

12" Addison Natural Gas Pipeline CIS & DCVG Overlay

Prepared for:

Vermont Gas

Prepared by:



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ARK Engineering & Technical Services, Inc.

639 Granite Street, Suite 200

Braintree, MA 02184

Phone: 781-849-3800

Fax: 781-849-3810

For Information, please contact:
Mr. Michael Placzek, Senior Engineer
NACE Cathodic Protection Specialist 7015
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1 EXECUTIVE SUMMARY

ARK Engineering conducted close interval surveys (CIS) and direct current voltage gradient surveys (DCVG) of the entire 12" Addison Natural Gas Pipeline in late 2016 into 2017. At the request of Vermont Gas, ARK Engineering has been requested to overlay the surveys and to add all the skipped sections into the graphical representation of the surveys.

There were only three gradable DCVG indications found for the whole pipeline. Two were located at test station locations and the third was located in a series of bends in the pipeline. Since there were only three found over the entire length of the pipeline of approximately 41 miles, cathodic protection was relatively easy to establish with a minimum of current. The small number of DCVG indications is also a compliment to the attention to detail maintained during the installation and construction phase of the installation.

There were many skips in the pipeline. Paved roads, HDD's, inaccessible areas such as wetlands were the reasons for the vast majority of the skips. The entire pipeline was 217,911 feet. 29,302 feet were skipped for a 13.4% of the pipeline skipped.

Note About Survey Stationing: The survey stationing used for this work was based on the design/construction survey station supplied by Vermont Gas via a KMZ (Google Earth) file. Should a different survey stationing be applied (such as As-Built), differences in the actual stationing may occur. The stationing was used for the express purpose of inserting skipped locations of the survey in the CIS graphs.

Tab A is the last section of this report. It contains a KMZ file and a CIS/DCVG survey graph representing one mile per graph. Note: The DCVG indications are represented by a purple dot in the (-) 0.2000 value. This value has no tie to the actual DCVG indication magnitude. It was used in order to tie the DCVG indications to the graph. Since there are only three indications, a second vertical axis was not used in order to simplify the graphs.

2 CIS SURVEY SKIP SUMMARY

Vermont Gas - 12" Addison Natural Gas Pipeline				
CIS Skip Summary				
Description	Status	Feet Skipped	SS Start	SS End
Mill Pond Road	Paved	26	26+46	26+72
Road	Dirt	50	39+10	39+60
HDD	Bore	1926	46+15	65+41
HDD	Bore	1495	70+25	85+20
Hwy 2A	Paved	51	109+70	110+21
Railroad	Bore	160	112+40	114+00
Field	Dirt	51	120+30	120+81
Field	Dirt	27	157+75	158+02
Hwy 15	Paved	70	214+30	215+00
Field	Dirt	41	216+51	216+92
Essex Hwy Ramp	Paved	30	239+10	239+40
Essex Hwy	Paved	67	239+49	240+16
Field	Dirt	2818	273+14	301+32
Stream	Water	19	348+80	348+99
Driveway	Paved	25	351+19	351+44
River HDD	Bore	978	356+23	366+01
Open Field Between Bores	Dirt	639	366+01	372+40
Railroad	Bore	144	372+40	373+84
Field	Dirt	18	389+06	389+24
Field	Dirt	26	389+28	389+54
Field	Dirt	23	389+93	390+16
Driveway	Paved	36	392+66	393+02
Redmond Road	Paved	37	395+87	396+24
Driveway	Paved	52	418+32	418+84
Driveway	Paved	43	427+05	427+48
Field	Dirt	74	429+08	429+82
Field	Dirt	54	430+15	430+69
Driveway	Dirt	19	431+18	431+37
Field	Dirt	55	435+14	435+69
Mountain View Road	Paved	40	481+21	481+61
Trail	Paved	13	519+53	519+66
Stream	Water	44	546+60	547+04
Hwy 2	Paved	46	548+65	549+11

I-89 HDD	Paved	899	596+53	60+52
Driveway	Paved	53	606+06	606+59
Driveway	Paved	45	611+41	611+86
Driveway	Paved	40	614+00	614+40
Driveway	Dirt	24	635+04	635+28
Hwy 2A	Paved	58	655+61	656+19
Road	Dirt	34	718+84	719+18
Driveway	Paved	55	776+22	776+77
Hwy 2A	Paved	70	887+05	887+75
Hwy 116	Paved	81	892+77	893+60
Field	Dirt	2094	979+06	1000+23
Wetland/Marsh	Water	1079	1014+87	1025+66
Field	Dirt	30	1046+21	1046+51
Charlotte Road	Paved	34	1048+03	1048+37
Baldwin Road	Paved	40	1114+11	1114+51
Road	Dirt	25	1116+54	1116+79
HDD??	Bore	1317	1167+81	1180+98
HDD - River ??	Bore	547	1203+31	1208+78
Stream	Water	26	1287+95	1288+21
Hollow Road	Paved	36	1397+36	1397+72
Post Road	Paved	68	1424+10	1424+78
HDD - Wetland / River	Bore	3158	1436+70	146+88
Monkton Road	Paved	44	1490+75	1491+19
Marshy Swale	Water	93	1495+12	1496+05
Wetland - Stream	Water	76	1536+37	1537+13
Field	Dirt	43	1589+73	1590+16
Field	Dirt	33	1650+11	165+44
HDD	Bore	1430	1697+59	1711+89
Survey Off Pipeline	Dirt	706	1824+52	1831+58
Rockydale Road	Paved	51	1842+09	1842+60
Driveway	Paved	26	1876+88	1877+14
Driveway	Paved	60	1880+05	1880+65
Townhill Road	Paved	25	1881+71	1881+96
Stream	Bore	6224	1891+66	1953+90
Hunt Road	Paved	134	2010+34	2011+68
River HDD	Bore	809	2069+85	2071+94
Driveway	Paved	18	2125+12	2125+30
Treeline	Dirt	149	2125+78	2127+22
Ethan Allen Highway	Paved	78	2127+41	2128+19
Driveway	Paved	94	2145+40	2146+34

Treeline	Dirt	170	2163+82	2165+52
Road	Dirt	29	2167+40	2167+69

3 DCVG SURVEY SUMMARY

Vermont Gas - 12" Addison Natural Gas Pipeline					
DCVG Indication Summary					
% IR	Calculated ANGP Survey Station	Calculated ANGP Milepost	Latitude	Longitude	Comment
4.57%	24+68	0.4674	44.52581406	-73.15340424	At Test Station
5.01%	108+66	2.0580	44.51839447	-73.12374878	At Test Station
9.95%	1828+36	34.6280	44.12634167	-73.16487767	In Field Bends

4 RECOMMENDATIONS

ARK Engineering has no recommendations for this blended survey product.

Please contact the author if you have any questions or require additional information.

5 TERMS & DEFINITIONS

The following terms and definitions were copied from **NACE International Standard Practice SP0207-2007, "Performing Close Interval Surveys and DC Surface Potential Gradient Surveys on Buried or Submerged Pipelines."**

Aboveground Marker (AGM): A portable or permanently installed device placed on the surface above a pipeline that both detects and records the passage of an in-line inspection (ILI) tool or transmits a signal that is detected and recorded by the tool.

AC Rejection: Measure of the influence of AC voltages on DC potential measurements by a voltmeter.

Alternating Current Voltage Gradient (ACVG) Survey: A method of measuring the change in leakage current in the soil along and around a pipeline to locate coating holidays and characterize corrosion activity.

Anode: The electrode of an electrochemical cell at which oxidation occurs. Electrons flow away from the anode in the external circuit. Corrosion usually occurs and metal ions enter the solution at the anode.

Anomaly: An unexamined deviation from the norm in pipe material, coatings, or welds.

Appurtenance: A component that is attached to the pipeline; e.g., valve, tee, casing, instrument connection.

Automatic Potential Controlled (APC) Rectifier: See *Constant Potential Controlled Rectifier*.

Bond (also Continuity Bond): A connection, usually metallic, that provides electrical continuity between structures that can conduct electricity.

Cable: A bound or sheathed group of insulated conductors.

Cathode: The electrode of an electrochemical cell at which reduction is the principal reaction. Electrons flow toward the cathode in the external circuit.

Cathodic Disbondment: The destruction of adhesion between a coating and the coated surface caused by products of a cathodic reaction.

Cathodic Protection (CP): A technique to reduce the corrosion of a metal surface by making that surface the cathode of an electrochemical cell.

Cathodic Protection (CP) Coupon: A metal specimen made of similar material as the structure under investigation, which is connected to the external surface of, and immersed in the electrolyte adjacent to, the structure being protected by cathodic protection.

Cell-to-Cell Survey: A survey measuring the potential difference between two reference electrodes. Cell-to-cell surveys include ACSVG, DCSVG, side-drain, and hot-spot surveys.

Close-Interval Potential Survey (CIPS) (also Close- Interval Survey [CIS]): A potential survey performed on a buried or submerged metallic pipeline, in order to obtain valid DC structure-to-electrolyte potential measurements at a regular interval sufficiently small to permit a detailed assessment.

Close-Interval Survey with Laterals: A hybrid survey that simultaneously measures the structure-to-electrolyte potentials and the potential at a point lateral to the pipeline.

Coating: A liquid, liquefiable, or mastic composition that, after application to the surface, is converted into a solid protective, decorative, or functional adherent film. For the purposes of this standard, coating refers to a dielectric material applied to a structure to separate it from the environment.

Coating Fault: Any imperfection or defect in the coating, including disbonded areas and holidays.

Conductor: A material suitable for carrying an electric current. It may be bare or insulated.

Constant Current Controlled Rectifier: A rectifier with circuitry and controls to maintain a constant current output.

Constant Potential Controlled Rectifier: A rectifier with circuitry and controls to maintain a constant level of potential on a structure.

Contact Point: A location at which an electrical connection can be made with the pipeline, such as a test lead or aboveground pipe or appurtenance.

Contact Resistance: Electrical resistance at the interface between the reference electrode and the electrolyte.

Corrosion: The deterioration of a material, usually a metal, that results from a reaction with its environment.

Corrosion Potential (E_{corr}): The potential of a corroding surface in an electrolyte relative to a reference electrode under open-circuit conditions (also known as *rest potential*, *open-circuit potential*, or *freely corroding potential*).

Criterion: Standard for assessment of the effectiveness of a CP system.

Current Density: The current to or from a unit area of an electrode surface.

Current Interrupter: A device that interrupts CP current.

Defect: A physically examined anomaly with dimensions or characteristics that exceed acceptable limits.

Depolarization: The removal of factors resisting the current in an electrochemical cell. For the purposes of this standard, depolarization refers to a reduction in the level of protection due to a reduction or elimination of cathodic protection current.

Depolarized Close-Interval Potential Survey: A CIS performed after influencing CP current sources have been turned off for a sufficient duration of time for depolarization to have occurred. This is often called a native-state CIS if it is performed prior to the initial application of CP.

Differential Global Positioning System (DGPS): Global Positioning System survey using differential error correction in order to obtain more accurate positioning.

Direct Current Voltage Gradient (DCVG) Survey: A method of measuring the change in the electrical voltage gradient in the soil along and around the pipeline to locate coating holidays.

Disbonded Coating: Any loss of adhesion between the protective coating and a pipe surface as a result of adhesive failure, chemical attack, mechanical damage, hydrogen concentrations, etc. Disbonded coating may or may not be associated with a coating holiday. See also *Cathodic Disbondment*.

Downstation: In the direction of increasing station number or kilometer post (KP)/milepost (MP).

Downstream: In the direction of flow.

Drop-Cell Survey: CIS of conventional submerged vertical riser.

Duty Cycle: The ratio of the duration CP current is applied to the duration CP current is interrupted.

Dynamic Stray Current: Stray current with changing amplitude and/or geographical path.

Electrical Connection: Point at which the structure is metallicity connected to the measurement circuit.

Electrical Isolation: The condition of being electrically separated from other metallic structures or the environment.

Electrical Survey: Any technique that involves coordinated electrical measurements taken to provide a basis for deduction concerning a particular electrochemical condition relating to corrosion or corrosion control.

Electrode: A conductor used to establish contact with an electrolyte and through which current is transferred to or from an electrolyte.

Electrolyte: A chemical substance containing ions that migrate in an electric field. For the purpose of this standard, electrolyte refers to the soil or liquid adjacent to and in contact with a buried or submerged metallic piping system, including the moisture and other chemicals contained therein.

External Corrosion Direct Assessment (ECDA): A four- step process that combines pre-assessment, indirect inspections, direct examinations, and post assessment to evaluate the impact of external corrosion on the integrity of a pipeline.

Far-Ground (FG) Potential: A structure-to-electrolyte potential measured directly over the pipeline, away from the electrical connection to the pipeline.

Fast-Cycle Interruption: An interruption cycle in which the "off" cycle is less than one second. Usually used so that both an "on" and an instant-off structure-to-electrolyte potential can be measured at each measurement location.

Fast-Cycle Survey: An interrupted CIS using fast-cycle interruption.

Field Comments: Comments entered by the surveyor during the CIS.

Field Plots: CIS graphs generated during the survey.

Flag: A pin flag, or the interval that the flag represents, generally 30 m (100 ft).

Footer Information: Set of comments, measurements, and other information entered at the end of a survey run.

Foreign Structure: Any metallic structure that is not intended as a part of a system under CP.

Free Corrosion Potential: See *Corrosion Potential*.

Galvanic Anode: A metal that provides sacrificial protection to another metal that is more noble when electrically coupled in an electrolyte. This type of anode is the electron source in one type of CP.

Global Positioning System (GPS): The navigational system utilizing satellite technology to provide a user a position on the earth's surface.

Header Information: Set of comments, measurements, and other information entered at the start of a survey run.

Holiday: A discontinuity in a protective coating that exposes unprotected surface to the environment.

Hot-Spot Survey: A cell-to-cell surface potential gradient survey consisting of a series of potential gradients measured along the pipeline, often used on pipelines that are not electrically continuous or on bare or ineffectively coated pipelines in order to detect the probable current discharge (anodic) areas along a pipeline. Where the pipeline is electrically continuous, a close-interval survey and lateral potentials will also detect areas of probable current discharge (anodic areas).

Imperfection: An anomaly with characteristics that do not exceed acceptable limits.

Impressed Current: An electric current supplied by a device employing a power source that is external to the electrode system. (An example is direct current for CP.)

In-Line Inspection (ILI): The inspection of a steel pipeline using an electronic instrument or tool that travels along the interior of the pipeline.

Indication: Any deviation from the norm as measured by an indirect inspection tool such as CIS. An indication may be further classified or characterized as an anomaly or imperfection.

Input Impedance: The equivalent electrical impedance of a voltmeter's internal circuitry in the measurement circuit.

Input Resistance: The equivalent electrical resistance of a voltmeter's internal circuitry in the measurement circuit.

Instant-Off Potential: The polarized half-cell potential of an electrode taken immediately after the CP current is stopped, which closely approximates the potential without IR drop (i.e., the polarized potential) when the current was on.

Intensive Measurement Survey: A hybrid survey that simultaneously measures the structure-to-electrolyte potentials and the potential difference between reference electrodes perpendicular to the pipeline. This survey is also known as a CIS with side drains.

Interference: Any electrical disturbance on a metallic structure as a result of stray current.

Interference Bond: An intentional metallic connection, between metallic systems in contact with a common electrolyte, designed to control electrical current interchange between the systems.

Interrupted Close-Interval Potential Survey (On/Off Survey): A series of structure-to-electrolyte potentials taken along a pipeline, with influencing CP current sources switched using equipment designed to interrupt the CP current briefly.

Interrupter: See *Current Interrupter*.

Interruption Cycle: Duration of current interruption in the "on" and "off" cycle.

Interval: See *Survey Interval*.

IR Drop: The voltage across a resistance in accordance with Ohm's Law.

Irregularity: See *Indication*.

Isolation: See *Electrical Isolation*.

Lateral Potentials: Structure-to-electrolyte potentials offset to each side of the pipeline, typically at a distance of approximately two and one-half times the pipe depth.

Line Current: The direct current flowing on a pipeline.

Long-Line Current: Current through the earth between an anodic and a cathodic area that returns along an underground metallic structure.

Long-Line Current Voltage Drop Error: The voltage drop error in the instant-off potential caused by current in the soil due to potential gradients along the pipe surface.

Metallic IR Drop: Component of IR drop that occurs in the metallic path of the measurement circuit, primarily in the pipeline, under normal conditions.

Near-Ground (NG) Potential: A structure-to-electrolyte potential taken directly over the pipeline, at the spot of electrical connection.

"Off" Cycle: The period of time CP current is interrupted during one cycle of interruption.

"Off" Potential: See *Instant-Off Potential*.

"On" Close-Interval Potential Survey: A series of structure-to-electrolyte potentials taken along a pipeline with the CP current applied.

"On" Cycle: The period of time CP current is applied during one cycle of interruption.

"On" Potential: A potential measured with CP current applied.

Open-Circuit Potential: The potential of an electrode measured with respect to a reference electrode or another electrode in the absence of current.

Pipe-to-Electrolyte Potential: See *Structure-to-Electrolyte Potential*.

Pipe-to-Soil Potential: See *Structure-to-Electrolyte Potential*.

Pipe-to-Water Potential: See *Structure-to-Electrolyte Potential*.

Plug: The porous tip of a reference electrode.

Point of Intersection (PI): A change in direction of a pipeline.

Polarization: The change from the open-circuit potential as a result of current across the electrode/electrolyte interface.

Polarized Potential: The potential across the structure/electrolyte interface that is the sum of the corrosion potential and the cathodic polarization.

Reference Electrode: An electrode whose open-circuit potential is constant under similar conditions of measurement, which is used for measuring the relative potentials of other electrodes. Examples include saturated copper/copper sulfate (CSE), saturated calomel (SCE), and silver/silver chloride (Ag/AgCl).

Reference Half-Cell: See *Reference Electrode*.

Remote Earth (also Electrically Remote): A location on the earth far enough from the affected structure that the soil potential gradients associated with currents entering the earth from the affected structure are insignificant.

Reverse Current Switch: A device that prevents the reversal of DC through a metallic conductor.

Rise Time: Time required for a voltmeter to measure a potential accurately after switching.

Run: See *Survey Run*.

Saturated: A solution obtained when a solvent (liquid) can dissolve no more of a solute (usually a solid) at a given temperature and pressure.

Scatter: Erroneous potentials, usually caused by contact resistance.

Shielding: (1) Protecting; protective cover against mechanical damage [not applicable to this standard]. (2) Preventing or diverting CP current from its natural path.

Shorted Pipeline Casing: A casing that is in direct metallic contact with the carrier pipe.

Side-Drain Potentials: Surface potential gradients measured between two reference electrodes, one located directly over the pipeline and the other offset to each side of the pipeline, typically at a distance of approximately two and one-half times the pipe depth.

Side-Drain Potential Survey: A cell-to-cell surface potential gradient survey consisting of a series of side-drain potentials measured along a pipeline.

Skip: A section of pipeline that is not surveyed during a CIS, for whatever reason.

Slow-Cycle Interruption: An interruption cycle in which the "off" cycle is greater than or equal to one second.

Slow-Cycle Survey: An interrupted CIS using slow-cycle interruption.

Spiking: A momentary surging of potential that occurs on a pipeline when the protective current from an operating CP device is interrupted or applied.

Station Number: Distance information from a reference on the pipeline, used to locate a point on a pipeline.

Stationing: See *Station Number*.

Stray Current: Current through paths other than the intended circuit.

Stray-Current Corrosion: Corrosion resulting from current through paths other than the intended circuit, e.g., by any extraneous current in the earth.

Structure-to-Electrolyte Potential: The potential difference between the surface of a buried or submerged metallic structure and the electrolyte that is measured with reference to an electrode in contact with the electrolyte.

Surface Potential Gradient: Change in the potential on the surface of the ground with respect to distance.

Surface Potential Gradient Survey: A series of surface potential gradients measured along or normal (perpendicular) to a pipeline. Surface potential gradient surveys include DCVG, ACVG, hot-spot surveys, and side- drain surveys.

Survey Direction: The direction a CIS is conducted along a pipeline, usually expressed as upstation or downstation.

Survey Interval: The specified distance between potential measurements along the pipeline in a CIS.

Survey Run: The set of data associated with a single electrical connection to the structure, usually the measurements from one test lead to the next.

Survey Wire: Insulated wire, usually copper, used to connect a survey instrument to the pipeline during a CIS.

Surveyor: Person conducting the CIS.

Synchronized Survey: An interrupted CIS in which the CP current sources are all switched simultaneously.

Telluric Current: Current in the earth as a result of geomagnetic fluctuations.

Telluric Survey: A survey that uses techniques such as listed in Section 10 to correct for telluric currents.

Test Lead (also Test Station, Test Post): A wire or cable attached to a structure for electrical connection of a survey instrument to make CP potential or current measurements.

Trailing-Wire DCVG: A hybrid survey that simultaneously measures the structure-to-electrolyte potentials and the potential difference between reference electrodes along the pipeline.

Upload: To send data from the field data acquisition system to a personal computer (PC).

Upstation: In the direction of decreasing station number or

Upstream: In the direction opposite to the direction of flow.

Voltage: An electromotive force or a difference in electrode potentials expressed in volts.

Voltage Drop: The voltage across a resistance according to Ohm's Law.

Voltage Spiking: See *Spiking*.

Voltmeter Accuracy: The capability of the instrument to faithfully indicate the value of the measured signal. This term is not related to resolution; however, it can never be better than the resolution of the instrument. For example, a 5 1/2 digit voltmeter can have an accuracy of 0.0125% of reading + 24 μ V on its 2.5-V range, which results in an error of 149 μ V when measuring a 1-V signal. On the other hand, the resolution of this same voltmeter is 12 μ V, 12 times better than the accuracy.⁴

Voltmeter Resolution: The smallest amount of input signal change that the instrument can detect reliably. For example, if a voltmeter has 5 1/2 digits displayed and is set to the 20-V input range, the resolution of this voltmeter is 100 μ V. This can be determined by looking at the change associated with the least significant digit.⁴

Voltmeter Sensitivity: The smallest signal the instrument can measure. For example, a meter with a lowest measurement range of 10 V may be able to measure signals with 1-mV resolution but the smallest detectable voltage it can measure may be 15 mV. In this case, the meter has a resolution of 1 mV but a sensitivity of 15 mV.⁴

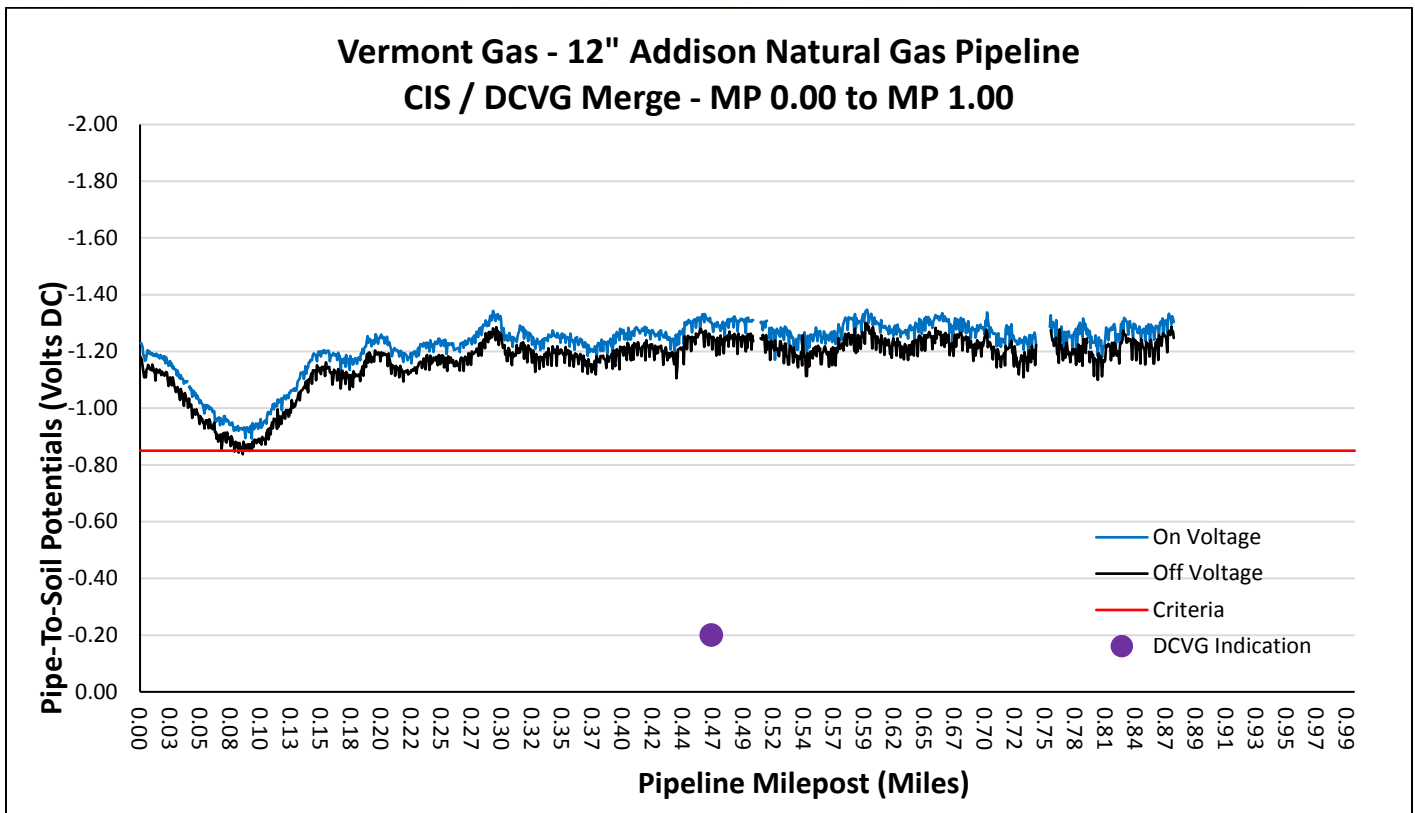
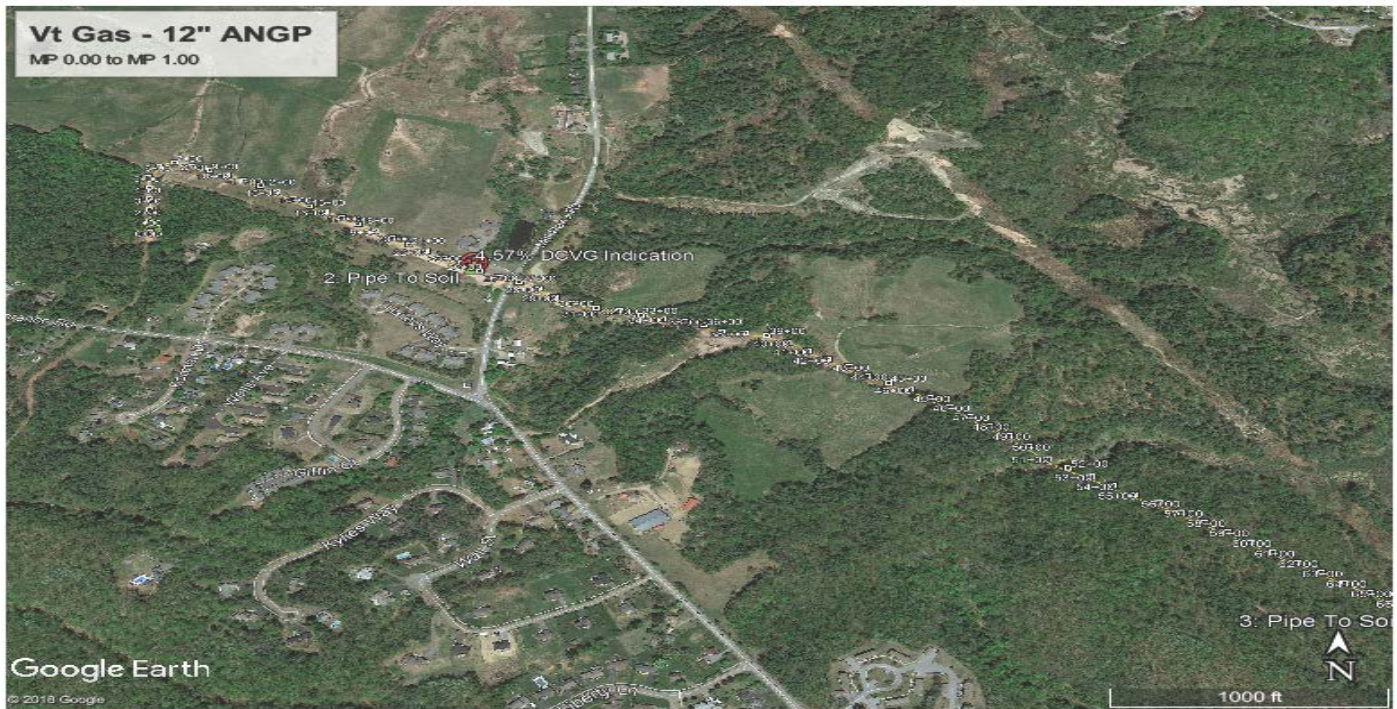
Waveprint: A digitized oscilloscopic plot of the structure-to- electrolyte potential over time, usually recorded during interruption for one or two interruption cycles.

Wire: A slender rod or filament of drawn metal. In practice, the term is also used for smaller-gauge conductors (6 mm² [No. 10 AWG] or smaller).

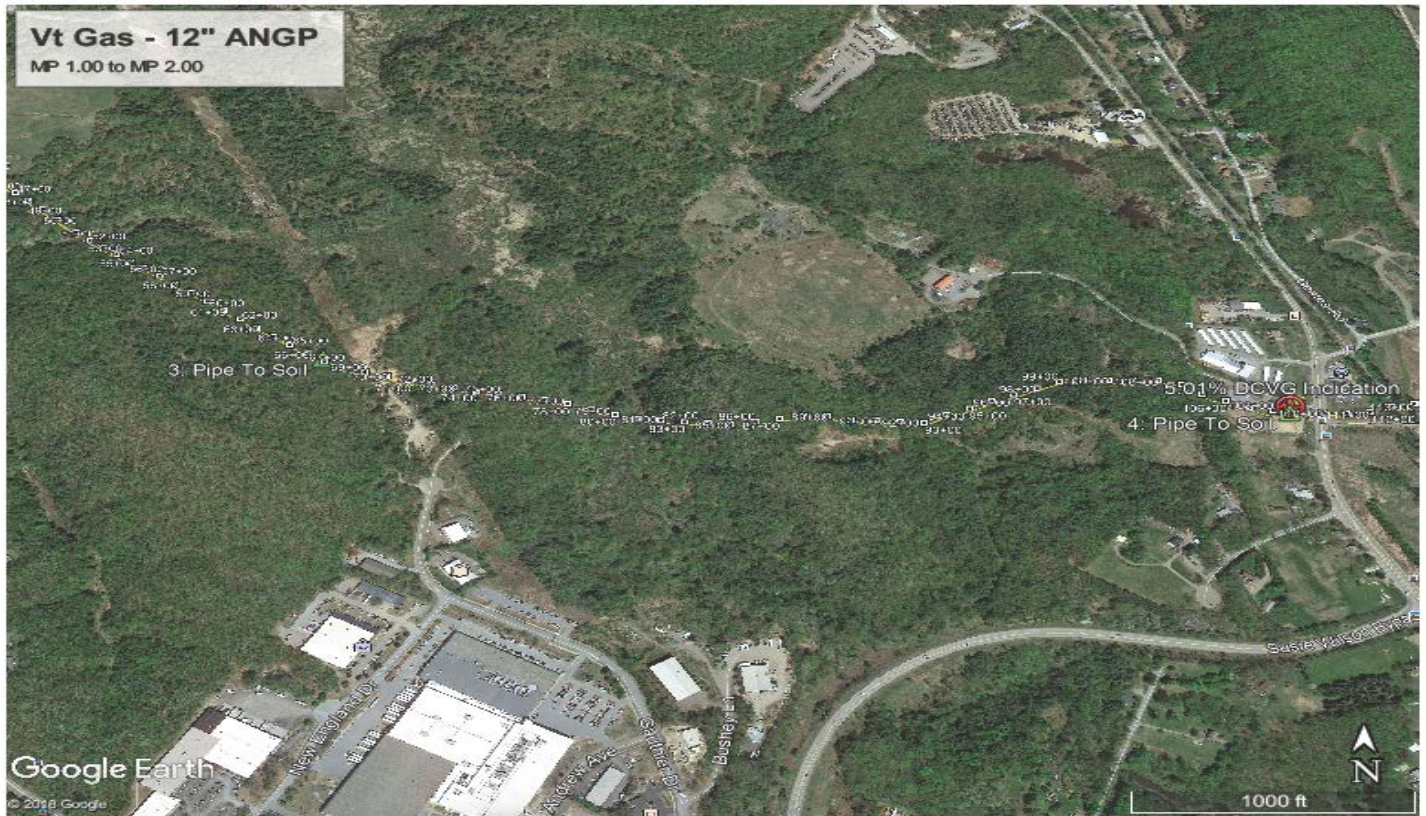
Wire Counter: A device that measures distance surveyed based on the length of wire spooled out.

