pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

November 17, 2015

Mr. Mark D. Reider, Environmental Manager
Lancaster County Solid Waste Management Authority
P.O. Box 4425
Lancaster, PA 17604

Re: Environmental Assessment
Frey Farm Landfill Vertical Expansion
Permit No. 101389
Manor Township, Lancaster County

Dear Mr. Reider:

The Department of Environmental Protection (DEP) has completed its initial environmental assessment review of your application and has the following comments:

1. **Table D(M)-1, Noise Level Projections** – Did these noise level estimates consider weather conditions; in particular, temperature inversions and wind speed/direction?

2. **Visual Aesthetic Impact** – The *Line of Sight Study* that was conducted assumed occlusion of view impacts from forested areas, which comprises a considerable portion of the study area. DEP believes that tree obstruction, while potentially effective when in place, is not a permanent mitigation. DEP also believes that tree obstruction of the visual impacts may be compromised in several areas with seasonal leaf loss. This is particularly concerning, when considering the visual impacts on several hiking trails and natural recreation areas within the study area.

It is asserted that the *Line of Sight Study* shows only a small, 4% increase in viewing area impacted by the proposed expansion, but this does not consider all of the area that is currently impacted by view of the current landfill. The increased visual impact of the proposed expansion on the current viewing area was not considered.

The *Line of Sight Study* assesses the visual impact on only the current population residing within the 3-mile radial study area. Given the level of recreation within this study area (e.g., Long Level Marina, Shanks Mare Outfitters, various hiking trails, etc.), DEP believes that the visual impact of the proposed expansion would need to also be assessed for the transient population.

It is clear that the main visual/aesthetics impact concern of the proposed vertical expansion is the viewshed from those recreating on on the Susquehanna River and in York County across the river. Additional photographs and artist renditions of the final grades of the current landfill, as well as the final grades of the proposed vertical expansion of the landfill are requested for various locations not included in the application. The Department suggests the following locations:

- Parking lot at the intersection of River Road and Bull Run Road
- Near home located at 1936 River Road
- The Lauxmont Farm Area
- Highpoint Scenic Vista and Recreational Area
- Other high points above the Susquehanna River on York County side

3. The only permanent mitigation offered by LSWMA to address the additional height of the landfill is *"final cover will be applied as soon as practical to areas that reach final grade, and that those areas will be revegetated to achieve ground cover composed of vegetative species that are indigenous to Lancaster County, thereby providing a permanent, aesthetically pleasant appearance."* Again, the primary concern is the visual impacts of the expansion on the York side of the landfill. This operational measure offered does little to mitigate the additional height of the landfill and belay the concerns of those that will see this in perpetuity. Much more attention should be paid to the York side of the landfill, as the significance of the visual impacts has not been clearly evaluated.

4. It is indicated that compliance officers and managers inspect trucks for environmental and safety compliance at the Frey Farm Landfill. Is there a designated person(s) who patrol the haul routes to ensure safety compliance? The Department has conducted haul route visits, specifically to SR441 and found that many LCSWMA trash trucks and ash trucks exceed posted speed limits along the route. There are areas of concern along SR441 such as the intersection of Anchor Road and SR441 with little sight distance on both sides with steep grades, the entrance to Turkey Hill Trail, "s" curves, and other curves along the route. In addition numerous residents that live along this route are concerned about the number of trucks and safety issues related to the trucks. With the large number of existing trucks utilizing the Frey Farm Landfill, as well as the large increase in truck traffic requested in this application, the Department questions the ability of LCSWMA to ensure trash truck safety along the entire haul routes without the use of one or several Traffic Compliance Officers. Overall there is a significant impact to the residents and existing traffic with the proposed increase in the number of trucks to be traveling SR441.

5. The drivers of trash hauling vehicles (LCSWMA as well as other haulers) must be made aware of all aspects of the haul routes before entering the haul routes. This includes school bus stops, intersections with limiting sight distance**, and strict enforcement of traffic speeds.** The traffic compliance plan must encompass all of the LCSWMA haul routes. Trash truck drivers that have never driven on the haul routes, must be aware of the traffic compliance plan prior to travelling on the haul routes. This is necessary because of the unique situation of integration and the ability to transport waste between LCSWMA owned facilities.

6. School bus stops should be located and plotted along SR441 between Columbia and the Frey Farm Landfill, and along SR999 (Haul Route 2). School bus pick-up and drop-off times should be indicated for each school bus stop. A letter should be sent to each school district located in these two areas describing the proposal, indicating the increase in truck traffic to and from the

landfill and requesting that if they have any comments or concerns, they may address them to both LCSWMA and DEP.

7. **Phase I, Form D, Section A, - Geologic**
   a. *Form D, Section A – Geologic* - Item 2 requests if there are any potential geologic hazards, foundation problems or groundwater conditions that may require site investigation. The proposed Frey Farm Landfill Vertical Expansion (FFVE) site is situated in an area where documentation indicates: complexly deformed underlying bedrock, weathered saprolite/bedrock, shallow groundwater, higher than normal seismic activity, and slippery rock types and micaceous soils. In order to ensure that the FFVE will be operated in a safe manner, it is recommended that additional information be provided and second opinions be acquired by experts in the field of geology and geotechnical engineering, satisfactory to both the Landfill and DEP, due to the possible cumulative effect pertaining to potential zones of weakness underlying the proposed FFVE area.

      1) *Phase 1, Form 6, Page 6(1)-5, Last Paragraph* of the permit application indicates that *"The intense deformation that occurred in the schistose members of the Wissahickon Formation resulted in formation of well-developed, parallel, structural alignments of platy minerals (mica) and other dominant mineral (i.e. quartz-rich stringers) within the bedrock fabric. These very closely spaced cleavage planes are referred to as a foliation or schistosity. These foliations and fractures are important hydrogeologic features because bedrock weathering and decomposition along the densely spaced cleavage and schistic foliation enhance permeability."*

         a) Three fracture traces noted on the *Phase I, Sheet 8 - Geologic Map* and *Phase I, Form 6, Page 6(1)-10, Fourth Paragraph* are documented at approximately:
            - N67°E – Northern limit of FFVE.
            - N45°E – SE of the FFVE between proposed landfill and Manns Run, oriented adjacent/parallel to Manns Run.
            - N22°W – East of FFVE and trending through Sediment Basin C running in line with Stream F and the stormwater conveyance channels upgradient of Stream F. Note: this fracture was inaccurately documented in the application on Page 6(1)-10 at N67°E.

         b) The average orientation (Strike; Dip) of the foliation planes (i.e. sheet-like orientation aka schistosity due to the parallel alignment of platy minerals) is documented on the *Phase I Sheet 8 - Geologic Map* at approximately N30°E; 50-90°NW (i.e. steeply dipping towards the Susquehanna River).

         c) *Phase I, Form 6, Page 6(1)-10, Third Paragraph* indicates that structural jointing occurs within the bedrock mass as three major joint sets (Strike; Dip):
            - N24-25°E; 81-88°SE
            - N81°E; 48°SE
            - N75°W; 78°NE.

