TOWN OF MONTEREY
P.O. BOX 460
50 FLEISHER AVENUE
MONTEREY, VIRGINIA 24465
PHONE: (540) 468-2472
FAX: (540) 468-3472

April 23, 2015

Federal Energy Regulatory Commission
888 First Street NE
Washington, DC 20426

RE: Docket # PF15-6-000 Atlantic Coast Pipeline Project

Dear Commissioners,

The attached report from karst hydrologist William K. Jones contains details about potential impact on our municipal water system if construction of the Atlantic Coast Pipeline goes forward. Our system provides clear, clean drinking water to about 500-600 people. Any interruption or degradation of service will create extreme hardship to our financial and physical resources.

We asked Dominion representatives on multiple occasions to provide us with a plan to deal with any damage to our system. Finally a semblance of an answer was given by Dominion spokesman Emmett Toms. In his words his company will do "only what the Federal Energy Regulatory Commission requires...".

We are asking your agency to put strict, detailed, requirements on Dominion and ACP to conduct proper testing and evaluation of risks to our water sources. Also, the company should be required to prepare a workable plan to supply water in the event of interruption, shortage, contamination or degradation.

Above all, the full cost of construction of the pipeline, including any and all impacts upon our community, should be the responsibility of Dominion and the ACP. Those who will reap the rewards of doing business should cover all associated costs.

Sincerely,

Richard S. Holman

Richard S. Holman, Mayor

Possible Impacts to the Water Resources of Monterey, Virginia from Construction of the Proposed Dominion High Pressure Gas Pipeline

Prepared for: Town of Monterey

Prepared by: William K. Jones, Hydrologist

Environmental Data
PO Box 356
Warm Springs, Virginia 24484

April 20, 2015

Monterey Water Supply Wells

The town of Monterey is the county seat of Highland County and has a population of about 140 people. It is situated in a synclinal valley between Monterey Mountain to the west and Jack Mountain to the east (Figure 1). The valley is about two miles wide at this point and is underlain by Devonian and Silurian rocks. The Devonian Millboro shale and Ridgely sandstone are exposed at the surface, but carbonate rocks of the Helderberg Group and the Tonoloway limestone underlie the town and crop out on the eastern and western flanks of the syncline (Figure 2). The drillers log for well number 1 shows 280 feet of shale and 60 feet of sandstone. The estimated depth from the land surface to the top of the carbonate rocks is about 380 feet at wells 1 and 3. Monterey is rather interestingly situated with the surface drainage divide passing through the middle of town for the north-flowing Potomac waters and the south-flowing Jackson (James River) waters.

The town of Monterey in Highland County has three wells that serve for the municipal water supply. Wells number 1 and 3 are situated about 1.6 miles north of the proposed Dominion gas transmission pipeline. The wells are just to the west of the axis of the Monterey Syncline (Figure 2 from Wilkes, 2013). Well number 3 is 805 feet deep and appears to be drilled through the Millboro Shale and completed in carbonate rocks (Helderberg Group and Tonoloway Limestone). Water reportedly enters the well along fractures at 565 feet below land surface (bls) and 750 feet bls. Yield is about 53 gpm at 581 feet of drawdown (see drillers log in Appendix). The specific capacity is 130 gallons per day per foot of drawdown (130 gpd/ft). The static water level was at 42 feet bls, so the well has characteristics of tapping a confined aquifer with the pressure head 500 hundred feet higher than the water bearing fractures. (The geologic log for this well does not appear to be very exact.)

Well number 1 is 360 feet deep and is probably completed in the Ridgely Sandstone. The static water level was 10 feet bls and the reported yield was 70 gpm with 90

feet of drawdown. This shows a specific capacity of 1120 gpd/ft. No record is available for well number 2 at this time.

The recharge areas for the town wells are presumably along the flank of Jack Mountain to the east of town where the producing formations are exposed to the surface and the rocks dip steeply toward the trough of the syncline and the wells. Recharge may also come from the west side of the syncline and it is impossible to determine the extent of the recharge zones to the north and south of the wells.

Neither wellhead protection zones nor recharge areas have been delineated for these wells. Both wells would be expected to produce elliptical shaped pumping cones of depression with the long axis extending NE-SW in the direction of the stratigraphic strike. No data is available to determine the extent of the cone of depression for these wells. It should be assumed that this is a confined fractured rock aquifer and with over 500 feet of drawdown at well number 3 the cone of depression could extend over a mile in the strike direction so the proposed route of the pipeline may pass over the area where the water table (piezometric surface) is lowered in the process of supply water to the town wells.