TAB A: KMZ and CIS/DCVG Graphs

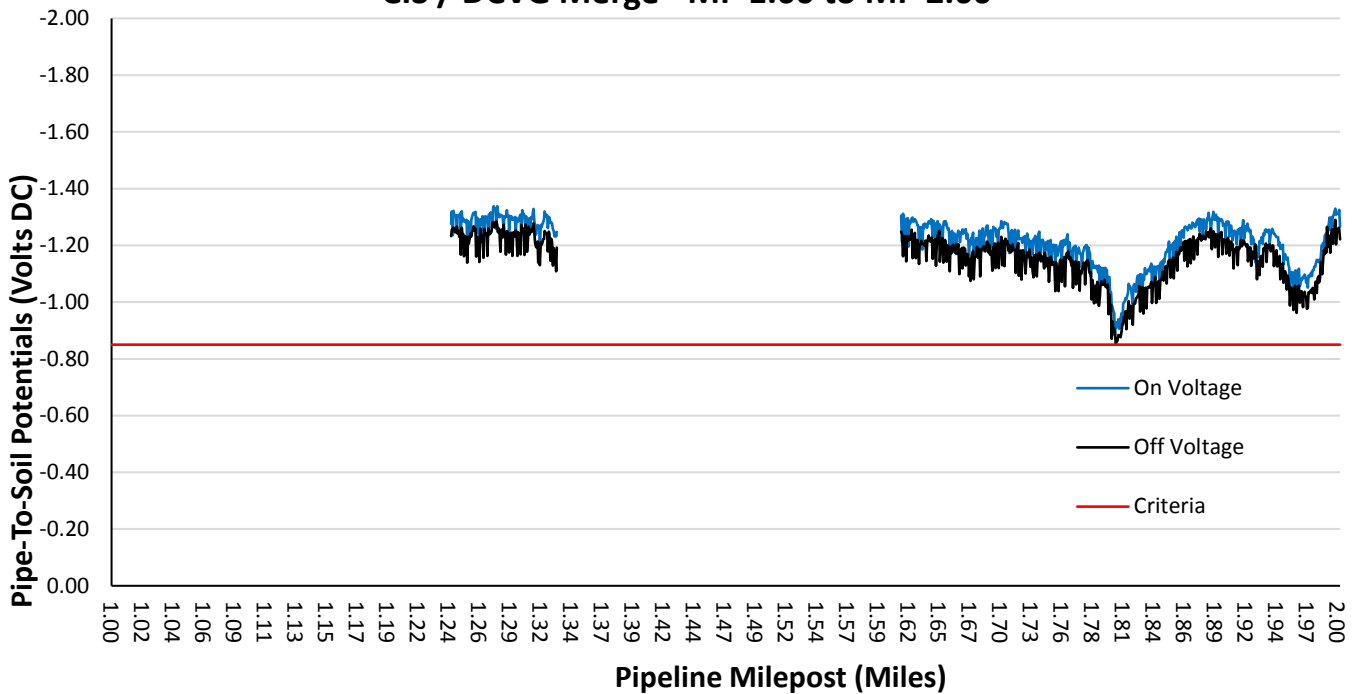
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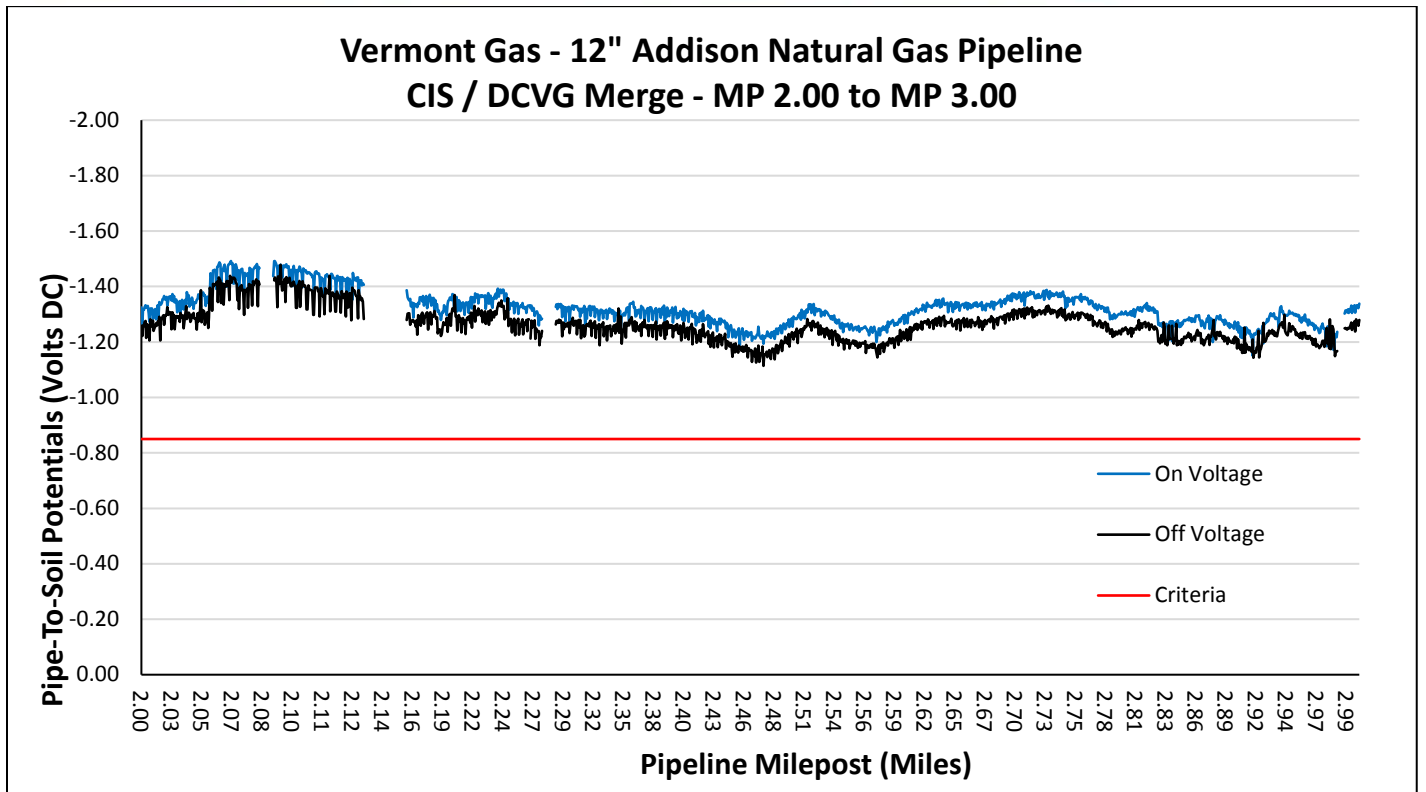
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**Vermont Gas - 12" Addison Natural Gas Pipeline
CIS / DCVG Merge - MP 1.00 to MP 2.00**



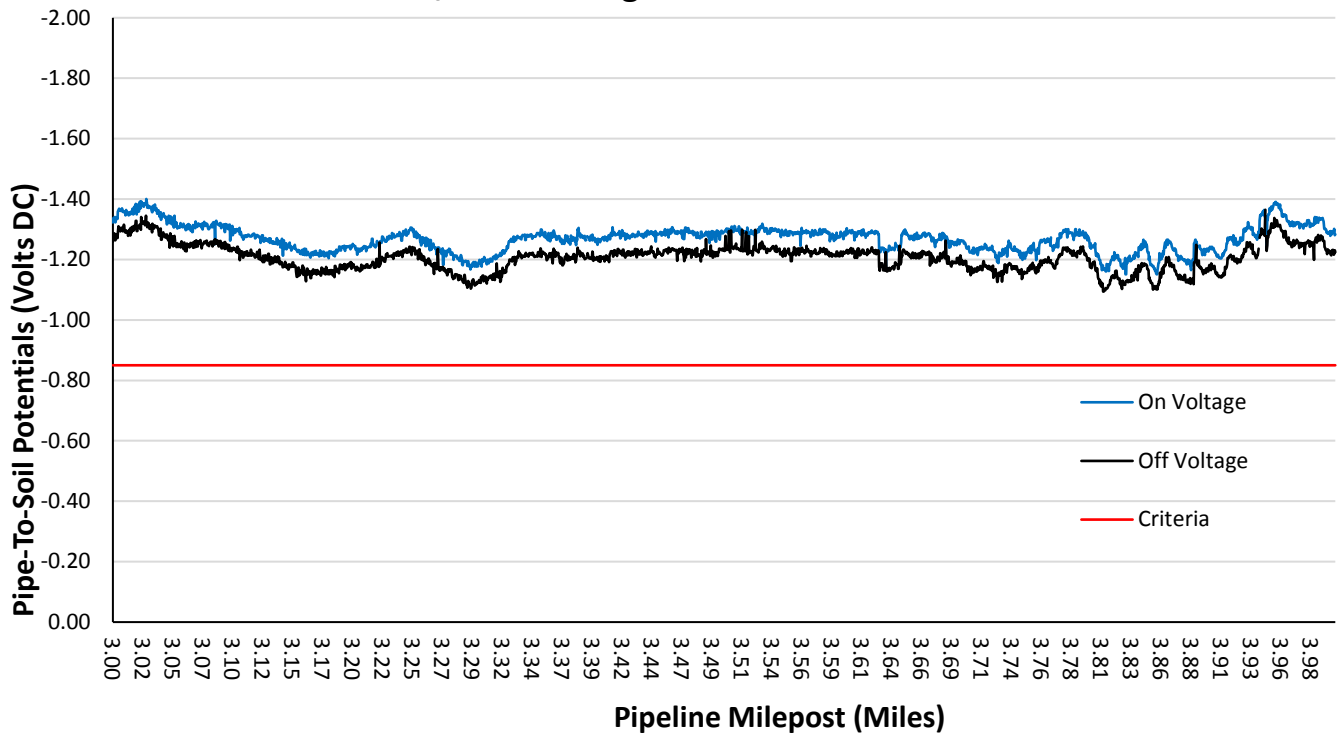
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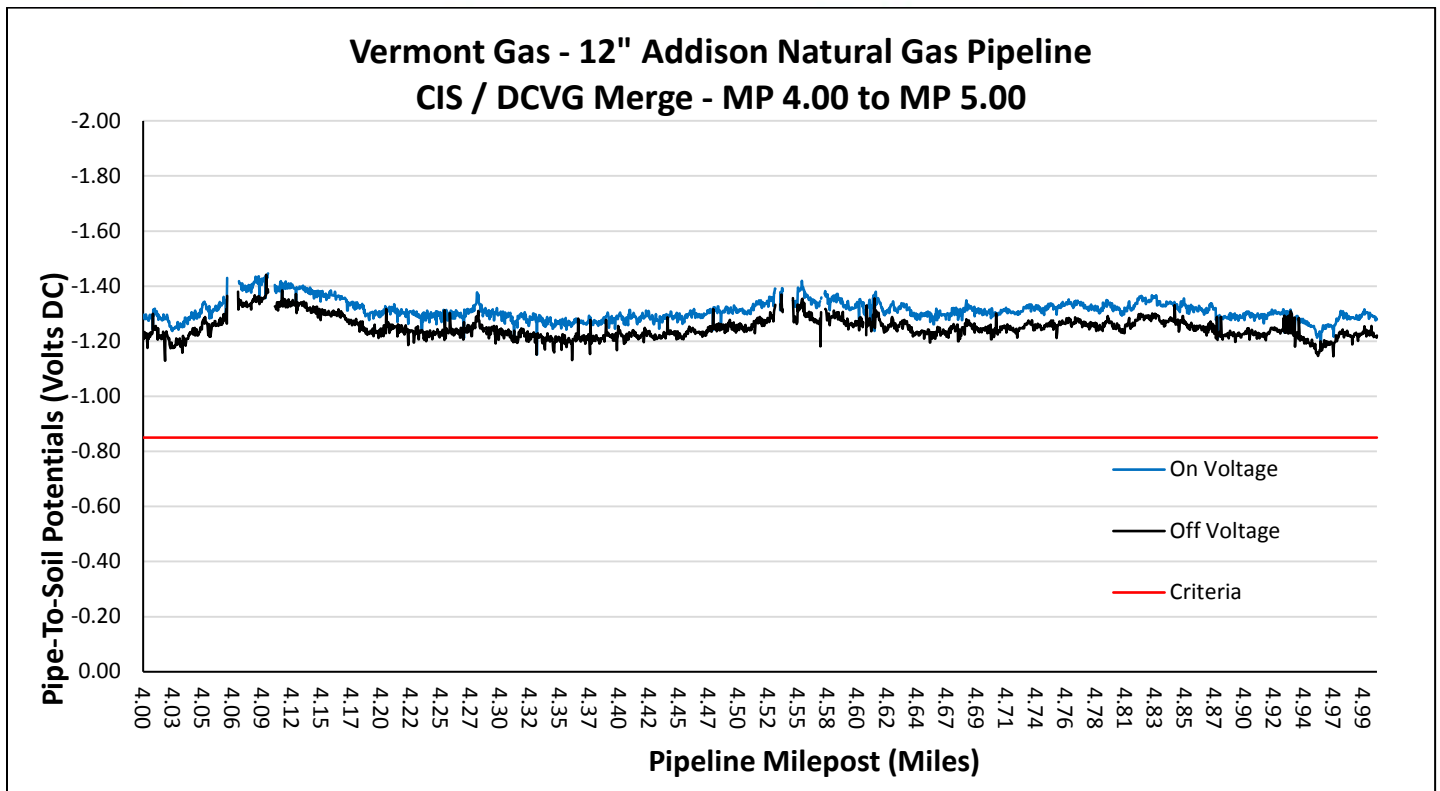
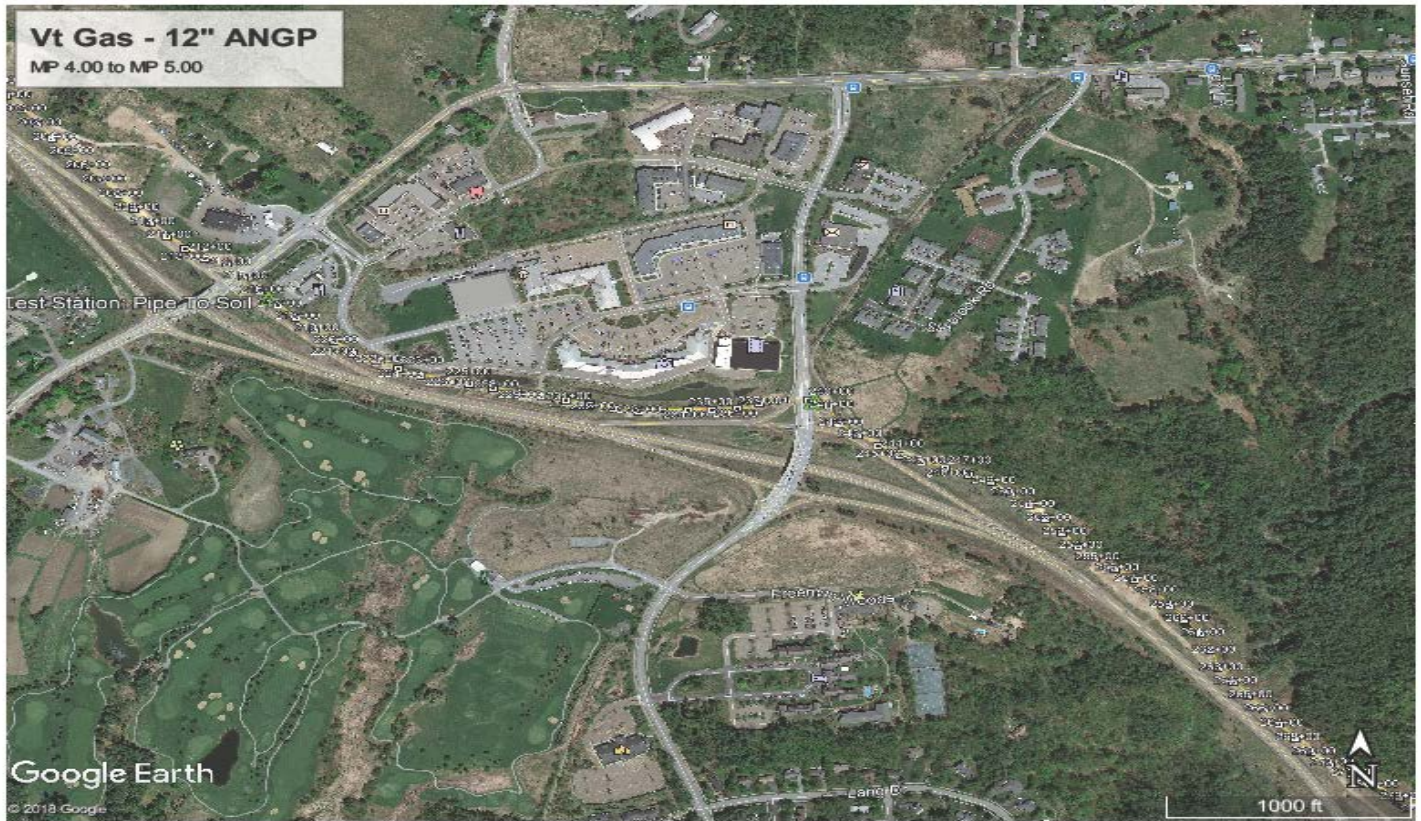
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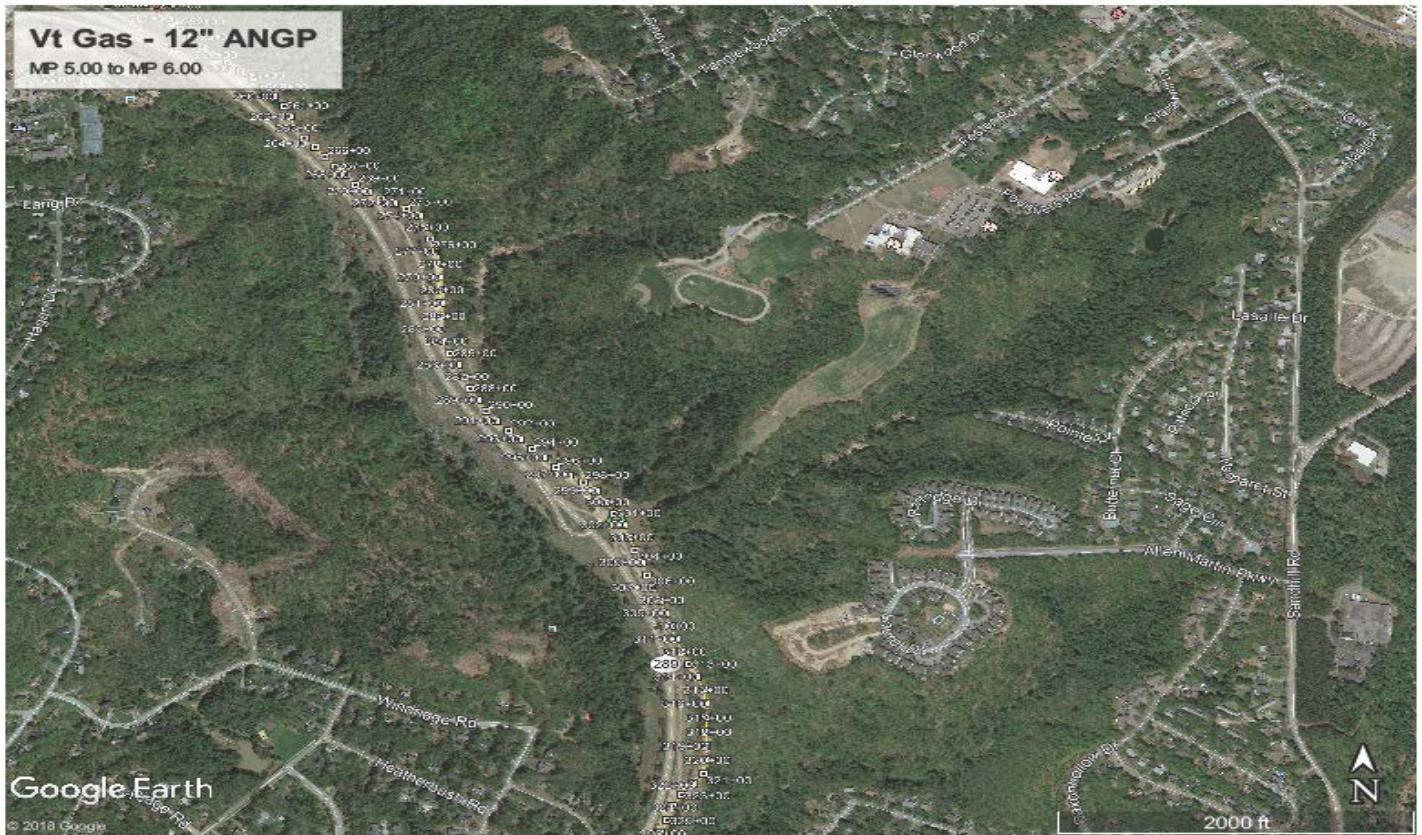
**Vermont Gas - 12" Addison Natural Gas Pipeline
CIS / DCVG Merge - MP 3.00 to MP 4.00**



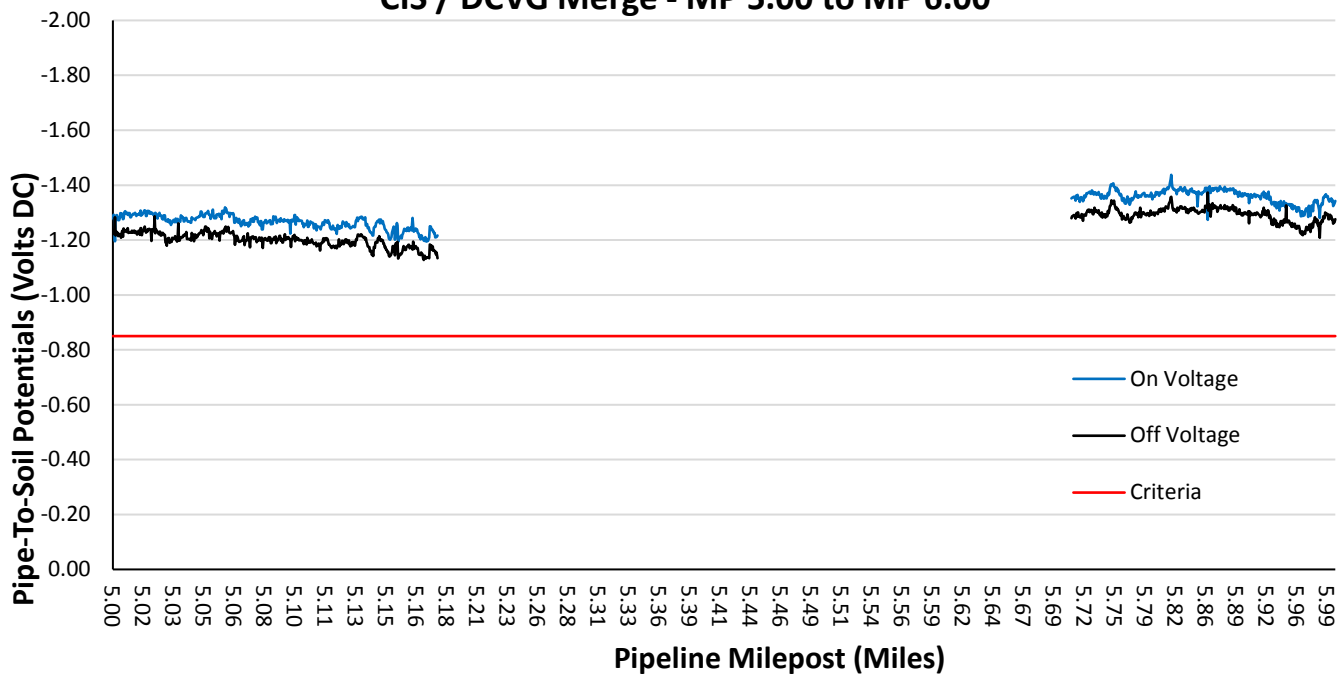
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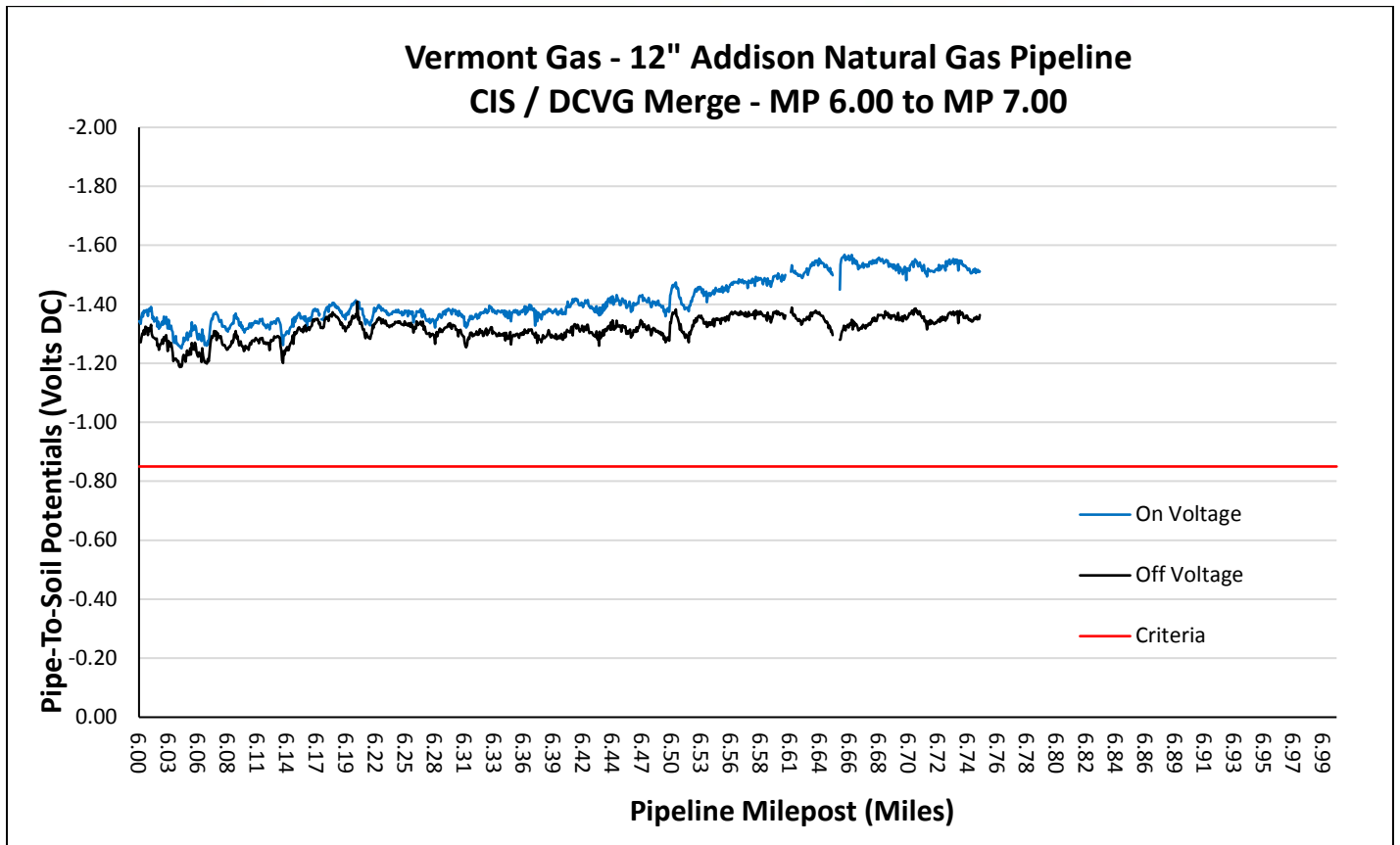
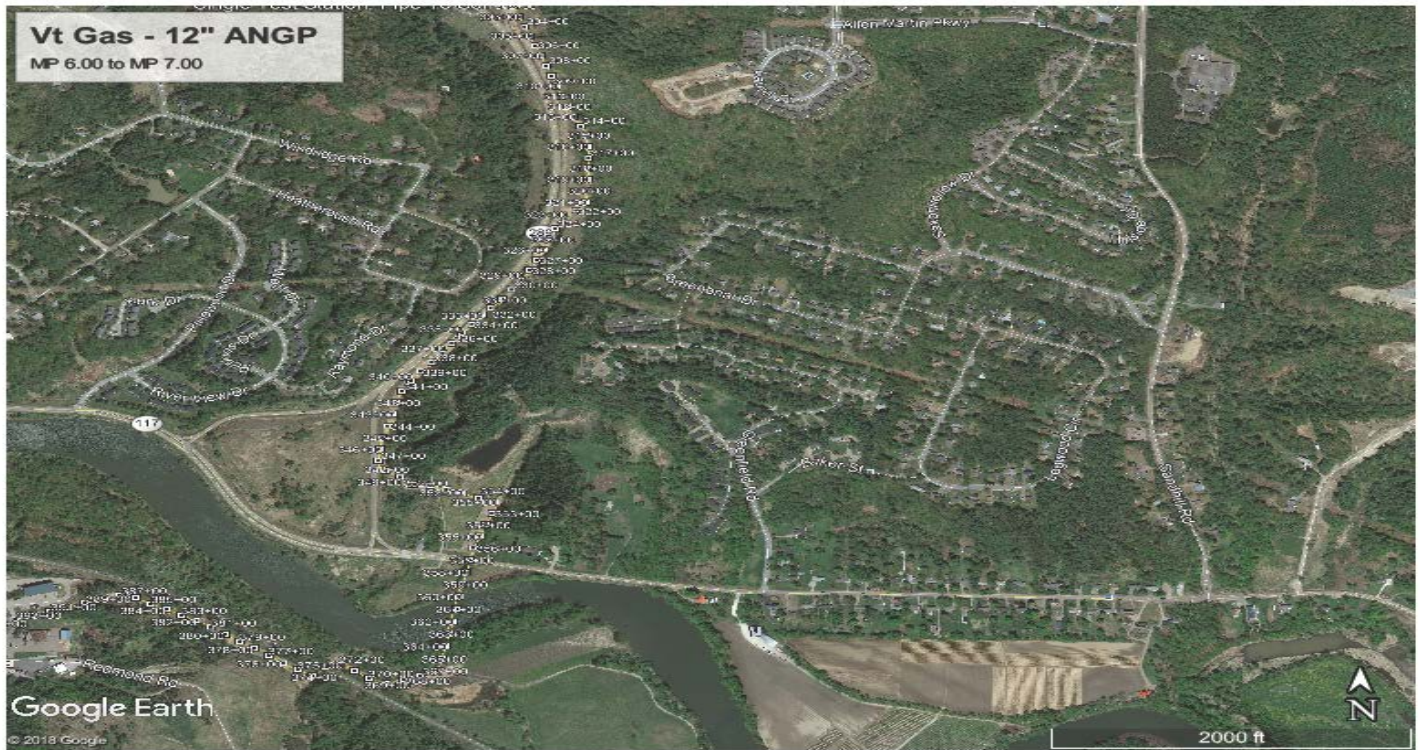
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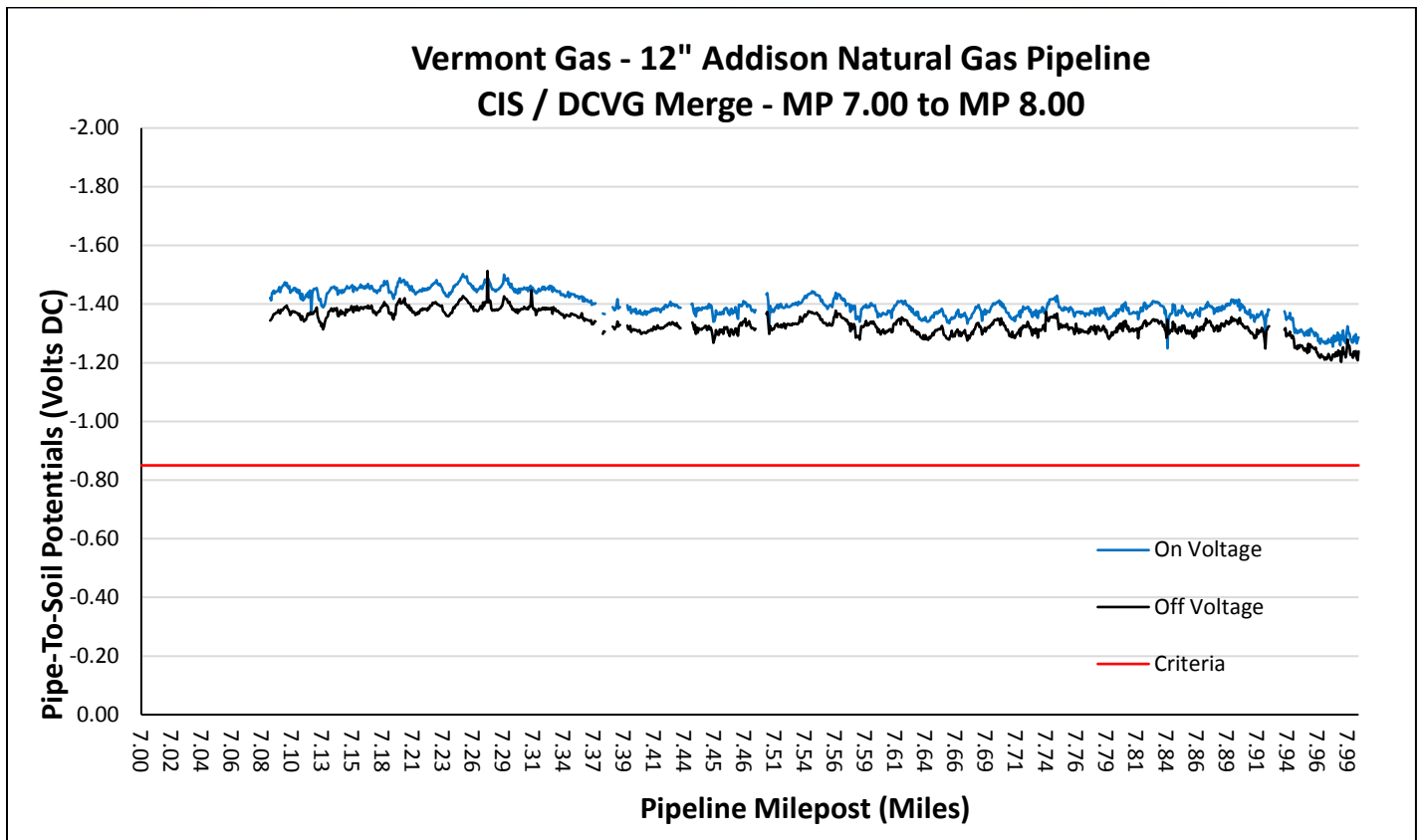
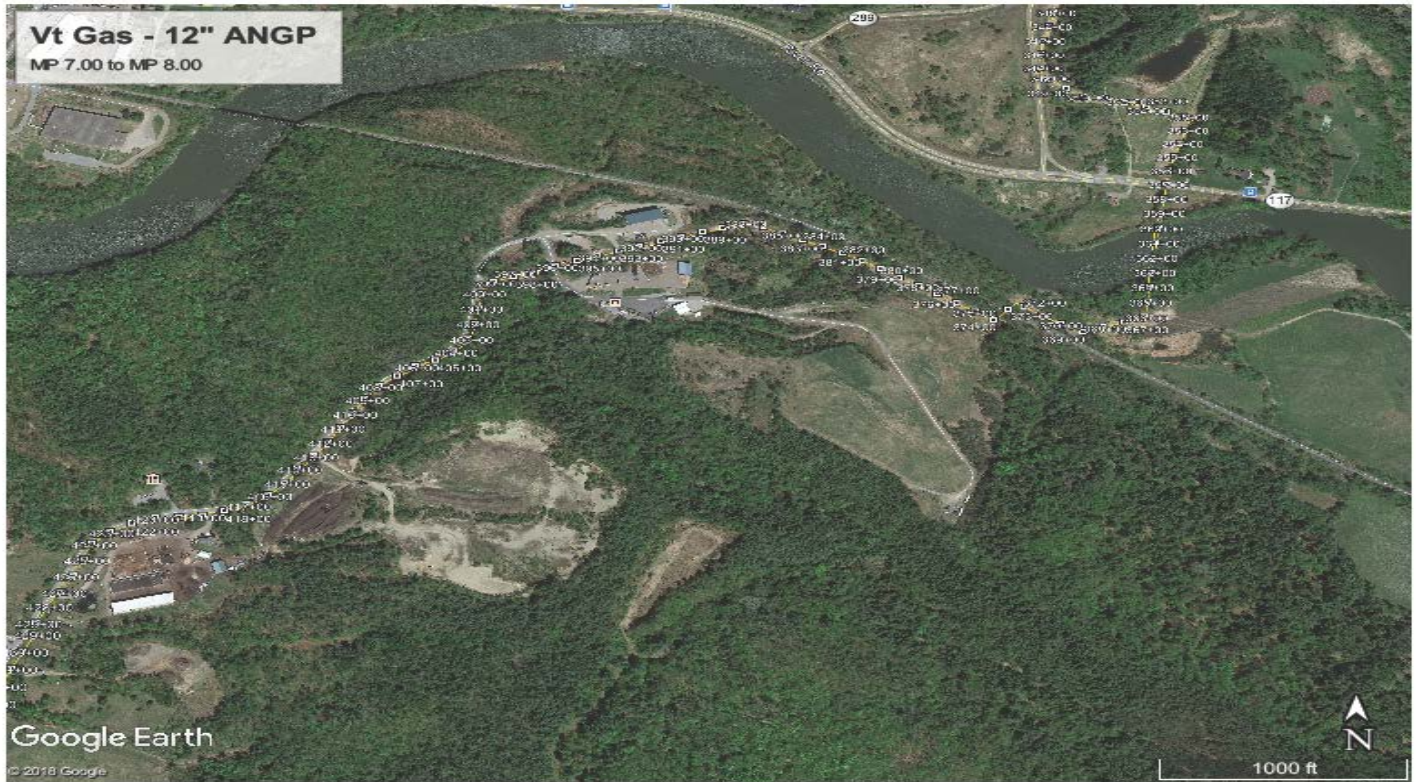
**Vermont Gas - 12" Addison Natural Gas Pipeline
CIS / DCVG Merge - MP 5.00 to MP 6.00**



