of the natural gas pressure in the pipeline. The fence will be a galvanized chain-link metal fence approximately 6 feet in height with three strands of barbed wire extending another foot. The fenced area will have a pervious crushed stone surface underlain by a geogrid to infiltrate rainwater and snowmelt. An access road, approximately 1,000 feet long, consisting of 470 feet of existing paved driveway and 530 feet of new stabilized pervious surface driveway will

extend from Severance Road to the Colchester Tie-In. Exhibit Petitioner Supp. JH-4 (2/28/13) is a site plan for the Colchester Tie-In.

To optimize the alignment of the Transmission Mainline corridor, Vermont Gas has attempted to co-locate the pipeline with, or adjacent to, other utility and road infrastructure where possible, in order to minimize impacts. The northern segment of the Transmission Mainline, from Colchester to Williston near Interstate 89, will generally be located within the ROW of VT 289 (also referred to as the Circumferential Highway, "CCCH" or "CIRC"). This segment of the Project corridor is approximately 11 miles from the Colchester Tie-In, and extends though portions of the towns of Colchester, Essex and Williston, to a point east of Interstate 89 in Williston, near the intersection of Interstate 89 and U.S. Route 2.

Near the intersections of Interstate 89 and Route 2 in Williston, the Transmission Mainline will leave the CIRC corridor. The Transmission Mainline continues south, within or adjacent to an existing Vermont Electric Power Company, Inc. ("VELCO") electric transmission line corridor that extends between Williston and Middlebury, Vermont. This segment of the Transmission Mainline extends about 30 miles and crosses through portions of the towns of Williston, St. George, Hinesburg, Monkton, New Haven and Middlebury. The details for this approximately 30-mile southern segment of the Transmission Mainline are shown in the Transmission Mainline Alignment Sheets, Exhibit Petitioner Supp. JH-3 (2/28/13).

A more detailed summary of the Transmission Mainline 2/28/13 Alignment is as follows:

- The proposed 12-inch transmission pipeline connects to an existing VGS 10-inch transmission pipeline in Colchester, VT. The pipeline exits this location (Colchester Tie-In Site) and runs west for approximately 0.1-miles within the existing VGS ROW to the northerly ROW edge of the un-built CCCH. The pipeline runs parallel to the ROW edge and within the CCCH ROW for approximately 2.1-miles crossing Mill Pond Road (MP-0.49), passing under Indian Brook (MP 0.99), crossing VELCO's K-22 transmission line (MP-1.3), passing under Indian Brook for a second time (MP-1.5), and crossing Route 2A and New England Central Railroad (MP-2.1); avoiding along the way, present and future constructability issues. This segment of the 2/28/13 Alignment is essentially unchanged from the December 20, 2012 proposal.

- The alignment then drops off the un-built CCCH ROW and runs along Route 289, approximately 40-ft off the edge of pavement for 0.9-miles until the pipeline crosses VELCO at MP-3.0. After crossing VELCO, the pipeline works its way back to the edge of Route 289 ROW, where again it parallels the ROW edge for a distance of 3-miles; crossing Indian Brook a third time (MP-3.6), crossing Route 15 (MP-4.1), Essex Way (MP-4.55), Alder Brook 9MP-5.05), and Alder Brook again (MP-6.25). The only substantive change in this segment is a location change for a temporary work space.

- Over the next 0.65-miles the alignment makes a cross country approach for a horizontal directional drill crossing under the Winooski River (MP-6.85) and Route 117 (MP-6.76), coming up on the south side of the river adjacent to Vermont Central Railroad (MP-7.0). The pipeline crosses under Vermont Central Railroad, and runs alongside the same for 0.1-miles and crosses another section of the un-built CCCH, crosses the Burlington Transfer Station site and Chittenden Solid Waste and picks up Redmond Road (MP-7.56), the location of VGS' first Mainline Valve. This segment is essentially unchanged from the Initial Proposal.

- The alignment runs south along the eastern edge of the Redmond Road ROW for 1.44-miles, then along the northern edge of Mountain View Road ROW for 0.1-miles before crossing Mountain View Road and re-entering the CCCH highway, where the Transmission Mainline follows the westerly edge of the un-built CCCH highway for 1-mile, makes an approach for and crosses Allen Brook (MP-10.3), Route 2 (Williston Rd), avoiding conflicts with sensitive environmental areas, and the possible future extension of the CCCH. On the south side of Williston Road, VGS proposes constructing the first of three Gate Stations (MP-10.45). The change of note in this segment is the shift of the Williston Station approximately 300 feet to the east.

- Upon leaving the Williston Station the pipeline re-enters the un-built CCCH ROW at its western edge and continues southerly to Interstate 89 and then west along I89 to MP-11.3 the location of the I89 crossing, thus avoiding potential conflicts with

the existing VELCO Sub Station infrastructure on the south side of I89 and the stakeholders along Hurricane Lane. The distance between the Gate Station and the I89 crossing location is approximately 0.85-miles. Any changes from the December 20, 2012 proposal in this area are minor.

- After crossing I89, the pipeline runs along the southerly edge of Hurricane Lane, for 0.2-miles, crosses to the west side of the VELCO ROW, avoiding existing utility infrastructure before generally running along and parallel to VELCO to the St. George/Williston town line (MP-14.7). In this section, the pipeline crosses VELCO at MP-12.35, St. George Road at MP-12.42, VELCO at MP-12.52, VELCO at MP-13, across Sucker Brook at MP-13.8, then south to VGS' second mainline valve location north of Lincoln Rd (MP-14.3), across Lincoln Rd (MP-14.31) and on to the St George/Williston town line. Any changes from the December 20, 2012 proposal in this area are minor.

- After crossing the St. George/Williston town line the transmission pipeline leaves the VELCO ROW to avoid stakeholder and constructability issues. This segment is essentially unchanged from the Initial Proposal.

- At MP-15.2 the alignment crosses the VELCO ROW to its western side, the alignment continues southerly generally parallel to the VELCO ROW western side (MP 15.3 to 16.2). This segment is essentially unchanged from the Initial Proposal

except for approximately 1,500 feet of pipeline that has been shifted into the VELCO ROW.

- The alignment then crosses the VELCO ROW (MP-16.2) and continues southerly 0.8 miles (MP 16.2 to 17.0) until crossing Route 2A (MP-16.8), Route 116 (MP-16.92), and VELCO again at MP-17.0. Any changes from the December 20, 2012 proposal in this area are minor.

- The alignment then continues southerly just west of VELCO to address landowner concerns and aligns with and parallels the VELCO ROW just inside the Hinesburg town line (MP-17.4 to MP-18.1), then moves west to avoid a tributary to the Laplatte River, crosses Shelburne Falls Road (MP-18.94) and joins back up with the western side of the VELCO ROW (MP-19.2), crosses under the Laplatte River MP-19.5 to VGS third mainline valve located at MP-19.81, just north of Charlotte Road in Hinesburg. Any changes from the December 20, 2012 proposal in this area are minor.

- The pipeline crosses Charlotte Road, continues southerly parallel to and 270 Ft. offset from the western VELCO ROW avoiding a meandering stream and wetlands for 0.9-miles (MP 19.9 to 20.8) where it re-enters the VELCO ROW. The 2/28/13 Proposal has been relocated off of Baldwin Road to a location that parallels the VELCO ROW.

- The pipeline continues 10 Ft. inside the western edge of VELCO crossing Baldwin Road (MP-21.1) and Drinkwater Road (MP-22.34) and Lewis Creek (MP-22.86) for 4.1-miles (MP 19.9 to 24.0). The 2/28/13 Proposal has been relocated off of Baldwin Road to a location within the VELCO ROW.

- The alignment leaves VELCO in the vicinity of Rotax Road in Monkton (i.e. the "Rotax Road Reroute") and continues southerly 0.9 miles (MP 24.0 to 24.9). The Initial Proposal was along public road ROW. The Rotax Road Reroute was selected due to constructability and landowner concerns.

- The alignment meets the VELCO ROW and continues southerly 0.9 miles (MP 24.9 to 25.8) parallel to and along the westerly side. The 2/28/13 Proposal has been relocated off of public road ROWs to a location adjacent to the VELCO ROW.

- The alignment enters and continues 10-ft inside the VELCO ROW for 1.5 miles (MP 25.8 to 27.3), crossing Stillson Road (MP-26.1), and Hollow Road (MP-25.4). VGS' fourth mainline valve is proposed just south of Hollow Road in Monkton (MP-26.48). The 2/28/13 Proposal has been relocated off of the public road ROW to a location within the VELCO ROW.

- The pipeline then continues west under Monkton Swamp using HDD, MP-27.3 – MP-27.65 and then back to and 10-ft inside the VELCO ROW at MP-28. The

2/28/13 Proposal has been relocated off of the public road ROW to a location within or parallel to the VELCO ROW.

- The pipeline continues inside VELCO's ROW until Old Stage Road, where it then runs within the Old Stage Road ROW (MP-28.9 to MP-29.63) to avoid a meandering stream and wetland. At MP 29.63, the Transmission Mainline crosses from Old Stage Road through approximately 330 feet of open field to the western edge of the VELCO ROW and continues southerly 10 ft within and parallel to VELCO until MP-31.6, crossing Parks –Hurlburt Road (MP-30.1) and the Monkton, New Haven town line (MP-31.1). The 2/28/13 Proposal has been primarily relocated off of the public road ROW to a location within the VELCO ROW.

- The proposed alignment then continues outside and parallel to the VELCO ROW 3.2 miles (MP 31.6 to 34.8) crossing Little Otter Creek (MP-32.3), Plank Road (MP-32.5), Quarry Road (MP-33.5), Route 17 (MP-34.9), and into the VELCO New Haven Substation property (MP-34.9 – MP-35.51). VGS' proposed fifth mainline valve is located at MP-32.39. The alignment then continues 0.6 miles (MP 35.1 to 35.7) briefly leaving VELCO to avoid structures and crossing Town Hill Road (MP-35.64) and VELCO to the eastern edge of VELCO. The most significant adjustment from the Initial Proposal is the shift of the New Haven Station location approximately a quarter mile west.

- The proposed alignment continues outside and parallel to the eastern edge of VELCO to MP-36.4 wherein the pipeline crosses VELCO and runs parallel to and outside the VELCO ROW to River Road (MP-39.54), crossing Hunt Road (MP-38.1) where Mainline Valve 6 will be installed and then crossing the New Haven River (MP-39.35). Any changes from the December 20, 2012 proposal in this area are minor.

- The pipeline continues westerly inside and outside the northerly ROW of River Road crossing to the westerly edge of Route 7, where it continues south 10 ft. outside and parallel to the road ROW terminating at the Proposed Middlebury Station (MP 41.23). The 2/28/13 Proposal changes the pipeline and the Station from the east side of Route 7 to the west.

Q5. Please describe the design specifications for the Transmission Mainline.

A5. The engineering design was guided by applicable federal and state standards including the following, which have not changed from the Initial Proposal:

- U.S. Department of Transportation, Office of Pipeline Safety, Code of Federal Regulations Title 49, Part 192 – Transportation of Natural and Other Gas by Pipeline: Minimum Safety Standards ("Code");
- American Society of Mechanical Engineers ("ASME") B31.8 – Gas Transmission and Distribution Piping Systems;

- Vermont Public Service Board General Order #43, Rules and Regulations Prescribing Standards for Gas Utilities;
- American Petroleum Institute ("API") 5L, Specification for Line Pipe, 2009;
- API Specification 6D, Specification for Pipeline Valves, 2008;
- American Society for Testing and Materials ("ASTM") A53/A53M-07, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless;
- ASTM D2513-99, Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings;
- MSS-Standard Practice SP-44-2006 Standard Practice, Steel Pipeline Flanges; and
- Vermont Public Service Board Rule 6.100.

The Transmission Mainline will be designed and constructed to a Maximum Allowable Operating Pressure ("MAOP") of 1,440 pounds per square inch ("psi"). The pipeline will be constructed of carbon-steel pipe (12.75-inch outside diameter), with a wall thickness of 0.283 inches in Class II (rural)[1] areas and 0.312 inches for the remainder of the route. The pipe material will have a specified minimum yield strength of 65,000 psi. For Class III areas, a design factor of 0.5 was used in the design pressure calculation, and for Class I and II areas a design factor of 0.6 was used, both of which are more stringent than

[1]Class location is the term used in the Code (49 C.F.R. Part 192) to classify the population density in the vicinity of the pipeline. The design of a pipeline may vary depending on the class location of the pipeline. Please refer to Mr. Teixeira's testimony for further explanation of this class location system.

required by the Code. This will allow the design pressure to stay the same even if there is a future change in the class location of the pipeline. The pipe will be manufactured in accordance with the API 5L, Specification for Line Pipe.

The pipe will have an external, corrosion-control coating; the coating will vary dependent upon soil conditions but in general it will consist of 15 mils thickness of fusion bond epoxy or Pritec. Segments of pipe to be installed by horizontal directional drill ("HDD") will have an additional 40 mils thickness of abrasion resistant coating over the external control coating. Cathodic protection will be provided by an impressed current rectifier system. The pipe will be hydrostatically-tested at a pressure of 1.5 times MAOP, at 2,160 psi for a minimum of eight hours before being placed in service. The test will assure there are no leaks and validate the MAOP of 1,440 psi. I discuss this testing below.

The pipeline will be entirely welded in accordance with API recommended practice standard 1104 – Welding of Pipelines and Related Facilities. All welds will be nondestructively tested in accordance with API 1104 by x-ray techniques. The test records will be kept for the life of the facility.

Q6. What is the width of the Transmission Mainline corridor?

A6. Generally, the Transmission Mainline corridor will occupy a 50-foot wide permanent ROW, together with a 25-five foot temporary easement area that will be used to complete

construction. This too is unchanged from the Initial Proposal. Vanasse Hangen Brustlin, Inc. ("VHB") has studied up to a 300-foot wide area for purposes of conducting its environmental resource impact analysis for this Section 248 application.

In areas where construction will parallel a public road ROW, VGS will utilize a 20-foot ROW on private land adjacent to the road ROW where possible. If obtaining a ROW on private land is not possible, the pipeline will be located in the public ROW and the construction crews will utilize the road as work space. The entire ROW on the side of the road where the pipeline will be located will be cleared of vegetation in order to allow for construction. After completion of construction, the disturbed ROW area will be graded back to its previous contours and restored consistent with the Erosion Prevention and Sediment Control Plan (provided as an attachment to Exhibit Petitioner Supp. JAN-9 2/28/13).

Q7. Earlier you mentioned a number of reroutes and revisions that occurred to accommodate sensitive environmental and cultural resources along the route first identified in the Preliminary Alignment for the Transmission Mainline. Please summarize those revisions.

A7. Designing the Project is a complex, interdisciplinary and iterative process that has taken months to develop. Once the CIRC and VELCO corridors were identified as the Preliminary Alignment for the Transmission Mainline (the process for which is more fully discussed in Mr. Howe's prefiled testimony), VGS hired CHA and environmental,

archaeological and aesthetic consultants to undertake detailed assessments of the Preliminary Alignment. Based upon that input, we continued to refine the Project design in dozens of locations to avoid or minimize impacts. With this 2/28/13 Proposal we have continued to minimize impacts as well as address community concerns. We have modified over 21 miles or about 51% of the Preliminary Alignment in order to avoid or mitigate these sensitive resource areas, as follows:

- 16 miles (pipeline reroutes and alignment shifts)
- 7.6 miles (narrowing of ROW)
- 3.6 miles (HDD)

Please refer to Exhibits Petitioner Supp. JH-14 (2/28/13) (Impact Minimization/Avoidance, Pipeline Reroutes and Alignment Shifts), JH-15 (2/28/13) (Impact Minimization/Avoidance, Through Horizontal Directional Drill) and JH-16 (2/28/13) (Impact Minimization/Avoidance, Through Right-of-Way Narrowing).

One significant re-route from the Preliminary Alignment is located on the southern side of the Winooski River in the area parallel to Redmond Road in Williston. There, the 2/28/13 Alignment, like the Initial Proposal, will extend west of the CIRC to connect to Redmond Road near the Chittenden Solid Waste Facilities, and continue south and southeast along Redmond Road at a point where Mountain View Road in Williston meets up with the CIRC corridor. This re-route, the so-called “Redmond Road Re-Route” is approximately 1.9 miles in length. This change to the Preliminary Alignment along the CIRC was undertaken by VGS following input from regulators and stakeholders in order

to avoid and minimize potential impacts to forested wetlands and wetland habitat, as discussed in more detail in the testimony and exhibits of Jeffrey Nelson of VHB. These areas are depicted on the Transmission Mainline Alignment Plans, Exhibit Petitioner Supp. JH-3 (2/28/13). Mr. Nelson also addresses this re-route in his testimony and exhibits.

The approximately 7.4 miles of the pipeline ROW that was narrowed from 75 feet to 50 feet, results in an approximate 7.4-acre reduction in wetland impacts. The reduction of ROW width will result in additional costs to the Project which are currently estimated at approximately $1.2 million. These additional costs are also included in the Project Cost Estimate, Exhibit Petitioner Supp. JH-11 (2/28/13).

Q8. What other measures will be taken to minimize impacts?

A8. Because of the nature of a long, linear pipeline expansion project such as this, complete avoidance of all environmental and cultural resource areas is not possible, but a number of precautions will be taken to minimize impacts. In wetlands and agricultural areas, where trenches are used, soil horizons will be removed in order and stockpiled so that horizons can be restored as closely as possible to pre-construction conditions. In some cases, we will employ coffer dams for stream crossings and we will use matting for all work in wetland areas. Silt fences and other erosion control techniques will be used, as well as matting, construction limit barriers, etc. Mr. Nelson's testimony describes the

techniques that will be employed to minimize environmental impacts to sensitive areas during Project construction.

As I have also noted, where appropriate, we will horizontally directional drill under certain streams, rivers, wetlands, and other resources. These areas include:

Indian Brook, MP 0.9;

Indian Brook, MP 1.3;

Indian Brook, MP 3.6;

Winooski River, MP 6.7;

Allen Brook, MP 10.3;

LaPlatte River, MP 19.6;

Resources near Drinkwater Road, MP 22.1;

Lewis Creek, MP 22.6;

Monkton Swamp, MP 27.2:

VT AD-1560&1561-Locus 1 and 2 (Arch Sites), South of Monkton Road, MP 28.2:

VT AD-1562 (Arch Site), South of Monkton Road, MP 28.6:

VT AD 446 (Arch site), North of Quarry Road, MP 33.2;

VT AD 793(Arch site), Locus 2 and 3, MP 33.7;

VT AD 806 (Arch Site) South of Town Hill Road, MP 35.8;

VT AD 808 (Arch Site), MP 36;

New Haven River, MP 39.35.

The use of HDD in these areas has eliminated over 6.7 acres of wetland impact, nearly 60,000 square feet of stream impact, impact to four rare, threatened and endangered species habitat and nine archaeological sites. The additional cost associated with the installation of HDDs in these areas is approximately $5.4 million and is reflected in the Project Cost Estimate, see Exhibit Petitioner Supp. JH-11 (2/28/13).

These areas are identified in Exhibit Petitioner Supp. JH-15 (2/28/13).

2.2 Distribution Mainlines to Vergennes and Middlebury

Q9. Please describe the Distribution Mainlines.

A9. There are two Distribution Mainlines. The site plans are included as Exhibit Petitioner Supp. JH-5 (2/28/13). The first is a 3.7-mile segment of 6-inch polyethylene ("PE") pipe that will begin at the new Plank Road Gate Station in New Haven, that runs through the Towns of New Haven, Ferrisburgh, and Waltham, to the intersection of Route 7 in Waltham, just east of Vergennes (the "Vergennes Distribution Mainline"). Network construction will begin at this point extending into the City of Vergennes. As a result of the change in the location of Plank Road Station, the Vergennes Distribution Mainline is slightly shorter than the Initial Proposal.

The second Distribution Mainline is also 6-inch PE pipe which will run approximately 1.35 miles along Route 7 and Exchange Street in Middlebury, between the new

Middlebury Station and into the Middlebury industrial park. As a result of the change in the location of Middlebury Station, the Middlebury Distribution Mainline is slightly longer than the Initial Proposal.

Both Distribution Mainlines will be located within the public ROWs of Plank Road and Route 7/Exchange Street. The Project plans for the Distribution Mainlines are included as Exhibit Petitioner Supp. JH-5 (2/28/13).

2.3 Gate Stations and Valves

Q10. Please describe each of the three Gate Stations.

A10. A gate station is a necessary component of a gas distribution system. The purpose of a gate station is to reduce the higher pressure in the transmission pipeline to the lower pressure used in the distribution network. A photograph of a VGS gate station was provided as Exhibit Petitioner JH-6.1.

The first Gate Station will be located near Route 2 in Williston to reinforce the existing distribution system. A site plan for the Williston Gate Station is included as Exhibit Petitioner Supp. JH-7 (2/28/13). It will include an approximately 55-foot by 85-foot fenced-in yard with a small parking area, an approximately 12-foot wide by 32-foot long precast concrete meter and regulator building, a-foot wide by 8-foot long SCADA[2] building and an approximately 8-foot wide by 12-foot long concrete pad on which the

[2]The acronym SCADA stands for "supervisory control and data acquisition."

pipeline heater will be mounted. Each enclosure building will be approximately 9 feet high from ground level to the roof peak. The enclosure buildings will house three major components of the Gate Station: (1) SCADA and telecommunications equipment, (2) the pressure regulation equipment, and (3) the meter. A Dry-Line heater system will be installed outside on the concrete pad. A Dry-Line heater works by producing steam within a vacuum, and heating the gas passing through pipes within the heater shell with low temperature steam.

Plantings will be installed to provide screening for the facility, as shown on the visual report provided by Michael Buscher, Exhibit Petitioner Supp. MJB-2.1 (2/28/13).

The design criteria for the Williston Gate Station are described as follows:

- Design maximum station inlet pressure (current): 605 psig
- Design maximum station inlet pressure (future): 1440 psig
- Design minimum station inlet pressure, at regulators: 250 psig
- Design normal station inlet pressure, at regulators: 400 psig
- Design maximum station outlet pressure: 100 psig
- Design flow volume, summer: 350 Mcfh
- Design flow volume, peak: 1,000 Mcfh
- Design minimum flow volume: 50 Mcfh
- Pipeline size into station: 6-inch
- Station piping wall thickness: Schedule 80 or XH Seamless

• Station piping grade:	Gr. B or X-42
• Safety device:	Monitor and Relief
• Relief set pressure at 110% of MOP:	110 psig
• Inlet gas temperature:	32°F
• Outlet gas temperature:	40°F
• Heater:	CWT Dry-Line Heater
• Filter:	PECO 30F
• Meter:	6-inch Turbine
• Odorizer:	N/A
• Station outlet control methodology:	3-inch Grove 900TE Monitor/Regulator

The changes to the Williston Station from the Initial Proposal are primarily related to a slight change in the equipment configuration. The footprint of the Williston Station is unchanged.

A second Gate Station will be located on Plank Road in New Haven to initially provide natural gas service to Vergennes. A site plan for the Plank Road Gate Station is included as Exhibit Petitioner Supp. JH-8 (2/28/13). It will include an approximately 85-foot by 55-foot fenced-in yard with a small parking area, an approximately 12-foot wide by 32-foot long precast concrete meter and regulator building, an 8-foot wide by 8-foot long SCADA building and an approximately 8-foot wide by 12-foot long concrete pad on

which the pipeline heater will be located. Each enclosure building will be approximately 9 feet high from ground level to the roof peak. The enclosure buildings will house three major components of the Gate Station: (1) SCADA and telecommunications equipment, (2) the pressure regulation equipment, and (3) the meter. A Dry-Line heater system will be installed outside on the concrete pad. Plantings will be installed to provide screening for the facility, as shown on the visual report provided by Michael Buscher, Exhibit Petitioner Supp. MJB-2.1 (2/28/13).

The design criteria for the Plank Road Gate Station are as follows:

- Design maximum station inlet pressure (current): 605 psig
- Design maximum station inlet pressure (future): 1440 psig
- Design minimum station inlet pressure, at regulators: 250 psig
- Design normal station inlet pressure, at regulators: 400 psig
- Design maximum station outlet pressure: 125 psig
- Design flow volume, summer: 250 Mcfh
- Design flow volume, peak: 400 Mcfh
- Design minimum flow volume: 25 Mcfh
- Pipeline size into station: 4-inch
- Station piping wall thickness: Schedule 80 or XH Seamless
- Station piping grade: Gr. B or X-42
- Safety device: Monitor and Relief
- Relief set pressure at 110% of MOP: 137 psig

- Inlet gas temperature: 32°F
- Outlet gas temperature: 40°F
- Heater: CWT Dry-Line Heater
- Filter: PECO
- Meter: 6-inch Turbine
- Odorizer: N/A
- Station outlet control methodology: 2" Grove 900TE Monitor/Regulator

The changes to the Plank Road Station from the Initial Proposal are primarily related to a slight increase in the footprint to accommodate changes in the equipment configuration.

The third Gate Station, the Middlebury Gate, will be located on the westside of Route 7 behind Paquette Enterprises Self Storage Facility in Middlebury. A site plan for the Middlebury Gate Station is provided as Exhibit Petitioner Supp. JH-9 (2/28/13). It will include an approximately 55-foot by 85-foot fenced-in yard with a small parking area, an approximately 12-foot wide by 32-foot long precast concrete meter and regulator building, an 8-foot wide by 8-foot long SCADA building and an approximately 8-foot wide by 12-foot long concrete pad on which the pipeline heater will be located. Each enclosure building will be approximately 9 feet high from ground level to the roof peak. The enclosure buildings will house three major components of the Station: (1) SCADA and telecommunications equipment, (2) the pressure regulation equipment, and (3) the meter. A Dry-Line heater system will be installed outside on the concrete pad. Plantings

will be installed to provide screening for the facility, as shown on the visual report provided by Michael Buscher, Exhibit Petitioner Supp. MJB-2.1 (2/28/13).

The design criteria for the Middlebury Gate Station are described as follows:

- Design maximum station inlet pressure (current): 605 psig
- Design maximum station inlet pressure (future): 1440 psig
- Design minimum station inlet pressure, at regulators:250 psig
- Design normal station inlet pressure, at regulators: 400 psig
- Design maximum station outlet pressure: 125 psig
- Design flow volume, summer: 350 Mcfh
- Design flow volume, peak: 500 Mcfh
- Design minimum flow volume: 75 Mcfh
- Pipeline size into station: 4-inch
- Station piping wall thickness: Schedule 80 or XH Seamless
- Station piping grade: Gr. B or X-42
- Safety device: Monitor and Relief
- Relief set pressure at 110% of MOP: 137 psig
- Inlet gas temperature: 32°F
- Outlet gas temperature: 40°F
- Heater: CWT Dry-Line Heater
- Filter: PECO 30F
- Meter: 6-inch Turbine

- Odorizer: N/A
- Station outlet control methodology: 3" Grove 900TE Monitor/Regulator

The Station configuration being proposed consists of two separate regulator runs, with one run serving as a full back up to the other. Each regulator run consists of two identical regulators set up in what is termed a working and monitor set. The Station will also include a relief valve to provide a secondary device for overpressure protection. This configuration provides for both overpressure protection and redundancy. A single regulator run in the Station is designed to handle the existing load requirement of the local distribution system.

The changes to the Middlebury Station from the Initial Proposal are primarily related to a decrease in the footprint. The new location allowed for a smaller footprint than the location contained in the Initial Proposal.

Q11. What is the height of the fence to be installed at each Gate Station?

A11. It is unchanged from the Initial Proposal. The fence will be 6-foot high galvanized chain link with one additional foot of barbed wire at the top.

Q12. Please describe the access and parking areas for each Gate Station.

A12. They are unchanged from the Initial Proposal. The access will consist of a 15-foot wide stabilized pervious surface underlain by geogrid. The parking area will be large enough for two vehicles and will consist of the same surface material as the access drive.

Q13. Please describe the Gate Station external lighting plans.

A13. It is unchanged from the Initial Proposal Only limited night-time lighting will be needed at each Gate Station, at the entrance and at the building. The lights will be 100-watt floodlights or luminaries, angled downwards.

Q14. Please describe the valves and valve locations.

A14. Other than the specific valve locations described below, the valve plans are unchanged. Eight sectionalizing valves will be installed along the pipeline length to allow for isolation of pipeline segments in the event that they need maintenance or in the case of an incident. Valve spacing is dictated by the Code and is based on the class location of the pipeline. The valve placement along the Transmission Mainline will exceed the requirements of 49 C.F.R. Section 192.179 (Transmission Line Valves).

A photograph of a VGS Mainline Valve ("MLV" or "Sectionalizing Valve") was included as Exhibit Petitioner JH-6.2. A typical MLV site is shown in Exhibit Petitioner Supp. JH-10 (2/28/13). Valve locations along the Transmission Mainline are identified in Exhibit Petitioner JH-3 at the following mile points:

MLV 0 at the Colchester Tie-In, MP 0.0;

MLV 1 at Redmond Road, Williston, MP 7.56;

MLV 2 at Lincoln Road, Williston, MP 14.3;

MLV 3 at Charlotte Road, Hinesburg, MP 19.81;

MLV 4 at Hollow Road, Monkton, MP 26.48;

MLV 5 at Plank Road, New Haven, MP 32.4;

MLV 6 at Hunt Road, New Haven, MP 38.11; and

MLV 7 at Middlebury Gate Station, MP 41.24.

3. <u>Project Construction</u>

Q15. Please describe the pipeline construction process.

A15. The process involves a series of sequential steps, as graphically illustrated on Exhibit JH-13, previously provided. The pipeline construction process, which is essentially unchanged from the December 20 Proposal, will generally proceed in the following sequence:

1. The construction is expected to be sequenced from north to south although there will be multiple construction sections called "spreads."
2. The route is first cleared and temporary work areas are prepared.
3. Perimeter erosion control measures, such as silt fences, are installed along sensitive resource areas such as stream edges and wetlands to control sediment.
4. For the Transmission Mainline, a four to five-foot wide trench will be excavated to a depth of approximately five-feet, and soil from the trench will

be stockpiled adjacent to the trench within the construction corridor. There will be different construction configurations for each of the different types of area to be crossed, including wetlands, agricultural areas and within the public highway ROW. These configurations are shown in Exhibit Petitioner Supp. JH-3 (2/28/13). Smaller trenches of approximately four-feet by five-feet will be used for the Distribution Mainlines.

5. Pipe lengths will be welded together, inspected, laid in the trench and warning tape will be laid over the line, and then the trench will be backfilled. The pipe will be covered by at least 36 inches of soil. The pipeline will have four-feet of cover in agricultural areas, within the VELCO ROW and residential areas, and generally five-feet of cover at road crossings and seven of feet cover at open cut streams.

6. The landscape will be restored as close as possible to pre-construction conditions in accordance with applicable permit requirements.

As Project Manager, it will be my responsibility to oversee that the Project is constructed in accordance with all applicable Code and permit requirements.

Q16. Is water required for Project construction or operation?

A16. The Project will not require the use of water for on-going operations. The three Gate Stations are unmanned and therefore do not have sink or toilet facilities. However, as part of construction, the Project will require approximately 1.4 million gallons of water to hydrostatically pressure test the Transmission Mainline. The pipe will be hydrostatically

tested at a pressure of at least 2160 psi for a minimum of eight hours before being placed in service. The test will prove there are no leaks and will validate the MAOP of 1440 psi. For the hydrostatic test, water will be taken from a Town of Colchester municipal water hydrant near the Colchester Tie-In. VGS has contacted the Champlain Water District which supplies Colchester Fire District #3, where we propose to obtain the water for our test. The Champlain Water District has stated that it will be able to provide the water volume required. When the test is complete, the water will be discharged to a nearby potential upland area at the tap as indicated on the Erosion Prevention and Sediment Control Plans included with Mr. Nelson's prefiled testimony as Exhibit Petitioner Supp. JAN-9 (2/28/13). These plans are being submitted as part as the Construction Stormwater Discharge Permit to the Vermont Department of Environmental Conservation, as discussed in more detail in Mr. Nelson's Supplemental testimony.

The two sections of Distribution Mainlines will be tested independently with air at a pressure of 190 psi for a period of eight hours.

In addition, water, sourced from a local water hauler, will be used to control dust during construction.

Q17. Has VGS identified the construction access points and laydown areas?

A17. Yes. We have identified locations where access to the Transmission Mainline corridor will be used as well as temporary work areas for equipment and materials staging areas.

These locations are identified in Exhibit Petitioner Supp. JH-3 (2/28/13)and were studied by our environmental and cultural resource experts and are noted in the VHB natural resources mapping, provided as an appendix to Exhibit Petitioner Supp. JAN-2 (2/28/13).

Q18. How will VGS manage construction waste?

A18. Unchanged from the Initial Project, the generation of construction debris from the Project will be minimal. Construction debris will be disposed of at an approved landfill. While not generally considered construction waste, VGS will handle woody debris as follows: trees under 6 inches in diameter, slash and brush will be chipped—not burned—and spread along the ROW in upland areas. Trees greater than 6 inches in diameter will be cut into logs, stacked in upland areas and offered to landowners along the ROW for landowner use.

Q19. Will blasting be required for pipeline installation?

A19. Yes, we anticipate that blasting will be required for approximately 35% of the proposed route. The 2/28/13 Proposal requires similar levels of blasting to the Initial Proposal, accordingly there is no change to the blasting protocols described below. Areas requiring blasting will be further defined during the final design process. VGS will use a blasting contractor licensed in the State of Vermont. It should be noted that blasting for projects of this nature will have limited impacts. Any blasting that is required for the Project would be conducted by state-licensed professionals in accordance with applicable blasting codes and local blasting requirements. All blasting would be conducted during

daylight hours and would not begin until appropriate local authorities and the occupants of nearby buildings, including residences and places of business, have been notified. In general, blasting would involve installation of small drill holes, and the use of low energy charges. Potential fracture impacts would be avoided through the use of open-face blasting techniques, which would direct the energy of the blast upward to the surface instead of downward. Delayed charges would be ignited in sequence to facilitate the upward movement of rock along the rock face. VGS will also conduct pre-blast inspections of nearby facilities and structures; install blasting mats to control the scattering of loose rock; use warning signals, flags and barricades to limit access to the blast area; and conduct post-blast surveys as necessary to assess damage. Notwithstanding the limited impact of the blasting, VGS will adhere to a rigorous blasting plan, highlights of which are described below.

Pre-Blast Surveys/Notifications

Pre-blast surveys and Water Quality/Flow Testing will be offered to all property owners that are within a 600-foot radius from the blast site. Appropriate notices will be given and appointments arranged for those owners who desire a survey. Pre-blast surveys will be conducted by a qualified firm approved by VGS. Results of those surveys will be documented through video or still photographs and appropriate narration or written reports.

Blast Monitoring

All blasts will be monitored by a representative of a qualified firm approved by VGS who has been properly trained in the setup and use of seismic monitoring equipment. At least one seismograph will be in use at all times. Placement of monitoring equipment will be at the nearest structure to the blast site. Results of blast monitoring will typically be available before the next blast. Results can be reviewed and modifications can be made to the blast design for the next blast if necessary.

Sequence of Blasting

All blasting operations will be strictly coordinated with VGS's on-site representative and local Fire Departments. Emphasis will be on the safe and efficient removal of the rock existing on this project without impact to surrounding structures.

Blasting Procedures

1. Blasting operations shall commence after 7:00 AM and cease before 7:00 PM, Monday through Saturday.
2. Blasting cannot be conducted at times different from those announced in the blasting schedule except in emergency situations, such as electrical storms or public safety required unscheduled detonation.
3. Warning and all-clear signals of different character that are audible within a range of one-quarter mile from the point of the blast shall be given. All persons within the permit area shall be notified of the meaning of the signals through appropriate instructions and signs posted.

4. Access to the blasting area shall be regulated to protect the public from the effects of blasting. Access to the blasting area shall be controlled to prevent unauthorized entry before each blast and until the perimeter's authorized representative has determined that no unusual circumstances exist after the blast. Access to and travel in or through the area can then safely resume.
5. Areas in which charged holes are awaiting firing shall be guarded, barricaded and posted, or flagged against unauthorized entry.
6. Blasting mats shall be used to cover blasts and prevent fly rock.

Blast Security

Each blast will be preceded by a security check of the affected area. Communications will be made with job site supervisors and local officials as required to ensure the safest possible operation. All personnel in the vicinity closest to the blast area will be warned.

No blast will be fired until the area has been secured and determined safe. The blast site will be examined by the blaster prior to the all-clear signal to determine that it is safe to resume work.

Blast Vibration

Blast vibration will be monitored at the blast site, typically at the structure(s) closest to the blast site. Vibration limits will closely follow industry limits and the State and Local Regulations. Blast designs will be modified as required to stay within the guidelines.

Blasting operations will be modified accordingly when approaching buildings and utilities.

4. Right of Way Acquisition

Q20. Will the Project require ROW acquisition?

A20. Yes. VGS will purchase easements from landowners along the Transmission Mainline where public ROWs are not being used. Landowner parcels along the Final Alignment are shown on Exhibit Petitioner Supp. JH-3 (2/28/13). VGS has contacted all landowners along the pipeline route and is currently in discussions to obtain easements. As a result of moving the alignment off of public roads in some locations at the request of the communities, the 2/28/13 Alignment will require VGS to obtain easements associated with approximately 200 land parcels. This is an increase of approximately 40 parcels from the Initial Proposal. VGS is targeting to have all easements in place by the end of 2013.

5. Noise Impacts

Q21. Will the Project generate noise?

A21. During construction, the Project will generate general construction noise associated with construction vehicles and equipment. Construction activities will normally occur between 7 a.m. and 7 p.m. and will only last during the construction period. Once constructed, because they are buried, the Project pipelines will not generate any additional noise.

The sectionalizing valves are not pressure-reduction valves containing any mechanized components, and therefore will not result in additional noise.

VGS has selected a heater system for the Gate Stations that emits very little noise. VGS has calculated that after construction of the Project and during the peak hour of operation, the noise level at each Gate Station will be approximately 50 dBA when measured at the fence line. The closest occupied structure (a bookstore in Middlebury) to any of our proposed Gate Stations is approximately 150 feet. While this is closer than the nearest occupied structure in the Initial Proposal, the Gate Station was relocated at the request of the community, and at this distance, the noise is projected to drop well below the 45 dBA nighttime and 55 dBA daytime noise levels required in other Board proceedings.

6. <u>Transportation Impacts</u>

Q22. What impacts will the Project construction have on traffic and transportation facilities?

A22. We plan to conduct horizontal directional drilling ("HDD") or boring under a number of street crossing and railway crossings, namely:

Mill Pond Road, Colchester; Uncased bore

Colchester Rd. (Route 2A), Essex; Uncased bore

New England Central RR, Essex; Cased bore

Upper Main St. (Route 15), Essex; Uncased bore

Essex Way, Essex; Uncased bore

River Rd. (Route 117), Essex; HDD with Winooski River

New England Central RR, Essex; Cased bore

Redmond Road at CSWD, Williston; Uncased bore

Mountain View Rd. , Williston; Uncased bore

Williston Rd. (Route 2), Williston; HDD with Allen Brook

Interstate Highway 89, Williston; HDD

Hurricane Lane, Williston; Uncased bore

St. George Rd. (Route 2A), Williston; Uncased bore

St. George Rd (Route 2A), St. George; Uncased Bore

Vermont Route 116, St. George; Uncased bore

Shelburne Falls Road, Hinesburg; Uncased bore

Charlotte Road, Hinesburg; Uncased bore

Hollow Road, Monkton; Uncased bore

Monkton Road, Monkton; Uncased bore

Plank Road, New Haven; Uncased bore

North Road, New Haven; Uncased bore

Plank Road, New Haven; Uncased bore

Quarry Road, New Haven; Uncased bore

Main St. (Route 17), New Haven; Uncased bore

Town Hill Road, New Haven; Uncased bore

Hunt Road, New Haven; Uncased bore

River Road, New Haven; Uncased bore

Vermont Route 7, New Haven; Uncased Bore

Beldon Road, New Haven; Uncased Bore

HDD or boring involves the installation of pits at either side of the area to be crossed and drilling or auguring the pipe beneath that area, creating no disturbance at the surface. This technique, although more expensive, allows us to avoid direct impacts to these areas. These locations reflect the route alignment changes previously described.

In areas where we will install the pipe with traditional open-cut methods across roadways, we will employ standard traffic control measures to maintain at least one lane of traffic during installation. Additionally, there are areas where we will be installing pipe within the road ROW or shoulder. In these areas we will employ traffic control measures and maintain one lane of traffic during construction. Road surfaces will be protected and restored to original or better condition if impacted by construction.

During construction in these areas, VGS will utilize traffic control methods that comply with Vermont Agency of Transportation ("VTrans") standards, including employment of appropriate signage and the services of sheriffs or other traffic control personnel to manage traffic flow. VGS will obtain highway permits from VTrans and local municipalities for work in state and local roadways.

The Winooski River is considered a navigable water under Section 10 of the Rivers and Harbors Act of 1899, and is subject to the permit jurisdiction of the Army Corps of

Engineers ("ACOE"). As explained in Mr. Nelson's testimony, VGS has applied for a Section 10 permit for this crossing. From a practical standpoint, this will have no impact on river transportation and navigation, as we plan to HDD the crossing, and thus will not impact surface waters.

7. Cost Estimate

Q23. Please provide the estimated cost of the Project.

A23. The Project is estimated to cost $86,612,944, which includes the proposed Transmission Mainline and Distribution Mainlines; it does not include the distribution networks in Middlebury and Vergennes. This reflects an increase of $2.8 million, primarily associated with additional HDD to mitigate environmental impacts as discussed in MR. Nelson's supplemental testimony. A breakdown of the cost estimate is set forth in Exhibit Petitioner Supp. JH-11 (2/28/13). The cost estimate was prepared using quotes from equipment vendors, discussions with contractors familiar with the work and historical costs from similar projects.

8. Schedule

Q24. What is the schedule for the Project?

A24. The current schedule is to construct the Project in 2014. This will bring gas service to anchor customers in the Middlebury industrial park by late 2014. The distribution networks in Middlebury and Vergennes would be constructed in 2015, with residential and commercial customers receiving gas service by the 2015/16 winter.

9. Conclusion

Q25. Does this conclude your testimony at this time?

A25. Yes, it does.

Vermont Gas Systems, Inc.
Addison Natural Gas Project

Section 248 Stormwater Technical Memorandum
Attachment 1
Erosion Prevention and Sediment Control Plan

NOTES:

1. USE DIVERSION FLUME STREAM CROSSING ON WATER COURSES WITH LIMITED STREAM FLOW TO PREVENT SEDIMENTATION AND INTERRUPTION OF STREAM FLOW DURING CONSTRUCTION. THIS METHOD IS APPROPRIATE IN LOCATIONS WHERE FISH PASSAGE IS A CONCERN.

2. SCHEDULE CONSTRUCTION DURING LOW FLOW PERIOD, IF POSSIBLE.

3. THIS DETAIL REPRESENTS ONE POSSIBLE CONFIGURATION OF CONSTRUCTION ELEMENTS WITHIN THE TEMPORARY AND PERMANENT ROW. ALTERNATE CONFIGURATIONS OF CONSTRUCTION ELEMENTS BETWEEN THE UPSTREAM AND DOWNSTREAM DIVERSION STRUCTURES ARE ALLOWABLE SO LONG AS APPROPRIATE MEASURES ARE MAINTAINED TO PROTECT WATER QUALITY .

4. SET UP STEEL OR HDPE PIPE AS SHOWN, OR USE PRACTICAL ALTERNATIVES. PIPE (OR PIPES) MUST BE SIZED TO HAVE TWICE THE CAPACITY OF ANTICIPATED FLOW. DEPENDING ON STREAM FLOW, DIG SUMP HOLE TO CONCENTRATE WATER AT INTAKE.

5. INSTALL UPSTREAM DAM COMPOSED OF SANDBAGS, METAL PLATING OR A COMBINATION OF BOTH, INSTALL DOWNSTREAM DAM, IF REQUIRED, TO KEEP STREAM BED DRY.

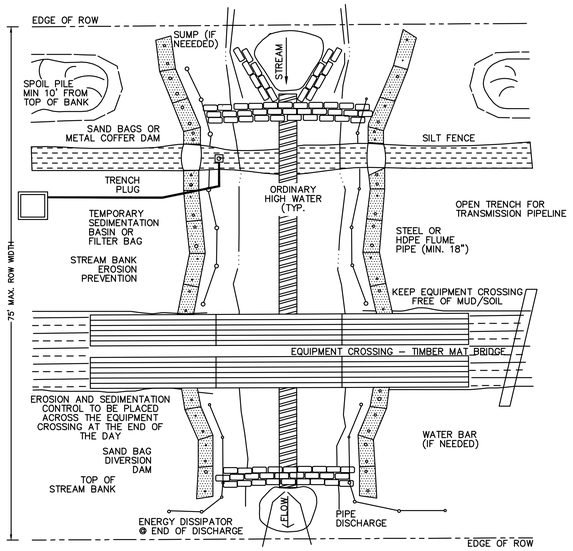
6. AFTER DAMS ARE IN PLACE, IT MAY BE NECESSARY TO USE A SUMP PUMP AND DEWATERING FILTER BAG TO KEEP WORK AREA DRY.

7. ALL MECHANIZED EQUIPMENT TO PERFORM WORK FROM ADJACENT TOP OF BANK AREAS. MAT STREAM IF WORK TO OCCUR IN STREAM CHANNEL.

8. EXCAVATE TRENCH AND LOWER IN PIPE UNDER DIVERSION FLUME. MOVE FLUME AS REQUIRED OR DISCONNECT IF TEMPORARY FLOW BLOCKAGE IS ACCEPTABLE. BACKFILL TRENCH.

9. DISMANTLE DOWNSTREAM DAM, THEN UPSTREAM DAM.

10. RESTORE DISTURBED CHANNEL, STREAM BANKS AND APPROACHES FOR A MINIMUM DISTANCE OF AT LEAST 50 FT. FROM THE STREAM EDGES AND PERMANENTLY STABILIZE WITHIN 1 DAY OF INITIAL RESTORATION. REFER TO THE STREAMBANK RESTORATION DETAIL FOR RESTORATION REQUIREMENTS.



1 Diversion Flume Stream Crossing

N.T.S. Source: VHB 12/12 LD_

NOTES:

1. USE DAM AND PUMP METHOD ON WATER COURSES WITH LIMITED STREAM FLOW TO PREVENT SEDIMENTATION AND INTERRUPTION OF STREAM FLOW DURING CONSTRUCTION.

2. SCHEDULE CONSTRUCTION DURING LOW FLOW PERIOD, IF POSSIBLE.

3. THIS DETAIL REPRESENTS ONE POSSIBLE CONFIGURATION OF CONSTRUCTION ELEMENTS WITHIN THE TEMPORARY AND PERMANENT ROW. ALTERNATE CONFIGURATIONS OF CONSTRUCTION ELEMENTS BETWEEN THE UPSTREAM AND DOWNSTREAM DIVERSION STRUCTURES ARE ALLOWABLE SO LONG AS APPROPRIATE MEASURES ARE MAINTAINED TO PROTECT WATER QUALITY .

4. SET UP PUMP AND HOSE AS SHOWN, OR USE PRACTICAL ALTERNATIVES. PUMP SHOULD HAVE TWICE THE PUMPING CAPACITY OF ANTICIPATED FLOW. HAVE STANDBY PUMP ON SITE. DEPENDING ON STREAM FLOW, DIG SUMP HOLE TO CONCENTRATE WATER AT INTAKE.

5. USE TEMPORARY SEDIMENTATION BASIN OR FILTER BAG PRIOR TO DISCHARGING WATER BACK TO STREAM.

6. INSTALL UPSTREAM DAM COMPOSED OF SANDBAGS, METAL PLATING OR A COMBINATION OF BOTH, INSTALL DOWNSTREAM DAM, IF REQUIRED, TO KEEP STREAM BED DRY.

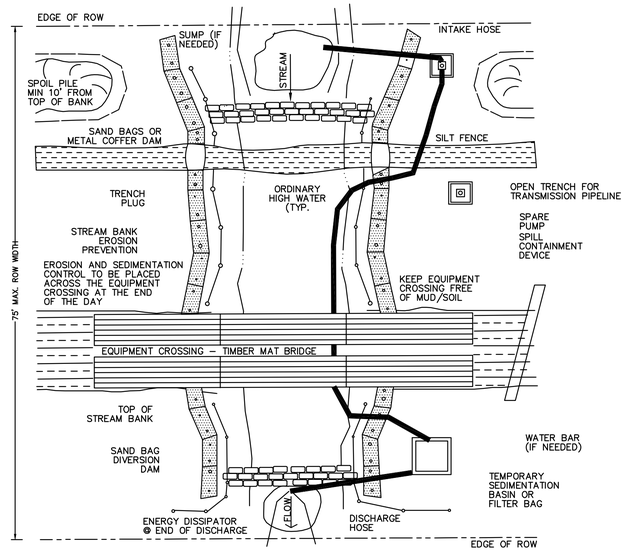
7. AFTER DAMS ARE IN PLACE, IT MAY BE NECESSARY TO USE ADDITIONAL PUMPS TO HANDLE STREAM FLOW.

8. EXCAVATE TRENCH AND LOWER IN PIPE UNDER HOSE. BACKFILL TRENCH.

9. ALL MECHANIZED EQUIPMENT TO PERFORM WORK FROM TEMPORARY BRIDGE OR ADJACENT TOP OF BANK AREAS. USE TIMBER MATS IS TO OCCUR IN STREAM CHANNEL.

10. DISMANTLE DOWNSTREAM DAM, THEN UPSTREAM DAM.

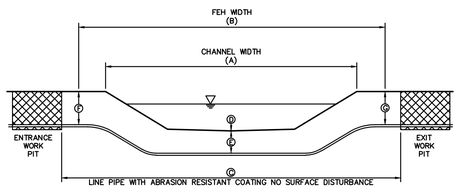
11. RESTORE DISTURBED CHANNEL, STREAM BANKS AND APPROACHES FOR A MINIMUM DISTANCE OF AT LEAST 50 FT. FROM THE STREAM EDGES AND PERMANENTLY STABILIZE WITHIN 1 DAY OF INITIAL RESTORATION. REFER TO THE STREAMBANK RESTORATION DETAIL FOR RESTORATION REQUIREMENTS.



2 Open Trench Stream Crossing - Dam and Pump Around Detail

N.T.S. Source: VHB 12/12 LD_

MILEPOST	STREAM NAME	CHANNEL WIDTH (A)	FEH WIDTH (B)	HDD LENGTH (C)	CHANNEL ELEV. (D)	ELEV. BELOW CHANNEL (E)	ENTRY ELEV. (F)	EXIT ELEV. (G)
1.52	INDIAN BROOK	15	125	650	196	< 189	< 196	< 196
3.62	INDIAN BROOK	7	N/A (185)	550	432	< 425	< 432	< 432
6.85	WINOOSKI RIVER	320	N/A (1,195)	1,100	275	< 268	< 275	< 275
10.32	ALLEN BROOK	35	360	850	381	< 374	< 374	< 374
19.57	LAPLATTE RIVER	30	360	550	315	< 308	< 315	< 315
22.88	LEWIS CREEK	80	N/A (250)	1,100	310	< 303	< 310	< 310
24.75	UNNAMED TRIB. TO LEWIS CREEK	6	384	2,400	455	< 448	< 455	< 455
33.13	LITTLE OTTER CREEK	25	N/A (330)	550	276	< 269	< 276	< 276
36.64–36.72	UNNAMED TRIB. TO LITTLE OTTER CREEK	4	640	950	303	< 296	< 303	< 303
40.21	NEW HAVEN RIVER	120	785	800	245	< 238	< 245	< 245



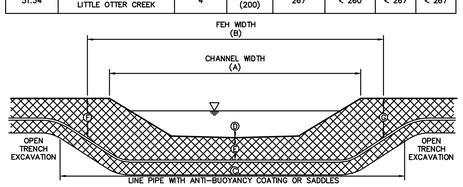
Notes:

1. THIS CONFIGURATION IS FOR HORIZONTAL DIRECTIONAL DRILL OF STREAM CROSSINGS AS SHOWN ON PROJECT PLANS. SEE ALIGNMENT SHEETS FOR LOCATIONS OF THIS CONFIGURATION.
2. TOP OF PIPELINE MUST BE AT LEAST AS DEEP AS THE CHANNEL BOTTOM (DIMENSION D) THROUGHOUT THE FLUVIAL EROSION HAZARD (FEH) CORRIDOR.
3. MINIMUM SEPARATION BETWEEN THE TOP OF PIPELINE AND THE CHANNEL BOTTOM (DIMENSION E) MUST BE AT LEAST 7 FEET.
4. ELEVATIONS PROVIDED ARE BASED ON APPROXIMATE NAVD 88 DATUM AND MUST BE FIELD VERIFIED PRIOR TO INSTALLATION OF PIPELINE.
5. FEH CORRIDOR IS LISTED AS NOT APPLICABLE (N/A) WHERE THE STREAM CROSSES OR IS ADJACENT TO AN EXISTING ROADWAY OR OTHER INFRASTRUCTURE THAT RESULTS IN RIVER MANAGEMENT CONSTRAINTS AT THAT LOCATION. FEH CORRIDOR WIDTHS AT THESE LOCATIONS ARE SHOWN FOR INFORMATION PURPOSES ONLY.