2) The Nearby Martic Line (aka Martic Overthrust Fault) has been documented in close proximity of the proposed landfill expansion and is seismically active.

3) The DCNR website at http://www.gis.dcnr.state.pa.us/geology/index.html and Penn State website at http://maps.psiee.psu.edu/ImageryNavigator/ provide access to aerials in addition to National Geographic, topographic, light and radar (Lidar), and/or geologic maps of this area. As noted on the attached aerials and maps (i.e. Figure 1, Figure 2, and Figure 3), a fracture or possible fault trends NE-SW in the vicinity of the north side of the existing landfill footprint and is believed to correlate with the N67°E fracture trace documented on the *Phase I, Sheet 8 - Geologic Map* and is located beneath the northern side of the existing disposal area and in close proximity of the north and northwest sides of the proposed FFVE Mechanically Stabilized Earth (MSE) berm. As documented on the attached topographic map (Figure 4), this fracture/fault bisects a topographic high creating a saddle area (i.e. a low point between two areas of higher ground) on the west side of the landfill.

4) Zones of weakness occur in numerous directions due to relict joints, fractures, micaceous foliation, and shallow groundwater system beneath the area of the proposed MSE berm.

    a) Soils and/or rocks were examined via nine test borings on the north to northwest sides of the proposed FFVE MSE berm; yet only three rock cores were obtained from these locations. It appears that only the soils were tested and not the underlying unconsolidated saprolite and weathered schist. Testing of the underlying weathered saprolite/schist would be beneficial to determine the possibility of these relic features creating weak zones beneath the proposed MSE berm due to micaceous foliation planes steeply dipping towards the Susquehanna River (i.e. N30°E; 50-90°NW) in this area, directly upgradient of the Susquehanna River, as documented on the *Phase I, Sheet 8 - Geologic Map*.

        1. The location, orientation, and depth of the NE-SW trending fracture/fault, located in close proximity of the north side of the proposed MSE berm, have not been thoroughly defined.

        2. As a result of the Northwest end of the MSE berm being proposed in close proximity of the edge of cliff overlooking the Susquehanna River, it is recommended that the depth of weathering be determined due to the potential increased risk of slippage via the proposed liner, proposed MSE berm, and potential zones of weakness in the underlying unconsolidated weathered overburden and bedrock. Additional investigation would help

determine if there is potential for soil/rock creep in the vicinity of the proposed FFVE.

b) Soils and/or rocks were examined via 17 test borings from the North-northeast to South side of the proposed FFVE MSE berm and rock cores were taken from eight of these borings. Five of these eight locations are on the east side of the proposed FFVE in the vicinity of a former spring and head of hollow area which can be viewed on the original topographic map (Figure 4). The stream in this area has been previously reworked and designated as two stormwater conveyance channels due to earlier landfill disposal activities upgradient of Stream F. DEP recommends:

1. The depth to groundwater and base of the proposed MSE berm be closely evaluated due to shallow groundwater and the tallest section of the MSE berm wall (i.e. 52 feet high) proposed for this area. Test boring MSEB-12 is located nearby and detected groundwater at 10.5 feet below ground surface during the 2010 soil/rock boring investigation. Additionally, former Spring SP-01 (i.e. original sampling point extended and renamed as FFMP001P due to previous landfill disposal activities) is located in close proximity of this area. Additional testing/borings in this area are recommended to ensure that the MSE berm will not be compromised in the future due to shallow groundwater or soil settlement issues.

2. Well FFMP016W (Total Depth = 150 FT) is presently pumped at an average rate of 10,000 to 12,000 gallons per day and the extracted groundwater used for landfill dust control. Lowering of the groundwater table due to the pumping of Well FFMP016W has been documented in nearby well FFMP025W (40 FT Total Depth), which was documented as being dry during the May 2015 groundwater sampling event. The shallow and deep groundwater in the area of the FFVE and MSE berm needs to be fully evaluated/characterized to ensure an appropriate final design for the MSE berm and FFVE.

c) The underlying geology is complexly deformed in the vicinity of Turkey Hill and the proposed FFVE. The attached Figure 6, taken from Pennsylvania Geology (April 1990) publication, illustrates the highly deformed Zone of S2 Schistosity in the vicinity of Turkey Hill, which is more highly deformed than the S1 Schistosity Zone located to the south in-between Turkey Hill and Safe Harbor. The Pennsylvania Geology publication documents that:

"The Wissahickon schists and phyllites bear interesting schistosity relationships in the area between Safe Harbor and Turkey Hill. At Safe Harbor, schistosity in Wissahickon schist is defined by parallel alignment of coarse chlorite, muscovite, biotite, and planar aggregates of

plagioclase feldspar and quartz (S1). This S1 schistosity strikes 245° to 260° and dips moderately 40° to 50°NW. North of Safe Harbor, the S1 schistosity gradually steepens. As Turkey Hill is approached from the south, the schistosity (S1) progressively shows signs of weak to intense upright crenulation (small-scale folding having wavelengths up to a few millimeters). At Turkey Hill, crenulation of the S1 schistosity was so intense that a new subvertical schistosity (S2) striking 070° developed and practically obliterated the S1 schistosity. This new (S2) schistosity is now defined by parallel alignment of very fine (submillimeter) muscovite and chlorite crystals and recrystallized planar quartz aggregates. Diamond-shaped profiles of intersection lineations (S2 x S1) clearly show the relative timing between the two schistosities."