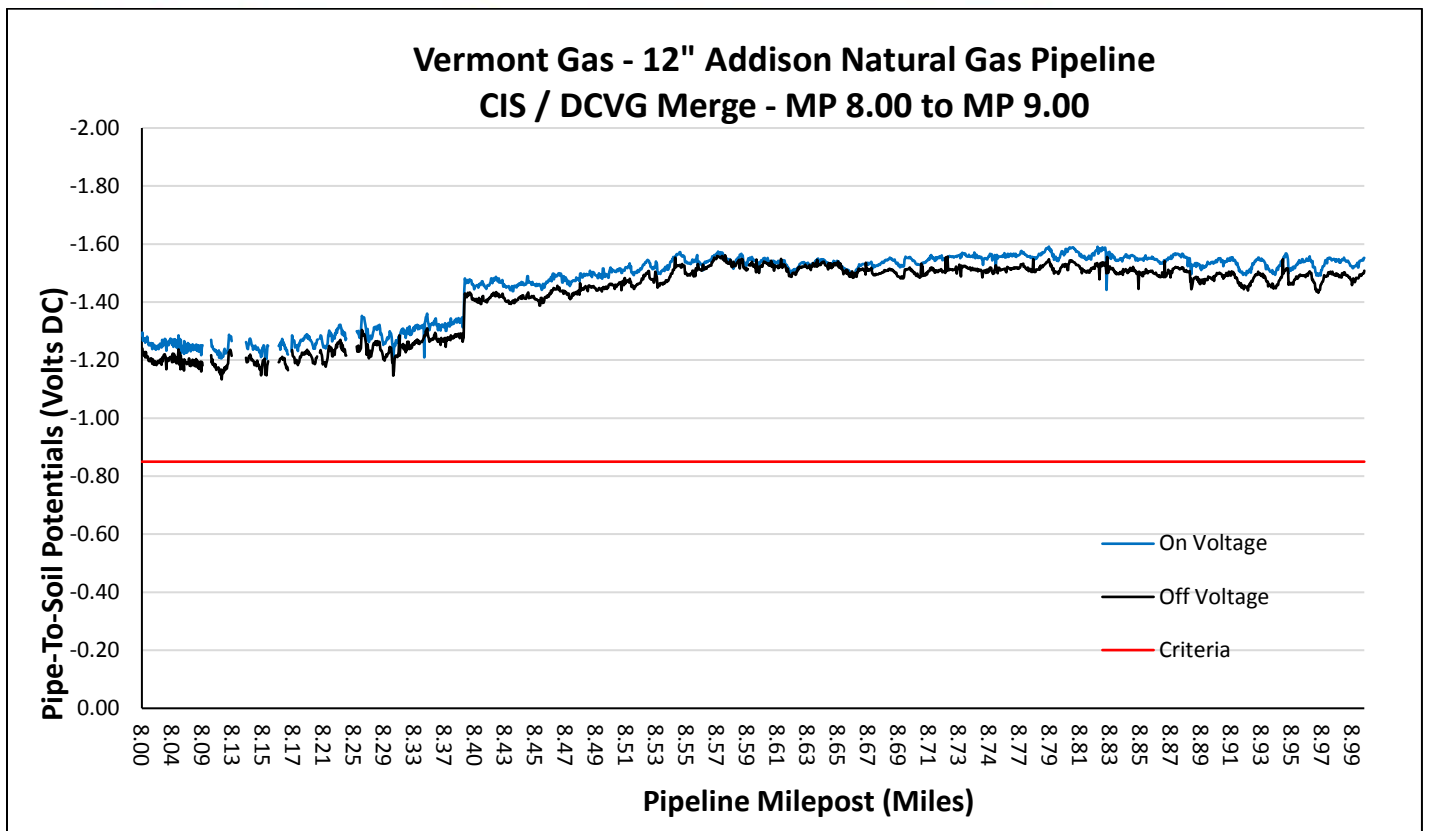
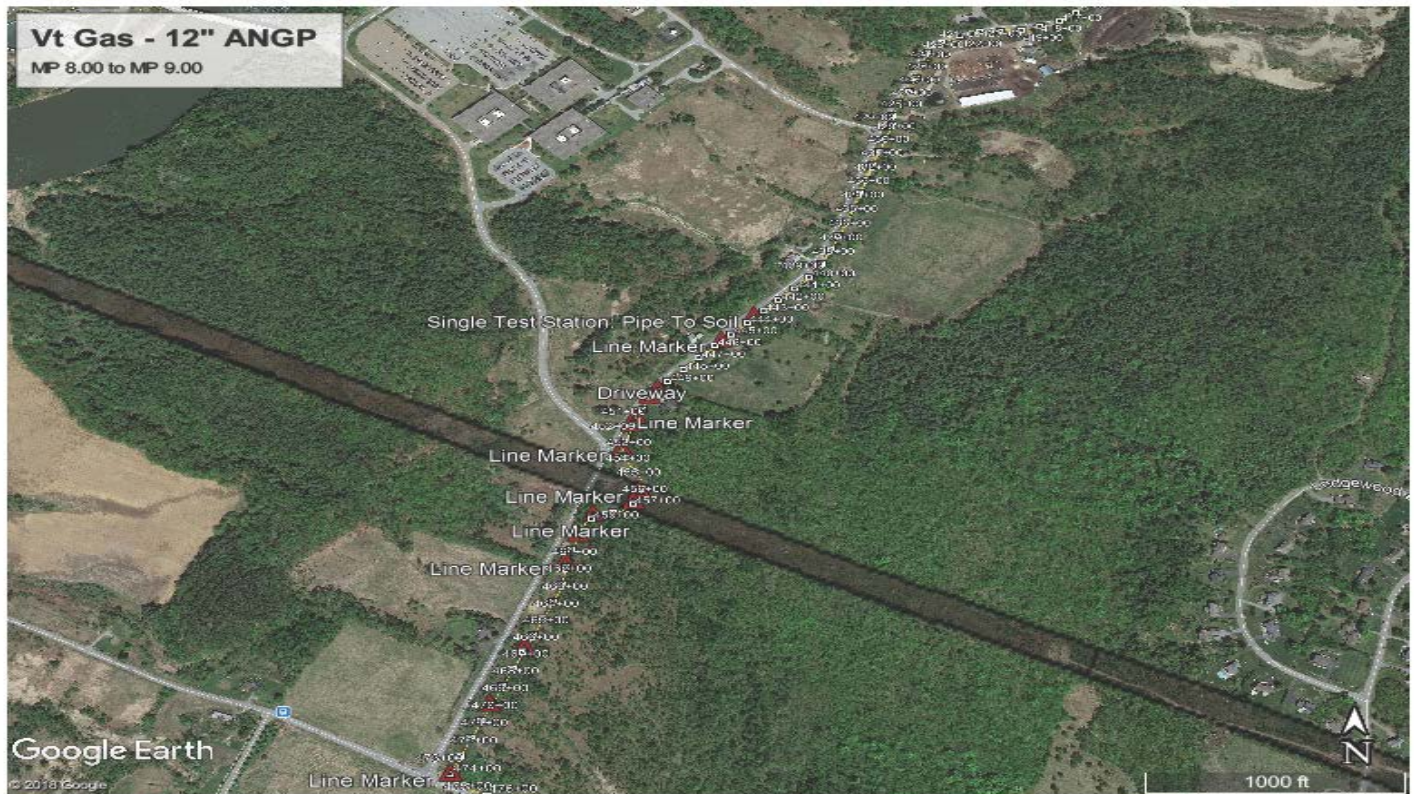
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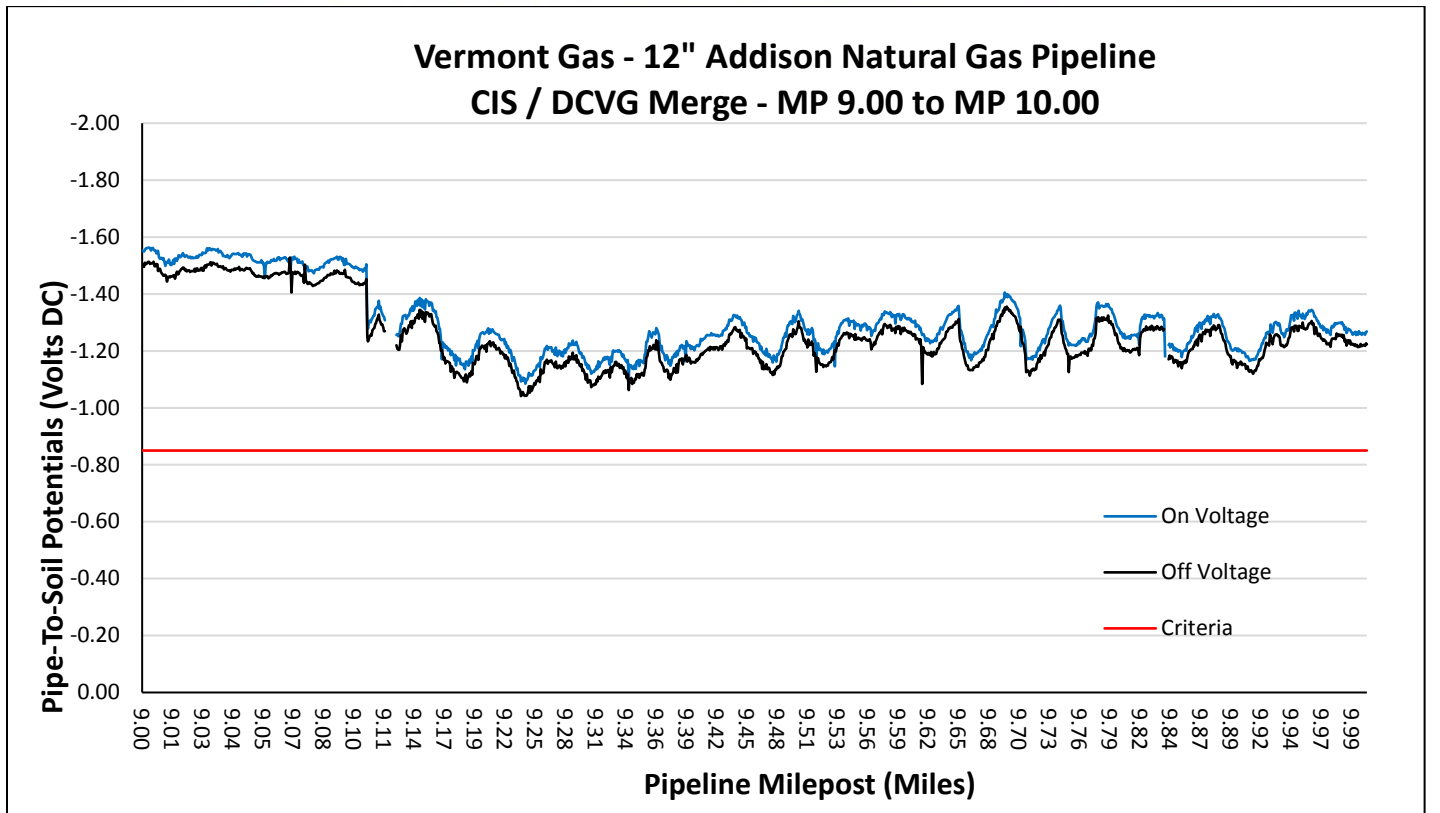
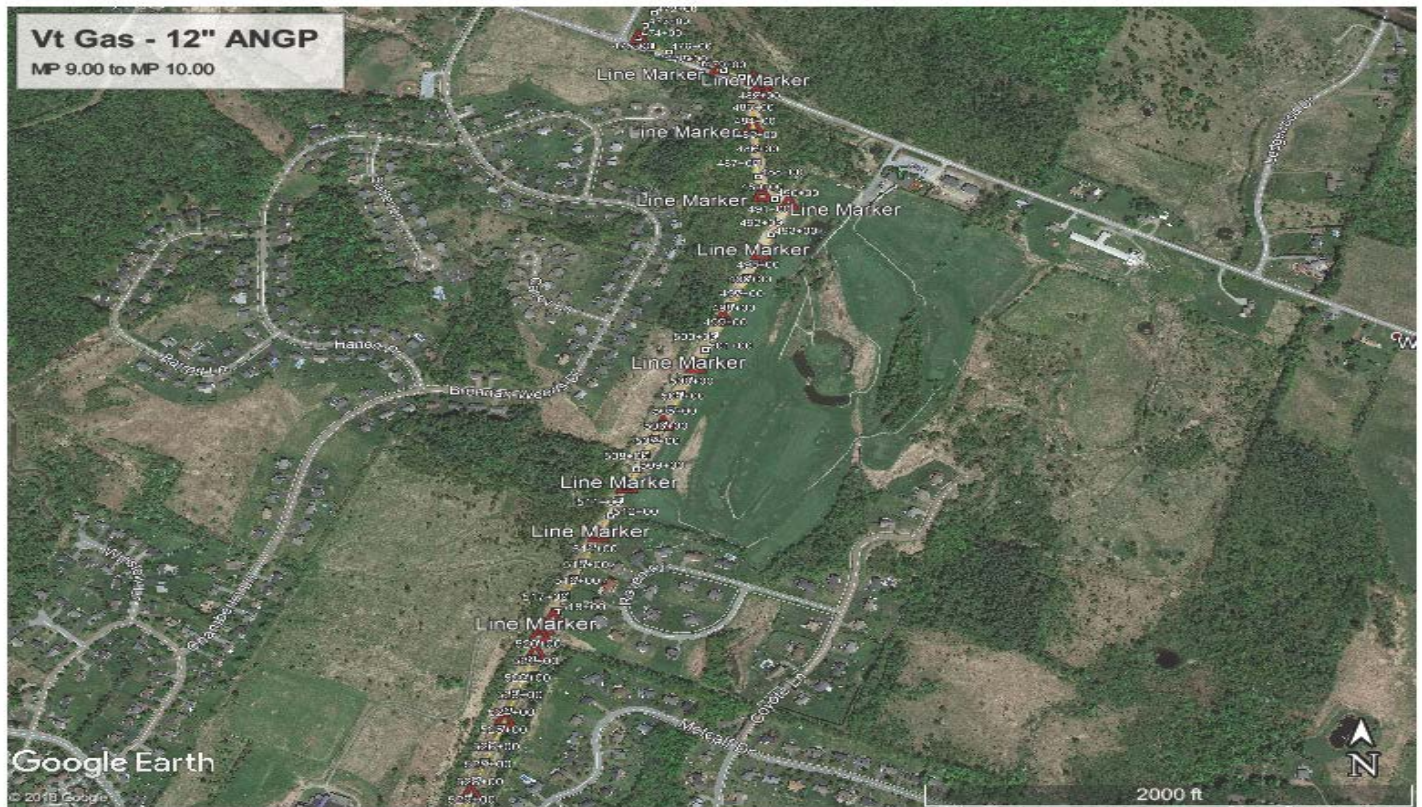
Milepost 7.00 to 8.00:



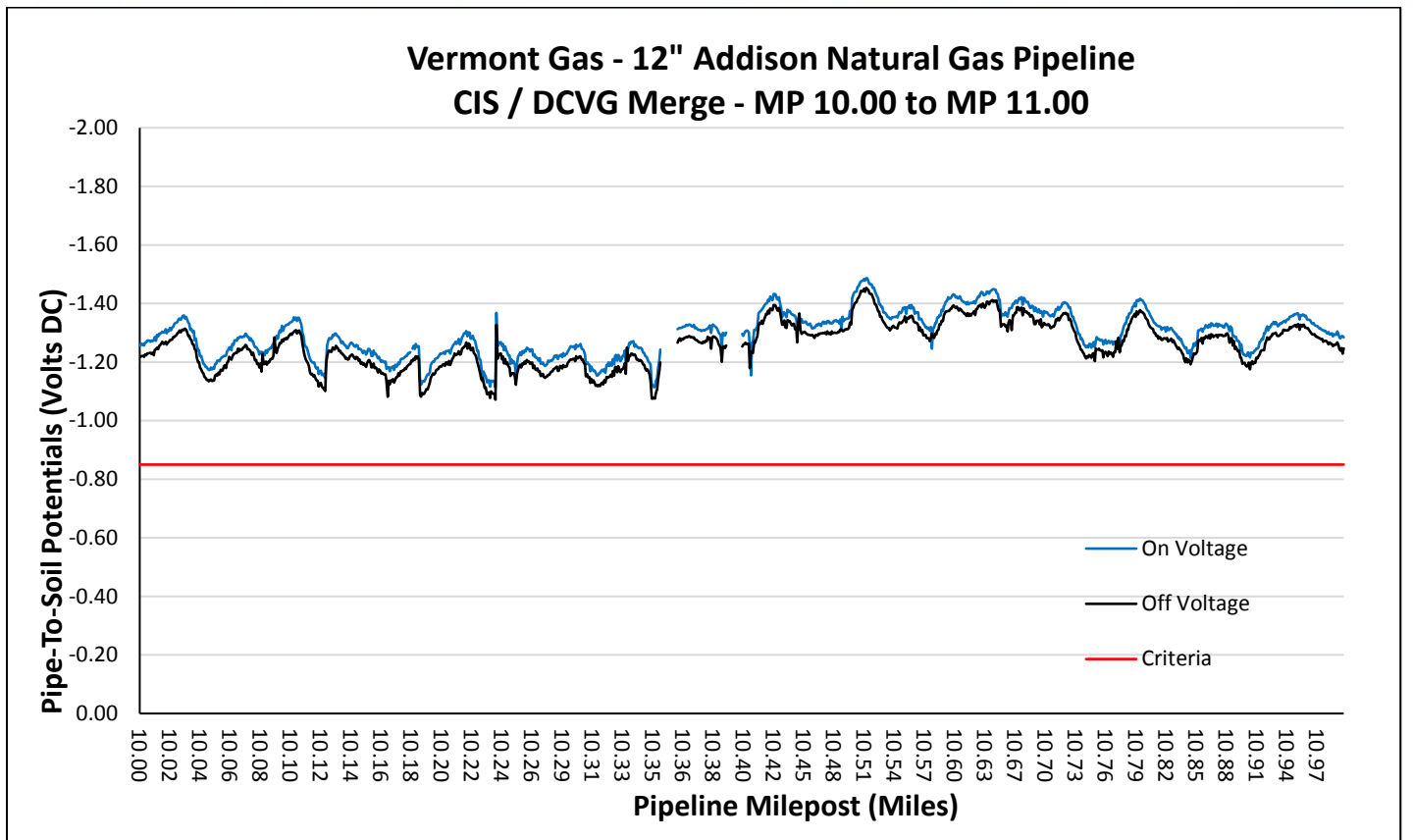
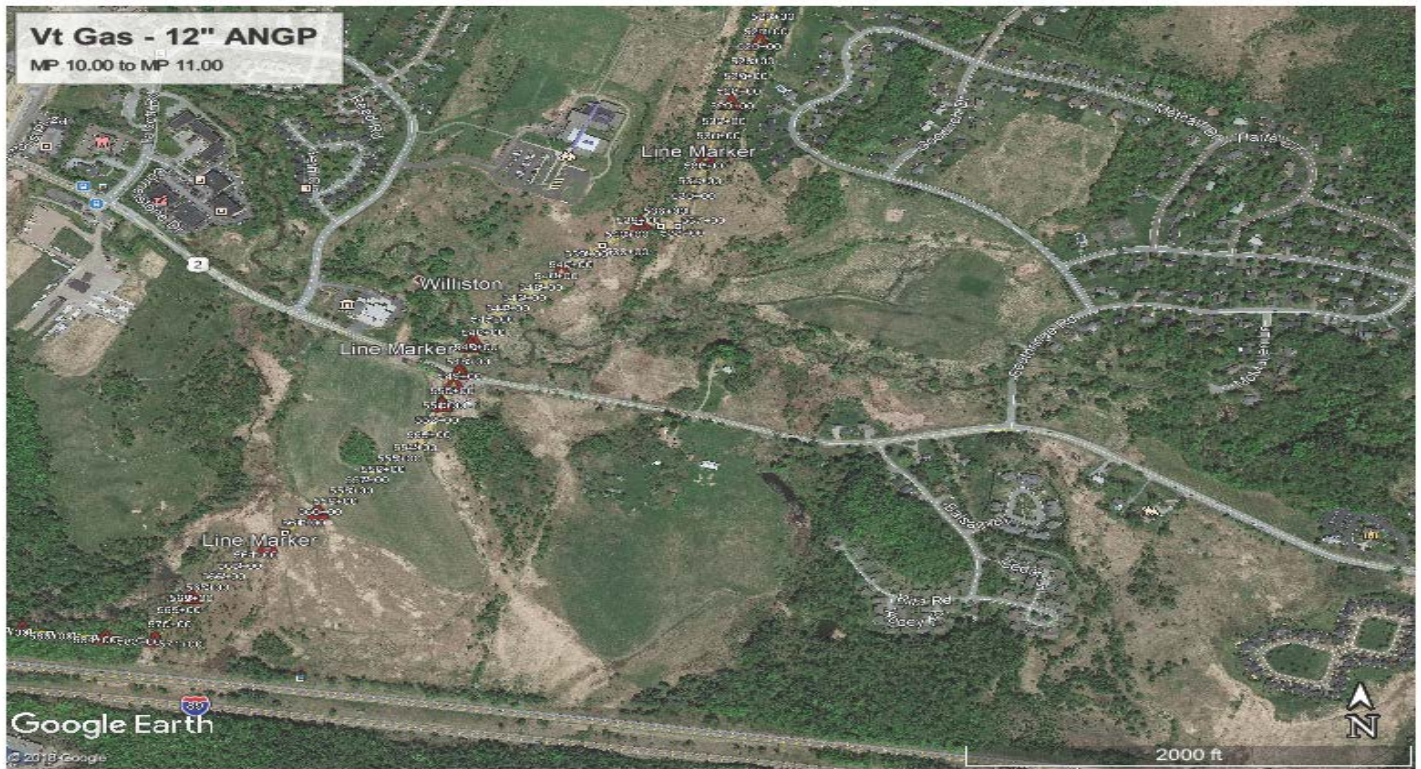
Milepost 8.00 to 9.00:



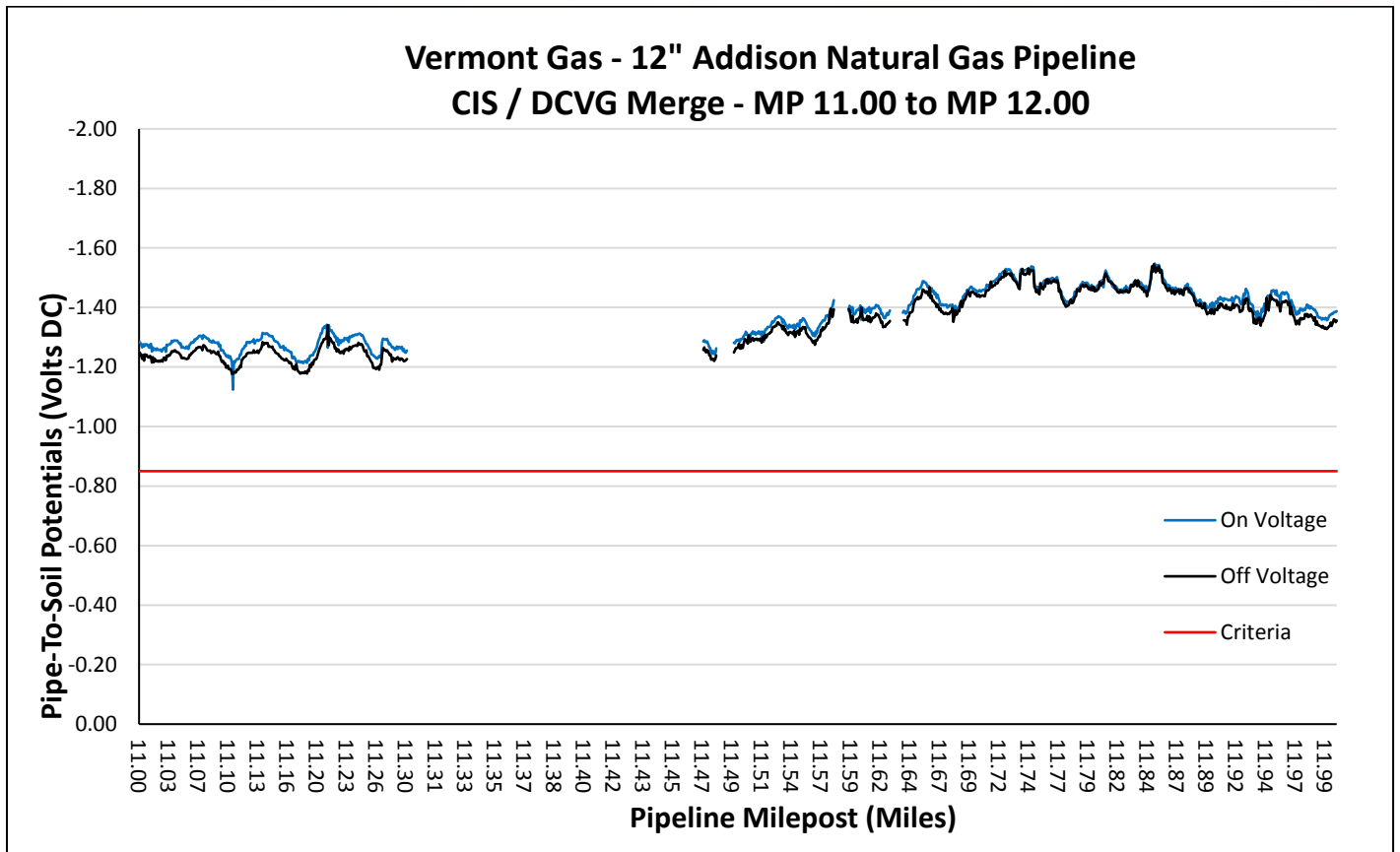
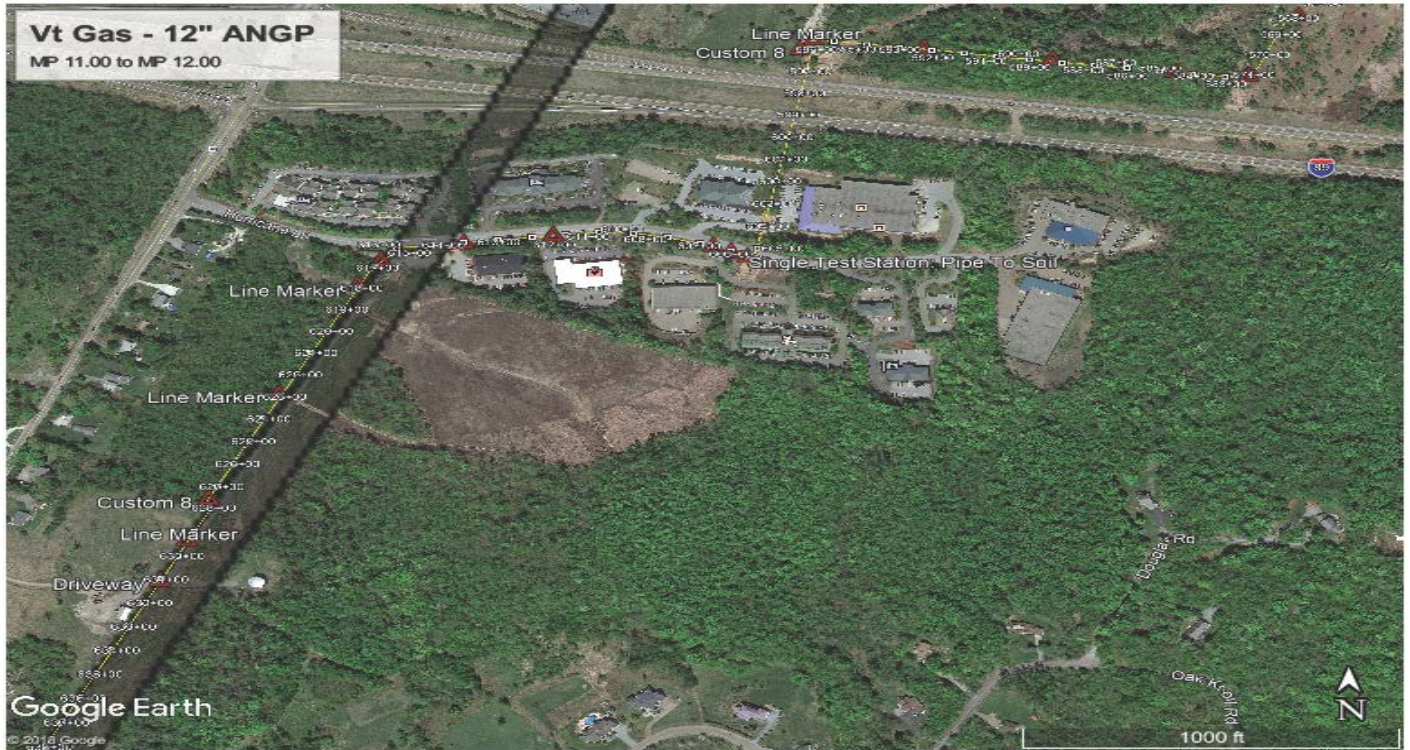
Milepost 9.00 to 10.00:



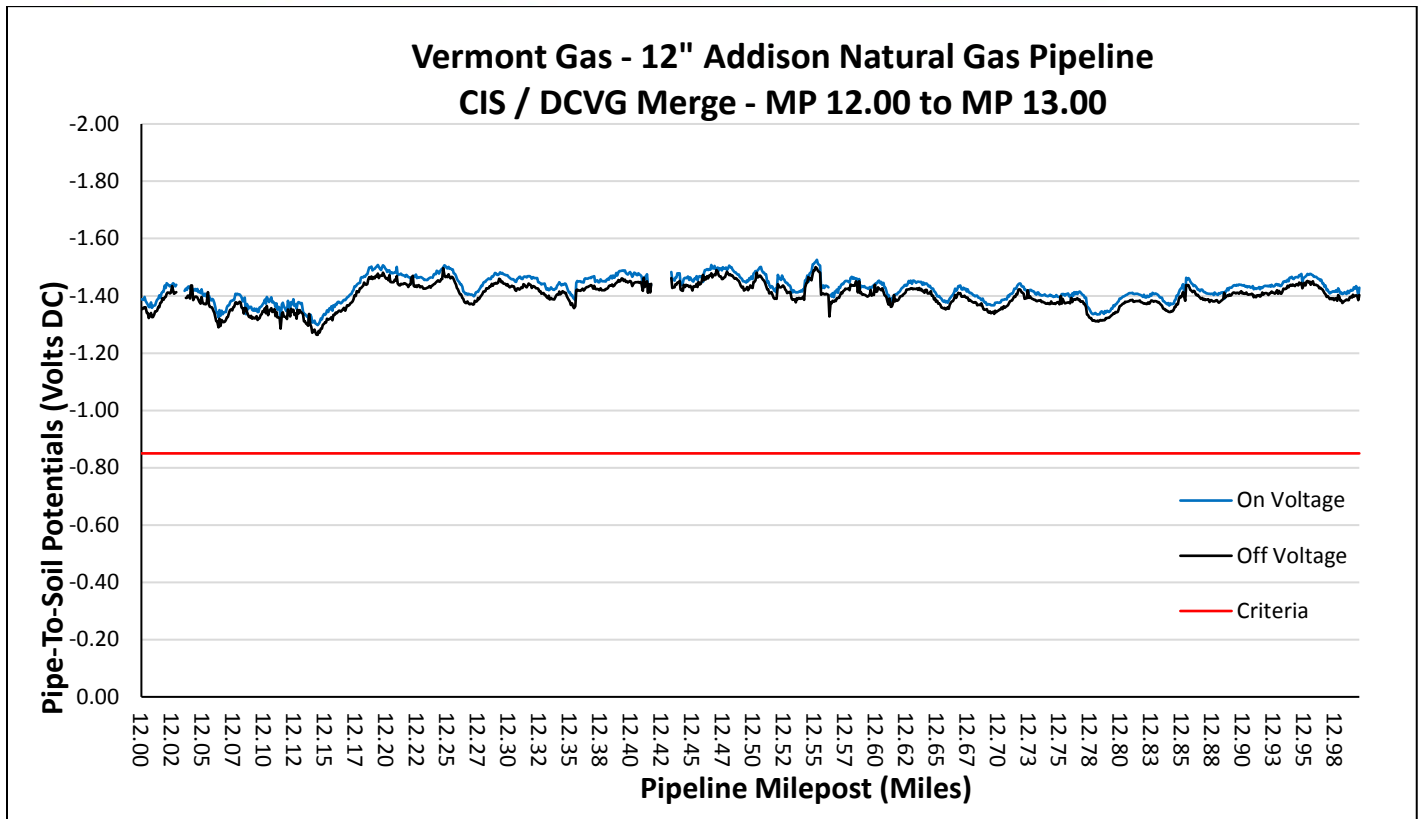
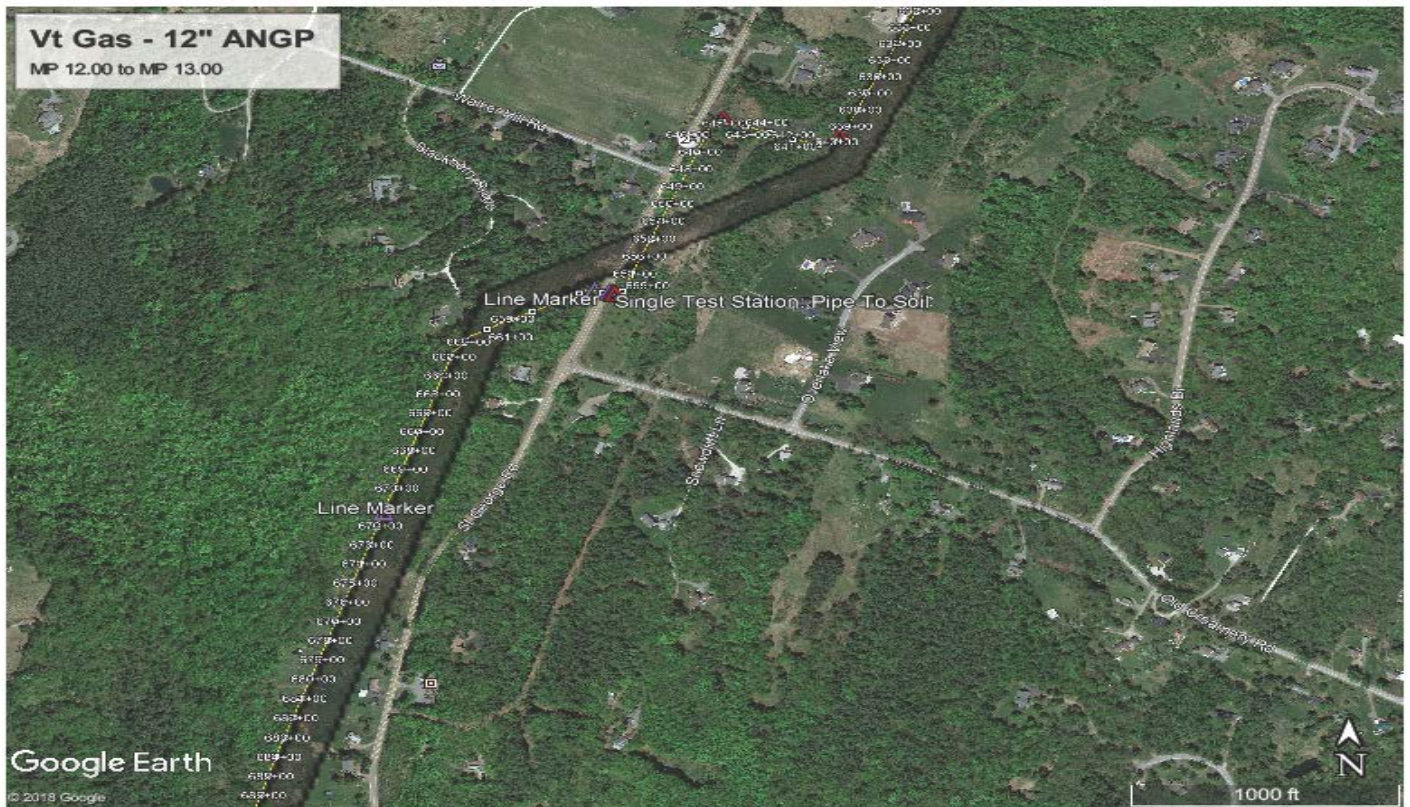
Milepost 10.00 to 11.00:



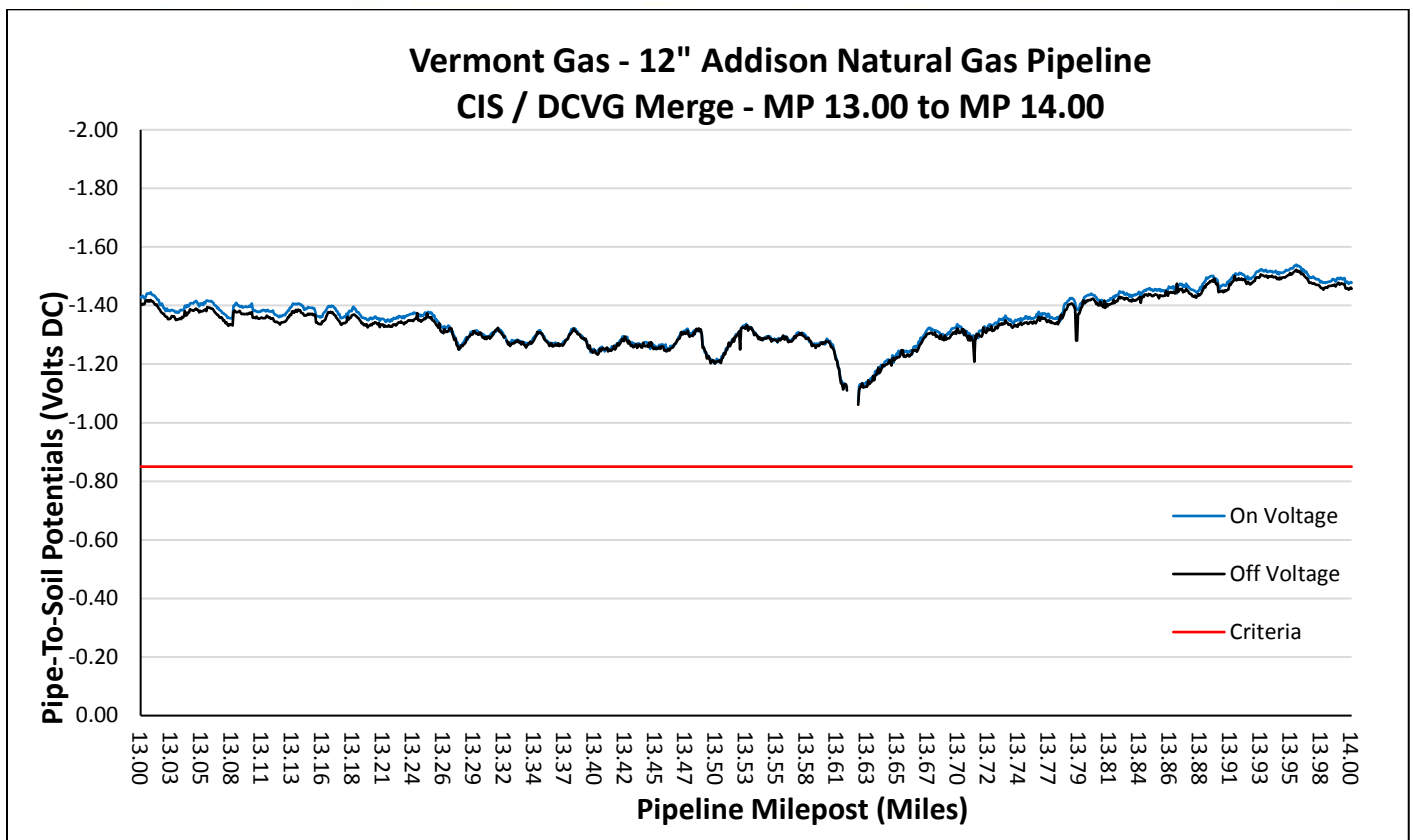
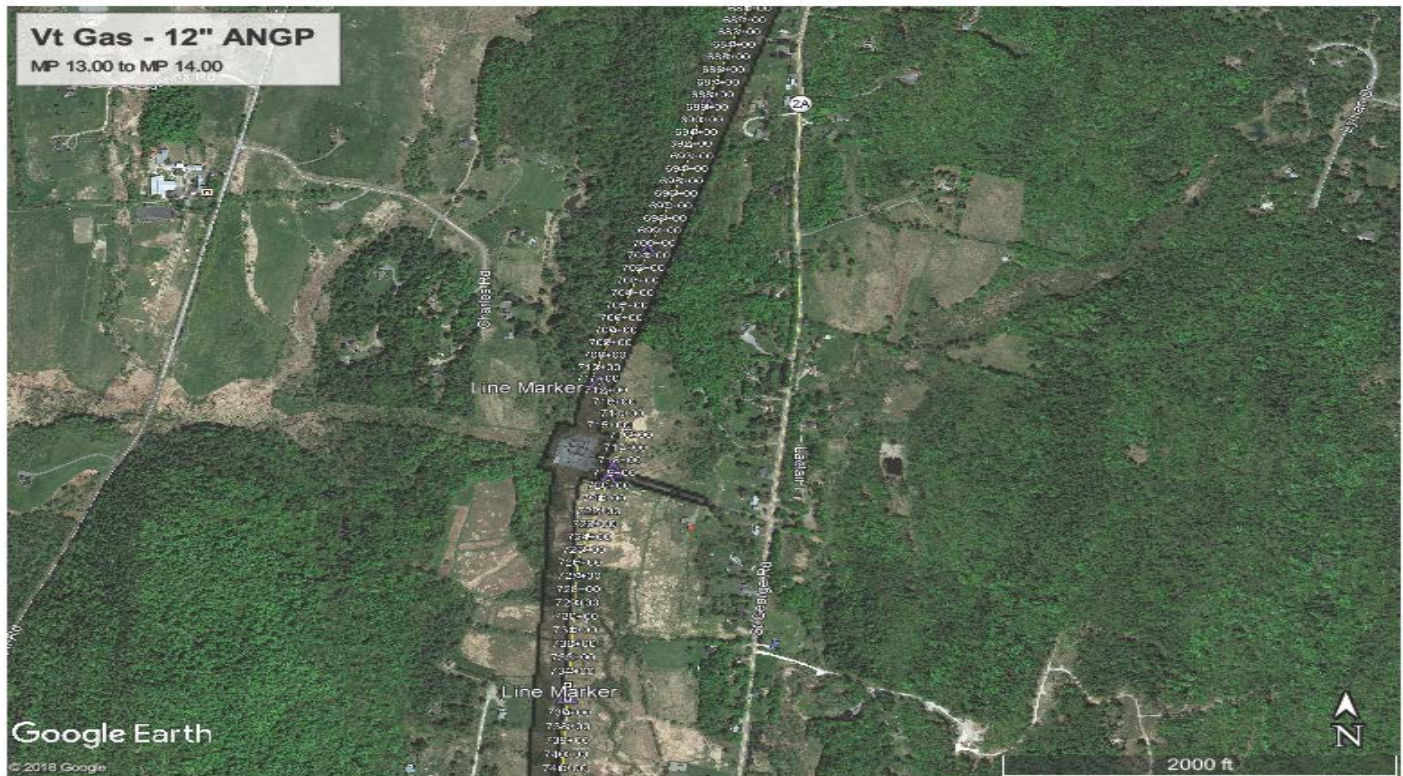
Milepost 11.00 to 12.00:



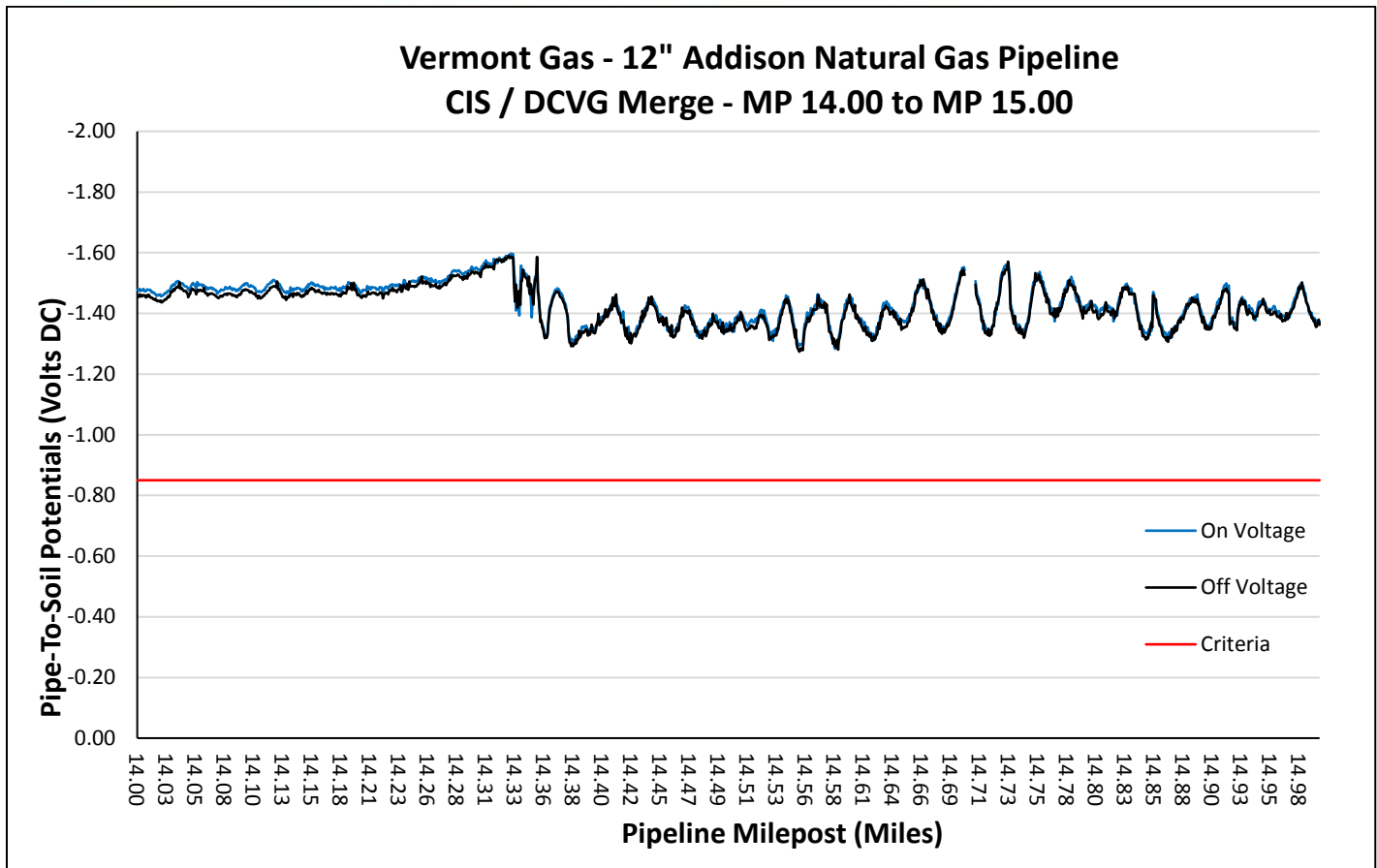
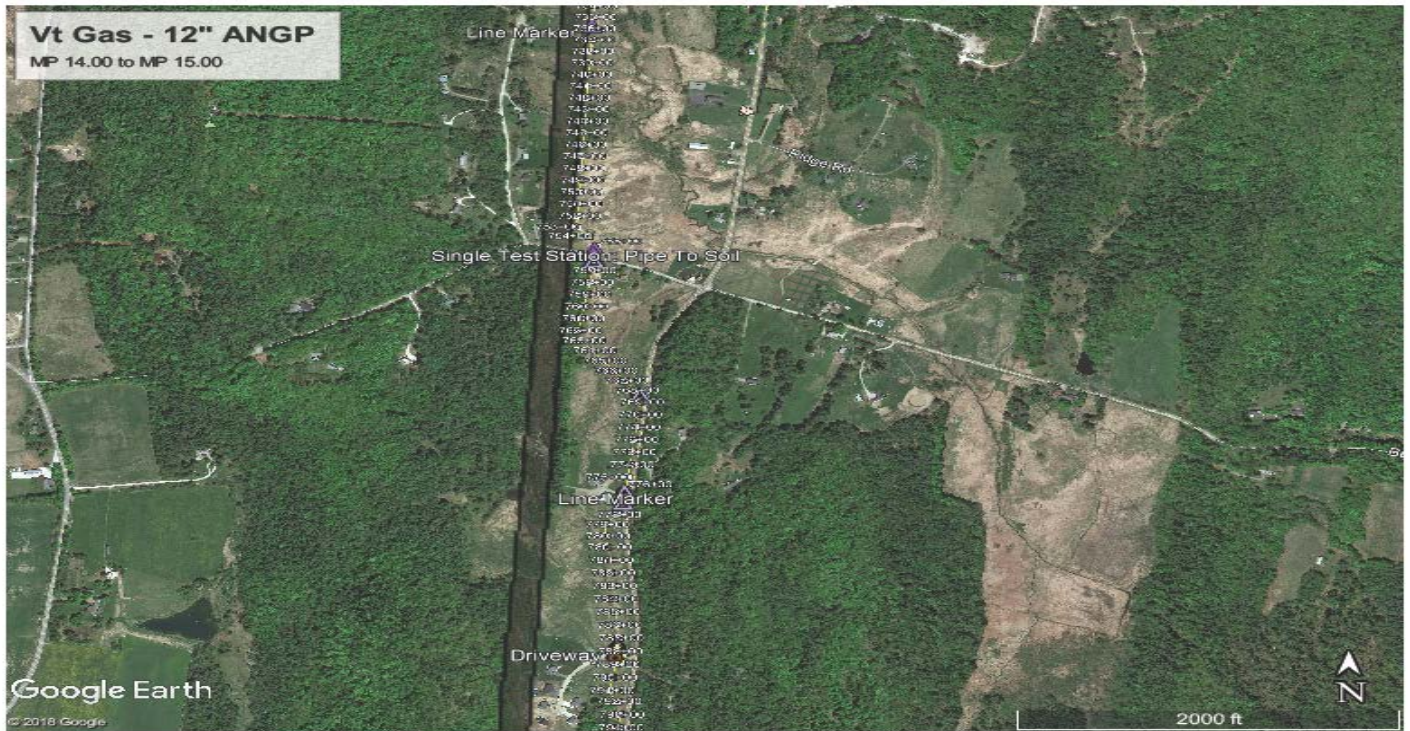
Milepost 12.00 to 13.00:



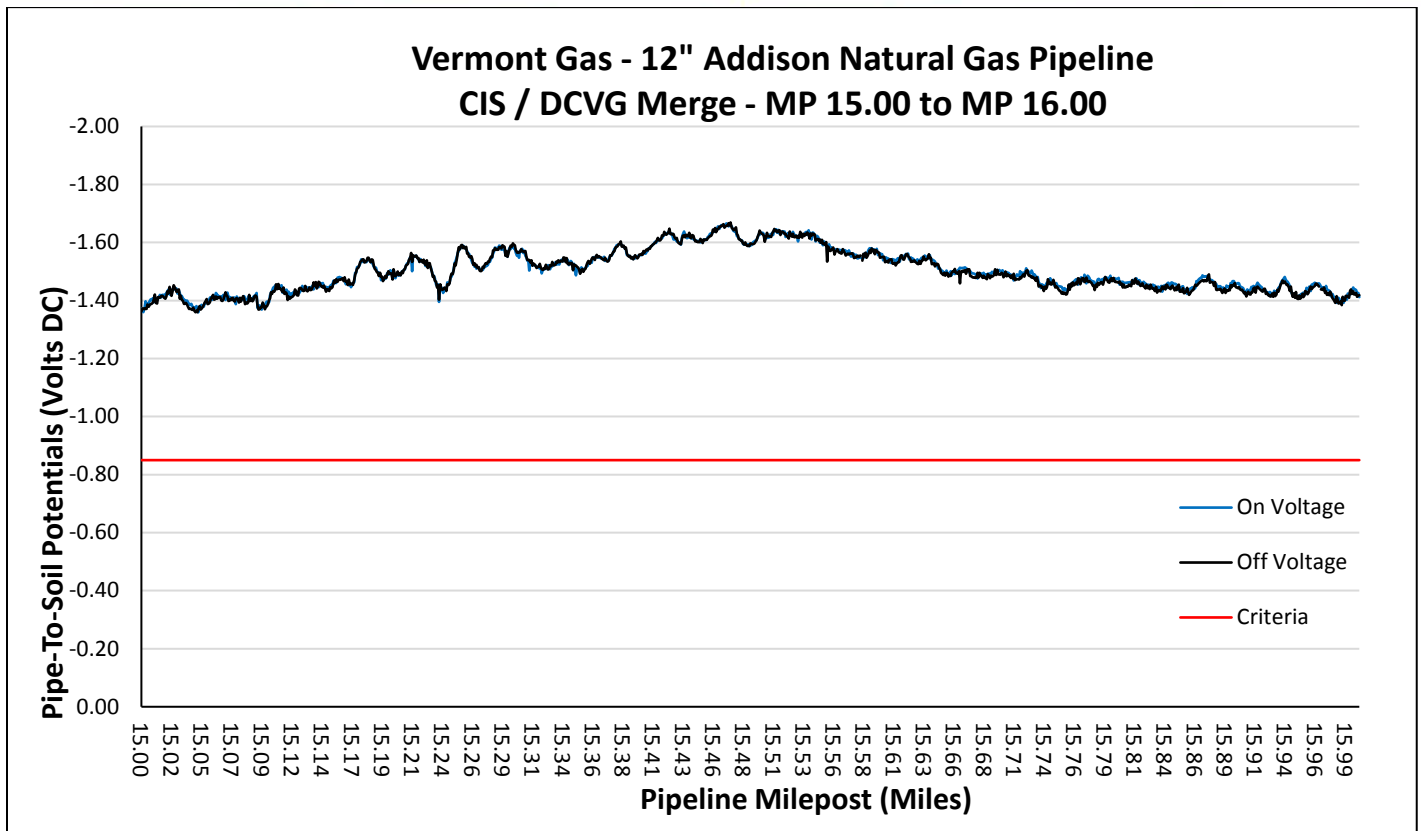
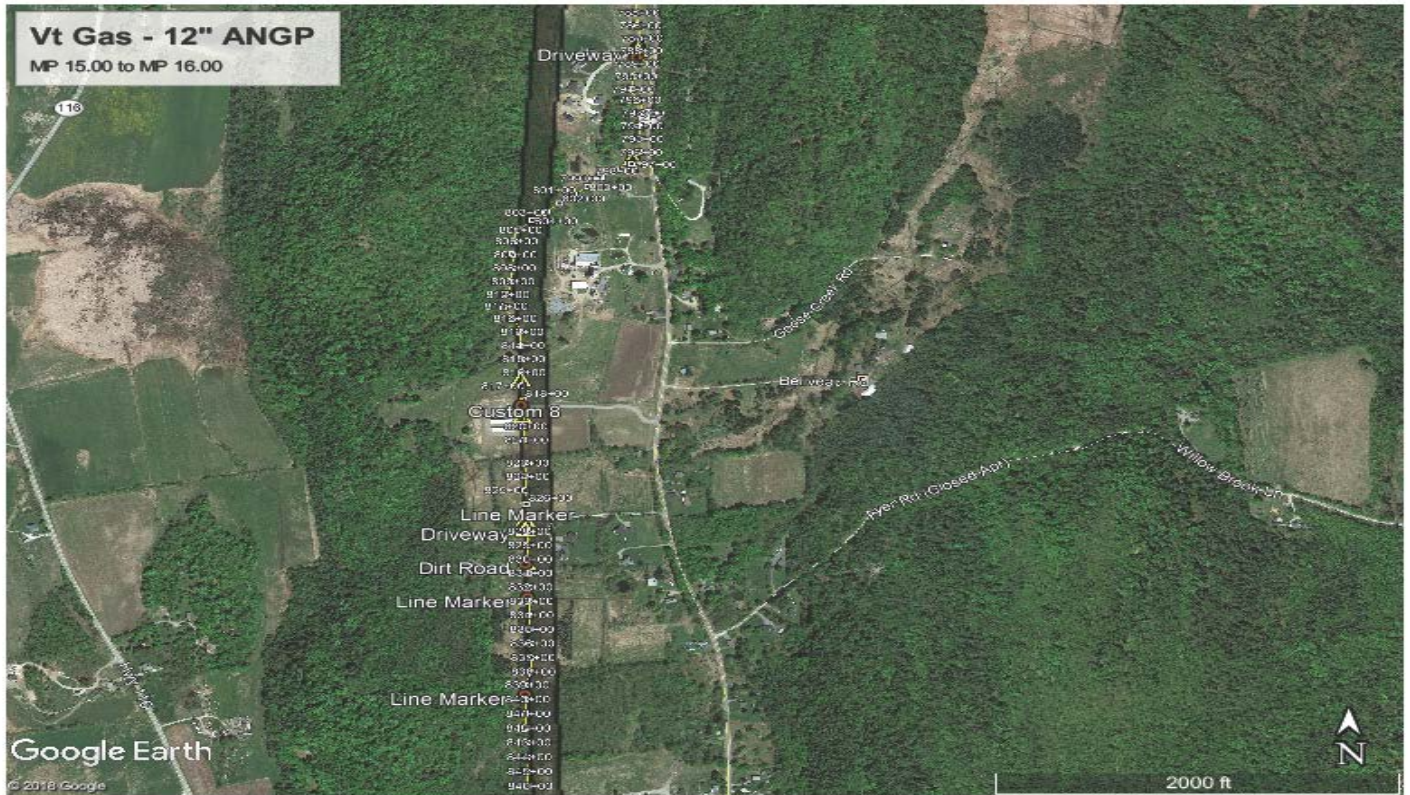
Milepost:13.00 to 14.00:



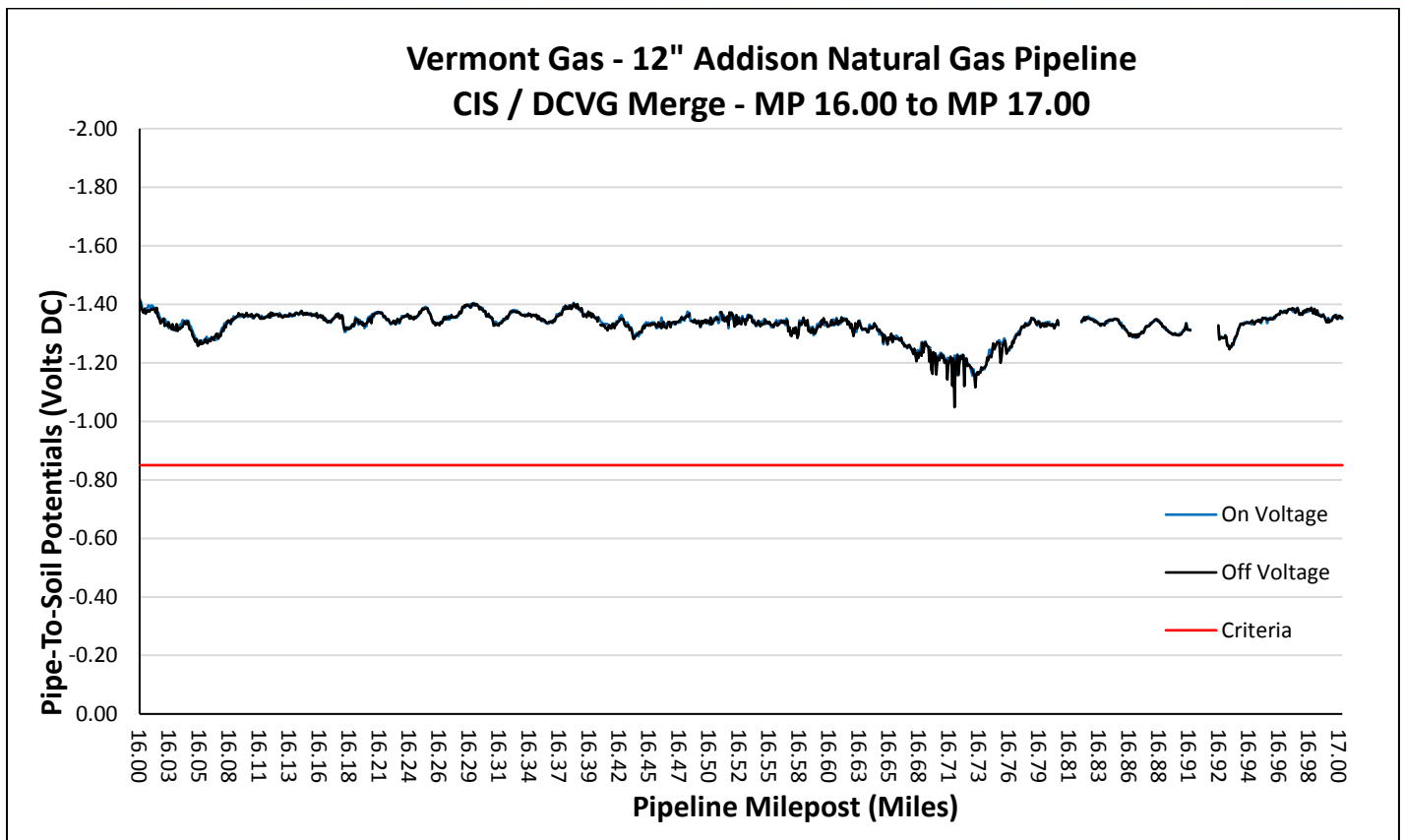
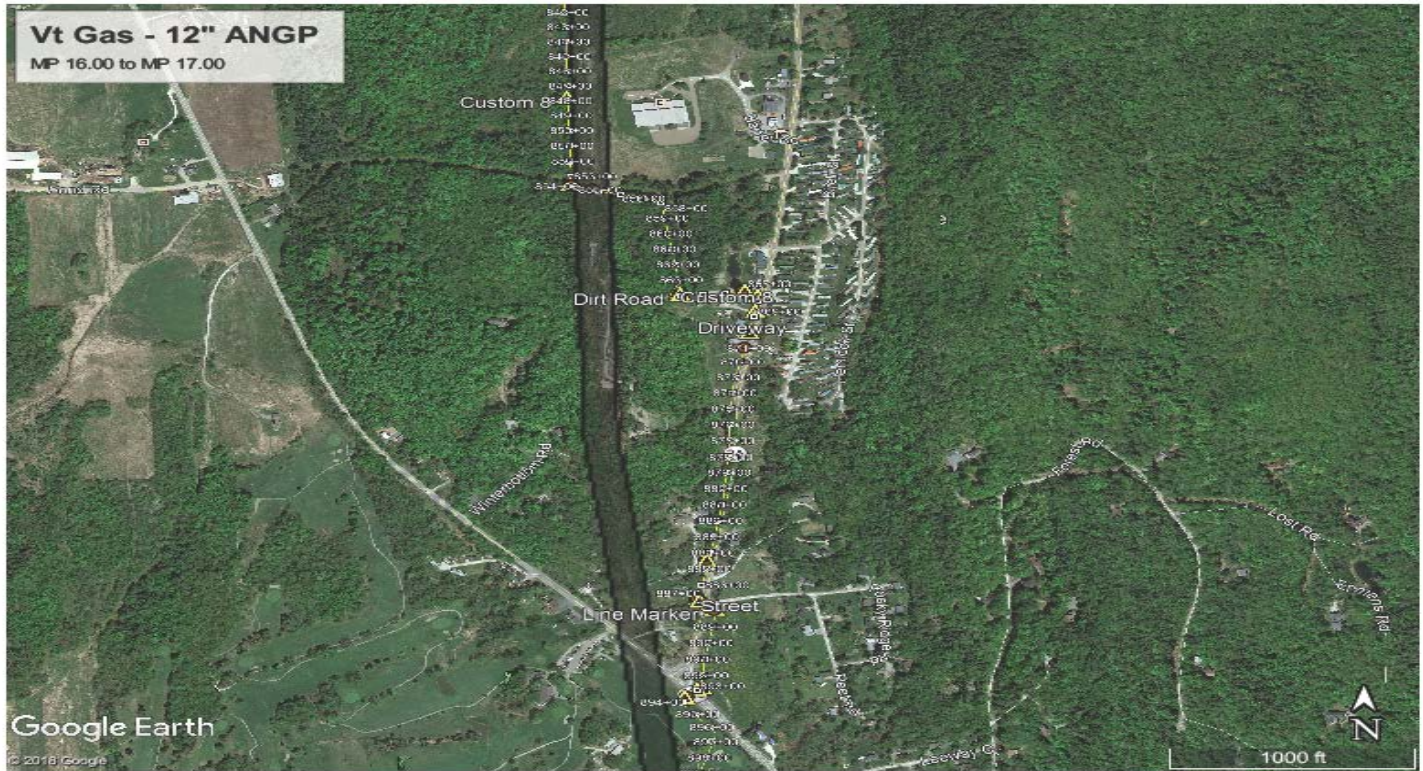
Milepost 14.00 to 15.00:



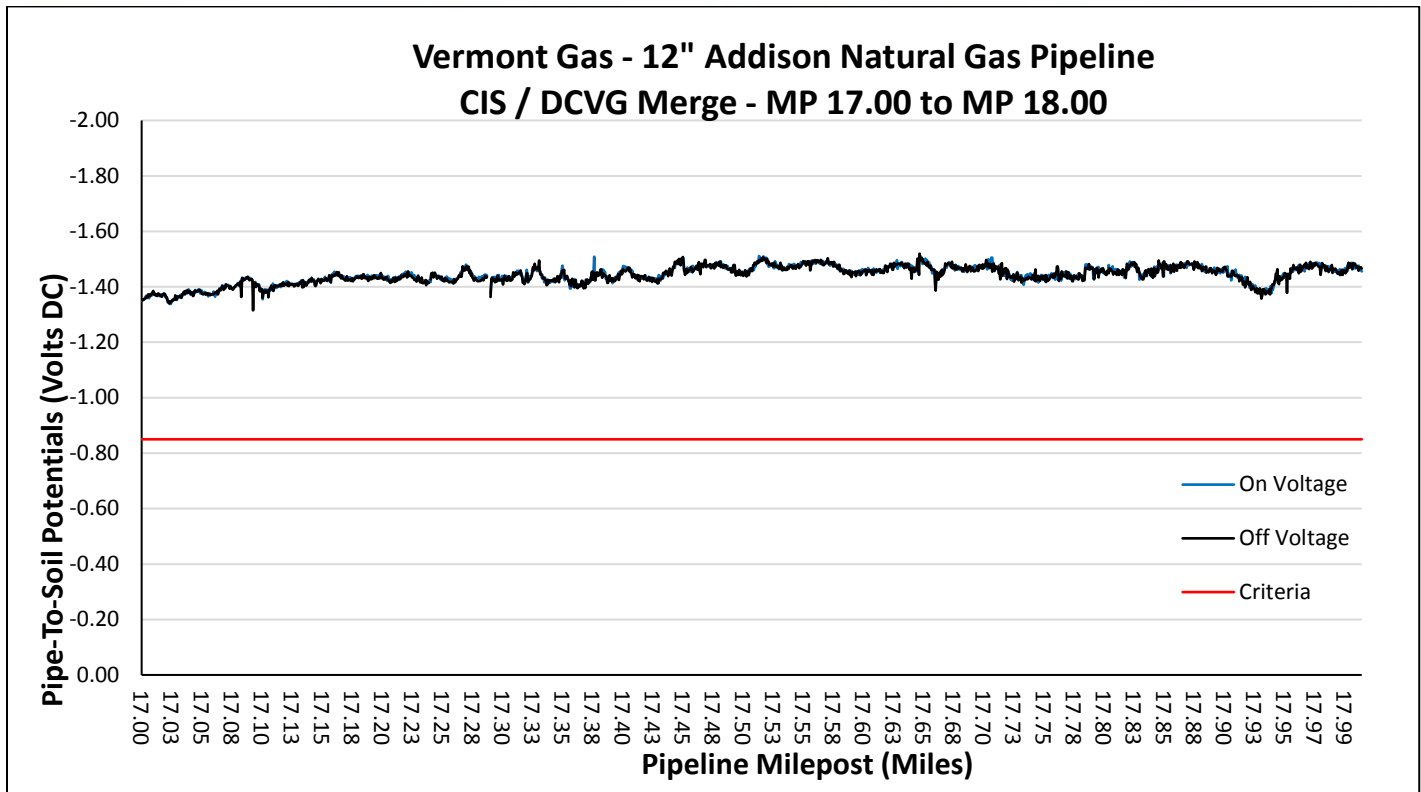
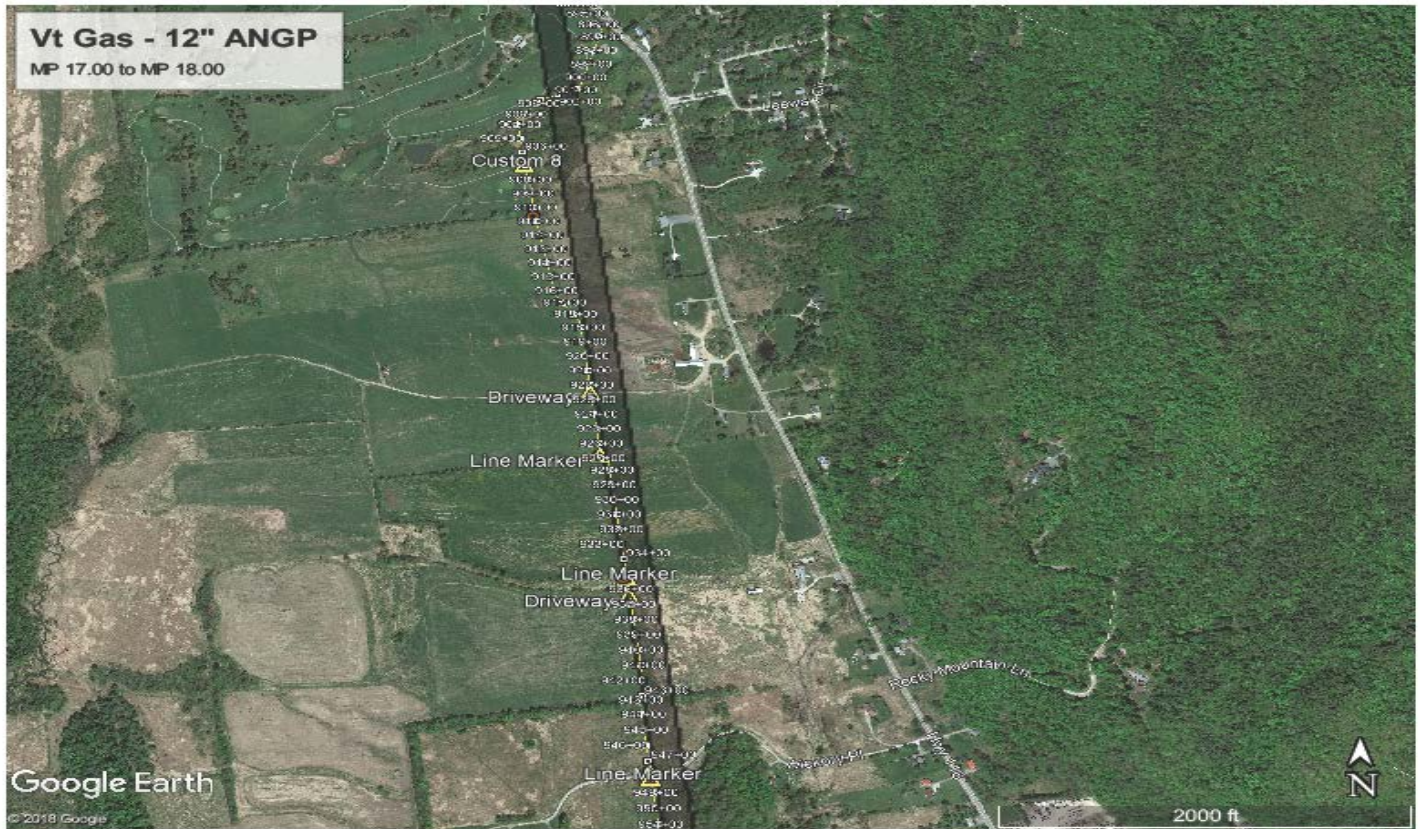
Milepost 15.00 to 16.00:



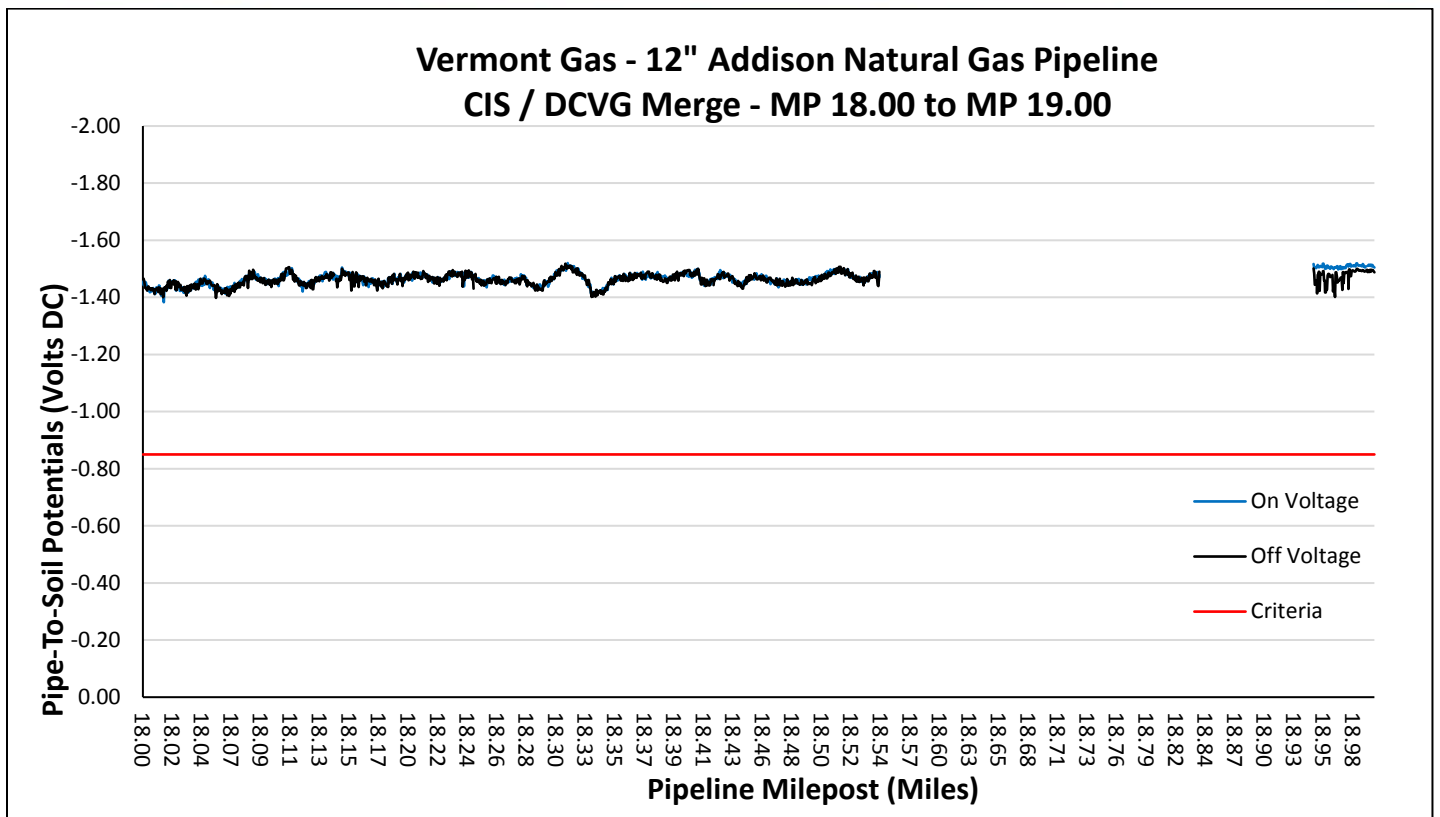
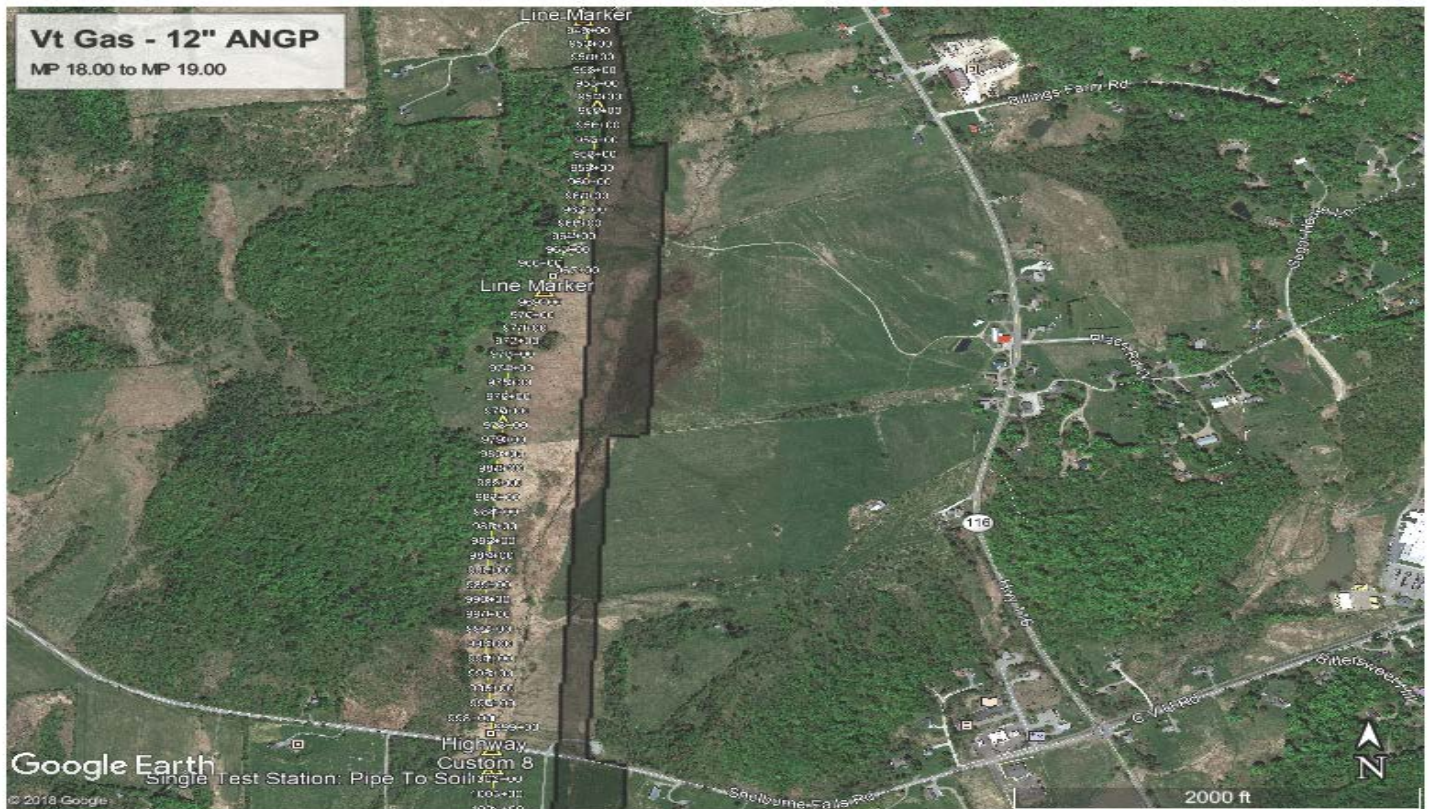
Milepost 16.00 to 17.00:



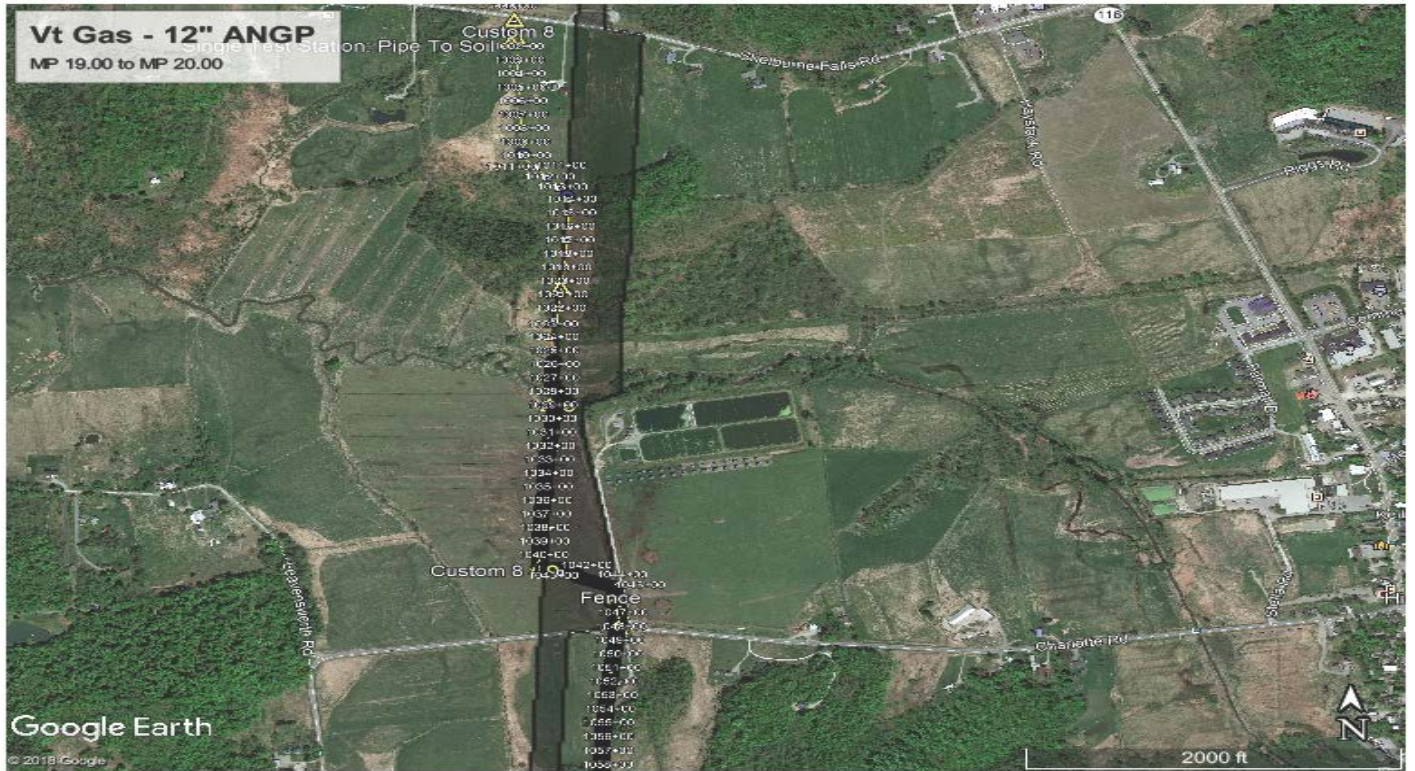
Milepost 17.00 to 18.00:



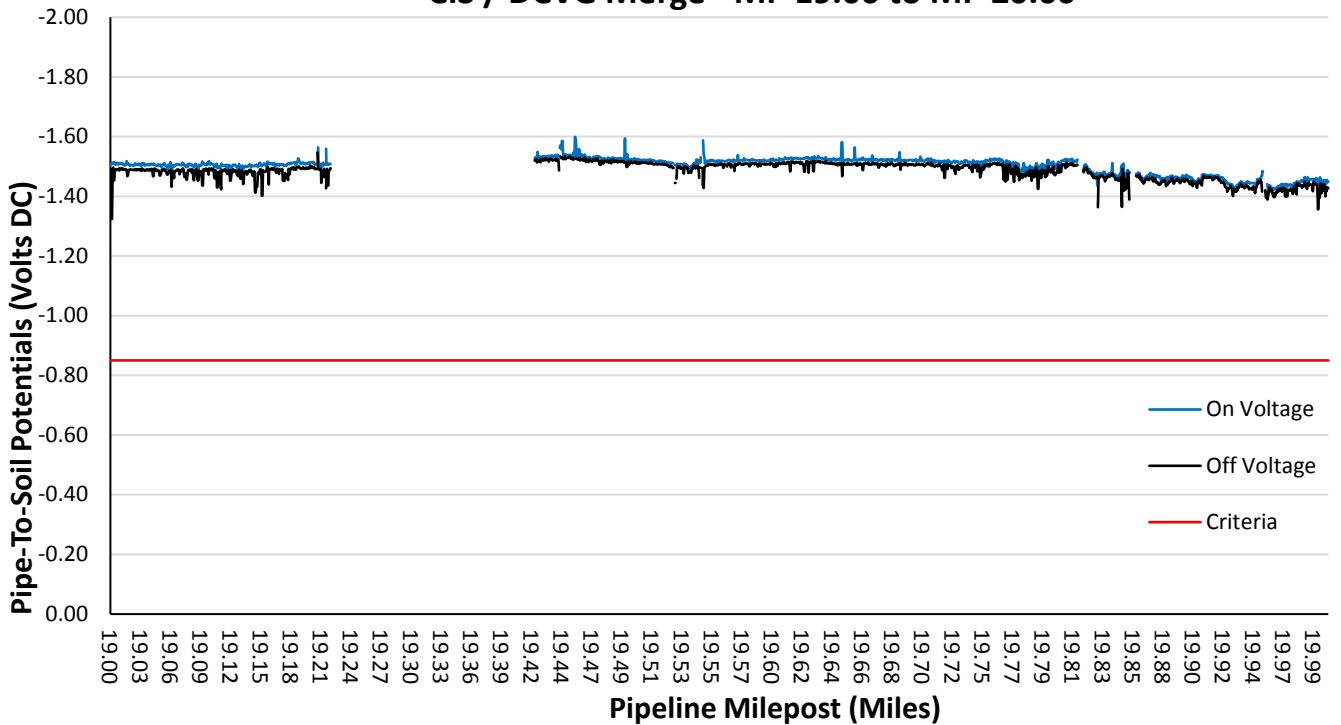
Milepost 18.00 to 19.00:



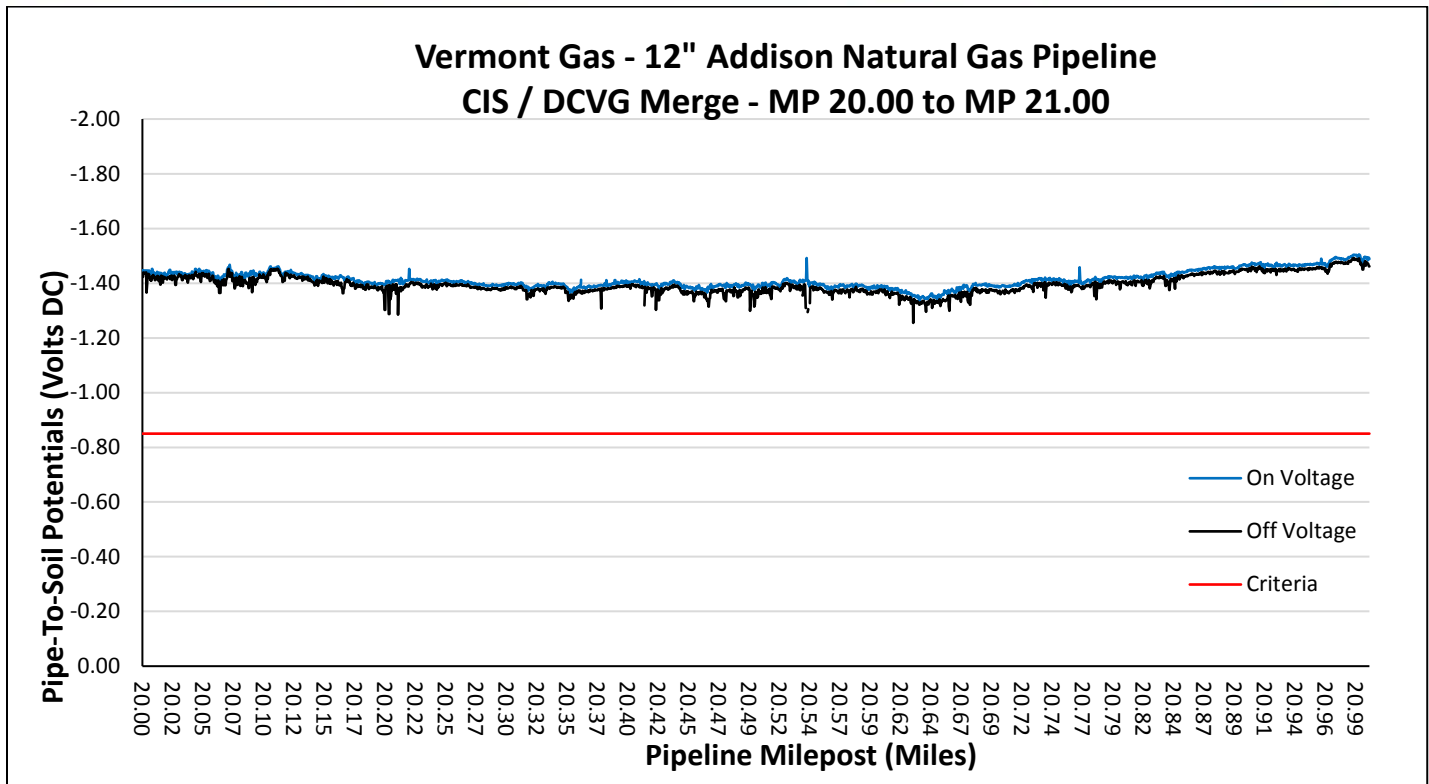
Milepost 19.00 to 20.00:



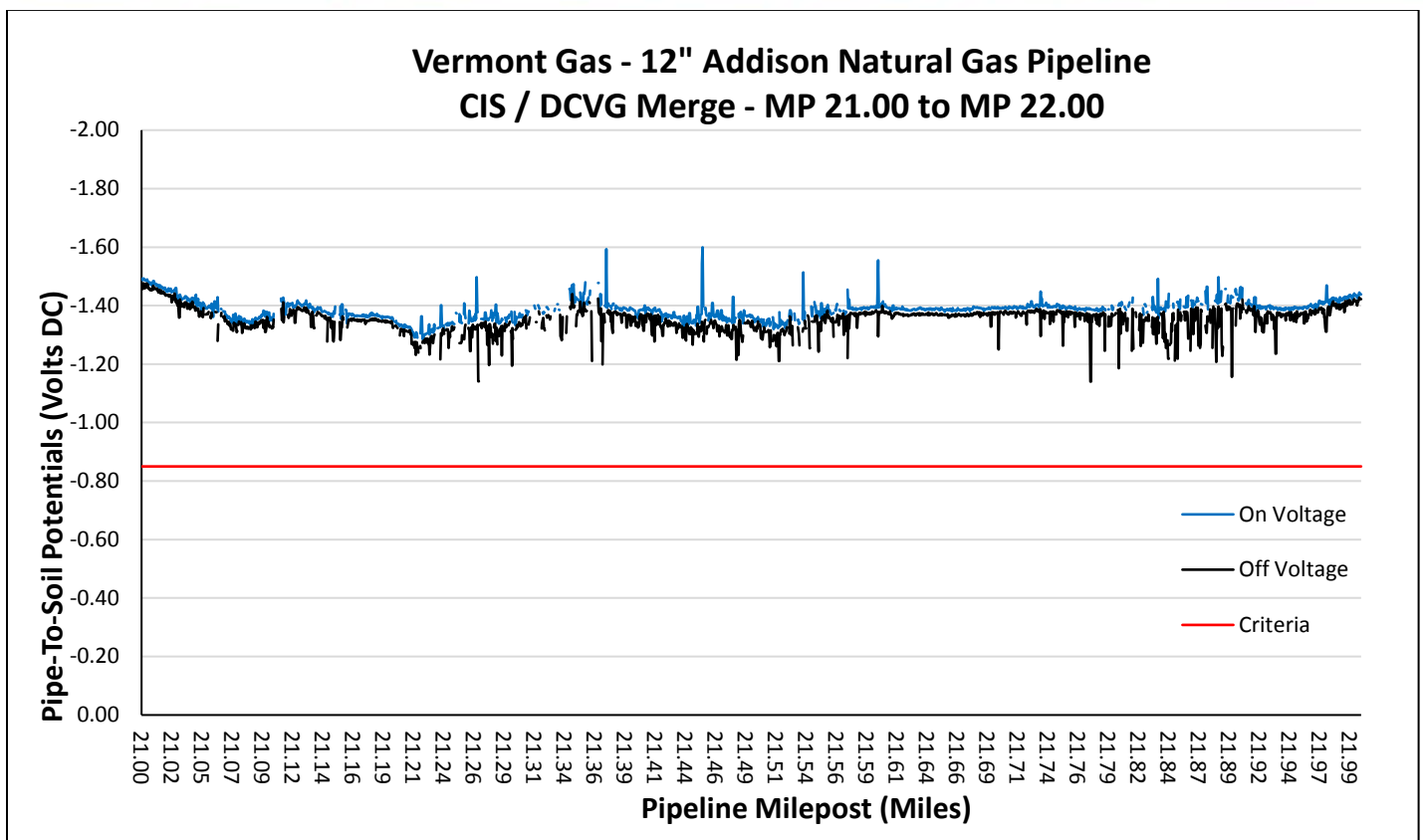
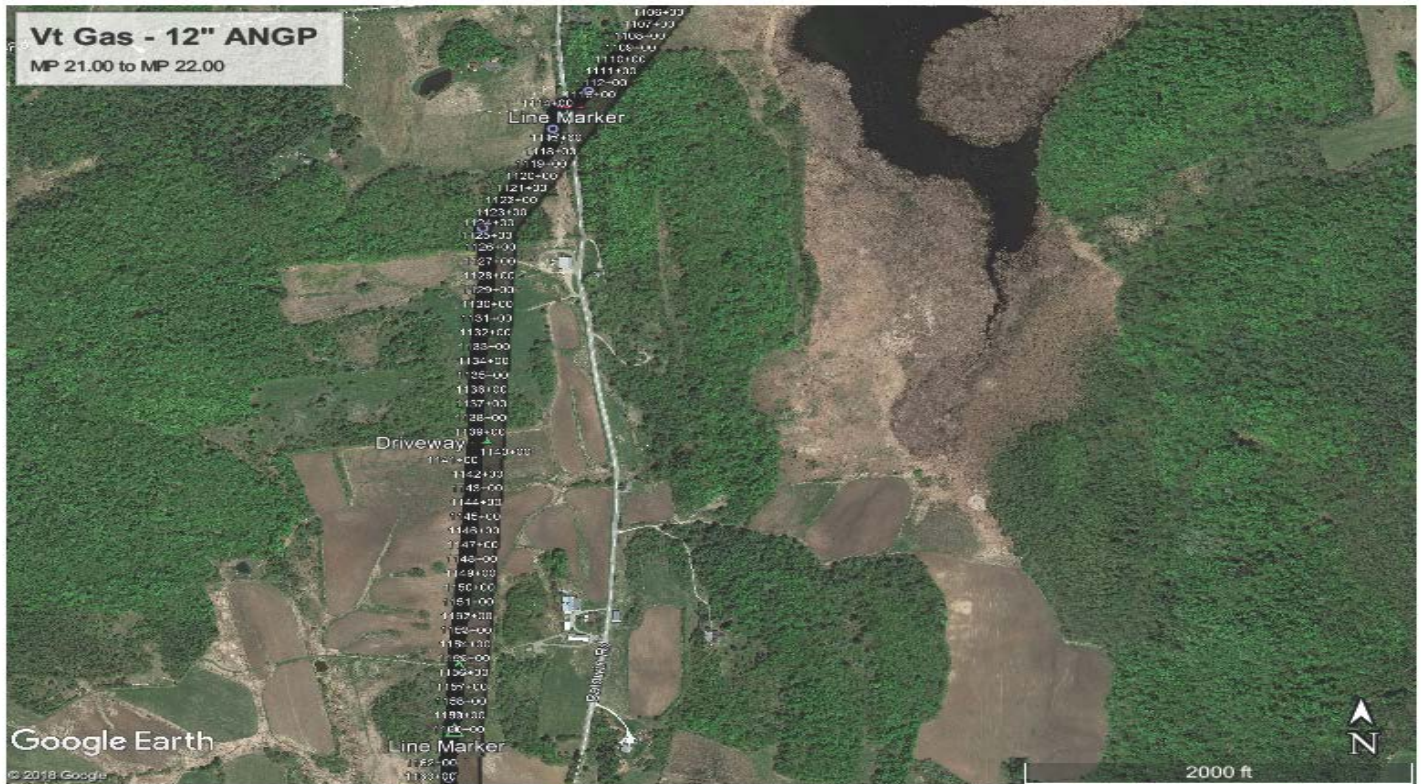
**Vermont Gas - 12" Addison Natural Gas Pipeline
CIS / DCVG Merge - MP 19.00 to MP 20.00**



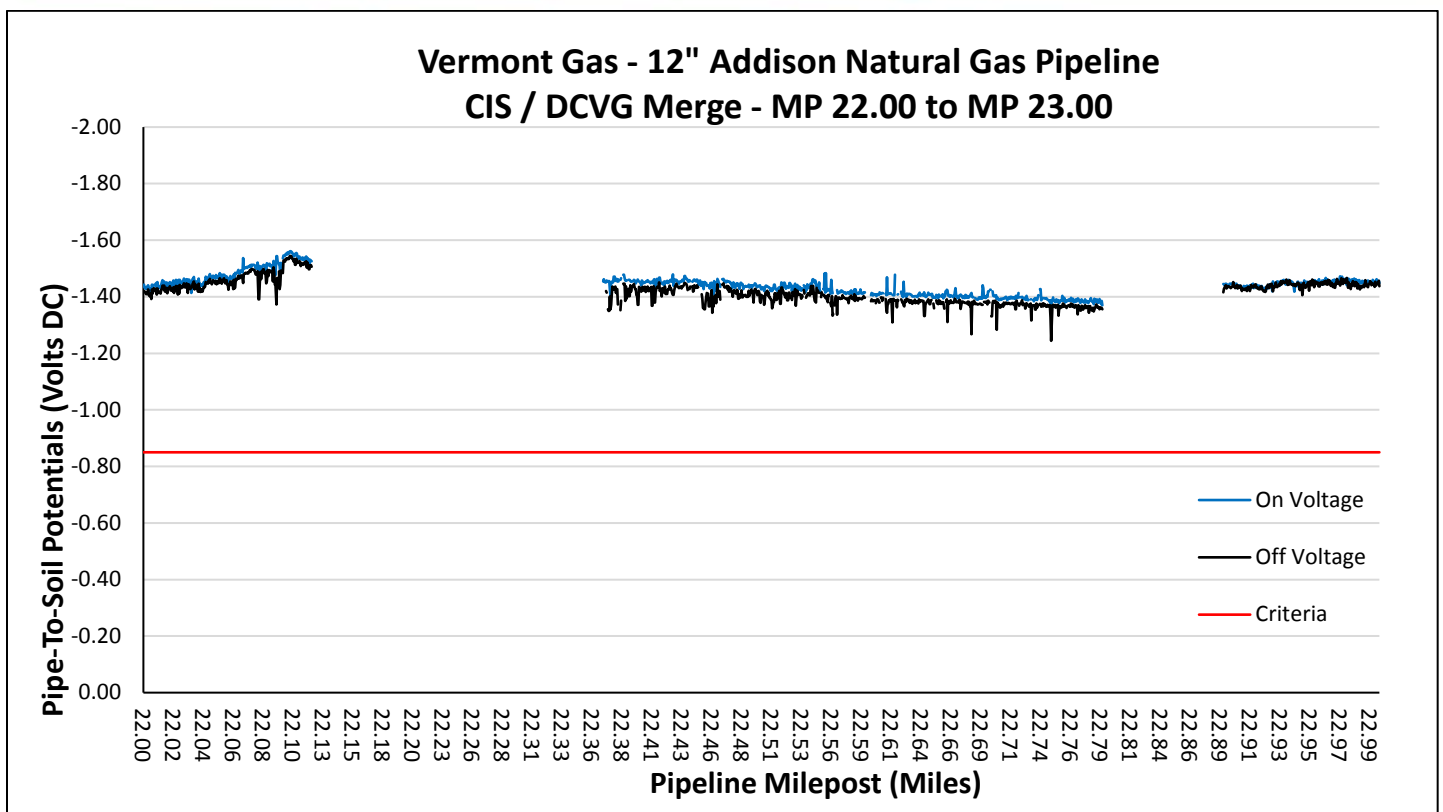
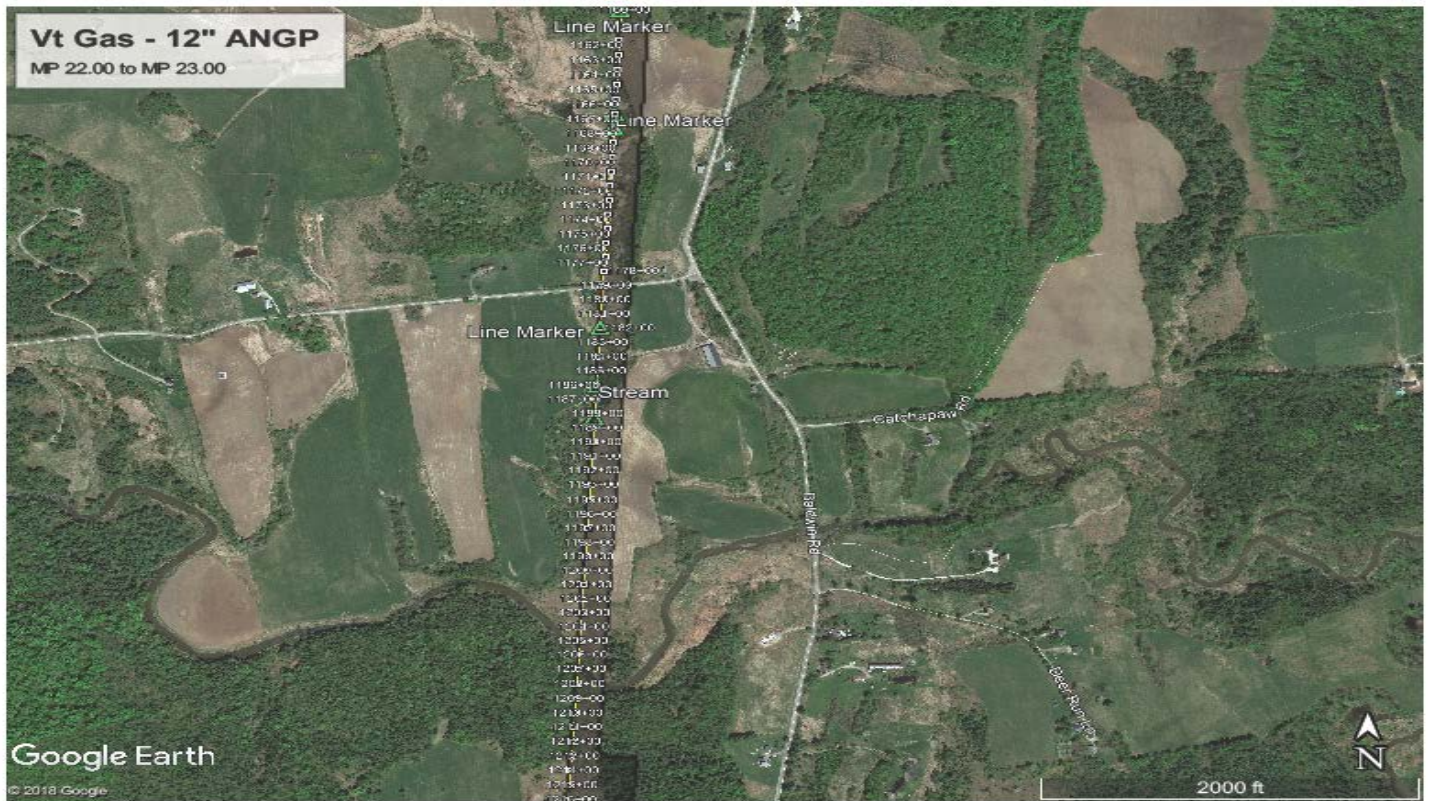
Milepost 20.00 to 21.00:



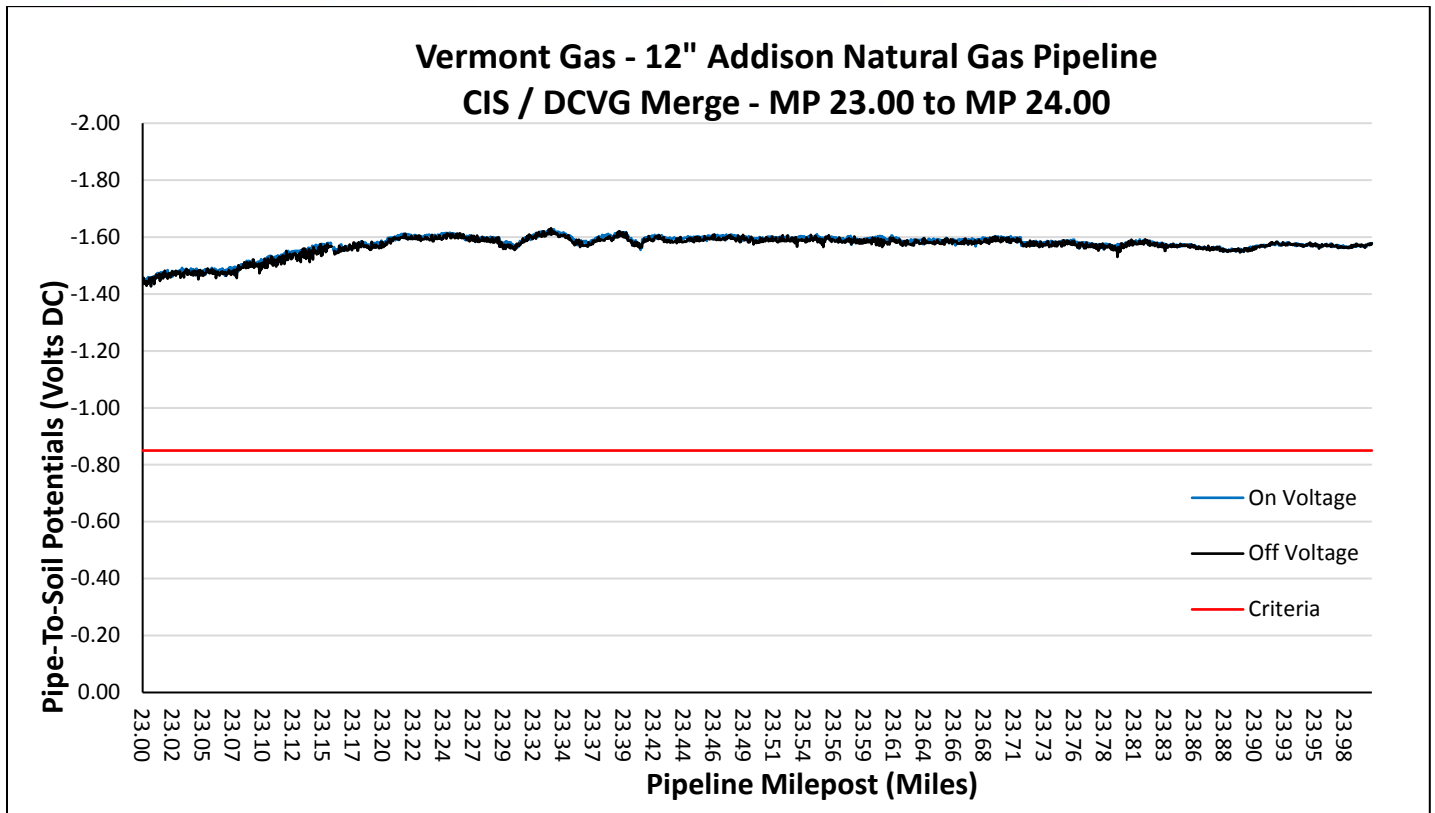
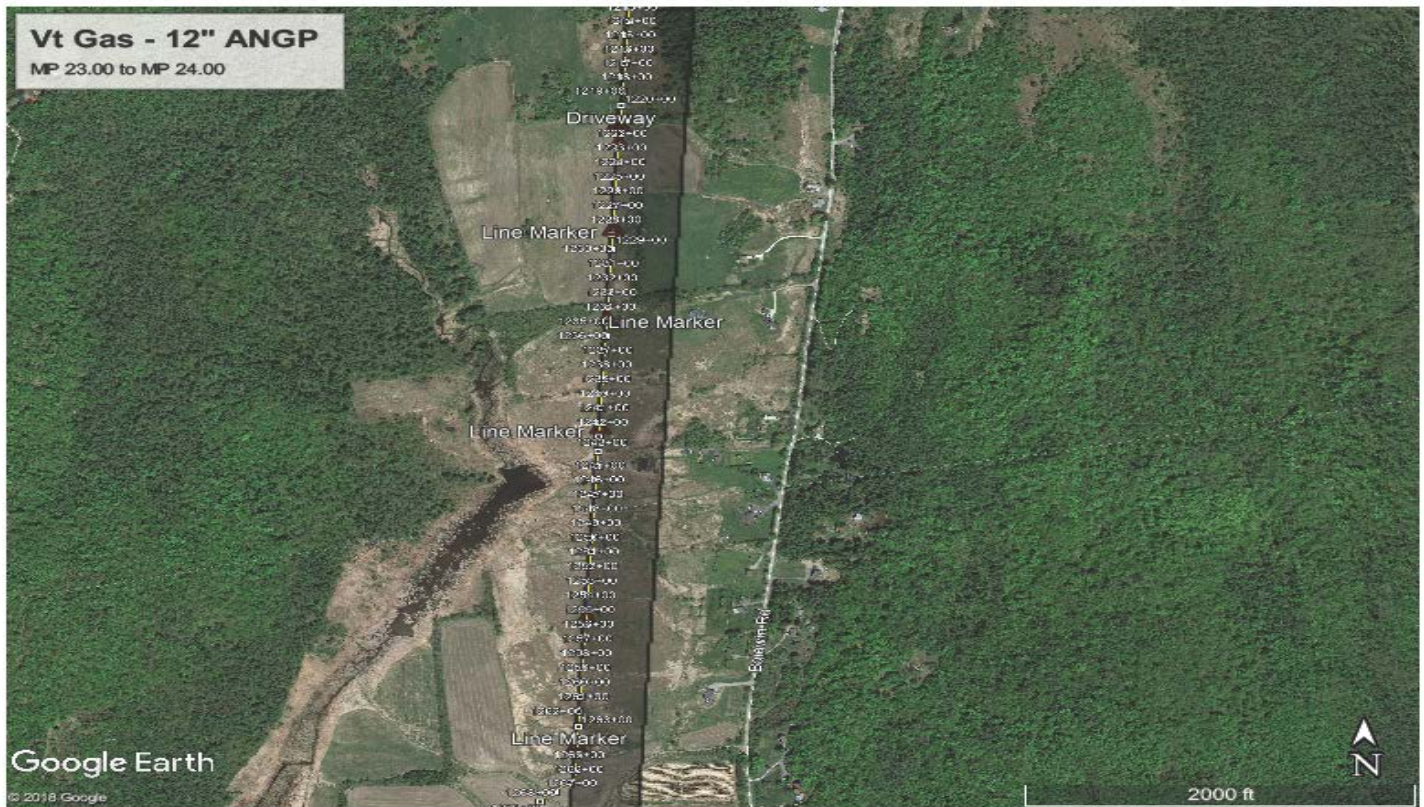
Milepost 21.00 to 22.00:



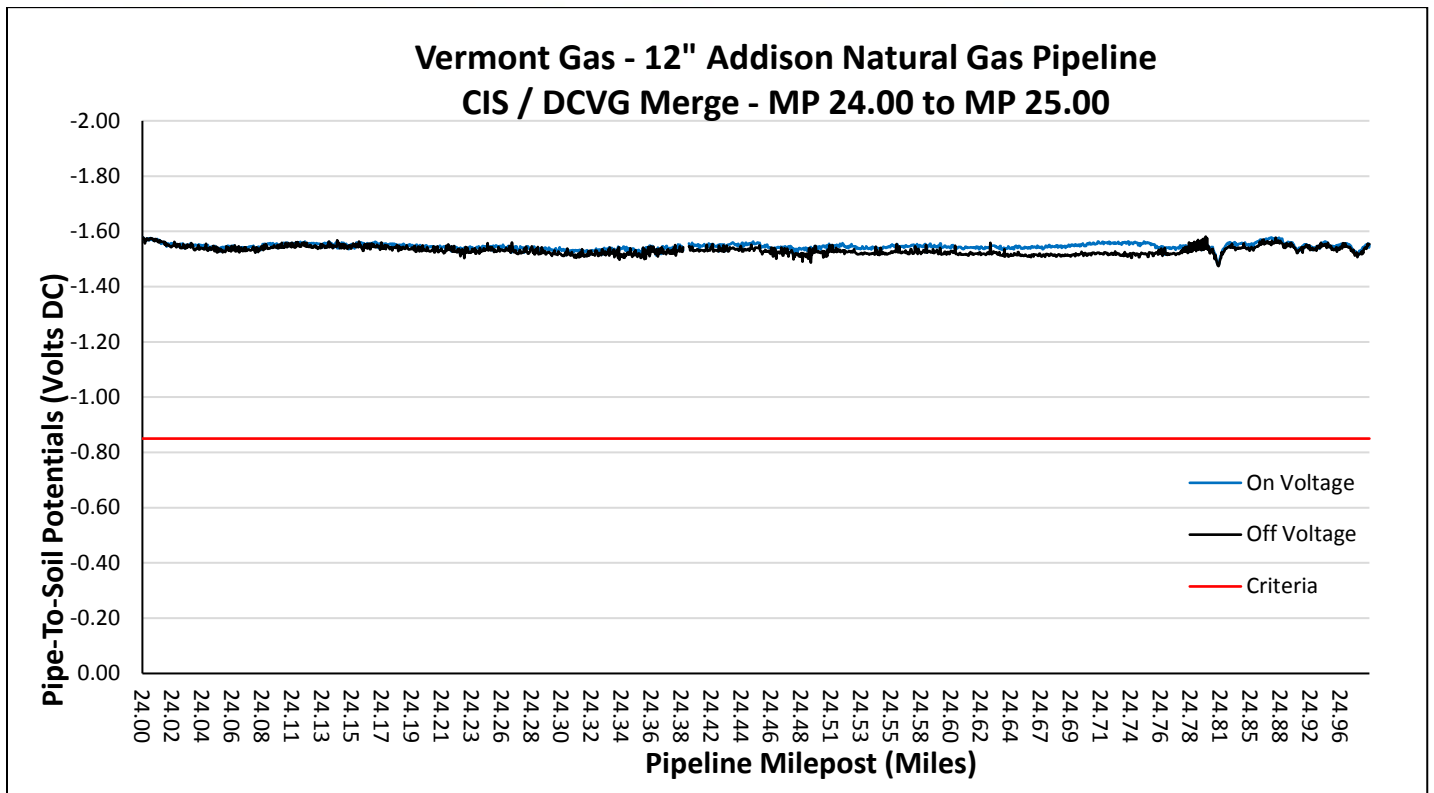
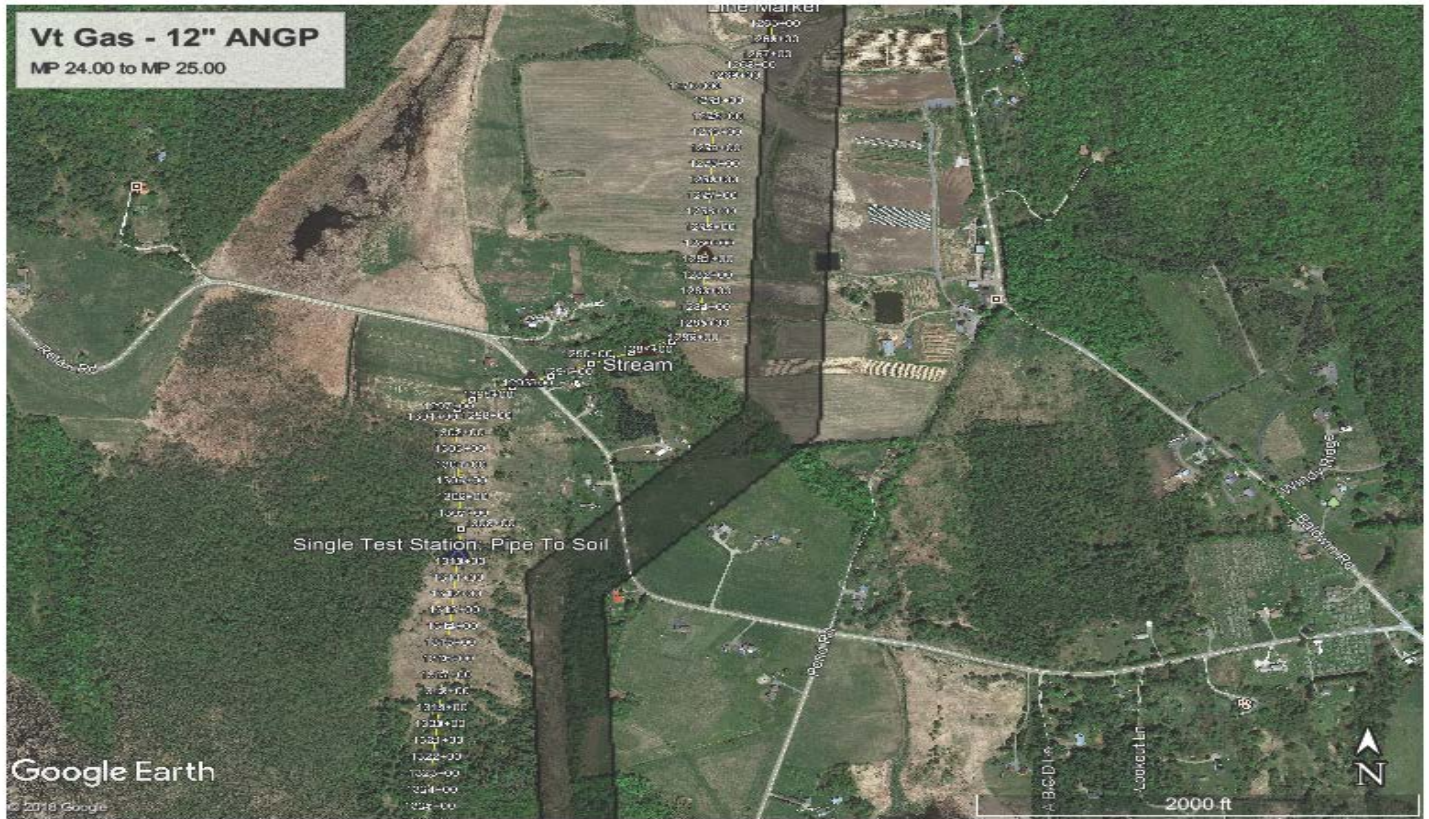
Milepost 22.00 to 23.00:



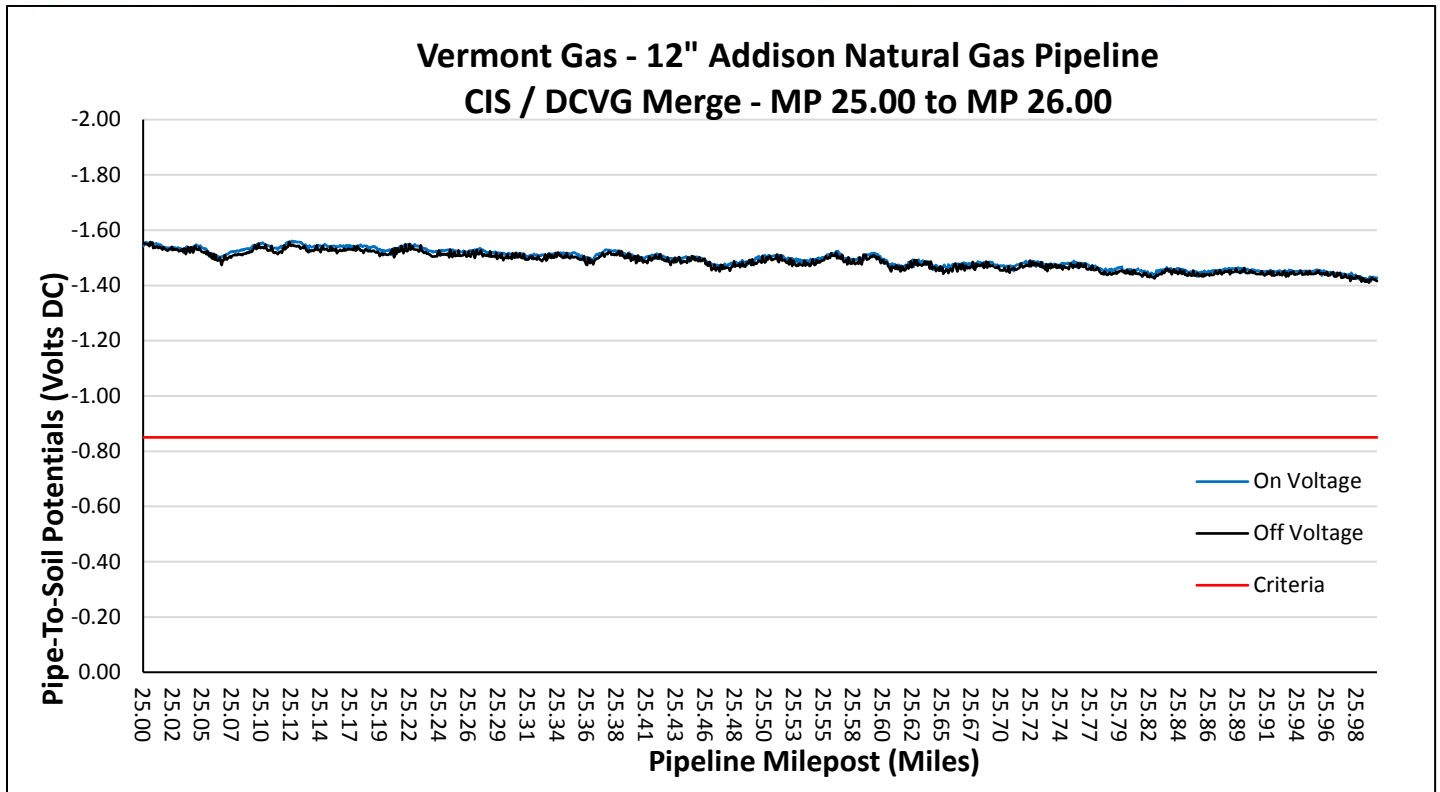
Milepost 23.00 to 24.00:



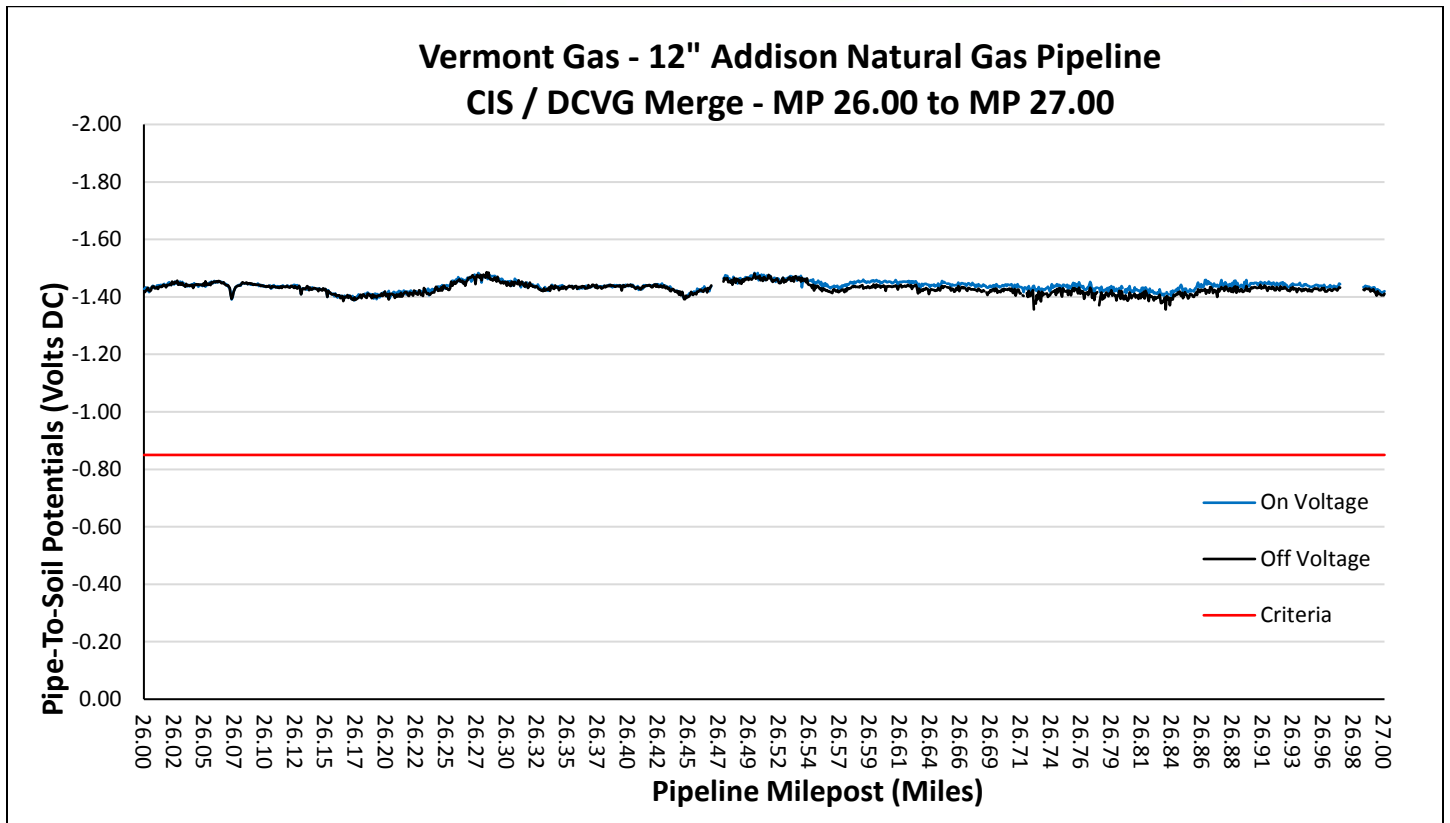
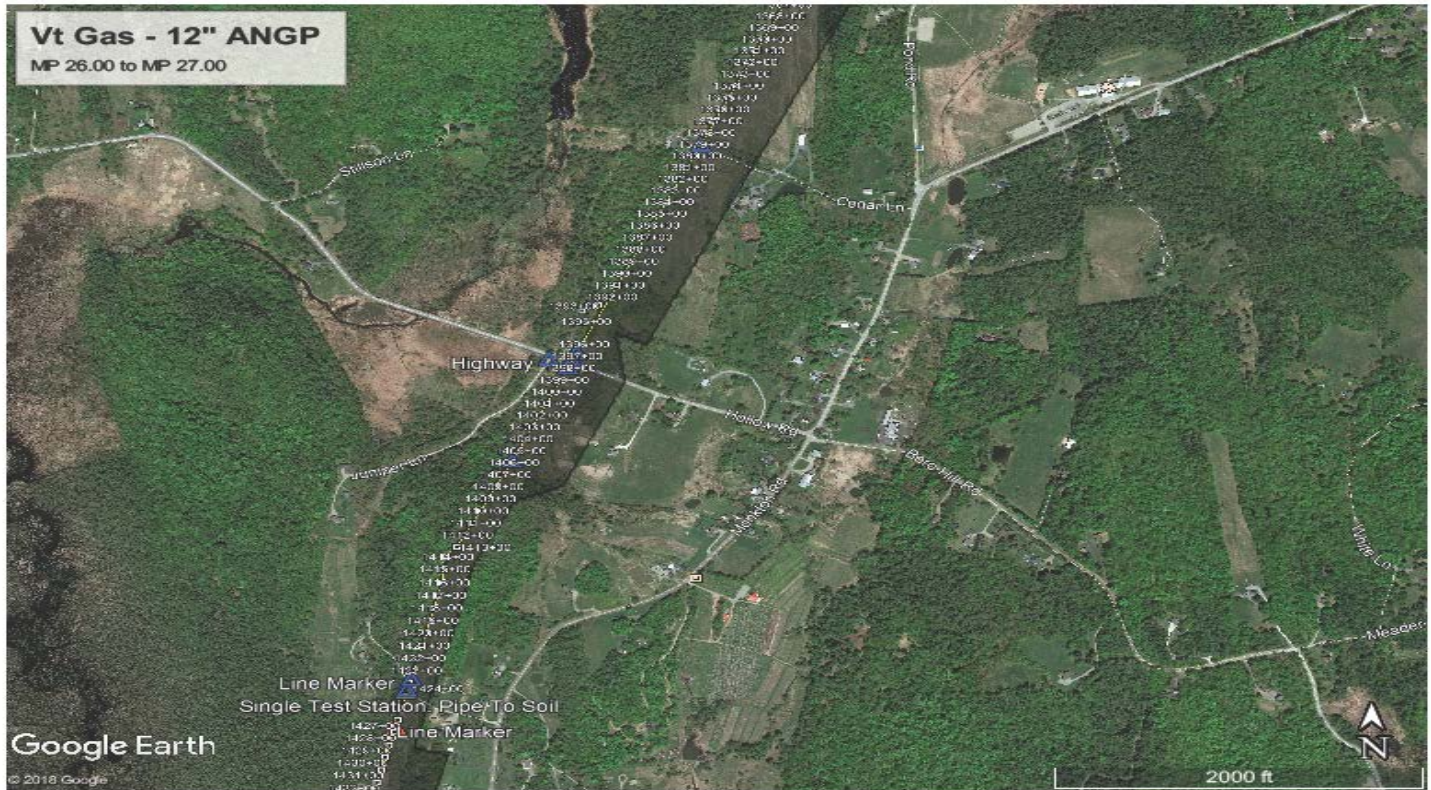
Milepost 24.00 to 25.00:



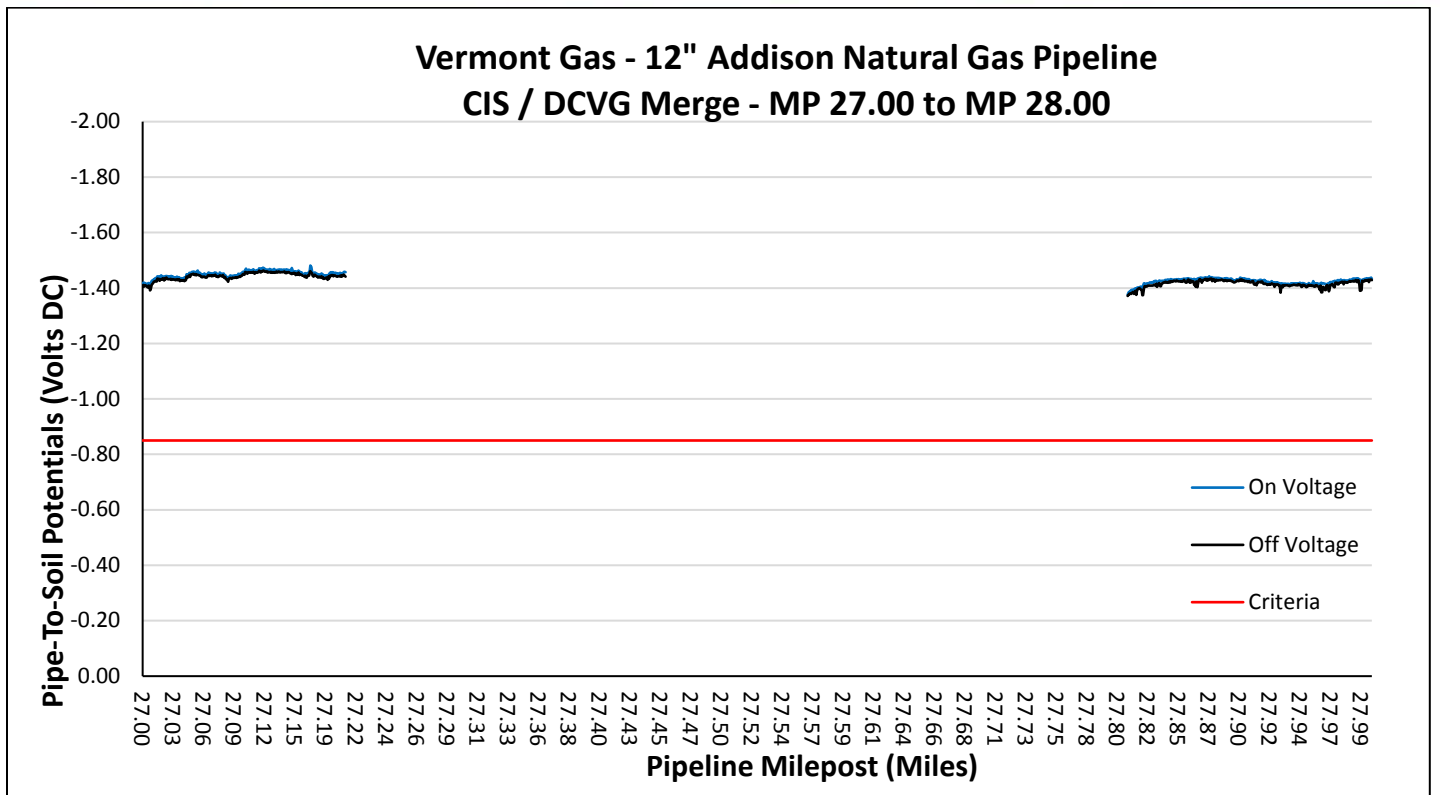
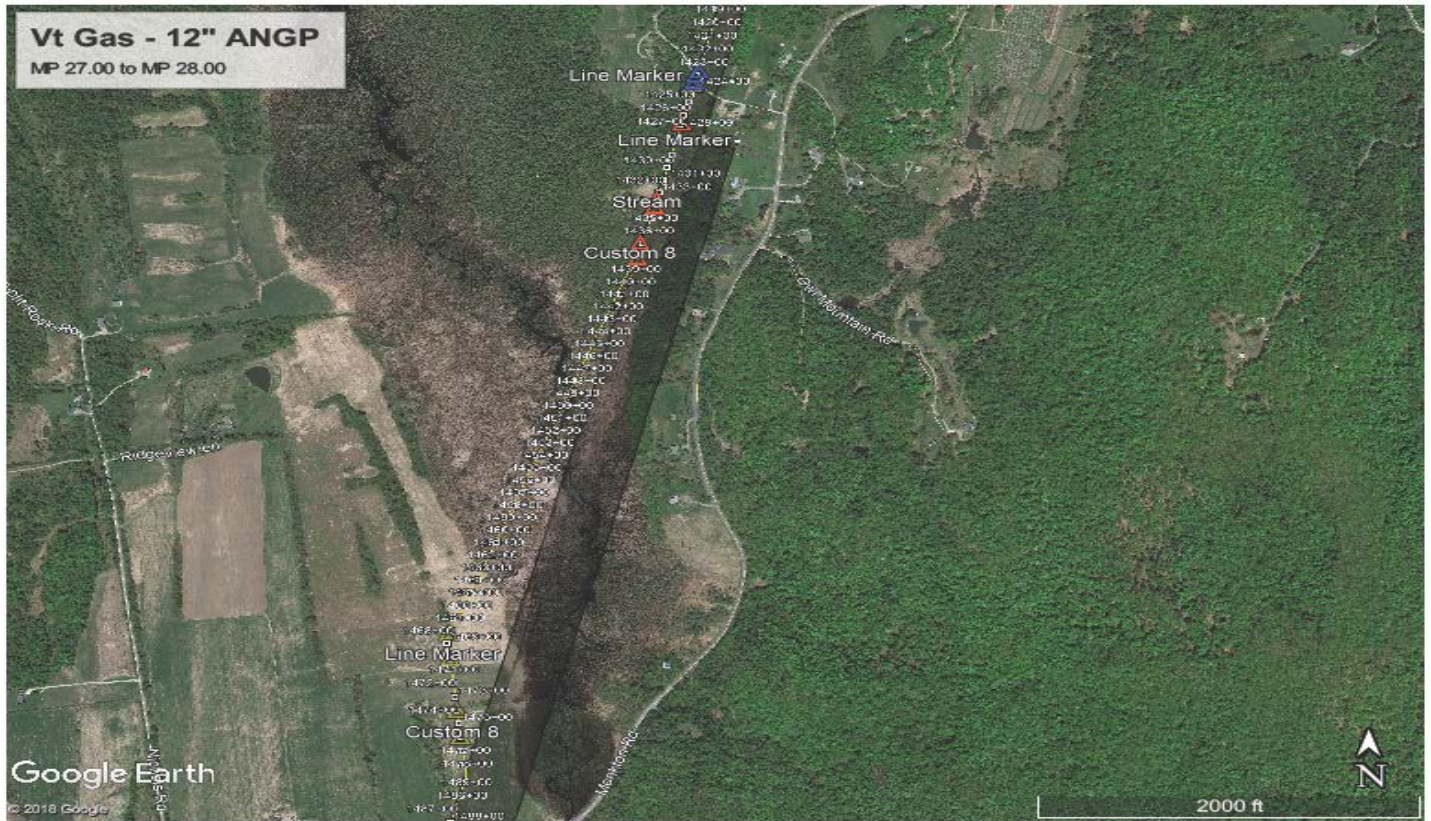
Milepost 25.00 to 26.00:



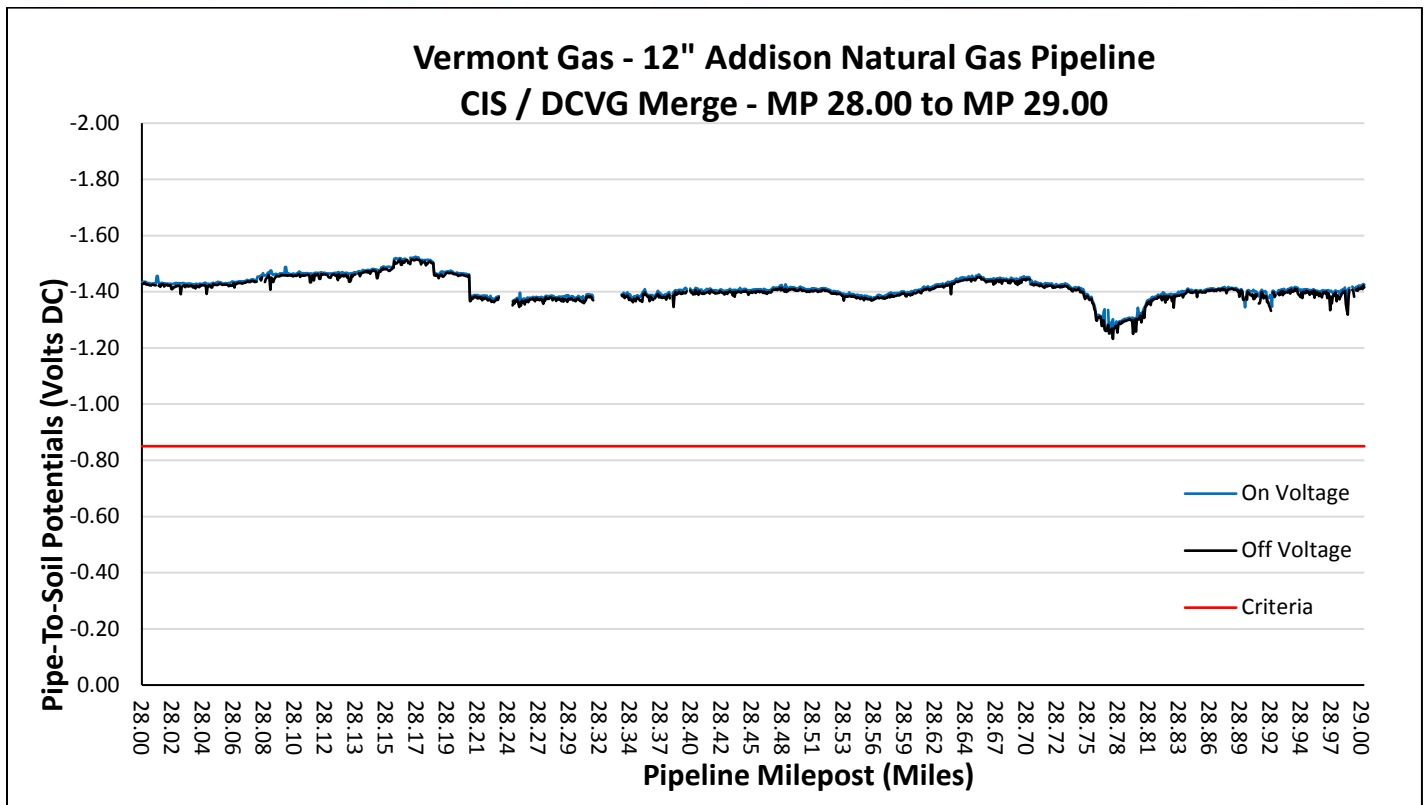
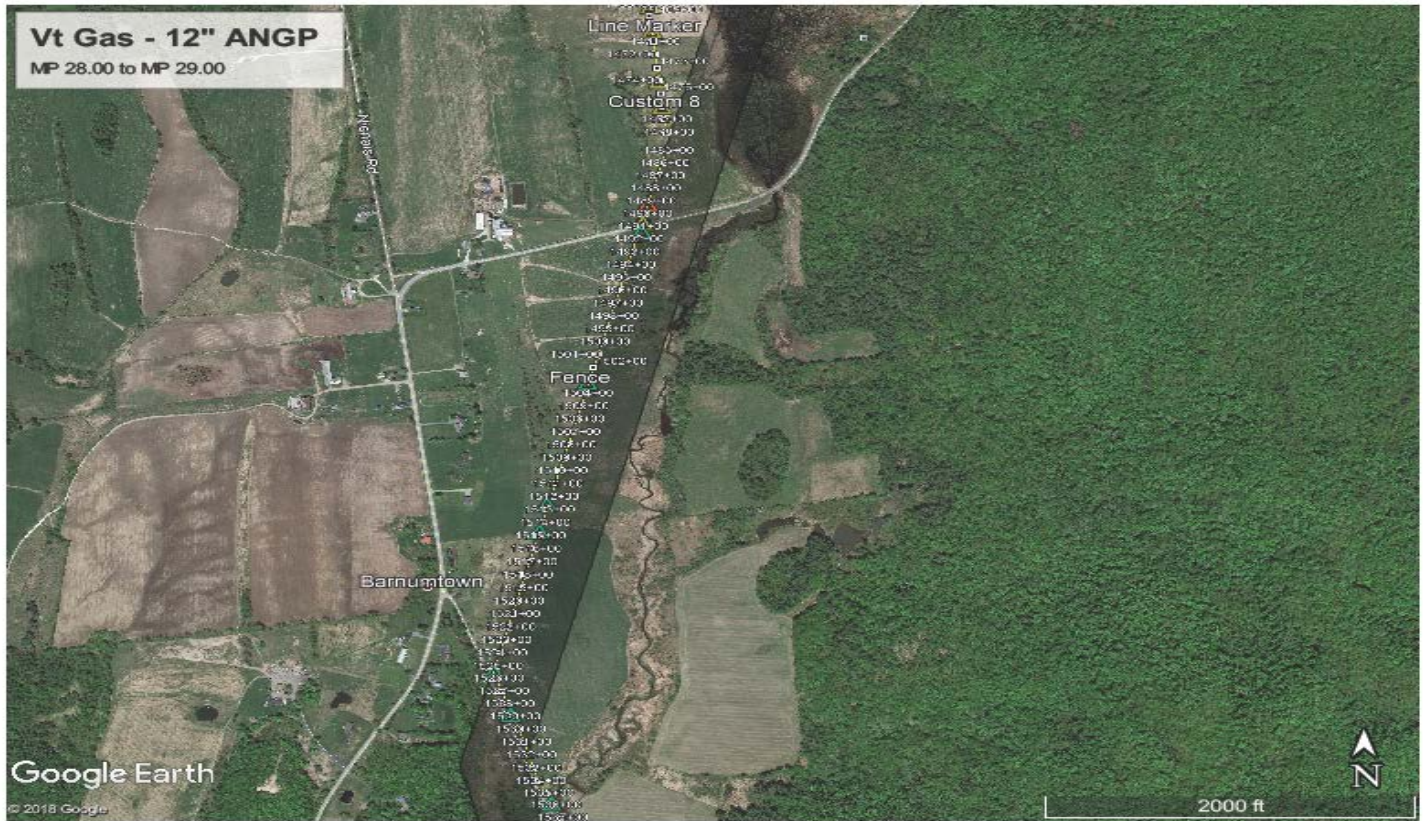
Milepost 26.00 to 27.00:



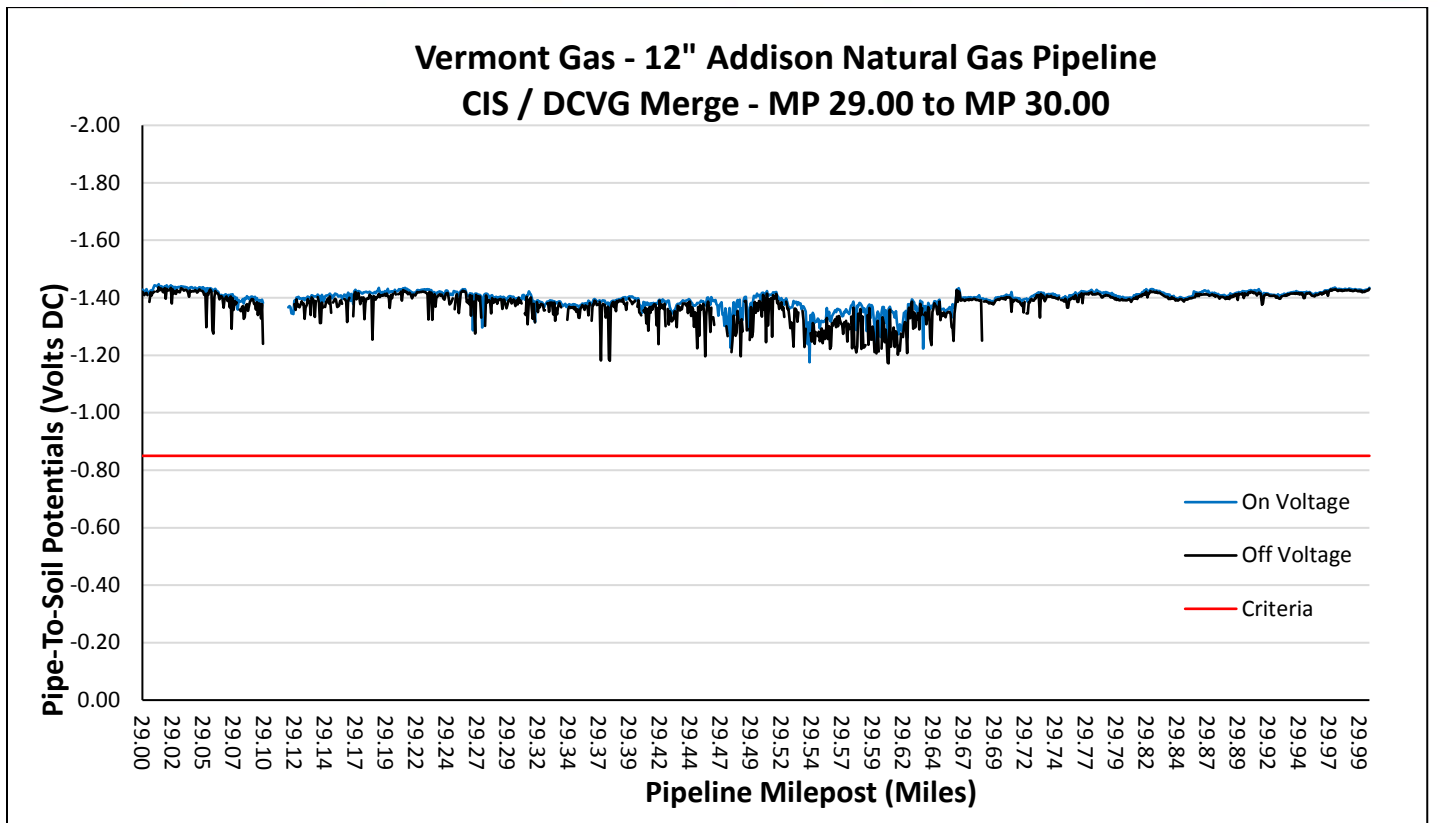
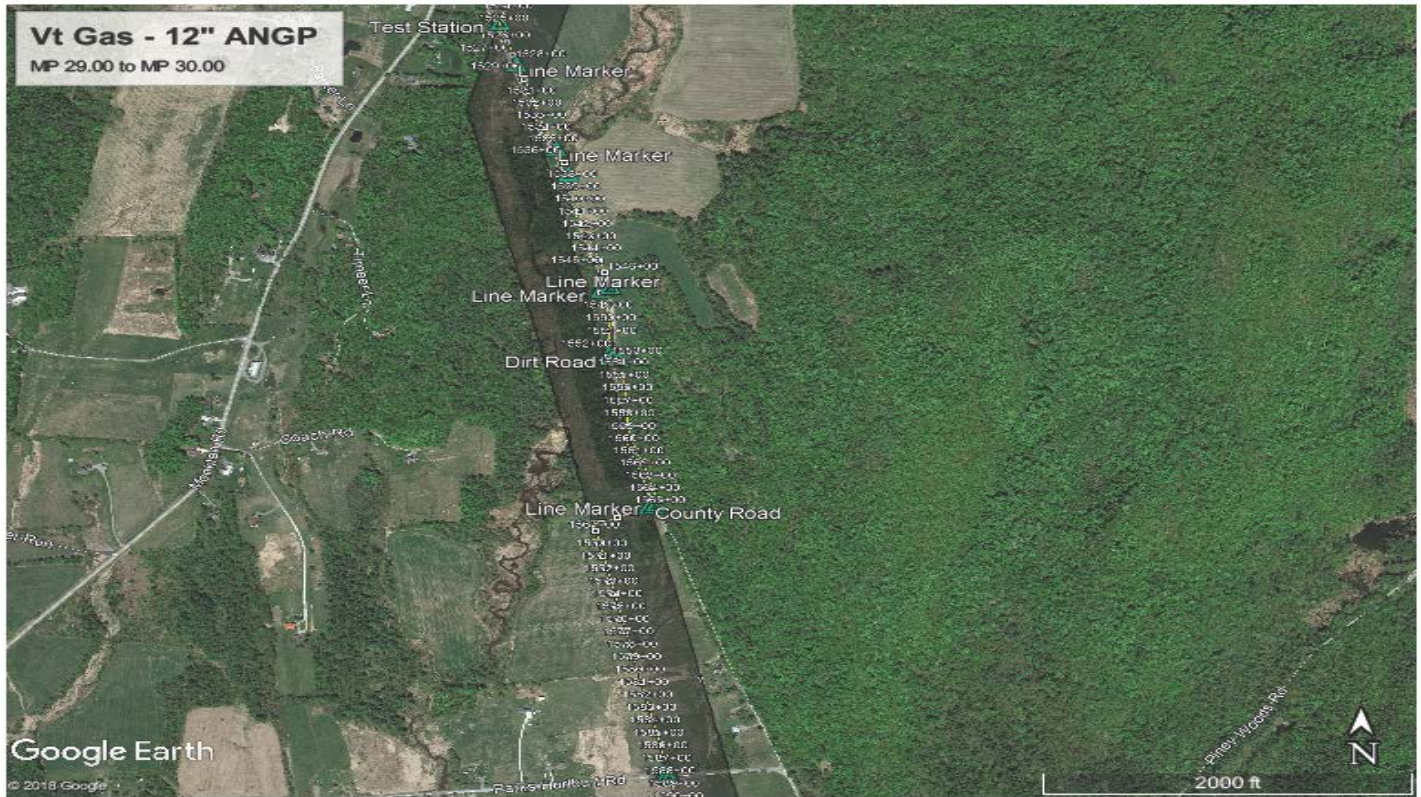
Milepost 27.00 to 28.00:



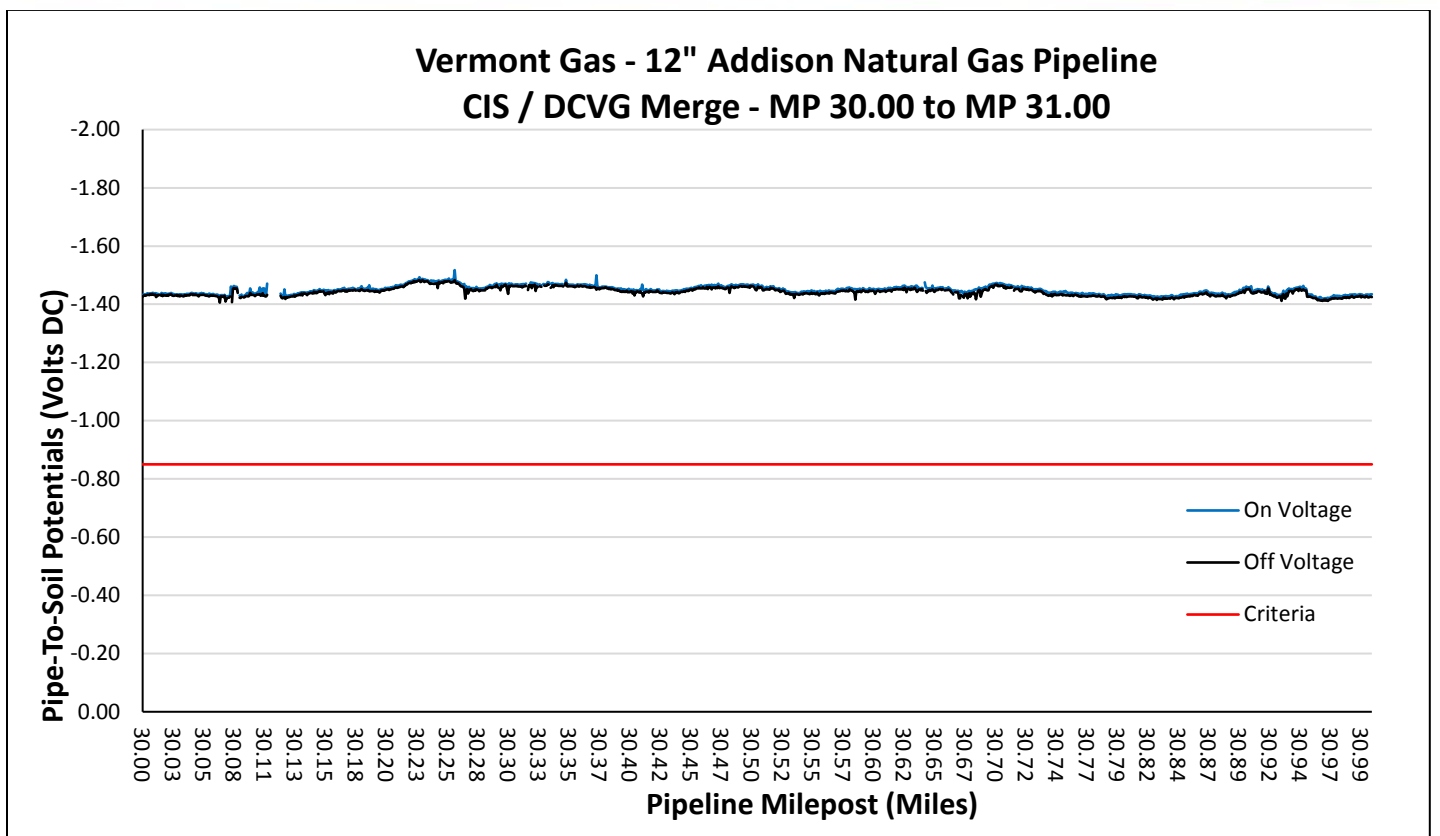
Milepost 28.00 to 29.00:



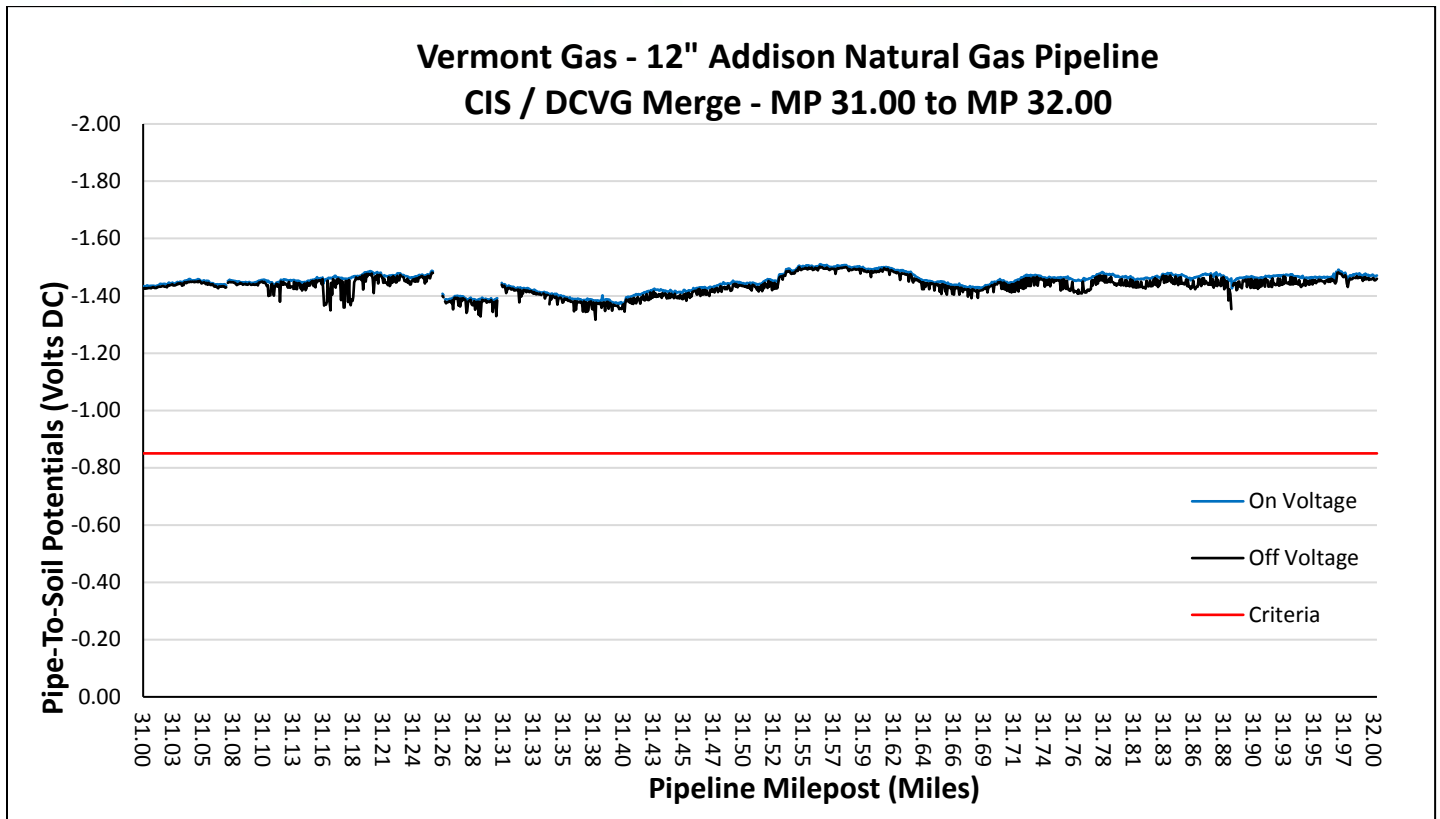
Milepost 29.00 to 30.00:



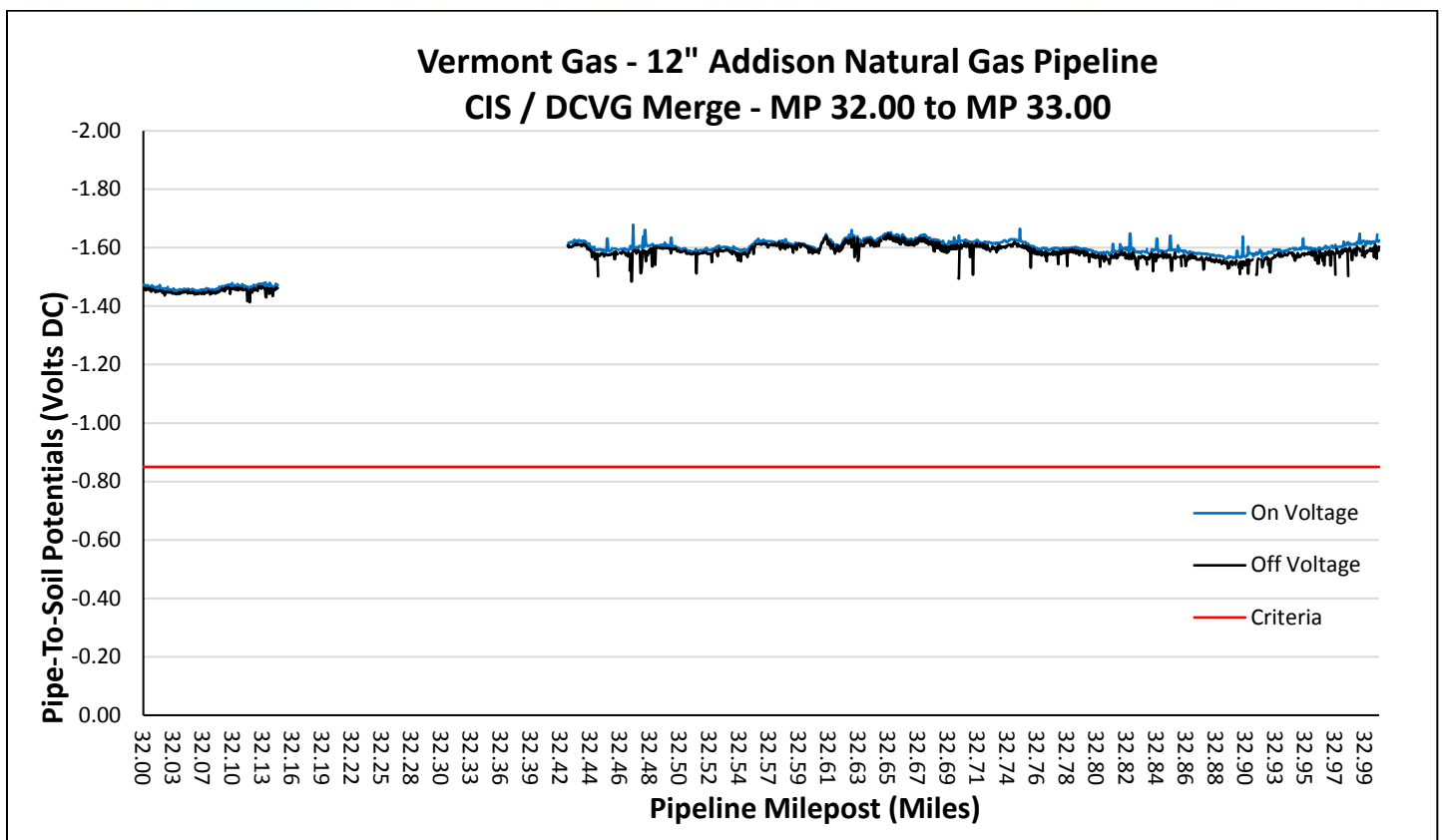
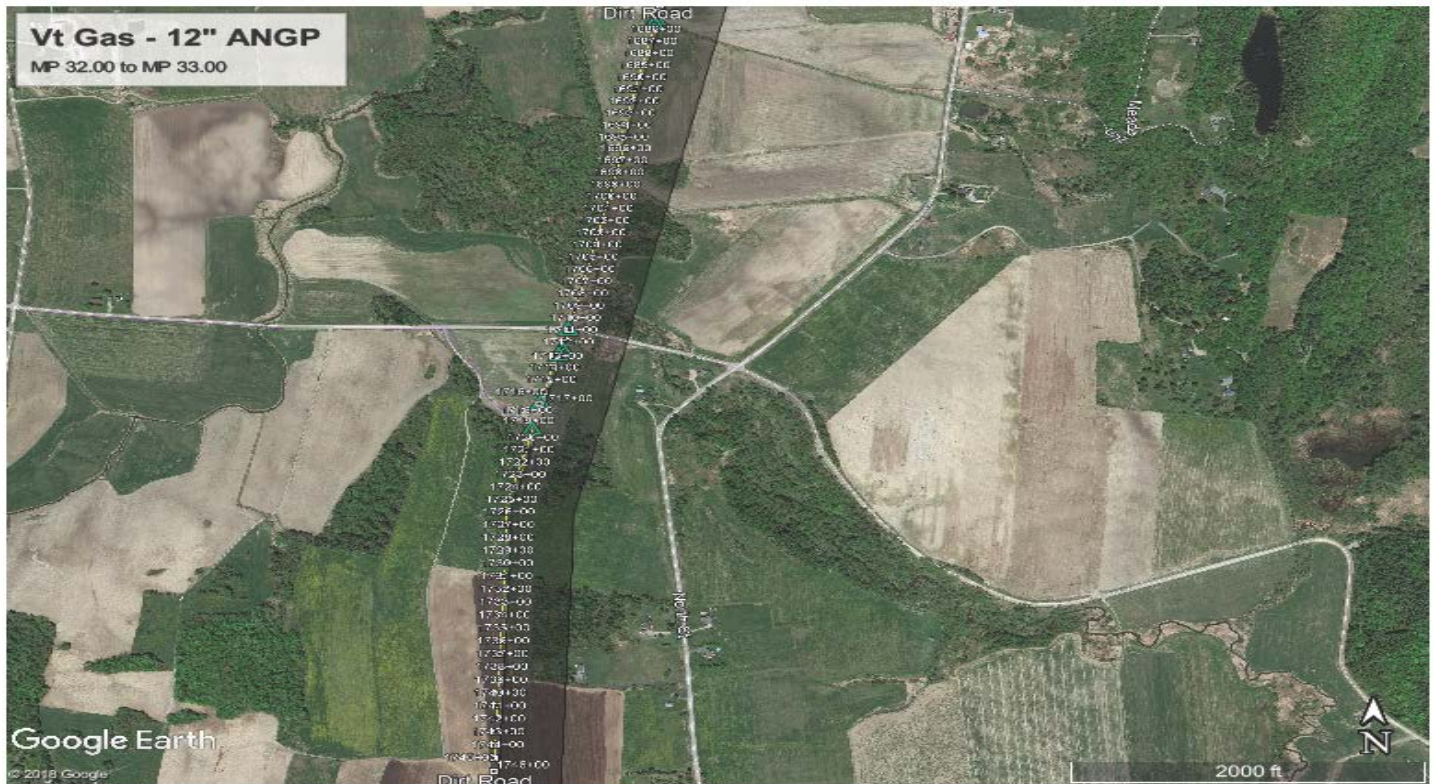
Milepost 30.00 to 31.00:



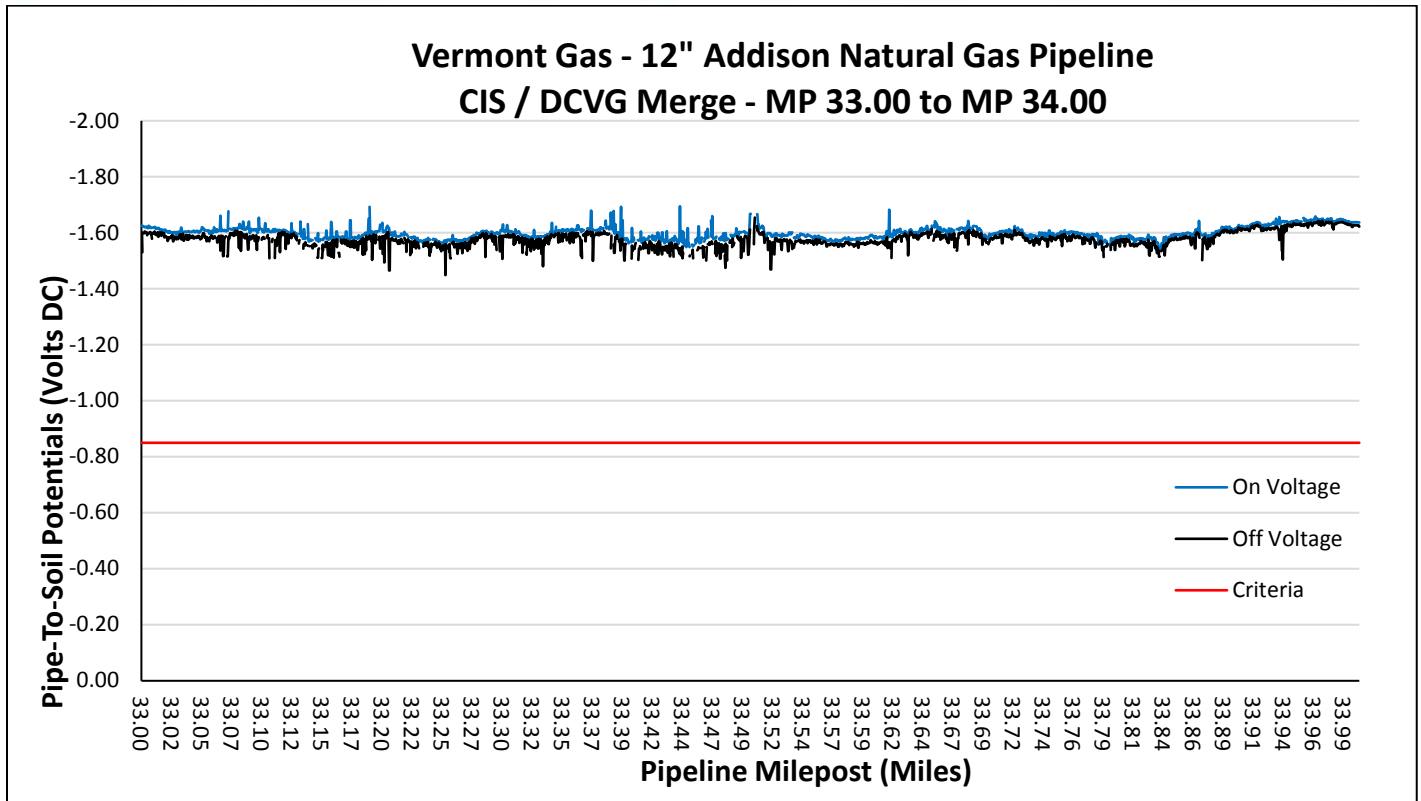
Milepost 31.00 to 32.00:



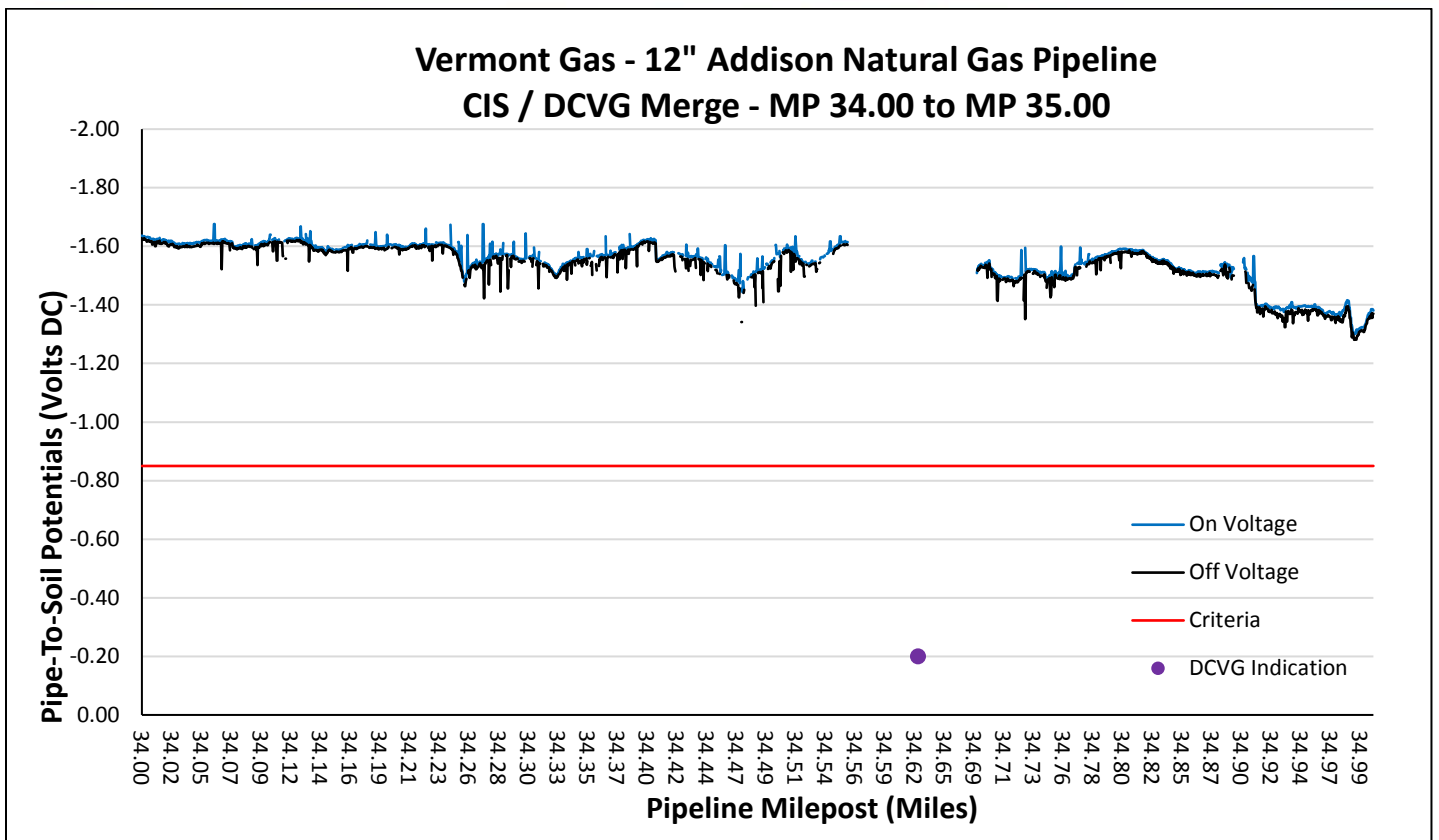
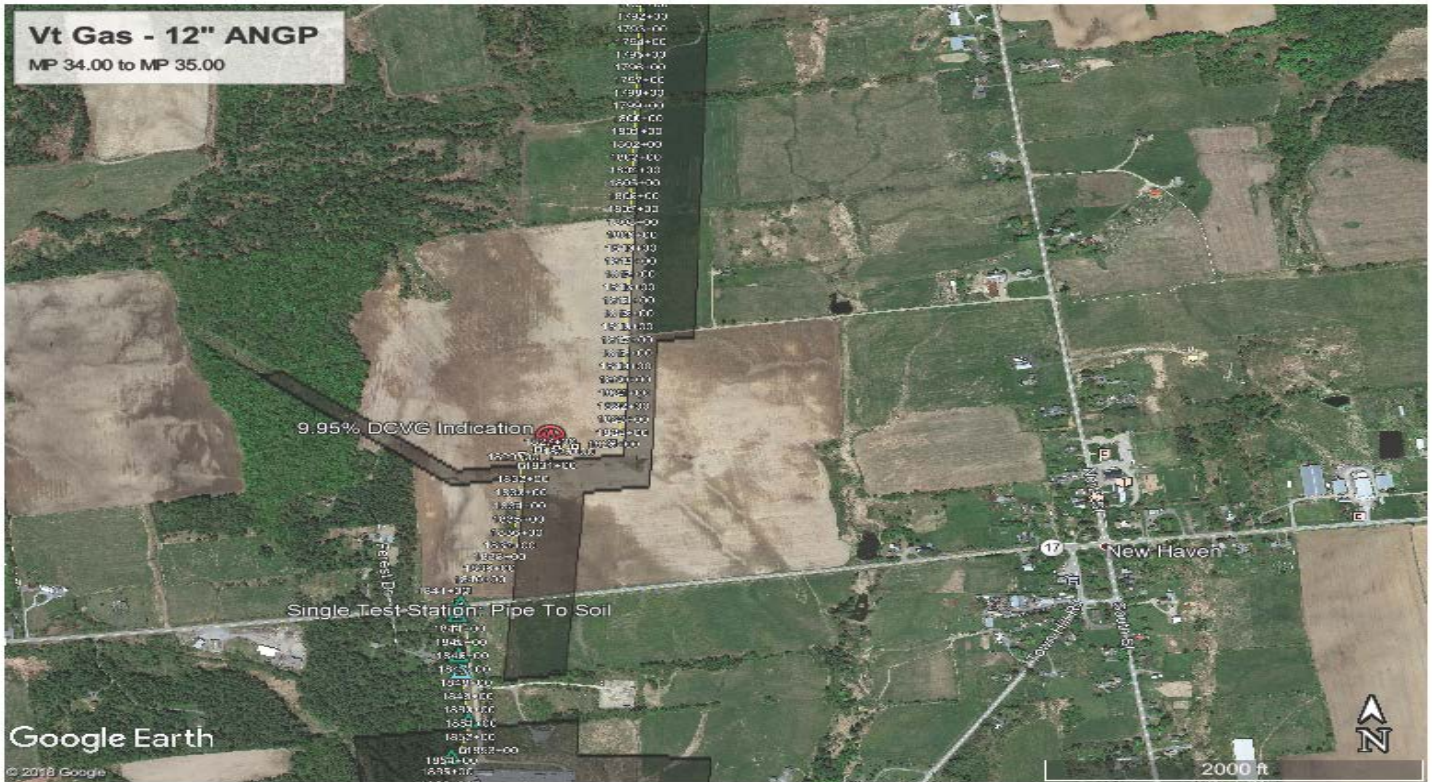
Milepost 32.00 to 33.00:



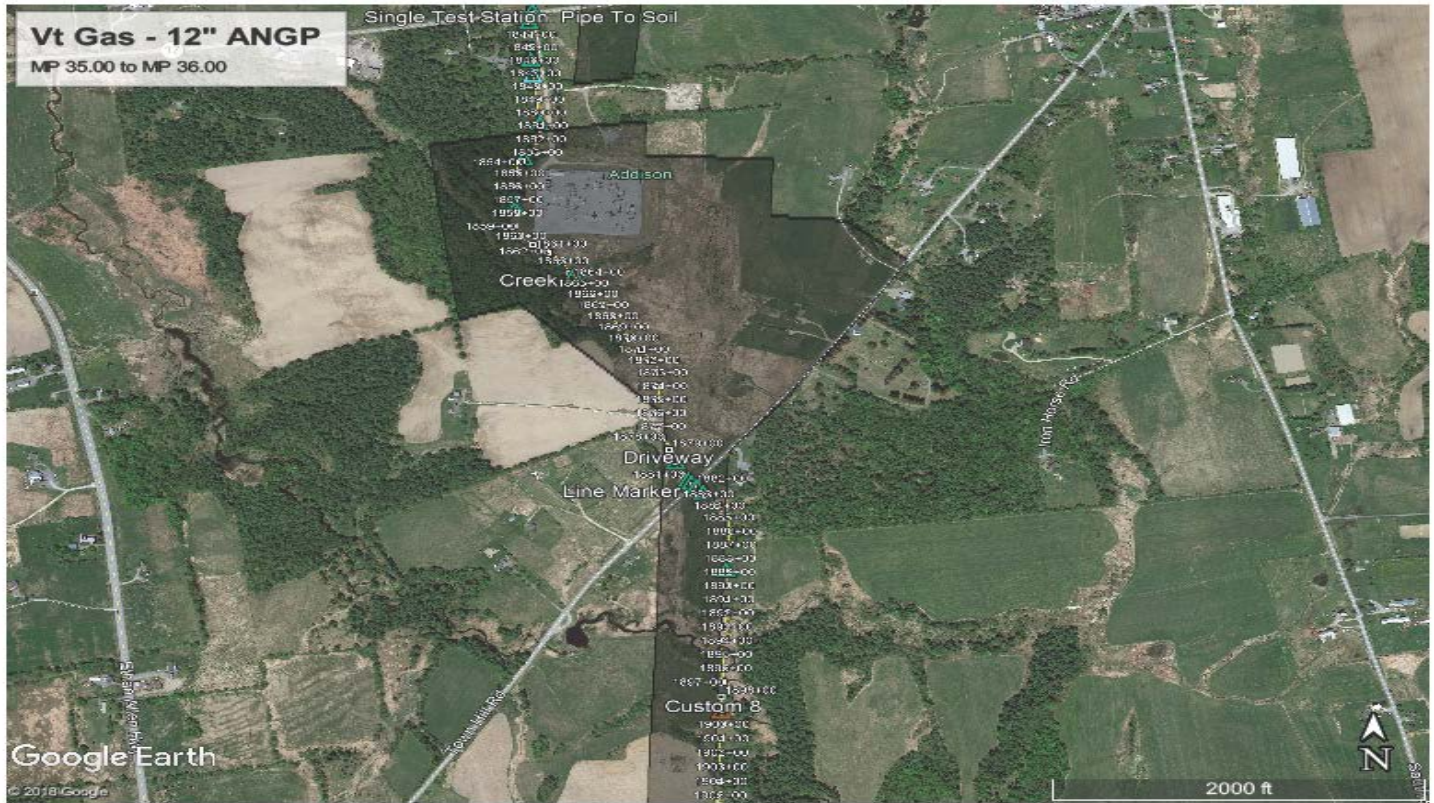
Milepost 33.00 to 34.00:



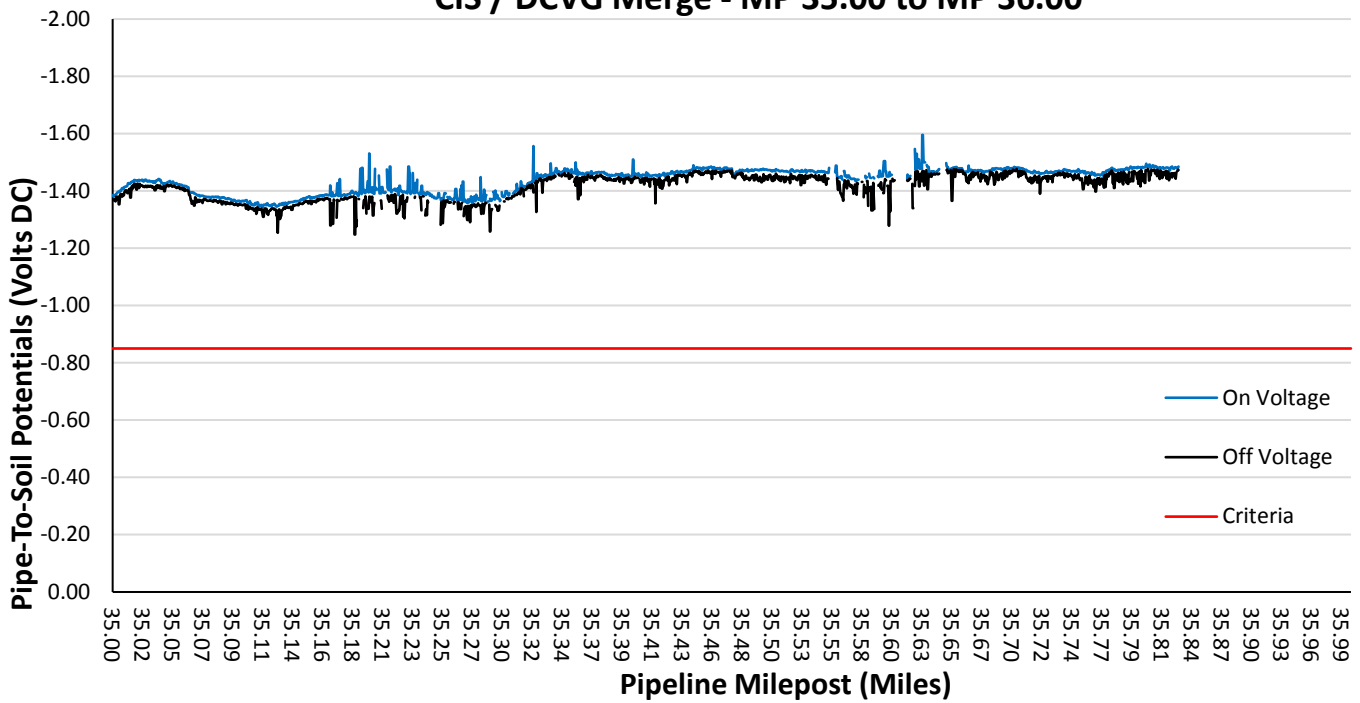
Milepost 34.00 to 35.00:



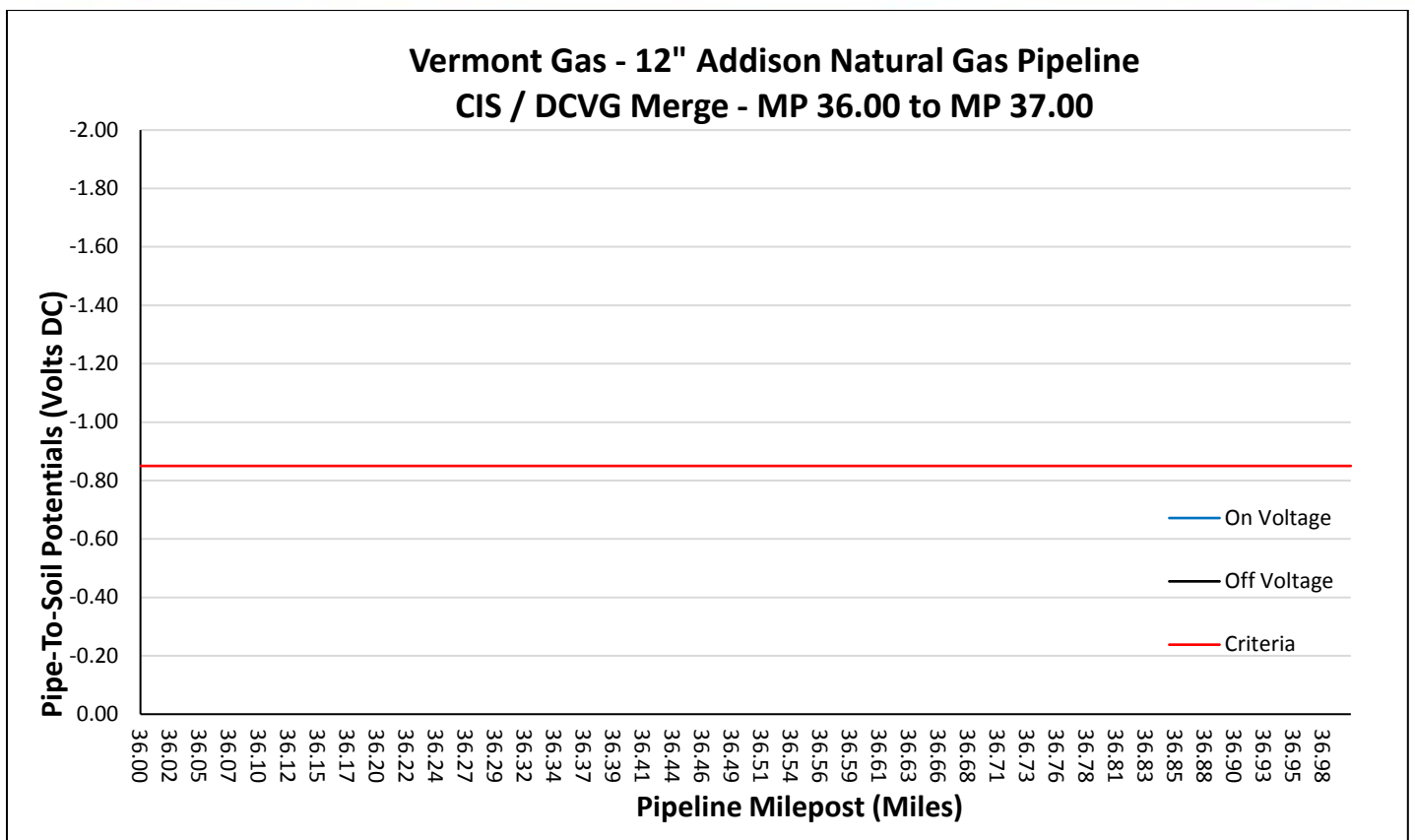
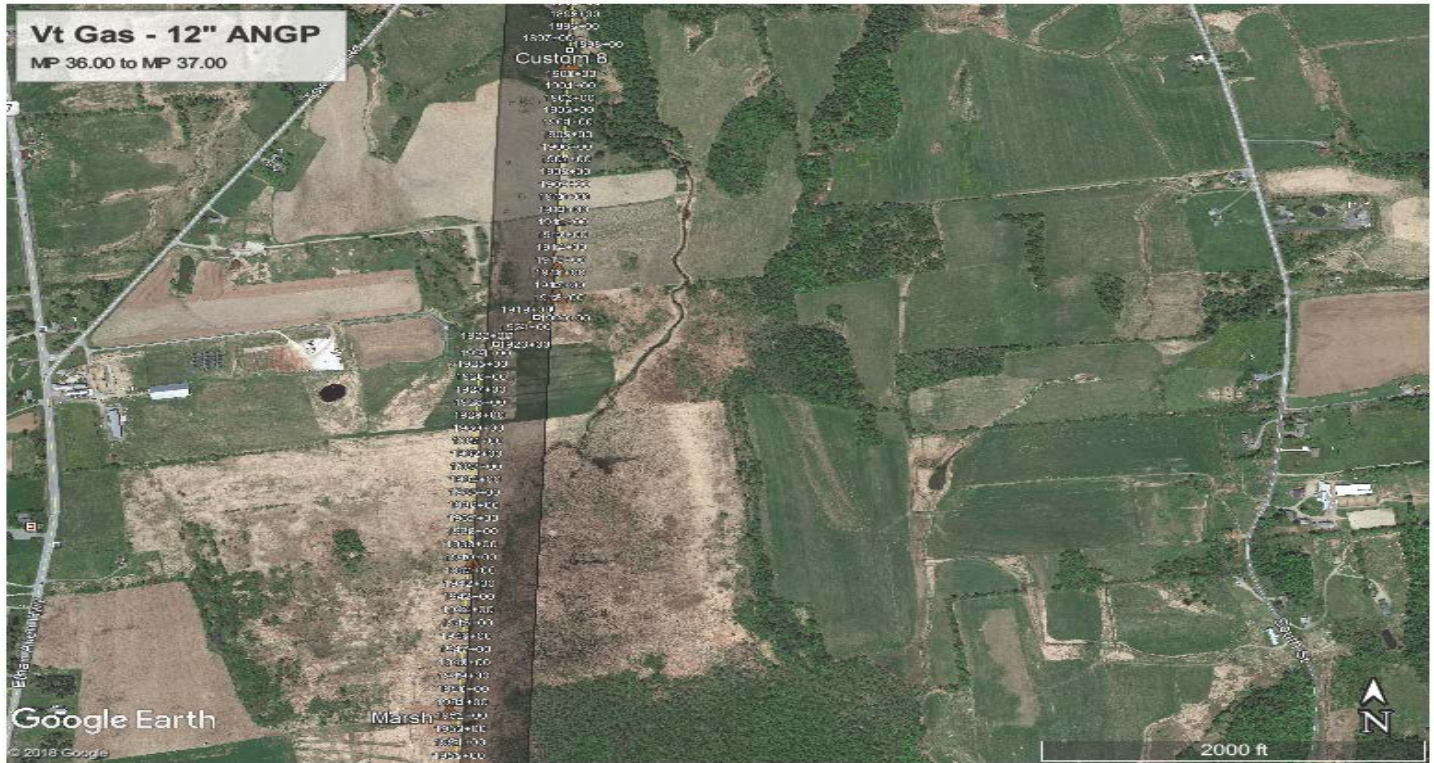
Milepost 35.00 to 36.00:



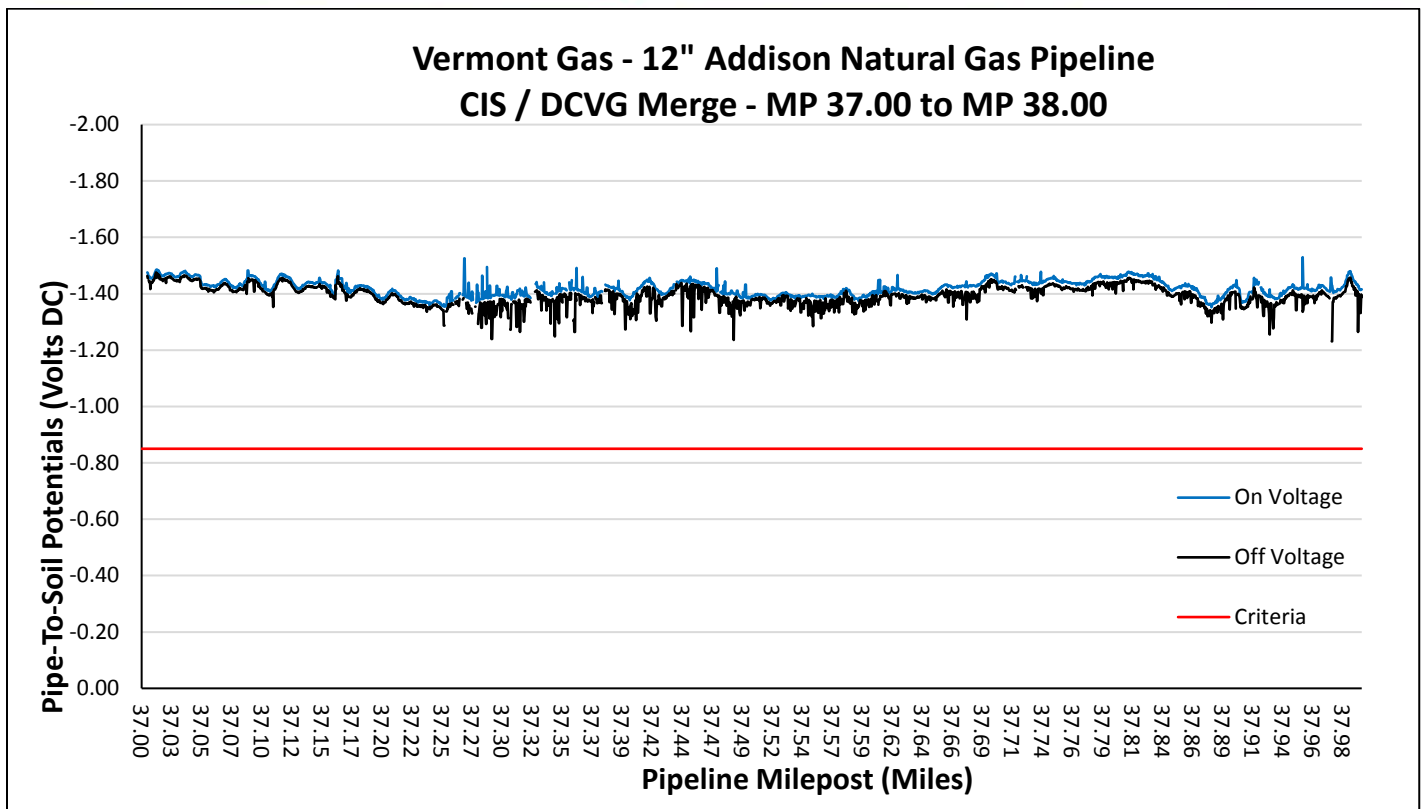
**Vermont Gas - 12" Addison Natural Gas Pipeline
CIS / DCVG Merge - MP 35.00 to MP 36.00**



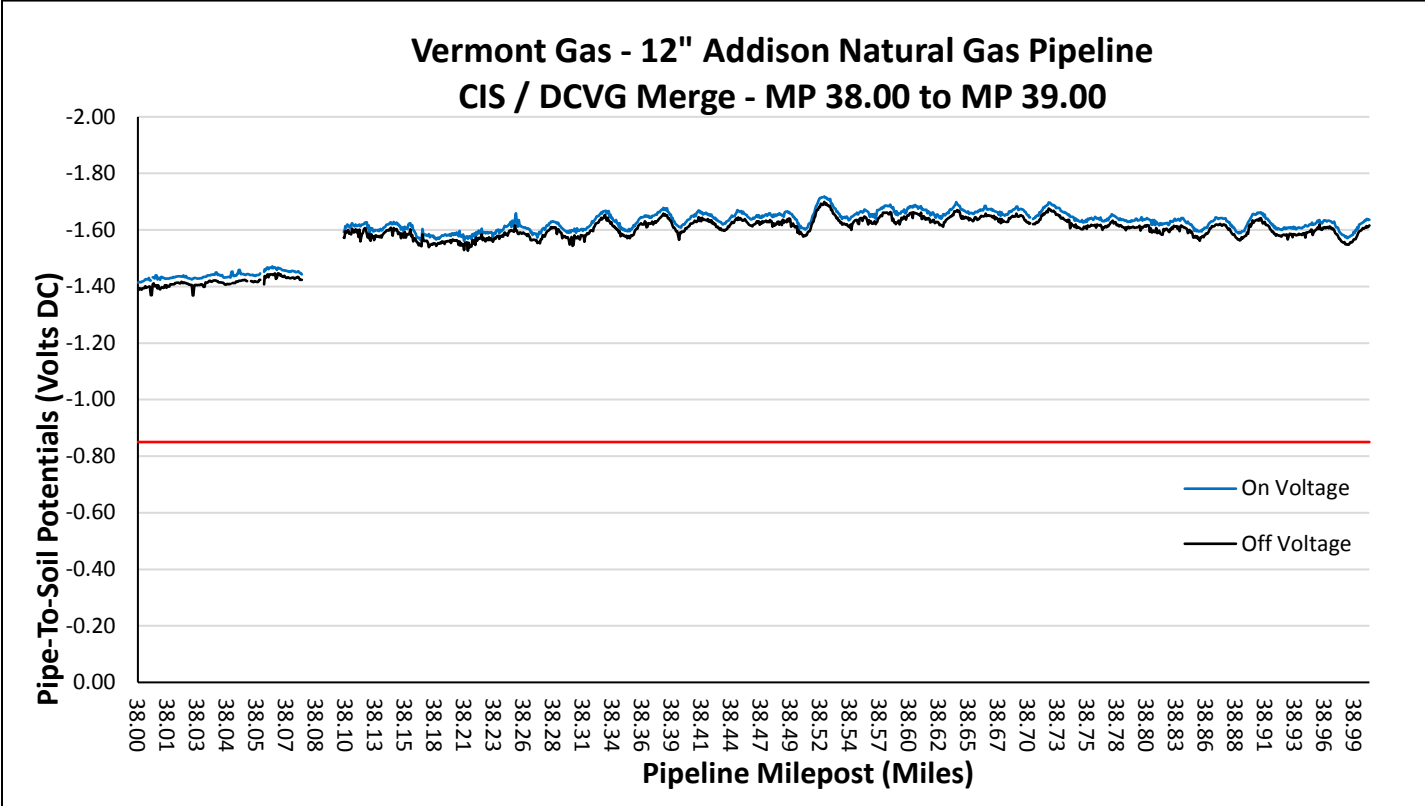
Milepost 36.00 to 37.00:



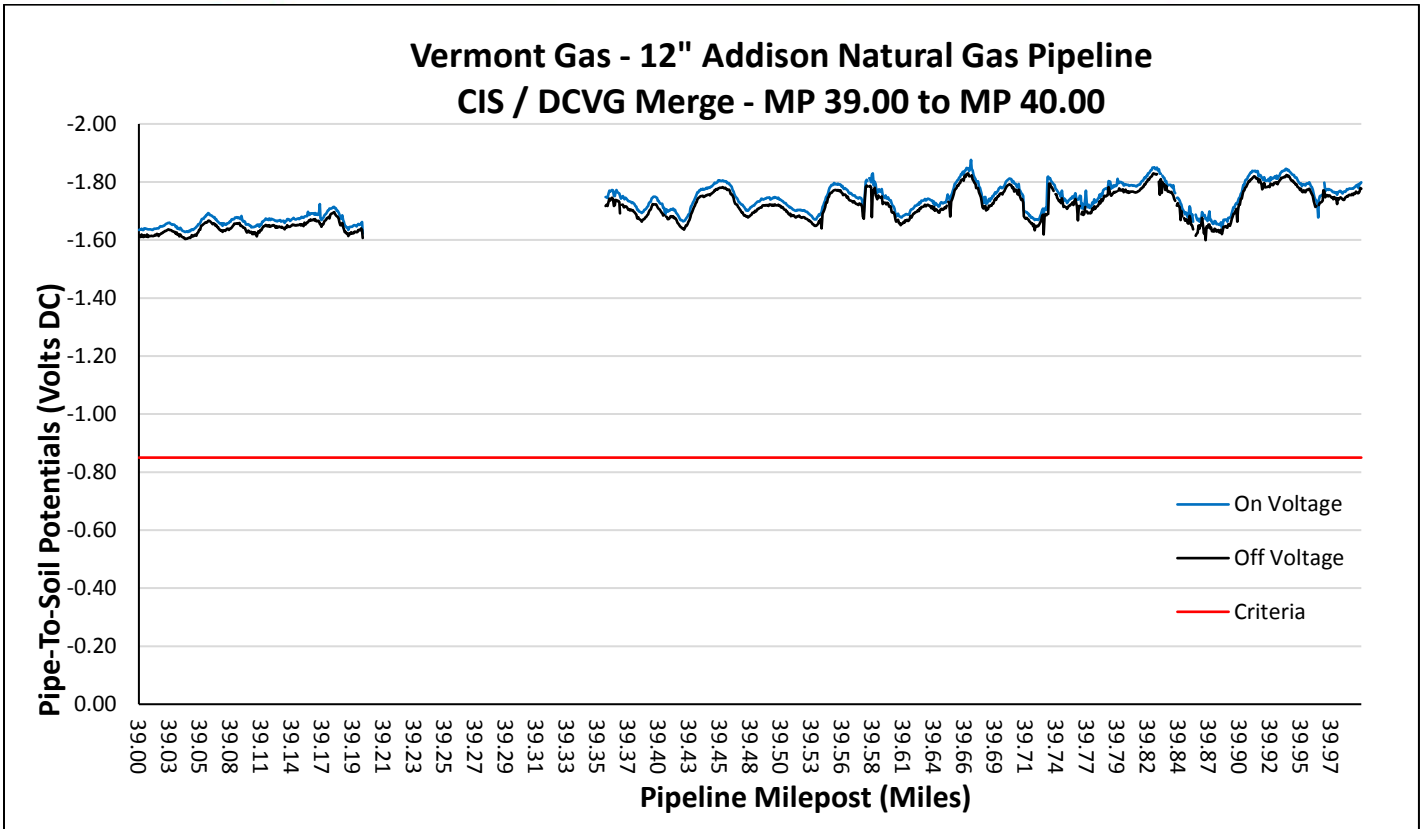
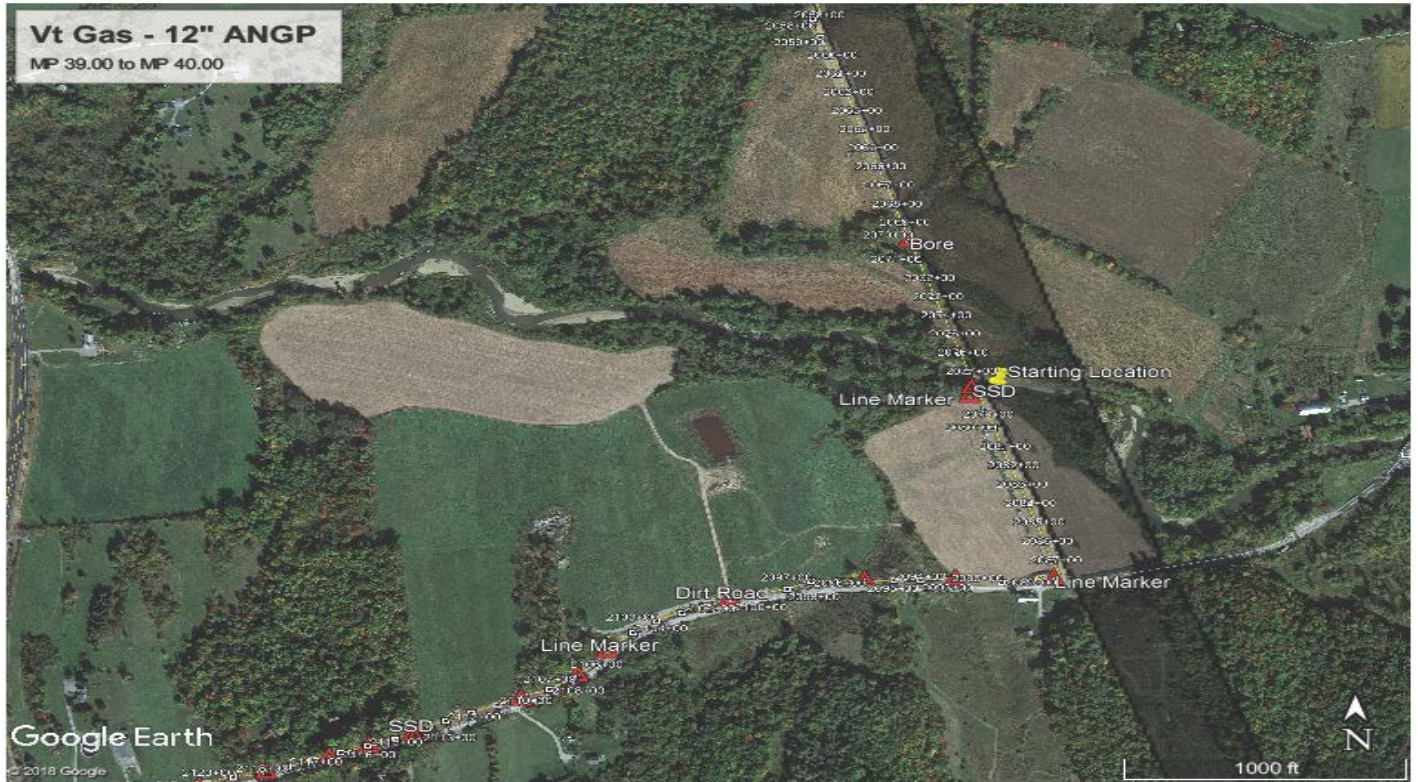
Milepost 37.00 to 38.00:



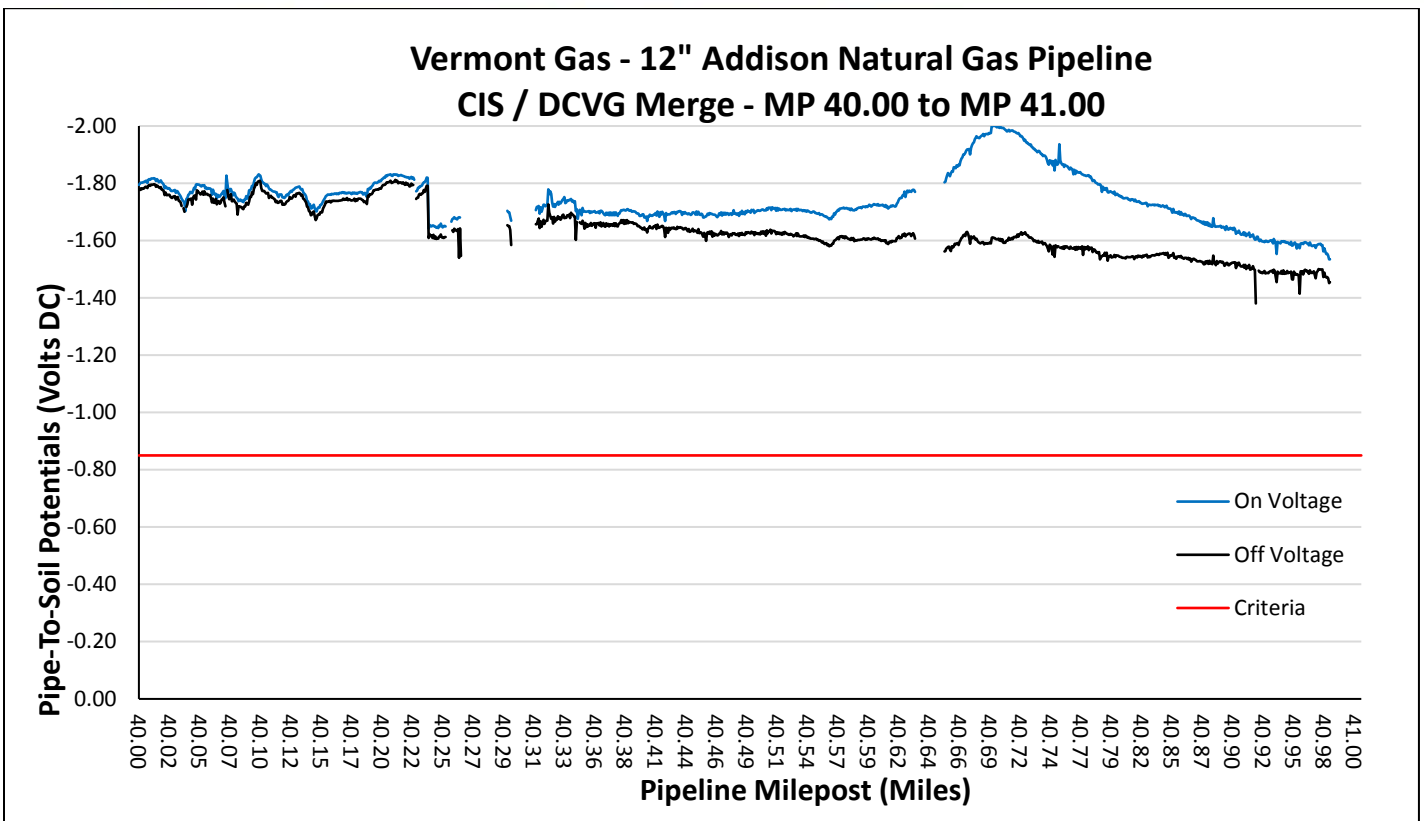
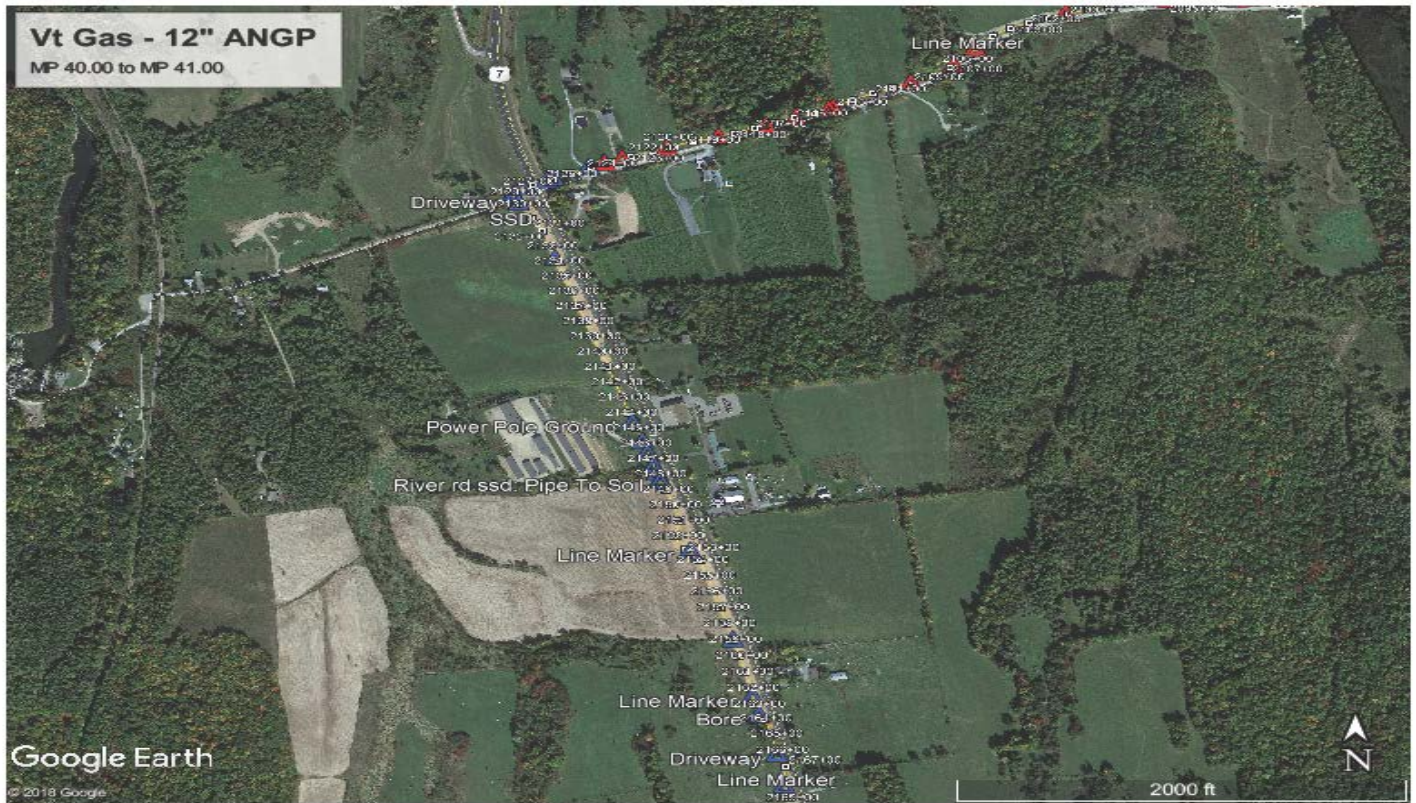
Milepost 38.00 to 39.00:



Milepost 39.00 to 40.00:



Milepost 40.00 to 41.00:



Milepost 41.00 to End of Survey:



**Vermont Gas - 12" Addison Natural Gas Pipeline
CIS / DCVG Merge - MP 41.00 to MP 41.2708 (End of Survey)**