3 Horizontal Directional Drill Stream Crossing - Typical Section

N.T.S. Source: VHB 12/12 LD_

MILEPOST	STREAM NAME	CHANNEL WIDTH (A)	FEH WIDTH (B)	CHANNEL ELEV. (D)	ELEV. BELOW CHANNEL (E)	ENTRY ELEV. (F)	EXIT ELEV. (G)
5.04	ALDER BROOK	50	N/A (80)	N/A – NOT CROSSING IN CHANNEL			
6.14	ALDER BROOK	40	N/A (190)	N/A – NOT CROSSING IN CHANNEL			
6.23	ALDER BROOK	40	N/A (190)	295	< 288	< 295	< 295
13.79	SUCKER BROOK	15	120	367	< 360	< 367	< 367
18.99	UNNAMED TRIBUTARY TO LAPLATTE RIVER	4	N/A (310)	329	< 322	< 329	< 329
19.93	UNNAMED TRIBUTARY TO LAPLATTE RIVER	4	N/A (125)	328	< 321	< 328	< 328
28.43	UNNAMED TRIBUTARY TO LITTLE OTTER CREEK	8	N/A (200)	372	< 365	< 372	< 372
29.63	UNNAMED TRIBUTARY TO LITTLE OTTER CREEK	8	N/A (200)	363	< 356	< 363	< 363
31.34	UNNAMED TRIBUTARY TO LITTLE OTTER CREEK	4	N/A (200)	267	< 260	< 267	< 267



Notes:

1. THIS CONFIGURATION IS FOR OPEN TRENCH EXCAVATION OF STREAM CROSSINGS AS SHOWN ON PROJECT PLANS. SEE ALIGNMENT SHEETS FOR LOCATIONS OF THIS CONFIGURATION.
2. TOP OF PIPELINE MUST BE AT LEAST AS DEEP AS THE CHANNEL BOTTOM (DIMENSION D) THROUGHOUT THE FLUVIAL EROSION HAZARD (FEH) CORRIDOR.
3. MINIMUM SEPARATION BETWEEN THE TOP OF PIPELINE AND THE CHANNEL BOTTOM (DIMENSION E) MUST BE AT LEAST 7 FEET.
4. ELEVATIONS PROVIDED ARE BASED ON APPROXIMATE NAVD 88 DATUM AND MUST BE FIELD VERIFIED PRIOR TO INSTALLATION OF PIPELINE.
5. FEH CORRIDOR IS LISTED AS NOT APPLICABLE (N/A) WHERE THE STREAM CROSSES OR IS ADJACENT TO AN EXISTING ROADWAY OR OTHER INFRASTRUCTURE THAT RESULTS IN RIVER MANAGEMENT CONSTRAINTS AT THAT LOCATION. FEH CORRIDOR WIDTHS AT THESE LOCATIONS ARE SHOWN FOR INFORMATION PURPOSES ONLY.
6. RESTORE DISTURBED CHANNEL, STREAM BANKS, AND APPROACHES FOLLOWING PIPELINE INSTALLATION.

4 Open Trench Stream Crossing - Typical Section

N.T.S. Source: VHB 12/12 LD_

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SPACE INTENTIONALLY LEFT BLANK

DWG. NO.	REFERENCE DWG.	REV	DSN	CK		DESCRIPTION		BID DATE	CONSTRUCTION INITIALS	CONSTRUCTION DATE
							ENVIRONMENTAL			
							DRAFTING DESIGNER	GIL 02/28/13		
							DRAFTING SUPERVISOR	BZD 02/28/13		
		1	SAB	JEO		ISSUED FOR AMENDED ARTICLE 248 FILING	DESIGN ENGINEER	SAB 02/28/13		
		0	SAB	JEO		ISSUED FOR VERMONT STATUTES ARTICLE 248 FILING	DESIGN MANAGER	JEO 02/28/13		

VERMONT GAS
PROPOSED 12" PIPELINE
ADDISON NATURAL GAS PROJECT
CONSTRUCTION DETAILS

LOC. CHITTENDEN & ADDISON COUNTIES

YEAR: 2013 | W.O. | SCALE: NOTED | DWG. ANGP–T–G–020 | REV. 1

Vanasse Hangen Brustlin, Inc.
CHA design / construction solutions
COLER & COLANTONIO INC ENGINEERS AND SCIENTISTS
TEL: 781-982-5400 FAX: 781-982-5490 WWW.COL-COL.COM
36 CORDAGE PARK CIR., STE 340 PLYMOUTH, MA 02360

Vermont Gas

CONSTRUCTION DEMARCATION:

1. CONSTRUCTION DEMARCATION TO BE INSTALLED ALONG PERIMETER OF LIMITS OF DISTURBANCE PER THE EPSC PLAN.
2. DEMARCATION IS NOT TO CROSS ACTIVE ACCESS ROUTES.
3. WITHIN AT LEAST 50 FEET OF A WATER RESOURCE AREA, DEMARCATION MUST INCLUDE:
   a. 2 TO 3 ROWS OF STAKED (OR STAPLED) 3 INCH ORANGE BARRIER MESH TAPE OR ROPE,
   b. ORANGE CONSTRUCTION FENCE, OR
   c. ORANGE SNOW FENCE.
   d. OTHER INTERCHANGEABLE AND/OR DEC APPROVED MEASURE.
4. GREATER THAN AT LEAST 50 FEET FROM WATER RESOURCE AREAS, DEMARCATION MAY INCLUDE:
   a. ONE ROW OF STAKED (OR STAPLED) 3 INCH ORANGE BARRIER MESH TAPE OR ROPE, OR
   b. ORANGE FLAGGING OR PAINT.
   c. OTHER INTERCHANGEABLE AND/OR DEC APPROVED MEASURE.

1 Construction Demarcation Table

12/12

N.T.S. Source: VHB LD_

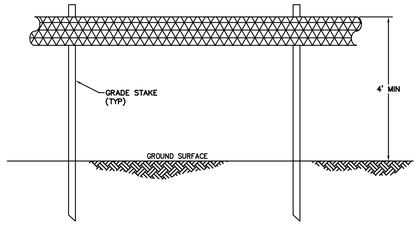
PERIMETER CONTROLS:

1. PERIMETER CONTROLS ARE TO BE INSTALLED ON DOWNSLOPE SIDE OF AREAS OF DISTURBANCE WHERE THERE IS POTENTIAL FOR SEDIMENT RUNOFF AND/OR SOIL EROSION.
2. PERIMETER CONTROLS ARE NOT TO CROSS ACTIVE ACCESS ROUTES (E.G., ROADS) OR ACTIVE FLOW PATHS (E.G., A STREAM).
3. PARTICULAR CARE IS TO BE TAKEN WHEN INSTALLING PERIMETER CONTROLS IN A WETLAND.
4. WITHIN AT LEAST 50 FEET OF WATER RESOURCE AREAS, PERIMETER CONTROLS MUST INCLUDE:
   a. REINFORCED SILT FENCE – TO BE REINFORCED WITH WIRE MESH, STAKED HAYBALES, STAKED FIBER ROLLS, EROSION CONTROL MIX BERMS, OR WOOD CHIP BERMS.
   b. STONE BERMS
   c. OTHER INTERCHANGEABLE AND/OR DEC–APPROVED MEASURE.
5. GREATER THAN AT LEAST 50 FEET FROM WATER RESOURCE AREAS, PERIMETER CONTROLS MAY INCLUDE:
   a. SILT FENCE (NON–REINFORCED)
   b. STAKED FIBER ROLLS
   c. EROSION CONTROL MIX BERMS
   d. OTHER INTERCHANGEABLE AND/OR DEC–APPROVED MEASURE.

2 Perimeter Control Table

12/12

N.T.S. Source: VHB LD_



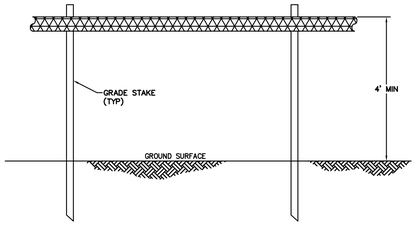
Notes:

1. BARRIER MESH TAPE OR ROPE SHALL BE INSTALLED ALONG THE PERIMETER OF THE PROJECT AREA TO DEMARCATE THE LIMIT OF DISTURBANCE. NO EARTHWORK OR STORAGE OF MATERIALS SHALL BE CONDUCTED BEYOND THIS LIMIT WITHOUT PRIOR APPROVAL FROM THE OSPC.
2. USE 3" ORANGE BARRIER MESH TAPE OR 1/2" YELLOW POLYPROPYLENE ROPE.
3. WITHIN 50' OF WATER RESOURCE AREAS, USE 2–3 ROWS OF TAPE OR ROPE. BEYOND 50' OF WATER RESOURCE AREAS USE 1 ROW OF TAPE OR ROPE.
4. TAPE OR ROPE MAY BE FASTENED TO STAKES, TREES, OR OTHER APPROPRIATE FIXED OBJECTS.
5. PROJECT DEMARCATION SHALL NOT CROSS ACTIVE ACCESS ROUTES (E.G. ROADS). PROJECT DEMARCATION MAY CROSS RESOURCE AREAS WITH EXCEPTION OF LARGER WATER BODIES WHERE IT IS NOT FEASIBLE OR ADVISABLE.
6. PROJECT DEMARCATION SHALL REMAIN IN PLACE AND BE MAINTAINED/REPLACED AS NEEDED UNTIL FINAL STABILIZATION IN THE AREA HAS BEEN ACHIEVED.

3 Barrier Mesh Tape or Rope

12/12

N.T.S. Source: VHB LD_



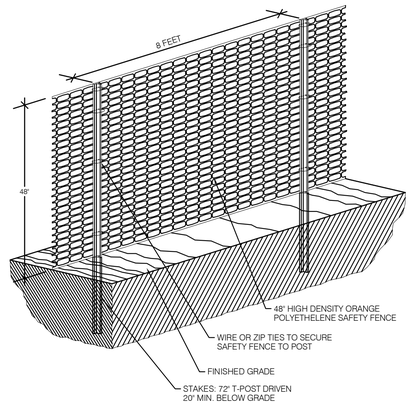
Notes:

1. BARRIER FLAGGING OR PAINT SHALL BE INSTALLED ALONG THE PERIMETER OF THE PROJECT AREA TO DEMARCATE THE LIMIT OF DISTURBANCE. NO EARTHWORK OR STORAGE OF MATERIALS SHALL BE CONDUCTED BEYOND THIS LIMIT WITHOUT PRIOR APPROVAL FROM THE OSPC.
2. FLAGGING OR PAINT MAY BE FASTENED TO STAKES, TREES, OR OTHER APPROPRIATE FIXED OBJECTS.
3. PROJECT DEMARCATION SHALL NOT CROSS ACTIVE ACCESS ROUTES (E.G. ROADS). PROJECT DEMARCATION MAY CROSS RESOURCE AREAS WITH THE EXCEPTION OF LARGER WATER BODIES WHERE IT IS NOT FEASIBLE OR ADVISABLE.
4. PROJECT DEMARCATION SHALL REMAIN IN PLACE AND BE MAINTAINED/REPLACED AS NEEDED UNTIL FINAL STABILIZATION IN THE AREA HAS BEEN ACHIEVED.

4 Barrier Flagging or Paint

12/12

N.T.S. Source: VHB LD_



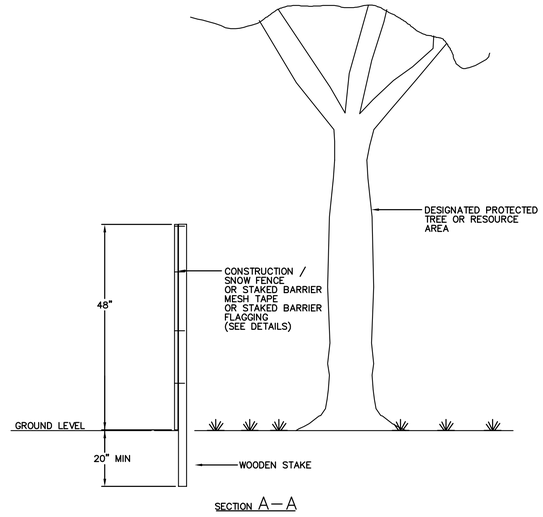
Notes:

1. CONSTRUCTION/SNOW FENCE SHALL BE INSTALLED WITHIN 50' OF A WATER RESOURCE, (STREAM, BROOK, LAKE, POND, ETC.) UNLESS THE AREA IS DENSELY WOODED, IN WHICH CASE 2 TO 3 ROWS OF ORANGE BARRIER MESH TAPE OR ROPE MAY BE USED.
2. CONSTRUCTION/SNOW FENCE SHALL NOT CROSS ACTIVE ACCESS ROUTES (E.G. ROADS). CONSTRUCTION/SNOW FENCE MAY CROSS RESOURCE AREAS WITH THE EXCEPTION OF LARGER WATER BODIES WHERE IT IS NOT FEASIBLE OR ADVISABLE.
3. CONSTRUCTION/SNOW FENCE SHALL REMAIN IN PLACE AND BE MAINTAINED/REPLACED AS NEEDED UNTIL FINAL STABILIZATION IN THE AREA HAS BEEN ACHIEVED.

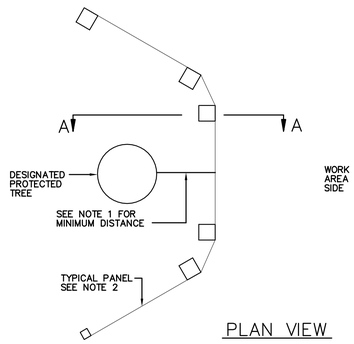
5 Construction/Snow Fence

12/12

N.T.S. Source: VHB LD_651



SECTION A–A



PLAN VIEW

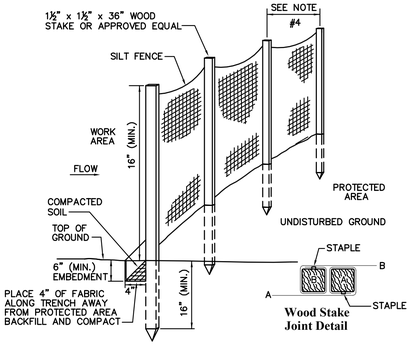
NOTES:

1. MINIMUM DISTANCE BETWEEN RESOURCE AND BARRIER SHALL BE 25' UNLESS OTHERWISE DIRECTED BY OSPC.
2. RESOURCES REQUIRING PROTECTION FOR ALL SIDES WILL BE BOXED WITH A MINIMUM OF 4 PANELS.
3. BARRIER MAY BE CONSTRUCTION/SNOW FENCE, STAKED BARRIER MESH TAPE, OR STAKED BARRIER FLAGGING. (SEE DETAILS.)
4. BARRIER TO REMAIN IN PLACE UNTIL CONSTRUCTION ACTIVITIES IN AREA ARE COMPLETE OR AS AS OTHERWISE DIRECTED BY OSPC.

6 Wetland, RTE, and Vegetation Protection Barrier

12/12

N.T.S. Source: CHA LD_



Notes:

1. SEE DETAIL # 2 ON SHEET ANGP–T–G–012 FOR LIST OF APPROPRIATE PERIMETER CONTROLS TO USE.
2. FILTER CLOTH SHALL BE EITHER FILTER X, MIRAFI 100X, STABILINKA T140N OR APPROVED EQUIVALENT.
3. FOR FILTER CLOTH FENCE WHEN ELONGATION IS >50%, POST SPACING SHALL NOT EXCEED 4 FT. FOR FILTER CLOTH FENCE WHEN ELONGATION IS <50%, POST SPACING SHALL NOT EXCEED 6 FT.
4. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVER–LAPPED BY 6 INCHES AND FOLDED.
5. PREFABRICATED UNITS SHALL BE GEOFAB, ENVIROFENCE OR APPROVED EQUIVALENT.
6. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN SEDIMENT REACHES HALF OF FABRIC HEIGHT AND DISPOSED OF IN AN UPLAND AREA.
7. PERIMETER CONTROLS SHALL NOT CROSS ACTIVE ACCESS ROUTES (E.G., ROADS) IR ACTIVE FLOW PATHS (E.G., LARGER STREAMS/RIVERS).
8. PERIMETER CONTROLS SHALL REMAIN IN PLACE AND BE MAINTAINED/REPLACED AS NEEDED UNTIL FINAL STABILIZATION IN THE AREA HAS BEEN ACHIEVED.

7 Silt Fence

12/12

N.T.S. Source: VHB LD_650VT

DWG. NO.	REFERENCE DWG.	REV	DSN	CK		DESCRIPTION		BID INITIALS	BID DATE	CONSTRUCTION INITIALS	CONSTRUCTION DATE
							ENVIRONMENTAL	JLS	06/28/13		
							DRAFTING DESIGNER	GIL	06/28/13		
							DRAFTING SUPERVISOR	BZD	06/28/13		
							DESIGN ENGINEER	MDF	06/28/13		
		0	MDF	SAB		ISSUED FOR CONSTRUCTION	DESIGN MANAGER	SAB	06/28/13		

VERMONT GAS
PROPOSED 12" PIPELINE
ADDISON NATURAL GAS PROJECT
CONSTRUCTION DETAILS

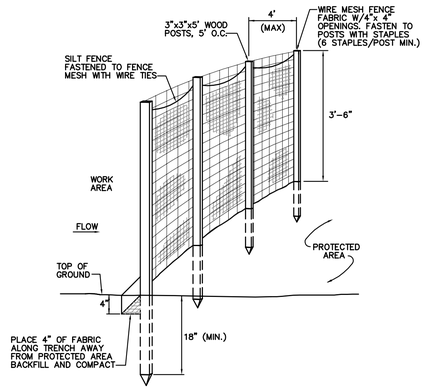
LOC. CHITTENDEN & ADDISON COUNTIES

Vermont Gas

VHB Vanasse Hangen Brustlin, Inc.

CHA
36 Cordage Park Circle , Suites 321, 326, 329, 336
Plymouth, MA 02360
Main: (781) 982-7700 - www.chacompanies.com

YEAR: 2013	W.O.	SCALE: NOTED	DWG. ANGP–T–G–012	REV. 0

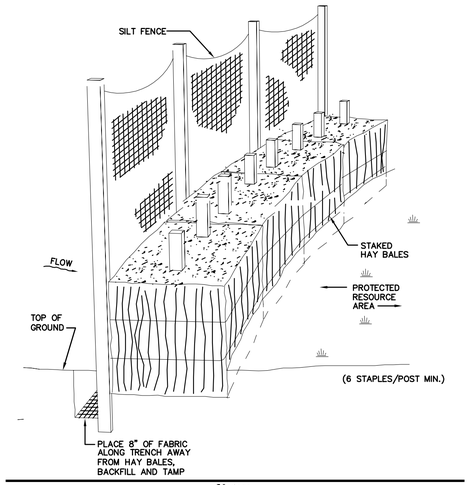


Notes:

1. SEE DETAIL #2 ON SHEET ANGP-T-G-012 FOR LIST OF APPROPRIATE PERIMETER CONTROLS TO USE
2. FILTER CLOTH SHALL BE EITHER FILTER X, MIRAFI 100X, STABILINKA T140N OR APPROVED EQUIVALENT.
3. FOR FILTER CLOTH FENCE WHEN ELONGATION IS >50% POST SPACING SHALL NOT EXCEED 4 FT. FOR FILTER CLOTH FENCE WHEN ELONGATION IS <50% POST SPACING SHALL NOT EXCEED 6 FT.
4. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVER-LAPPED BY 6 INCHES AND FOLDED.
5. PREFABRICATED UNITS SHALL BE GEOFAB, ENVIROFENCE OR APPROVED EQUIVALENT.
6. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN SEDIMENT REACHES HALF OF FABRIC HEIGHT AND DISPOSED OF IN AN UPLAND AREA.
7. PERIMETER CONTROLS SHALL NOT CROSS ACTIVE ACCESS ROUTES (E.G., ROADS) OR ACTIVE FLOW PATHS (E.G., LARGER STREAMS/RIVERS).
8. PERIMETER CONTROLS SHALL REMAIN IN PLACE AND BE MAINTAINED/REPLACED AS NEEDED UNTIL FINAL STABILIZATION IN THE AREA HAS BEEN ACHIEVED.

1 Reinforced Silt Fence with Wire Mesh

12/12 — N.T.S. — Source: VHB — LD_651

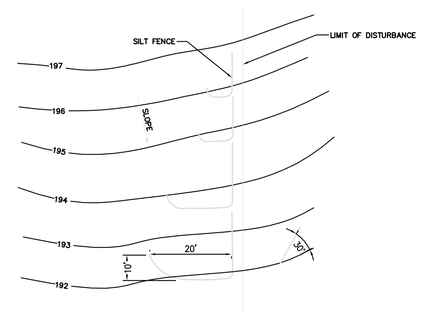


Notes:

1. SEE DETAIL # 2 ON SHEET ANGP-T-G-012 FOR LIST OF APPROPRIATE PERIMETER CONTROLS TO USE
2. SEE SILT FENCE DETAIL AND NOTES FOR INSTALLATION SPECIFICATIONS FOR SILT FENCE.
3. SEE STAKED HAY BALE DETAIL AND NOTES FOR INSTALLATION SPECIFICATIONS FOR STAKED HAY BALES.
4. STAKED HAY BALES MAY BE INTERCHANGED WITH STAKED FIBER ROLLS, EROSION CONTROL MIX BERM, WOOD CHIP BERM, OR STONE BERM. IN WATER RESOURCE AREAS USE OF BERMS IS NOT RECOMENDED.
5. PERIMETER CONTROLS SHALL NOT CROSS ACTIVE ACCESS ROUTES (E.G., ROADS) OR ACTIVE FLOW PATHS (E.G., LARGER STREAMS/RIVERS).
6. PERIMETER CONTROLS SHALL REMAIN IN PLACE AND BE MAINTAINED/REPLACED AS NEEDED UNTIL FINAL STABILIZATION IN AREA HAS BEEN ACHIEVED.

2 Reinforced Silt Fence with Staked Hay Bales

12/12 — N.T.S. — Source: VHB — LD_

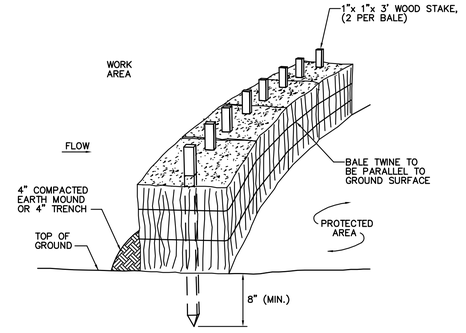


Notes:

1. SILT FENCE SHALL BE INSTALLED IN SHORTER RUNS WITH "J-HOOKS" TO AVOID CONCENTRATION OF FLOWS AT ONE LOCATION BY TRAPPING RUNOFF AT MULTIPLE POINTS ALONG A SLOPE.
2. MINIMUM WIDTH OF J-HOOK RECOMMENDED AT 20 FT WITH A DEPTH OF 10 FT. WHERE SPACE IS LIMITED (E.G., ALONG NARROW RIGHTS OF WAY), NARROWER HOOKS CAN BE USED WITH A HIGHER SPACING FREQUENCY.
3. START DOWN-GRADIENT SILT FENCE LINE AS CLOSE AS POSSIBLE TO UP-GRADIENT J-HOOK.
4. SEE SILT FENCE NOTES FOR INSTALLATION SPECIFICATIONS.

3 Silt Fence "J-Hooks"

12/12 — N.T.S. — Source: VHB — LD_

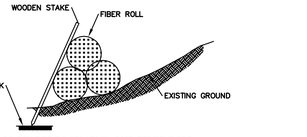


Notes:

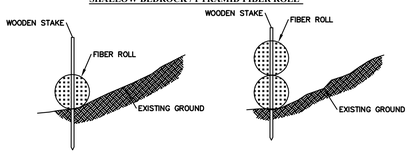
1. ENSURE BALES ARE TRENCHED INTO THE GROUND (4" MIN) OR A 4" COMPACTED EARTH MOUND IS PRESENT ON UP GRADIENT SIDE OF BARRIER.
2. ENSURE BALES ARE INSTALLED SO ROPE RUNS PARALLEL TO GROUND.
3. ENSURE STAKES ARE PROPERLY HAMMERED IN, LEAVING ~ 4" OF EXPOSURE ABOVE THE BALE.
4. REMOVE ACCUMULATED SEDIMENT WHEN IT REACHES ½ OF THE OVERALL HEIGHT. DISPOSE OF IN AN UPLAND AREA AWAY FROM WATER FLOW.
5. MAINTAIN AND REPLACE HAY BALES AS NEEDED.

4 Staked Hay Bales

12/12 — N.T.S. — Source: VHB — LD_653



SHALLOW BEDROCK / PYRAMID FIBER ROLL



SINGLE STAKED FIBER ROLL

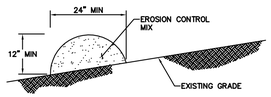
STACKED STAKED FIBER ROLL

Notes:

1. SEE DETAIL # 2 ON SHEET ANGP-T-G-012 FOR LIST OF APPROPRIATE PERIMETER CONTROLS TO USE.
2. FIBER ROLL SHALL BE PLACED IN SHALLOW TRENCH UP TO 4", WHERE FEASIBLE, PLACING SOIL REMOVED FROM TRENCH BEHIND THE ROLL.
3. FIBER ROLLS SHALL BE ANCHORED WITH 2" BY 2" WOODEN STAKES (36" LONG), OR SIMILAR, WHERE FEASIBLE, EITHER INSTALLED THROUGH CENTER OF ROLL (AS SHOWN) OR PLACED ON BOTH SIDES OF ROLL.
4. STAKES TO BE PLACED 4 FT APART, MINIMUM.
5. SINGLE OR DOUBLE STACKED STAKED FIBER ROLLS TO BE INSTALLED WHERE SOIL DEPTH ALLOWS. WHERE SHALLOW TO BEDROCK, PYRAMID FIBER ROLLS TO BE UTILIZED WITH STAKES, AS FEASIBLE.
6. FIBER ROLLS TO BE REPLACED OR REPLENISHED AS NEEDED DURING ACTIVE EARTH WORK.
7. PERIMETER CONTROLS SHALL NOT CROSS ACTIVE ACCESS ROUTES (E.G., ROADS) OR ACTIVE FLOW PATHS (E.G., STREAMS/RIVERS).
8. PERIMETER CONTROLS SHALL REMAIN IN PLACE AND BE MAINTAINED/REPLACED AS NEEDED UNTIL FINAL STABILIZATION IN AREA HAS BEEN ACHIEVED.

5 Staked Fiber Roll

12/12 — N.T.S. — Source: VHB — LD_



Notes:

COMPOSITION

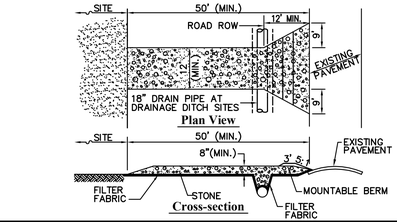
EROSION CONTROL MIX BERM SHALL CONSIST PRIMARILY OF ORGANIC MATERIAL AND MAY INCLUDE: SHREDDED BARK, STUMP GRINDINGS, COMPOSTED BARK AND/OR ACCEPTABLE MANUFACTURED PRODUCTS. WOOD AND BARK CHIPS, GROUND CONSTRUCTION DEBRIS, OR REPROCESSED WOOD PRODUCTS ARE NOT ACCEPTABLE AS THE ORGANIC COMPONENT OF THE MIX.

INSTALLATION

1. SEE DETAILS # 2 ON SHEET ANGP-T-G-012 FOR LIST OF APPROPRIATE PERIMETER CONTROLS TO USE.
2. THE BERM SHALL BE PLACED ALONG A RELATIVELY LEVEL CONTOUR.
3. EXISTING GROUND SHALL BE PREPARED AS NEEDED SUCH THAT THE BERM LIES NEARLY FLAT ALONG THE GROUND TO AVOID THE CREATION OF VOIDS AND BRIDGES IN ORDER TO MINIMIZE THE POTENTIAL OF WASH OUTS UNDER THE BERM.
4. ON SLOPES < 5% OR AT THE BOTTOM OF STEEPER SLOPES (<2:1) UP TO 20' LONG, THE BERM MUST BE A MINIMUM OF 12" HIGH, AS MEASURED ON THE UPHILL SIDE OF THE BERM, AND A MINIMUM OF 2 FT. WIDE. ON LONGER OR STEEPER SLOPES, THE BERM SHALL BE WIDER TO ACCOMMODATE ADDITIONAL FLOW.
5. BERM MAY BE INSTALLED IN PLACE OF SILT FENCE EXCEPT IN, BUT NOT LIMITED TO, THE FOLLOWING AREAS: WETLAND AREAS, AT POINTS OF CONCENTRATED FLOW, BELOW STORMWATER OUTFALLS, AROUND CATCH BASINS AND CLOSED STORM SYSTEMS AND AT THE BOTTOM OF STEEP SLOPES THAT ARE MORE THAN 50 FEET FROM TOP TO BOTTOM. BERM MAY BE USED IN WETLAND BUFFER AREAS BUT MAY NOT BE USED IN WETLANDS AREA.
6. PERIMETER CONTROLS SHALL NOT CROSS ACTIVE ACCESS ROUTES (E.G., ROADS) OR ACTIVE FLOW PATHS (E.G., LARGER STREAMS RIVERS).
7. PERIMETER CONTROLS SHALL REMAIN IN PLACE AND BE MAINTAINED/REPLACED AS NEEDED UNTIL FINAL STABILIZATION IN AREA HAS BEEN ACHIEVED.

6 Erosion Control Mix Berm

12/12 — N.T.S. — Source: VHB — LD_



Notes:

1. STONE SIZE: USE 1 TO 4 INCH DIAMETER STONE, OR RECLAIMED OR RECYCLED CONCRETE EQUIVALENT.
2. LENGTH: NOT LESS THAN 50 FEET.
3. THICKNESS: NOT LESS THAT 8 INCHES.
4. WIDTH: EXIT WIDTH SHALL BE A TWELVE (12) FOOT MINIMUM, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS.
5. GEOTEXTILE: MUST BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING STONE.
6. SURFACE WATER: ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION EXITS SHALL BE PIPED BENEATH THE EXIT. IF PIPING IS IMPRACTICAL, A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED.
7. MAINTENANCE: THE EXIT SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY. MAINTENANCE MAY REQUIRE TOP DRESSING W/ADDITIONAL AGGREGATE.
8. WHEN WHEEL/EQUIPMENT WASHING IS REQUIRED IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.
9. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED ACCORDING TO PERMIT REQUIREMENTS.
10. STABILIZED CONSTRUCTION EXIT SHALL BE REMOVED PRIOR TO FINAL FINISH MATERIALS BEING INSTALLED.

7 Stabilized Construction Exit

12/12 — N.T.S. — Source: VHB — LD_

SPACE INTENTIONALLY LEFT BLANK

DWG. NO.	REFERENCE DWG.	REV	DSN	CK		DESCRIPTION
		0	MDF	SAB		ISSUED FOR CONSTRUCTION

		BID		CONSTRUCTION	
		INITIALS	DATE	INITIALS	DATE
ENVIRONMENTAL	JLS		06/28/13		
DRAFTING DESIGNER	GIL		06/28/13		
DRAFTING SUPERVISOR	BZD		06/28/13		
DESIGN ENGINEER	MDF		06/28/13		
DESIGN MANAGER	SAB		06/28/13		

VERMONT GAS
PROPOSED 12" PIPELINE
ADDISON NATURAL GAS PROJECT
CONSTRUCTION DETAILS

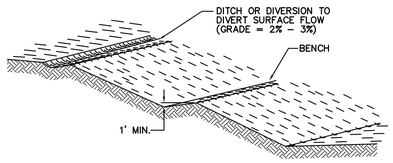
LOC. CHITTENDEN & ADDISON COUNTIES

Vermont Gas

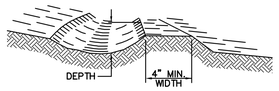
VHB Vanasse Hangen Brustlin, Inc.

CHA
36 Cordage Park Circle, Suites 321, 326, 329, 336
Plymouth, MA 02360
Main: (781) 982-7700 - www.chacompanies.com

YEAR: 2013	W.O.	SCALE: NOTED	DWG. ANGP-T-G-013	REV. 0



PLAN VIEW
N.T.S.



CROSS-SECTION
N.T.S.

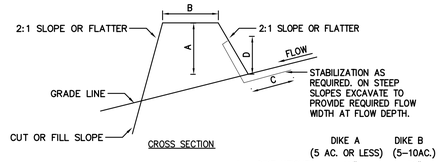
Notes:

1. ALL TREES, BRUSH, STUMPS, OBSTRUCTIONS, AND OTHER OBJECTIONABLE MATERIAL SHALL BE REMOVED AND DISPOSED OF SO AS NOT TO INTERFERE WITH THE PROPER FUNCTIONING OF THE DIVERSION.
2. THE DIVERSION SHALL BE EXCAVATED OR SHAPED TO LINE, GRADE, AND CROSS SECTION AS REQUIRED TO MEET CRITERIA SPECIFIED HEREIN, AND BE FREE OF BANK PROJECTIONS OR OTHER IRREGULARITIES WHICH WILL IMPEDE NORMAL FLOW.
3. FILLS SHALL BE COMPACTED AS NEEDED TO PREVENT UNEQUAL SETTLEMENT THAT WOULD CAUSE DAMAGE IN THE COMPLETED DIVERSION.
4. ALL GRADED AREAS SHALL BE PERMANENTLY STABILIZED FOLLOWING FINISHED GRADING.
5. SILT FENCE OR HAY BALES SHALL BE PLACED AT THE OUTLET OF EACH STRUCTURE.

1 Diversion Swale and Bench

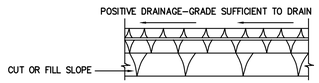
12/12

N.T.S. Source: VHB LD_



CROSS SECTION

	DIKE A (5 AC. OR LESS)	DIKE B (5-10AC.)
A – DIKE HEIGHT	18"	36"
B – DIKE WIDTH	24"	36"
C – FLOW WIDTH	48"	60"
D – FLOW DEPTH	8"	15"



CONSTRUCTION SPECIFICATIONS

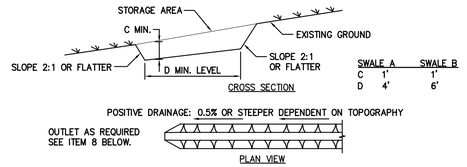
1. ALL DIKES SHALL BE COMPACTED BY EARTH-MOVING EQUIPMENT.
2. ALL DIKES SHALL HAVE POSITIVE DRAINAGE TO AN OUTLET.
3. TOP WIDTH MAY BE WIDER AND SIDE SLOPES BE FLATTER IF DESIRED TO FACILITATE CONSTRUCTION TRAFFIC.
4. FIELD LOCATION SHOULD BE ADJUSTED AS NEEDED TO UTILIZE A STABILIZED SAFE OUTLET.
5. EARTH DIKES SHALL HAVE AN OUTLET THAT FUNCTIONS WITH A MINIMUM OF EROSION. RUNOFF SHALL BE CONVEYED TO A SEDIMENT TRAPPING DEVICE SUCH AS A SEDIMENT TRAP OR SEDIMENT BASIN WHERE EITHER THE DIKE CHANNEL OR THE DRAINAGE AREA ABOVE THE DIKE ARE NOT ADEQUATELY STABILIZED.
6. STABILIZATION SHALL BE: (A) IN ACCORDANCE WITH STANDARD SPECIFICATIONS FOR MULCH IF NOT IN SEEDING SEASON, (B) PER THE FOLLOWING CHART

TYPE OF TREATMENT	CHANNEL GRADE	A(5 AC OR LESS)	B(5 AC – 10 AC)
1	0.5%-3.0%	SEED AND STRAW MULCH	SEED AND STRAW MULCH
2	3.1%-5.0%	SEED AND STRAW MULCH	SEED AND COVER USING RECP
3	5.1%-8.0%	SEED AND COVER WITH RECP	LINED WITH 4-8" RIP-RAP OR GEOTEXTILE
4	8.1%-20.0%	LINED WITH 4-8" RIP-RAP	ENGINEERED DESIGN

2 Earth Dike

12/12

N.T.S. Source: VHB / VT S+S EPSC LD_



CROSS SECTION

SWALE A	SWALE B
C 1'	1'
D 4'	6'

POSITIVE DRAINAGE: 0.5% OR STEEPER DEPENDENT ON TOPOGRAPHY

PLAN VIEW

CONSTRUCTION SPECIFICATIONS

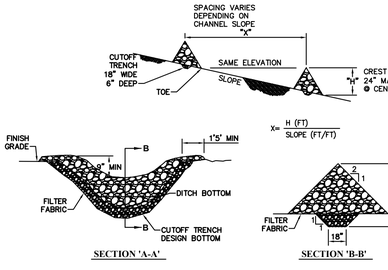
1. ALL TEMPORARY SWALES SHALL HAVE UNINTERRUPTED POSITIVE GRADE TO AN OUTLET.
2. DIVERTED RUNOFF FROM A DISTURBED AREA SHALL BE CONVEYED TO A SEDIMENT TRAPPING DEVICE.
3. DIVERTED RUNOFF FROM AN UNDISTURBED AREA SHALL OUTLET DIRECTLY INTO AN UNDISTURBED STABILIZED AREA AT NON-EROSIVE VELOCITY.
4. ALL TREES, BRUSH, STUMPS, OBSTRUCTIONS, AND OTHER OBJECTIONABLE MATERIAL SHALL BE REMOVED AND DISPOSED OF SO AS NOT TO INTERFERE WITH THE PROPER FUNCTIONING OF THE SWALE.
5. THE SWALE SHALL BE EXCAVATED OR SHAPED TO LINE, GRADE, AND CROSS SECTION AS REQUIRED TO MEET THE CRITERIA SPECIFIED HEREIN AND BE FREE OF BANK PROJECTIONS OR OTHER IRREGULARITIES WHICH WILL IMPEDE NORMAL FLOW.
6. FILLS SHALL BE COMPACTED BY EARTH MOVING EQUIPMENT.
7. ALL EARTH REMOVED AND NOT NEEDED FOR CONSTRUCTION SHALL BE PLACED SO THAT IT WILL NOT INTERFERE WITH THE FUNCTIONING OF THE SWALE.
8. STABILIZATION SHALL BE AS PER THE FLOW CHANNEL STABILIZATION CHART BELOW:

TYPE OF TREATMENT	CHANNEL GRADE	A(5 AC OR LESS)	B(5 AC – 10 AC)
1	0.5%-3.0%	SEED AND STRAW MULCH	SEED AND STRAW MULCH
2	3.1%-5.0%	SEED AND STRAW MULCH	SEED AND COVER USING RECP
3	5.1%-8.0%	SEED AND COVER WITH RECP	LINED WITH 4-8" RIP-RAP OR GEOTEXTILE
4	8.1%-20.0%	LINED WITH 4-8" RIP-RAP	ENGINEERED DESIGN

3 Temporary Swale

12/12

N.T.S. Source: VHB / VT S+S EPSC LD_



SECTION 'A-A'

SECTION 'B-B'

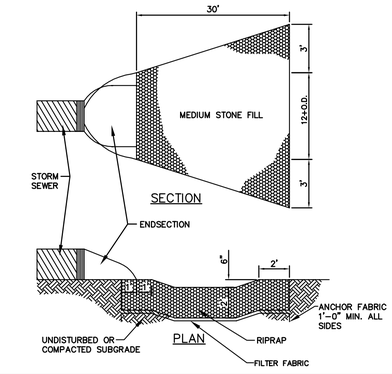
Notes:

1. STONE WILL BE PLACED ON A FILTER FABRIC FOUNDATION TO THE LINES, GRADES AND LOCATIONS SHOWN IN THE PLAN USING A WELL GRADED STONE MATRIX 2 TO 9 INCHES IN SIZE.
2. SET SPACING OF CHECK DAMS TO ASSUME THAT THE ELEVATIONS OF THE CREST OF THE DOWNSTREAM DAM IS AT THE SAME ELEVATION OF THE TOE OF THE UPSTREAM DAM.
3. EXTEND THE STONE A MINIMUM OF 1.5 FEET BEYOND THE DITCH BANKS TO PREVENT CUTTING AROUND THE DAM.
4. PROTECT THE CHANNEL DOWNSTREAM OF THE LOWEST CHECK DAM FROM SCOUR AND EROSION WITH STONE OR LINER AS APPROPRIATE.
5. ENSURE THAT CHANNEL APPURTENANCES SUCH AS CULVERT ENTRANCES BELOW CHECK DAMS ARE NOT SUBJECT TO DAMAGE OR BLOCKAGE FROM DISPLACED STONE.
6. MAXIMUM DRAINAGE AREA ABOVE CHECK DAM SHALL NOT EXCEED 2 AC.

4 Stone Check Dam

12/12

N.T.S. Source: VHB / VT S+S EPSC LD_



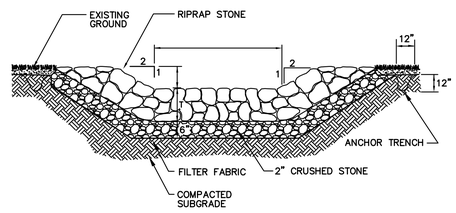
Notes:

1. OUTLET PROTECTION MAY BE DONE BY USING ROCK RIP-RAP, GROUTED RIP-RAP, OR GABIONS.
2. STONE SIZE SHALL BE A WELL GRADED MIXTURE SO THAT 50% OF THE STONE SIZE, BY WEIGHT, SHALL BE LARGER THAN THE d50 SIZE DETERMINED USING THE CHARTS.

5 Outlet Protection

12/12

N.T.S. Source: CHA LD_



Notes:

1. MIN. CAPACITY SHALL CARRY PEAK FLOW RATE DURING 10-YR, 24-HR STORM EVENT.
2. MAX SIZE OF RIPRAP STONE SHALL BE:

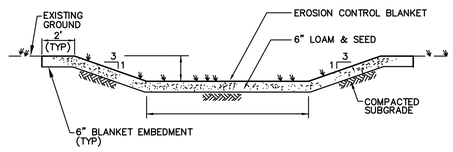
VEL. (FPS)	DMAX (IN.)
5.0	6
8.5	12
10	18
12	24
15	36

3. FOUNDATION AREA SHALL BE CLEARED OF TREES, STUMPS, ROOTS, SOD, LOOSE ROCK, OR OTHER OBJECTIONABLE MATERIAL.
4. OUTLET STABILIZATION MAY BE NEEDED TO PREVENT EROSION.

6 Stone-lined Swale

12/12

N.T.S. Source: VHB LD_358



Notes:

1. NOT TO BE USED IN AREAS WHERE FLOW VOLUME AND RATES MAY CAUSE EROSION AND SHOULD OTHERWISE BE CONVEYED VIA STONE-LINED SWALE.
2. FOUNDATION AREA SHALL BE CLEARED OF TREES, STUMPS, ROOTS, SOD, LOOSE ROCK, OR OTHER OBJECTIONABLE MATERIAL.
3. INSTALL TEMPORARY COVER (E.G., MULCH) TO PROTECT AREA WHILE SEED IS GERMINATING.
4. SEE SEEDING SPECIFICATIONS FOR SEED TYPES AND SEED APPLICATION RATES.

7 Grassed Swale

12/12

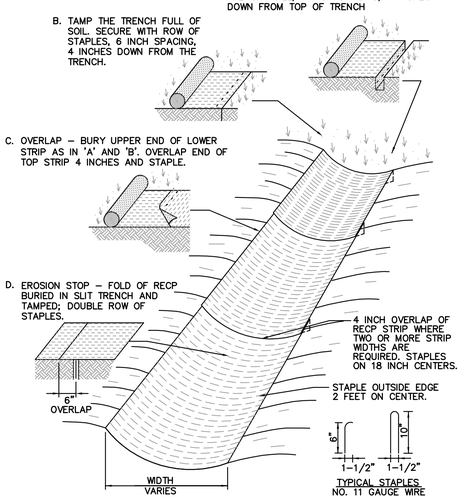
N.T.S. Source: VHB LD_171

A. BURY THE TOP END OF THE RECP STRIPS IN A TRENCH 6 INCHES OR MORE IN DEPTH. SECURE WITH ROW OF STAPLES IN VERTICAL TRENCH WALL, 6 INCH SPACING, 4 INCHES DOWN FROM TOP OF TRENCH

B. TAMP THE TRENCH FULL OF SOIL. SECURE WITH ROW OF STAPLES, 6 INCH SPACING, 4 INCHES DOWN FROM THE TRENCH.

C. OVERLAP – BURY UPPER END OF LOWER STRIP AS IN 'A' AND 'B'. OVERLAP END OF TOP STRIP 4 INCHES AND STAPLE.

D. EROSION STOP – FOLD OF RECP BURIED IN SLIT TRENCH AND TAMPED; DOUBLE ROW OF STAPLES.



1. INSTALLATION SHALL BE AS PER MANUFACTURER'S RECOMMENDATIONS
2. RECP TO BE BIODEGRADABLE; NO NYLON MESH. SEE SHEET ANGP-T-G-017 FOR RECP SPECIFICATIONS.

8 Rolled Erosion Control Blanket (RECP) - Swale Installation

12/12

N.T.S. Source: VHB LD_

							BID		CONSTRUCTION	
						ENVIRONMENTAL	JLS	06/28/13		
						DRAFTING DESIGNER	GIL	06/28/13		
						DRAFTING SUPERVISOR	BZD	06/28/13		
						DESIGN ENGINEER	MDF	06/28/13		
		0	MDF	SAB	ISSUED FOR CONSTRUCTION	DESIGN MANAGER	SAB	06/28/13		
DWG. NO.	REFERENCE DWG.	REV	DSN	CK	DESCRIPTION		INITIALS	DATE	INITIALS	DATE

VERMONT GAS
PROPOSED 12" PIPELINE
ADDISON NATURAL GAS PROJECT
CONSTRUCTION DETAILS

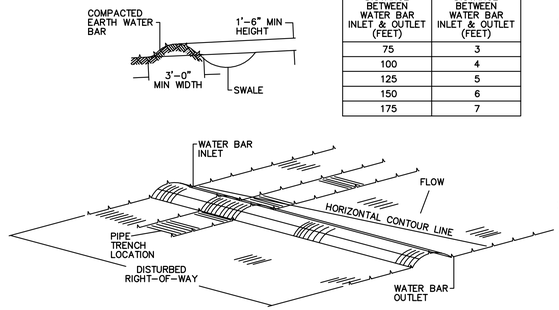
LOC. CHITTENDEN & ADDISON COUNTIES

YEAR: 2013 | W.O. | SCALE: NOTED | DWG. ANGP-T-G-014 | REV. 0

Vermont Gas

VHB Vanasse Hangen Brustlin, Inc.

CHA
36 Cordage Park Circle, Suites 321, 326, 329, 336
Plymouth, MA 02360
Main: (781) 982-7700 - www.chacompanies.com



4% SLOPE CHART	
HORIZONTAL DISTANCE BETWEEN WATER BAR INLET & OUTLET (FEET)	ELEVATION DISTANCE BETWEEN WATER BAR INLET & OUTLET (FEET)
75	3
100	4
125	5
150	6
175	7

NOTES:

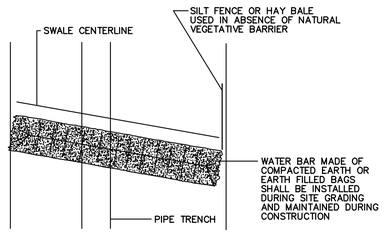
1. SPACE WATERBARS AS INDICATED IN TABLE OR AS DIRECTED BY OSPC.

Notes:

1. SPACE WATERBARS AS INDICATED IN TABLE OR AS DIRECTED BY OSPC.
2. COMPACT THE BAR.
3. THE OUTLET SHALL BE LOCATED ON AN UNDISTURBED AREA. OUTLET PROTECTION WILL BE PROVIDED WHEN NATURAL AREAS ARE NOT ADEQUATE.
4. EXPOSED AREAS SHALL BE IMMEDIATELY SEEDED AND STABILIZED.

NOTES:

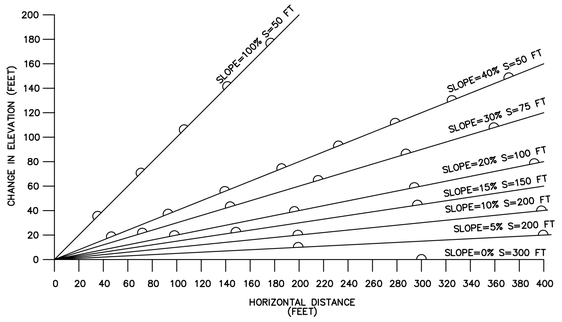
1. WATERBARS ARE TO BE SPACED ALONG THE RIGHT-OF-WAY IN ACCORDANCE WITH WATERBAR SPACING CHART OR AS SHOWN ON THE PLANS.
2. WATER SHALL BE DIVERTED OFF THE DISTURBED RIGHT-OF-WAY AT AN OUTSLOPE OF THREE TO FIVE PERCENT BY CONSTRUCTING WATERBARS ACCORDING TO THE FOLLOWING PROCEDURE:
   - 2.A. AT THE PROPOSED WATERBAR INTERCEPTOR LOCATION ESTABLISH A HORIZONTAL CONTOUR LINE (USING A POCKET TRANSIT OR HAND HELD LEVEL) WHICH EXTENDS COMPLETELY ACROSS THE DISTURBED RIGHT-OF-WAY. THIS LINE WILL ALWAYS BE PERPENDICULAR TO THE DIRECTION OF WATER FLOW AND SHOULD BE PARALLEL TO MAP CONTOURS SHOWN ON THE PLAN DRAWINGS.
   - 2.B. DETERMINE WHICH SIDE OF THE RIGHT-OF-WAY IS BEST SUITED FOR THE WATERBAR OUTLET (EVALUATE VEGETATION DENSITY, LOCAL TOPOGRAPHY, ETC.) AND DEVIATE WATERBARS AWAY FROM THE HORIZONTAL CONTOUR LINE SLIGHTLY DOWNWARD TOWARD THE SELECTED OUTLET SIDE MAINTAINING A THREE TO FIVE PERCENT OUT SLOPE.
   - 2.C. WHEN OUTLETING NEAR WATER BODIES, STREAMS, DITCHES AND CROP FIELDS, A SILT FENCE OR HAY BALES SHALL BE PLACED ON THE OUTLET END OF THE INTERCEPT WATERBAR.
3. SPACING SHOWN ARE RECOMMENDED GUIDELINES. OSPC REPRESENTATIVE MAY ADJUST SPACING IN THE FIELD.
4. ONE TRENCH BREAKER IS REQUIRED AT ALL STREAM BANKS AND AT WETLAND BOUNDARIES.