5) *Phase I, Sheet 6 – Top of Bedrock Contour Map* has several contour depressions in the vicinity of the following groups of wells/borings:
FFOB009W/FFOB022W/FFPZ002W/FFPZ03AW and FFOB020W

Could the 30 and 50-foot depressions noted for Wells FFOB022W and FFOB020W, respectively, be the result of different geologic interpretations by various geologists over the years and/or due to gradational contacts between the competent bedrock and weathered bedrock/saprolite/soil zones? The September 22, 1989 Frey Farm Landfill site map, titled *Recommended Groundwater Monitoring Plan,* documents areas of *"saturated unconsolidated/weathered bedrock"* in the vicinity of the proposed MSE berm. As a result, it is recommended that past drilling data/logs be reviewed more closely due to slip potential via these less stable weathered zones. Additional borings/wells may be necessary to thoroughly evaluate the area to ensure a stable foundation for the proposed MSE berm.

6) The *Phase I, Sheet 10 – Composite Historic High Groundwater Contour Map* included in the permit application only takes into account the shallow groundwater wells. It is recommended that springs/seeps on all sides of the existing Frey Farm Landfill that emerge during groundwater seasonal high periods and Susquehanna River water levels be included to provide a more accurate composite historic high groundwater contour map. Please also include locations of earlier documented former springs that no longer exist.

7) Additional hydrogeological studies are recommended to determine groundwater flow paths via the shallow and deep groundwater systems due to the complexly deformed underlying bedrock, weathered and unconsolidated bedrock/overburden, and numerous avenues for contaminants to migrate.

8) In regards to the *Phase I - Sheets 11A and 11B - Hydrologic Cross Sections*, it is recommended that a cross section be included in the permit application that intersects the area in the vicinity of FFMP001P (i.e. close to where former Spring SP-01 was

located) and where test boring MSEB-12 detected groundwater at 10.5 feet below ground surface. The depth to groundwater and base of the proposed MSE berm need to be closely evaluated in this area due to the shallow groundwater, possibility of future settlement issues due to the currently saturated unconsolidated zones, and the tallest section of the proposed MSE berm wall (i.e. 52 feet) being located in this area.

b. *Form D, Section A – Geologic* - Item 1 requests if the proposed facility is located within an area with a 10% or greater probability that a maximum horizontal acceleration will exceed 0.10 g in 250 years as mapped by the Pennsylvania Geologic Survey or the USGS? Please provide documentation pertaining to g values based on a 250-year time period.

For the permit application, the United States Geological Survey (USGS) National Seismic Hazard Mapping website and more recent information were utilized to assess the seismic risk for the area surrounding the proposed FFVE. As noted on *Phase I, Form 6, Page 6(1)-11, Section 3.4.3, Paragraphs 3 and 4*, the application indicated that, *"Seismic risk is expressed as a probability of exceeding peak ground acceleration (PGA), the projected maximum acceleration (% g) that could be experienced by a particle at or near ground level in a given area, over a 50-year time period."* LCSWMA indicated that according to the USGS information, last updated in June 2010, *"The FFVE site has a PGA with a 7% probability of exceedence in 75 years of 3 to 4% g (0.03 to 0.04 g) and a PGA with a 2% probability of exceedence in 50 years of approximately 6 to 9% g (0.06 to 0.09g)..... According to the USGS, the approximate threshold for earthquake-related shaking that causes damage to buildings not designed to withstand damage from earthquakes is 0.10 g."*

It is recommended that an expert in the field of geophysics, satisfactory to both the Landfill and DEP, present a second opinion whether or not this area would provide a sufficient stable foundation for the proposed FFVE MSE berm, due to the possible cumulative effect of gravity and zones of weakness previously noted that could possibly jeopardize the stability of the vertical expansion. DEP believes a more thorough evaluation is necessary as a result of:

1) This seismic risk evaluation included in the permit application is based on 50 to 75 years, yet the closed landfill would remain indefinitely after final closure of the Frey Farm Landfill (i.e. greater than 50 to 75 years).

2) On *Form 6, Page 6(1)-11* of the permit application, a review of data pertaining to a 5.8 magnitude earthquake that occurred in Mineral, Virginia on August 23, 2011 was included. As a result of this Virginia earthquake, nearby Pennsylvania PGA values were documented in the permit application as noted below and can also be reviewed at the following link. As previously noted, the USGS threshold for earthquake-related shaking causing damage to buildings not designed to withstand earthquake damage is 0.10 g.

http://earthquake.usgs.gov/earthquakes/shakemap/global/shake/082311a/#Peak_Ground_Acceleration

Location	Distance from FFVE	PGA (g)
Holtwood, PA	10.9 miles to the SE	0.0316
Felton, PA	9.4 miles to the SW	0.0491
Dallastown, PA	10.3 miles to the W-SW	0.0382
Quarryville, PA	15.2 miles to the E-SE	0.0593
For comparison purposes:		
Mineral, VA	160 miles to the S-SW	0.196103

The above calculations presented in the permit application were based on an earthquake that occurred approximately 160 miles S-SW of the proposed FFVE. Earthquakes above a 5.0 magnitude are possible in Pennsylvania. The largest documented Pennsylvania earthquake occurred in 1998 at a 5.1 magnitude in Crawford County (i.e. Northwest quadrant of Pennsylvania) as noted on Figure 8. The Earthquake Hazards in Pennsylvania publication indicates that many factors affect intensity of an earthquake such as *"topography, type and thickness of soil, direction from the epicenter relative to regional rock structure, and type of bedrock."*

Seismic activity has been documented higher than normal for this area of Pennsylvania due to the nearby Martic Line. As noted on Figure 7, two locations in close proximity of the Frey Farm Landfill documented earthquake activities in 1984 and 1989, at 4.2 and 4.3 magnitudes, respectively. These two points are located just outside the 5-mile radius of the Frey Farm Landfill as noted on Figure 7. The attached Figure 8 illustrates Pennsylvania statewide seismic activity. Both of these maps were created using earthquake data (i.e. circa 1724 to 2003) downloaded from the DCNR website.

3) *Phase I, Form 6, Page 6(1)-5, Section 2.4, Paragraph 3* of the permit application indicates that *"The Martic Overthrust fault line, if projected to the east, may trend through the FFVE footprint."*

4) The proposed FFVE area is underlain by complex geology and weathered zones due to the nearby Martic Line. The Wissahickon schist formation is severely deformed, metamorphosed, faulted, folded, fractured, jointed, foliated, and weathered in this area. As a result, varying zones of weakness are present in the bedrock and the overlying weathered bedrock and saprolite. Additionally, the proposed FFVE would be located on top of the existing landfill, on the Piedmont Upland Section of the Martic Line (i.e. Figure 5, Figure 6, and Figure 7), near the edge of a prominent area (i.e. Turkey Hill), directly upgradient of the Susquehanna River, and above complexly deformed unconsolidated weathered slippery rock types and micaceous soils.