Karst Aquifers

Karst is a special type of landscape that is formed by the dissolution of soluble rocks, including limestone and dolomite. Karst regions contain aquifers that are capable of providing large supplies of water. The main characteristic of karst aquifers is the rapid recharge of the aquifer through sinkholes and sinking streams and turbulent underground flow through caves and fractures enlarged by dissolution. There is a close connection between surface and ground water resources in these aquifers. The flow is typically at rates of feet per minute and water may emerge at springs some miles from the sink points.

Flow in karst aquifers is often modeled in terms of two zones of permeability. The classic karst aquifer is a high permeability zone characterized by pipe flow (open or closed channel) through discrete conduits. The bulk of the flow in carbonate aquifers passes through this zone. The second part of the aquifer consists of flow through tighter and typically deeper fractures. These fractures contain slower moving ground water under pressure and many water wells are be supplied by flow from these deeper fractures. There is usually some interchange of water between the conduits and the fractures, but this is very difficult to quantify. Primary permeability (flow through intergranular pore spaces) is generally negligible in older carbonates such as found in the Monterey area.

Another complication in studying carbonate aquifers is that recharge may be by the direct capture of surface water from sinking or losing streams, fast infiltration of rainfall through dolines (sinkholes), and slower percolation of rainfall through smaller pathways from the land surface (epikarst).

Basic questions such as where the water from a sinking stream emerges or the recharge area for a spring may be studied using water-tracing techniques. Water wells that draw from the deeper parts of the aquifer may be studied using conventional pump-test time draw down methods (with caution) but the delineation of the recharge zones is problematic at best. Wells that produce muddy water after heavy pumping or storm events are deemed to be "surface-water influenced" and require more stringent water treatment. Events on or in the shallow subsurface that change the recharge characteristics to the aquifer may decrease or possible increase flow to the well, but often with a degradation in water quality.

Characteristics that make protection karst or carbonate aquifers difficult include:

1. Often direct links to the land surface and rapid percolation of precipitation;
2. Enlarged fractures and conduits favor turbulent flow and little "filtering" of particulate mater;
3. Unpredictable flow routes and direction;
4. Events such as sinkhole collapse or the plugging of formerly open conduits may occur very suddenly.

Installation and Operation of Gas Pipelines

The proposed pipeline will cut across the structural grain of the Monterey Valley and will intersect a wide range of rock types and geologic structures. Of most concern to the town will be any activities or land disturbances that affect recharge to the wells or introduce sediments or other pollutants within the capture zone of the wells.

1. Trenching and installation of the pipe temporally exposes bare ground to possible sediment runoff during storm events. Blasting may adversely affect the bedrock fractures and conduits by closing existing fractures and mobilizing sediments in the aquifer. Several documented dolines are within the proposed pipeline corridor and excavating a ten-foot deep trench will certainly cause alteration of the epikarst and affect ground-water recharge along the route.
2. Although rare, explosions and leaks from high-pressure gas pipelines do occur. Regular inspections of the condition of the pipe are conducted, but even Dominion admits "no operator can assure or guarantee safety".
3. The pipeline will have some finite design life and will eventually be abandoned. The plan for abandonment and the probable environmental affects should be documented in the EIS.

Recommended Actions for the Town of Monterey

The town should assemble all available documentation to establish the present yield and water quality for the water supply wells. This baseline data will be needed if any changes occur during or after construction of the pipeline. A monitoring plan should be part of the requirements for Dominion Power to proceed with construction of the pipeline if approved. Special attention should be given to tracking ground-water levels and water quality (especially turbidity). A mitigation

plan should be presented to the town to cover any interruption of the current water supply. Some planning should go into considering the location for additional wells if the need arises in the future.

The town should be in a better position to consider potential threats to their water supply when more information is available. It is hoped that the Environmental Impact Statement will be very thorough and objective. The EIS should include LIDAR imagery along the proposed corridor. The EIS should also include estimates for the recharge areas of wells and springs that could be impacted by the pipeline. The town may request a route further away (to the south) but that would present a different set of threats to springs and the Jackson River. Wherever the line is routed, the contractors should be held to a very high standard in this sensitive and relatively undisturbed natural setting.

References

Emery & Garrett Groundwater Investigations, 2014, Report prepared for Augusta County Service Authority on risks of proposed Dominion pipeline in the Staunton area: 21p.

Field, M.S. 1990, Transport of chemical contaminants in karst terranes-outline and summary: Selected papers on Hydrogeology, 28th Intl. Geologic Congress, v.1.