OVERHEAD VIEW OF WATERBAR AND SILTFENCE

1 Waterbar and Waterbar with Silt Fence

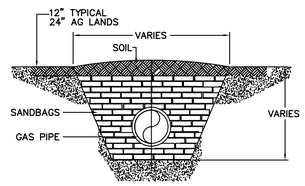
N.T.S. Source: CHA 12/12 LD_



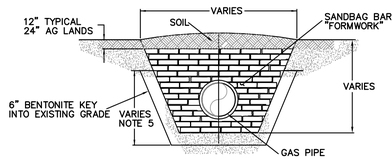
NOTE: S = WATERBAR SPACING

2 Waterbar Spacing Guideline

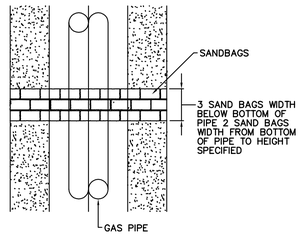
N.T.S. Source: CHA 12/12 LD_



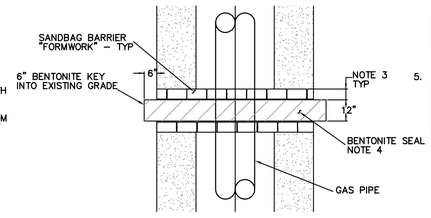
PROFILE VIEW



PROFILE VIEW



PLAN VIEW
SAND BAG TRENCH BREAKER



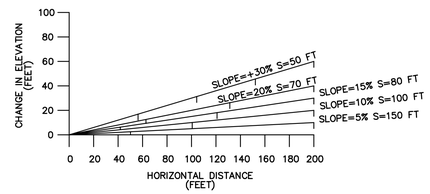
PLAN VIEW
TRENCH BREAKER WITH BENTONITE

NOTES:

1. PERMANENT TRENCH BREAKER WITH BENTONITE SEAL IS INTENDED TO PROHIBIT WATER FLOW THROUGH THE BREAKER.
2. PERMANENT TRENCH BREAKER WITH BENTONITE SEAL TO BE INSTALLED AT EDGE OF WETLANDS AND STREAMS.
3. SAND BAG BARRIER WIDTH SHALL BE MINIMUM 1 BAG WIDE AND/OR AS FIELD DETERMINED TO PROVIDE STABILITY.
4. BENTONITE IS TO BE INSTALLED IN THE VOID SPACE BETWEEN THE SANDBAG BARRIER "FORMWORK" IN SUCH A MANNER TO COMPLETELY SURROUND THE PIPE AND FILL THE VOID FROM THE BOTTOM OF THE TRENCH TO A HEIGHT 6" ABOVE THE LEVEL OF IMPORTED PADDING MATERIAL WHICH IS INSTALLED ON THE EXTERIOR SIDE OF THE SANDBAG BARRIER IN THE WETLAND ZONE.
5. AFTER BENTONITE PLACEMENT, INSTALL SAND BAGS ON TOP OF THE PERMANENT TRENCH BREAKER AND BENTONITE SEAL TO THE REQUIRED HEIGHT PER DETAIL 2 AND BACKFILL EXTERIOR SIDES OF SAND BAG BARRIERS.

3 Permanent Trench Break or Sandbags

N.T.S. Source: CHA 12/12 LD_



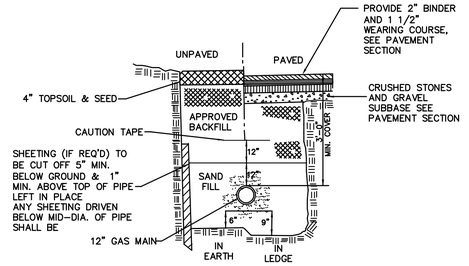
NOTE: S = TRENCH BREAKER SPACING

NOTES:

1. PERMANENT TRENCH BREAKER SANDBAGS SHALL NOT BE FILLED WITH TOPSOIL.
2. SPACINGS SHOWN ARE RECOMMENDED GUIDELINES. OSPC REPRESENTATIVE MAY ADJUST SPACING IN THE FIELD.
3. ONE TRENCH BREAKER IS REQUIRED AT ALL STREAM BANKS AND AT WETLAND BOUNDARIES.

4 Permanent Trench Break Spacing Guideline

N.T.S. Source: CHA 12/12 LD_



NOTES:

1. BACKFILL MATERIAL TO CONSIST OF GRANULAR MATERIAL CONTAINING NO STONES OR CLODS LARGER THAN 3" IN GREATEST DIMENSION. IN RESOURCE AREAS BACKFILL TO CONSIST OF NATIVE SUBSOIL AND TOPSOIL.
2. BACKFILL WITH CLEAN SAND TO 12" OVER PIPE.
3. REMOVE UNSUITABLE MATERIAL BELOW GRADE IF ENCOUNTERED, TO SUITABLE DEPTHS AS DIRECTED BY ENGINEER AND REPLACE WITH CLEAN GRANULAR FILL.
4. IN RESOURCE AREAS (E.G., WETLANDS AND PAS AREAS) SUBSOIL TO BE BACKFILLED TO MATCH DEPTH OF ADJACENT NATIVE, UNDISTURBED SUBSOIL/TOPSOIL INTERFACE FOLLOWED BY BACKFILL OF NATIVE TOPSOIL. EXCESS SUBSOIL TO BE PROPERLY DISPOSED OF AND STABILIZED.
5. ALL TRENCH CONSTRUCTION TO CONFORM TO APPLICABLE FEDERAL, STATE AND LOCAL REGULATIONS.
6. ALL BACKFILL MATERIAL, WITH THE EXCEPTION OF RESOURCE AREAS (SEE NOTE #4), SHALL BE COMPACTED AT NEAR OPTIMUM MOISTURE CONTENT IN LAYERS NOT EXCEEDING 6 INCHES IN COMPACTED THICKNESS BY PNEUMATIC TAMPERS, VIBRATOR COMPACTORS, OR OTHER APPROVED MEANS.
7. THE CONTRACTOR SHALL PROVIDE TESTING TO INSURE THAT THE INPLACE DENSITY OF THE BACKFILL MEETS THE ABOVE REQUIREMENTS.

5 Typical Trench Detail

N.T.S. Source: CHA 2/13 LD_

DWG. NO.	REFERENCE DWG.	REV	DSN	CK		DESCRIPTION
		0	MDF	SAB		ISSUED FOR CONSTRUCTION

	BID		CONSTRUCTION	
	INITIALS	DATE	INITIALS	DATE
ENVIRONMENTAL	JLS	06/28/13		
DRAFTING DESIGNER	GIL	06/28/13		
DRAFTING SUPERVISOR	BZD	06/28/13		
DESIGN ENGINEER	MDF	06/28/13		
DESIGN MANAGER	SAB	06/28/13		

VERMONT GAS
PROPOSED 12" PIPELINE
ADDISON NATURAL GAS PROJECT
CONSTRUCTION DETAILS

LOC. CHITTENDEN & ADDISON COUNTIES

YEAR: 2013 | W.O. | SCALE: NOTED | DWG. ANGP-T-G-015 | REV. 0

Vermont Gas

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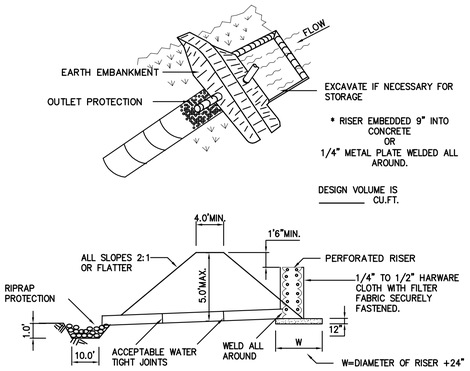


EMBANKMENT SECTION THRU RISER

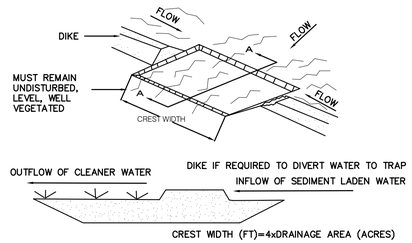
CONSTRUCTION SPECIFICATIONS

1. AREA UNDER EMBANKMENT SHALL BE CLEARED, GRUBBED AND STRIPPED OF ANY VEGETATION AND ROOT MAT. THE POOL AREA SHALL BE CLEARED.
2. THE FILL MATERIAL FOR THE EMBANKMENT SHALL BE FREE OF ROOTS OR OTHER WOODY VEGETATION AS WELL AS OVER-SIZED STONES, ROCKS, ORGANIC MATERIAL, OR OTHER OBJECTIONABLE MATERIAL. THE EMBANKMENT SHALL BE COMPACTED BY TRAVERSING WITH EQUIPMENT WHILE IT IS BEING CONSTRUCTED.
3. VOLUME OF SEDIMENT STORAGE SHALL BE 3600 CUBIC FEET PER ACRE OF CONTRIBUTORY DRAINAGE.
4. SEDIMENT SHALL BE REMOVED AND TRAP RESTORED TO ITS ORIGINAL DIMENSIONS WHEN THE SEDIMENT HAS ACCUMULATED TO 1/2 THE DESIGN DEPTH OF THE TRAP. REMOVED SEDIMENT SHALL BE DEPOSITED IN A SUITABLE AREA AND STABILIZED.
5. THE STRUCTURE SHALL BE INSPECTED AFTER EACH RAIN AND REPAIRS MADE AS NEEDED.
6. CONSTRUCTION OPERATIONS SHALL BE CARRIED OUT IN SUCH A MANNER THAT EROSION AND SEDIMENT ARE CONTROLLED.
7. THE STRUCTURE SHALL BE REMOVED AND AREA STABILIZED WHEN THE DRAINAGE AREA HAS BEEN PROPERLY STABILIZED.
8. ALL FILL SLOPES SHALL BE 2:1 OR FLATTER; CUT SLOPES 1:1 OR FLATTER.
9. ALL PIPE CONNECTIONS SHALL BE WATERTIGHT.
10. THE TOP 2/3 OF THE RISER SHALL BE PERFORATED WITH ONE (1) INCH DIAMETER HOLES OR SLITS SPACED SIX (6) INCHES VERTICALLY AND HORIZONTALLY AND PLACED IN THE CONCAVE PORTION OF PIPE. NO HOLES WILL BE ALLOWED WITHIN SIX (6) INCHES OF THE HORIZONTAL BARREL.
11. THE RISER SHALL BE WRAPPED WITH 1/4 TO 1/2 INCH HARDWARE CLOTH WIRE THEN WRAPPED WITH FILTER CLOTH (HAVING AN EQUIVALENT SIEVE SIZE OF 40-80). THE FILTER CLOTH SHALL EXTEND SIX (6) INCHES ABOVE THE HIGHEST HOLE AND SIX (6) INCHES BELOW THE LOWEST HOLE. WHERE ENDS OF THE FILTER CLOTH COME TOGETHER, THEY SHALL BE OVER-LAPPED, FOLDED AND STAPLED TO PREVENT BYPASS.
12. STRAPS OR CONNECTING BANDS SHALL BE USED TO HOLD THE FILTER CLOTH AND WIRE FABRIC IN PLACE. THEY SHALL BE PLACED AT THE TOP AND BOTTOM OF THE CLOTH.
13. FILL MATERIAL AROUND THE PIPE SPILLWAY SHALL BE HAND COMPACTED IN FOUR (4) INCH LAYERS. A MINIMUM OF TWO (2) FEET OF HAND COMPACTED BACKFILL SHALL BE PLACED OVER THE PIPE SPILLWAY BEFORE CROSSING IT WITH CONSTRUCTION EQUIPMENT.
14. THE RISER SHALL BE ANCHORED WITH EITHER A CONCRETE BASE OR STEEL PLATE BASE TO PREVENT FLOTATION. FOR CONCRETE BASED THE DEPTH SHALL BE TWELVE (12) INCHES WITH THE RISER EMBEDDED NINE (9) INCHES. A 1/4 INCH MINIMUM THICKNESS STEEL PLATE SHALL BE ATTACHED TO THE RISER BY A CONTINUOUS WELD AROUND THE BOTTOM TO FORM A WATERTIGHT CONNECTION AND THEN PLACE TWO (2) FEET OF STONE, GRAVEL, OR TAMPED EARTH ON THE PLATE.

1 Pipe Outlet Sediment Trap

12/12

N.T.S. Source: VHB / VT S+S EPSC LD_



SECTION A – A
EXCAVATED GRASS OUTLET SEDIMENT TRAP

CONSTRUCTION SPECIFICATIONS

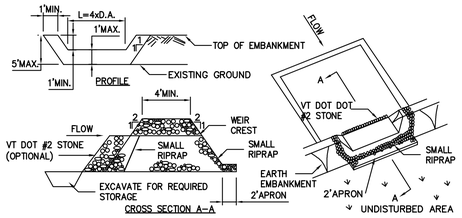
1. VOLUME OF SEDIMENT STORAGE SHALL BE 1800 CUBIC FEET PER ACRE OF CONTRIBUTORY DRAINAGE AREA.
2. MINIMUM CREST WIDTH SHALL BE 4 x DRAINAGE AREA
3. SEDIMENT SHALL BE REMOVED AND TRAP RESTORED TO ITS ORIGINAL DIMENSIONS WHEN THE SEDIMENT HAS ACCUMULATED TO 1/2 THE DESIGN DEPTH OF THE TRAP. REMOVED SEDIMENT SHALL BE DEPOSITED IN A SUITABLE AREA AND IN SUCH A MANNER THAT IT WILL NOT ERODE.
4. THE STRUCTURE SHALL BE INSPECTED AFTER EACH RAIN AND REPAIRS MADE AS NEEDED.
5. CONSTRUCTION OPERATIONS SHALL BE CARRIED OUT IN SUCH A MANNER THAT EROSION AND WATER POLLUTION SHALL BE MINIMIZED.
6. THE SEDIMENT TRAP SHALL BE REMOVED AND AREA STABILIZED WHEN THE REMAINING DRAINAGE AREA HAS BEEN PROPERLY STABILIZED.
7. ALL CUT SLOPES SHALL BE 1:1 OR FLATTER.

MAXIMUM DRAINAGE AREA: 5 ACRES

2 Grass Outlet Sediment Trap

12/12

N.T.S. Source: VHB / VT S+S EPSC LD_



CONSTRUCTION SPECIFICATIONS

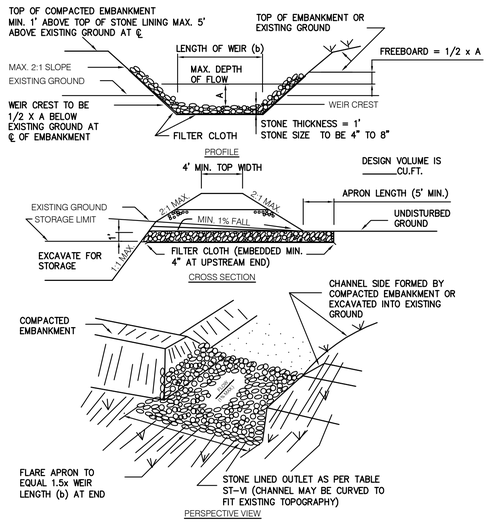
1. AREA UNDER EMBANKMENT SHALL BE CLEARED, GRUBBED AND STRIPPED OF ANY VEGETATION AND ROOT MAT. THE POOL AREA SHALL BE CLEARED.
2. THE FILL MATERIAL FOR THE EMBANKMENT SHALL BE FREE OF ROOTS AND OTHER WOODY VEGETATION AS WELL AS OVER-SIZED STONES, ROCKS, ORGANIC MATERIAL OR OTHER OBJECTIONABLE MATERIAL. THE EMBANKMENT SHALL BE COMPACTED BY TRAVERSING WITH EQUIPMENT WHILE IT IS BEING CONSTRUCTED.
3. ALL CUT AND FILL SLOPES SHALL BE 2:1 OR FLATTER.
4. THE STONE USED IN THE OUTLET SHALL BE SMALL RIPRAP 4"-8" ALONG WITH A 1' THICKNESS OF 2" AGGREGATE PLACED ON THE UP-GRADE SIDE ON THE SMALL RIPRAP OR EMBEDDED FILTER CLOTH IN THE RIPRAP.
5. SEDIMENT SHALL BE REMOVED AND TRAP RESTORED TO ITS ORIGINAL DIMEN- SIONS WHEN THE SEDIMENT HAS ACCUMULATED TO 1/2 THE DESIGN DEPTH OF THE TRAP.
6. THE STRUCTURE SHALL BE INSPECTED AFTER EACH RAIN AND AS REQUIRED BY THE PERMIT.
7. CONSTRUCTION OPERATIONS SHALL BE CARRIED OUT IN SUCH A MANNER THAT EROSION AND WATER POLLUTION IS MINIMIZED.
8. THE STRUCTURE SHALL BE REMOVED AND THE AREA STABILIZED WHEN THE DRAINAGE AREA HAS BEEN PROPERLY STABILIZED.

MAXIMUM DRAINAGE AREA 5 ACRES

3 Stone Outlet Sediment Trap

12/12

N.T.S. Source: VHB / VT S+S EPSC LD_



MAXIMUM DRAINAGE AREA = 15 ACRES

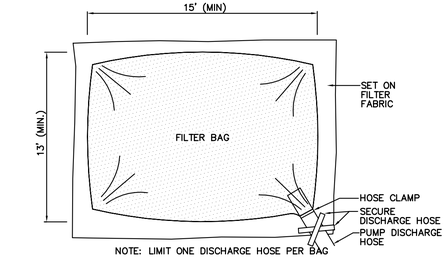
CONSTRUCTION SPECIFICATIONS

1. THE AREA UNDER EMBANKMENT SHALL BE CLEARED, GRUBBED AND STRIPPED OF ANY VEGETATION AND ROOT MAT. THE POOL AREA SHALL BE CLEARED.
2. THE FILL MATERIAL FOR THE EMBANKMENT SHALL BE FREE OF ROOTS OR OTHER WOODY VEGETATION AS WELL AS OVER-SIZED STONES, ROCKS, ORGANIC MATERIAL OR OTHER OBJECTIONABLE MATERIAL. THE EMBANKMENT SHALL BE COMPACTED BY TRAVERSING WITH EQUIPMENT WHILE IT IS BEING CONSTRUCTED. MAXIMUM HEIGHT OF EMBANKMENT SHALL BE FIVE (5) FEET, MEASURED AT CENTERLINE OF EMBANKMENT.
3. ALL FILL SLOPES SHALL BE 2:1 OR FLATTER, CUT SLOPES 1:1 OR FLATTER.
4. ELEVATION OF THE TOP OF ANY DIKE DIRECTING WATER INTO TRAP MUST EQUAL OR EXCEED THE HEIGHT OF EMBANKMENT.
5. STORAGE AREA PROVIDED SHALL BE FIGURED BY COMPUTING THE VOLUME AVAILABLE BEHIND THE OUTLET CHANNEL UP TO AN ELEVATION OF ONE (1) FOOT BELOW THE LEVEL WEIR CREST.
6. FILTER CLOTH SHALL BE PLACED OVER THE BOTTOM AND SIDES OF THE OUTLET CHANNEL PRIOR TO PLACEMENT OF STONE. SECTIONS OF FABRIC MUST OVERLAP AT LEAST ONE (1) FOOT WITH SECTION NEAREST THE ENTRANCE PLACED ON TOP. FABRIC SHALL BE EMBEDDED AT LEAST SIX (6) INCHES INTO EXISTING GROUND AT ENTRANCE OUTLET CHANNEL.
7. STONE USED IN THE OUTLET CHANNEL SHALL BE FOUR (4) TO EIGHT (8) INCH RIPRAP. TO PROVIDE A FILTERING EFFECT, A LAYER OF FILTER CLOTH SHALL BE EMBEDDED ONE (1) FOOT WITH SECTION NEAREST ENTRANCE PLACED ON TOP. FABRIC SHALL BE EMBEDDED AT LEAST SIX (6) INCHES INTO EXISTING GROUND AT ENTRANCE OF OUTLET CHANNEL.
8. SEDIMENT SHALL BE REMOVED AND TRAP RESTORED TO ITS ORIGINAL DIMENSIONS WHEN SEDIMENT HAS ACCUMULATED TO 1/2 THE DESIGN DEPTH OF THE TRAP. REMOVED SEDIMENT SHALL BE DEPOSITED IN A SUITABLE AREA AND IN SUCH A MANNER THAT IT WILL NOT ERODE.
9. THE STRUCTURE SHALL BE INSPECTED AFTER EACH RAIN AND REPAIRED AS NEEDED.
10. CONSTRUCTION OPERATIONS SHALL BE CARRIED OUT IN SUCH A MANNER THAT EROSION AND SEDIMENT ARE CONTROLLED.
11. THE STRUCTURE SHALL BE REMOVED AND THE AREA STABILIZED WHEN DRAINAGE AREA HAS BEEN PROPERLY STABILIZED.
12. DRAINAGE AREA FOR THIS PRACTICE IS LIMITED TO 15 ACRES OR LESS.

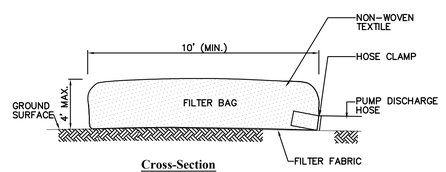
4 Riprap Outlet Sediment Trap

12/12

N.T.S. Source: VHB / VT S+S EPSC LD_



Plan View



Cross-Section

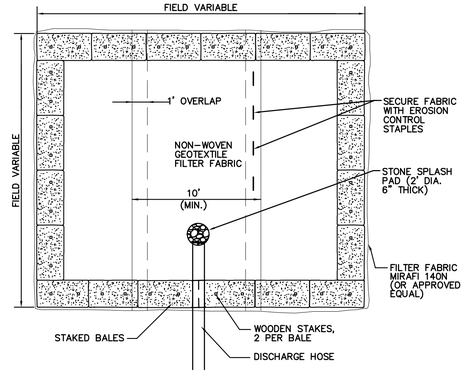
Notes:

1. BAG TO BE USED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.
2. MUST BE PLACED MIN. OF 50' FROM WETLAND OR STREAM ON STONE PAD. INSTALL DOWNGRADIENT OF BMPS INCLUDING SILT FENCE OR COMPOST LOGS AS NECESSARY.
3. INSPECT AND MAINTAIN BAG AS NECESSARY. EXPOSE OF ACCUMULATED SEDIMENT IN AN UPLAND AREA > 50' FROM WETLAND OR STREAM. STABILIZE, SEED, AND MULCH IMMEDIATELY.

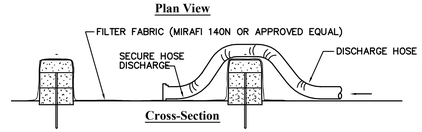
5 Dewatering Filter Bag

12/12

N.T.S. Source: VHB LD_



Plan View



Cross-Section

Notes:

1. NUMBERS OF BALES MAY VARY DEPENDING ON SITE CONDITIONS.
2. BASIN TO BE SIZED TO PREVENT DISCHARGE WATER FROM OVERTOPPING BASIN.
3. MUST BE PLACED MIN OF 50' FROM WETLAND OR STREAM, PREFERABLY IN A VEGETATED AREA.

6 Dewatering Straw Bale Basin

12/12

N.T.S. Source: VHB LD_

DWG. NO.	REFERENCE DWG.	REV	DSN	CK		DESCRIPTION
		0	MDF	SAB		ISSUED FOR CONSTRUCTION

	BID		CONSTRUCTION	
	INITIALS	DATE	INITIALS	DATE
ENVIRONMENTAL	JLS	06/28/13		
DRAFTING DESIGNER	GIL	06/28/13		
DRAFTING SUPERVISOR	BZD	06/28/13		
DESIGN ENGINEER	MDF	06/28/13		
DESIGN MANAGER	SAB	06/28/13		

VERMONT GAS
PROPOSED 12" PIPELINE
ADDISON NATURAL GAS PROJECT
CONSTRUCTION DETAILS

LOC. CHITTENDEN & ADDISON COUNTIES

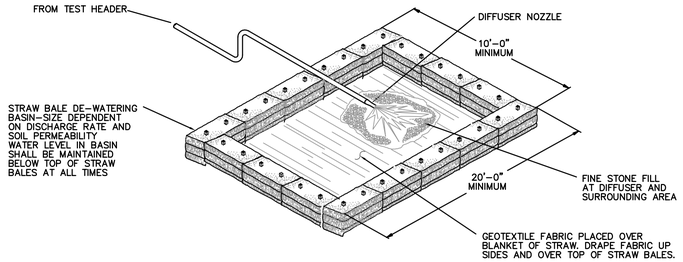
YEAR: 2013 | W.O. | SCALE: NOTED | DWG. ANGP-T-G-016 | REV. 0

Vanasse Hangen Brustlin, Inc.

Vermont Gas

CHA
36 Cordage Park Circle , Suites 321, 326, 329, 336
Plymouth, MA 02360
Main: (781) 982-7700 - www.chacompanies.com

May 20, 2019 Supplemental Attachments
00072



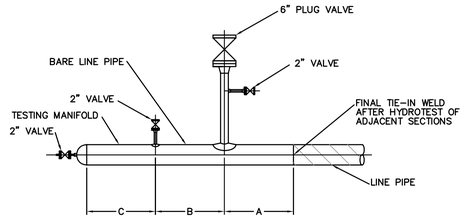
Notes:

1. MUST BE PLACED MIN. 50' FROM WETLAND OR STREAM
2. HAY BALES TO BE STAKED IN PLACE.

1 Hydrotest Discharge Detail

12/12

N.T.S. Source: CHA LD_



(ANSI CLASS 600 MINIMUM)
SEE NOTES 1-6

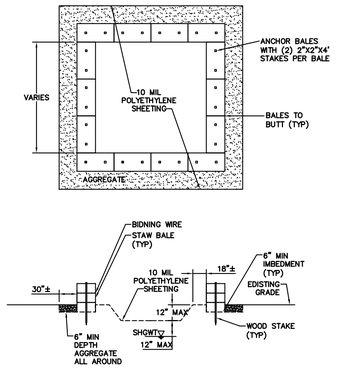
NOTES:

1. DIMENSIONS A, B & C ARE DEPENDENT ON PIPE DIAMETER & PIG LENGTH AND ARE TO BE DETERMINED BY CONTRACTOR.
2. FOR MANIFOLD TEST LOCATIONS & DISCHARGE LOCATIONS REFER TO EM&CP DRAWINGS.
3. TEST WATER SHALL BE TRANSFERRED BY PUMPING FROM ONE TEST SECTION TO THE NEXT ADJACENT TEST SECTION THROUGH THE 6" PIPE BRANCH AND MAKE-UP PIPING BETWEEN TEST SECTIONS. USE OF "HARD PIPING" & UNIONS IS RECOMMENDED.
4. FINAL TIE-IN WELD(S) BETWEEN TEST SECTIONS TO BE 100% RADIOGRAPHED.
5. TAP AND BRANCH SIZES AND VALVES FOR MANIFOLD ARE CONCEPTUAL AND SHALL BE DESIGNED BY CONTRACTOR TO BE COMPATIBLE WITH TEST EQUIPMENT AND PIPING.

2 Typical Hydrastatic Test Manifold

12/12

N.T.S. Source: CHA LD_



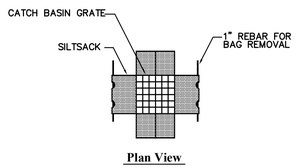
Notes:

1. CONTAINMENT MUST BE STRUCTURALLY SOUND AND LEAK FREE AND CONTAIN ALL LIQUID WASTES.
2. CONTAINMENT DEVICES MUST BE SUFFICIENT QUANTITY OR VOLUME TO COMPLETELY CONTAIN THE LIQUID WASTES GENERATED.
3. WASHOUT MUST BE CLEANED OR NEW FACILITIES CONSTRUCTED AND READY TO USE ONCE WASHOUT IS 75% FULL.
4. WASHOUT AREA(S) SHALL BE INSTALLED IN A LOCATION EASILY ACCESSIBLE BY CONCRETE TRUCKS.
5. ONE OR MORE AREAS MAY BE INSTALLED ON THE CONSTRUCTION SITE AND MAY BE RELOCATED AS CONSTRUCTION PROGRESSES.
6. AT LEAST WEEKLY REMOVE ACCUMULATION OF SAND AND AGGREGATE AND DISPOSE OF PROPERLY.
7. PLACE 50' FROM RIVER OR STREAM.

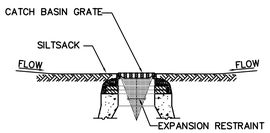
3 Concrete Washout Area

12/12

N.T.S. Source: VHB LD_



Plan View



Section View

Notes:

1. INSTALL SILTSACK IN ALL CATCH BASINS WHERE INDICATED ON THE PLAN BEFORE COMMENCING WORK OR IN PAVED AREAS AFTER BINDER COURSE IS PLACED AND HAY BALES HAVE BEEN REMOVED.
2. GRATE TO BE PLACED OVER SILTSACK.
3. SILTSACK SHALL BE INSPECTED PERIODICALLY AND AFTER ALL STORM EVENTS AND CLEANING OR REPLACEMENT SHALL BE PERFORMED PROMPTLY AS NEEDED. MAINTAIN UNTIL UPSTREAM AREAS HAVE BEEN PERMANENTLY STABILIZED
4. INLET PROTECTION MAY BE EXCAVATED, FILTER FABRIC DROP, STONE AND BLOCK, CURB DROP, OR OTHER INTERCHANGEABLE OR DEC-APPROVED MEASURE.

4 Storm Drain Inlet Protection

12/12

N.T.S. Source: VHB LD_

PRODUCT DESCRIPTION	MATERIAL COMPOSITION	LONGEVITY (MONTHS)	SLOPE APPLICATIONS*		CHANNEL APPLICATIONS*	MINIMUM TENSILE STRENGTH 1 kN/m(lbs/ft)
			MAXIMUM GRADIENT (H:V)	C FACTOR 2,5	MAXIMUM SHEAR STRESS 3,4,6 Pa (lbs/ft²)	
MULCH CONTROL NETS	MESH OR WOVEN BIODEGRADABLE NATURAL FIBER NETTING.	3	5:1	≤ 0.10	12 (0.25)	0.073 (5)
		12	5:1	≤ 0.10	12 (0.25)	0.073 (5)
		24	5:1	≤ 0.10	12 (0.25)	0.36 (25)
NETLESS ROLLED EROSION CONTROL BLANKETS	NATURAL FIBERS MECHANICALLY INTERLOCKED TOGETHER TO FORM A RECP.	3	4:1	≤ 0.10	24 (0.5)	0.073 (5)
		12	4:1	≤ 0.10	24 (0.5)	0.073 (5)
SINGLE-NET EROSION CONTROL BLANKETS	PROCESSED BIODEGRADABLE NATURAL FIBERS MECHANICALLY BOUND TOGETHER BY A SINGLE NATURAL FIBER NETTING OF PROCESSED NATURAL YARNS OR TWINES WOVEN INTO A CONTINUOUS MATRIX.	3	3:1	≤ 0.15	72 (1.5)	0.73 (50)
		12	3:1	≤ 0.15	72 (1.5)	0.73 (50)
DOUBLE-NET EROSION CONTROL BLANKETS	PROCESSED BIODEGRADABLE NATURAL FIBERS MECHANICALLY BOUND TOGETHER BETWEEN TWO NATURAL FIBER NETTING OF PROCESSED NATURAL YARNS OR TWINES WOVEN INTO A CONTINUOUS MATRIX.	3	2:1	≤ 0.20	84 (1.75)	1.09 (75)
		12	2:1	≤ 0.20	84 (1.75)	1.09 (75)
		24	1.5:1	≤ 0.25	96 (2.00)	1.45 (100)
		36	1:1	≤ 0.25	108 (2.25)	1.82 (125)

* "c" FACTOR AND SHEAR STRESS FOR MULCH CONTROL NETTINGS MUST BE OBTAINED WITH NETTING USED IN CONJUNCTION WITH PRE-APPLIED MATERIAL.
1 MINIMUM AVERAGE ROLL VALUES, MACHINE DIRECTION USING EROSION CONTROL TECHNOLOGY COUNCIL (ECTC) MOD. ASTM D 5035.
2 "C" FACTOR CALCULATED AS RATIO OF SOIL LOSS FROM RECP PROTECTED SLOPE (TESTED AT SPECIFIED OR GREATER GRADIENT, H:V) TO RATIO OF SOIL LOSS FROM UNPROTECTED (CONTROL) PLOT IN LARGE-SCALE TESTING. THESE PERFORMANCE TEST VALUES SHOULD BE SUPPORTED BY PERIODIC BENCH SCALE TESTING UNDER SIMILAR TEST CONDITIONS AND FAILURE CRITERIA USING ECTC TEST METHOD #2.
3 REQUIRED MINIMUM SHEAR STRESS RECP (UNVEGETATED) CAN SUSTAIN WITHOUT PHYSICAL DAMAGE OR EXCESS EROSION (> 12.7mm (0.5 IN) SOIL LOSS) SURING A 30-MINUTE FLOW EVENT IN LARGE-SCALE TESTING. THESE PERFORMANCE TEST VALUES SHOULD BE SUPPORTED BY PERIODIC BENCH SCALE TESTING UNDER SIMILAR TEST CONDITIONS AND FAILURE CRITERIA USING ECTC TEST METHOD #3.
4 THE PERMISSIBLE SHEAR STRESS LEVELS ESTABLISHED FOR EACH PERFORMANCE CATEGORY ARE BASED ON HISTORICAL EXPERIENCE WITH PRODUCTS CHARACTERIZED BY MANNINGS ROUGHNESS COEFFICIENTS IN THE RANGE OF 0.01 – 0.05.
5 ACCEPTABLE LARGE SCALE TEST METHODS MAY INCULDE ASTM D 6459, ECTC TEST METHOD #2 OR OTHERINDEPENDENT TESTING DEEMED ACCEPTABLE BY THE DEC.
6 RECOMMENDED ACCEPTABLE LARGE-SCALE TESTING PROTOCOL MAY INCLUDE ASTM D 6440, ECTC TEST METHOD #3 OR OTHER INDEPENDENT TESTING DEEMED ACCEPTABLE BY THE DEC.

5 Specifications for Temporary RECP

N.T.S. Source: VT S+S EPSC

TYPE	PRODUCT DESCRIPTION	MATERIAL COMPOSITION	SLOPE APPLICATIONS	CHANNEL APPLICATIONS	MINIMUM TENSILE STRENGTH2,3 kN/m (lbs/ft)
			MAXIMUM GRADIENT	MAXIMUM SHEAR STRESS4,6 Pa(lbs/ft²)	
A	TURF REINFORCED MAT	NON-DEGRADABLE SYNTHETIC FIBERS, FILAMENTS, NETS, WIRE MESH AND/OR OTHER ELEMENTS, PROCESSED INTO A PERMANENT THREE-DIMENSIONAL MATRIX OF SUFFICIENT THICKNESS. TRM'S, WHICH MAY BE SUPPLEMENTED WITH DEGRADABLE COMPONENTS ARE DESIGNED TO IMPART IMMEDIATE EROSION PROTECTION, ENHANCED VEGETATION ESTABLISHMENT AND PROVIDE LONG-TERM FUNCTIONALITY BY PERMANENTLY REINFORCING VEGETATION DURING AND AFTER MATURATION. NOTE: TRM'S ARE TYPICALLY USED IN HYDRAULIC APPLICATIONS, SUCH AS HIGH FLOW DITCHES AND CHANNELS, STEEP SLOPES, STREAM BANKS, AND SHORELINES, WHERE EROSIVE FORCES MAY EXCEED THE LIMITS OF NATURAL, UNREINFORCED VEGETATION OR IN AREAS WHERE LIMITED VEGETATION ESTABLISHMENT IS ANTICIPATED.	0.5:1	288 (6.0)	1.82 (125)
B	TURF REINFORCED MAT		0.5:1	384 (8.0)	2.19 (150)
C	TURF REINFORCED MAT		0.5:1	480 (10.0)	2.55 (175)

PERMANENT1 – ALL CATEGORIES OF TURF REINFORCEMENT MAT (TRM) MUST HAVE A MINIMUM THICKNESS OF 6.35mm (0.25 INCHES) PER ASTM D 6525 AND U.V. STABILITY OF 80% PER ASTM D 4355 (500 HOURS EXPOSURE)

1. FOR TRMS CONTAINING DEGRADABLE COMPONENTS ALL PROPERTY VALUES MUST BE OBTAINED ON THE NON-DEGRADABLE PORTION OF THE MATTING ALONE.
2. MINIMUM AVERAGE ROLL VALUES, MACHINE DIRECTION ONLY FOR TENSILE STRENGTH DETERMINATION USING ASTM D 6818 (SUPERSEDES MOD. ASTM D 5035 FOR RECP'S).
3. FIELD CONDITIONS WITH HIGH LOADING AND/OR HIGH SURVIVABILITY REQUIREMENTS MAY WARRANT THE USE OF A TRM WITH A TENSILE STRENGTH OF 44 k/N/m(3,000 lb/ft) OR GREATER.
4. REQUIRED MINIMUM SHEAR STRESS TRM (FULLY VEGETATED) CAN SUSTAIN WITHOUT PHYSICAL DAMAGE OR EXCESS EROSION (>12.7mm (0.5 IN.) SOIL LOSS) DURING A 30-MINUTE FLOW EVENT IN LARGE SCALE TESTING. THESE PERFORMANCE TEST VALUES SHOULD BE SUPPORTED BY PERIODIC BENCH SCALE TESTING UNDER SIMILAR TEST CONDIDTIONS AND FAILURE CRITERIA USING ECTC TEST METHOD #3.
5. ACCEPTABLE LARGE-SCALE TESTING PROTOCOL MAY INCLUDE ASTM D 6460 ECTC TEST METHOD #3 OR OHER INDEPENDENT TESTING DEEMED ACCEPTABLE BY THE DEC.

6 Specifications for Permanent RECP

N.T.S. Source: VT S+S EPSC

SPACE INTENTIONALLY LEFT BLANK

DWG. NO.	REFERENCE DWG.	REV	DSN	CK		DESCRIPTION
		0	MDF	SAB		ISSUED FOR CONSTRUCTION

	BID		CONSTRUCTION	
	INITIALS	DATE	INITIALS	DATE
ENVIRONMENTAL	JLS	06/28/13		
DRAFTING DESIGNER	GIL	06/28/13		
DRAFTING SUPERVISOR	BZD	06/28/13		
DESIGN ENGINEER	MDF	06/28/13		
DESIGN MANAGER	SAB	06/28/13		

VERMONT GAS
PROPOSED 12" PIPELINE
ADDISON NATURAL GAS PROJECT
CONSTRUCTION DETAILS

LOC. CHITTENDEN & ADDISON COUNTIES

YEAR: 2013 | W.O. | SCALE: NOTED | DWG. ANGP-T-G-017 | REV. 0

Vermont Gas

VHB Vanasse Hangen Brustlin, Inc.

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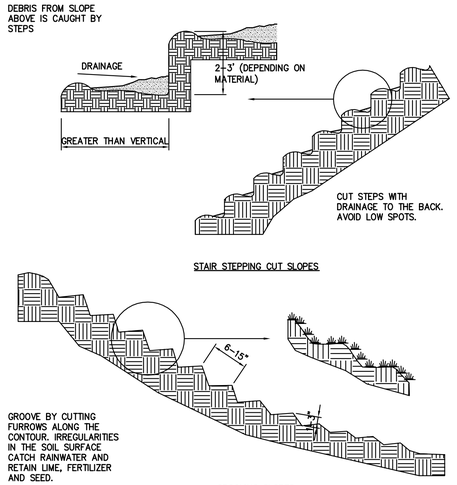


1 Surface Roughening

12/12

N.T.S. Source: VHB LD_

MULCH MATERIAL AND APPLICATION				
MULCH MATERIAL	*QUALITY STANDARDS*	*PER 1,000 SQ-FT*	*PER ACRE*	*DEPTH OF APPLICATION*
WOOD CHIPS OR SHAVINGS	*AIR DRIED, FREE OF OBJECTIONABLE MATERIAL*	*500 – 900 LBS*	*10 – 20 TONS*	*2" – 7"*
WOOD FIBER CELLULOSE (PARTIALLY DIGESTED WOOD FIBERS)	*MADE FROM NATURAL WOOD USUALLY WITH GREEN DYE AND DISPERSING AGENT*	*50 LBS*	*2,000 LBS*	*N/A*
GRAVEL, CRUSHED STONE OR SLAG	*WASHED; SIZE 2B OR 3A – 1 1/2"*	*9 CY*	*405 CY*	*3"*
HAY OR STRAW	*AIR-DRIED; FREE OF UNDESIRABLE SEEDS AND COARSE MATERIALS*	*90 – 100 LBS, 2–3 BALES*	*2 TONS (100–120 BALES)*	*COVER ABOUT 90% SURFACE*
COMPOST	*UP TO 3" PIECES, MODERATELY TO HIGHLY STABLE*	*3 – 9 CY*	*3 – 9 CY*	*1–3"*
Erosion Control Mix	*WELL-GRADED MIXTURE OF PARTICLE SIZES. ORGANIC CONTENT BETWEEN 80–100% DRY WEIGHT. PARTICLE SIZE SHALL PASS 6" SCREEN (100%)*	**Slopes 3(Hz.):1(Vert.) = 2 inch depth plus additional 1/2 inch depth per 20 ft. of slope up to 100 ft. **Slopes between 3(Hz.):1(Vert.) and 2(Hz.):1(Vert.) = 4 inch depth plus additional 1/2 inch per 20 ft. of slope up to 100 ft. ***Slopes steeper than 2(Hz.):1(Vert.) applicability to specific site and mulch depth to be reviewed and approved prior to use by OPSC or EPSC Specialist*		

Notes:

1. APPLY TACKIFIER AS NEEDED TO MINIMIZE POTENTIAL FOR MULCH TO BLOW AWAY.
2. MULCH MUST NOT CONTAIN INVASIVE PLANT SPECIES. (SEEDS OR SEEDLINGS)
3. TACKIFIER MAY BE WATER, NETTING, OR SIMILAR.
4. OTHER THAN EROSION CONTROL MIX, MULCH IS NOT TO BE INSTALLED ON SLOPES > 3:1.

2 Mulch Table

12/12

N.T.S. Source: VHB LD_

TEMPORARY SEEDING

1. AREA TO BE SEEDED MUST BE ROUGH GRADED AND SLOPES PHYSICALLY STABLE.
2. SEEDING METHOD TO RESULT IN GOOD SOIL TO SEED CONTACT.
3. AFTER SEEDING, MULCH THE AREA WITH HAY OR STRAW AT 2 TONS/AC (APPROX 90 LBS/1,000 SF OR 2 BALES/1,000 SF); SEE MULCH DETAIL AND SPECIFICATIONS.
4. MULCH ANCHORING MAY BE NEEDED WHERE WIND OR AREAS OF CONCENTRATED WATER ARE POSSIBLE.
5. WOOD FIBER HYDROMULCH OR OTHER SPRAYABLE PRODUCTS APPROVED FOR EROSION CONTROL MAY BE USED IF APPLIED ACCORDING TO MANUFACTURERS' SPECIFICATIONS.

PERMANENT SEEDING

1. SEE SEEDDING SPECIFICATIONS FOR RECOMMENDED SEED MIXES. USE RIPARIAN AND WETLAND SEEDING MIX WITHIN 50 FEET OF STREAM CROSSINGS AND IN DISTURBED WETLAND AREAS. USE UPLAND NATURAL COMMUNITY MIX WITHIN AREAS IDENTIFIED AS SIGNIFICANT NATURAL COMMUNITIES. USE PERMANENT SEEDING MIX FOR ALL OTHER DISTURBED UPLAND AREAS. SEE VERMONT STANDARDS AND SPECIFICATIONS FOR EROSION PREVENTION AND SEDIMENT CONTROL FOR ADDITIONAL SEED MIXTURES.
2. AREA TO BE SEEDED MUST BE ROUGH GRADED AND SLOPES PHYSICALLY STABLE; CHISELING OR DISKING MAY BE NEEDED IF SOIL IS COMPACTED.
3. SEEDING METHOD TO RESULT IN GOOD SOIL TO SEED CONTACT.
4. PERMANENT SEEDING TO OCCUR PRIOR TO SEPTEMBER 15TH UNLESS WEATHER PERMITS SEEDING BEYOND SEPTEMBER 15TH.
5. AFTER SEEDING, MULCH THE AREA WITH HAY OR STRAW AT 2 TONS/AC (APPROX 90 LBS/1,000 SF OR 2 BALES/1,000 SF); SEE MULCH DETAIL AND SPECIFICATIONS.
6. MULCH ANCHORING MAY BE NEEDED WHERE WIND OR AREAS OF CONCENTRATED WATER ARE POSSIBLE.
7. WOOD FIBER HYDROMULCH OR OTHER SPRAYABLE PRODUCTS APPROVED FOR EROSION CONTROL MAY BE USED IF APPLIED ACCORDING TO MANUFACTURERS' SPECIFICATIONS.
8. IRRIGATION MAY BE NEEDED TO FACILITATE GRASS GROWTH AND ESTABLISH ADEQUATE GRASS COVER.

3 Seeding Notes

12/12

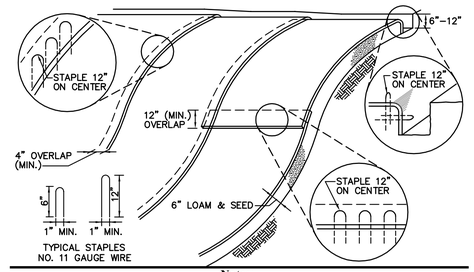
N.T.S. Source: VHB LD_

TEMPORARY SEEDING MIX		
TYPE	SEASON	RATE (LBS/ACRE)
RYEGRASS (ANNUAL OR PERENNIAL)	APRIL 15 – SEPTEMBER 15	20
"AROOSTOOK" WINTER RYE	SEPTEMBER 15 – APRIL 15	90
PERMANENT SEEDING MIX*		
TYPE	SEASON	RATE (LBS/ACRE)
BIRDSFOOT TREFOIL(1)**	APRIL 15 – SEPTEMBER 15	5
COMMON WHITE CLOVER (1)**	APRIL 15 – SEPTEMBER 15	8
TALL FESCUE (2)	APRIL 15 – SEPTEMBER 15	10
REDTOP (3)	APRIL 15 – SEPTEMBER 15	2
RYEGRASS (PERENNIAL) (3)	APRIL 15 – SEPTEMBER 15	5
*PERMANENT SEEDING MIX IS A COMBINATION OF BIRDSFOOT TREFOIL OR COMMON WHITE CLOVER PLUS TALL FESCUE PLUS REDTOP OR RYEGRASS (PERENNIAL). I.E. PERMANENT SEEDING MIX = (1) + (2) + (3). (SEE PAGE 4.27 OF THE VERMONT STANDARDS AND SPECIFICATIONS FOR EROSION PREVENTION AND SEDIMENT CONTROL.) ** ADD INOCULANT IMMEDIATELY PRIOR TO SEEDING		
RIPARIAN AND WETLAND SEEDING MIX		
TYPE	SEASON	RATE (LBS/ACRE)
"WET MEADOW AND DETENTION BASIN"* OR APPROVED EQUAL	APRIL 15 –SEPTEMBER 15	35
*SEED SPECIFIED IS FROM VERMONT WETLAND PLANT SUPPLY AND COMPOSED OF THE FOLLOWING SPECIES: PANICUM VIRGATUM, ELYMUS VIRGINICUS, FESTUCA RUBRA, CAREX VULPINOIDEA, CAREX SCOPARIA, SCIRPUS CYPERINUS, SCIRPUS ATROVIRENS, BIDENS CERNUA, EUPATORIUM PERFOLIATUM, EUPATORIADELPHUS MACULATUS, JUNCUS EFFUSUS, ONOCLEA SENSIBILIS, VERBENIA HASTATA, SYMPHYOTRICHUM NOVA-ANGLIAEA		
UPLAND NATURAL COMMUNITY MIX		
TYPE	SEASON	RATE (LBS/ACRE)
"VERMONT CONSERVATION AND WILDLIFE"* OR APPROVED EQUIVALENT	APRIL 15 –SEPTEMBER 15	25
*SEED SPECIFIED IS FROM VERMONT WETLAND PLANT SUPPLY AND COMPOSED OF THE FOLLOWING SPECIES: ELYMUS VIRGINICUS, FESTUCA RUBRA, SCHIZACHYRIUM SCOPARIUM, ANDROPOGON GERARDII, CHAMAECRISTA FASCICULATA, PANICUM CLANDESTINUM, SORGHASTRUM NUTANS, HELIOPSIS HELIANTHOIDES, ASCLEPIA SYRIACA, VERBENA HASTATA, EUPATORIUM FISTULOSUM, EUTHAMIA GRAMINIFOLIA, SOLIDAGO JUNCEA, SYMPHYOTRICHUM NOVAE-ANGLIAE		

4 Seeding Specifications

06/13

N.T.S. Source: VHB LD_



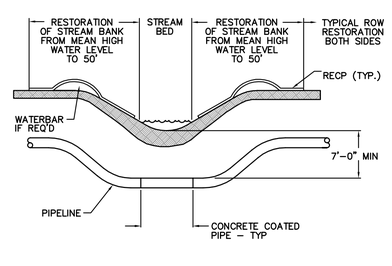
Notes:

1. APPLY TO SLOPES GREATER THAN 3H:1V OR WHERE NECESSARY TO AID IN ESTABLISHING VEGETATION.
2. APPLY TOP SOIL, FERTILIZER, LIME AND SEED PRIOR TO PLACING MATTING.
3. STAPLES ARE TO BE PLACED ALTERNATELY, IN COLUMNS APPROXIMATELY 2' APART AND IN ROWS APPROXIMATELY 3' APART. APPROXIMATELY 175 STAPLES ARE REQUIRED PER 4'x225' ROLL OF MATERIAL AND 125 STAPLES ARE REQUIRED PER 4'x150' ROLL OF MATERIAL.
4. DISTURBED AREAS SHALL BE SMOOTHLY GRADED. EROSION PREVENTION AND SEDIMENT CONTROL MATERIAL SHALL BE PLACED LOOSELY OVER GROUND SURFACE, DO NOT STRETCH AND ENSURE CLOSE CONTACT WITH THE GROUND SURFACE..
5. ALL TERMINAL ENDS AND TRANSVERSE LAPS SHALL BE STAPLED AT APPROXIMATELY 12" INTERVALS.
6. BEGIN AT THE TOP OF BLANKET INSTALLATION AREA BY ANCHORING BLANKET IN A 6" TO 12" DEEP TRENCH BACKFILL AND COMPACT TRENCH AFTER STAPLING.
7. ROLL THE BLANKET DOWN IN THE DIRECTION OF THE WATER FLOW.
8. THE EDGES OF BLANKETS MUST BE STAPLED WITH APPROX. 4" OVERLAP WHERE 2 OR MORE STRIP WIDTHS ARE REQUIRED.
9. WHEN BLANKETS MUST BE SPLICED, PLACE UPPER BLANKET END OVER LOWER END WITH 12" (MIN.) OVERLAP AND STAPLE BOTH TOGETHER.
10. METHOD OF INSTALLATION SHALL BE AS PER MANUFACTURER'S RECOMMENDATIONS. SEE SHEET ANGP-T-G-017 FPR RECP SPECIFICATIONS

5 Rolled Erosion Control Blanket (RECP) - Slope Installation

12/12

N.T.S. Source: VHB LD_680-vt



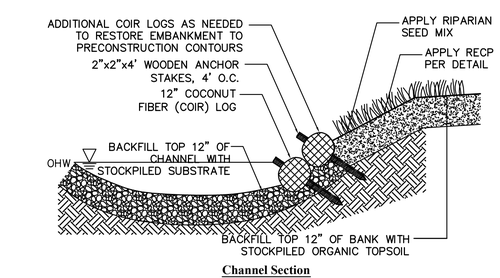
Notes:

1. SEE SHEET ANGP-T-G-017 FOR RECP SPECIFICATIONS

6 Streambank Restoration with RECP

12/12

N.T.S. Source: CHA LD_



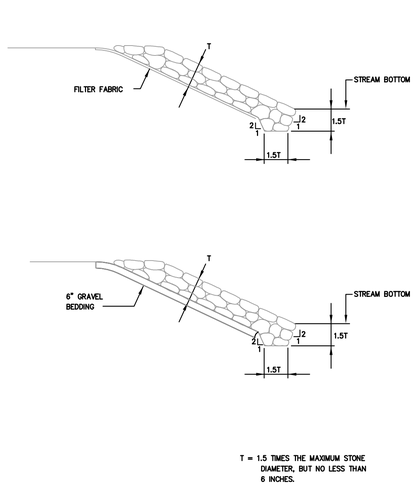
Notes:

1. APPLY COIR LOG DETAIL TO SITES WHERE STREAMBANK IS DISTURBED OR TRENCHED THROUGH DURING PIPELINE INSTALLATION AND BANK COMPOSITION PERMITS STAKES TO BE DRIVEN
2. INSTALL ROLLED EROSION CONTROL PRODUCT (RECP) PRIOR TO INSTALLATION OF COIR LOGS
3. PLACE COIR LOG IN 2" DEEP TRENCH ALONG SLOPE OF EMBANKMENT AND STAKE INTO PLACE THROUGH RCEP
4. KEY-IN COIR LOG BOTH UPSTREAM AND DOWNSTREAM FROM PIPELINE TRENCH TO MAKE COIR LOG FLUSH WITH STREAMBANK IN ORDER TO PREVENT UNRAVELING OF BANK DURING HIGH FLOW EVENTS.
5. COIR LOG MESH TO CONSIST OF BIODEGRADABLE MATERIAL.