5) *Phase I - Sheets 11A and 11B - Hydrologic Cross Sections* indicate that the proposed MSE berm will be built upon the weathered zone (i.e. residual soils and saprolite) and not competent bedrock and in an area of shallow groundwater. Settlement of unconsolidated overburden soils in this area are possible due to the lowering of the groundwater table.

8. **Phase I, Form D, Section F - Fish, Game and Plants, Item 8**
   a. Section 273.202(a)(12) of the Municipal Waste regulations states that a municipal waste landfill may not be operated within 100 feet of a perennial stream unless storage, processing and disposal will not occur within that distance and no adverse hydrologic or water quality impacts will result. The Form D narrative *Response to Question 8* documents the nearest perennial streams as Stream F and Manns Run, both located beyond the 100 feet setback requirement, and indicates that no adverse impacts will occur to these perennial streams due to erosion and sedimentation controls.

   Phase I, Form D, Attachment D(M)-13 mistakenly included Stream W under the *Surface Water Section (4.2, 4.2.2, 4.2.3)* as the stream being located southeast of the proposed FFVE and downgradient of Sediment Basin C. This unnamed stream should have indicated Stream F, not Stream W. *Form D - Attachment D(M)-13, Section 4.2.3 - Head of Hollow Impacts,* indicates that the base flow could diminish to Stream W (i.e. should have indicated Stream F) and Manns Run as a result of the placement of an additional nine acres of impermeable cap and liner for the FFVE disposal area. Rationale provided by LCSWMA for the potential harm to be mitigated included: 1) no measurable impact to stream flow due to the total drainage acreage of 90 acres for Stream W (i.e. should have indicated Stream F) being much smaller in comparison to the total drainage acreage for the Manns Run perennial stream, which is greater than 595 acres; and 2) after the disposal area is capped, FFVE stormwater runoff will be diverted to Basin C and subsequently discharged to Stream W (i.e. should have indicated Stream F) and Manns Run. Note: the Form D Section of the permit application did not include flow calculations for Stream W, the unnamed tributary located on the southwest side of the proposed FFVE and downgradient of Sediment Basin B.

   The hydrologic and water quality impact to the downgradient perennial streams needs to be further evaluated. It is recommended that the base flow calculations be re-estimated due to the mix-up in stream names (i.e. Stream F and Stream W) in addition to the use of worst-case scenario (i.e. ash used in the MSE berm) calculations. In this situation, additional acreage would be impacted because if ash is used in the MSE berm, a liner system beneath the berm would be required equivalent to the FFVE liner system. Additionally, please include calculations for Stream W. It is recommended that additional mitigation measures be included in the permit application that would address the reduction of base flow to the downgradient perennial streams during the active life of the FFVE.

b. Section 273.202(a)(6) of the Municipal Waste regulations states that a municipal waste landfill may not be operated in a valley, ravine or head of hollow where the operation would result in the elimination, pollution or destruction of a portion of a perennial stream, except that rechanneling may be allowed as provided in Chapter 105. LCSWMA indicates in *Form D - Attachment D(M)-13, Section 4.2.*, that no portion of the project area is located within a valley, ravine, or head of hollow associated with these streams.

   As a result of past landfilling operations, the head of hollow area has already been modified, the original spring SP-01 extended via PVC piping, and the upper reaches of Stream F referred to as stormwater conveyance channels. For the FFVE, the DEP Waterways and Wetlands Program provided a waiver letter per Chapter 105 permit requirements pertaining to the stormwater conveyance channels for this area, but requested LCSWMA to secure Federal authorization via a Clean Water Act Section 404 State Programmatic General Permit (SPGP) for the waived activity to place and maintain fill in two unnamed tributaries to Manns Run. Please include a copy of the final SPGP in the permit application. In regards to the reduction of base flow to nearby perennial streams, please see previous review comment.

If you believe that any of the stated deficiencies is not significant, instead of submitting a response to that deficiency, you have the option of asking DEP to make a decision based on the information with regard to the subject matter of that deficiency that you have already made available. If you choose this option with regard to any deficiency, you should explain and justify how your current submission satisfies that deficiency. Please keep in mind that if you fail to respond, your application may be denied.

Should you have any questions regarding the identified deficiencies, please contact us to discuss your concerns or to schedule a meeting.