Jones, W.K., Hobbs, H. H., III, Wicks, C.M., Currie, R.R., Hose, L.D., Kerbo, R.C., Goodbar, J.R., and Trout, J., 2003, Recommendations and guidelines for managing caves on protected lands: Karst Waters Institute, Special Publication 8, Charles Town, 81p.

Lambert, R., 2015, Highland County Cave Survey Karst Feature Maps PR-4 and PR-5: Unpublished Report, 4 pages.

Virginia Places, Year?, Natural gas pipelines in Virginia: www.virginiaplaces.org/transportation/gaspipeline.html

Wilkes, G.P., 2013, Geology of the Monterey Quadrangle, Virginia: VA Div. of Geol. and Mineral Resources, Publication 178, 24pp plus Map.

Figures

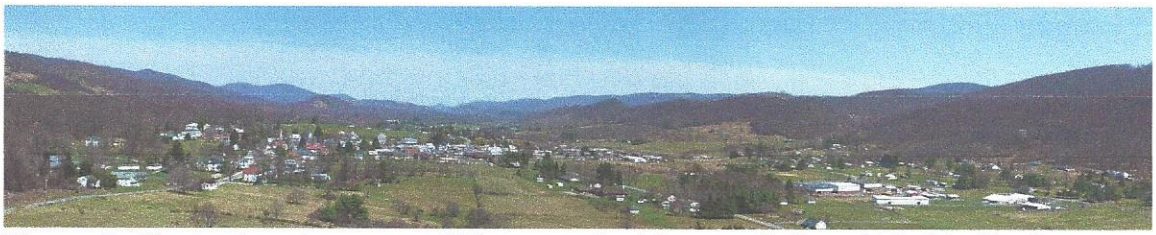

Figure 1. Photo showing town of Monterey looking north from Trimble Knob.

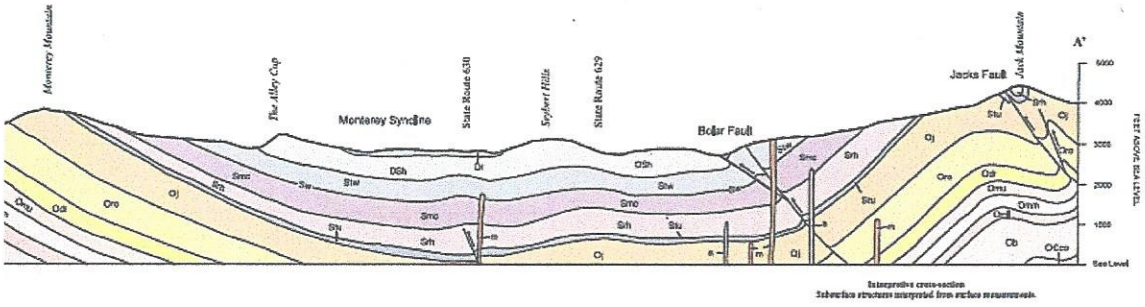

Figure 2. Geologic cross section taken just north of town showy the Monterey Syncline (from Wilkes, 2013). The Millboro shale does not extend as far north as this cross section but overlies the Ridgely sandstone and appears to be about 300 feet thick at town well number 1.

Appendix 1 – Drillers logs for Wells 1 and 3.

Appendix 2 – CV for William K. Jones

FROM :VDH ODW LFO FAX NO. :5404633892 Mar. 01 2012 09:13AM P2/5

[redacted]
O. Box 11143
2111 North Hamilton Street
Richmond, Virginia 23230

COMMONWEALTH OF VIRGINIA
STATE WATER CONTROL BOARD

WATER WELL COMPLETION REPORT
(Certification of Completion)

BWCM WELL NO. 1
PERMIT NUMBER
DATE REC'D

Chapter 3.4 62.1-44.90, Groundwater Act of 1973, requires well owners to submit information to the State Water Control Board. Complete fully and accurately. Send to Office of region where drilling was done. Drilling contractors acting as agents for owners please complete this report on behalf of owners.

NAME of well Lewstis Well no.
Owner Town of Monterey Address Monterey Va. 24465
Drilling contractor Kenneth D Lewstis Address Box 67 - Covingtville, Va. 24430

WELL LOCATION: County/City Highland - Monterey; Located approx. 300 feet/miles South (direction) of Town of Monterey and feet/miles (direction) of . (Use county map points as reference points)

Include copy of county or 7 1/2 minute topographic map with well location marked. If a partial map is copied, mark the name of the map on the map.