7 Streambank Restoration with Coir Logs

6/13

N.T.S. Source: VHB



8 Streambank Stabilization with Rip Rap

12/12

N.T.S. Source: VHB LD_

DWG. NO.	REFERENCE DWG.	REV	DSN	CK		DESCRIPTION		BID INITIALS	BID DATE	CONSTRUCTION INITIALS	CONSTRUCTION DATE
		0	MDF	SAB		ISSUED FOR CONSTRUCTION	ENVIRONMENTAL	JLS	06/28/13		
							DRAFTING DESIGNER	GIL	06/28/13		
							DRAFTING SUPERVISOR	BZD	06/28/13		
							DESIGN ENGINEER	MDF	06/28/13		
							DESIGN MANAGER	SAB	06/28/13		

VERMONT GAS
PROPOSED 12" PIPELINE
ADDISON NATURAL GAS PROJECT
CONSTRUCTION DETAILS

LOC. CHITTENDEN & ADDISON COUNTIES

Vermont Gas

VHB Vanasse Hangen Brustlin, Inc.

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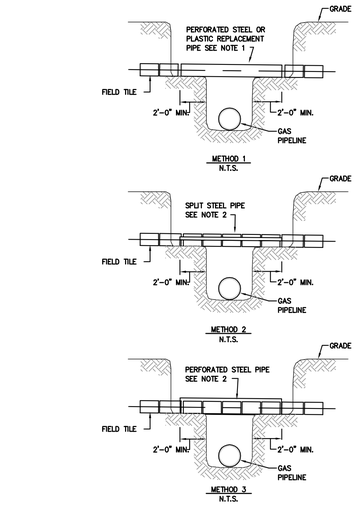
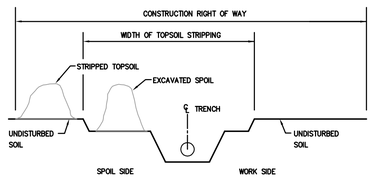
36 Cordage Park Circle , Suites 321, 326, 329, 336
Plymouth, MA 02360
Main: (781) 982-7700 - www.chacompanies.com

YEAR: 2013 | W.O. | SCALE: NOTED | DWG. ANGP-T-G-018 | REV. 0

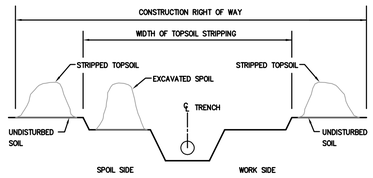


NOTES:
1. REPLACEMENT PIPE TO BE AS NEAR AS POSSIBLE TO THE DIAMETER OF THE FIELD TILE.
2. STEEL CARRIER PIPE TO HAVE INSIDE DIAMETER AS NEAR AS POSSIBLE TO THE OUTSIDE DIAMTER OF THE FIELD TILE.
3. MAINTAIN ORIGINAL FLOW LINE OF FIELD TILE IN ALL METHODS.

1 Typical Drain Tile Protection
12/12
N.T.S. Source: VHB LD_



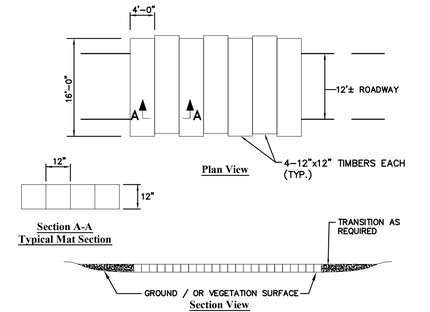
DITCH PLUS SPOILSIDE TOPSOIL SEGREGATION
N.T.S.



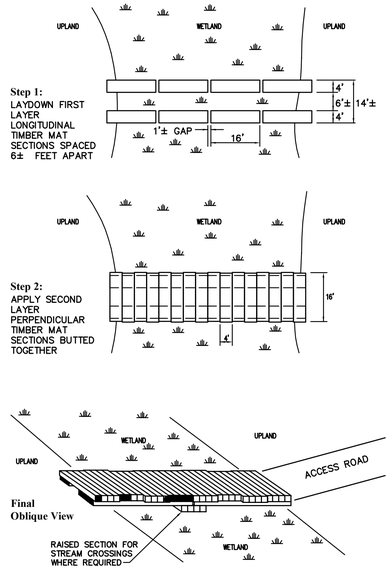
FULL RIGHT OF WAY TOPSOIL STRIPPING
N.T.S.

NOTES:
1. TOPSOIL MAY BE STORED IN LOCATIONS AS SHOWN ABOVE OR AT OTHER LOCATIONS WITHIN THE CONSTRUCTION ROW.
2. SEE SHEET ANGP-T-G-015 FOR TRENCH BACK-FILLING DETAIL AND SPECIFICATIONS

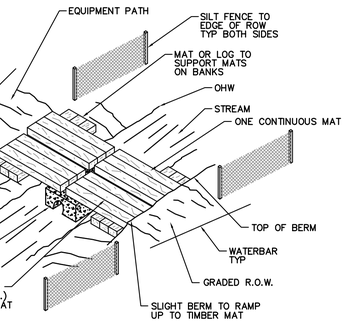
2 Topsoil Segregation
12/12
N.T.S. Source: VHB LD_



Notes:
1. TO BE INSTALLED WHERE NECESSARY IN WETLAND FOR ACCESS FOR CONSTRUCTION. ALTERNATIVE CONSTRUCTION MATTING (E.G., RUBBER MATS) MAY BE SUBSTITUTED FOR TIMBER MATTING.
2. PREPARATION FOR INSTALLATION OF TIMBER MATS WILL CONSIST OF CUTTING TALL WOODY SPECIES AND TRIMMING SHRUBS IF CONDITIONS REQUIRE. VEGETATION ROOT MASS IS TO REMAIN UNDISTURBED. MATS TO BE PLACED TO MAINTAIN NATURAL SOIL CONTOURS/CONDITIONS.
3. TIMBER SECTIONS TO BE SECURED TOGETHER WITH NO SPACES BY BOLTS, NAILS, STRAPS OR OTHER APPROPRIATE METHODS.
4. TIMBER MATS TO BE REMOVED UPON COMPLETION OF PROJECT AND AREA RESTORED TO NEAR ORIGINAL CONDITIONS PER EPSC PLANS
5. SNOW/ICE REMOVAL BY MECHANICAL METHODS: NO DEICING SALT OR CHEMICALS TO BE USED. LIGHT APPLICATION OF SAND FOR TRACTION ACCEPTABLE SO AS RESIDUE DOES NOT ACCUMULATE IN WETLAND.
6. MATS ARE TO BE IN PLACE FOR MINIMUM DURATION FEASIBLE.

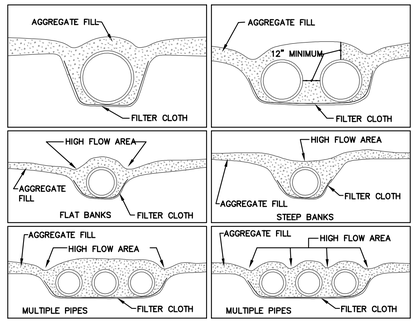


3 Construction Matting - Timber Mat Typ.
12/12
N.T.S. Source: VHB LD_

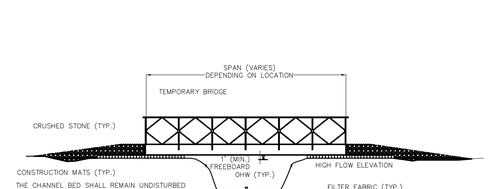


NOTES:
1. THERE IS TO BE NO UNNECESSARY MOVEMENT OF EQUIPMENT THROUGH WATER.
2. TIMBER MATS TO BE POSITIONED TO RUN FROM TOP OF BANK TO TOP OF BANK WHERE POSSIBLE. AT MINIMUM, THE TIMBER MAT BRIDGE SHALL SPAN THE ORDINARY HIGH WATER (OHW) WIDTH OF THE CHANNEL.
3. TIMBER MATS SHALL BE CLEANED OF SEDIMENT PRIOR TO EACH INSTALLATION.
4. TIMBER MATS SHOULD BE INSTALLED SO THERE ARE NO GAPS BETWEEN MATS.

4 Construction Mat Bridge
12/12
N.T.S. Source: CHA LD_

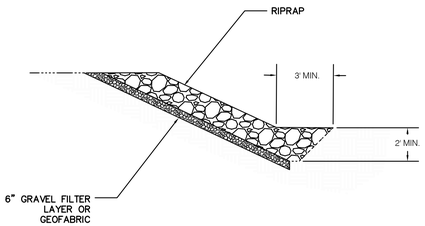


5 Temporary Access Culverts
12/12
N.T.S. Source: VHB LD_



NOTES:
1. BRIDGE SHALL BE DESIGNED TO PROVIDE A CLEAR SPAN THAT IS EQUAL TO OR GREATER THAN OHW AT THE CROSSING SITE.
2. NO MATERIALS SHALL BE PLACED IN THE CHANNEL BELOW OHW WITHOUT PRIOR AUTHORIZATION.
3. BRIDGE SHALL BE DESIGNED TO CARRY THE MAXIMUM ANTICIPATED CONSTRUCTION LOADS. HOWEVER SHALL NOT BE LESS THAN AASHTO HS-25 LOADING CRITERIA.
4. BRIDGE SHALL BE DESIGNED SUCH THAT A MINIMUM ONE FOOT (1 FT) OF FREE BOARD EXISTS BETWEEN THE LOWEST MEMBER AND THE ANTICIPATED HIGH FLOW (Q25) WATER ELEVATION.
5. ADDITIONAL LOAD BEARING DEVICES BEYOND CONSTRUCTION MATTING MAY BE REQUIRED. THE CONTRACTOR SHALL CONDUCT A GEOTECHNICAL ANALYSIS OF EACH BRIDGE SITE TO DETERMINE THE NECESSARY BEARING CAPACITY OF SOILS AND TO DETERMINE THE MINIMUM DISTANCE BETWEEN BEARING SURFACES AND THE TOP OF STREAM/CHANNEL BANK.
6. APPROACH GRADES SHALL BE AS DEEMED NECESSARY BY THE CONTRACTOR.

6 Temporary Bridge Detail
N.T.S. Source: VHB LD_



Notes:
1. MINIMUM THICKNESS SHALL BE 1.5X MAX STONE DIAMETER, BUT IN NO CASE < 6".
2. THE TOE OF RIP RAP SHALL BE KEYED IN STABLE FOUNDATION @ IT'S BASE.
3. STONE SIZE SHOULD BE BASED ON ANGLE OF REPOSE FOR SPECIFIC SIZE. (FIG 4.3 P 4.38)

6 Riprap Slope Protection
12/12
N.T.S. Source: VHB LD_

DWG. NO.	REFERENCE DWG.	REV	DSN	CK		DESCRIPTION
		0	MDF	SAB		ISSUED FOR CONSTRUCTION

	BID		CONSTRUCTION	
	INITIALS	DATE	INITIALS	DATE
ENVIRONMENTAL	JLS	06/28/13		
DRAFTING DESIGNER	GIL	06/28/13		
DRAFTING SUPERVISOR	BZD	06/28/13		
DESIGN ENGINEER	MDF	06/28/13		
DESIGN MANAGER	SAB	06/28/13		

VERMONT GAS
PROPOSED 12" PIPELINE
ADDISON NATURAL GAS PROJECT
CONSTRUCTION DETAILS
LOC. CHITTENDEN & ADDISON COUNTIES

Vermont Gas

Vanasse Hangen Brustlin, Inc.
CHA
36 Cordage Park Circle , Suites 321, 326, 329, 336
Plymouth, MA 02360
Main: (781) 982-7700 - www.chacompanies.com

YEAR: 2013 | W.O. | SCALE: NOTED | DWG. ANGP-T-G-019 | REV. 0

NOTES:

1. USE DIVERSION FLUME STREAM CROSSING ON WATER COURSES WITH LIMITED STREAM FLOW TO PREVENT SEDIMENTATION AND INTERRUPTION OF STREAM FLOW DURING CONSTRUCTION. THIS METHOD IS APPROPRIATE IN LOCATIONS WHERE FISH PASSAGE IS A CONCERN.

2. SCHEDULE CONSTRUCTION DURING LOW FLOW PERIOD, IF POSSIBLE.

3. THIS DETAIL REPRESENTS ONE POSSIBLE CONFIGURATION OF CONSTRUCTION ELEMENTS WITHIN THE TEMPORARY AND PERMANENT ROW. ALTERNATE CONFIGURATIONS OF CONSTRUCTION ELEMENTS BETWEEN THE UPSTREAM AND DOWNSTREAM DIVERSION STRUCTURES ARE ALLOWABLE SO LONG AS APPROPRIATE MEASURES ARE MAINTAINED TO PROTECT WATER QUALITY .

4. SET UP STEEL OR HDPE PIPE AS SHOWN, OR USE PRACTICAL ALTERNATIVES. PIPE (OR PIPES) MUST BE SIZED TO HAVE TWICE THE CAPACITY OF ANTICIPATED FLOW. DEPENDING ON STREAM FLOW, DIG SUMP HOLE TO CONCENTRATE WATER AT INTAKE.

5. INSTALL UPSTREAM DAM COMPOSED OF SANDBAGS, METAL PLATING OR A COMBINATION OF BOTH, INSTALL DOWNSTREAM DAM, IF REQUIRED, TO KEEP STREAM BED DRY.

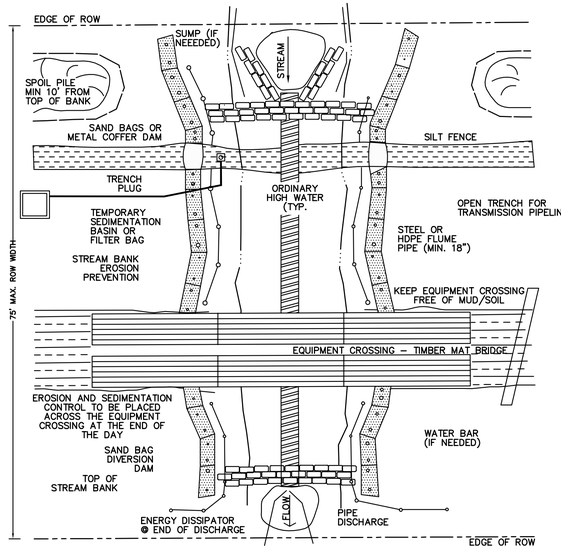
6. AFTER DAMS ARE IN PLACE, IT MAY BE NECESSARY TO USE A SUMP PUMP AND DEWATERING FILTER BAG TO KEEP WORK AREA DRY.

7. ALL MECHANIZED EQUIPMENT TO PERFORM WORK FROM ADJACENT TOP OF BANK AREAS. MAT STREAM IF WORK TO OCCUR IN STREAM CHANNEL.

8. EXCAVATE TRENCH AND LOWER IN PIPE UNDER DIVERSION FLUME. MOVE FLUME AS REQUIRED OR DISCONNECT IF TEMPORARY FLOW BLOCKAGE IS ACCEPTABLE. BACKFILL TRENCH.

9. DISMANTLE DOWNSTREAM DAM, THEN UPSTREAM DAM.

10. RESTORE DISTURBED CHANNEL, STREAM BANKS AND APPROACHES FOR A MINIMUM DISTANCE OF AT LEAST 50 FT. FROM THE STREAM EDGES AND PERMANENTLY STABILIZE WITHIN 1 DAY OF INITIAL RESTORATION. REFER TO THE STREAMBANK RESTORATION DETAIL FOR RESTORATION REQUIREMENTS.



1 Diversion Flume Stream Crossing

12/12

N.T.S.

Source: VHB

LD_

NOTES:

1. USE DAM AND PUMP METHOD ON WATER COURSES WITH LIMITED STREAM FLOW TO PREVENT SEDIMENTATION AND INTERRUPTION OF STREAM FLOW DURING CONSTRUCTION.

2. SCHEDULE CONSTRUCTION DURING LOW FLOW PERIOD, IF POSSIBLE.

3. THIS DETAIL REPRESENTS ONE POSSIBLE CONFIGURATION OF CONSTRUCTION ELEMENTS WITHIN THE TEMPORARY AND PERMANENT ROW. ALTERNATE CONFIGURATIONS OF CONSTRUCTION ELEMENTS BETWEEN THE UPSTREAM AND DOWNSTREAM DIVERSION STRUCTURES ARE ALLOWABLE SO LONG AS APPROPRIATE MEASURES ARE MAINTAINED TO PROTECT WATER QUALITY .

4. SET UP PUMP AND HOSE AS SHOWN, OR USE PRACTICAL ALTERNATIVES. PUMP SHOULD HAVE TWICE THE PUMPING CAPACITY OF ANTICIPATED FLOW. HAVE STANDBY PUMP ON SITE. DEPENDING ON STREAM FLOW, DIG SUMP HOLE TO CONCENTRATE WATER AT INTAKE.

5. USE TEMPORARY SEDIMENTATION BASIN OR FILTER BAG PRIOR TO DISCHARGING WATER BACK TO STREAM.

6. INSTALL UPSTREAM DAM COMPOSED OF SANDBAGS, METAL PLATING OR A COMBINATION OF BOTH, INSTALL DOWNSTREAM DAM, IF REQUIRED, TO KEEP STREAM BED DRY.

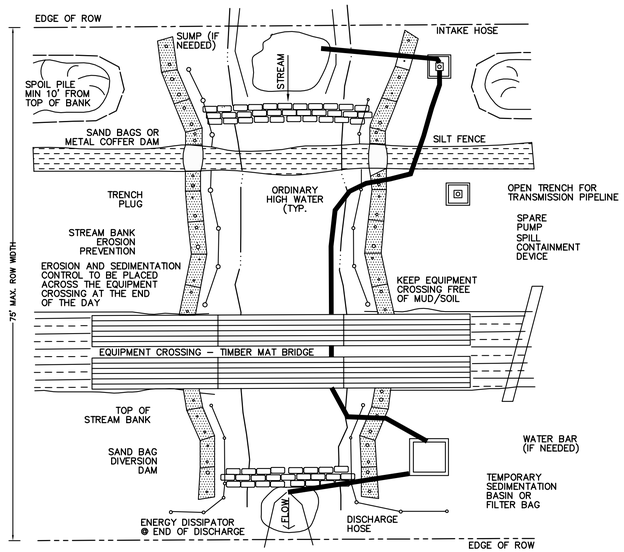
7. AFTER DAMS ARE IN PLACE, IT MAY BE NECESSARY TO USE ADDITIONAL PUMPS TO HANDLE STREAM FLOW.

8. EXCAVATE TRENCH AND LOWER IN PIPE UNDER HOSE. BACKFILL TRENCH.

9. ALL MECHANIZED EQUIPMENT TO PERFORM WORK FROM TEMPORARY BRIDGE OR ADJACENT TOP OF BANK AREAS. USE TIMBER MATS IS TO OCCUR IN STREAM CHANNEL.

10. DISMANTLE DOWNSTREAM DAM, THEN UPSTREAM DAM.

11. RESTORE DISTURBED CHANNEL, STREAM BANKS AND APPROACHES FOR A MINIMUM DISTANCE OF AT LEAST 50 FT. FROM THE STREAM EDGES AND PERMANENTLY STABILIZE WITHIN 1 DAY OF INITIAL RESTORATION. REFER TO THE STREAMBANK RESTORATION DETAIL FOR RESTORATION REQUIREMENTS.



2 Open Trench Stream Crossing - Dam and Pump Around

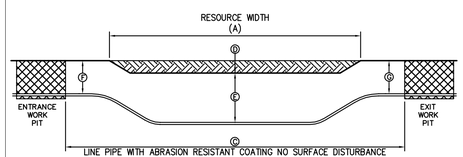
12/12

N.T.S.

Source: VHB

LD_

MILEPOST	RESOURCE NAME	RESOURCE AREA WIDTH (A)	HDD LENGTH (C)	DEPTH OF RESOURCE AREA. (D)	ELEV. BELOW RESOURCE (E)	ENTRY ELEV. (F)	EXIT ELEV. (G)
28.2	VT-AD-1560 VT-AD-1561	300	775	400	< 393	396	396
28.57	VT-AD-1562	200	375	406	< 399	412	412
33.25	VT-AD-446	230	700	438	< 431	436	446
33.72	VT-AD-793	320	980	454	< 447	456	452
35.77	VT-AD-806	160	950	310	< 303	323	323
36.0	VT-AD-808 (1), (2)	320	520	350	< 346	346	350



Notes:

1. THIS CONFIGURATION IS FOR HORIZONTAL DIRECTIONAL DRILL OF UPLAND NATURAL AND CULTURAL (ARCHAEOLOGICAL) RESOURCE SITES AS SHOWN ON PROJECT PLANS. SEE ALIGNMENT SHEETS FOR LOCATIONS OF THIS CONFIGURATION.
2. MINIMUM SEPARATION BETWEEN THE TOP OF PIPELINE AND THE CHANNEL RESOURCE BOTTOM (DIMENSION E) MUST BE AT LEAST 2 FEET.
3. ELEVATIONS PROVIDED ARE BASED ON APPROXIMATE NAVD 88 DATUM AND MUST BE FIELD VERIFIED PRIOR TO INSTALLATION OF PIPELINE.

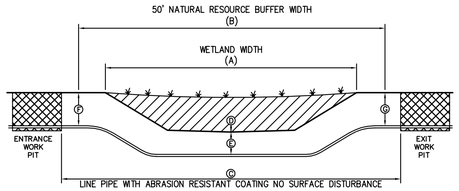
3 Horizontal Directional Drill (HDD) Upland Natural / Cultural Resource - Typical Section

04/13

N.T.S.

Source: VHB

MILEPOST	WETLAND ID	WETLAND WIDTH (A)	BUFFER WIDTH (B)	HDD LENGTH (C)	UNCON. MATERIAL ELEV. (D)	CONSOL. MATERIAL ELEV. (E)	ENTRY ELEV. (F)	EXIT ELEV. (G)
22.1	2012-CM-84 2012-PW-85	1,110	1,520	1,600	398	< 391	424	404
27.3	2012-PW-67 RTE-PS-045	2,300	2,450	2,270	358	< 356	< 376	< 400



Notes:

1. THIS CONFIGURATION IS FOR HORIZONTAL DIRECTIONAL DRILL OF WETLAND CROSSINGS AS SHOWN ON PROJECT PLANS. SEE ALIGNMENT SHEETS FOR LOCATIONS OF THIS CONFIGURATION.
2. TOP OF PIPELINE MUST BE BELOW THE DEPTH OF PEAT OR OTHER UNCONSOLIDATED ORGANIC MATERIALS (DIMENSION D) THROUGHOUT THE LENGTH OF THE DRILL.
3. MINIMUM SEPARATION BETWEEN THE UNCONSOLIDATED MATERIAL AND THE TOP OF PIPELINE (DIMENSION E) MUST BE AT LEAST 2 FEET.
4. ELEVATIONS PROVIDED ARE BASED ON APPROXIMATE NAVD 88 DATUM AND MUST BE FIELD VERIFIED PRIOR TO INSTALLATION OF PIPELINE.

4 Horizontal Directional Drill (HDD) Wetland Crossing - Typical Section

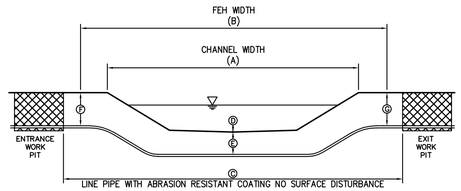
04/13

N.T.S.

Source: VHB

MILEPOST	STREAM NAME	CHANNEL WIDTH (A)	FEH WIDTH (B)	HDD LENGTH (C)	CHANNEL ELEV. (D)	ELEV. BELOW CHANNEL (E)	ENTRY ELEV. (F)	EXIT ELEV. (G)
0.99	INDIAN BROOK	4	100	1,150	208 [1]	< 198	< 208	< 208
1.52	INDIAN BROOK	15	125	1,530	188 [2]	< 178	< 188	< 188
6.75	WINOOSKI RIVER (SECTION 10 WATERS)	320	N/A (1,195)	900	263 [3]	< 238	< 275	< 275
19.47	LAPLATTE RIVER	30	360	640	317 [2]	< 307	< 317	< 317
22.86	LEWIS CREEK	80	435	2,500	310 [1]	< 300	< 310	< 310
35.85	UNNAMED TRIB. TO LITTLE OTTER CREEK	4	640	1,010	303 [2]	< 293	< 303	< 303
39.30	NEW HAVEN RIVER	120	785	530	245 [2]	< 235	< 245	< 245

1. CHANNEL ELEVATION BASED ON CONTOURS SHOWN ON EPSC PLAN PROVIDED BY CHA, INC. DATED 02/28/2013 AND NOT ASSESSED IN THE FIELD BY VHB.
2. CHANNEL ELEVATION BASED ON CONTOURS SHOWN ON EPSC PLAN PROVIDED BY CHA, INC. DATED 02/28/2013 AND MODIFIED BASED ON FIELD ASSESSMENT BY VHB.
3. CHANNEL ELEVATION BASED ON BATHYMETRIC SURVEY PROVIDED BY COLER & COLANTONIO DATED 12/12/2012 AND NOT ASSESSED IN THE FIELD BY VHB.



Notes:

1. THIS CONFIGURATION IS FOR HORIZONTAL DIRECTIONAL DRILL OF STREAM CROSSINGS AS SHOWN ON PROJECT PLANS. SEE ALIGNMENT SHEETS FOR LOCATIONS OF THIS CONFIGURATION.
2. TOP OF PIPELINE MUST BE AT LEAST AS DEEP AS THE CHANNEL BOTTOM (DIMENSION D) THROUGHOUT THE FLUVIAL EROSION HAZARD (FEH) CORRIDOR.
3. MINIMUM SEPARATION BETWEEN THE TOP OF PIPELINE AND THE CHANNEL BOTTOM (DIMENSION E) MUST BE AT LEAST 7 FEET.
4. ELEVATIONS PROVIDED ARE BASED ON APPROXIMATE NAVD 88 DATUM AND MUST BE FIELD VERIFIED PRIOR TO INSTALLATION OF PIPELINE.
5. FEH CORRIDOR IS LISTED AS NOT APPLICABLE (N/A) WHERE THE STREAM CROSSES OR IS ADJACENT TO AN EXISTING ROADWAY OR OTHER INFRASTRUCTURE THAT RESULTS IN RIVER MANAGEMENT CONSTRAINTS AT THAT LOCATION. FEH CORRIDOR WIDTHS AT THESE LOCATIONS ARE SHOWN FOR INFORMATION PURPOSES ONLY.

5 Horizontal Directional Drill (HDD) Stream Crossing - Typical Section

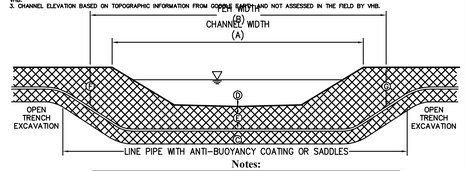
04/13

N.T.S.

Source: VHB

MILEPOST	STREAM NAME	CHANNEL WIDTH (A)	FEH WIDTH (B)	CHANNEL ELEV. (C)	ELEV. BELOW CHANNEL (D)	ENTRY ELEV. (E)	EXIT ELEV. (F)
3.62	INDIAN BROOK	7	N/A (185)	430 [2]	< 420	< 430	< 430
6.60	ALDER BROOK	35	N/A (150)	281 [1]	< 274	< 281	< 281
10.32	ALLEN BROOK	35	360	376 [2]	< 366	< 376	< 376
13.79	SUCKER BROOK	15	120	367 [2]	< 360	< 367	< 367
18.93	UNNAMED TRIBUTARY TO LAPLATTE RIVER	4	N/A (310)	328 [1]	< 321	< 328	< 328
19.94	UNNAMED TRIBUTARY TO LAPLATTE RIVER	4	125	330 [2]	< 323	< 330	< 330
24.52	UNNAMED TRIBUTARY TO LEWIS CREEK	8	N/A (200)	407 [3]	< 400	< 407	< 407
29.11	UNNAMED TRIBUTARY TO LITTLE OTTER CREEK	8	N/A (400)	362 [2]	< 355	< 362	< 362
30.94	UNNAMED TRIBUTARY TO LITTLE OTTER CREEK	4	200	267 [2]	< 260	< 267	< 267
32.30	LITTLE OTTER CREEK	35	240	267 [1]	< 260	< 267	< 267

1. CHANNEL ELEVATION BASED ON CONTOURS SHOWN ON EPSC PLAN PROVIDED BY CHA, INC. DATED 02/28/2013 AND MODIFIED BASED ON FIELD ASSESSMENT BY VHB.
2. CHANNEL ELEVATION BASED ON CONTOURS SHOWN ON EPSC PLAN PROVIDED BY CHA, INC. DATED 02/28/2013 AND NOT ASSESSED IN THE FIELD BY VHB.
3. CHANNEL ELEVATION BASED ON TOPOGRAPHIC INFORMATION FROM GOOGLE EARTH AND NOT ASSESSED IN THE FIELD BY VHB.



Notes:

1. THIS CONFIGURATION IS FOR OPEN TRENCH EXCAVATION OF STREAM CROSSINGS AS SHOWN ON PROJECT PLANS. SEE ALIGNMENT SHEETS FOR LOCATIONS OF THIS CONFIGURATION.
2. TOP OF PIPELINE MUST BE AT LEAST AS DEEP AS THE CHANNEL BOTTOM (DIMENSION D) THROUGHOUT THE FLUVIAL EROSION HAZARD (FEH) CORRIDOR.
3. MINIMUM SEPARATION BETWEEN THE TOP OF PIPELINE AND THE CHANNEL BOTTOM (DIMENSION E) MUST BE AT LEAST 7 FEET.
4. ELEVATIONS PROVIDED ARE BASED ON APPROXIMATE NAVD 88 DATUM AND MUST BE FIELD VERIFIED PRIOR TO INSTALLATION OF PIPELINE.
5. FEH CORRIDOR IS LISTED AS NOT APPLICABLE (N/A) WHERE THE STREAM CROSSES OR IS ADJACENT TO AN EXISTING ROADWAY OR OTHER INFRASTRUCTURE THAT RESULTS IN RIVER MANAGEMENT CONSTRAINTS AT THAT LOCATION. FEH CORRIDOR WIDTHS AT THESE LOCATIONS ARE SHOWN FOR INFORMATION PURPOSES ONLY.
6. RESTORE DISTURBED CHANNEL, STREAM BANKS, AND APPROACHES FOLLOWING PIPELINE INSTALLATION PER EPSC PLAN.

6 Open Trench Stream Crossing - Typical Section

04/13

N.T.S.

Source: VHB

DWG. NO.	REFERENCE DWG.	REV	DSN	CK		DESCRIPTION
		0	MDF	SAB		ISSUED FOR CONSTRUCTION

	BID		CONSTRUCTION	
	INITIALS	DATE	INITIALS	DATE
ENVIRONMENTAL	JLS	06/28/13		
DRAFTING DESIGNER	GIL	06/28/13		
DRAFTING SUPERVISOR	BZD	06/28/13		
DESIGN ENGINEER	MDF	06/28/13		
DESIGN MANAGER	SAB	06/28/13		

VERMONT GAS
PROPOSED 12" PIPELINE
ADDISON NATURAL GAS PROJECT
CONSTRUCTION DETAILS

LOC. CHITTENDEN & ADDISON COUNTIES

YEAR: 2013 | W.O. | SCALE: NOTED | DWG. ANGP-T-G-020 | REV. 0

Vermont Gas

VHB Vanasse Hangen Brustlin, Inc.

CHA

36 Cordage Park Circle , Suites 321, 326, 329, 336
Plymouth, MA 02360
Main: (781) 982-7700 - www.chacompanies.com

STATE OF VERMONT
PUBLIC SERVICE BOARD

Petition of Vermont Gas Systems, Inc., requesting a Certificate of Public Good pursuant to 30 V.S.A. § 248, authorizing the construction of the **"Addison Natural Gas Project"** consisting of approximately 43 miles of new natural gas transmission pipeline in Chittenden and Addison Counties, approximately 5 miles of new distribution mainlines in Addison County, together with three new gate stations in Williston, New Haven, and Middlebury, Vermont	)	Docket No. 7970

2-28-13 SUPPLEMENTAL PREFILED TESTIMONY OF
JEFFREY A. NELSON
ON BEHALF OF
VERMONT GAS SYSTEMS, INC.

February 28, 2013

Mr. Nelson's testimony supplements and replaces his original prefiled direct testimony dated December 20, 2012. The intent is to introduce and sponsor an updated report titled *Section 248 Natural Resources Report. Vermont Gas Systems, Inc. Addison Natural Gas Project* prepared by Vanasse Hangen Brustlin, Inc. for the Project, as well as impact assessments prepared which address air and water quality and the natural environment pursuant to 30 V.S.A. § 248(b)(5), which provides for due consideration to be given to the statutory (so-called "Act 250") criteria including: headwaters (10 V.S.A. § 6086(a)(1)(A)), waste disposal (10 V.S.A. § 6086(a)(1)(B)), water conservation (10 V.S.A. § 6086(a)(1)(C)), floodways (10 V.S.A. § 6086(a)(1)(D)), streams (10 V.S.A. § 6086(a)(1)(E)), shorelines (10 V.S.A. § 6086(a)(1)(F)), wetlands (10 V.S.A. § 6086(a)(1)(G)), water supply (10 V.S.A. § 6086(a)(2) & (3)), soil erosion (10 V.S.A. § 6086(a)(4)), rare and irreplaceable natural areas (10 V.S.A. § 6086(a)(8)), wildlife habitat and endangered species (10 V.S.A. § 6086(a)(8)(A)) and outstanding resource waters (10 V.S.A. § 1424a(d) & 30 V.S.A. § 248(b)(8)). The supplemental testimony and its accompanying exhibits are intended to provide updated information with regards to air and water resources resulting from route refinements made to the Project after the initial filing. Based on these assessments, Mr. Nelson has analyzed the Project's potential impacts on the Act 250 criteria and he concludes that the Project will not result in any undue adverse impacts under any of the criteria he addresses provided that the required Vermont Department of Environmental Conservation permits are issued for the Project.

TABLE OF CONTENTS

2/28/13 EXHIBITS

Exhibit Petitioner Supp. JAN-2 (2/28/13)	Section 248 Natural Resources Report
Exhibit Petitioner Supp. JAN-3 (2/28/13)	Collateral Permit Application Schedule and Supplemental Field Activities Schedule
Exhibit Petitioner Supp. JAN-4 (2/28/13)	Vermont Significant Wetlands (Class II) Summary Memorandum
Exhibit Petitioner Supp. JAN-7 (2/28/13)	Stream Alteration/FEH Review Documentation
Exhibit Petitioner Supp. JAN-8 (2/28/13)	Section 401/404 Permit Application Description Memo
Exhibit Petitioner Supp. JAN-9 (2/28/13)	Section 248 Stormwater Technical Memorandum
Exhibit Petitioner Supp. JAN-10 (2/28/13)	Public Water Sources and Source Protection Area Summary and Mapping
Exhibit Petitioner Supp. JAN-11 (2/28/13)	Primary Agricultural Soils Mapping and Letter
Exhibit Petitioner Supp. JAN-13 (2/28/13)	Alternatives Analysis for Section 404/Section 10 Review (2/28/13)

STATE OF VERMONT
PUBLIC SERVICE BOARD

Petition of Vermont Gas Systems, Inc., requesting a Certificate of Public Good pursuant to 30 V.S.A. § 248, authorizing the construction of the **"Addison Natural Gas Project"** consisting of approximately 43 miles of new natural gas transmission pipeline in Chittenden and Addison Counties, approximately 5 miles of new distribution mainlines in Addison County, together with three new gate stations in Williston, New Haven, and Middlebury, Vermont	)	Docket No. 7970

2-28-13 SUPPLEMENTAL PREFILED TESTIMONY OF
JEFFREY A. NELSON
ON BEHALF OF
VERMONT GAS SYSTEMS, INC.

1. Introduction

Q1. Please state your name, occupation, and business address.

A1. My name is Jeffrey A. Nelson, and I am the Director of Energy and Environmental Services for the Vermont office of Vanasse Hangen Brustlin, Inc. ("VHB"), located at 7056 U.S. Route 7, in North Ferrisburgh, Vermont.

Q2. Please describe your education and employment background.

A2. I have worked as a consulting hydrologist and hydrogeologist in Vermont since 1982. I have a Bachelor of Science degree in Geology and a Master of Science degree in Civil Engineering, both from the University of Vermont. My educational training includes extensive scientific coursework, with a specialization in surface water hydrology and

groundwater hydrogeology. My professional background includes the direction, completion, and presentation of technical studies, evaluation and review of scientific data pertaining to water resources, determination of compliance with various State and Federal regulatory requirements and application for various permits and authorizations. Specific areas of expertise include stormwater treatment and control; erosion prevention and sediment control planning and design; and wetland and stream assessment, impact assessment, restoration and mitigation. I have designed and implemented a large number of projects in Vermont and the northeastern United States involving water resources assessment, planning, impact analysis, permitting and monitoring. My full resume is provided as Exhibit Petitioner JAN-1.

Q3. Do you hold any professional licenses or certifications?

A3. Yes. I am a *Certified Professional in Erosion and Sediment Control* ("CPESC") and a *Certified Professional in Storm Water Quality* ("CPSWQ").

Q4. Have you previously provided testimony before the Vermont Public Service Board (the "Board")?

A4. Yes, I have provided testimony to the Board previously in several different proceedings, including petitions for Certificate of Public Good ("CPG") on behalf of UPC Vermont Wind, LLC in Docket No. 7156, and provided prefiled testimony on behalf of the Vermont Electric Power Company, Inc. ("VELCO") and Green Mountain Power

Corporation ("GMP") in Docket No. 7314 (East Avenue Loop), and GMP, et al. in Docket No. 7628 (Kingdom Community Wind Project).

I have also presented the results of analyses and testified before all nine Vermont District Environmental Commissions, the former Environmental Board, the former Vermont Water Resources Board, the Vermont Environmental Court, and other regional and municipal tribunals.

Q5. What is the purpose of your testimony?

A5. The purpose of my testimony is to replace the testimony filed on December 20, 2012. Information provided herein, and as exhibits to this testimony, are intended to address changes in natural resource impacts resulting from route refinements (the "2/28/13 Alignment"), as described in the supplemental testimony of John Heintz. My testimony will introduce the updated Section 248 Natural Resources Report (Exhibit Petitioner Supp. JAN-2 (2/28/13)) and related impact assessments prepared by VHB in connection with the Vermont Gas Systems, Inc. ("Vermont Gas," "VGS" or the "Company") Addison Natural Gas Project ("Project" or "ANGP") to assess natural resource-related criteria of 30 V.S.A. § 248(b)(5). This section provides, in pertinent part, that a generation or transmission facility should not have an undue adverse effect on air or water purity or the natural environment, with due consideration having been given to the criteria specified in 10 V.S.A. §§ 1424a(d) (outstanding resource waters) and 6086(a)(1) through (8) and (9)(K) (various Act 250 criteria). VHB's report, as well as the

accompanying impact analysis documentation and permit applications to be filed in Spring, 2013 address the Project's potential impacts upon outstanding resource waters (10 V.S.A. § 1424a(d) and 30 V.S.A. § 248(b)(8)), headwaters (10 V.S.A. § 6086(a)(1)(A)), waste disposal (10 V.S.A. § 6086(a)(1)(B)), water conservation (10 V.S.A. § 6086(a)(1)(C)), floodways (10 V.S.A. § 6086(a)(1)(D)), streams (10 V.S.A. § 6086(a)(1)(E)), shorelines 10 V.S.A. § 6086(a)(1)(F)), wetlands (10 V.S.A. § 6086(a)(1)(G)), water supply (10 V.S.A. § 6086(a)(2) and (3)), soil erosion (10 V.S.A. § 6086(a)(4)), rare and irreplaceable natural areas (10 V.S.A. § 6086(a)(8)) and necessary wildlife habitat and endangered species (10 V.S.A. § 6086(a)(8)(A)).

The scope of changes associated with the 2/28/13 Alignment in this testimony include the following, with reference to specific VHB Natural Resources plan sheets:

- Sheet 3 - Specification of the dewatering area west of Colchester Tie-In
- Sheet 4 - Change in additional temporary work space (ATWS) areas near MP 2.2 (Route 2A)
- Sheet 9 – Transmission Mainline alignment change at MP 8.6 to avoid VELCO infrastructure (500 feet)
- Sheet 11 - Transmission Mainline alignment change at Allen Brook/Route 2 crossing (MP 10.3) (1,100 feet) and addition of an ATWS south of Route 2
- Sheet 11 - Williston gate station moved to the east 300 feet along transmission line

- Sheet 11 - Transmission Mainline alignment change at I-89 crossing to Hurricane Lane (MP 11.4) and concurrent pullback area shift (1,400 feet)
- Sheet 13 - Transmission Mainline alignment shift further east of VELCO K-23 ROW (MP 13.5) north of Williston Switching Station (600 feet)
- Sheet 13 -Transmission Mainline a shift from west to east side of VELCO K-43 ROW from MP 13.84 to MP 14.25 (2,200 feet)
- Sheet 15 - Transmission Mainline alignment shift toward VELCO K-43 ROW at MP 15.6 (1,500 feet)
- Sheets 15 & 16 - Transmission Mainline alignment shift along Route 116 to Route 2A Crossing (MP 16.9) (1,700 feet)
- Sheet 16 - Transmission Mainline alignment shift toward VELCO K-43 ROW (MP 17.35) (700 feet)
- Sheets 18 to 21 - Transmission Mainline alignment change from along Charlotte/Baldwin Rd to VELCO K-43 ROW and parallel VELCO line (MP 19.8 to 24) (22,200 feet)
- Sheets 21 & 22 - Transmission Mainline alignment change from VELCO K-43 ROW to (MP 24 to MP 24.9), crossing Rotax Rd. (4,800 feet)
- Sheets 23 to 25 - Transmission Mainline alignment change from along Monkton Rd to continuing to follow VELCO K-43 ROW, with HDD under Monkton Swamp and with access from Split Rock Rd, to Old Stage Rd (MP 25.75 to MP 28.9) (16,600 feet)

- Sheets 26 to 28 - Transmission Mainline alignment change from along Old Stage Rd/Parks-Hurlburt Rd/North St (MP 29.65) to west side of VELCO K-43 ROW to Plank Rd (MP 32.4) (14,500 feet)
- Sheet 28 - Plank Rd gate station moved from east of North St/Plank Rd intersection to west side of VELCO K-43 ROW at MP 32.5
- Sheet 30 - Transmission Mainline alignment shift from west side of VELCO K-64 ROW to cross Route 17 (Main St) and parallel New Haven Substation access (MP 34.6 to MP 35.1) (1,500 feet)
- Sheet 31 - Transmission Mainline alignment change under VELCO K-64 ROW and crossing Town Hill Rd (MP 35.6) (1,050 feet)
- Sheets 34 & 35 - Alignment change from east side of Route 7 at River Rd intersection to west side with additional temporary workspace on north west corner of Belden Falls Rd/Route 7 intersection (MP 40.3 to 41.2, end of ANGP transmission mainline) (4,900 feet)
- Sheet 35 - Middlebury gate station moved from south of Exchange St/Route 7 intersection, approximately 0.5 miles north
- Sheet 35 - Change from Transmission to Distribution Mainline from end of ANGP at Middlebury Gate Station (MP 41.2) along west side of Route 7 to Exchange St/Route 7 intersection (2,400 feet)

2. <u>Natural Resources Assessment (30 V.S.A. § 248(b)(5) and (b)(8))</u>

Q6. Please generally describe the scope of investigations performed by VHB.

A6. In connection with our assessment of the natural resource-related criteria of 30 V.S.A. § 248(b)(5),VHB has performed on-site investigations to assess natural resource features within the area of the proposed Project, as described by John Heintz as the Preliminary Alignment. The investigation areas for this work included various design alternatives leading to the 2/28/13Alignment, which consists of the following Project elements:

- Transmission Mainline (41.2 miles)
- Distribution Mainline to Vergennes (3.7 miles)
- Distribution Mainline to Middlebury (1.35 miles)
- Ancillary features (Colchester Tie-In, Gate Stations, valve sites, construction access roads, staging/laydown areas)

These Project components are described in the testimony and exhibits of the ANGP Project Manager, John Heintz, and shown on the ANGP Project Map[1] (see Exhibit Petitioner Supp. JH-2 (2/28/13)). The Preliminary Alignment of the Transmission Mainline and Distribution Mainlines has evolved in order to avoid or minimize impacts to various resources, resulting in the Final Alignment that was filed with the Board on December 20, 2012, and which is referenced herein as the "Initial Proposal." Based on community input, this process continued after December 20, resulting in the 2/28/13 Alignment. VHB completed detailed natural resource assessments during the 2012 growing season of various alignment options for the ANGP components, including

[1] The distribution networks, although not subject to 248 review, are subject to review by the Agency of Natural Resources under the Vermont Wetland Rules, Water Quality Certification process, and by U.S. Army Corps of Engineers under Section 404 of the Clean Water Act, all to the extent that this Project component would impact protected natural resources. Therefore the natural resources inventory and impact analyses prepared by VHB includes the distribution networks within Vergennes and Middlebury.

investigation of corridor widths of up to 300 feet, resulting in an approximately 3,360-acres of area studied, including large areas of the 2/28/13 Alignment (see Natural Resources mapping, Exhibit Petitioner Supp. JAN-2 (2/28/13), Appendix 1). Subsequently we have assessed an additional 250 acres on a preliminary basis associated with the route refinement described above. Thus, the supplemental areas of assessment completed during 2013 represent a small component of the overall area of resource investigations. The preliminary field investigations and desktop evaluations completed during January and February 2013 will be supplemented by additional field work to be completed as necessary during Spring 2013. The area associated with this supplemental field work is approximately 4.4 miles out of the total length of 46 miles associated with both the transmission and distribution mainlines. These areas of additional investigation predominantly consist of locations immediately adjacent to areas previously studied by VHB and thus we are confident in the expected findings. Only one area, in the vicinity of Rotax Road, has not been previously field assessed, and we expect that our preliminary evaluations overstate the extent of resources and associated impacts in this area. Exhibit Petitioner Supp. JAN-3 (2/28/13) provides a summary of the protocols, including anticipated timeframe and reporting to be followed with respect to each of the natural resource features.

Q7. Please describe the design criteria which have been used to minimize natural resource impacts due to construction of the Project.

A7. Following the completion of natural resource inventories, VHB worked with the Project design team as the Preliminary Alignment was prepared to identify areas where impact avoidance and minimization should be evaluated. Various project alternatives were evaluated, as I discuss in Section 3, below. These efforts occurred with particular input and consultation with the Vermont Agency of Natural Resources ("ANR") and the United States Army Corps of Engineers ("USACE") personnel. Some of the specific aspects of this iterative design process considered reroutes, shifts, and realignments as well as other avoidance or impact minimization measures within various areas of the pipeline route, which included:

- Re-routing pipeline along Redmond Road in Williston to avoid clearing forested upland and wetland habitat along the Interstate 289 (also referred to as the "Circumferential Highway," "CCCH," or "CIRC") corridor in Williston, resulting in the avoidance of approximately 15.5 acres of forest clearing, including both upland and wetland areas and approximately 2.1 acres of wetland impacts;
- Where the transmission mainline corridor follows the VELCO corridor, narrowing the width of clearing and disturbance to avoid resource impacts, by locating the pipeline within the VELCO easement rather than adjacent to it;
- Impact avoidance areas are summarized as Exhibit Petitioner Supp. JH-14 (2/28/13). In total, these 20 re-routes avoided impacts to nearly 12 acres of wetland and 1.15 acres of streams. However, some wetland and stream impacts will occur within these areas along the 2/28/13 Alignment, but to a much lesser degree;

- Use of Horizontal Direct Drilling ("HDD") to avoid impacts to streams, rivers and other sensitive resources. At a total of 16 locations along the 2/28/13 Alignment, including the Winooski River crossing, HDD is proposed to avoid resource impacts (see Exhibit Petitioner Supp. JH-15 (2/28/13)). A total of approximately 3.5 miles of the Transmission Mainline will be constructed using HDD for the purpose of avoiding and/or reducing resource impacts, as described in the testimony of John Heintz. Additional portions of the line will utilize HDD construction to avoid the interruption of traffic along transportation corridors such as Interstate 89, active railroads, and State Highways. As a result, the use of this construction method avoids over 6.7 acres of direct wetland impact (including the Monkton swamp crossing) and direct trenching impacts at 13 stream/river crossing locations (59,720 square feet of impact avoided). Further, the HDD design has been developed in a manner that maximizes long-term protection of these streams as described further below and in Exhibit Petitioner Supp. JAN-7 (2/28/13);
- Narrowing the width of the Transmission Mainline construction corridor in specific locations, from 75 feet, as described in the testimony of John Heintz, to 50 feet, to minimize tree clearing and other potential impacts, including the following examples:
    - At mile post ("MP") 9.78 to MP 10.09: approximately a 1,600-foot distance to minimize wetland\buffer impacts in Williston;

- At MP 19.21 to MP 19.45: approximately a 1,300-foot distance to minimize wetland impacts in Hinesburg;
- At four locations between MP 20.80 to MP 26.99: for approximately a 5,900-foot total distance to minimize wetland\buffer, stream, natural community and tree clearing impacts in Hinesburg and Monkton;
- At MP 29.75 to MP 31.58: approximately a 9,650-foot distance to minimize wetland/buffer, stream, natural and tree clearing impacts in Monkton and New Haven as well as minimize impacts to a large Red Maple Green Ash Swamp natural community in New Haven;
- At MP 36.37 to MP 37.24: approximately a 4,600-foot distance to minimize wetland/buffer impacts at the Monkton swamp; and
- At MP 36.37 to MP 37.24: approximately a 4,500-foot distance to minimize wetland/buffer impacts in New Haven.

- A total of approximately 2.8 miles of the Transmission Mainline will be subject to construction corridor narrowing, as described in the testimony of John Heintz, including 29 locations, resulting in a total of approximately 4.8 acres of wetland impact reduction, as well as about 2.9 acres of Class II wetland buffer reduction. Also, six rare, threatened or endangered ("RTE") plant sites areas were avoided through this technique. All such areas of narrowing are depicted on the Project Plans (Exhibits Petitioner Supp. JH-3 and JH-5 (2/28/13)), and listed on Exhibit Petitioner Supp. JH-16 (2/28/13).

- Use of temporary mats to cross wetlands and buffers, thereby minimizing impact within these areas;
- Use of temporary bridges for stream crossings to provide equipment access where appropriate; and
- Restoration of ground topography and appropriate natural revegetation following construction of the Project.

Q8. Could you please summarize the extent of avoidance and minimization measures associated with the 2/28/13 Alignment?

A8. Yes. In some cases minor relocations have occurred, and in other cases, substantial reroutes are proposed. In addition to the alignment changes, within the 2/28/13 Alignment, mitigating measures, such as use of HDD or reduction in the cleared corridor width have been applied to 11.2 miles or 27 percent of the route.

Q9. Based upon your evaluation and analyses, will the Project have an undue adverse effect upon air and water purity or the natural environment, with due consideration having been given to the criteria specified in Section 248(b)(5)?

A9. No. As explained in documentation which has been prepared based on the natural resources report and impact assessments, VHB has investigated and evaluated the Project's potential impacts under each of the above-mentioned criteria and has determined that the Project will meet each criterion. In areas of reroutes where supplemental field information will be required in Spring 2013, which represents only 4 miles of the overall 46 mile alignment, there is sufficient information available, based on

field work during January/February 2013 and/or desktop assessments from which we have been able to conservatively assess anticipated Project impacts, and thus reach a conclusion of compliance with applicable criteria. Therefore, it is my professional opinion that the Project will not have an undue adverse effect on air and water purity or the natural environment, with due consideration having been given to the specific requirements associated with these criteria, as discussed in detail below.

Outstanding Resource Waters [10 V.S.A. §1424a(d) & 30 V.S.A. § 248(b)(8)]

Q10. Will the Project have any impacts on Outstanding Resource Waters?

A10. No. Section 1-03(D) of the Vermont Water Quality Standards ("VWQS") (effective January 1, 2008) provides that the Water Resources Panel ("WRP") may, under 10 V.S.A. §1424a, designate Outstanding Resource Waters. A list of these waters is maintained on the WRP web-site. The following waterways have been classified by the WRP as Outstanding Resource Waters:

1. Batten Kill River, Towns of East Dorset and Arlington;
2. Pike's Falls/Ball Mountain, Town of Jamaica;
3. Poultney River, Towns of Poultney and Fair Haven; and
4. Great Falls, Ompompanoosuc River, Town of Thetford.

There are no waters in the Project vicinity that have been designated as outstanding resource waters, and therefore, the Project will not result in an undue adverse impact under this criterion.

Criterion 1(A): Headwaters [10 V.S.A. §6086(a)(1)(A)]

Q11. Will the Project have an undue adverse impact to Headwaters?