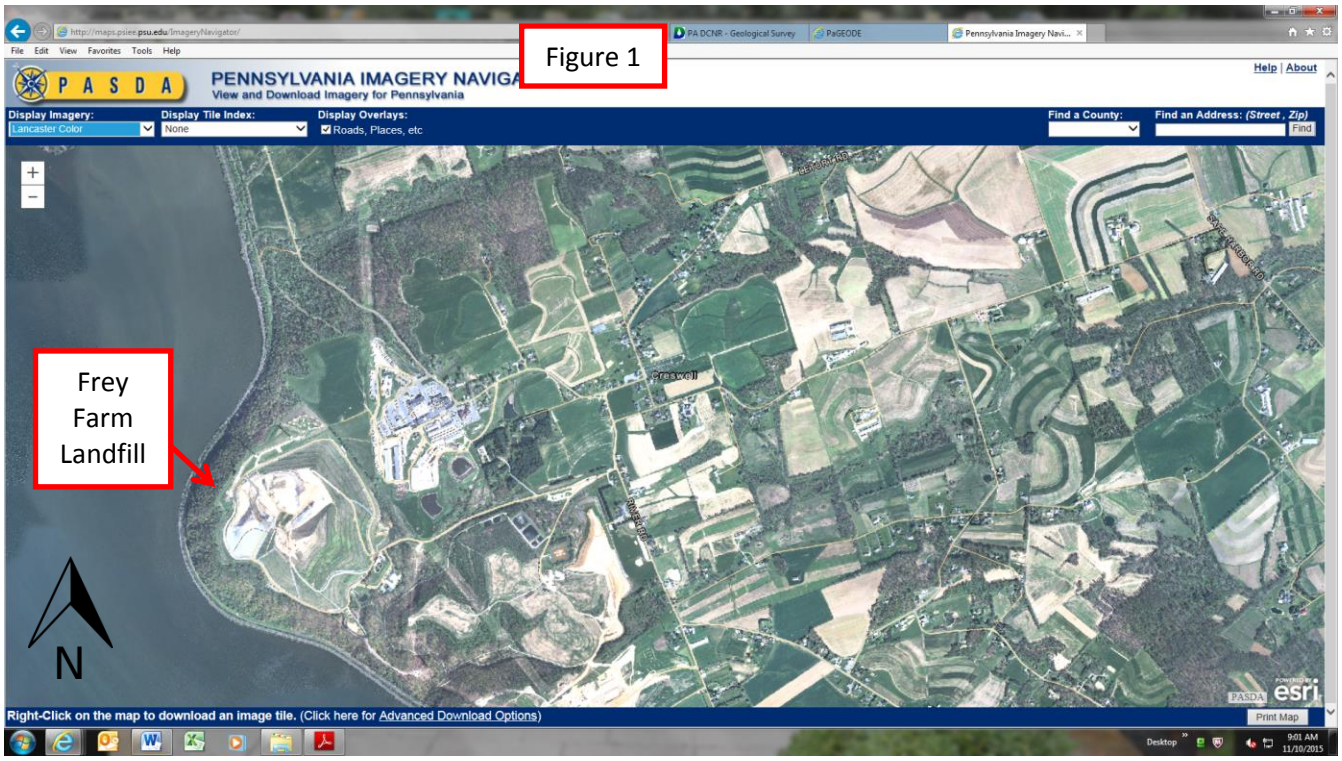
Sincerely,

John L. Oren

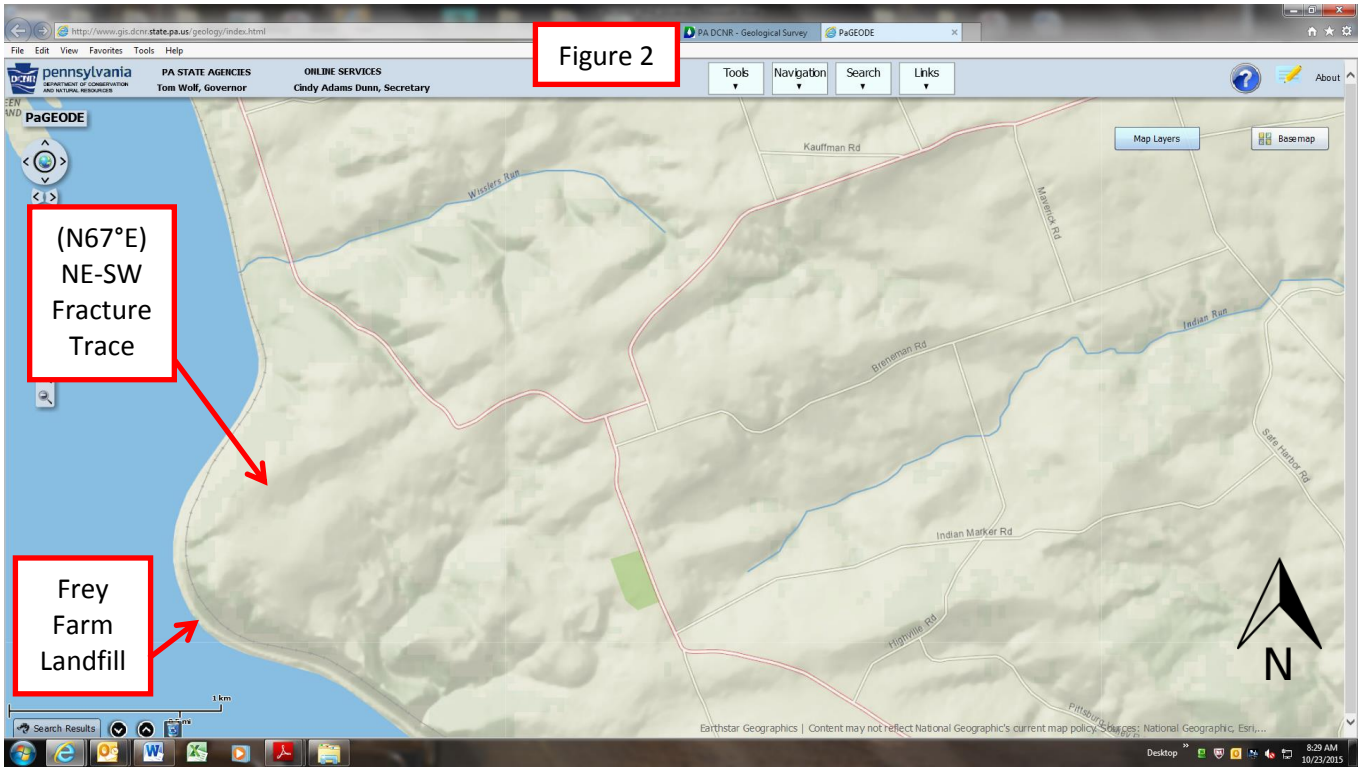
John Oren, P.E.
Permits Chief
Waste Management Program

Attachments

cc: Manor Township
Lancaster County Planning Commission



Source: http://maps.psiee.psu.edu/ImageryNavigator/
Aerial Photo – Lancaster 2012