OFFICE USE: Topo. no. Va. Plane Coord. N E
U.S.G.S./Obs. Well no. Lat. & Long. N W

Total depth 360 ft.; Date started 6-19-78 completed 6-22-78; Type rig C. P. Rotary
WELL: (circle one) (New) Alteration, Rehabilitation, Extension of existing well.
Numbers of Certificates of Groundwater Right of existing wells
WELL USE: (circle) Home, Farm, Irrigation, (Town) Subdivision, School, Public Bldg., Industry, Commercial, Research, Heat Exchange, Injection, Recharge, Exploration, Other
No. of people served No. of connections expected .

WATER DATA: Water level unpumped stands 10 feet below surface or has a natural flow of gpm and a pressure of psi. Stabilized, pumping, water level stands 100 feet below the surface at 70 gpm.
WATER: Color Clear Taste good Odor none Temp. °F
Description of impurities
Analysis available Yes ? Where? Both Highland County Health Dept.
Depths of useable water: from 10 to 360 ft, from to ft, from to ft.

Drill cuttings ? Yes/No (required by State Water Control Board unless exempted).* Sent to Left with Mr. Lewstis for delivery to Control Board When? 6-22-78
Geophysical logs made? Yes/No, Type , Copy sent? Yes/No*
Geologic log made? Yes/No,* Sketch made of well? Yes/No* Type mud

HOLE SIZE: 10 inches from 0 to 100 ft.
6 inches from 100 to 360 ft.
inches from to ft.
UNDERCUT: inches from to ft.
inches from to ft.
inches from to ft.
SCREENS: inches from to ft.
inches from to ft.

GROUTING: from 0 to 100 ft.
from to ft.
type Portland
CASING (OUTER) 6 3/4 inches from 0 to 100 ft.
inches from to ft.
inches from to ft.
(INNER): 6 inches from 0 to 100 ft.
inches from to ft.

PUMP DATA: Brand name Type Model no.
Rated capacity: gpm at ft. of head, Rated horsepower , Depth of intake

* Send to Regional Office, State Water Control Board (see map) express collect. Sample bags free upon request.

FROM :VDH ODW LFO FAX NO. :5404633892 Mar. 01 2012 09:14AM P3/5

WATER WELL COMPLETION REPORT
(Certification of Completion)

BWCM WELL NO. Well No. 1

WELL NAME: Lustig

DRILLER'S LOG

DEPTH (feet) From	DEPTH (feet) To	TYPE OF ROCK OR SOIL PENETRATED Color Hardness Fossils & Minerals Rock Type (gravel, clay, etc.)	Drilling Time (minutes)	REMARKS (Water, caving, cavities, broken, screen, reaming, shot, core, etc.)
0	20'	Yellow Clay dirt		good solid formation to 340'
20'	300'	black Shale		6" opening at 340' letting water in.
300'	360'	black Very hard sand stone		

FROM :VDH ODW LFO FAX NO. :5404633892 Mar. 01 2012 09:14AM P4/5

06/12/2003 09:08 15404683472 TOWN OF MONTEREY

Jun 06 [illegible] 09:16a Drinking Water-LFO 540-4[illegible]-3892 p.2

WATER WELL COMPLETION REPORT

(Certificate of Completion)

Well No. 3

County/City Town of Monterey

- Owner Town of Monterey
- Well Designation of Number #3

Address Route 220 South
Carver Meadow
Monterey

Phone 540-468-2472

- Drilling Contractor Nicely's Contracting Inc
603 Main ST

Address Clifton Forge VA
24422

Phone 540 862 3191

VDH ID No.
Tax Map ID No.
Subdivision
Section/Block/Lot/GPIN No(s)
Class Well
Long/Lat

WELL LOCATION: 500 (feet/miles south direction) of 220 etc 100 FT feet/miles west (direction) of 220 From stop light in Monterey in the Carver Meadow
(If possible please include map showing location marked)