A11. No. VHB analyzed available information to determine if the Project will be located on any lands that meet the criteria of 10 V.S.A. §6086 (a)(1)(A), which are incorporated in the Section 248 review, including:

i) headwaters or watersheds characterized by steep slopes and shallow soils;

ii) drainage areas of 20 square miles or less;

iii) above 1,500 feet elevation;

iv) watersheds of public water supplies designated by the ANR; or

v) areas supplying significant amounts of recharge waters to aquifers.

Within portions of the ANGP, there are small areas of steep slopes and the drainage areas of several of the delineated features are less than 20 square miles. None of the Project components are located above 1,500 feet elevation. Portions of the Project are located within the watersheds of public water supplies.

Since Project components meet one or more of the headwaters criteria, as described in Section 5.0 of the Natural Resources Report (Exhibit Petitioner Supp. JAN-2 (2/28/13)), the Project, at least in part, will meet the definition of a headwaters area and must conform to applicable regulations including Vermont Department of Environmental Conservation ("DEC") rules (described below) and the 2011 VWQS. The primary components of the Project involve the subsurface placement of pipeline and restoration of

the landforms to pre-construction conditions. The above-ground components include the Colchester Tie-In, the three Gate Stations and the valve sites.

The management of stormwater runoff during construction is regulated under the National Pollutant Discharge Elimination System ("NPDES") Construction Stormwater Discharge program, which is administered in Vermont by DEC. To ensure conformance with this criterion, the design and construction of the Project components will incorporate DEC's Best Management Practices ("BMPs") to protect water quality during construction, by implementing a comprehensive Erosion Prevention and Sediment Control ("EPSC") Plan, which I will describe further with respect to Criterion 4. Exhibit Petitioner Supp. JAN-9 (2/28/13) provides the EPSC narrative, and EPSC plan set. With respect to DEC permitting for the construction stormwater discharges associated with the Project, it has been determined that an Individual Discharge Permit will be required for the Project, which is being applied for concurrently with the filing of the Section 248 petition. As a component of the EPSC Plan, particular attention has been given to those areas of earth disturbance that are located within close proximity to receiving waters, as discussed further under Criterion 4 below.

The operational phase of the Project will not result in the creation of new, redeveloped, or expanded impervious surface that will trigger the need for permit coverage pursuant to 10 V.S.A § 1264. This is discussed further with respect to Criterion 1(B) below.

Therefore, with incorporation of the BMPs, and adherence to the approved EPSC plan as part of the Project's Individual Discharge Permit authorization, the Project will meet the DEC regulations regarding any reduction of the quality of ground or surface waters in a headwaters area.

Criterion 1(B): Waste Disposal [10 V.S.A. §6086(a)(1)(B)]

Q12. Will the Project meet applicable requirements with respect to waste disposal?

A12. Yes. The Act 250 Waste Disposal criterion incorporated into Section 248 review provides that a project must meet applicable health and environmental conservation department regulations regarding the disposal of waste, and must not involve the injection of waste materials into groundwater or wells. Consideration of wastewater disposal involves both sanitary wastewater and stormwater runoff. With respect to sanitary wastewater, during construction of the Project, portable toilets serviced by a licensed septic hauler will be used on the site. Once the Project is operational, no sanitary facilities will be required.

During construction, water will be used for the pressure testing of pipeline segments. I will describe the sufficiency of water supply for this purpose below under Criterion 2. With respect to the disposal of water used for these purposes, the construction phase EPSC plan (Exhibit Petitioner Supp. JAN-9 (2/28/13)) will apply, requiring the implementation of BMPs at the proposed dewatering site in Colchester, such as staked

hay bale dike structures and filter fabric, which allow for dispersal and infiltration of flows to prevent erosive conditions.

As I describe in further detail below, the Project will result in the creation of less than one acre of new, expanded, or redeveloped impervious surface. Therefore, pursuant to the *Vermont Environmental Protection Rules, Chapter 18, Stormwater Management Rule* (VT ANR, DEC 2011), permit coverage is not required. Coverage under the General Permit is required for discharges of regulated stormwater runoff[2] from new development, redevelopment, and/or expansion of existing development that results in at least one (1) acre of impervious surface to waters of the State. As noted above, the majority of this Project involves the installation of underground infrastructure with restoration of the ground surface to pre-construction contours with permanent vegetative cover, and these components do not result in the creation of any new impervious surfaces. Permanent impervious surfaces that will be generated by the Project include infrastructure at the Colchester Tie-In, and at the three Gate Stations. There will be no new impervious surface associated with the six proposed valve sites. At each Gate Station, the new impervious area will be 544 square feet (0.01 acres), resulting in a Project total of 1,632 square feet (0.04 acres) (see Exhibit Petitioner Supp. JAN-9 (2/28/13)). Within each Gate Station enclosure, infrastructure will be situated upon a pervious 12-inch thick

[2] Pursuant to the Vermont Environmental Protection Rules, Chapter 18, *Stormwater Management Rule*, "regulated stormwater runoff" is defined as "precipitation, snowmelt, and the material dissolved or suspended in precipitation and snowmelt that runs off impervious surfaces and discharges into surface waters or into groundwater via infiltration."

(minimum) crushed stone surface underlain by a geosynthetic material. The access roads and parking areas for the Gate Stations, and pull-offs for the valve sites, will be constructed of stabilized pervious surfaces (e.g., geotextiles) to maximize infiltration and reduce runoff of rainfall and snowmelt. These proposed areas and the associated runoff characteristics are described in detail in Exhibit Petitioner Supp. JAN-9 (2/28/13)**.**

Given that the total amount of impervious surface does not trigger the need for an operational phase stormwater discharge permit, permanent stormwater treatment systems are not a part of the overall Project design. This design minimizes the construction of new impervious surfaces, protects natural drainage patterns, and maximizes infiltration of stormwater in order to protect water quality of receiving waters, consistent with Vermont water quality policy.

For these reasons, the Project meets applicable health and environmental conservation department regulations regarding the disposal of waste and does not involve the injection of waste materials into groundwater or wells.

Criterion 1(C): Water Conservation [10 V.S.A. §6086(a)(1)(C)]

Q13. Will the Project's design meet applicable requirements with respect to water conservation?

A13. Yes. The Act 250 Water Conservation criterion (10 V.S.A.§ 6086 (a)(1)(C)) incorporated into Section 248 review requires that a project's design incorporate water

conservation principles. As described previously, the Project involves temporary and very limited water usage. During construction, small amounts of water usage may be necessary for dust suppression, in accordance with the EPSC Plan, as well as for pressure testing of the pipeline. Once operational, there will be no ongoing water use associated with the Project.

Given the above, the Project will ensure that reasonable efforts will be made to conserve water.

Criterion 1(D): Floodways [10 V.S.A. §6086(a)(1)(D)]

Q14. Will the Project have an undue adverse impact on lands described as floodways?

A14. No. Under Act 250 Criterion 1(D)(Floodways), a project satisfies this criterion whenever it is demonstrated that the development within a floodway will not restrict or divert the flow of flood waters, and endanger the health, safety and welfare of the public or riparian owners during flooding, and the development within a floodway fringe will not significantly increase the peak discharge of the river or stream within or downstream from the area of development and endanger the health, safety, or welfare of the public or riparian owners. The term "floodway" is defined in Section 6001(6) of Act 250 to mean "the channel of a watercourse which is expected to flood on an average of at least once every 100 years and the adjacent land areas which are required to carry and discharge the flood of the watercourse…." The term "floodway fringe" is defined in Section 6001(17)

as "an area which is outside a floodway and is flooded with an average frequency of once or more in each 100 years…."

To evaluate the floodways criterion, two areas must be examined. The first is flooding due to inundation and the second is flooding due to the lateral migration of stream and river channels over time, which is known as "fluvial erosion." To assess inundation flooding, VHB utilized the available Federal Emergency Management Agency ("FEMA") Flood Insurance Rate Maps and determined the locations of FEMA-mapped floodways within the Project area. To address the second consideration, fluvial erosion hazard ("FEH") zones have been identified by ANR for certain streams and rivers. The FEH area is the lateral width of a stream corridor that may be subject to fluvial erosion from stream channel lateral migration over time. The FEH is determined by geomorphic assessments of channel bank full width, meander centerline, confining lateral topography, channel type, and current channel adjustments; then typically defined by a channel-width to belt-width ratio, dependent on stream sensitivity type and adjacent landform (ANR 2009). FEH zones have been established by DEC for most, but not all, perennial streams and rivers within the Project area. All floodways, floodway fringes, or FEH zones that will be crossed by the Project alignment are depicted within the Natural Resources Report (see Exhibit Petitioner Supp. JAN-2, Section 6.0 (2/28/13)). However, construction impacts to these areas have been avoided through the use of HDD where feasible, and there are no anticipated permanent alterations to waterways, flood elevations, or the ability of the land to hold water. As described in the testimony of John

Heintz, underground infrastructure within floodways or floodway fringes will include buoyancy compensation to provide additional weight to prevent the pipe from migrating upwards. Gate Stations and other ancillary facilities associated with the Project are located outside of FEMA Zone A designated areas and, thus, these facilities will not impact floodways or floodway fringes. The FEMA maps for the Project components are contained in Exhibit Petitioner Supp. JAN-2 (2/28/13) and Appendix 1 included therein.

Based upon the measures included in Project design and construction, the Project will not permanently restrict or divert the flow of flood waters, or endanger the health, safety and welfare of the public or of riparian owners during flooding; and the Project work within a floodway fringe will not increase the peak discharge of the river or stream within or downstream of the Project area or endanger the health, safety, or welfare of the public or riparian owners during flooding.

Criterion 1(E): Streams [10 V.S.A. §6086(a)(1)(E)]

Q15. Will the Project be located on or adjacent to streams and, if so, will the natural condition of the streams be maintained where feasible, and/or will the health, safety, or welfare of the public or adjoining landowners be endangered?

A15. Yes, portions of the Project will of necessity be located in the vicinity of streams; however, the natural condition of the streams will be maintained. This criterion requires that projects located on or adjacent to streams will, whenever feasible, maintain the

stream channel condition, or address whether the project will endanger the health, safety, or welfare of the public or adjoining landowners.

Q16. Please describe the methods employed by VHB to evaluate streams in the context of the Project.

A16. To gather necessary information to address this criterion, VHB initially conducted stream delineations along the preliminary pipeline alignment and at the locations of all other Project components. See Exhibit Petitioner Supp. JAN-2, Section 7.0 (2/28/13) for additional details. From this information VHB and the design team worked to determine how the Project could avoid and minimize impacts to streams, which resulted in the 2/28/13 Alignment and the associated series of other avoidance and minimization measures.

The Project is located within the Champlain Valley, and Project lands are within the Otter Creek, Upper Lake Champlain, and Winooski River ANR River Basins (Basins 3, 5, 8, respectively). Within the Project area, all delineated streams and rivers are Class B waters as designated pursuant to the 2011 VWQS.

The Project will involve buried pipeline crossings (either through use of HDD or open-cut trenching, as presented in Exhibit Petitioner Supp. JAN-7 (2/28/13)) of the following waters that would typically be under VT DEC Stream Alteration Permit jurisdiction (for

non-exempt projects[3]) with greater than 10 square mile drainage areas: Winooski River, LaPlatte River, Lewis Creek, Little Otter Creek, and the New Haven River. Additionally, Indian Brook (twice), Alder Brook (three times), Allen Brook, Sucker Brook, and eight unnamed streams, with drainage areas between 1 and 10 square miles, will be crossed by the Project. In total, the Project will cross 17 unique streams or rivers at 22 discrete locations that have been mapped by the DEC with watershed sizes greater than one (1) square mile which are subject to review and comment by DEC personnel. In addition there are 26 stream channel reaches of less than 1 square mile of drainage area crossed by the Project. See Exhibit Petitioner Supp. JAN-2 (2/28/13), Appendix 1. As further described in the Natural Resources Report (Exhibit Petitioner Supp. JAN-2 (2/28/13)), for all perennial and intermittent streams within the 2/28/13 Alignment, riparian buffer zones have been determined, based on the ANR Buffer Guidance.

Q17. Please describe the measures that have been incorporated into the Project design to avoid or minimize impacts to streams.

A17. The Project design team developed the Project plans so as to avoid any permanent impacts to streams. During construction, temporary impacts have been avoided where feasible, and where not feasible, the Project has been designed to minimize impacts to these resources. In particular, this involves the construction of the pipeline using HDD techniques for larger stream/river crossings, as described in greater detail in the testimony

[3] Projects subject to jurisdiction under 30 VSA § 248 are exempt from jurisdiction under the Stream Alteration Statute.

of John Heintz. Site-specific characterizations of all proposed stream crossing locations as well as the proposed methodology of crossing (HDD vs. open trench), along with stream crossing protocols, have been reviewed with DEC personnel. Specifically, the design has considered the mapped extent of FEH zones, in order to ensure that the pipeline segments installed by HDD were extended to a sufficient depth and lateral extent to minimize the potential for the pipeline to become exposed over time. Exhibit Petitioner Supp. JAN-7 (2/28/13) provides a listing and description of these locations.

In addition, temporary stream work road crossings are expected to be necessary for construction phase access to work areas. For perennial streams, these access points will utilize temporary bridges, and such crossings have been designed in accordance with the 2006 Vermont Standards and Specifications for Erosion Prevention and Sediment Control which, along with the comprehensive EPSC Plan that has been developed for construction activities, will protect and mitigate against secondary stream channel impacts from erosion and sedimentation, and ensure prompt natural revegetation of these areas.

Finally, as noted above, riparian buffers have been designated adjacent to perennial and intermittent streams along the 2/28/13 Alignment of the Project, consistent with the ANR Buffer Guidance. Within perennial stream riparian buffers, where other existing management practices (e.g., roadside mowing) are not currently occurring, a special vegetation management protocol will be implemented on a permanent basis to ensure

protection of riparian functions and values (see Exhibit Petitioner JAN-12). Vermont Gas will limit vegetation maintenance adjacent to these waterbodies to allow a riparian strip generally 50 feet wide, as measured from the mapped top of bank/top of slope, to permanently revegetate with native plant species across the entire construction right-of-way. However, to facilitate periodic pipeline corrosion/leak surveys, a corridor centered on the pipeline and up to 20 feet wide may be maintained in a herbaceous state. In addition, trees within 25 feet of the pipeline that are greater than 15 feet in height may be selectively cut and removed from the permanent right-of-way. A detail showing the Riparian Zone Vegetation Management plan to be implemented in these areas is provided as Exhibit Petitioner JAN-12.

A Department of the Army Section 404 Permit and a Vermont State Section 401 Water Quality Certification is required for the Project, and narrative is provided as Exhibit Petitioner Supp. JAN-8 (2/28/13) that describes the Project's applications for these approvals, which were submitted on December 20, 2012, and will be amended or refiled in Spring, 2013. These filings present the results of the natural resource assessments, the avoidance and minimization measures that have been implemented and the resulting unavoidable impacts to streams and wetlands.

Q18. Please summarize your conclusions with respect to Criterion 1(E) streams.

A18. The Project design has carefully considered protection of streams. This began with the complete delineation of all streams within the Project corridor, including mapping of

riparian buffers. The design then sought to implement construction practices that would avoid and minimize impacts through the following:

- Complete avoidance of any permanent stream channel impacts;
- Minimization of the number of buried pipeline crossings of streams;
- Use of FEH data as a tool to plan and design stream crossings to prevent pipeline exposure;
- Use of HDD where feasible to avoid direct impacts to stream channels;
- Implementation of stringent EPSC measures to protect water quality during construction;
- Use of temporary bridges to cross perennial streams;
- Implementation of prompt restoration and revegetation at all stream crossings; and
- Development of a specific long-term management protocol for implementation within riparian buffer areas that will be crossed by the Project.

Therefore, the design and implementation measures, taken in combination with the review and conditional requirements included with the Section 404/401 permitting, will protect the natural condition of streams, and will not result in endangerment to the health, safety, or welfare of adjoining or downstream landowners from stream channel impacts.

Criterion 1(F): Shorelines [10 V.S.A. § 6086(a)(1)(F)]

Q19. Will the Project have any undue adverse impact on shorelines?

A19. No. This criterion requires that the Project will, insofar as possible and reasonable in light of the purpose of the proposed Project, retain all shorelines and waters in their natural condition, allow continued access to the waters and the recreational opportunities provided by the waters, retain or provide vegetation which will screen the Project from the waters, and stabilize the bank from erosion, as necessary, with vegetation cover. Shorelines are defined for purposes of Act 250 and Section 248 as the land adjacent to the waters of lakes, ponds, reservoirs, and rivers. Shorelines include the land between the mean high water mark and the low water mark of such waters (Argentine, 1998). As defined and presented in Section 8.0 of Exhibit Petitioner Supp. JAN-2 (2/28/13), the only such water bodies within the Project area associated with the Section 248 review are the Winooski River, LaPlatte River, Lewis Creek, and New Haven River. Although the number of crossing locations has been minimized, the crossing of these water bodies by the pipeline is necessary to meet the overall Project purpose.

However, no undue adverse permanent impacts are anticipated as a result of the pipeline, particularly because the impacts will largely be temporary during construction of the Project. Further, as described above, the Project will cross each of these water bodies using the HDD method, which will avoid direct impacts altogether. The HDD design has been based on the width of FEH zones for these waters, so as to provide reasonable assurance that the pipeline will not become exposed or damaged by anticipated future changes in river channel configuration. This design also ensures that the shorelines

associated with these waters will remain undisturbed, both during and following construction, except for the necessary maintenance clearing over the pipeline corridor. In addition, prompt soil stabilization and natural revegetation are incorporated in the Project EPSC plans to further minimize impacts. For these reasons, there will be no undue or adverse impacts to shorelines as a result of the Project as specified in 10 V.S.A. § 6086(a)(1)(F).

Criterion 1(G): Wetlands [10 V.S.A. §6086(a)(1)(G)]

Q20. Will the Project have any undue adverse effect on significant wetlands?

A20. No. This criterion requires that the Project not create any undue adverse effect on significant wetlands. The wetlands criterion for an Act 250 Permit, as incorporated into Section 248, requires that the proposed project comply with the Vermont Wetland Rules ("VWR"). The VWR regulates significant wetlands (Class I and Class II wetlands) and their buffers. As with the stream criterion under Section 1(E) above, VHB delineated all surface waters, including wetlands, within the vicinity of the Project associated with the Initial Proposal, including most areas associated with the 2/28/13 Alignment. In addition, reconnaissance level or off-site database review of the limited reroute areas not previously assessed has been performed in January/February 2013, with plans to complete supplemental resource assessments in these areas in Spring 2013. Further, we have established proposed classifications of all delineated wetlands in accordance with VWR procedures, and we have reviewed these classifications with DEC wetland scientists. The identified wetland features, and the associated functions and values, are

described in detail in the Natural Resources Report, Section 9.0 (Exhibit Petitioner Supp. JAN-2 (2/28/13)).

In order to mitigate against undue adverse effects to Class II wetlands and buffers, several planning and design considerations have been applied. These are described in detail in the Vermont Significant Wetlands Summary Memorandum (Exhibit Petitioner Supp. JAN-4 (2/28/13)). These measures are summarized as follows:

- Transmission alignment modified where possible to avoid significant wetlands or minimize impacts;
- Use of HDD at specific locations to avoid or minimize impacts (e.g. Monkton swamp);
- Narrowing of temporary construction work space where possible within wetlands/buffers to minimize forested wetland clearing;
- Use of timber mats during construction to minimize wetland disturbance;
- Temporary access routes will be chosen to minimize wetland and buffer impact; and
- Vernal pool avoidance and minimization of terrestrial envelope impacts.

Further, the Project is required to obtain a Department of the Army Section 404 Permit and Vermont Section 401 Water Quality Certification prior to undertaking activities with permanent or temporary Class II or Class III wetland impacts. Therefore, the design and implementation measures taken, in combination with the permitting review and

conditional requirements included with the VWP and Section 404/401 permitting, will ensure that undue adverse effects to significant Vermont wetlands are avoided. In order to comply with federal regulations, which require the applicant to provide an accounting of potential effects to resources for an entire project, the 404 and VWP applications for the ANGP cover the Transmission, Gate Stations, Distribution Mainlines, and also include the estimated locations of the local distribution network in Vergennes and Middlebury.

Notably, the Project will result in zero permanent impact to Class II wetlands. All Project impacts will either be temporary (e.g. construction related) or secondary (conversion of forested area to other vegetated areas). A summary of Class II wetland and buffer impacts is provided in Exhibit Petitioner Supp. JAN-4 (2/28/13). In addition to the review of proposed Class II wetland/buffer impacts pursuant to the VWR, all proposed wetland impacts (Class II and Class III) will be reviewed by ANR for the Section 401 WQC. All Project wetland impacts are summarized in a memorandum summarizing the Section 401/404 Assessments, which is provided as Exhibit Petitioner Supp. JAN-8 (2/28/13).

Criteria 2 & 3: Sufficiency of Water and Burden on Existing Water Supply [10 V.S.A. §6086(a)(2) and (3)]

Q21. Will the Project have sufficient water available?

A21. Yes, sufficient water will be available for the Project. During construction, water will be used for dust suppression, equipment washing, and pipeline testing. No water will be required for the Project following the completion of construction. The construction-phase water needs for dust control will be met through water to be supplied by Project contractors from approved sources. As described in the testimony of John Heintz, water needs for the hydrostatic testing of the Transmission Mainline, at the completion of construction, can be provided by the Colchester Fire District #3. Therefore, there will be sufficient water available for the temporary needs of the Project.

Q22. Will the Project cause a burden to any existing water supply?

A22. No. The Project is not expected to cause any impacts such as loss of yield to any existing well. During construction of the Project, blasting will be conducted only to the extent necessary to remove ledge to allow the gas pipeline to be buried to a depth of about three to four feet below ground. Where ledge is not present, blasting will not be required. Any blasting that is performed will be conducted in a manner that conforms with industry standards and practices and will follow the blasting plan as described in the testimony of John Heintz. This plan is intended to ensure that explosives are properly managed so that off-site blast impacts to existing water supplies will be avoided.

The Project will cross through a number of designated source protection areas ("SPAs") for public water supplies or in the vicinity of public water supplies. These include four water systems using groundwater sources and one water system using a surface water

source (see Exhibit Petitioner Supp. JAN-10 (2/28/13)) that have either designated SPAs or public water sources within the immediate vicinity of the Project. The Project also will pass by various existing private water supplies, including drilled bedrock wells. Relative to the depth of a typical drilled well (generally 200 to 400 feet), the three- to four-foot depth of blasting is very limited. Likewise the width of the trench to be blasted is on the order of only a few feet, and thus minimizes the amount of blasting needed. Based on the fact that blasting for the Project will not alter existing ground topography, will not increase impervious surfaces, will implement a blasting plan, and is limited in extent, it is not expected that the Project will have any effect on water sources. Therefore, given the analyses performed, we conclude that the Project has sufficient water available for its needs and that the Project will not cause an unreasonable burden on existing water supplies.

Criterion 4: Soil Erosion [10 V.S.A. §6086(a)(4)]

Q23. Will the Project cause undue soil erosion, or significant drainage or runoff problems?

A23. No. In order to satisfy the soil erosion criterion for Section 248 review, a project must not cause unreasonable soil erosion or reduction in the capacity of the land to hold water so that a dangerous or unhealthy condition may result. As I describe in further detail below, the ANGP will not cause undue soil erosion.

Q24. Please describe the Project's design elements that will minimize soil erosion.

A24. Under the NPDES program and the Clean Water Act, construction projects that involve one (1) or more acres of land disturbance require a permit for the discharge of stormwater runoff associated with these construction activities. In Vermont, the NPDES program is administered by the DEC, which has adopted a risk-based permitting approach. Construction projects that pose a low or moderate risk, with regard to the potential for construction site discharges, are required to obtain authorization to discharge from the DEC under the Construction General Permit ("CGP") 3-9020 (2006, amended February 2008). For projects that do not qualify for coverage under the CGP, an Individual Discharge Permit for Stormwater Runoff from Construction Sites ("Individual Permit") is required. For the ANGP, it has been determined that an Individual NPDES Permit will be required. The management of construction phase stormwater runoff is described in greater detail in Exhibit Petitioner Supp. JAN-9 (2/28/13).

As a component of the Individual Permit application process, Project-specific EPSC Plans have been prepared utilizing BMPs selected and designed in compliance with *The Vermont Standards and Specifications for Erosion Prevention and Sediment Control* (VT DEC 2006, amended 2008). As part of EPSC Plan design, particular attention has been given to: (1) minimizing disturbance, (2) managing runoff, (3) stabilizing promptly, and (4) monitoring, maintaining, and, if necessary, adapting EPSC measures to evolving site conditions. Minimizing disturbance involves, to the extent practicable, maintaining existing topography, phasing major disturbance activities, and maintaining existing vegetation. With regard to managing runoff and stabilizing promptly, actions will be

taken to (for example): maintain existing areas of concentrated flow (e.g., ditches), divert potential run-on, stabilize flow paths, disperse concentrated flows through EPSC measures, and stabilize areas of disturbed soil within a specified time frame. With regard to phasing major disturbance activities, the general approach will involve (for example) the following sequence of activities:

1. Installation of specified EPSC measures (e.g., limits of disturbance barrier tape and fence, stabilized construction entrance, silt fence, sediment basins, sediment traps) prior to disturbance of any work area.
2. Clearing of vegetation with earth disturbance (e.g., removal of stumps) within work areas.
3. Construction of temporary access roads, lay down/staging areas.
4. Trench excavation and installation of transmission and distribution main lines.
5. Final stabilization and clean up.

The sequence of Project construction activities is described in the testimony of John Heintz. In total, approximately 343 acres of soil disturbance will be required to construct the Project. The Project will, in general, be segmented into specific work areas, with limited disturbance occurring in sequence within those work areas, to ensure that the maximum allowable concurrent area of earth disturbance, as specified by the approved Individual Permit, is not exceeded.

As earthwork is completed, the area will be stabilized by means of gravel, seed/mulch, etc., in order to limit unstabilized soils which will be subject to potential erosion, as required by the approved Individual Permit. The areas will then be cleaned up and permanently stabilized. Construction activities and EPSC measures will be inspected at least as often as required by the Individual Permit.

For these reasons, the Project will not cause unreasonable soil erosion or cause significant drainage or runoff problems.

Q25. Will the Project impact primary agricultural soils?

A25. Primary Agricultural Soils ("PAS") are defined as those soils with the potential to support agricultural activity and have an agricultural value between 1 and 7 in the Natural Resource Conservation Service ("NRCS") rating system, or soils of with a "Local" agricultural significance and an agricultural value of 8. Approximately 23 of the 41 miles of the Transmission Mainline, would be constructed under PAS (See Exhibit Petitioner Supp. JAN-11 (2/28/13)). The Distribution Mainline will be constructed along the shoulder of existing roadways, with public ROWs, and thus not within soils suitable for agricultural use. However, the Project primarily will consist of underground infrastructure that, in areas of farming and PAS will be buried 4 feet deep. Additionally, the construction methodology will involve the segregation of soils such that the topsoil is placed back at the ground surface and subsoil placed beneath as the pipeline trench is refilled. Therefore, these pipelines will not affect the potential for agricultural activity

once installed. VGS currently maintains many miles of pipeline underneath agricultural fields, which has not impacted the ability of the farmers to conduct their business.

The above-ground infrastructure associated with the Project has been placed away from PAS where possible. Permanent PAS impacts will occur at the Williston, New Haven and Middlebury Gate Stations, the Colchester Tie-in, as well as four of the valve sites. The total resulting PAS impact is approximately 1.0 acres, dispersed among these eight locations. These PAS impacts associated with the Project will be mitigated in accordance with the Agency of Agriculture requirements.

Criteria 8: Rare and Irreplaceable Natural Areas (RINAs) and Necessary Wildlife Habitat and Endangered Species [10 V.S.A § 6086(a)(8), (a)(8)(A)]

Q26. Have the potential impacts of the Project on rare and irreplaceable natural areas ("RINAs"), necessary wildlife habitat and endangered species been evaluated?

A26. Yes. In order to meet these criteria, a project must not have undue adverse impacts upon RINAs, or destroy or significantly imperil necessary wildlife habitat ("NWH") or any endangered species. As described in Section 10.0 of Exhibit Petitioner Supp. JAN-2 (2/28/13), Gilman and Briggs Environmental ("GBE") conducted surveys for natural communities that may be considered significant and therefore potentially subject to RINA designation, as well as for Vermont RTE plant and select animal species. VHB also conducted surveys for NWH, which is most often considered as deer wintering area ("DWA"), black bear habitat (forage or travel), or in some cases, moose overwintering

areas. Following surveys, the Vermont Fish and Wildlife Department ("FWD") biologists and Wildlife Diversity Program ("WDP") staff were consulted to review the survey and the Project.

Q27. Please describe your evaluation of natural communities which may be considered RINA.

A27. As described in Exhibit Petitioner Supp. JAN-2 (2/28/13), a natural community should be considered significant before it can be considered RINA. Natural communities can be considered significant by the WDP based on an evaluation of the community occurrence ranking, which includes ranking of current condition, landscape context, and size, in order to estimate an overall quality rank. Once a community is considered a significant example, the Vermont WDP can recommend that such be deemed RINA under Act 250 Criterion 8, based on the combination of the natural community rarity and quality ranking. The presence of RTE species and these significant communities may be used by the WDP to make RINA recommendations. Rare (S1 and S2) natural communities can be considered RINA when quality-ranked A, B, or C. Uncommon (S3) types require a quality rank of A or B to be considered as RINA. As this is often the convention used by the WDP, projects are ultimately subjected to a four-part test project in order to evaluate a project's effect on RINAs (10 V.S.A. § 6086(a)(8)), as developed by the Act 250 natural resources board ("NRB") and used during Section 248 review. First, the NRB must determine whether the project is located in a natural area. Second, it determines whether the natural area is rare and irreplaceable. Third, it determines whether the

project will have an adverse effect on the rare and irreplaceable natural area. Fourth, it determines whether the adverse effect, if any, would be undue.

The field surveys for the Project have been conducted in order to identify any natural communities that are considered rare or uncommon and likely significant, or any that would otherwise be considered significant to enable this four-part test to be applied. The results of the survey conducted for the proposed Project for significant natural communities that may be considered RINA by the WDP are presented in Appendix 6 of Exhibit Petitioner Supp. JAN-2 (2/28/13), and graphically represented in Appendix 1. From this, two rare community types were identified within the Project survey areas: the Pine –Oak–Heath Sandplain Forest and Valley Clayplain Forest. In addition, four uncommon communities were identified within the 2/28/13 Project alignment: the Silver Maple – Ostrich Fern Riverine Floodplain Forest, Mesic Maple–Ash–Hickory Forest, Red Maple-Green Ash Swamp, and Northern White Cedar Swamp. Other natural communities of interest that were identified in the vicinity of the Project are as follows:

- A small Red Maple – Sphagnum Acidic Basin Swamp (Rank S3) occurs in a bedrock-controlled pocket just outside the CCCH corridor, east of VT Rte. 2A in Essex;
- A small patch of Northern Hardwood Talus Woodland (Rank S3) occurs on the west side of the VELCO powerline in Williston;
- A large Cattail Marsh (Rank S4) occurs as a significant component of the large wetland complex west of Monkton Road.

All of these natural communities are depicted on the Natural Community map of the Project area (see Exhibit Petitioner Supp. JAN-2, Appendix 1 (2/28/13)).

Q28. Would any of the rare or uncommon natural communities in the immediate vicinity of the 2/28/13 Alignment be considered RINA?

A28. Through consultation with the WDP, the Pine–Oak-Heath Sandplain Forest within the 2/28/13 Alignment (near the northern terminus, generally off the end of Gauthier Drive) is under consideration as RINA by the WDP, as it is a very rare community type. From our discussions with the WDP, this is primarily due the following: 1) it is currently forested, 2) it occurs over soils known to support this very rare community type, and 3) it occurs in close proximity with other forests of this type, including lands that have been conserved for the purpose of preserving this type. Although it does retain the formative elements of this type, the particular area of this community type that is within the Project alignment occurs only in small patches and is not of high quality as it has been disturbed from its natural condition due to historic and ongoing land uses, including roads, trails, encampments, and illicit solid waste disposal scattered throughout. Also, the dominant overstory trees do not include pitch pine (which is present, but not in dominant abundance), which is typically a co-dominant of high quality examples of this type, indicating through lack of this indicator canopy dominant, that the current condition where the line would pass is not of high quality. Due to the degraded nature of the community, it is difficult for me to ascertain that it would meet the “natural condition” test required for an area to be considered RINA. However, it is recognized that this type

is very rare in Vermont, is under threat of further loss from development in the region, and therefore should be considered significant, although we do not believe that this particular area warrants RINA designation. Nonetheless, the Project design incorporates mitigating measures, as described further below, including narrowing of the cleared corridor and implementation of a special vegetation management detail (see Exhibit Petitioner JAN-12).

The other rare community type within the Project alignment, the Valley Clayplain Forest types, occurs in three places along the alignment (north of Charlotte Road in Hinesburg, and north of Plank Road as well as north of River Road in New Haven), as well as one potential area on lands south of Rotax Road in Monkton. From field assessments and discussions with the WDP, the Hinesburg and north of River Road, New Haven locations would not be of sufficient size or quality to be considered RINA. The location north of Plank Road in New Haven has previously been included in WDP-mapping as a significant type, but subject to further discussions with the WDP would likely not rise to the level of RINA given its relatively small size and forest assemblage indicative of regeneration from past agricultural abandonment. The fourth location has not yet been studied in detail, but further study, mapping, and review coordination with the WDP of this area will occur in the Spring 2013. From initial review, it appears the Project will be able to avoid any significant disturbance within this feature, and a RINA designation may not be applicable.

The uncommon (S3) natural communities within the Project alignment include the Silver Maple – Ostrich Fern Riverine Floodplain Forest, Mesic Maple–Ash–Hickory Forest, Red Maple-Green Ash Swamp and Northern White Cedar Swamp. The Silver Maple-Ostrich Fern Riverine Floodplain Forest occurs along the southern bank of the Winooski River in Williston, and due to small size and existing impacts from agriculture would not be considered significant or RINA. The Mesic Maple-Ash-Hickory Forest occurs within the Project alignment along the east side of Old Stage Road in Monkton, and could be considered significant by the WDP as a B-ranked example, although it has not been previously mapped as such by the WDP, and should not be considered RINA. The Red-Maple-Green Ash Swamp occurs west of North Street in New Haven (a small portion in Monkton), where it is surrounded by farmland and is bisected by the existing VELCO corridor, but given its large overall size, relatively undisturbed condition, and occurrence of several rare plant elements, would likely meet WDP ranking criteria to be considered significant, and as a B-ranked example of this type, may warrant further consideration as RINA. Two Northern White Cedar Swamp communities identified by the field survey are crossed by the Project alignment (along the VELCO corridor in Monkton, and north of Plank Road in New Haven). The feature in Monkton occurs within the Project alignment along the fringe of the community type, which extends north and westward from the area studied, and is part of a large wetland/marsh complex. Due to the comparatively small size of the northern white cedar swamp at this location, it is a C-ranked example of the type, and likely would not be significant, nor RINA. The occurrence of this feature type north of Plank Road is a small patch within a larger Valley

Clayplain Forest (described above) surrounded by other lands disturbed by past agriculture and land use activity, and also as a C-ranked example, would likely not be considered significant or RINA on its own.

In brief summary, therefore, it is my opinion that the Project alignment would not cross areas that would meet the required test for RINA designation, but the following rare or uncommon communities would likely meet the criteria for significance:

- Pine-Oak-Heath Sandplain Forest (Colchester/Essex);
- Valley Clayplain Forest (New Haven);
- Mesic Maple-Ash-Hickory Forest (Monkton);
- Red Maple-Green Ash Swamp (Monkton/New Haven).

Q29. Has the Project been designed to avoid these areas or minimize impacts to significant or potentially significant communities?

A29. Yes. The 2/28/13 Alignment avoids significant impacts to all the natural communities noted in my answers above with the exception of necessary crossing through small areas of sandplain forest in Colchester and Essex, minimal clearing along the edges of three patches of clayplain forest adjacent to the VELCO corridor in Hinesburg and New Haven, minimal clearing within the Mesic Maple-Ash-Hickory Forest in Monkton, and minimal clearing within Northern White Cedar Swamp in Monkton and New Haven. There may also be some minimal impact at the edge of the preliminarily mapped Valley Clayplain forest south of Rotax Road in Monkton. The Project alignment avoids impact

to the Silver Maple-Ostrich Fern Riverine Floodplain Forest and Cattail Marsh communities via use of HDD.

With respect to the sandplain forest, Vermont Gas has worked with WDP personnel to assess how the Project could be designed in a manner that would minimize impacts. Although it is my opinion this forest type within the Project alignment should not be considered RINA, to mitigate against undue adverse impacts to this rare community type, VGS will take the following steps:

- Evaluation of an alternative route along the VELCO K-22 corridor as a potential alignment which included a natural resource delineation and preliminary pipeline design and calculation of impacts. The K-22 alternative was found to have greater potential impacts than the 2/28/13 Alignment;
- Avoidance and minimization to natural community impacts by routing the Project along the edge of the community where feasible;
- Use of HDD for construction through portions of this area to minimize construction corridor width (50 feet vs. 75 feet) and disturbance by equipment;
- Maintaining a narrow forest opening (50 feet), which will not prevent plant or animal movement and which may provide rare plant species habitat in future; and
- Within the patch of sandplain forest found between MP 1.35 and MP 1.45, Vermont Gas will permanently implement the Riparian Zone Vegetation Management protocol (Exhibit Petitioner JAN-12) to further narrow the clearing within this area.

With respect to the Red Maple-Green Ash Swamp, the 2/28/13 Alignment through this natural community has been determined to be unavoidable as a result of stakeholder concerns with respect to the original alignment. The 2/28/13 Alignment has minimized the impacts to this natural community, which are limited to minor clearing of an approximately 10-foot wide portion off the western edge of the already cleared VELCO corridor. Such impacts would not result in any new bisecting of the community, and Project activities are not expected to change the formative nature of the community (the wetland hydrology, which is driven by periodic surface inundation), and impacts should therefore not be considered undue.

With respect to the Valley Clayplain forest in New Haven, north of Plank Road, the Project re-alignment through this natural community has been determined to be unavoidable as a result of stakeholder concerns with respect to the original alignment. The 2/28/13 Alignment has minimized the impacts to this natural community, which are limited to minor clearing of an approximately 10-foot wide portion off the western edge of the already cleared VELCO corridor. Such impacts should therefore not be considered undue.

The other natural communities are ranked S3 or S4 in Vermont, meaning that high quality examples are rare but the community itself is not (S3), or the community is widespread in the state (or the number of high quality sites or total size is low) (S4).

Only one of the identified sites, the Mesic Maple – Ash – Oak – Hickory forest along Old Stage Road in Monkton would likely be considered significant (not RINA), but impacts here would be minimal, to the fringe of the community, through Project clearing for construction along the east side of Old Stage Road, minimizing impacts to the forest interior and the overall community. The other natural communities noted are either too small in size to be considered significant examples or are subject to ongoing land uses that will prevent them from being high quality examples.

Natural communities that have been preliminarily mapped (such as the Clayplain Forest in Monkton), or areas where natural community mapping would be subject to detailed field review or further discussion with the WDP in the Spring 2013, will be mapped and reported in supplemental testimony and exhibits to be included in the 6/28/13 filing.

Q30. Please describe the evaluation completed to assess potential impacts of the Project on RTE species.

A30. From the survey conducted for the proposed Project for RTE species, numerous plant species were documented. Of these, seven (7) species within the study areas are protected as threatened or endangered under Vermont regulations. These are Plains Frostweed, Muhlenberg's Sedge, Hairy Lettuce, Harsh-leaved Sunflower, Short-styled Snakeroot, Houghton's cyperus, and Fringe-top Closed Gentian. The 2/28/13 Alignment has been chosen to avoid RTE species to the greatest extent practicable, particularly protected species. As a result, the populations of all these protected plants lie outside of the proposed corridor and are either so remote that no protection is necessary or, if nearby

(i.e., at or just beyond the edge of the proposed corridor), they can be protected by fencing and signage. Of particular note, though, is a population of the Vermont Threatened Harsh-leaved sunflower that was previously identified as part of another project that could not be evaluated in detail for this Project. The alignment passes near this previously mapped population, and it appears it can be avoided, but will need to be inspected in June 2013 to determine if impacts would be unavoidable (and a Endangered Species Permit necessary), or to identify any further avoidance measures that may be necessary (beyond those already suggested).

There will be impacts to three rare (but not protected) species. One, the Three-Leaved Rattlesnake Root, occurs in the aforementioned Pine – Oak – Heath Sandplain Forest, as scattered individuals. Once the Project is constructed, the cleared corridor will provide suitable habitat for this species, which was also observed in a nearby cleared area. Hairy Sedge (ranked S2/S3 by the Vermont Natural Heritage Inventory), was found in six (6) places along the proposed corridor (as well as at least 3 other sites within the overall study area) and at each location is represented by a very large population (or several subpopulations) that extend well off the proposed corridor as well as lying within in it. Potential impacts to this species will be minimized through the use of wetland matting and/or restoration of the plants in the Project corridor from rhizomes after construction. Water hemp (S1) is found in an extensive population of scattered plants within an agricultural ditch/farm field west of North Street in New Haven, as well as scattered individuals in the VELCO corridor just to the north. Impacts may be unavoidable by the

Project alignment, but may be minimized through the use of fencing and signage where able, as well as through use of wetland matting during construction.

A fourth rare species, Virginia bugleweed, lies within the 2/28/13 Alignment, but will not be impacted because it occurs on the south bank of the Winooski River where a directional drill is planned that will pass at depth under the population. It also occurs in scattered populations west of North Street in New Haven, where it can be protected by fencing and signage.

Populations of a fifth species, Canada Frostweed and a sixth, Hairy Wild-Rye, occur at the margins of the proposed corridor or adjacent to access roads and can be protected by fencing and signage.

A seventh species, marsh-mermaid weed, occurs within the Cattail Marsh west of Monkton Road in Monkton, where impacts will be avoided by a HDD.

Several other rare plant populations, mostly of the species noted above, were observed in the study area, but these populations are remote from the Project as currently planned. Additional such species include Broad beech-fern, Fescue sedge, Fernald's sedge, and Smaller forget-me-not. No impacts are likely to accrue to these species.

With respect to areas along the 2/28/13 Alignment where rare, threatened, or endangered plant species may exist, the supplemental data collection protocol addresses the timing for additional field investigations (see Exhibit Petitioner Supp. JAN-3 (2/28/13)). Should a state-listed plant be found within the additional investigation areas, feasible efforts to avoid impacts will be undertaken. If impacts cannot be avoided, which is not anticipated, then an Endangered Species Permit application will be prepared and filed.

In regard to terrestrial (non-aquatic) animals, habitats for two listed species were particularly searched. One, the newly listed (November 2012) Whip-poor-will, is a bird that has experienced significant declines in recent years. Evening listening surveys were conducted at a series of fourteen sites along the study area where the Project is near or adjacent to forests, but no Whip-poor-wills were heard which indicates that no prime breeding habitat is currently present.

Another protected species potentially within the Project area is Indiana bat, a species that uses tree cavities as daytime roosting sites during the late spring and summer months. In the Project area, their summer range extends northward from Middlebury through New Haven and Monkton to Hinesburg, but not north of Hinesburg. Following protocols developed for other projects and verbally discussed with the ANR personnel, potential bat trees were identified and surveyed throughout the study area in these towns for suitability for use by Indiana bats as maternity colony trees. Several potential trees with the characteristics noted above were located, only one of which lies within the 2/28/13

Alignment, which is on River Road in New Haven, which will require cutting. Others trees surveyed occur along North Street in New Haven, in a swamp west of North Street in New Haven, south of Shelburne Falls Road in Hinesburg, and near Baldwin Road in Hinesburg, but all of these are avoided by the 2/28/13 Alignment. An evening "exit survey" was conducted at each of these potentially suitable trees and no bats were observed exiting any of these trees. Other trees, or groups of trees, that may be potentially suitable for maternity roosts were noted in other areas of the study, which were not surveyed, but are outside the Project impact area.

With respect to the 2/28/13 Alignment, VHB has consulted with ANR regarding survey protocols for Indiana bat in areas that detailed surveys for potential bat trees has not been conducted. ANR has advised that the protocol of identifying potential maternity colony trees, followed by exit surveys of those trees in May-June 2013, is satisfactory. This agreed upon approach is presented in the supplemental field work protocol (see Exhibit Petitioner Supp. JAN-3 (2/28/13)).

Q31. Please describe your assessment of necessary wildlife habitat within the Project corridor.

A31. As presented in Exhibit Petitioner Supp. JAN-2 (2/28/13), Section 10.0, VHB's survey for NWH within the Project alternatives studied several areas that are considered deer wintering area ("DWA"). There is no necessary black bear or moose habitat. The 2/28/13 alignment has been designed to avoid or minimize impacts (tree clearing) to DWA, but approximately 3.9 acres of DWA will require clearing for the Project,

representing approximately 4.6 percent of the DWA mapped within the Project areas studied. Of these, 3 acres will be permanently cleared, and 0.9 acres will be temporarily cleared for construction. Due to the limited clearing of DWA, the Project will not significantly impact the shelter value of the overall mapped DWA or any individual functioning DWA. Further, minor clearing within the shelter should create edge habitat, enhancing the amount of available tree regeneration for deer to browse upon during the winter. The minimal clearing width required and, in some cases, the habitat benefits of introduction of forest edge and browse created by the cleared corridor, will reduce impacts to DWA. The Project's avoidance and minimization of clearing within DWA will mitigate against undue adverse impacts to DWA.

Q32. Will the Project result in an undue adverse effect on RINAs or destroy or imperil necessary wildlife habitat or endangered species?

A32. No. Based on the analyses that have been performed, these resources have been mapped, and the appropriate mitigation measures will be undertaken, as described above, such that the Project will not result in an undue adverse impact to RINAs, or destroy or significantly imperil necessary wildlife habitat or endangered plant species.

3. Project Alternatives

Q33. Please describe the consideration of alternatives in order to minimize the environmental impacts of the Project.

A33. As described in the testimony of James Howe, a series of seven criteria were established which governed the development of conceptual project alternatives from an engineering perspective. Various alternatives included different combinations of pipeline segments in the northern portion of the Project (in/around Burlington) as well as the southern portion, to access Vergennes and Middlebury. Ultimately, a total of five alternatives were identified for the comparison of potential environmental impacts of the Project. These consist of two conceptual alignments for the northern segment and three alternatives for the southern segment. To the north, the alternative segments studied consisted of the CCCH alignment, and a more westerly alignment closer to Burlington that follows a portion of the I-89 corridor. For the southern portion, the segments consist of the VELCO Northwest Vermont Reliability Project ("NRP") alignment, the US Route 7 corridor, and finally the more easterly VELCO K43 / K63 & 370 corridor. Thus, the five alternatives can be summarized as follows:

- Alternative 1: I-89 to NRP;
- Alternative 2: I-89 to US-7;
- Alternative 3:CCCH to NRP;
- Alternative 4: CCCH to US-7; and
- Alternative 5: CCCH to VELCO K43 / K63 & 370 Corridor.

These alternatives are described more fully in the testimony of James Howe, as well as in the Alternatives Analysis report prepared by VHB to support the Project's application to the USACE pursuant to Section 404/Section 10 (see Exhibit Petitioner Supp. JAN-13 (2/28/13)).

Q34. What types of criteria were considered in the Alternatives Analysis?

A34. Broadly speaking, the categories that were considered included: land use (number of parcels), system risk and consequence, archaeological resources, aesthetics (land cover), wetlands, streams, floodplains, water source protection areas and plant/wildlife habitat. The specific metrics used and quantities determined for each of the five alternatives studied are presented in the Alternatives Analysis report (Exhibit Petitioner Supp. JAN-13 (2/28/13)). The system components (e.g. transmission pipeline length) and projected cost are also presented for each alternative.

Q35. Please describe the results of the Alternatives Analysis.

A35. Because of the high amount of natural resources impact and degree of potential system risk and consequence associated with not only passing through more densely developed areas including in close proximity to railroad lines, Alternative 1 (I-89/ NRP) was not selected as the preferred alternative. Alternative 3 (CCCH / NRP) was dismissed for similar reasons; it has the overall highest natural resources impact and would involve the most land during construction. Though Alternatives 2 and 4 have the lowest overall natural resources impacts, because of the potential for considerable system risk and consequences associated with pursuing an alignment along US Route 7, neither alignment was deemed to be practicable. Therefore neither Alternative 2 nor 4 was selected as the preferred alternative. While Alternative 5 has higher natural resources impacts than Alternatives 2 and 4, these alignments along US Route 7 are not practicable due to the

potential for considerable system risk and consequences. Compared to Alternatives 1 and 3 (NRP alignments), Alternative 5 would have lower system risk and consequence and would generally have lower natural resource impacts. Based on the impact analysis for Alternatives 1 through 5, Alternative 5 was chosen as the preferred alternative. A significant contributing factor to this selection was the greater flexibility of the Alternative 5 corridor with respect to strategic refinement of the pipeline alignment. In other words, existing land uses, including more north-to-south trending roadways, are present along Alternative 5 compared to Alternatives 1 and 3, and are a distinguishing factor. This setting provides a more suitable corridor for evaluating potential alignment rerouting and identifying opportunities to avoid impacts to natural resources and minimize unavoidable impacts. Alternative 5 became referred to as the Preliminary Alignment, with the results of the refinement of the alignment becoming Alternative 5a or the "Final Alignment," which was the basis for the December 2012 filing. With the proposed reroutes as described herein, the 2/28/13 Alignment is also referred to as Alternative 5b. I have previously described the avoidance and minimization measures that have been accomplished through the development of the Project.

4. <u>Collateral Permits</u>

Q36. Does the Project require any collateral permits relating to the criteria you address above?

A36. Yes, as noted above, the Project will require the issuance by DEC and FWD of several permits or authorizations. A summary of the status of collateral permits is provided as Exhibit Petitioner Supp. JAN-3 (2/28/13).

5. Conclusion

Q37. Does this conclude your testimony?

A37. Yes.

STATE OF VERMONT
PUBLIC SERVICE BOARD

Petition of Vermont Gas Systems, Inc., requesting a Certificate of Public Good pursuant to 30 V.S.A. § 248, authorizing the construction of the "Addison Natural Gas Project" consisting of approximately 43 miles of new natural gas transmission pipeline in Chittenden and Addison Counties, approximately 5 miles of new distribution mainlines in Addison County, together with three new gate stations in Williston, New Haven, and Middlebury, Vermont	)	Docket No. 7970

SUPPLEMENTAL & REBUTTAL TESTIMONY OF JEFFREY A. NELSON ON BEHALF OF VERMONT GAS SYSTEMS, INC.

June 28, 2013

Mr. Nelson's testimony provides supplemental material resulting from the collection of additional field information during Spring 2013, as well as from proposed modifications to the Project which have been made in response to stakeholder comments which result in overall reductions in Project impacts. Second, his testimony responds to the testimony provided by other parties regarding environmental issues.

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6/28/13 EXHIBITS

Exhibit Petitioner Supp. JAN-2 (6/28/13)	Supplemental Natural Resources Memorandum dated 6/27/13 with Attachments: 1. VHB Spring 2013 Natural Resource Studies Supplemental Memorandum, May 3, 2013 2. Updated NR mapping 3. Wetland/stream summary tables 4. Supplemental Art Gilman memo (6/24) 5. Supplemental Art Gilman memo (4/23) 6. Swamp substrate memo (5/24)
Exhibit Petitioner Supp. JAN-4 (6/28/13)	Vermont Significant Wetlands (Class II) Summary Memorandum
Exhibit Petitioner Supp. JAN-7 (6/28/13)	Stream Alteration/FEH Review Documentation Memorandum
Exhibit Petitioner Supp. JAN-8 (6/28/13)	Section 401/404 Permit Application Description Memo
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STATE OF VERMONT
PUBLIC SERVICE BOARD

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SUPPLEMENTAL & REBUTTAL TESTIMONY OF
JEFFREY A. NELSON
ON BEHALF OF
VERMONT GAS SYSTEMS, INC.

1. Introduction

Q1. Please state your name, occupation, and business address.

A1. My name is Jeffrey A. Nelson, and I am the Director of Energy and Environmental Services for the Vermont office of Vanasse Hangen Brustlin, Inc. ("VHB"), located at 7056 U.S. Route 7, in North Ferrisburgh, Vermont.

Q2. Are you the same Jeffrey A. Nelson that previously provided testimony in this docket on December 20, 2012 and February 28, 2013?

A2. Yes.

Q3. What is the purpose of your testimony?

A3. The purpose of my testimony is twofold. First, I will present supplemental material to the Board resulting from the collection of additional field information during Spring 2013, as well as from proposed modifications to the Project which have been made in response to stakeholder comments which result in overall reductions in project impacts. Second, I will respond to the testimony provided by other parties regarding environmental issues.