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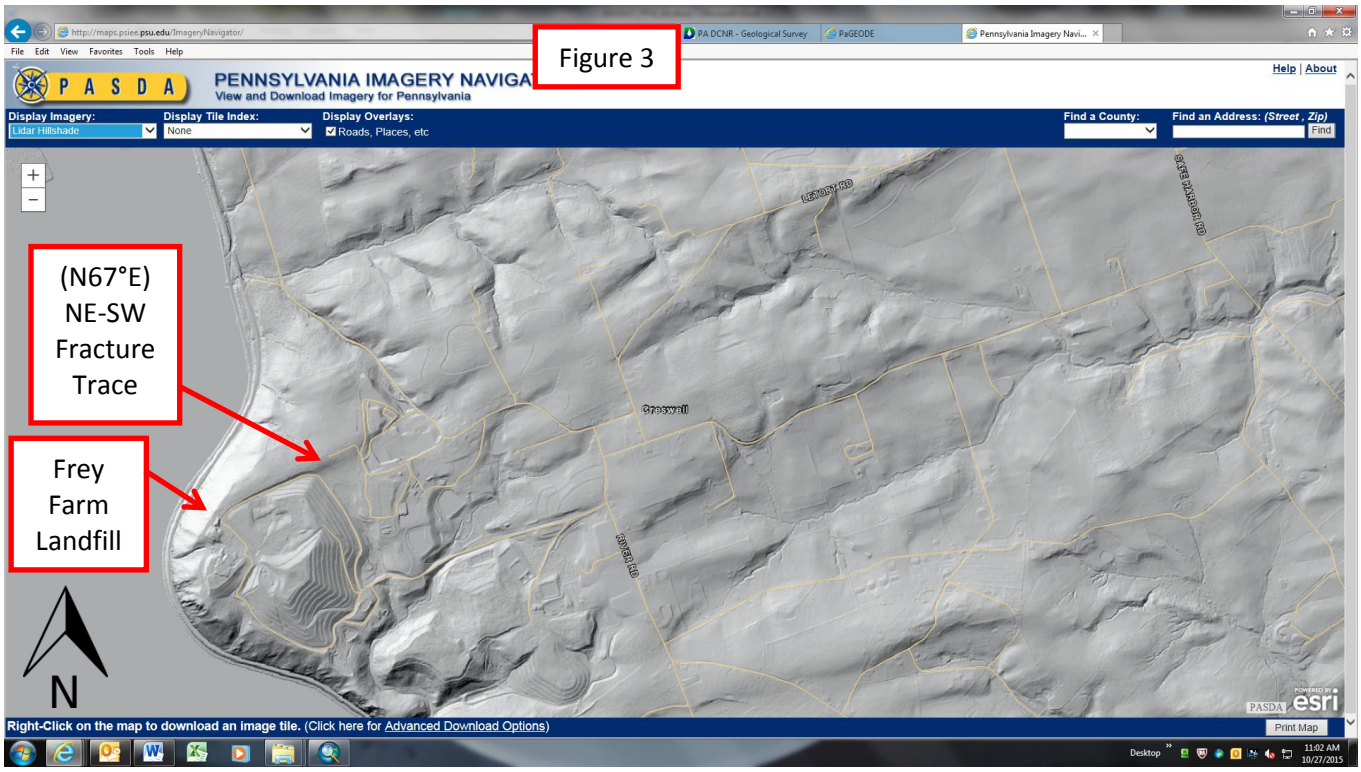
National Geographic Map