- Date started 8/15
- Date completed 8/22
- Type rig AiR

1. WELL DATA: New X Rework ___ Deepened ___

- Total Depth 805 ft.
- Depth to bedrock 4 FT ft.
- Hole size (Also include reamed zones)
  - 10 inches 0 to 105 ft.
  - 6 inches 105 to 805 ft.
  - ___ inches ___ to ___ ft.
- Casing size (I.D.) and material
  - 6¼ inches 0 to 105 ft.
  - Material Steel
  - Wt. per foot ___ or wall thickness ¼ in.
  - ___ inches ___ to ___ ft.
  - Material ___
  - Wt. per foot ___ or wall thickness ___ in.
  - ___ inches ___ to ___ ft.
  - Material ___
  - Wt. per foot ___ or wall thickness ___ in.
- Screen size and mesh for each zone (where applicable)
  - ___ inches ___ to ___ ft.
  - Mesh size ___ Type ___
  - ___ inches ___ to ___ ft.
  - Mesh size ___ Type ___
  - ___ inches ___ to ___ ft.
  - Mesh size ___ Type ___
  - ___ inches ___ to ___ ft.
  - Mesh size ___ Type ___

- Gravel pack
  - Size ___ From ___ to ___ ft.
  - Size ___ From ___ to ___ ft.
- Grout
  - From 0 to 100 ft. Type concerte pump
  - From ___ to ___ ft. Type ___

2. WATER DATA: Water temperature ___

- Static water level (unpumped level-measured) 42 ft.
- Stabilized measured pumping water level 623 ft.
- Stabilized yeild 53.9 gpm after 48 hours 48hr

Natural Flow: Yes X No ___ flow rate 53.9 gpm

Comment on quality GREAT water

3. WATER ZONES: From ___ To ___
From ___ To ___ From ___ To ___
From ___ To ___ From ___ To ___

4. PUMP DATE: Type [illegible] - Rated H.P. 15
- Intake depth 760 - Capacity 53.9 at 725 head
- Model & No ___

5. DISINFECTION: Well disinfected X yes ___ no
Date 8/22 Disinfectant Used Chlorine
Amount 20 pills Hours used ___

6. ABANDONMENT: Date ___
Casing pulled yes ___ no X not applicable ___
Chlorinated well (explain Method) ___

Plugging grout From ___ to ___ material ___

FROM :VDH ODW LFO FAX NO. :5404633892 Mar. 01 2012 09:14AM P5/5
12/2003 09:08 15404683472 TOWNOFMONTEREY PAGE 03
Jun 06 03 09:17a Drinking Water-LFO 540-[illegible]-3892 p.3

Well No. 3

Owner Town of Monterey

7. DRILLERS LOG (use additional Sheets if necessary)

Depth (feet)		TYPE OF ROCK OR SOIL	REMARKS
From	To	(color, material, fossils, hardness, etc.)	(water, caving, cavities, broken, core, shot, etc.)
0	4 FT	dirt	CORE WAS broken AT 300 FT small AMOUNT OF WATER CORE WAS broken AT 565 FT 10 GPM CORE WAS broken 750 FT 40 GPM PLUS THE Rock STayed in lime STONE
4	805	lime STONE All The way down	
0	105 FT	CASING AND GRouT Concrete pump in from bottom up	

8. I certify that the information contained herein is true and correct and that this well has been installed and constructed in accordance with the requirements for well constructions specified in compliance with appropriate county or independent city ordinances and the laws and rules of the Commonwealth of Virginia.

Signature [signature] (Well Driller or authorized person) (Seal), Date _____ License No. 2705-04447

623922
4252162 21'

38 24 40
79 34 50

William K. Jones
Hydrologist
Environmental Data
P. O. Box 356
Warm Springs, VA 24484
540-839-3377
www.karsthydrology.com

Mr. Jones is a consulting hydrologist with Environmental Data in Warm Springs, Virginia. He studies physical hydrology of surface and ground-water resources with an emphasis on areas underlain by carbonate (karst) aquifers. He has studied karst areas across North America, France, Eastern Europe, China and Southeast Asia. Mr. Jones is the author of over thirty papers on karst hydrology and water tracing. He is the author of the "**Karst Hydrology Atlas of West Virginia**" (1997) and served as the guest editor for a special issue of the National Speleological Society Bulletin on water tracing using fluorescent tracers (1984). He wrote chapters on karst and water tracing for the "**Encyclopedia of Caves**". He is a consultant to the US Army Environmental Center on the remediation of hazardous wastes in karst aquifers on military bases. He also studies ground-water movement in fractured aquifers and statistical characterization of water resources. Current research projects include the problems of instrumenting small catchments to measure precipitation and flows for water balance studies. Mr. Jones holds a BSF degree in Forest Management from West Virginia University (1973) and an MS degree in Environmental Science (Hydrology) from the University of Virginia (1989). He was an adjunct professor of hydrology at the American University, Washington, DC and is on the board of directors of the Karst Waters Institute, Leesburg, Virginia.