Q4. Please describe the overall impact of changes to the Project since the prior filing with the Board (the "2/28/13 Alignment).

A4. The supplemental testimony of John Heintz describes the specific design changes that have occurred between the 2/28/13 Alignment and the 6/28/13 Alignment. A summary of significant environmental impact avoidance and minimization efforts associated with these changes are as follows:

- Responsive to Agency of Natural Resources ("ANR") requests, all wetland crossings have been re-examined and additional construction phase narrowing of the disturbed corridor width will occur at 34 wetland and wetland buffer locations (beyond the 36 locations where narrowing was previously included), where this is feasible as presented in Exhibit Petitioner Supp. JH-16 (6/28/13).
- Similarly, for areas where the Project will cross significant natural communities, additional narrowing of the construction zone will occur at three locations, beyond the one crossing previously included.

- A Class II wetland in Williston, along the CCCH alignment has been avoided as a result of realignment based on stakeholder input, resulting in a decrease of over one acre in wetland impact.

Q5. As a result of the supplemental field work completed during Spring 2013, is the evaluation of the project corridor complete?

A5. As described in A9 of my 2/28/13 Supplemental Testimony, certain areas along the Project alignment required further field investigation (See Exhibit Petitioner Reb. JAN-4). This work has been completed during Spring 2013 to the degree possible given landowner permission. As a result, data collection has occurred within all but 1.8 miles of the 46 miles of transmission and distribution main alignments, and all but certain minor areas of proposed access roads. Within the remaining areas we have utilized available information from prior surveys, publically available GIS-based data, or approximated features from off-site locations. As a result, I believe that there is sufficient data available at all locations for the review of conformance with the criteria that I describe below. We have prepared a summary memorandum which lists and describes these areas, which is provided as Exhibit Petitioner Reb. JAN-4.

2. Updated Project Analyses

Criterion 1(B) Waste Disposal and Criterion 4 Soil Erosion

Q6. Please describe additional information with respect to stormwater that has been prepared by VHB for the Project.

A6. Since the 2/28/13 filing, VHB has prepared and filed, on May 3, 2013, an Individual NPDES Construction Stormwater Discharge Permit ("INDC") Application. This application was provided to all parties in this Section 248 proceeding through a supplemental discovery response by VGS on May 8, 2013. Also, an updated Stormwater Technical Memorandum including a revised EPSC Plan set and an Access Road Details summary table have been prepared to reflect those changes that resulted from collection of additional field information and stakeholder input. (See Exhibit Petitioner Supp. JAN 9 (6/28/13)). The plan changes presented in these materials reflect only minor changes to the information presented on 2/28/13.

Q7. Do these proposed modifications to the Project change your opinion with respect to the conformance of the project with incorporated Act 250 Criterion 1(B)?

A7. No. Since the changes that have been made generally result in reduced environmental impacts (e.g. narrowing of construction corridor within sensitive areas), the EPSC Plan provides comparable or improved construction practices and protection of water resources. Therefore, my opinion is that the Project will continue to meet applicable health and environmental conservation department regulations regarding the disposal of waste and does not involve the injection of waste materials into groundwater or wells.

Criterion 1(D) Floodways

Q8. Please describe additional information with respect to floodways that has been gathered by VHB for the Project.

A8. Supplemental mapping has been prepared to evaluate proposed minor revisions to project alignment. See Exhibit Petitioner Supp. JAN-7 (6/28/13).

Q9. Have the number of proposed stream crossings changed in comparison to the 2/28/13 Alignment?

A9. Yes. A total of 22 crossings of streams/rivers with greater than 1.0 square miles watershed area were proposed in the 2/28/13 Alignment. The 6/28/13 Alignment includes 21 crossings. Of these, 14 are unchanged, either with respect to location or proposed crossing type, from the 2/28/13 Alignment, and for the seven which have been revised, supplemental analyses are presented in Exhibit Petitioner Supp. JAN 7 (6/28/13).

Q10. Have additional analyses with respect to flood prone areas been performed?

A10. Yes. At the request of ANR made during a meeting held on June 7, 2013, VHB has evaluated locations or stream segments at which the proposed transmission line is adjacent to a stream/river, but does not cross the water body. These locations include:

- Unnamed Tributary to the LaPlatte River (Hinesburg) – South of Charlotte Rd crossing
- Unnamed Tributary to Lewis Creek (Monkton) – North of Rotax Road crossing
- Unnamed Tributary to Little Otter Creek(Monkton) – Monkton Swamp to Parks-Hurlburt Road
- Little Otter Creek (New Haven)

- Unnamed Tributary to the Little Otter Creek (New Haven) – Town Hill Road crossing, south approximately 1 mile.

Q11. What was the outcome of these analyses?

A11. VHB determined that there are no additional locations where the project alignment will intersect a Fluvial Erosion Hazard ("FEH") associated with a defined stream channel (i.e. not located within a wetland complex), beyond the stream crossings previously identified and evaluated. Put another way, the Project has been designed in a way that avoids the pipeline being located within FEH zones, except where there are necessary stream/river crossing, which have been previously described.

Q12. Do these proposed modifications to the Project change your opinion with respect to the conformance of the project with incorporated Act 250 Criterion 1(D)?

A12. No. The changes that have been made do not result in any changes that would result in additional impacts to floodways. Therefore, my opinion continues to be that the Project will not permanently restrict or divert the flow of flood waters, or endanger the health, safety and welfare of the public or of riparian owners during flooding; and the Project work within a floodway fringe will not increase the peak discharge of the river or stream within or downstream of the Project area or endanger the health, safety, or welfare of the public or riparian owners during flooding.

Criterion 1(E) Streams

Q13. Please describe additional information and analyses completed with respect to the Project's impacts on streams.

A13. Since the 2/28/13 filing, VHB has provided an updated filing to Chris Brunelle, River Management Engineer at the Vermont Department of Environmental Conservation ("VT DEC" or "DEC") on May 3, 2013 with detailed information regarding the proposed stream crossings. This information was provided to all parties in this Section 248 proceeding through a supplemental discovery response by VGS, on May 8, 2013. We have also worked with VT DEC and the U.S. Army Corps of Engineers ("USACE") to assist in their review of the application materials, and to identify additional opportunities for impact avoidance and minimization. As noted above, the Project alignment crosses one less stream than previously proposed (a reduction from 22 to 21 crossings). The resultant updated summary of impacts to streams is provided as Exhibit Petitioner Supp. JAN 7 (6/28/13).

Q14. Has information been provided regarding the design of the Horizontal Directional Drilling ("HDD") crossings?

A14. Yes. On sheet ANGP-T-G-020 of the EPSC Plan Set (See Attachment 1 to Exhibit Petitioner Supp. JAN 9 (6/28/13)), a table has been provided which indicates design criteria that will be used for each HDD location associated with stream, wetland or cultural resource crossings, including:

- Resource width

- HDD length (to avoid resource)
- Elevation below resource (of proposed drill)
- Entry elevation
- Exit elevation

Q15. How will the collateral permits associated with the Project ensure the protection of streams?

A15. The protections built into the EPSC Plan as presented in the INDC, Section 404/401, and Section 248 Stream Alteration review, as well as the types of conditions typically imposed in such permits, will protect streams in the vicinity of the Project.

Q16. Do these proposed modifications to the Project change your opinion with respect to the conformance of the project with incorporated Act 250 Criterion 1(E)?

A16. No. The changes that have been made will not result in additional significant impacts to streams. Therefore, my opinion continues to be that the design and implementation measures, taken in combination with the review and conditional requirements included with Project permitting, will protect the natural condition of streams, and will not result in endangerment to the health, safety, or welfare of adjoining or downstream landowners from stream channel impacts.

Criterion 1(F) Shorelines

Q17. Have there been any changes to the Project since the 2/28/13 filing that would alter your evaluation of the Project under incorporated Act 250 Criterion 1(F) as presented in your prior testimony?

A17. No. None of the Project changes alter the analysis that I have previously described. Therefore, my opinion continues to be that there will be no undue or adverse impacts to shorelines as a result of the Project as specified in Criterion 1(F).

Criterion 1(G) Wetlands

Q18. Please describe additional information and analyses completed with respect to the Project's impacts on wetlands.

A18. Since the 2/28/13 filing, VHB has prepared and filed with VT DEC on May 3, 2013, a Vermont Wetland Permit application and Section 401 Water Quality Certification application for the Project. These applications were provided to all parties in the Section 248 proceeding through a supplemental discovery response by VGS on May 8, 2013. We have also been continuing to work with VT DEC and USACE to assist in their review of the application materials, and to identify any further feasible opportunities for impact avoidance and minimization. These resulting changes are reflected in an updated summary of impacts to class two wetlands and buffers which is provided as Exhibit Petitioner Supp. JAN 4 (6/28/13).

Q19. Have the proposed Class II wetland impacts from the Project changed?

A19. Yes. Impacts have been reduced. From the 2/28/13 plan set, the total Class II wetland impact was 6.68 acres, consisting solely of temporary and secondary impacts (i.e. no permanent fill impacts). Based on the 6/28/13 plan set, the total impacts from the Project will be 5.29 acres. As with the prior plans, direct fill impacts to Class II wetlands will be fully avoided.

Q20. Have the proposed Class II wetland buffer impacts from the Project changed?

A20. Yes. Impacts have been reduced. From the 2/28/13 plan set, the total impact to buffers of Class II wetlands was 6.62 acres, including 0.15 acres of permanent fill impacts. Based on the 6/28/13 plan set, the total impacts from the Project will be reduced to 6.22 acres, including 0.13 acres of permanent buffer fill.

Q21. Do these proposed modifications to the Project change your opinion with respect to the conformance of the project with incorporated Act 250 Criterion 1(G)?

A21. No. The changes that have been made reduce the amount of impact to Class II wetlands and buffers. Therefore, my opinion continues to be that the design and implementation measures, taken in combination with the review and conditional requirements included with the Section 404/401 and Vermont Wetland permitting, will ensure that undue adverse effects to significant Vermont wetlands are avoided.

Criteria 2 & 3 Water Supply

Q22. Have there been any changes to the Project since the 2/28/13 filing that would alter your evaluation of the Project under incorporated Act 250 Criteria 2 & 3 as presented in your prior testimony?

A22. No. None of the Project changes alter the analysis that I have previously described. Therefore, my opinion continues to be that the Project has sufficient water available for its needs and that the Project will not cause an unreasonable burden on existing water supplies.

Criterion 8 RINA, Necessary Wildlife Habitat and Endangered Species

Q23. Please describe additional information and analyses completed with respect to the Project's impacts under Criterion 8.

A23. Since the 2/28/13 filing, Gilman & Briggs Environmental have completed additional Spring 2013 field assessments of potential RTE plant occurrences. This information is provided as Attachments 4 and 5 to Exhibit Petitioner Supp. JAN 2 (6/28/13). We have conducted a springtime field visit with ANR personnel to inspect areas that may comprise forested significant natural communities. As described further below, VHB has also performed an impact analysis to assess both temporary and permanent impacts to RTE plants and significant natural communities. (See Exhibit Petitioner Reb. JAN-2).

Q24. Have the Project impacts on protected species changed?

A24. With respect to animals, the Project will result in no impacts to threatened or endangered species. With respect to plants, since the 2/28/13 filing, additional avoidance and mitigation measures have been undertaken as summarized in Exhibit Petitioner Reb. JAN-2. Also, much more specific and detailed information has been compiled on the locations, extent, and size of existing RTE plant populations. Consistent with my 2/28/13 testimony, no impacts to plants protected under Chapter 123 of Title 10 (threatened and endangered) species will occur as a result of the Project. With respect to rare plants, impacts have been reduced, as a result of the numerous efforts to avoid both temporary (construction phase) and permanent impacts. Of 31 rare plant population occurrences within or immediately adjacent to the Project LOD, no long term impacts are projected to occur at 24 of these, and for only three of these locations (all of the same plant species) do the impacts exceed 20% of the mapped population, with none of these impact amounts being considered undue or having the potential to result in imperilment of this species (See Exhibit Petitioner Reb. JAN-2).

Q25. Have the Project impacts to significant natural communities changed?

A25. Since the 2/28/13 filing, additional avoidance and mitigation measures have been undertaken to protect these areas, as summarized in Exhibit Petitioner Reb. JAN-2. Again, a more detailed evaluation has been performed of Project activities and potential temporary and permanent impacts. Our evaluation of these communities is described in greater detail below, in my responses to the testimony of ANR witness Eric Sorenson. As a result, the permanent Project impacts will be no more than seven percent of any of

the identified significant natural communities, with none of these impact amounts being considered undue or having the potential to result in imperilment of these communities.

Q26. Do these proposed modifications to the Project change your opinion with respect to the conformance of the project with incorporated Act 250 Criterion 8?

A26. No. By incorporating numerous revisions and refinements, the Project will not result in an undue adverse impact, nor imperil, any protected or rare plant species, or significant natural community. Further, given the minimal impact associated with Project activities, we do not believe that further mitigation is warranted.

3. <u>Status of Collateral Permits</u>

Q27. Can you provide an update on the status of the collateral permit applications?

A27. Yes. As I have described above, all applicable collateral permits which were originally filed with VT DEC in December 2012 were re-filed with the individual DEC programs on May 3, 2013, reflecting the alignment revisions made on 2/28/13 and 4/30/13. These collateral permit filings will be updated and filed with DEC to reflect the subsequent minor changes described above, which reduce project impacts further. However, in the meantime, I believe that the DEC programs have sufficient information to review the permit applications that have been filed for the Project.

Q28. Is it uncommon in your experience to have multiple filings to review agencies for a project of this type?

A28. No. For a project of this type, it is very common. As a project undergoes detailed review and as stakeholder concerns are presented, I believe that it is a responsible approach for an applicant to work with reviewers and stakeholders to see if it is possible to make changes to a project, as feasible, to address concerns raised. Additionally, as a project is further defined from an engineering design standpoint, there are certain constructability issues that may come to light. All of these are considerations which have led to the revised alignments and refinements that have occurred. The fact that numerous opportunities have been identified to address concerns, avoid or minimize impacts, or enhance constructability, and that Vermont Gas has worked constructively with those involved to implement changes to the Project alignment where feasible show that the Project is achieving the objectives of the involved permitting programs.

Q29. Have you been in communication with ANR regulators regarding their review of the Project?

A29. Yes. We have conducted several meetings and site visits to explain and review various aspects of the Project, as well as to obtain Agency staff feedback. We have made our staff continuously available to provide additional information and address questions or comments of reviewers as they have arisen. As a result of these communications, as described above, the Project has been modified in many instances to further reduce environmental impacts.

4. Response to ANR Witnesses

Q30. Have you reviewed the testimony of ANR witnesses in this matter?

A30. Yes, I have reviewed the testimony of ANR witnesses Calvi, Popp, Quackenbush and Sorenson.

Q31. Regarding the testimony of Robert Popp at page 4, please explain the difference in protection accorded to rare, threatened and endangered ("RTE") species in Vermont.

A31. Yes. State-listed threatened and endangered species are protected in Vermont pursuant to Chapter 123 of Title 10. Any proposed impacts to such species require a Takings Permit from ANR. Rare species are not regulated under this statute.

Q32. How does this difference apply to the Project?

A32. First, as described previously, all RTE species in the Project Investigation area have been mapped by Art Gilman of Gilman & Briggs Environmental ("GBE"), and this information has been presented previously (see. Attachment 6 of Exhibit Petitioner Supp. JAN-2 (6/28/13)). With one possible exception, the Project has avoided all protected (threatened and endangered) plant and animal species, and therefore no Takings Permit is expected to be required. That possible exception is the potential occurrence of Harsh sunflower, which may occur on a property that VGS does not have landowner permission to access.

No rare animal species will be impacted by the Project. Further, all feasible efforts have voluntarily been made to avoid rare plant species. We have recently prepared a summary of all RTE occurrences (including the size of each population), mitigation measures and proposed potential unavoidable permanent impacts (see Exhibit Petitioner Reb. JAN-2). Given the degree of avoidance and impact mitigation that has been accomplished with respect to both the construction and operational phases of the project, we conclude that the Project's impact to rare plants is not undue.

Q33. Please address Mr. Popp's comment at pp. 5-6 regarding the completion of RTE inventories.

A33. To the extent that property owner permission has been obtained, all resource inventories, including RTE surveys, have been completed. This is summarized in our Natural Resources Supplemental Memorandum (See Exhibit Petitioner Supp. JAN-2 (6/28/13)). No further resource information is anticipated to be available for the Project during the permitting/review phase. Should Harsh sunflower be found on the parcel once site access is available for inventory work, avoidance or permitting would need to be completed prior to project construction.

Q34. Please address Mr. Popp's comment at pp. 9-10 regarding the placement of matting over rare plants for more than five consecutive days during the growing season.

A34. As described in the supplemental testimony of John Heintz, the Project cannot commit to restricting the duration of mat placement in such locations for this duration. However, to

minimize potential impacts, the Project's EPSC plan has been modified to specify that the duration of mat placement in resource areas be minimized. See Attachment 1 to Exhibit Petitioner Supp. JAN 9 (6/28/13), at Sheet ANGP-T-C-011. As such, and from review of post-construction revegetation of similar wetland areas matted during construction (e.g. VELCO's Northwest Reliability Project), it is my opinion that with adherence to the EPSC plan, vegetation, including those rare plants that would be matted, would successfully re-establish.

Q35. Please address Mr. Popp's comment at page 12 and Mr. Sorenson's comment at page 24 regarding the need for post-construction restoration plans for specific areas of the Project.

A35. At the request of ANR, VGS has engaged VHB to prepare a Post-Construction Restoration Plan which has been incorporated as notes in the EPSC plan set. See Attachment 1 to Exhibit Petitioner Supp. JAN 9 (6/28/13) at Sheet ANGP-T-C-011. Specifically, this plan provides that for natural resource areas such as significant natural communities, RTE plant vicinities, wetlands, and stream buffers, specific site restoration protocols have been provided to facilitate restoration beyond routine EPSC stabilization. This includes the types of seeding (where applicable) and mulching (where applicable) to be performed, as well as any other special treatments.

Q36. Please address Mr. Popp's comment at page 13 and Mr. Sorenson's comment at page 24-25 regarding non-native invasive species.

A36. At the request of ANR, VGS has engaged VHB to prepare a non-native invasive species plan, which is included as a component of the Vegetation Management Plan. See Exhibit Petitioner Reb. JAN-1. VGS has agreed to monitor for and remove newly-found invasive species that enter the project area in the vicinity of wetlands, significant natural communities, stream buffers, and RTE plants, where there is project-related disturbance, as specified in the plan. However, it is important to recognize that much of the Project corridor is currently (pre-Project) inhabited by numerous invasive species, and other species are colonizing the area on an ongoing basis, therefore it is not possible for VGS to eradicate these. Further, to the extent that new infestations which may occur post-project are associated with a broader areal occurrence, control of such occurrences would be beyond the ability of VGS to control.

Q37. With respect to the testimony of Alan Quackenbush at A19, do you believe that the materials previously presented constitute a complete application for the purposes of DEC Wetland program review?

A37. Yes. The VWP and 401 applications were originally filed with DEC on December 20, 2012. These applications were updated on May 3, 2013 reflecting the re-alignments described previously as the 4/30/13 Alignment. In our initial filing we presented an overall Project permitting schedule, including collateral permits (See Exhibit Petitioner Supp. JAN-3 (2/28/13)), which remains valid. Additionally, we have conducted meetings and site visits with wetland program personnel in the context of these applications. The materials previously provided in these two filings with DEC are complete, and we would

urge DEC wetlands personnel to expeditiously review these applications and provide any further comments they may have.

Q38. Please comment on Mr. Quackenbush's testimony at A20, requesting that additional re-examination of avoidance/minimization measures might be accomplished, including relocation of the alignment parallel to roads, and reducing the construction width through wetlands and significant natural communities.

A38. Please see the testimony of John Heintz and Exhibit Petitioner Supp. JAN-13 (6/28/13) for a discussion of why additional relocation of the alignment adjacent to roads is not feasible, based on stakeholder/community input. With respect to narrowing, we have comprehensively re-reviewed the entire project alignment, including all wetland and natural community vicinities with an eye toward additional narrowing opportunities, and have identified 34 such locations, which are now incorporated to the current EPSC Plan set. As noted above, this further reduces wetland and buffer impacts associated with the Project.

Q39. Please comment on Mr. Quackenbush's testimony at A24, suggesting that ANR may request seasonal limitations on construction due to breeding birds.

A39. As described previously, there are no RTE animal species (including birds) within the Project corridor. I am not aware of the Board imposing such a sweeping limitation on construction practices, particularly where no protected species are involved. As described in the testimony of John Heintz, there are many complex and overlapping

constraints that impact the sequence and timing of construction of a linear pipeline project such as this. Introducing this type of seasonal limitation which would preclude project construction for 60 to 90 days during the prime earthwork season in Vermont (i.e. no frozen soil and challenging EPSC implementation) would be highly problematic, and as described by John Heintz, create major disruption of project schedule and cost. Therefore, I do not believe such a limitation is appropriate or warranted.

Q40. Please comment on the testimony of ANR witness Eric Sorenson at A7 regarding his proposed determination of RINA areas associated with the Project.

A40. We do not agree that all of the areas cited by Mr. Sorenson qualify to be determined by the Board to be RINA, as explained below.

Q41. Please review the first site identified by Mr. Sorenson, and your response in consideration of the proposed Project design and associated impacts.

A41. With respect to the Pine-Oak-Heath Sandplain Forest in Colchester and Essex, which is designated by ANR as an S1, or extremely rare natural community, we agree that this area is appropriate to be considered RINA. However, several mitigating factors need to also be considered with respect to the extent and existing quality of this natural community. First, the project passes through or adjacent to four small patches of this community type based on VHB field assessments and GIS mapping provided by ANR. Starting at the north, the project passes along the edge of a small patch of this community type at MP 0.85 to MP 0.95. The overall size of this patch is 16 acres, and the project

would affect approximately 0.32 acres (permanent impact only), at the edge of the forested patch, representing approximately 2% of the area.

The second area is from MP 1.07 to 1.3 where the project would cross a patch of this community type of fair quality (C ranking), which currently features numerous off-road vehicle tracks, solid waste disposal areas, and other human disturbances. The project would permanently impact approximately 1.18 acres of this 43 acre block, or about 2.7%.

The third area, from MP 1.36 to MP 1.46 is ranked as a good quality sandplain forest (B ranking), and VGS has proposed to cross this area using HDD to avoid construction phase soil disturbance. A reduced width corridor is also proposed for the operational phase of the project to minimize ongoing impacts (See Exhibit Petitioner Reb. JAN-1). The permanent impact due to the Project would be 0.57 acres.

The fourth and final forested patch is located at MP 1.65 to 2.0. This is also a good quality example of this community type, and the project has made efforts to avoid and minimize impacts, including locating the pipeline alignment along the edge of the patch where possible and reducing the construction width. As a result, the project would permanently impact 1.61 acres of this 24 acre patch, or approximately 6.7% of the area.

Q42. What will the permanent clearing width be through these sandplain areas?

A42. For the four areas where the Project alignment passes through a patch of sandplain, the permanent cleared width of the corridor will be 50 feet. However, to minimize the impact on this community, a special vegetation management detail involving a "feathered" edge treatment will be implemented, as described in my direct testimony as well as the vegetation management plan (See Exhibit Petitioner Reb. JAN-1). The idea here is that the permanent cleared/mowed corridor would be reduced to only 20 feet wide, with 15 feet on either side of this corridor to be allowed to regenerate as shrub/tree growth with progressively greater heights maintained closer to the edge of the corridor. This will allow for the necessary aerial observation of the pipeline corridor, as explained by Marc Teixeira, since the pipeline alignment would not be obscured by tree canopy. At the same time, this technique ensures that the loss of forest cover is minimized to the degree feasible.

Q43. Do you believe these impacts are undue?

A43. No. As I have described above, the Project has made significant efforts to minimize impacts from construction and operation of the pipeline, while continuing to meet the overall purpose. Additionally, the narrow openings that will remain would more or less mimic natural openings in this type of forest, which are compatible with continued maintenance of forest cover and in fact provide opportunities for rare species to colonize. Therefore, I would not consider the Project impacts to be undue nor imperil the ongoing viability of this natural community.

Q44. Please comment on Mr. Sorenson's discussion at pp. 15-16 regarding the Wet Clayplain Forest at the LaPlatte River in Hinesburg.

A44. At MP 19.2-19.4, the Project passes adjacent to an area (18 acres) of wet clayplain forest (ranked as S2) which is currently bisected by an existing VELCO corridor. We are not aware that the Board or another tribunal has found this community type to be RINA. In fact there are numerous efforts around the Champlain Valley to restore clayplain forest, suggesting that it is not "irreplaceable." However, we do agree that this community constitutes a state significant natural community, and the Project alignment has been planned accordingly.

Q45. Will the Project impact this area?

A45. The Project has been designed to minimize impacts to this feature. The pipeline alignment is 10 feet within the existing, cleared VELCO corridor and as described in the supplemental testimony of John Heintz, construction type 2D (and type W) will be used, which results in a narrowed work corridor to minimize clearing. Additionally, the area of permanent clearing amounts to a ten foot wide swath at the edge of the western edge of the VELCO corridor, which would also be maintained in a "feathered" configuration. This area in its current state is partially cleared due to the irregular forested edge along the VELCO ROW. Given these protections, the Project will not adversely impact this feature.

Q46. Please respond to Mr. Sorenson's discussion at pp. 16-17 regarding the Wet Clayplain Forest at Lewis Creek in Hinesburg.

A46. Again, we do not believe this community type has been generally regarded as RINA. With respect to this specific location, at MP 22.85 to 22.97, the pipeline alignment again is located 10 feet within the VELCO corridor, a measure specifically proposed by Vermont Gas to minimize clearing of forest cover. This entire area (including the Lewis Creek crossing) will be drilled using HDD, thus avoiding soil disturbance. A ten foot width of clearing, to be maintained as a feathered edge, is proposed immediately west of the existing 150 foot wide cleared VELCO ROW. We do not believe that this area constitutes a wet clayplain forest type, as the initial natural community survey in this location did not identify it as the type, and if it does occur, is likely more accurately mapped further west of the VELCO corridor. However, no landowner permission is currently available at this time so the absence of this feature cannot be conclusively verified by ANR.

Q47. Will the Project impact this area?

A47. As described above, the Project has been designed to minimize impacts to this feature. The strip of permanent clearing at the western edge of the VELCO corridor is likely to be maintained as a feathered edge if found to be this community type, and is an area which is currently partially cleared due to the irregular forested edge along the VELCO ROW. Post-construction management of this area is subject to coordination with the Vermont

Land Trust, however. Given these protections, the Project will not adversely impact this feature, should it be determined that it is indeed a wet clayplain.

Q48. Please address Mr. Sorenson's comments at pp. 17-18 regarding the Wet Clayplain Forest south of Rotax Road in Monkton.

A48. At this location (MP 24.66 to 24.77), the permanent and temporary cleared corridor are entirely within the existing agricultural field. Since we do not have access to this property, we are providing a georeferenced photograph, taken from the South (at Bailey parcel property line) with the project alignment superimposed (See Exhibit Petitioner Reb. JAN 3 (6/28/13)). This photograph documents that the Project would not result in any impact to this feature, therefore relocation of the alignment as suggested by Mr. Sorenson is not warranted.

Q49. Please respond to Mr. Sorenson's discussion at pp. 18-20 regarding the Northern White Cedar Swamp and Cattail Marsh within the Mt. Florona (Monkton) Swamp.

A49. Mr. Sorenson has requested information on the depth of the peat layer. Preliminary field data was obtained by VHB and is provided as Attachment 6 to the Natural Resources Supplemental Memorandum (Exhibit Petitioner Supp. JAN-2 (6/28/13)). As described in the testimony of John Heintz, the Project has been designed to avoid or minimize impacts to this feature through the use of HDD, which will be at a depth below the unconsolidated layer as is known from a survey of the former alignment in the swamp. Additionally, the Project proposes the implementation of a vegetation management plan which would

involve feathering or no clearing of vegetation over the HDD within these natural communities within the swamp.

Q50. Will the Project impact this area?

A50. As described above, and in the testimony of John Heintz and Marc Teixeira, the Project has been designed to minimize impacts to this feature. Given these protections, the Project will not adversely impact these natural communities.

Q51. Please respond to Mr. Sorenson's discussion at pp. 20-22 regarding the Red/Silver Maple-Green Ash Swamp at the Monkton-New Haven town line.

A51. The project alignment is located 10 feet within the VELCO corridor, and passes adjacent to this feature at MP 31.11 to 31.54. This community is not rare and is considered "S3", and we do not believe that it warrants designation as a RINA.

Q52. Will the Project impact this area?

A52. The Project has been designed to minimize impacts to this feature. The pipeline alignment is 10 feet within the existing, cleared VELCO corridor and will utilize construction types 2D and W, which result in a narrowed work corridor to minimize clearing. The area of permanent clearing amounts to a ten foot wide swath at the edge of the western edge of the VELCO corridor, to be maintained as a feathered edge, and is in an area which is currently partially cleared due to the irregular forested edge along the

VELCO ROW. Given these protections, the Project will not adversely impact this feature.

Q53. Please address Mr. Sorenson's comments at pp. 22-23 regarding the Wet Clayplain Forest at Little Otter Creek in New Haven.

A53. Again, we do not believe this community type has been generally regarded as RINA. With respect to this specific location, at MP 32.1 to 32.34, the pipeline alignment again is located 10 feet within the VELCO corridor and will utilize construction types 2D and W, which result in a narrowed work corridor, where feasible, to minimize clearing. This additional narrowing has been added to the most recent EPSC plan set in direct response to the suggestion of Mr. Sorenson. These measures have been specifically proposed by Vermont Gas to minimize clearing of forest cover. A ten foot swath of clearing, to be maintained as a feathered edge, is proposed immediately west of the VELCO ROW for operational purposes.

Q54. Will the Project impact this area?

A54. As described above, the Project has been designed to minimize impacts to this feature. Given these protections, the Project will not adversely impact this feature.

5. Response to Landowner Witnesses

Q55. Have you reviewed the testimony of Palmer witnesses Heather Darby and Craig Heindel?

A55. Yes I have.

Q56. Do you have any comments on the testimony of Heather Darby at A6 that "severe soil disturbance such as that created by VGS during the construction of the pipeline is the equivalent of an earthquake, hurricane, tornado, and forest fire occurring simultaneously to the world of soil organism"?

A56. Yes. I find Ms. Darby's characterization to be absurd. Excavations are conducted routinely in Vermont for water lines, power lines, sewer lines, culverts, etc. which differ little from the proposed pipeline here. However, this Project differs in one important way, in that a topsoil segregation procedure will be implemented for segments within agricultural lands or wetlands, including the Palmer lands (See Attachment 1 to Exhibit Petitioner Supp. JAN-9 (6/28/13), Sheet ANGP-EPSC-051). In the context of the Project, the Vermont Agency of Agriculture and other agricultural intervenors have agreed to specific practices for construction on agricultural lands, which include the proposed topsoil segregation procedure, to protect the agricultural value of these soils (See Ag. Interests VGS MOU, dated June 13, 2013). I would further note that the width of the excavated trench for pipeline installation (to be restored per the above referenced protocol) will be only five feet, which is a far cry from the widespread destruction alleged by Ms. Darby.

Q57. Please comment on the testimony of Craig Heindel at A10 that the construction of the Project "will increase the amount of groundwater or surface water flowing onto or discharging at specific locations" on the Palmer property.

A57. Mr. Heindel does not mention in his testimony that the Project EPSC Plan includes the use of "trench breakers" at specified intervals along slopes and adjacent to wetlands. This detail and the trench breaker spacing is provided on Sheet ANGP-T-G-015 of the EPSC Plan set (Details 3 and 4 respectively) (see Attachment 1 to Exhibit Petitioner Supp. JAN 9 (6/28/13)). As also described in the testimony of John Heintz, the purpose of the trench breakers is to prevent the pipeline trench altering the existing patterns of water movement and acting as a conduit for the movement of groundwater or surface water, in the manner described by Mr. Heindel. Therefore, I have no reason to believe that there will be any perceptible change to existing patterns of surface water or groundwater movement on the Palmer parcel.

6. Conclusion

Q58. Please comment on the overall impact of the Project on the environmental resources you have evaluated.

A58. As a result of the extensive efforts by the Project team to plan and design the Project, in consideration of significant stakeholder input, in a manner that fully considers the protection of the natural environment, the resultant impacts of the Project to natural resources will be minimal. The process began with the comprehensive identification and mapping of natural resource elements within a broad investigation corridor so that a complete understanding of constraints could be developed, and the Project alignment could be defined. Throughout this entire process extensive coordination has occurred with state and federal regulatory agencies to understand and where possible, address

concerns, through minor refinements of the Project alignment. Also, in many cases, specialized (and more costly) construction techniques such as the use of HDD or narrowing of the construction corridor width, have been made to further reduce impacts.

Q59. Does this conclude your testimony?

A59. Yes.

14318438.1

TO: Tim Duggan, Esq., Department of Public Service ("DPS")
FROM: Debra L. Bouffard, on behalf of Vermont Gas Systems, Inc. ("VGS")
DATE: June 21, 2017
RE: Docket 7970, Non-Substantial Change Determination
VGS Supplemental Responses to DPS Informal Information Requests

1. Please confirm that Vermont Gas commits to performing the actions memorialized in the April 25, 2017 letter from VELCO to Vermont Gas included as Attachment 1 to the filing.

   RESPONSE: Yes, Vermont Gas commits.

2. With respect to Bullet 1 of Attachment 1, please explain what portion of the May 25, 2016 Mott McDonald engineering analysis applies to the area described in the Vermont's Gas's June 2 Non-Substantial Change Request. That is, the analysis describes areas where the pipe is in different soil types at different depths. What soil type is present in the area described in the Vermont's Gas's June 2 Non-Substantial Change Request.

   RESPONSE: The soil type present is silts with high plasticities.

   SUPPLEMENTAL RESPONSE: The design drawings listed soil type LK (Livingston clay – flooded), **which would fall into the same category as the estimated soil type. Mott McDonald utilized the most conservative soil type and fully saturated soils in calculating their original analysis.**

3. With respect to Bullet 2 of Attachment 1, please describe the process for revising the as-built drawings and explain when the revisions to the as-built drawings will be completed.

   RESPONSE: The actual depths will be incorporated as part of the final as-builts. Since the as-builts have not been issued, there is no update required. The final as-builts will simply incorporate the actual depths.

4. With respect to Bullet 2 of Attachment 1, please confirm that the additional yellow location markers have been installed.

   RESPONSE: Confirmed, the location markers were installed during winter 2016/17.

   SUPPLEMENTAL RESPONSE: In the ordinary course of operations, markers are placed according to DOT code 49 CFR 192.707 at road and rail crossings and "wherever necessary to identify the location of the transmission line or main to reduce the possibility of damage or interference". Consistent with the agreement with VELCO set forth in the April 25, 2017 VELCO letter, VGS installed additional yellow location markers in the area of the VELCO ROW where the pipe is not installed at 4' of depth. These additional yellow location markers are placed approximately fifty feet.

5. With respect to Bullet 3 of Attachment 1, please explain Vermont Gas's inspection plans after the first two years. Please also explain the action Vermont Gas will take if back-filled material has settled in a manner that reduces the depth of cover to less than 3 feet

RESPONSE: The standard is to meet HS20+15% loading. Should settling occur during routine (quarterly) surveys, a calculation to determine conformity with HS20+15% will be made to determine next steps. As with any erosion issue, the actual mitigation strategy will depend on the situation encountered. Some erosion situations only require the stream bed to be rebuilt with additional stone. Others may require check dams, or possibly, but infrequently, require a new pipe to be installed.

6. What protocols will Vermont Gas have in place to ensure safety when/if any particularly heavy equipment is brought on the right of way in the area described in the Vermont's Gas's June 2 Non-Substantial Change Request.

RESPONSE: Any heavy equipment would only be brought onto this location by VELCO or VGS. The gas line is installed just off the tree line on the western edges of the ROW, thus reducing the potential for vehicle travel. The majority of heavy vehicle use would occur to the east of the natural gas transmission line. Should VELCO or VGS require travel across the natural gas transmission line in this area, VGS would treat it like any other location of its transmission line and evaluate the need for additional protection and facilitate the installation of a temporary mat bridge over the pipeline to allow vehicles to traverse as needed. Velco and VGS have entered into an Operating agreement that provides additional collaboration and protection including:

> **"Each year , Prior to VGS conducting its routine ROW maintenance activities and no later than April 1st, the parties will meet in Rutland or by teleconference and review and coordinate then known VGS and VELCO ROW maintenance activities anticipated fro that calendar year."**

In the event of an emergency, VGS will be notified and will coordinate with VELCO should any assistance be required:

> **"In the case of an emergency related to VELCO's electric transmission line(s), VELCO shall immediately notify VGS Gas Control at 802-951-0337 and VGS shall suspend all work until VELCO notifies VGS that the emergency has been resolved."**

In our general course of business, we will notify each other should we see anything out of the ordinary that may be of concern:

> **"VGS and VELCO shall provide each other prompt notice for any out of the ordinary events or activities including, but not limited to adverse landowner**

interaction/claims, that have the potential to impact the other Party's operations in the VELCO ROW."

7. Finding 273 of the December 23, 2013 Final Order in Docket No. 7970 states: "VGS will also develop and implement a plan to monitor for and mitigate occurrence of unstable soil and ground movement and if observed conditions indicate the possible loss of cover, perform a depth of cover study, and replace cover as necessary to restore the depth of cover or apply alternative means to provide protection equivalent to the originally required depth of cover for both transmission and distribution pipes. Berger reb. pf. at 9." Please provide this plan, describe the current state of implementation, and explain how it will be implemented in the area described in the Vermont's Gas's June 2 Non-Substantial Change Request.

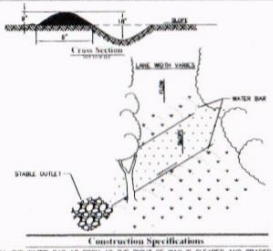
RESPONSE: VGS patrols the natural gas transmission line in accordance with VGS' Operations and Maintenance Procedure for Patrolling System (see attached). The program was modified for the ANGP line to incorporate quarterly patrols. The first patrol was conducted in May 2017. As noted in item 5 above, the actual mitigation steps would be designed for the erosion or loss of cover found in a specific location.

Supplemental Question

8. Are there other depth of cover issues, e.g., with stream beds?

RESPONSE: VGS is unaware of any other depth of cover issues, including stream beds. By way of background, the plans submitted for the CPG showed design plans for 18 specific streams with each stream listed individually and the specified depth requirement (see ANGP-1-G-017) titled "Open trench stream crossing – typical section" and "Horizontal directional drill (hdd) stream crossing – typical section," all of which were denoted by "FEH" (Fluvial Erosion Hazard). The two tables indicate that all fluvial streams are to be installed at depth of 7' or greater. The depth of cover at these fluvial streams is at least 7' feet. There are other minor and inconsequential stream crossings that are non-fluvial and were not specifically listed in the plans.

When a depth of cover table was created to assist the construction contractors, the non-fluvial stream depth was listed at 5' since no depth of cover for this type of stream was specified in any plans. VGS opted to require the contractor to install the pipe in these non-fluvial stream crossings at 5' rather than the 3' required by code.

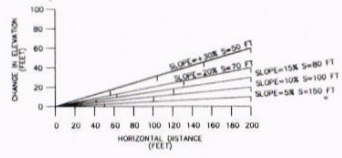


Construction Specifications

1. INSTALL THE WATER BAR AS SOON AS THE RIGHT OF WAY IS CLEARED AND GRADED.
2. DISK OR STRIP THE SOD FROM THE BASE FOR THE CONSTRUCTED RIDGE BEFORE PLACING FILL.
3. TRACK THE RIDGE TO COMPACT IT TO THE DESIGN CROSS SECTION.
4. THE OUTLET SHALL BE LOCATED ON AN UNDISTURBED AREA. FIELD SPACING WILL BE ADJUSTED TO USE THE MOST STABLE OUTLET AREAS. OUTLET PROTECTION WILL BE PROVIDED WHEN NATURAL AREAS ARE NOT ADEQUATE.
5. FOR PERMANENT WATER BARS, VEHICLE CROSSING SHALL BE STABILIZED WITH GRAVEL. EXPOSED AREAS SHALL BE SEEDED AND MULCHED. FOR TEMPORARY WATER BARS, VEHICLE CROSSING SHALL BE COMPACTED AND MAINTAINED PER THESE SPECIFICATIONS. FOLLOWING THEIR USE, WATER BARS SHALL BE REGRADED TO MATCH PRE-CONSTRUCTION CONDITIONS. TOPSOIL SHALL BE RE-APPLIED THEN ALL AREAS OF EXPOSED SOIL SHALL BE FULLY STABILIZED PER THE EPSC PLAN.
6. INSPECT WATER BARS FOR EROSION DAMAGE AND SEDIMENT. CHECK OUTLET AREAS AND MAKE REPAIRS AS NEEDED TO RESTORE OPERATION.
7. SPACING:

SLOPE (%)	SPACING (FT)
<5	125
5-10	100
10-20	75
20-25	50
>35	25

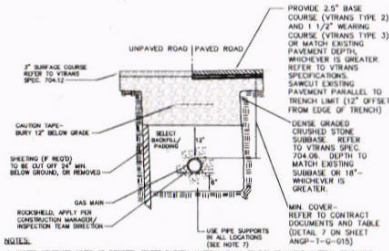
1 Water Bars 10/13
NTS — Source: Vermont Standards and Specs for EPSC 2006 — LD_



NOTE: S = TRENCH BREAKER SPACING

NOTES:
1. PERMANENT TRENCH BREAKER SANDBAGS SHALL NOT BE FILLED WITH TOPSOIL.
2. SPACINGS SHOWN ARE RECOMMENDED MINIMUM GUIDELINES. OSPC REPRESENTATIVE MAY ADJUST SPACING IN THE FIELD WITH PRIOR WRITTEN APPROVAL OF OWNER.
3. ONE TRENCH BREAKER IS REQUIRED AT ALL STREAM BANKS AND AT WETLAND BOUNDARIES.

2 Permanent Trench Break Spacing Guideline 12/12
NTS — Source: CHA — LD_



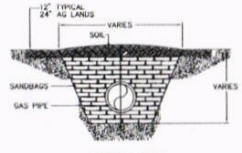
NOTES:
1. UNLESS OTHERWISE NOTED OR DIRECTED, SELECT BACKFILL MATERIAL SHALL CONSIST OF NATIVE MATERIAL CONTAINING STONES NO LARGER THAN 1.5" IN THE LONGEST DIMENSION. A SHAKER BUCKET OR SCREEN MAY BE USED IF NATIVE MATERIAL IS TOO LARGE. SAND MAY BE REQUIRED FOR SELECT BACKFILL IF DIRECTED BY CONSTRUCTION MANAGER/ INSPECTION TEAM.
2. IN AREAS OF ROCK OR UNSUITABLE SOILS OR AS DETERMINED BY CONSTRUCTION MANAGER, PIPE SHALL BE BEDDED WITH COMPACTED SELECT BACKFILL. WHEN NATIVE MATERIALS ARE UNSUITABLE FOR BACKFILLING, AS DIRECTED BY CONSTRUCTION MANAGER, CONTRACTOR SHALL BACKFILL WITH COMPACTED SAND TO 12" ABOVE TOP OF PIPE. THE REMAINING TRENCH SHALL BE BACKFILLED WITH AN APPROVED MATERIAL.
3. IN RESOURCE AREAS (E.G. WETLANDS AND FAS AREAS) GENERAL BACKFILL SHALL BE NATIVE MATERIAL TO MATCH PROFILE DEPTH OF ADJACENT NATIVE, UNDISTURBED SUBSOIL/SUBPAVE SOIL INTERFACE. EXCESS SUBSOIL TO BE PROPERLY DISPOSED OF AND STABILIZED.
4. THE OWNER SHALL PROVIDE TESTING SERVICES TO INSURE THAT THE IN-PLACE DENSITY OF THE BACKFILL MEETS REQUIREMENTS DETERMINED IN THE SPECIFICATIONS.
5. ALL TRENCH CONSTRUCTION SHALL CONFORM TO APPLICABLE FEDERAL, STATE AND LOCAL REGULATIONS.
6. CONTRACTOR SHALL ENSURE BACKFILL IS PLACED/COMPACTED IN 12" (MAX) LIFTS ABOVE THE PIPE.
7. PROVIDE SUPPORTS IN ALL LOCATIONS (PIPE PILLS, STACKED SAND BAGS, OR OWNER APPROVED EQUAL). SUPPORTS SHALL BE SECURE AND STABLE AND ADEQUATE TO SUPPORT PIPE DURING LOWERING AND BACKFILL OPERATIONS.

3 Typical Trench Detail-Roadways and Driveways 11/14
NTS — Source: CHA — LD_

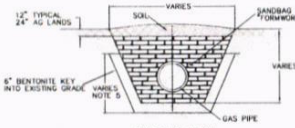
CHA PLAN SHEET #	TOWN	PROJECT COMPONENT	PLANT ID CODE	STATE RANK	MATTING LOCATIONS (STATION)
ANGP-EPSC-014	MILLISTON	TRANSMISSION (ACCESS ROAD)	2012-RTE-CT-03 1	S2/S3	368+50 TO 368+75 AND ON ACCESS ROAD
ANGP-EPSC-022	MILLISTON	TRANSMISSION	2012-RTE-CT-08 4	S2/S3	562+50 TO 563+75
ANGP-EPSC-029	HINESBURG	TRANSMISSION	2012-RTE-CT-08 0	S2/S3	992+80 TO 993+50
ANGP-EPSC-029	HINESBURG	TRANSMISSION	2012-RTE-CT-08 1	S2/S3	1001+20 TO 1002+20
ANGP-EPSC-029	HINESBURG	TRANSMISSION	2012-RTE-CT-08 2	S2/S3	1003+90 TO 1005+80
ANGP-EPSC-040	HINESBURG	TRANSMISSION	2012-RTE-CT-04 1	S2/S3	1021+20 TO 1023+00
ANGP-EPSC-051	MONKTON	TRANSMISSION	2012-RTE-ACT-0 83	S2/S3	1302+10 TO 1307+90
ANGP-EPSC-066	NEW HAVEN	TRANSMISSION	2012-RTE-CT-05 1	S2/S3	1649+50 TO 1652+00
ANGP-EPSC-066	NEW HAVEN	TRANSMISSION	2012-RTE-CT-06 1	S2/S3	1660+50
ANGP-EPSC-066	NEW HAVEN	TRANSMISSION	2012-RTE-AT-05 1	S1	1658+60
ANGP-EPSC-066	NEW HAVEN	TRANSMISSION	2012-RTE-LY-05 1	S2	1658+60
ANGP-EPSC-066	NEW HAVEN	TRANSMISSION	2012-RTE-AT-06 1	S1	1669+70 TO 1670+80
ANGP-EPSC-075, 076, 077	NEW HAVEN	TRANSMISSION	2012-RTE-CT-06 2	S2/S3	1918+00 TO 1966+50
ANGP-EPSC-V011	FERRISBURGH	DISTRIBUTION MAIN	2012-RTE-CT-06 6	S2/S3	118+80 TO 119+10

Notes:
1. INSTALL CONSTRUCTION MATS ON STATION LOCATIONS LISTED IN TABLE TO PROTECT RARE PLANT SPECIES.
2. LIMIT DURATION OF MATTING DURING GROWING SEASON TO EXTENT PRACTICABLE.
3. REMOVE MATTING IMMEDIATELY FOLLOWING THEIR USE. FOR EXAMPLE, WHERE MATTING IS USED FOR TEMPORARY STOCKPILING OF SOIL FROM TRENCHING OPERATIONS, REMOVE MATTING IMMEDIATELY FOLLOWING BACKFILL OPERATIONS.
4. AT A MINIMUM, MATTING IS NOT TO BE LEFT IN PLACE FOR MORE THAN 28 DAYS WHERE FEASIBLE.
5. REFER TO ADDITIONAL ENVIRONMENTAL NOTE 12 ON SHEET ANGP-T-G-011

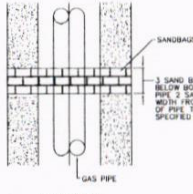
4 RTE Matting Table 09/13
NTS — Source: VHB



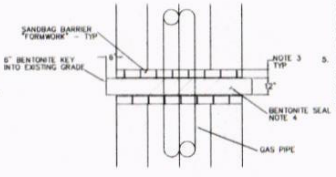
PROFILE VIEW



PROFILE VIEW



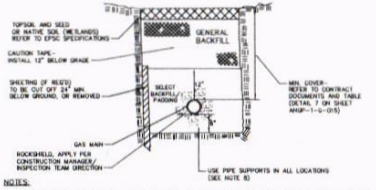
PLAN VIEW
SAND BAG TRENCH BREAKER



PLAN VIEW
TRENCH BREAKER WITH BENTONITE

NOTES:
1. PERMANENT TRENCH BREAKER WITH BENTONITE SEAL IS INTENDED TO PROHIBIT WATER FLOW THROUGH THE BREAKER.
2. PERMANENT TRENCH BREAKER WITH BENTONITE SEAL TO BE INSTALLED AT EDGE OF WETLANDS AND STREAMS.
3. SAND BAG BARRIER WIDTH SHALL BE MINIMUM 1 BAG WIDE, AND/OR AS FIELD DETERMINED TO PROVIDE STABILITY.
4. BENTONITE IS TO BE INSTALLED IN THE VOID SPACE BETWEEN THE SANDBAG BARRIER "FORMWORK" IN SUCH A MANNER TO COMPLETELY SURROUND THE PIPE AND FILL THE VOID FROM THE BOTTOM OF THE TRENCH TO A HEIGHT 6" ABOVE THE LEVEL OF IMPORTED PADDING MATERIAL WHICH IS INSTALLED ON THE EXTERIOR SIDE OF THE SANDBAG BARRIER IN THE WETLAND ZONE.
5. AFTER BENTONITE PLACEMENT, INSTALL SAND BAGS ON TOP OF THE PERMANENT TRENCH BREAKER AND BENTONITE SEAL TO THE REQUIRED HEIGHT PER DETAIL 2, AND BACKFILL EXTERIOR SIDES OF SAND BAG BARRIERS.

5 Permanent Trench Break or Sandbags 12/12
NTS — Source: CHA — LD_



NOTES:
1. UNLESS OTHERWISE NOTED OR DIRECTED, SELECT BACKFILL MATERIAL SHALL CONSIST OF NATIVE MATERIAL CONTAINING STONES NO LARGER THAN 1.5" IN THE LONGEST DIMENSION. A SHAKER BUCKET OR SCREEN MAY BE USED IF NATIVE MATERIAL IS TOO LARGE. SAND MAY BE REQUIRED FOR SELECT BACKFILL IF DIRECTED BY CONSTRUCTION MANAGER/ INSPECTION TEAM.
2. UNLESS OTHERWISE NOTED OR DIRECTED, GENERAL BACKFILL MATERIAL SHALL CONSIST OF NATIVE MATERIAL CONTAINING NO STONES OR CLODS LARGER THAN 3" IN THE LONGEST DIMENSION.
3. IN AREAS OF ROCK OR UNSUITABLE SOILS OR AS DETERMINED BY CONSTRUCTION MANAGER, PIPE SHALL BE BEDDED WITH COMPACTED SELECT BACKFILL. WHEN NATIVE MATERIALS ARE UNSUITABLE FOR BACKFILLING, AS DIRECTED BY CONSTRUCTION MANAGER, CONTRACTOR SHALL BACKFILL WITH COMPACTED SAND TO 12" ABOVE TOP OF PIPE. THE REMAINING TRENCH SHALL BE BACKFILLED WITH AN APPROVED MATERIAL.
4. IN RESOURCE AREAS (E.G. WETLANDS AND FAS AREAS) GENERAL BACKFILL SHALL BE NATIVE MATERIAL TO MATCH PROFILE DEPTH OF ADJACENT NATIVE, UNDISTURBED SUBSOIL/PUMPKIN SOIL INTERFACE. EXCESS SUBSOIL TO BE PROPERLY DISPOSED OF AND STABILIZED.
5. THE OWNER SHALL PROVIDE TESTING SERVICES TO INSURE THAT THE IN-PLACE DENSITY OF THE BACKFILL MEETS REQUIREMENTS DETERMINED IN THE SPECIFICATIONS.
6. ALL TRENCH CONSTRUCTION SHALL CONFORM TO APPLICABLE FEDERAL, STATE AND LOCAL REGULATIONS.
7. CONTRACTOR SHALL ENSURE BACKFILL IS PLACED/COMPACTED IN 12" (MAX) LIFTS ABOVE THE PIPE.
8. PROVIDE SUPPORTS IN ALL LOCATIONS (PIPE PILLS, STACKED SAND BAGS, OR OWNER APPROVED EQUAL). SUPPORTS SHALL BE SECURE AND STABLE AND ADEQUATE TO SUPPORT PIPE DURING LOWERING AND BACKFILL OPERATIONS.