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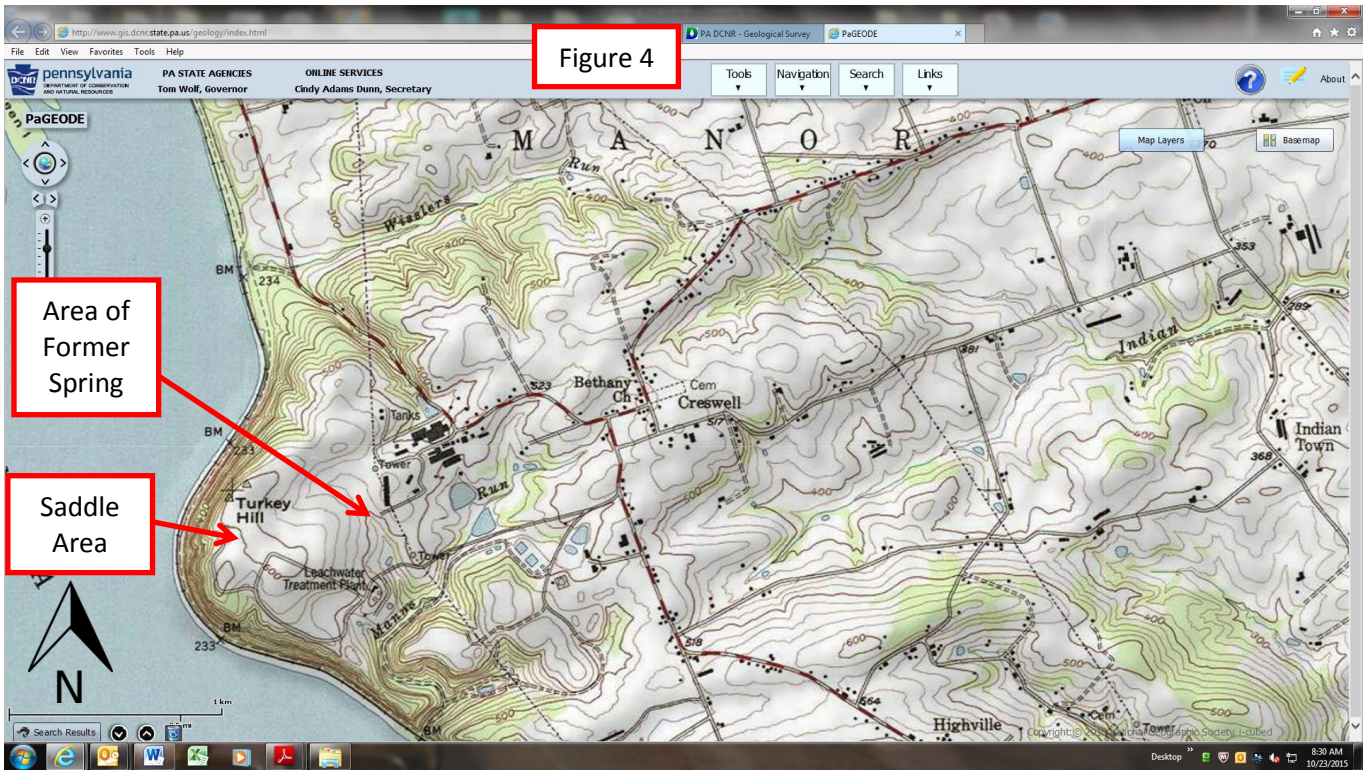
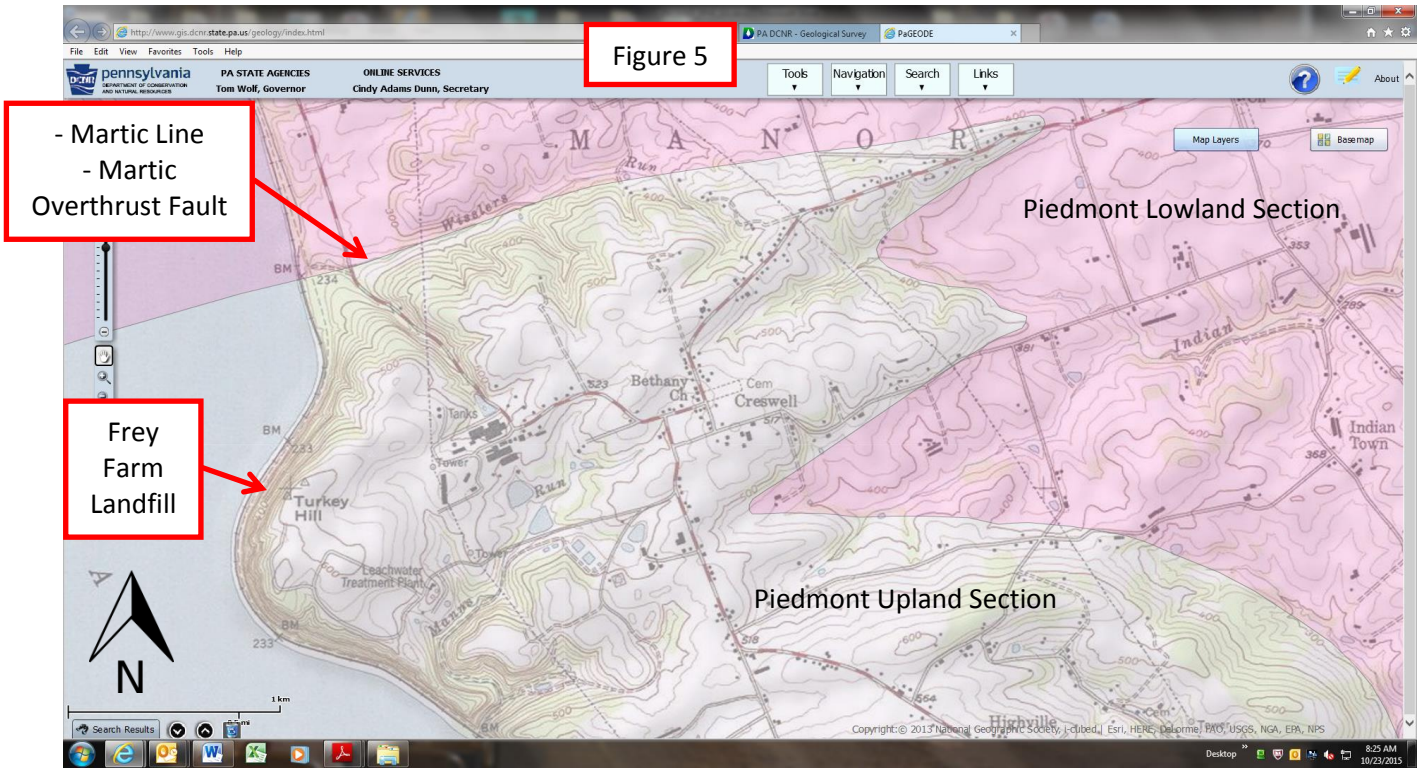
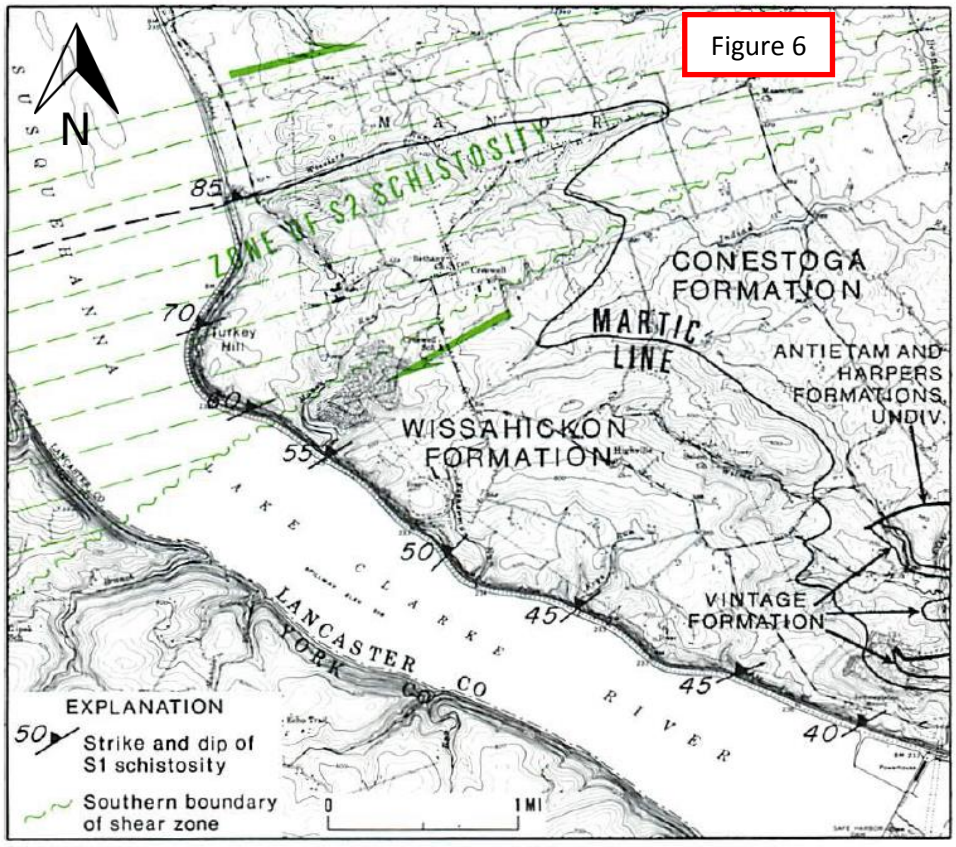
LIDAR Map