6 Typical Trench Detail-Cross Country 11/14
NTS — Source: CHA — LD_

PIPELINE MINIMUM COVER REQUIREMENTS	
AREA	COVER
VELCO ROW OR ROW ACCESS POINT	4'
VTRANS ROW*	4'
AG AREAS*	4'
PAVED AREAS	3'
BOTTOM OF DITCHLINE	4'
STREAMS	5' MIN. UNLESS OTHERWISE NOTED ON SHEET ANGP-T-G-017
ALL OTHER AREAS*	3'

*UNLESS OTHERWISE NOTED ON APPROVED PERMIT PLANS OR CONSTRUCTION LINE LIST

7 Typical Minimum Cover of Pipeline 11/14
NTS — Source: CHA — LD_

DWG. NO.	REFERENCE DWG.	REV	DSN	CK	DESCRIPTION
		1	BCK	TDB	DEPTH OF COVER UPDATE (6/11/15)

	BID		CONSTRUCTION	
	INITIALS	DATE	INITIALS	DATE
ENVIRONMENTAL	JLS	06/28/13	JLS	04/02/15
DRAFTING DESIGNER	GIL	06/28/13	GIL	04/02/15
DRAFTING SUPERVISOR	BZD	06/28/13	BCK	04/02/15
DESIGN ENGINEER	MDF	06/28/13	TDB	04/02/15
DESIGN MANAGER	SAB	06/28/13	JEO	04/02/15

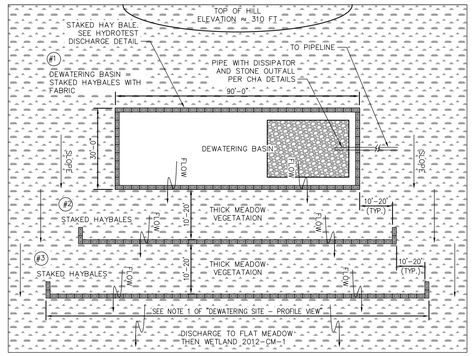
VERMONT GAS
PROPOSED 12" PIPELINE
ADDISON NATURAL GAS PROJECT
CONSTRUCTION DETAILS

LOC. CHITTENDEN & ADDISON COUNTIES

Vermont Gas

Vanasse Hangen Brustlin, Inc
CHA
38 Eastwood Drive, Suite 120
South Burlington, VT 05403
Main: (802) 735-0372 www.vhbcha.com

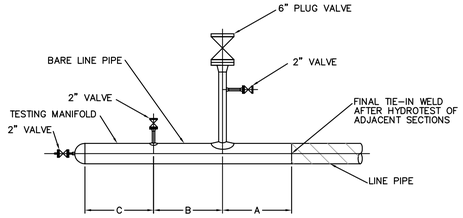
YEAR: 2015 | W.O. | SCALE: NOTED | DWG. ANGP-T-G-015 | REV. 1



1 Dewatering Site - Plan View

09/13

N.T.S. Source: VHB



(ANSI CLASS 600 MINIMUM)
SEE NOTES 1-6

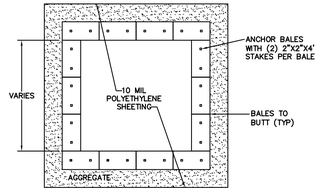
NOTES:

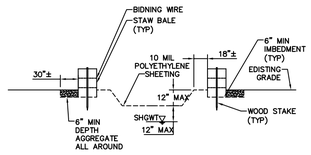
1. DIMENSIONS A, B & C ARE DEPENDENT ON PIPE DIAMETER & PIG LENGTH AND ARE TO BE DETERMINED BY CONTRACTOR.
2. FOR MANIFOLD TEST LOCATIONS & DISCHARGE LOCATIONS REFER TO EM&CP DRAWINGS.
3. TEST WATER SHALL BE TRANSFERRED BY PUMPING FROM ONE TEST SECTION TO THE NEXT ADJACENT TEST SECTION THROUGH THE 6" PIPE BRANCH AND MAKE-UP PIPING BETWEEN TEST SECTIONS. USE OF "HARD PIPING" & UNIONS IS RECOMMENDED.
4. FINAL TIE-IN WELD(S) BETWEEN TEST SECTIONS TO BE 100% RADIOGRAPHED.
5. TAP AND BRANCH SIZES AND VALVES FOR MANIFOLD ARE CONCEPTUAL AND SHALL BE DESIGNED BY CONTRACTOR TO BE COMPATIBLE WITH TEST EQUIPMENT AND PIPING.

2 Typical Hydrastatic Test Manifold

12/12

N.T.S. Source: CHA LD_





Notes:

1. CONTAINMENT MUST BE STRUCTURALLY SOUND AND LEAK FREE AND CONTAIN ALL LIQUID WASTES.
2. CONTAINMENT DEVICES MUST BE SUFFICIENT QUANTITY OR VOLUME TO COMPLETELY CONTAIN THE LIQUID WASTES GENERATED.
3. WASHOUT MUST BE CLEANED OR NEW FACILITIES CONSTRUCTED AND READY TO USE ONCE WASHOUT IS 75% FULL.
4. WASHOUT AREA(S) SHALL BE INSTALLED IN A LOCATION EASILY ACCESSIBLE BY CONCRETE TRUCKS.
5. ONE OR MORE AREAS MAY BE INSTALLED ON THE CONSTRUCTION SITE AND MAY BE RELOCATED AS CONSTRUCTION PROGRESSES.
6. AT LEAST WEEKLY REMOVE ACCUMULATION OF SAND AND AGGREGATE AND DISPOSE OF PROPERLY.
7. PLACE 50' FROM RIVER OR STREAM.

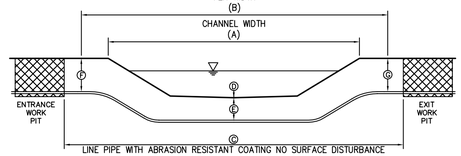
3 Concrete Washout Area

12/12

N.T.S. Source: VHB LD_

MILEPOST	STREAM NAME	CHANNEL WIDTH (A)	FEH WIDTH (B)	HDD LENGTH (C)	CHANNEL ELEV. (D)	ELEV. BELOW CHANNEL (E)	ENTRY ELEV. (F)	EXIT ELEV. (G)
0.99	INDIAN BROOK	4	100	2,339	208 [1]	< 198	< 208	< 208
1.52	INDIAN BROOK	15	125	1,530	188 [2]	< 178	< 188	< 188
6.75	WINOOSKI RIVER (SECTION 10 WATERS)	320	N/A (1,195)	900	263 [3]	< 238	< 275	< 275
19.47	LAPLATTE RIVER	30	360	640	317 [2]	< 307	< 317	< 317
22.86	LEWIS CREEK	80	435	2,500	310 [1]	< 300	< 310	< 310
32.30	LITTLE OTTER CREEK	35	240	1,680	267 [1]	< 260	< 267	< 267
35.85	UNNAMED TRIB. TO LITTLE OTTER CREEK	4	640	1,010	303 [2]	< 293	< 303	< 303
39.30	NEW HAVEN RIVER	120	785	530	245 [2]	< 235	< 245	< 245
DISTRIBUTION MAIN 30+00	UNNAMED TRIB TO LITTLE OTTER CREEK	8	N/A (108)	300	261 [1]	< 254	< 261	< 261

1. CHANNEL ELEVATION BASED ON CONTOURS SHOWN ON EPSC PLAN PROVIDED BY CHA, INC. DATED 02/28/2013 AND NOT ASSESSED IN THE FIELD BY VHB.
2. CHANNEL ELEVATION BASED ON CONTOURS SHOWN ON EPSC PLAN PROVIDED BY CHA, INC. DATED 02/28/2013 AND MODIFIED BASED ON FIELD ASSESSMENT BY VHB.
3. CHANNEL ELEVATION BASED ON BATHYMETRIC SURVEY PROVIDED BY COLER & COLANTONIO DATED 12/12/2012 AND NOT ASSESSED IN THE FIELD BY VHB.

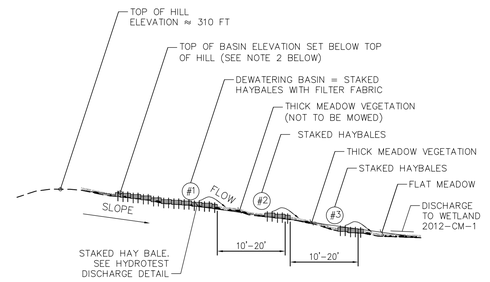


Notes:

1. THIS CONFIGURATION IS FOR HORIZONTAL DIRECTIONAL DRILL OF STREAM CROSSINGS AS SHOWN ON PROJECT PLANS. SEE ALIGNMENT SHEETS FOR LOCATIONS OF THIS CONFIGURATION.
2. TOP OF PIPELINE MUST BE AT LEAST AS DEEP AS THE CHANNEL BOTTOM (DIMENSION D) THROUGHOUT THE FLUVIAL EROSION HAZARD (FEH) CORRIDOR.
3. MINIMUM SEPARATION BETWEEN THE TOP OF PIPELINE AND THE CHANNEL BOTTOM (DIMENSION E) MUST BE AT LEAST 7 FEET.
4. ELEVATIONS PROVIDED ARE BASED ON APPROXIMATE NAVD 88 DATUM AND MUST BE FIELD VERIFIED PRIOR TO INSTALLATION OF PIPELINE.
5. FEH CORRIDOR IS LISTED AS NOT APPLICABLE (N/A) WHERE THE STREAM CROSSES OR IS ADJACENT TO AN EXISTING ROADWAY OR OTHER INFRASTRUCTURE THAT RESULTS IN RIVER MANAGEMENT CONSTRAINTS AT THAT LOCATION. FEH CORRIDOR WIDTHS AT THESE LOCATIONS ARE SHOWN FOR INFORMATION PURPOSES ONLY.

4 Horizontal Directional Drill (HDD) Stream Crossing - Typical Section

N.T.S. SOURCE 4/13



Notes:

1. THE DEWATERING SITE SHALL CONSIST OF THREE ROWS OF STAKED HAYBALES. THE TOP ROW SHALL BE ENCLOSED TO ACT AS A BASIN WITH FILTER FABRIC AND STONE OUTFALL AT THE DISCHARGE OUTLET. EACH DOWNSLOPE ROW OF HAYBALES SHALL BE CONSECUTIVELY LONGER THAN THE ROW UPSLOPE OF IT AS PER THE PLAN VIEW DETAIL. THE BOTTOM ROW IS TO EXTEND ACROSS THE ENTIRE WIDTH OF THE DENSELY VEGETATED MEADOW
2. THE HIGHEST ELEVATION OF THE TOP ROW OF HAY BALES SHALL BE LOWER THAN THE ELEVATION AT THE TOP OF THE HILL TO ENSURE DISCHARGE DOES NOT FLOW OVER THE HILL.
3. DURING TESTING, THE CONTRACTOR SHALL HAVE ADDITIONAL STONE, HAYBALES, AND STAKES ON SITE FOR USE IF ADDITIONAL EPSC MEASURES ARE NEEDED.
4. SEE HYDROTEST DISCHARGE DETAIL FOR DEWATERING BASIN INSTALLATION SPECIFICATIONS.
5. SEE HAY BALE BARRIER DETAIL FOR STAKED HAYBALE INSTALLATION SPECIFICATIONS.
6. MEADOW IS NOT TO BE MOWED PRIOR TO USE FOR FILTERING FLOW.

5 Dewatering Site - Profile View

09/13

N.T.S. Source: VHB

PRODUCT DESCRIPTION	MATERIAL COMPOSITION	LONGEVITY (MONTHS)	SLOPE APPLICATIONS*		CHANNEL APPLICATIONS*	MINIMUM TENSILE STRENGTH [1] kN/m(lbs/ft)
			MAXIMUM GRADIENT (H:V)	C FACTOR [2,5]	MAXIMUM SHEAR STRESS [3,4,6] Pa (lbs/ft²)	
MULCH CONTROL NETS	MESH OR WOVEN BIODEGRADABLE NATURAL FIBER NETTING.	3	5:1	≤ 0.10	12 (0.25)	0.073 (5)
		12	5:1	≤ 0.10	12 (0.25)	0.073 (5)
		24	5:1	≤ 0.10	12 (0.25)	0.36 (25)
NETLESS ROLLED EROSION CONTROL BLANKETS	NATURAL FIBERS MECHANICALLY INTERLOCKED TOGETHER TO FORM A RECP.	3	4:1	≤ 0.10	24 (0.5)	0.073 (5)
		12	4:1	≤ 0.10	24 (0.5)	0.073 (5)
SINGLE-NET EROSION CONTROL BLANKETS	PROCESSED BIODEGRADABLE NATURAL FIBERS MECHANICALLY BOUND TOGETHER BY A SINGLE NATURAL FIBER NETTING OF PROCESSED NATURAL YARNS OR TWINES WOVEN INTO A CONTINUOUS MATRIX.	3	3:1	≤ 0.15	72 (1.5)	0.73 (50)
		12	3:1	≤ 0.15	72 (1.5)	0.73 (50)
DOUBLE-NET EROSION CONTROL BLANKETS	PROCESSED BIODEGRADABLE NATURAL FIBERS MECHANICALLY BOUND TOGETHER BETWEEN TWO NATURAL FIBER NETTING OF PROCESSED NATURAL YARNS OR TWINES WOVEN INTO A CONTINUOUS MATRIX.	3	2:1	≤ 0.20	84 (1.75)	1.09 (75)
		12	2:1	≤ 0.20	84 (1.75)	1.09 (75)
		24	1.5:1	≤ 0.25	96 (2.00)	1.45 (100)
		36	1:1	≤ 0.25	108 (2.25)	1.82 (125)

* "C" FACTOR AND SHEAR STRESS FOR MULCH CONTROL NETTINGS MUST BE OBTAINED WITH NETTING USED IN CONJUNCTION WITH PRE-APPLIED MATERIAL.

1 MINIMUM AVERAGE ROLL VALUES, MACHINE DIRECTION USING EROSION CONTROL TECHNOLOGY COUNCIL (ECTC) MOD. ASTM D 5035.

2 "C" FACTOR CALCULATED AS RATIO OF SOIL LOSS FROM RECP PROTECTED SLOPE (TESTED AT SPECIFIED OR GREATER GRADIENT, H:V) TO RATIO OF SOIL LOSS FROM UNPROTECTED (CONTROL) PLOT IN LARGE-SCALE TESTING. THESE PERFORMANCE TEST VALUES SHOULD BE SUPPORTED BY PERIODIC BENCH SCALE TESTING UNDER SIMILAR TEST CONDITIONS AND FAILURE CRITERIA USING ECTC TEST METHOD #2.

3 REQUIRED MINIMUM SHEAR STRESS RECP (UNVEGETATED) CAN SUSTAIN WITHOUT PHYSICAL DAMAGE OR EXCESS EROSION (> 12.7mm (0.5 IN) SOIL LOSS) SURING A 30-MINUTE FLOW EVENT IN LARGE-SCALE TESTING. THESE PERFORMANCE TEST VALUES SHOULD BE SUPPORTED BY PERIODIC BENCH SCALE TESTING UNDER SIMILAR TEST CONDITIONS AND FAILURE CRITERIA USING ECTC TEST METHOD #3.

4 THE PERMISSIBLE SHEAR STRESS LEVELS ESTABLISHED FOR EACH PERFORMANCE CATEGORY ARE BASED ON HISTORICAL EXPERIENCE WITH PRODUCTS CHARACTERIZED BY MANNINGS ROUGHNESS COEFFICIENTS IN THE RANGE OF 0.01 - 0.05.

5 ACCEPTABLE LARGE SCALE TEST METHODS MAY INCULDE ASTM D 6459, ECTC TEST METHOD #2 OR OTHERINDEPENDENT TESTING DEEMED ACCEPTABLE BY THE DEC.

6 RECOMMENDED ACCEPTABLE LARGE-SCALE TESTING PROTOCOL MAY INCLUDE ASTM D 6440, ECTC TEST METHOD #3 OR OTHER INDEPENDENT TESTING DEEMED ACCEPTABLE BY THE DEC.

6 Specifications for Temporary RECP

N.T.S. Source: VT S+S EPSC

TYPE	PRODUCT DESCRIPTION	MATERIAL COMPOSITION	SLOPE APPLICATIONS	CHANNEL APPLICATIONS	MINIMUM TENSILE STRENGTH[2,3] kN/m (lbs/ft)
			MAXIMUM GRADIENT	MAXIMUM SHEAR STRESS[4,5] Pa(lbs/ft²)	
A	TURF REINFORCED MAT	NON-DEGRADABLE SYNTHETIC FIBERS, FILAMENTS, NETS, WIRE MESH AND/OR OTHER ELEMENTS, PROCESSED INTO A PERMANENT THREE-DIMENSIONAL MATRIX OF SUFFICIENT THICKNESS. TRM'S, WHICH MAY BE SUPPLEMENTED WITH DEGRADABLE COMPONENTS ARE DESIGNED TO IMPART IMMEDIATE EROSION PROTECTION, ENHANCED VEGETATION ESTABLISHMENT AND PROVIDE LONG-TERM FUNCTIONALITY BY PERMANENTLY REINFORCING VEGETATION DURING AND AFTER MATURATION. NOTE: TRM'S ARE TYPICALLY USED IN HYDRAULIC APPLICATIONS, SUCH AS HIGH FLOW DITCHES AND CHANNELS, STEEP SLOPES, STREAM BANKS, AND SHORELINES, WHERE EROSIVE FORCES MAY EXCEED THE LIMITS OF NATURAL, UNREINFORCED VEGETATION OR IN AREAS WHERE LIMITED VEGETATION ESTABLISHMENT IS ANTICIPATED.	0.5:1	288 (6.0)	1.82 (125)
B	TURF REINFORCED MAT		0.5:1	384 (8.0)	2.19 (150)
C	TURF REINFORCED MAT		0.5:1	480 (10.0)	2.55 (175)

PERMANENT[1] – ALL CATEGORIES OF TURF REINFORCEMENT MAT (TRM) MUST HAVE A MINIMUM THICKNESS OF 6.35mm (0.25 INCHES) PER ASTM D 6525 AND U.V. STABILITY OF 80% PER ASTM D 4355 (500 HOURS EXPOSURE)

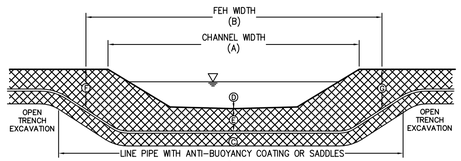
1. FOR TRMS CONTAINING DEGRADABLE COMPONENTS ALL PROPERTY VALUES MUST BE OBTAINED ON THE NON-DEGRADABLE PORTION OF THE MATTING ALONE.
2. MINIMUM AVERAGE ROLL VALUES, MACHINE DIRECTION ONLY FOR TENSILE STRENGTH DETERMINATION USING ASTM D 6818 (SUPERSEDES MOD. ASTM D 5035 FOR RECP'S).
3. FIELD CONDITIONS WITH HIGH LOADING AND/OR HIGH SURVIVABILITY REQUIREMENTS MAY WARRANT THE USE OF A TRM WITH A TENSILE STRENGTH OF 44 k/N/m(3,000 lb/ft) OR GREATER.
4. REQUIRED MINIMUM SHEAR STRESS TRM (FULLY VEGETATED) CAN SUSTAIN WITHOUT PHYSICAL DAMAGE OR EXCESS EROSION (>12.7mm (0.5 IN.) SOIL LOSS) DURING A 30-MINUTE FLOW EVENT IN LARGE SCALE TESTING. THESE PERFORMANCE TEST VALUES SHOULD BE SUPPORTED BY PERIODIC BENCH SCALE TESTING UNDER SIMILAR TEST CONDITIONS AND FAILURE CRITERIA USING ECTC TEST METHOD #3.
5. ACCEPTABLE LARGE-SCALE TESTING PROTOCOL MAY INCLUDE ASTM D 6460 ECTC TEST METHOD #3 OR OHER INDEPENDENT TESTING DEEMED ACCEPTABLE BY THE DEC.

7 Specifications for Permanent RECP

N.T.S. Source: VT S+S EPSC

MILEPOST	STREAM NAME	CHANNEL WIDTH (A)	FEH WIDTH (B)	CHANNEL ELEV. (C)	ELEV. BELOW CHANNEL (D)	ENTRY ELEV. (E)	EXIT ELEV. (F)
3.62	INDIAN BROOK	7	N/A (185)	430 [2]	< 420	< 430	< 430
6.60	ALDER BROOK	35	N/A (150)	281 [1]	< 274	< 281	< 281
10.32	ALLEN BROOK	35	360	376 [2]	< 366	< 376	< 376
13.79	SUCKER BROOK	15	120	371 [2]	< 364	< 371	< 371
18.93	UNNAMED TRIBUTARY TO LAPLATTE RIVER	4	N/A (310)	328 [1]	< 321	< 328	< 328
20.45	UNNAMED TRIBUTARY TO LAPLATTE RIVER	4	185	364 [2]	< 357	< 364	< 364
24.40	UNNAMED TRIBUTARY TO LEWIS CREEK	6	106	437 [2]	< 430	< 437	< 437
29.11	UNNAMED TRIBUTARY TO LITTLE OTTER CREEK	8	N/A (400)	364 [2]	< 357	< 364	< 364
30.94	UNNAMED TRIBUTARY TO LITTLE OTTER CREEK	4	200	267 [2]	< 260	< 267	< 267

1. CHANNEL ELEVATION BASED ON CONTOURS SHOWN ON EPSC PLAN PROVIDED BY CHA, INC. DATED 02/28/2013 AND MODIFIED BASED ON FIELD ASSESSMENT BY VHB.
2. CHANNEL ELEVATION BASED ON CONTOURS SHOWN ON EPSC PLAN PROVIDED BY CHA, INC. DATED 02/28/2013 AND NOT ASSESSED IN THE FIELD BY VHB.



Notes:

1. THIS CONFIGURATION IS FOR OPEN TRENCH EXCAVATION OF STREAM CROSSINGS AS SHOWN ON PROJECT PLANS. SEE ALIGNMENT SHEETS FOR LOCATIONS OF THIS CONFIGURATION.
2. THE INFORMATION PROVIDED IN THIS TABLE WAS UTILIZED FOR PERMITTING. ACCURATE PIPELINE PROFILE DRAWINGS HAVE BEEN CREATED THAT SHOW THE INTENT OF THIS TABLE USING FIELD VERIFIED SURVEY. CONTRACTOR SHALL REFERENCE SHEETS ANGPT-C-028A, 039A, 042A, 051A, 061AA, AND 065A FOR CONSTRUCTION.
3. TOP OF PIPELINE MUST BE AT LEAST AS DEEP AS THE CHANNEL BOTTOM (DIMENSION D) THROUGHOUT THE FLUVIAL EROSION HAZARD (FEH) CORRIDOR.
4. MINIMUM SEPARATION BETWEEN THE TOP OF PIPELINE AND THE CHANNEL BOTTOM (DIMENSION E) MUST BE AT LEAST 7 FEET.
5. ELEVATIONS PROVIDED ARE BASED ON APPROXIMATE NAVD 88 DATUM AND MUST BE FIELD VERIFIED PRIOR TO INSTALLATION OF PIPELINE.
6. FEH CORRIDOR IS LISTED AS NOT APPLICABLE (N/A) WHERE THE STREAM CROSSES OR IS ADJACENT TO AN EXISTING ROADWAY OR OTHER INFRASTRUCTURE THAT RESULTS IN RIVER MANAGEMENT CONSTRAINTS AT THAT LOCATION. FEH CORRIDOR WIDTHS AT THESE LOCATIONS ARE SHOWN FOR INFORMATION PURPOSES ONLY.
7. RESTORE DISTURBED CHANNEL, STREAM BANKS, AND APPROACHES FOLLOWING PIPELINE INSTALLATION PER EPSC PLAN.

8 Open Trench Stream Crossing - Typical Section

04/13

N.T.S. Source: VHB

DWG. NO.	REFERENCE DWG.	REV	DSN	CK		DESCRIPTION
		2	BCK	TDB		VHB EDITS (12/10/15)
		1	BCK	TDB		VHB EDITS (6/09/15)

		BID		CONSTRUCTION	
	INITIALS	DATE	INITIALS	DATE
ENVIRONMENTAL	JLS	06/28/13	JLS	05/2016
DRAFTING DESIGNER	GIL	06/28/13	GJM	05/2016
DRAFTING SUPERVISOR	BZD	06/28/13	BCK	05/2016
DESIGN ENGINEER	MDF	06/28/13	GEW	05/2016
DESIGN MANAGER	SAB	06/28/13	JEO	05/2016

VERMONT GAS
PROPOSED 12" PIPELINE
ADDISON NATURAL GAS PROJECT
CONSTRUCTION DETAILS

LOC. CHITTENDEN & ADDISON COUNTIES

Vermont Gas

YEAR: 2016 | W.O. | SCALE: NOTED | DWG. ANGP-T-G-017 | REV. 2

VHB Vanasse Hangen Brustlin, Inc.

CHA
38 Eastwood Drive, Suite 105
South Burlington, VT 05403
Main: (802) 735-0372 ~ www.chacompanies.com

STATE OF VERMONT
PUBLIC SERVICE BOARD

Petition of Vermont Gas Systems, Inc., requesting a Certificate of Public Good pursuant to 30 V.S.A. § 248, authorizing the construction of the **"Addison Natural Gas Project"** consisting of approximately 43 miles of new natural gas transmission pipeline in Chittenden and Addison Counties, approximately 5 miles of new distribution mainlines in Addison County, together with three new gate stations in Williston, New Haven, and Middlebury, Vermont	)	Docket No.

PREFILED TESTIMONY OF JOHN HEINTZ ON BEHALF OF VERMONT GAS SYSTEMS, INC.

December 20, 2012

Mr. Heintz is the Project Manager for the Addison Natural Gas Project. His testimony describes the Project design, construction and schedule, and provides an estimate of the Project costs. Mr. Heintz also describes construction-related impacts with respect to noise, water supply, waste disposal and transportation.

TABLE OF CONTENTS

EXHIBITS

Exhibit Petitioner JH-10	Typical Sectionalizing Valve Site
Exhibit Petitioner JH-11	Project Cost Estimate
Exhibit Petitioner JH-12	Permitting and Construction Schedule
Exhibit Petitioner JH-13	Construction Process Diagram
Exhibit Petitioner JH-14	Impact Minimization/Avoidance, Pipeline Reroutes and Alignment Shifts
Exhibit Petitioner JH-15	Impact Minimization/Avoidance, Through Horizontal Directional Drill (HDD)
Exhibit Petitioner JH-16	Impact Minimization/Avoidance, Through Right-of-Way Narrowing

STATE OF VERMONT
PUBLIC SERVICE BOARD

Petition of Vermont Gas Systems, Inc., requesting a Certificate of Public Good pursuant to 30 V.S.A. § 248, authorizing the construction of the **"Addison Natural Gas Project"** consisting of approximately 43 miles of new natural gas transmission pipeline in Chittenden and Addison Counties, approximately 5 miles of new distribution mainlines in Addison County, together with three new gate stations in Williston, New Haven, and Middlebury, Vermont	)	Docket No.

PREFILED TESTIMONY OF
JOHN HEINTZ
ON BEHALF OF
VERMONT GAS SYSTEMS, INC.

1. Introduction

Q1. Please state your name, occupation, and business address.

A1. My name is John Heintz. I am the President of International Engineering and Development Corporation and have been retained by Clough Harbour & Associates ("CHA") to serve as Project Manager of the Vermont Gas Systems, Inc. ("Vermont Gas" or "VGS" or the "Company") Addison Natural Gas Project ("Project" or "ANGP"). My business address is 2812 Shipping Ave, Miami, FL 33133.

Q2. Please describe your education and professional experience.

A2. A copy of my resume is included as Exhibit Petitioner JH-1. I have over twenty-five years of experience working in the oil and gas industry, including serving as

project manager in connection with the design, siting and construction of numerous natural gas transmission projects. The details of my experience are set forth in my resume.

Q3. What is the purpose of your testimony?

A3. My testimony and exhibits provide a detailed description of the Project layout and engineering design, including the refinements and modifications undertaken to the preliminary conceptual route alignment identified by VGS (the "Preliminary Alignment") in the course of the engineering design, resource assessments and right-of-way ("ROW") work to improve the layout and mitigate resource and landowner impacts where feasible. The result of these revisions is referred to here and in other witnesses' testimony as the "Final Alignment" and it is the Final Alignment Project Plans that are being submitted for approval in this Section 248 proceeding.

My testimony also describes the equipment specifications and the pipeline construction process that will be involved in building the Project. I also address ROW acquisition, material procurement, and Project noise and transportation impacts. Finally, I provide the Project cost estimate and schedule.

2. Project Description

Q4. Please describe the Project.

A4. The Project includes the following principal components:

(1) Approximately 43 miles of new 12-inch transmission pipeline, extending from a new tie-in to be located at Vermont Gas's existing 10-inch mainline north of Severance Road in Colchester ("Colchester Tie-In"), Vermont, to the intersection of U.S. Route 7 and Exchange Street in Middlebury, Vermont (the "Transmission Mainline");

(2) Approximately 5 miles of new six-inch distribution mainlines ("Distribution Mainlines") that will extend distribution service to Vergennes (4 miles) and Middlebury (1 mile); and

(3) Three new pressure regulation stations ("Stations" or "Gate Stations"), one located near Route 2 in Williston to reinforce the existing distribution system, one on Plank Road in New Haven, and the third just south of the intersection of U.S. Route 7 and Exchange Street in Middlebury.

The Transmission Mainline is approximately 43 miles in length from the point of interconnection in Colchester to the terminus at the new Exchange Street Gate Station in Middlebury. The line will pass through the towns of Colchester, Essex, Williston, St. George, Hinesburg, Monkton, New Haven and Middlebury.

The Distribution Mainline to Vergennes will extend from a new Plank Road Gate Station in New Haven, running along Plank Road approximately 4 miles through the towns of New Haven, Ferrisburgh and Waltham, to the intersection of Route 7 in Waltham, just east of Vergennes. The Middlebury Distribution Mainline will extend from the new Exchange Street Gate Station in Middlebury to the Middlebury industrial park on Exchange Street.

2.1 Transmission Mainline from Colchester to Middlebury

Q5. Please describe the Transmission Mainline.

A5. A one page map with the Project layout is included as Exhibit Petitioner JH-2. Detailed engineering plan sheets of the Transmission Mainline with design details are included as Exhibit Petitioner JH-3.

At the point of interconnection with the existing VGS transmission system in Colchester, the Colchester Tie-In will be configured with an approximately 30-foot by 70-foot fenced-in yard to enclose the valve and an area for utilizing a pipeline in-line cleaning or inspection tool or "PIG" launcher. A PIG is a tool used in the industry to clean the pipe or to inspect the integrity of the pipeline walls for things such as defects or corrosion. It moves down the pipeline by the force of the natural gas pressure in the pipeline. The fence will be a galvanized chain-link metal fence approximately 6 feet in height with three strands of barbed

wire extending another foot. The fenced area will have a pervious crushed stone surface underlain by a geogrid to infiltrate rainwater and snowmelt. An access road, approximately 1,000 feet long, consisting of 470 feet of existing gravel driveway and 530 feet of new stabilized pervious surface extending from Severance Road to the Colchester Tie-In. Exhibit Petitioner JH-4 is a site plan for the Colchester Tie-In.

To optimize the alignment of the Transmission Mainline corridor, Vermont Gas has attempted to co-locate the pipeline with or adjacent to other utility and road infrastructure where possible in order to minimize impacts. The northern segment of the Transmission Mainline, from Colchester to Williston near Interstate 89, will generally be located within the ROW of VT 289 (also referred to as the Circumferential Highway, "CCCH" or "CIRC"). This segment of the Project corridor is approximately 11 miles from the Colchester Tie-In, and extends though portions of the towns of Colchester, Essex and Williston, to a point east of Interstate 89 in Williston, near the intersection of Interstate 89 and U.S. Route 2.

Near the intersections of Interstate 89 and Route 2 in Williston, the Transmission Mainline will leave the CIRC corridor. Based on the Preliminary Alignment, the plan was to have the Transmission Mainline continue south, adjacent to an existing Vermont Electric Power Company, Inc. ("VELCO") electric transmission line corridor that extends between Williston and Middlebury, Vermont. As I

explain below, multiple re-alignments have occurred to the Preliminary Alignment design to avoid or mitigate impacts to sensitive environmental and cultural resources, such that approximately 18 miles of this southern segment of the Transmission Mainline will now run along public roads in the Final Alignment. This segment of the Transmission Mainline extends about 32 miles and crosses through portions of the towns of Williston, St. George, Hinesburg, Monkton, New Haven and Middlebury. The details for this approximately 32-mile southern segment of the Transmission Mainline are shown in the Transmission Mainline Alignment Sheets, Exhibit Petitioner JH-3.

A more detailed summary of the Transmission Mainline Final Alignment is as follows:

- The proposed pipeline connects to the existing VGS 10-inch transmission pipeline in Colchester and proceeds northerly for approximately 0.1 mile, Milepost ("MP") 0.0 to 0.1, within the existing pipeline ROW to the northerly edge of the un-built CCCH ROW. The alignment follows approximately parallel to the northerly ROW, avoiding present and future constructability issues for 2.0 miles (MP 0.1 to 2.1).
- The built section of the CCCH Highway begins at approximately MP 2.1. The alignment continues to follow the northerly ROW limit of the built section of the CCCH highway for approximately 4.1 miles (MP 2.1 to 6.2).

- The next approximately 1.1 miles (MP 6.2 to 7.3) of the alignment allows for a constructible crossing of the Winooski River, avoiding conflicts with Alder Brook and the possible future extension of the CCCH. The alignment continues southerly within the Redmond Road and Mountain View Road ROWs for approximately 1.8 miles (MP 7.3 to 9.1).
- The alignment re-enters the un-built CCCH ROW at MP 9.1 and continues southerly for approximately 1.8 miles (MP 9.1 to 10.9).
- The alignment parallels the northerly ROW of Interstate 89 and continues westerly for approximately 0.5 mile (MP 10.9 to 11.4).
- The alignment proceeds approximately 0.3 mile (MP 11.4 to 11.7) to allow for a constructible crossing of Interstate 89, avoiding conflicts with the VELCO Taft Corners substation and the densely-built Hurricane Lane. The alignment continues southerly parallel to the westerly VELCO ROW for approximately 1.4 miles (MP 11.7 to 13.1).
- The following approximately 0.8 mile (MP 13.1 to 13.9) of the alignment crosses the VELCO ROW and continues southerly on private land avoiding the VELCO Williston substation.
- The following approximately 0.3 mile (MP 13.9 to 14.2) of the alignment continues southerly parallel to the westerly VELCO ROW.
- The alignment crosses the VELCO ROW and continues southerly 1.0 mile (MP 14.2 to 15.2) on private land avoiding side hill slopes and the King George Estates Development.

- The alignment continues southerly generally parallel to the westerly VELCO ROW for approximately 0.7 mile (MP 15.2 to 15.9).
- The alignment crosses the VELCO ROW and continues southerly approximately 1.0 mile (MP 15.9 to 16.9) on private land and within the Route 2A ROW avoiding large rock formations until continuing across Route 116.
- The alignment continues southerly generally parallel to the westerly VELCO ROW for approximately 3.0 miles (MP 16.9 to 19.9) to Baldwin Road in Hinesburg.
- The alignment continues southerly within the westerly ROW limits of Charlotte, Baldwin and Davis Roads for approximately 4.2 miles (MP 19.9 to 24.1).
- The following approximately 0.2 mile (MP 24.1 to 24.3) of the alignment returns to the westerly side of the VELCO ROW.
- The alignment continues southerly generally parallel to the westerly VELCO ROW for approximately 1.6 miles (MP 24.3 to 25.9).
- The alignment crosses the VELCO ROW to Monkton Road and continues southerly approximately 3.4 miles (MP 25.9 to 29.3) parallel and adjacent to the easterly ROW limit of Pond Road and Monkton Road.
- The alignment continues southerly approximately 3.6 miles (MP 29.3 to 32.9) within the Old Stage Road/ Parks-Hurlburt/North Street ROW.

- The alignment continues westerly approximately 0.2 mile (MP 32.9 to 33.1) within the Plank Road ROW to return to the westerly side of the VELCO ROW.
- The alignment continues southerly generally parallel to the westerly VELCO ROW for approximately 2.3 miles (MP 33.1 to 35.4).
- The following approximately 1.7 miles (MP 35.4 to 37.1) of the alignment shifts to avoid the VELCO New Haven Substation and the Maine Drilling and Blasting Facility.
- The alignment continues southerly generally parallel to the westerly VELCO ROW for approximately 3.3 miles (MP 37.1 to 40.4) to River Road in New Haven.
- The alignment continues westerly within the River Road ROW limit for approximately 0.7 mile (MP 40.4 to 41.1) to Route 7.
- The alignment continues southerly within the Route 7 ROW limit for approximately 1.6 miles (MP 41.1 to 42.7) past the Exchange Street intersection ending at the Proposed Middlebury Gate Station.

Q6. Please describe the design specifications for the Transmission Mainline.

A6. The engineering design was guided by applicable federal and state standards including:

- U.S. Department of Transportation, Office of Pipeline Safety, Code of Federal Regulations Title 49, Part 192 – Transportation of Natural and Other Gas by Pipeline: Minimum Safety Standards ("Code");
- American Society of Mechanical Engineers ("ASME") B31.8 – Gas Transmission and Distribution Piping Systems;
- Vermont Public Service Board General Order #43, Rules and Regulations Prescribing Standards for Gas Utilities;
- American Petroleum Institute ("API") 5L, Specification for Line Pipe, 2009;
- API Specification 6D, Specification for Pipeline Valves, 2008;
- American Society for Testing and Materials ("ASTM") A53/A53M-07, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless;
- ASTM D2513-99, Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings;
- MSS-Standard Practice SP-44-2006 Standard Practice, Steel Pipeline Flanges; and
- Vermont Public Service Board Rule 6.100.

The Transmission Mainline will be designed and constructed to a Maximum Allowable Operating Pressure ("MAOP") of 1,440 pounds per square inch ("psi"). The pipeline will be constructed of carbon-steel pipe (12.75-inch outside

diameter), with a wall thickness of 0.283 inches in Class II (rural) [1] areas and 0.312 inches for the remainder of the route. The pipe material will have a specified minimum yield strength of 65,000 psi. For Class II and III areas, a design factor of 0.5 was used in the design pressure calculation, and for Class I areas a design factor of 0.6 was used, both of which are more stringent than required by the Code. This will allow the design pressure to stay the same even if there is a future change in the class location of the pipeline. The pipe will be manufactured in accordance with the API 5L, Specification for Line Pipe.

The pipe will have an external, corrosion-control coating; the coating will vary dependent upon soil conditions but in general it will consist of 15 mils thickness of fusion bond epoxy or Pritec. Segments of pipe to be installed by horizontal directional drill ("HDD") will have an additional 40 mils thickness of abrasion resistant coating over the external control coating. Cathodic protection will be provided by an impressed current rectifier system. The pipe will be hydrostatically-tested at a pressure of at least 2,160 psi for a minimum of eight hours before being placed in service. The test will assure there are no leaks and validate the MAOP of 1,440 psi. I discuss this testing below.

[1] Class location is the term used in the Code (49 C.F.R. Part 192) to classify the population density in the vicinity of the pipeline. The design of a pipeline may vary depending on the class location of the pipeline. Please refer to Mr. Teixeira's testimony for further explanation of this class location system.

The pipeline will be entirely welded in accordance with API recommended practice standard 1104 – Welding of Pipelines and Related Facilities. All welds will be nondestructively tested in accordance with API 1104 by x-ray techniques. The test records will be kept for the life of the facility.

Q7. What is the width of the Transmission Mainline corridor?

A7. Generally, the Transmission Mainline corridor will occupy a 50-foot wide permanent ROW, together with a 25-five foot temporary easement area that will be used to complete construction. Vanasse Hangen Brustlin, Inc. ("VHB") has studied up to a 300-foot wide area for purposes of conducting its environmental resource impact analysis for this Section 248 application.

In areas where construction will parallel a public road ROW, VGS will utilize a 20-foot ROW on private land adjacent to the road ROW where possible. If obtaining a ROW on private land is not possible, the pipeline will be located in the public ROW and the construction crews will utilize the road as work space. The entire ROW will be cleared of vegetation in order to allow for construction. After completion of construction, the entire ROW area will be graded back to its previous contours and restored consistent with the Erosion Prevention and Sediment Control plan (provided as an attachment to Exhibit Petitioner JAN-9).

Q8. Earlier you mentioned a number of reroutes and revisions that occurred to accommodate sensitive environmental and cultural resources along the route first identified in the Preliminary Alignment for the Transmission Mainline. Please summarize those revisions.

A8. Designing the Project is a complex, interdisciplinary and iterative process that has taken months to develop. Once the CIRC and VELCO corridors were identified as the Preliminary Alignment for the Transmission Mainline (the process for which is more fully discussed in Mr. Howe's prefiled testimony), VGS hired CHA and environmental, archaeological and aesthetic consultants to undertake detailed assessments of the Preliminary Alignment. Based upon that input, we continued to refine the Project design in dozens of locations to avoid or minimize impacts. Overall, we modified over 31 miles or about 73% of the Preliminary Alignment in order to avoid or mitigate these sensitive resource areas, as follows:

- 26 miles (pipeline reroutes and alignment shifts)
- 3.6 miles (narrowing of ROW)
- 2.3 miles (HDD)

Please refer to Exhibits Petitioner JH-14 (Impact Minimization/Avoidance, Pipeline Reroutes and Alignment Shifts), JH-15 (Impact Minimization/ Avoidance, Through Horizontal Directional Drill) and JH-16 (Impact Minimization/Avoidance, Through Right-of-Way Narrowing).

One significant re-route is located on the southern side of the Winooski River in the area parallel to Redmond Road in Williston. There, the Final Alignment will extend west of the CIRC to connect to Redmond Road near the Chittenden Solid Waste Facilities, and continue south and southeast along Redmond Road at a point where Mountain View Road in Williston meets up with the CIRC corridor. This re-route, the so-called "Redmond Road Re-Route" is approximately 1.9 miles in length. This change to the Preliminary Alignment along the CIRC was undertaken by VGS following input from regulators and stakeholders in order to avoid and minimize potential impacts to forested wetlands and wetland habitat, as discussed in more detail in the testimony and exhibits of Jeffrey Nelson of VHB. These areas are depicted on the Transmission Mainline Engineering Plans, Exhibit Petitioner JH-3. Mr. Nelson also addresses this re-route in his testimony and exhibits.

Additionally, a number of the re-routes noted in Exhibit Petitioner JH-14 resulted in the pipeline being located within the public highway corridor to avoid environmental and cultural resources. Proposed construction within built portions of the public highway ROW has increased by approximately 9.0 miles for a total of 18.3 miles. This results in an approximate $5.0 million dollars in addition to the Project costs, which are included in Exhibit Petitioner JH-11.

The approximately 3.6 miles of the pipeline ROW that was narrowed from 75 feet to 50 feet, results in an approximate 5.5-acre reduction in wetland impacts. The reduction of ROW width will result in additional costs to the Project which are currently estimated at approximately $560,000. These additional costs are also included in the Project Cost Estimate, Exhibit Petitioner JH-11.

Q9. What other measures will be taken to minimize impacts?

A9. Because of the nature of a long, linear pipeline expansion project such as this, complete avoidance of all environmental and cultural resource areas is not possible, but a number of precautions will be taken to minimize impacts. In wetlands and agricultural areas, where trenches are used, soil horizons will be removed in order and stockpiled so that horizons can be restored as closely as possible to pre-construction conditions. In some cases, we will employ coffer dams for stream crossings and we will use matting for all work in wetland areas. Silt fences and other erosion control techniques will be used, as well as matting, construction limit barriers, etc. Mr. Nelson's testimony describes the techniques that will be employed to minimize environmental impacts to sensitive areas during Project construction.

As I have also noted, where appropriate, we will horizontally directional drill under certain streams, rivers, wetlands, and other natural resources. These areas include:

Indian Brook, MP 0.88;

Indian Brook, MP 1.35;

Indian Brook, MP 3.6;

Winooski River, MP 6.8;

Allen Brook, MP 10.2;

LaPlatte River, MP 19.6;

Lewis Creek, MP 22.9;

Norris Farm Archaeological Site, MP 24.4;

Little Otter Creek, MP 33.1;

VT AD 446 (Arch site), North Quarry Road, MP 34.1;

VT AD 793(Arch site), Locus 2 and 3, MP 34.6;South of Town Hill Road (Arch site), MP 36.6; and

New Haven, MP 40.2.

The use of HDD in these areas has eliminated over 1.7 acres of wetland impact, over 58,000 square feet of stream impact, impact to six rare, threatened and endangered species habitat and seven archaeological sites. The additional cost associated with the installation of HDDs in these areas is approximately $3.0 million and is reflected in the Project Cost Estimate, see Exhibit Petitioner JH-11.

These areas are identified in Exhibit Petitioner JH-15.

2.2 Distribution Mainlines to Vergennes and Middlebury

Q10. Please describe the Distribution Mainlines.

A10. There are two Distribution Mainlines. The site plans are included as Exhibit Petitioner JH-5. The first is an approximately 4-mile segment of 6-inch polyethylene ("PE") pipe that will begin at the new Plank Road Gate Station in New Haven, and run approximately 4 miles though the Towns of New Haven, Ferrisburgh, and Waltham, to the intersection of Route 7 in Waltham, just east of Vergennes (the "Vergennes Distribution Mainline"). Network construction will begin at this point extending into the City of Vergennes.

The second Distribution Mainline is also 6-inch PE pipe which will run approximately 1.0 mile along Route 7 and Exchange Street in Middlebury, between the new Exchange Street Gate Station and into the Middlebury industrial park.

Both Distribution Mainlines will be located within the public ROWs of Plank Road and Route 7/Exchange Street. The Project plans for the Distribution Mainlines are included as Exhibit Petitioner JH-5.

2.3 Gate Stations and Valves

Q11. Please describe each of the three Gate Stations.

A11. A gate station is a necessary component of a gas distribution system. The purpose of a gate station is to reduce the higher pressure in the transmission pipeline to the lower pressure used in the distribution network. A photograph of a VGS gate station is provided as Exhibit Petitioner JH-6.1.

The first Gate Station will be located near Route 2 in Williston to reinforce the existing distribution system. A site plan for the Williston Gate Station is included as Exhibit Petitioner JH-7. It will include an approximately 55-foot by 85-foot fenced-in yard with a small parking area, an approximately 12-foot wide by 32-foot long prefabricated metal meter and regulator building, a 6-foot wide by 8-foot long SCADA[2] building and an approximately 6-foot wide by 15-foot long concrete pad on which the pipeline heater will be mounted. Each enclosure building will be approximately 11 feet high from ground level to the roof peak. The enclosure buildings will house three major components of the Gate Station: (1) SCADA and telecommunications equipment, (2) the pressure regulation equipment, and (3) the meter. A Dry-Line heater system will be installed outside on the concrete pad. A Dry-Line heater works by producing steam within a vacuum, and heating the gas passing through pipes within the heater shell with low temperature steam.

[2] The acronym SCADA stands for "supervisory control and data acquisition."

Plantings will be installed to provide screening for the facility, as shown on the visual report provided by Michael Buscher, Exhibit Petitioner MJB-2.

The design criteria for the Williston Gate Station are described as follows:

Design maximum station inlet pressure: 1440 psi;

Design minimum station inlet pressure, at regulators: 250 psi;

Design normal station inlet pressure, at regulators: 400 psi;

Design maximum station outlet pressure: 100 psi;

Design flow volume, summer: 350 mcfh;

Design flow volume, peak: 500 mcfh;

Gate Station piping wall thickness: Schedule 80 or XH Seamless;

Gate Station piping grade: API 5L Grade B or X-42;

Safety device: monitor and relief;

Relief set pressure at 110% of Maximum Operating Pressure ("MOP"): 110 psi;

Inlet gas temperature: 32 deg. F;

Outlet gas temperature: 40 deg. F;

Heater: Dry-Line heater system;

Meter: Turbine; and

Gate Station outlet control methodology: redundant Grove 900TE monitor/regulator runs.

A second Gate Station will be located on Plank Road in New Haven to initially provide natural gas service to Vergennes. A site plan for the Plank Road Gate Station is included as Exhibit Petitioner JH-8. It will include an approximately 55-foot by 55-foot fenced-in yard with a small parking area, an approximately 12-foot wide by 32-foot long prefabricated metal meter and regulator building, a 6-foot wide by 8-foot long SCADA building and an approximately 6-foot wide by 15-foot long concrete pad on which the pipeline heater will be located. Each enclosure building will be approximately 11 feet high from ground level to the roof peak. The enclosure buildings will house three major components of the Gate Station: (1) SCADA and telecommunications equipment, (2) the pressure regulation equipment, and (3) the meter. A Dry-Line heater system will be installed outside on the concrete pad. Plantings will be installed to provide screening for the facility, as shown on the visual report provided by Michael Buscher, Exhibit Petitioner MJB-2.

The design criteria for the Plank Road Gate Station are as follows:

Design maximum station inlet pressure: 1440 psi;

Design minimum station inlet pressure, at regulators: 250 psi;

Design normal station inlet pressure, at regulators: 400 psi;

Design maximum station outlet pressure: 125 psi;

Design flow volume, summer: 250 mcfh;

Design flow volume, peak: 400 mcfh;

Gate Station piping wall thickness: Schedule 80 or XH Seamless;

Gate Station piping grade: API 5L Grade B or X-42;

Safety device: monitor and relief;

Relief set pressure at 110% of MOP: 137 psi;

Inlet gas temperature: 32 deg. F;

Outlet gas temperature: 40 deg. F;

Heater: Dry-Line heater system;

Meter: Turbine; and

Gate Station outlet control methodology: redundant Grove 900TE monitor/regulator runs.

The third Gate Station will be located on the southeast side of the intersection of Route 7 and Exchange Street in Middlebury. A site plan for the Middlebury Gate Station is provided as Exhibit Petitioner JH-9. It will include an approximately 85-foot by 85-foot fenced-in yard with a small parking area, an approximately 12-foot wide by 32-foot long prefabricated metal meter and regulator building, a 6-foot wide by 8-foot long SCADA building and an approximately 6-foot wide by 15-foot long concrete pad on which the pipeline heater will be located. Each enclosure building will be approximately 11 feet high from ground level to the roof peak. The enclosure buildings will house three major components of the Station: (1) SCADA and telecommunications equipment, (2) the pressure regulation equipment, and (3) the meter. A Dry-Line heater system will be

installed outside on the concrete pad. Plantings will be installed to provide screening for the facility, as shown on the visual report provided by Michael Buscher, Exhibit Petitioner MJB-2.

The design criteria for the Middlebury Gate Station are described as follows;

Design maximum station inlet pressure: 1440 psi;

Design minimum station inlet pressure, at regulators: 250 psi;

Design normal station inlet pressure, at regulators: 400 psi;

Design maximum station outlet pressure: 125 psi;

Design flow volume, summer: 350 mcfh;

Design flow volume, peak: 500 mcfh;

Gate Station piping wall thickness: Schedule 80 or XH Seamless;

Gate Station piping grade: API 5L Grade B or X-42;

Safety device: monitor and relief;

Relief set pressure at 110% of MOP: 137 psi;

Inlet gas temperature: 32 deg. F;

Outlet gas temperature: 40 deg. F;

Heater: Dry-Line heater system;

Meter: Turbine; and

Gate Station outlet control methodology: redundant Grove 900TE monitor/regulator runs.

The Station configuration being proposed consists of two separate regulator runs, with one run serving as a full back up to the other. Each regulator run consists of two identical regulators set up in what is termed a working and monitor set. The Station will also include a relief valve to provide a secondary device for overpressure protection. This configuration provides for both overpressure protection and redundancy. A single regulator run in the Station is designed to handle the existing load requirement of the local distribution system.

Q12. What is the height of the fence to be installed at each Gate Station?

A12. The fence will be 6-foot high galvanized chain link with one additional foot of barbed wire at the top.

Q13. Please describe the access and parking areas for each Gate Station.

A13. The access will consist of a 15-foot wide stabilized pervious surface underlain by geogrid. The parking area will be large enough for two vehicles and will consist of the same surface material as the access drive.

Q14. Please describe the Gate Station external lighting plans.

A14. Only limited night-time lighting will be needed at each Gate Station, at the entrance and at the building. The lights will be 100-watt floodlights or luminaries, angled downwards.