Source: http://www.gis.dcnr.state.pa.us/geology/index.html
Topographic Map

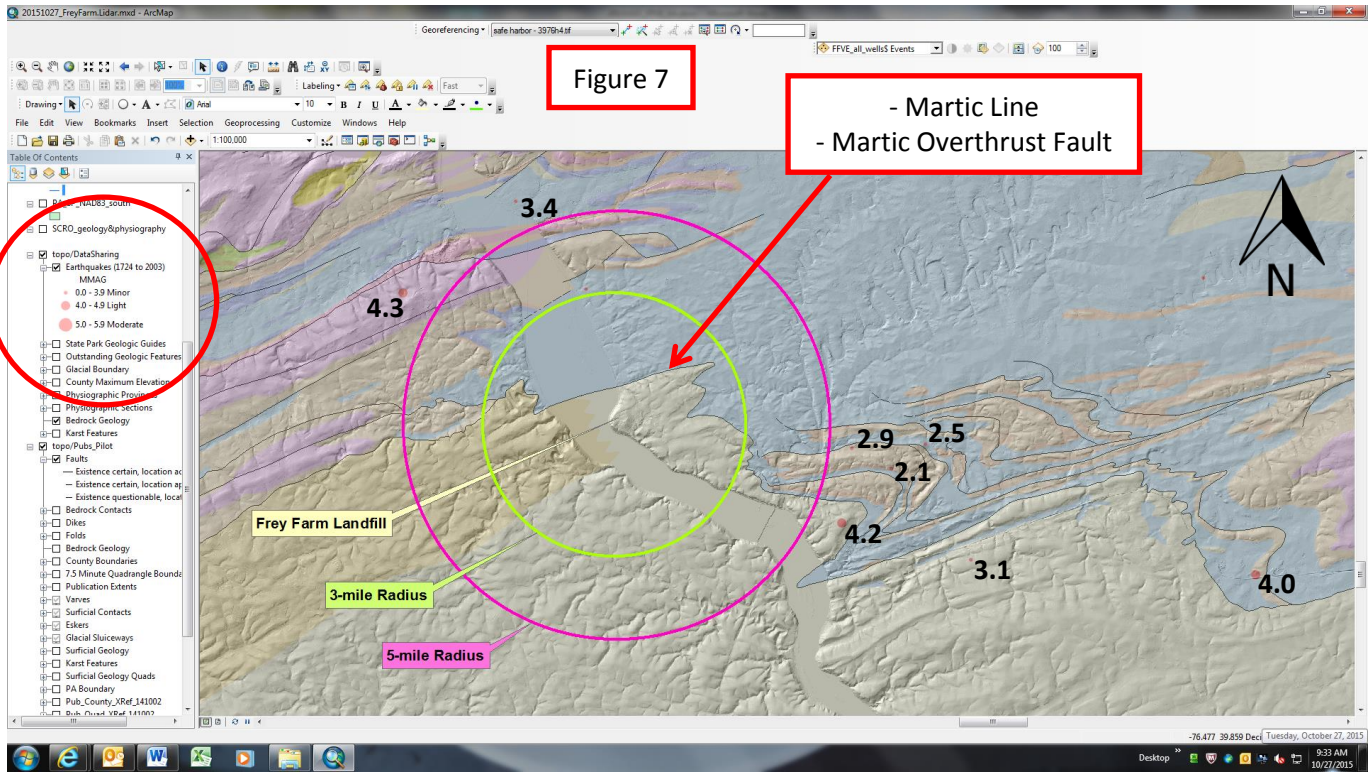


Source: http://www.gis.dcnr.state.pa.us/geology/index.html
Topographic Map and Physiographic Sections

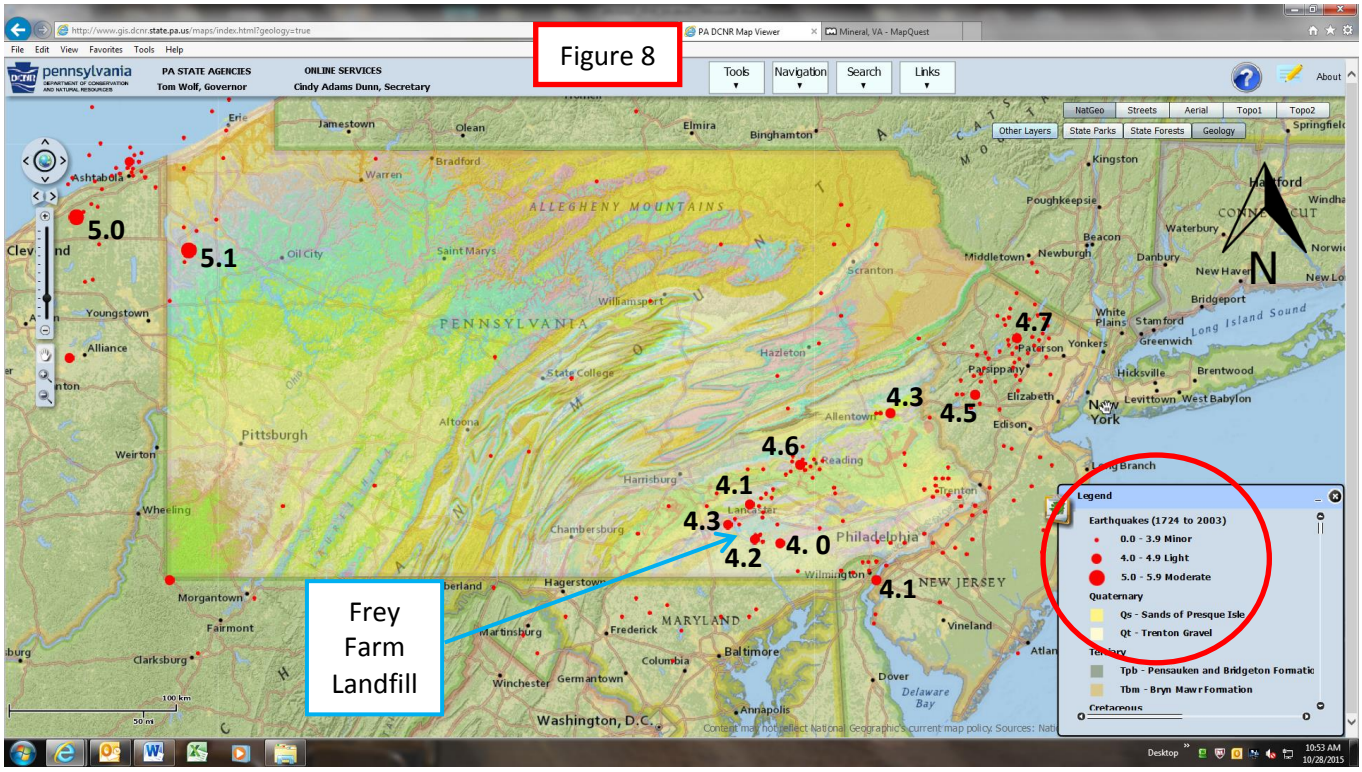


Bedrock and structure map of the Turkey Hill area, Lancaster County, Pennsylvania. The northern boundary of the zone of S2 schistosity is beyond the upper limit of this map.

Source: Valentino, David W., *A Linear Segment of the Martic Line: an Example of Dextral Transposition in the Piedmont Province of Pennsylvania*, Pennsylvania Geological Survey, Pennsylvania Geology, April 1990, Vol.21/2, Page 5.



Source: PADEP GIS and shared data from http://www.gis.dcnr.state.pa.us/geology/index.html
Geologic Map and Earthquakes from 1724 to 2003



Source: http://www.gis.dcnr.state.pa.us/geology/index.html
Geologic Map and Earthquakes from 1724 to 2003