Q15. Please describe the valves and valve locations.

A15. Eight sectionalizing valves will be installed along the pipeline length to allow for isolation of pipeline segments in the event that they need maintenance or in the case of an incident. Valve spacing is dictated by the Code and is based on the class location of the pipeline. The valve placement along the Transmission Mainline will exceed the requirements of 49 C.F.R. Section 192.179 (Transmission Line Valves).

A photograph of a VGS Mainline Valve ("MLV" or "Sectionalizing Valve") is included as Exhibit Petitioner JH-6.2. A typical MLV site is shown in Exhibit Petitioner JH-10. Valve locations along the Transmission Mainline are identified in Exhibit Petitioner JH-3 at the following mile points:

MLV 0 at the Colchester Tie-In, MP 0.0;

MLV 1 at Redmond Road, Williston, MP 7.6;

MLV 2 at Lincoln Road, Williston, MP 14.4;

MLV 3 at Charlotte Road, Hinesburg, MP 19.9;

MLV 4 at Pond Road, Monkton, MP 26.4;

MLV 5 at Plank Road, New Haven, MP 33.0;

MLV 6 at Hunt Road, New Haven, MP 39.0; and

MLV 7 at Middlebury Gate Station, MP 42.7.

3. Project Construction

Q16. Please describe the pipeline construction process.

A16. The process involves a series of sequential steps, as graphically illustrated on Exhibit JH-13. The pipeline construction process will generally proceed in the following sequence:

1. The construction is expected to be sequenced from north to south although there will be multiple construction sections called "spreads."
2. The route is first cleared and temporary work areas are prepared.
3. Perimeter erosion control measures, such as silt fences are installed along sensitive resource areas such as stream edges and wetlands to control sediment.
4. For the Transmission Mainline, a four to five-foot wide trench will be excavated to a depth of approximately five feet, and soil from the trench will be stockpiled adjacent to the trench within the construction corridor. There will be different construction configurations for each of the different types of area to be crossed, including wetlands, agricultural areas and within the public highway ROW. These configurations are shown in Exhibit Petitioner JH-3. Smaller trenches of approximately four feet by five feet will be used for the Distribution Mainlines.

5. Pipe lengths will be welded together, inspected, laid in the trench and warning tape will be laid over the line, and then the trench will be backfilled. The pipe will be covered by at least 36 inches of soil. The pipeline will have four feet of cover in agricultural areas and residential areas; and generally five feet of cover at road crossings and seven feet of cover at open cut streams.
6. The landscape will be restored as close as possible to pre-construction conditions in accordance with applicable permit requirements.

As Project Manager, it will be my responsibility to oversee that the Project is constructed in accordance with all applicable Code and permit requirements.

Q17. Is water required for Project construction or operation?

A17. The Project will not require the use of water for on-going operations. The three Gate Stations are unmanned and therefore do not have sink or toilet facilities. However, as part of construction, the Project will require approximately 1.4 million gallons of water to hydrostatically pressure test the Transmission Mainline. The pipe will be hydrostatically tested at a pressure of at least 2,160 psi for a minimum of eight hours before being placed in service. The test will prove there are no leaks and will validate the MAOP of 1,440 psi. For the hydrostatic

test, water will be taken from a Town of Colchester municipal water hydrant near the Colchester Tie-In. VGS has contacted the Champlain Water District which supplies Colchester Fire District #3, where we propose to obtain the water for our test. The Champlain Water District has stated that it will be able to provide the water volume required. When the test is complete, the water will be discharged to a nearby upland area at the tap as indicated on the Erosion Prevention and Sediment Control Plans included with Mr. Nelson's prefiled testimony as Exhibit Petitioner JAN-9. These plans are being submitted as part as the Construction Stormwater Discharge Permit to the Vermont Department of Environmental Conservation, as discussed in more detail in Mr. Nelson's testimony.

The two sections of Distribution Mainlines will be tested independently with air at a pressure of 190 psi for a period of eight hours.

In addition, water, sourced from a local water hauler, will be used to control dust during construction.

Q18. Has VGS identified the construction access points and laydown areas?

A18. Yes. We have identified locations where access to the Transmission Mainline corridor will be used as well as temporary work areas for equipment and materials staging areas. These locations are identified in Exhibit Petitioner JH-3 and were studied by our environmental and cultural resource experts and are noted in the

VHB natural resources mapping, provided as an appendix to Exhibit Petitioner JAN-2.

Q19. How will VGS manage construction waste?

A19. The generation of construction debris from the Project will be minimal. Construction debris will be disposed of at an approved landfill. While not generally considered construction waste, VGS will handle woody debris as follows: trees under 6 inches in diameter, slash and brush will be chipped—not burned—and spread along the ROW in upland areas. Trees greater than 6 inches in diameter will be cut into logs, stacked in upland areas and offered to landowners along the ROW for landowner use.

Q20. Will blasting be required for pipeline installation?

A20. Yes, we anticipate that blasting will be required for approximately 35% of the proposed route. Areas requiring blasting will be further defined during the final design process. VGS will use a blasting contractor licensed in the State of Vermont. It should be noted that blasting for projects of this nature will have limited impacts. Any blasting that is required for the Project would be conducted by state-licensed professionals in accordance with applicable blasting codes and local blasting requirements. All blasting would be conducted during daylight hours and would not begin until appropriate local authorities and the occupants of nearby buildings, including residences and places of business, have been notified.

In general, blasting would involve installation of small drill holes, and the use of low energy charges. Potential fracture impacts would be avoided through the use of open-face blasting techniques, which would direct the energy of the blast upward to the surface instead of downward. Delayed charges would be ignited in sequence to facilitate the upward movement of rock along the rock face. VGS will also conduct pre-blast inspections of nearby facilities and structures; install blasting mats to control the scattering of loose rock; use warning signals, flags and barricades to limit access to the blast area; and conduct post-blast surveys as necessary to assess damage. Notwithstanding the limited impact of the blasting, VGS will adhere to a rigorous blasting plan, highlights of which are described below.

Pre-Blast Surveys/Notifications

Pre-blast surveys and Water Quality/Flow Testing will be offered to all property owners that are within a 600-foot radius from the blast site. Appropriate notices will be given and appointments arranged for those owners who desire a survey. Pre-blast surveys will be conducted by a qualified firm approved by VGS. Results of those surveys will be documented through video or still photographs and appropriate narration or written reports.

Blast Monitoring

All blasts will be monitored by a representative of a qualified firm approved by VGS who has been properly trained in the setup and use of seismic monitoring equipment. At least one seismograph will be in use at all times. Placement of monitoring equipment will be at the nearest structure to the blast site. Results of blast monitoring will typically be available before the next blast. Results can be reviewed and modifications can be made to the blast design for the next blast if necessary.

Sequence of Blasting

All blasting operations will be strictly coordinated with VGS's on-site representative and local Fire Departments. Emphasis will be on the safe and efficient removal of the rock existing on this project without impact to surrounding structures.

Blasting Procedures

1. Blasting operations shall commence after 7:00 AM and cease before 7:00 PM, Monday through Saturday.
2. Blasting cannot be conducted at times different from those announced in the blasting schedule except in emergency situations, such as electrical storms or public safety required unscheduled detonation.

3. Warning and all-clear signals of different character that are audible within a range of one-quarter mile from the point of the blast shall be given. All persons within the permit area shall be notified of the meaning of the signals through appropriate instructions and signs posted.
4. Access to the blasting area shall be regulated to protect the public from the effects of blasting. Access to the blasting area shall be controlled to prevent unauthorized entry before each blast and until the perimeter's authorized representative has determined that no unusual circumstances exist after the blast. Access to and travel in or through the area can then safely resume.
5. Areas in which charged holes are awaiting firing shall be guarded, barricaded and posted, or flagged against unauthorized entry.
6. Blasting mats shall be used to cover blasts and prevent fly rock.

Blast Security

Each blast will be preceded by a security check of the affected area. Communications will be made with job site supervisors and local officials as required to ensure the safest possible operation. All personnel in the vicinity closest to the blast area will be warned.

No blast will be fired until the area has been secured and determined safe. The blast site will be examined by the blaster prior to the all-clear signal to determine that it is safe to resume work.

Blast Vibration

Blast vibration will be monitored at the blast site, typically at the structure(s) closest to the blast site. Vibration limits will closely follow industry limits and the State and Local Regulations. Blast designs will be modified as required to stay within the guidelines. Blasting operations will be modified accordingly when approaching buildings and utilities.

4. Right-of-Way Acquisition

Q21. Will the Project require ROW acquisition?

A21. Yes. VGS will purchase easements from landowners along the Transmission Mainline where public ROWs are not being used. Landowner parcels along the Final Alignment are shown on Exhibit Petitioner JH-3. VGS has contacted all landowners along the pipeline route and is currently in discussions to obtain easements. VGS is targeting to have all easements in place by the end of 2013.

5. Noise Impacts

Q22. Will the Project generate noise?

A22. During construction, the Project will generate general construction noise associated with construction vehicles and equipment. Construction activities will normally occur between 7:00 AM and 7:00 PM and will only last during the

construction period. Once constructed, because they are buried, the Project pipelines will not generate any additional noise.

The sectionalizing valves are not pressure-reduction valves containing any mechanized components, and therefore will not result in additional noise.

VGS has selected a heater system for the Gate Stations that emits very little noise. VGS has calculated that after construction of the Project and during the peak hour of operation, the noise level at each Gate Station will be approximately 50 dBA when measured at the fence line. The closest occupied structure to any of our proposed Gate Stations is approximately 215 feet, and at this distance, the noise is projected to drop well below the 45 dBA nighttime and 55 dBA daytime noise levels required in other Board proceedings.

6. <u>Transportation Impacts</u>

Q23. What impacts will the Project construction have on traffic and transportation facilities?

A23. We plan to conduct horizontal directional drilling ("HDD") or boring under a number of street crossing and railway crossings, namely:

Mill Pond Road, Colchester; Uncased bore;

Colchester Rd. (Route 2A), Essex; Uncased bore;

New England Central RR, Essex; Cased bore;

Upper Main St. (Route 15), Essex; Uncased bore;

Essex Way, Essex; Uncased bore;

River Rd. (Route 117), Essex; HDD with Winooski River;

New England Central RR, Essex; Cased bore;

Redmond Road at CSWD, Williston; Uncased bore;

Mountain View Rd. , Williston; Uncased bore;

Williston Rd. (Route 2), Williston; Uncased bore;

Interstate Highway 89, Williston; HDD;

Hurricane Lane, Williston; Uncased bore;

St. George Rd. (Route 2A), Williston; Uncased bore;

Vermont Route 116, St. George; Uncased bore;

Shelburne Falls Road, Hinesburg; Uncased bore;

Charlotte Road, Hinesburg; Uncased bore;

Hollow Road, Monkton; Uncased bore;

Monkton Road, Monkton; Uncased bore;

Plank Road, New Haven; Uncased bore;

North Road, New Haven; Uncased bore;

Plank Road, New Haven; Uncased bore;

Quarry Road, New Haven; Uncased bore;

Main St. (Route 17), New Haven; Uncased bore;

Town Hill Road, New Haven; Uncased bore;

Hunt Road, New Haven; Uncased bore;

River Road, New Haven; Uncased bore; and

Happy Valley Road, Middlebury; Uncased bore.

HDD or boring involves the installation of pits at either side of the area to be crossed and drilling or auguring the pipe beneath that area, creating no disturbance at the surface. This technique, although more expensive, allows us to avoid direct impacts to these areas.

In areas where we will install the pipe with traditional open-cut methods across roadways, we will employ standard traffic control measures to maintain at least one lane of traffic during installation. Additionally, there are areas where we will be installing pipe within the road ROW or shoulder. In these areas we will employ traffic control measures and maintain one lane of traffic during construction. Road surfaces will be protected and restored to original or better condition if impacted by construction.

During construction in these areas, VGS will utilize traffic control methods that comply with Vermont Agency of Transportation ("VTrans") standards, including employment of appropriate signage and the services of sheriffs or other traffic control personnel to manage traffic flow. VGS will obtain highway permits from VTrans and local municipalities for work in state and local roadways.

The Winooski River is considered a navigable water under Section 10 of the Rivers and Harbors Act of 1899, and is subject to the permit jurisdiction of the Army Corps of Engineers ("ACOE"). As explained in Mr. Nelson's testimony, VGS has applied for a Section 10 permit for this crossing. From a practical standpoint, this will have no impact on river transportation and navigation, as we plan to HDD the crossing, and thus will not impact surface waters.

7. Cost Estimate

Q24. Please provide the estimated cost of the Project.

A24. The Project is estimated to cost $83,800,444, which includes the proposed Transmission Mainline and Distribution Mainlines; it does not include the distribution networks in Middlebury and Vergennes. A breakdown of the cost estimate is set forth in Exhibit Petitioner JH-11. The cost estimate was prepared using quotes from equipment vendors, discussions with contractors familiar with the work and historical costs from similar projects.

8. Schedule

Q25. What is the schedule for the Project?

A25. The current schedule is to construct the Project in 2014. This will bring gas service to anchor customers in the Middlebury industrial park by late 2014. The distribution networks in Middlebury and Vergennes would be constructed in

2015, with residential and commercial customers receiving gas service by the 2015/16 winter.

9. Conclusion

Q26. Does this conclude your testimony at this time?

A26. Yes, it does.

STATE OF VERMONT
PUBLIC UTILITY COMMISSION

Investigation pursuant to 30 V.S.A. §§ 30 and 209 regarding the alleged failure of Vermont Gas Systems, Inc. to comply with the certificate of public good in Docket 7970 by burying the pipeline at less than required depth in New Haven, Vermont	)	Case No. 17-3550-INV

Affidavit and Certification of John St. Hilaire

I, John St. Hilaire, being duly sworn, hereby depose and state as follows:

1. I am employed by Vermont Gas Systems, Inc. ("VGS") as Vice President of Operations and I have held that position since 2015. I have been employed by VGS for 26 years in positions of increasing authority including Manager Gas Supply/Control and Director, Operations Services, Gas Supply and Gas control. I have an Associate in Science Degree in Mechanical Engineering Technology from Vermont Technical College (1989), a B.S. in Business Management from Champlain College (1999), an M.S. in Administration from St. Michaels College (2005) and a B.S. in Accounting from Champlain College (2010). I have personal knowledge of the information submitted in this affidavit, except where noted to be on information and belief.

2. The Addison Natural Gas Project ("ANGP" or "Project") route commences at the pre-existing transmission line at Severance Road in Colchester and extends to Route 7 in Middlebury traversing through portions of the towns of Essex, Williston, St. George, Hinesburg, Monkton and New Haven. The Public Utility Commission approved the Certificate of Public Good for the Project on December 23, 2013. *Petition of Vermont Gas Systems, Inc., for a certificate of public, pursuant to 30 V.S.A. § 248, authorizing the construction of the "Addison*

Natural Gas Pipeline," Docket 7970 (Vt. Pub. Util. Comm., Dec. 23, 2013) Final Order (hereafter "2013 Final Order").

Depth of Cover Survey Information for Project

3. I am personally familiar with the 2013 Final Order in Docket 7970 (Vt. Pub. Util. Comm., Dec. 23, 2013), the plans and evidence submitted in Docket 7970, and the permits and other agreements that contain requirements for the construction of the Project (collectively all referred to as "Project Documents").

4. VGS engaged the engineering firm of Clough, Harbour & Associates ("CHA") to provide survey services, including staking out right-of-way and the pipeline centerline, and taking top of pipe readings at the time of installation and depth of cover readings after final grade was achieved by the pipeline contractor. VGS also engaged CHA to provide as-built drawings, which CHA has not yet completed.

5. Based on the depth of cover information from CHA and that gathered by VGS employed surveyors, more than 95% of the ANGP pipeline was installed to a depth of at least 4 feet.

6. The entire ANGP pipeline was installed at least 36 inches underground at every one of the more than 4500 welds along its 41 mile length.

7. Based on the CHA survey data and that gathered by VGS employed surveyors, VGS has prepared a Depth Table that provides information about the depth of cover at each of over 4,500 locations. The Depth Table is attached here as **Exhibit 1.**

8. VGS' survey engineers confirmed installed depth of cover at approximately 4500 welds and inflection points along the length of the pipeline (approximately 4050 through survey

measurement of welds and 450 from Horizontal Directional Drilling ("HDD") reports and pipe locators).

9. The several portions of ANGP within an HDD or other drilled section were not measured at every weld. With respect to the HDDs, compliance is described in the notes section of the Depth Table, which specifically references the drill profile and describes our method for determining the shallowest depth of cover. For the road bores not involving HDD, compliance is described in the notes section of the Depth Table, which specifically references the depth identified using the pipe locator.

10. The Commission's summary of the Project's construction made this finding expressly related to depth of cover:

> e. Pipe lengths will be welded together, inspected, laid in the trench and warning tape will be laid over the line, and then the trench will be backfilled. The pipe will be covered by at least 36 inches of soil. The pipeline will have four feet of cover in agricultural areas and within the VELCO ROW, generally five feet of cover at road crossings, and seven feet of cover at open cut streams.

2013 Final Order at 40, Finding 62(e).

11. The PUC ordered VGS to comply with the terms of all state and federal agency permits and all separate landowner and other agreements, some of which contained specific depth of cover requirements. 2013 Final Order, at 11.

12. These specific permits and agreements include the Department of Environmental Conservation stream alteration permit and water quality permit, VTrans ROW permits, railroad licenses, Army Corp of Engineer permits, the VELCO MOA, and landowner agreements. VGS entered into agreements with more than 30 landowners along the route that specified depth of cover requirements. These requirements were at 3 or 4 feet, except one (Hurlburt) that required 5 feet; none set forth any deeper standard.

13. As outlined in VGS' August 4 filing, there is no requirement in the 2013 Final Order regarding depth of cover for "residential areas."

14. The attached Depth Table lists the type of regulation, permit or agreement that requires the deepest installed cover applicable to every measured location, and what that requirement is, except where that standard is tied to "as built" depths, which are described in the notes section. Notes in the Depth Table provide detail where needed on permit changes or amendments, and on other information specific to a particular measured location. For example, the depth required by VTrans per its permit varied by location. There are five locations in the VTrans right-of-way that VTrans has preliminarily indicated are acceptable at the installed depth, but which are subject to final inspection by VTrans once it has the "as-built" drawings from VGS. There are also individual location notations for a spot where a landowner put in a drainage swale over the pipeline between the time of installation and final measurement (and we have agreed that VGS will come onsite to restore this spot).

15. Also based upon these survey data and measurements, VGS has prepared maps for each town through which the ANGP passes. These maps illustrate the surveyed depths of cover over the pipeline, along with showing the depth of cover that VGS' contractors used to guide the pipeline construction. The maps are attached to this affidavit as **Exhibits 2 through 15**.

16. I am personally familiar with and knowledgeable about the information in Exhibits 1 through 15 because I worked closely with CHA and VGS personnel to compile the measurement data into Exhibit 1 and to prepare the maps attached as Exhibits 2 through 15.

17. The attached Depth Table and maps show that based on survey data, the pipeline's installed depth of cover complies with applicable regulations, permits and agreements, with the exception of the 18 locations in the Clay Plains Swamp.

18. On behalf of VGS, I certify that, other than the 18 welds in the Clay Plains Swamp, based on the information compiled by the CHA and VGS survey teams as shown in the Depth Table attached here as Exhibit 1, the pipeline's installed depth complies with the Project's permits, agreements, and the 2013 Final Order.

ANGP Project Background

19. VGS engaged Over & Under and later Michels Corporation ("Michels") for the Project to perform pipeline construction and related activities including clearing/grading, ditching, stringing (transporting and placing pipe along the right-of-way), bending, welding, coating, lowering-in, backfill, testing, clean up, and restoration.

20. Vermont Gas contracted with Michels to undertake mainline construction in 2015 and 2016, including approximately 30 miles of the ANGP in 2016. As the contractor, Michels was responsible for construction means and methods.

21. As noted above, VGS engaged the engineering firm of CHA to provide survey services, including staking out right-of-way and the pipeline centerline, taking top of pipe readings at the time of installation and depth of cover readings after final grade was achieved by the pipeline contractor, and providing as-built services.

22. VGS engaged Hatch Mott McDonald ("HMM") in 2016 to provide construction inspection services including providing inspection of the construction management and all construction, welding, and coating inspectors. Previously, McDaniel Technical Services, Inc.

provided inspection services in 2015, and AK Environmental, LLC, provided construction inspection services in 2014.

23. VGS engaged PWC to provide construction management services.

24. In addition, VGS had a management team of VGS employees, who, together with PWC personnel, oversaw construction of the Project, providing, among other things, engineering support and project management services.

25. Throughout the construction of this pipeline, VGS worked with the Department of Public Service ("Department"), through both its gas engineer G.C. Morris and John MacCauley, its outside expert hired to help with field oversight for Project.

26. VGS had weekly meetings during the construction with the Department to address any concerns that arose, and the Department's representatives were on-site frequently during installation. VGS continues to have weekly meetings with the Department to review and close out remaining details on the Project.

27. The Project, which consists of 41 miles of pipeline, is connected by over 4,500 welds and buried beneath the ground either through open trenching or Horizontal Directional Drilling ("HDD").

28. As constructed, the pipeline passes through a portion of New Haven that is identified in the ANR MOU as the Red/Silver Maple Green Ash Swamp. This area is also called the Clay Plains Swamp and will be referred to as such in this Affidavit.

29. The pipeline contractors and CHA knew the required depth of cover for a particular area based on the documents provided to them by VGS at the time of construction, including the 2013 Final Order, and related materials submitted to the PUC in Docket 7970, the collateral permits related to the ANGP, and construction level plans.

30. Michels began construction work for the season on approximately May 23, 2016 and completed construction activities on December 12, 2016. During construction, Michels met with VGS personnel frequently, including weekly construction management meetings to discuss the current status of pipeline construction and plans for upcoming work.

The Process for Determining Depth of Cover Along the Pipeline

31. During the construction process for the ANGP, depth of cover verification involved the following four step process for open cut installations:

a. Sections of the pipeline were prepared for installation and "cribbed" or placed in a "staging trench" to protect it while the trench was prepared. Pipelines are typically staged on wood cribbing along a trench line until they are ready to be lowered into the final trench. In wet swamp conditions, where the soil does not support the pipeline on wood cribbing, the pipe is put in a shallow "staging trench" until the contractor is ready to move forward with installing the pipe by digging along each side to remove muddy soil and slowly lower the pipe. To do this, the contractor digs a small trench, not much larger than the pipe, to stage the pipe until the trenching and installation can occur. Once the pipeline contractor has completed welding, coating, x-ray, trenching, and lowered the pipe into the trench, CHA was called in to take an electronic measurement of "elevation" at the top of each weld. The elevation measurement records an X, Y, Z coordinate. This gave a longitudinal and latitudinal measurement for each weld.

b. The pipeline contractor then backfilled and restored the site including replacing topsoil and contouring to return the site as close to its original condition as practicable. Once this step was complete, CHA returned to the location and took a second elevation recording at the top of cover and a new X, Y, Z coordinate. Collecting the data took several weeks.

c. CHA then compiled its survey data and compared the initial top of weld elevations with the post installation top of cover elevation measurements to calculate depth of the pipe.

d. After performing its data compilation, CHA then provided VGS with a list of welds where the expected depth of cover may not have been achieved. VGS then did further surveys at locations provided by CHA to again measure depth of cover.

32. In general, if a calculation confirmed a weld was not at required depth of cover, VGS worked with Michels to remediate the depth of cover at these locations.

33. After remediation, CHA or VGS personnel performed additional survey work to confirm that the required depth of cover had been met through the remediation efforts.

The Installation of the Pipeline in the Clay Plains Swamp

34. The VELCO MOA provides: "VGS will design the Project in VELCO's ROW and access roads into VELCO's ROW to meet an HS-20+15% standard which VGS plans to meet by using Class 3 pipe interred at a depth of 4 feet." VELCO MOA, at 3, attached here as **Exhibit 16**.

35. Consistent with VGS' plan to meet the VELCO loading standard as set forth in the VELCO MOA, the construction specifications provided to Michels called for a 4-foot depth of cover in this area.

36. I am informed that the pipe was staged in the Clay Plains Swamp in early September and installed on September 15, 16, 19 and 20, 2016. It took four days to install approximately 2,500 feet of pipeline due to the wet conditions. Based on the pace of work in other locations, I would have expected it to take around two days to install this amount of pipe.

37. There is very limited public access in the area of the Clay Plains Swamp where the pipe was installed. There is no road or trail meant for a vehicle. For practical purposes, the only expected loading in this area would be by VELCO to access its own facilities, though the loading standard would protect the pipeline from public uses as well.

38. I oversaw the completion of the Root Cause Analysis of the Clay Plains depth of cover matter requested by the Commission, which is attached here as **Exhibit 17**. I believe the following facts in Paragraphs 39-62 reflected in that Root Cause analysis to be true based upon the work done to create it.

39. Given the wet soil conditions in this location, Michels began its work by constructing a mat road to access and install the pipeline, using 8 foot wooden mats. In the Clay Plains Swamp area, the ROW and work space was narrow, compared to other areas of the ANGP. Michels used a staging trench as the field team prepared for actual trenching and pipe lowering at a later date.

40. On September 15, Michels began the process of excavating to lower the pipe and was unable to achieve depth within the planned working hours.

41. On September 16, Michels continued efforts to lower the pipe, using wider wooden mats placed along the wall of the dug trench along with multiple excavators to help hold wet soil and aid in lowering the pipe. The work proceeded slowly, extending into the following work week on September 19 and 20. Michels reported progress, but told VGS representatives that great care had to be taken to protect equipment and workers using the wooden mats for stability. Michels reported that at one point, a piece of equipment exiting the site slipped off its mat and became stuck temporarily in mud.

42. VGS personnel directed its inspection contractor, HMM, to inform Michels to continue using its best efforts to get the pipe buried to the planned depth of four feet.

43. On September 19, VGS informed VELCO of the challenges Michels was experiencing installing the pipeline within the Clay Plains Swamp ROW. Concerned that Michels may not achieve the planned 4-foot depth specified, VGS discussed with VELCO whether its loading standards could be achieved with a shallower burial at this location. On September 20, VGS shared with VELCO an engineering analysis performed in May 2016 that showed VELCO's loading standard would be met with depths at 3 feet. See September 20 email from John St. Hilaire to Peter Lind at VELCO, with Mr. Lind's response, attached hereto at

Exhibit 18 (the attachment to this email is the May 25 Mott McDonald engineering analysis of the loading standard VGS provided to VELCO). VGS also informed VELCO that its contractor would continue to work to reach a 4-foot depth and complete installation in this area.

44. Following the protocol for the pipeline installed though open trenching, during initial installation VGS' survey contractor CHA took a measurement at the top of the pipe at each weld in the Clay Plains Swamp, so that final interred depth could be determined after fill, contouring and clean-up. Actual depth of cover cannot be determined until after these steps occur and cover is placed on the pipe.

45. On September 20, Michels completed installation in this section of the VELCO ROW and discontinued trenching activities.

46. On September 21, VELCO told VGS that it agreed that its loading standard could be met at a shallower depth than 4 feet, so long as other protective measures were put in place, such as additional markers, and the companies memorialized in writing any modified methods employed. See Exhibit 18.

47. After the installation, Michels spent approximately 8 days on clean-up and final grade in the Clay Plains Swamp. Based on the pace of work in other locations, I would have expected it to take about 3 days for these activities in typical open field conditions.

48. Due to the wet, muddy soil, CHA was unable to reenter the Clay Plains Swamp until November 4 and 6 to take final grade depth of cover measurements.

49. On November 9, 2016, CHA reported to VGS that, for the 2016 season, 290 welds may not have been installed to depth, including 18 in Clay Plains Swamp. All other measurements in the Clay Plains Swamp met the 4-foot specification.

50. On November 11, 2016, VGS informed Michels of the depth deficiencies for the 2016 season identified by the surveyor, and Michels worked to remediate these locations.

51. By December 12, 2016, Michels had remediated the depth of cover issues except the 18 locations in the Clay Plains Swamp. The remediation work typically involves adding more cover and further contouring the soil surface.

52. Michels informed VGS during this remediation work that the Clay Plains Swamp locations could not be successfully remediated through adding cover and further contouring due to the environmentally-sensitive area. As well, Michels communicated to VGS that it lacked confidence that a second attempt at burying the pipe would be any more successful in terms of getting the pipe to four feet throughout the Clay Plains Swamp.

53. Given the challenges faced by VGS' contractors when installing the pipeline within the Clay Plains Swamp, VGS believes that any attempts to rebury the pipeline at these locations would cause greater environmental harm than leaving the pipeline where it is.

54. The 18 locations in the Clay Plains Swamp had an installed depth of between 3.0 and 3.8. At these depths, the VELCO MOA loading standard is still met according to the engineering analysis VGS obtained.

55. The 18 locations in the Clay Plains Swamp were installed at a safe depth because they are at least as deep as the federal depth requirement adopted by the PUC, and meet the VELCO loading standard. VGS also implemented additional protective measures requested by VELCO, as described below.

56. Given the practical challenges of working in the Swamp and the environmental concerns, VGS management determined that it would pursue leaving the pipeline interred at

installed depth at those locations since VELCO loading standards were achieved at those depths, and would seek party and regulatory approval for that plan.

57. During remediation work in mid-November, 2016, VGS informed VELCO that certain locations within the Clay Plains Swamp did not meet 4-foot planned installation depth according to survey measurements.

58. On December 1, 2016, I updated the Department's gas engineer regarding its depth of cover survey results and remediation, including the locations in the Clay Plains Swamp.

59. During the week of December 28, I discussed the "leave in place" option with the Department's public advocacy staff.

60. On January 3, 2017, I spoke in detail with the Department engineer regarding the 18 locations in the Clay Plains Swamp, the work involved in installing the pipeline, and the decision to pursue leaving the pipeline as is with Department support if VELCO agreed.

61. From January through April 25, 2017, VGS worked with VELCO to determine whether VELCO, consistent with its initial September review of the issue, would agree to leave the pipe as installed given satisfaction of the loading standard. On April 25, 2017, VELCO provided its letter of approval to VGS to leave the pipe in place with additional conditions. See VELCO April 25, 2017 Letter, attached here **Exhibit 19** (also provided with VGS' June 2 NSC request).

62. This letter and the engineering analysis performed in May 2016 that showed VELCO's loading standard would be met with depths at 3 feet was provided to the Department on April 26, 2017 for review by the Department gas engineer and Dave Berger, the Department independent engineering consultant.

Safety Measurement Implemented By VGS

63. VGS has implemented numerous "layers of protection," to maintain the integrity of the pipeline in addition to burying it at a certain depth. Together, these measures are all aimed at protecting the buried pipe and include: 1) placement of pipeline markers, 2) implementation of a damage prevention program, 3) use of the One-Call System – federal law requiring use of 811, 4) patrolling the pipeline, 5) performing leak surveys, 6) utilizing the company's public awareness programs, 7) odorization of the gas, 8) observation of excavations, and 9) requirements for soft excavation techniques in tolerance zones, meaning use of hand shoveling close to pipe.

64. The PUC's 2013 Final Order specifically requires ongoing monitoring and remediation:

> 273. VGS will also develop and implement a plan to monitor for and mitigate occurrence of unstable soil and ground movement and if observed conditions indicate the possible loss of cover, perform a depth of cover study, and replace cover as necessary to restore the depth of cover or apply alternative means to provide protection equivalent to the originally required depth of cover for both transmission and distribution pipes. Berger reb. pf. at 9.

65. VGS' ongoing Transmission Maintenance Plan fulfills this requirement.

66. As I described above, VGS also has kept the Department involved in its progress on the Project during construction and to date.

67. Department compliance personnel were present regularly on site during construction of the ANGP, for the purpose of monitoring pipeline safety compliance. In addition, the Department's gas engineer conducted weekly meetings with VGS project team members to review, discuss and assess pipeline construction safety and compliance. Those meetings still occur, as VGS closes out remaining items with the Department.

Project Opponents' Two Claims Regarding Depth Of Cover

68. The picture attached to the Project Opponent's June 23 filing, submitted by Lawrence Shelton, shows the pipeline during an interim point of construction, in a staging trench where it would be lowered and installed at a later date. Mr. Shelton has also sent this photo to PHMSA. PHMSA has not yet closed its review, but as VGS has noted, all locations along the pipeline were installed deeper than the 3-foot depth of cover required by federal regulations.

69. Based on its review of the photo and description of it being taken just south of the Hurlburt property, it appears the photo was taken in the VELCO ROW within Clay Plains Swamp.

70. I cannot say specifically which section of the Clay Plains Swamp pipeline is shown in Mr. Shelton's photo, but based on survey data, VGS has information that all of the pipeline in the Clay Plains Swamp was installed between 3 and 4 feet, not at 18 inches as suggested by Mr. Shelton's photo.

71. Project Opponents' comments also claim that G.C. Morris, the Department's gas engineer, informed Mr. Shelton that VGS made the pipeline deeper at this location by pushing a backhoe down directly on the pipe or the ground above it. I can say unequivocally that the method described was not utilized here (or elsewhere – it is not a method of pipe installation). It is possible that what was described was instead the common industry installation method described above for swampy areas that was in fact used in this location – to stage the pipe in a shallow trench and then dig through the muddy soil on each side next to the pipe, creating a deeper trench as the digging continues and thereby lowering the staged pipe as mud beneath it subsides into the void created by the trenching.

72. Regarding the photograph claiming to depict a crossing on the Sucker Brook in Williston covered by the DEC's Stream Alteration Permit, the Project Opponents reference a VELCO inspector field note on August 29, 2016 that the pipe is not to required depth at a stream in Williston. The note itself suggests additional work in the rock is needed to achieve depth.

73. The installation of this crossing was not completed on August 29. The contractors were able to install the pipe under the Sucker Brook to a depth in excess of 7 feet. See Attachment 1 (ANGP Stream Depth Table) to my August 4, 2017 Affidavit submitted in this matter.

Root Cause Analyses

74. Attached to this Affidavit are Root Cause Analyses for: a) the Clay Plains Swamp depth of cover matter; b) the 2016 Harsh Sunflower incident that was the subject of Docket 8791; c) and the induced voltage protections subject to a Notice of Potential Violation and settlement in Docket 8814, which are labeled **Exhibits 17, 20, and 21**, respectively

75. I oversaw the preparation of these documents for VGS and am familiar with their content, including the information regarding contractor work onsite which I believe to be true.

76. These Root Cause Analyses demonstrate that VGS' project management has been proactive and effective in addressing compliance issues that have arisen in this large and complex Project.

Dated at Burlington, Vermont this 11 day of August, 2017.

John St. Hilaire

Subscribed and sworn to before me this 11 day of August, 2017.

Notary Public
My commission expires: 2/10/19

STATE OF VERMONT
PUBLIC UTILITIES COMMISSION

Petition of Vermont Gas Systems, Inc., for a certificate of public good, pursuant to 30 V.S.A. § 248 , authorizing the construction of the "Addison Natural Gas Project" consisting of approximately 43 miles of new natural gas transmission pipeline in Chittenden and Addison Counties, approximately 5 miles of new distribution mainlines in Addison County, together with three new gate stations in Williston, New Haven and Middlebury, Vermont	)	Case No. 17-3550-INV

SUPPLEMENTAL AFFIDAVIT OF LAWRENCE SHELTON

I, Lawrence Shelton, upon being duly sworn, do depose and say:

1. I am a highly experienced project manager. I began my career as a mason over 40 years ago, and for the past 30 years have worked as a masonry project manager and estimator. My experience includes project estimation and management of construction of what at the time was advertised as the largest brick building in the world -- the new offices of the National Institutes of Health.

2. The attached MP-3 video was taken by me on my cell phone. It was taken late in the day, after all construction had ceased, on September 19, 2016, at the site of the Clay Plain Swamp that is subject to VGS's nonsubstantial change request.

3. The video starts by looking north toward the Hurlburt property. Then it swings around to the south. The video shows the surroundings of the pipeline. There is only one trench. The pipeline is in that trench. The trench is less than 2 feet deep and the 12-inch pipeline is lying on top of the trench. This was at the end of the day on September 19.

4. Mr. St. Hilaire's Affidavit, in Paragraph 45, states that construction was completed the next day, on September 20. VGS claims that the pipeline was left between 3 and 4 feet deep.

5. For the 12-inch pipeline to be 3 feet deep, the trench would have to be at least 4 feet deep. It would have been impossible to commence and complete digging a new 4-foot deep trench, and then commence and complete installing the pipeline into the new trench, over the hundreds of yards of the Clay Plain Swamp area, all during one working day. This is particularly the case in this location – a wetland that an excavator had been almost entirely mired in. This was a very difficult work environment. In addition, when I was present at the end of the day on September 19, there was no heavy equipment on the site. Therefore, all of the equipment that would have been needed to excavate the four foot deep trench would have had to be brought to the site and then – again, in a wetland – positioned and repositioned to dig the new trench. In contrast, to cover the pipeline that I photographed would have been readily feasible in one day

using one piece of equipment and using the wooden matting that is evident in my photographs and video.

6. I do not disagree with Mr. St. Hilaire that the pipeline was completed on September 20. The pipeline and trench I documented in my photographs and video are the pipeline and trench that were covered with fill and completed on September 20. That pipeline was not placed in a new 4-foot deep trench that did not exist the day before.

Lawrence Shelton

On September 3, 2017, Lawrence Shelton appeared before me and subscribed and swore to the truth of this affidavit.

Notary Public Emily Haskins

ROOT CAUSE ANALYSIS
ADDISON NATURAL GAS PIPELINE

CLAY PLAINS CONSTRUCTION
DEPTH OF COVER – SEPTEMBER 6 TO NOVEMBER 9, 2016

VERMONT GAS SYSTEMS, INC.
85 SWIFT STREET
SOUTH BURLINGTON, VT 05403

PREPARED BY: JOHN ST. HILAIRE
AUGUST 11, 2017

INTRODUCTION

The purpose of this Root Cause Analysis ("RCA") is to examine the events that occurred and determine the causes that contributed to the installation of the Addison Natural Gas Pipeline ("ANGP") within the Red/Silver Maple Green Ash Swamp (also referred to as Clay Plains) at a depth of less than 4 feet at 18 locations.

As described below, after notification of the achieved depths from its survey contractor, VGS pursued an agreed remediation plan with the ROW owner, VELCO, and sought the Department of Public Service's ("Department") input. Those efforts led to a request to the Public Utility Commission ("PUC") on June 2, 2017 for a determination of a Non-Substantial Change ("NSC") related to the remediation plan.

EVENT DESCRIPTION AND TIMELINE

VGS entered into a Memorandum of Agreement with VELCO ("VELCO MOA") regarding the installation of the ANGP within its ROW, including in the Clay Plains Swamp, approved by the PUC in its Final Order granting a CPG for the project. The VELCO MOA stated: "5. Loading. VGS will design the Project in VELCO's ROW to meet an HS-20+15% standard which VGS plans to meet by using Class 3 pipe interred at a depth of 4 feet." The PUC's Final Order required compliance with the VELCO MOA.

Vermont Gas contracted with Michels to undertake mainline construction in 2015 and 2016, including approximately 30 miles of the ANGP in 2016. As the contractor, Michels was responsible for construction means and methods. Michels was provided contractor specifications, including for the VELCO ROW, for the 2016 season.

Michels began construction work for the season on approximately May 23, 2016 and completed construction activities on December 12, 2016. During construction, Michels met with VGS personnel frequently, including weekly construction management meetings to discuss the current status of pipeline construction and plans for upcoming work.

In early September 2016, Michels began the process of installing the pipeline in the Clay Plains Swamp. Consistent with VGS' plan to meet the VELCO loading standard as set forth in the VELCO MOA, VGS' construction specifications called for a 4-foot depth of cover in this area. Given the wet soil conditions in this location, Michels began its work by constructing a mat road to access and install the pipeline, using 8' wooden mats. In the Clay Plains Swamp area, the ROW and work space was narrow, compared to other areas of the ANGP. As a result, Michels initially placed the pipe in a staging trench as the field team prepared for actual trenching and pipe lowering at a later date.

On September 15, Michels began the process of excavating to lower the pipe and was unable to achieve depth within the planned working hours.

On September 16, Michels continued efforts to lower the pipe, using longer wooden mats placed along the wall of the dug trench along with multiple excavators to help hold wet soil and aid in lowering the pipe. The work proceeded slowly, extending into the following work week on September 19 and 20. Michels reported progress, but noted that great care had to be taken to protect equipment and workers using the wooden mats for stability. At one point, a piece of equipment slipped off its mat and became stuck temporarily in mud.

On September 19, VGS informed VELCO of the challenges Michels was experiencing installing the pipeline within the Clay Plains Swamp ROW. Concerned that Michels may not achieve the planned 4-foot depth specified, VGS discussed with VELCO whether its loading standards could be achieved with a shallower burial at this location. VGS shared with VELCO an engineering analysis performed in May 2016 that showed VELCO's loading standard would be met with depths at 3 feet. VGS also informed VELCO that its contractor would continue to work to reach a 4-foot depth and complete installation in this area. Michels finished installation on September 20, 2016.

Following the protocol for the pipeline installed through open trenching, during initial installation, VGS' survey contractor CHA took a measurement at the top of the pipe at each weld in the Clay Plains Swamp, so that final interred depth could be determined after fill, contouring and clean-up.

On September 21, VELCO told VGS that it agreed that its loading standard could be met at a shallower depth than 4 feet, so long as other protective measures were put in place, such as additional markers, and the companies memorialized in writing any modified methods employed.

Michels then finished contour and clean-up of the site. Michels spent 8 days on this work. This distance would normally take approximately 3 days for these activities in typical open field conditions.

Due to the wet, muddy soil, CHA was unable to reenter the Clay Plains swamp until November 4 and 6 to take final grade depth of cover measurements.

On November 9, 2016, CHA reported to VGS that, for the entire 2016 season, 290 welds were not to depth, including 18 in Clay Plains Swamp. All other measurements in the Clay Plains Swamp met the 4-foot specification.

On November 11, 2016, VGS informed Michels of the depth deficiencies for the 2016 season identified by the surveyor, and Michels proceeded to remediate these locations.

By December 12, 2016, Michels had remediated all of these depth of cover issues except the 18 locations in the Clay Plains Swamp.

Michels informed VGS that it lacked confidence that an attempt to remediate depths in the Clay Plains Swamp locations would be any more successful than it had been during initial installation due to the challenging site conditions. As well, Michels informed VGS that this areas could not be remediated through cover or further contouring due to the environmentally-sensitive area.

Given the practical challenges of working in the Swamp and the environmental concerns, VGS management determined that it would pursue leaving the pipeline interred at installed depth at those locations since VELCO loading standards were achieved at those depths, and by seeking party and regulatory approval for that plan.

Timeline of Post-Installation Communications with VELCO and Department:

- During remediation work in mid-November, VGS informed VELCO that certain locations within the Clay Plains Swamp did not meet 4-foot planned installation depth according to survey measurements.
- On December 1, 2016, VGS updated the Department's gas engineer regarding its depth of cover survey results and remediation, including the locations in the Clay Plains Swamp.
- During the week of December 28, VGS discussed the "leave in place" option with the Department's public advocacy staff.
- On January 3, 2017, VGS spoke in detail with the Department engineer regarding all the 18 locations in the Clay Plains Swamp, the work involved in installing the pipeline, and the decision to pursue leaving the pipeline as is with Department support if VELCO agrees.
- January through April 25, 2017: VGS works with VELCO to determine whether it agrees to leaving pipe as installed given loading satisfaction. VELCO provides letter of approval to leave in place on April 25, 2017. Letter is provided to Department on April 26, 2017.
- This letter and the engineering analysis performed in May 2016 that showed VELCO's loading standard would be met with depths at 3 feet was provided to the Department on April 26, 2017 for review by the Department gas engineer and Dave Berger, the Department independent engineering consultant.
- June 2, 2017, VGS files NSC with Commission to seek confirmation that leaving the pipe in place as installed while meeting loading factor is a non-substantial change to the CPG.

FINDINGS AND ROOT CAUSE

Contributing Factors:

- Muddy soil conditions in Clay Plains Swamp, wetter and deeper than had been expected
- Apparent settling of the wet soils after construction

Root Cause:

- The soils in the Clay Plains Swamp were deep and wet, resulting in the inability to maintain trench stability while installing the pipeline along its entire length

Root Cause Summary:

- Contractor encountered deep wet muddy conditions during pipeline installation that resulted in the inability to maintain trench stability allowing for 4-foot depth

along entire stretch of Clay Plains Swamp. These conditions contributed to the pipeline not being at 4 feet in 18 locations within the Clay Plains Swamp.

FOLLOW-UP ACTION

See above description of communication and analysis regarding loading factor with VELCO during and after installation, and communications with Department. VGS will adhere to additional protocols as reflected in VELCO's letter of April 25, 2016 and the Department's June 23, 2016 filing regarding these locations.

Pending PUC approval of the NSC, no additional follow up is required at this time.

The Vermont Secretary of State's Office of Professional Regulation considers the information in the online licensee look up contained on this website to be a secure and primary source for license verification. The Office certified this information at the date and time noted below. License status may have changed since this record was printed. Use the Office's online licensee lookup for real-time license verification.

Conduct decisions may be found online at
www.sec.state.vt.us./professional-regulation/professional-conduct

Cases indicating "Charges Filed" or "Pending Hearing" are allegations only and must be proved at a hearing held by the licensing authority. If no discipline is listed below, there are no disciplinary records related to this licensee.

Lookup Detail View

Name and Address

Name of Licensee	Address	City / Town	State	Zip Code	Country
Michael Hollowood	234 Falsetto Ct	Ballston Spa	NY	12020-2679	US

License Information

License Number	Profession Type	First Issuance Date	Effective Date	Expiration Date
018.0097764	Professional Engineer	9/5/2013	08/01/2018	7/31/2020

License Status	Supervisor	Employer	Specialty
Active			Civil

Case History

Case Number	Date Opened	Date Closed	Status
No Records Found			

Generated on : May 20, 2019 2:54:56 PM

COLER & COLANTONIO INC
ENGINEERS AND SCIENTISTS

December 17, 2012

John V. Heintz, PE
CHA
70 S. Winooski Ave., #204
Burlington, VT 05401

Re.: Transmittal Letter
Transmission Mainline Engineering Plans
and
Distribution Mainline Engineering Plans
Revision 0, Issued for Vermont Statues Article 248 Filing
Vermont Gas System
Addison Natural Gas Project
IP Extension and IP Lateral

Mr. Heintz:

Find transmitted herewith, the above referenced engineering plans to support your testimony in the Vermont Statues Article 248 Proceedings.

The following design progress drawings have been prepared under my direct supervision and have been reviewed by me prior to this submittal for inclusion in the Vermont Gas Systems, Addison Natural Gas Project 248 Application.

Do not hesitate to contact either Jeffrey O'Donnell or me for any clarification or additional information you may need.

Sincerely,
COLER & COLANTONIO, INC:

James C. Colantonio, P.E.
CEO

STATE OF VERMONT
JAMES J. COLANTONIO
No. 5983
REGISTERED
PROFESSIONAL ENGINEER
12-17-12

36 Cordage Park Circle, Suite 340
Plymouth, MA 02360
Phone: 781-792-2232
Fax: 781-792-2290

RIGHT-OF-WAY

0+00.0 | 1.01 N/F KILMOYER, RALPH; OTTEN, AMY | 1.02 N/F PAGE, GARY & SUSAN | 1 N/F THIBAULT, JO ANN | 2 N/F STATE OF VERMONT | 2.01 N/F LINCKS, MICHAEL & ELIZABETH | MATCHLINE

SURVEY DATA

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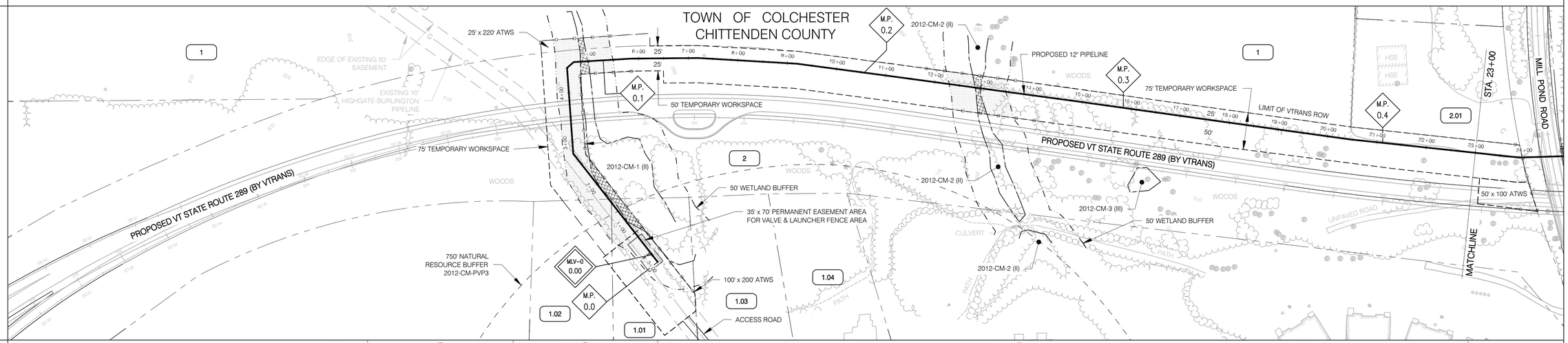
ALIGNMENT DETAIL



CONST. TYPE: 1A | 1G | 1B

PROFILE

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NOT FOR CONSTRUCTION

MATERIALS

	0+00.0	1	1	1	1	MATCHLINE
		548 FT	681 FT	115 FT	956 FT	
COATING		C	A	C	A	
CLASSIFICATION		3				
DESIGN FACTOR		0.5				
ROCK PROB.		0% - 5%				

LEGEND		INTERCEPTOR DIKE/TRENCH PLUG SPACING	
SYMBOL	DESCRIPTION	SLOPE	SPACING
○	PERMANENT INTERCEPTOR DIKE.	< 5%	NO STRUCTURE
△	TRENCH PLUG (AS REQUIRED).	5 – 15%	300 FT
⇧	INTERMEDIATE STREAM CROSSING CULVERT WITH CRUSHED STONE BRIDGE, SILT FENCE, TRENCH PLUGS, INTERCEPTOR DIKES.	15 – 30%	200 FT
⇧	MINOR STREAM CROSSING : CULVERT WITH CRUSHED STONE BRIDGE, SILT FENCE, FLUME PIPE ACROSS OPEN TRENCH.	> 30%	100 FT
	ROAD CROSSING : CRUSHED STONE ACCESS, SILT FENCE (AS REQ'D), EROSION CONTROL FABRIC (2:1 SLOPES OR GREATER).		

HORIZONTAL SCALE
100 50 0 100 200 300 feet
VERTICAL SCALE
100 50 0 100 200 300 feet

PIPE MATERIAL:
1 12.75" O.D. X 0.312" WT, API-5L, GR. X65, PSL-2 — 2,300 FT
2 12.75" O.D. X 0.250" WT, API-5L, GR. X65, PSL-2B — 0 FT
3 18" O.D. X 0.500" WT, API-5L, GR. B — 0 FT

PIPE COATING:
A EPOXY POLYETHYLENE 10/40, PRITEC OR APPROVED EQUAL — 1,637 FT
B ABRASION RESISTANT COATING, 40 MILS, WARRIOR 100 OR APPROVED EQUAL — 0 FT
C EPOXY POLYETHYLENE 10/40, PRITEC OR APPROVED EQUAL, W/ 1-1/2" REINFORCED CONCRETE W/ 140 LBS/FT³ — 663 FT

DWG. NO.	REFERENCE DWG.	REV	DSN	CK	DESCRIPTION
ANGP-EPSC-001	EPSC PLAN				
G-001 – 010	COVER, INDEX, LEGEND & NOTES, AND CONSTRUCTION DETAILS	0	SAB	JEO	ISSUED FOR VERMONT STATUTES ARTICLE 248 FILING

	BID		CONSTRUCTION	
	INITIALS	DATE	INITIALS	DATE
ENVIRONMENTAL				
DRAFTING DESIGNER	GIL	12/17/12		
DRAFTING SUPERVISOR	BZD	12/17/12		
DESIGN ENGINEER	SAB	12/17/12		
DESIGN MANAGER	JEO	12/17/12		

VERMONT GAS
PROPOSED 12" PIPELINE
ADDISON NATURAL GAS PROJECT
ALIGNMENT SHEET

LOC. CHITTENDEN COUNTY, VERMONT

YEAR: 2012 | W.O. | SCALE: 1" = 100' | DWG. ANGP-T-C-001 | REV. 0

Vermont Gas

VHB Vanasse Hangen Brustlin, Inc.
CHA design/construction solutions
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