

PF15-1

# BETHLEHEM AUTHORITY

<b>BOARD OF DIRECTORS</b>	Room B311 — City Administration Building 10 E. Church Street Bethlehem, PA 18018	
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July 16, 2015

Mr. Anthony Cox  
 PennEast Pipeline/UGI Services  
 Suite 2C01  
 One Meridian Boulevard  
 Wyomissing, PA 19610

 ORIGINAL

FILED  
 SECRETARY OF THE  
 COMMISSION  
 2015 JUL 22 A 9:22  
 FEDERAL ENERGY  
 REGULATORY COMMISSION

**Re: Preliminary NG Pipeline Impact Study  
 Wild Creek Watershed and Public  
 Water Supply Facilities  
 Carbon County, PA**

Dear Mr. Cox:

On July 9, 2015, at its regular monthly meeting, the Bethlehem Authority ("Authority") reviewed and accepted the attached report by Maser Consulting P.L. ("Maser Report"), which was commissioned by the Authority to evaluate the potential impacts of a proposed PennEast natural gas pipeline currently planned to go through Authority property and which will be adjacent to several of the Authority's facilities.

The Authority owns over 23,000 acres of watershed property in Carbon and Monroe Counties, PA ("Watershed") and leases its water system facilities to the City of Bethlehem ("City") to manage and operate the entire water system. The City's public water supply system produces approximately **15.0 million gallons per day** of pristine, high quality drinking water which serves the potable water needs of over **115,000 people and 1,315 commercial and industrial customers** in the City of Bethlehem, the Boroughs of Fountain Hill and Freemansburg, and the Townships of Allen, East Allen, Hanover Lehigh, Hanover Northampton, Lower Saucon, Upper Saucon and Salisbury. The City's water comes entirely from two reservoirs located in the Watershed. The major components of the water supply system, which the Authority controls and has a duty and obligation to protect and preserve for its customers and bondholders, include these two reservoirs which hold a combined **9.9 billion gallons** of water, the headwaters and streams that feed the reservoirs, and the pipeline conveyance system that carries the highest quality drinking water to its consumers in the Lehigh Valley. The PennEast Pipeline project, as currently planned, negatively impacts all of these water system facilities.

Mr. Anthony Cox  
July 16, 2015  
Page 2

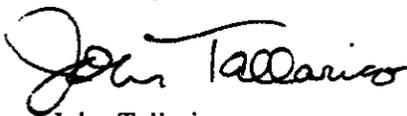
The Maser Report highlights the fact that the Wild Creek earth filled dam and the single water transmission main and rock bore tunnel through Wire Ridge were constructed in 1939. There is no redundancy or alternate system to replace the 33 million gallons per day of water transmission capacity through these 75-year-old facilities, should they be compromised by the currently proposed PennEast Pipeline during its construction and operation stage, or in the event of a catastrophic accident which compromises the integrity of the pipeline.

The Maser Report recommends that PennEast redesign the proposed pipeline route to completely avoid the Watershed, the Authority's reservoirs and water transmission lines to the fullest extent possible, to minimize, to the fullest extent possible, the risk of a catastrophic event that could bring undue hardship to thousands of consumers.

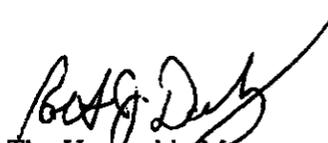
**As Chairman of the Bethlehem Authority, and as Mayor of the City of Bethlehem, we jointly support the Maser Report and its findings and recommendations, and strongly urge PennEast Pipeline to move the proposed pipeline route away from the Authority's and City's water system facilities and Watershed, such that there is no potential, negative impact on the water supply for the over 115,000 consumers in ten Lehigh Valley communities.**

We thank you for your serious consideration in this matter and trust you will do what is right for our drinking water customers. We would be happy to discuss the attached report and its recommendations with any and all parties associated with this project.

Sincerely,



John Tallarico  
Bethlehem Authority Chairman



The Honorable Mayor  
Robert J. Donchez

Cc: Federal Energy Regulating Commission  
Bethlehem Authority  
PA Department of Environmental Protection  
Bethlehem City Council  
The Honorable Patrick Toomey  
The Honorable Senator Robert Casey  
The Honorable Matthew Cartwright  
The Honorable Charles Dent  
The Honorable Lou Barletta



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July 10, 2015

**VIA E-MAIL & U.S. MAIL**

Mr. Stephen Repasch  
Executive Director  
Bethlehem Authority  
10 East Church Street  
Bethlehem, PA 18018

Re: Preliminary NG Pipeline Impact Study  
Wild Creek Watershed and Public Water Supply Facilities  
Carbon County, PA  
MC Proposal No. 14002428P

Dear Mr. Repasch:

Maser Consulting, P.A. is pleased to have this opportunity to serve you and the Bethlehem Authority in providing this Preliminary NG Pipeline Impact Study.

The PennEast Pipeline Co., LLC (PennEast) has proposed a 108-mile natural gas pipeline connecting the Marcellus Shale area of Luzern County, PA to the Transco Trenton-Woodbury interconnection in southern New Jersey (see PennEast Pipeline Overall Map enclosed). The currently proposed alignment would cross Bethlehem Authority property in Carbon County just west of the reservoirs. The intent of this preliminary NG Pipeline Impact Study is to identify and preliminarily qualify the potential negative impacts the PennEast NG Pipeline may have on the Bethlehem Authority watershed, water supply, reservoir dams and water supply transmission assets (see Maser Consulting Study Area Exhibit enclosed). It is also believed that the Bethlehem Authority will share this study with both PennEast and the Federal Energy Regulatory Commission (FERC).

**Executive Summary:**

The Bethlehem Authority owns over 22,000 acres within Carbon and Monroe Counties, with the Wild Creek Watershed comprising almost 14,000 of these acres. The watershed is the primary drinking water supply to over 115,000 people and 1,315 commercial and industrial customers. The Wild Creek earth filled dam and the single water transmission line and rock bore Wire Ridge Tunnel were constructed in 1939. There is no redundancy to replace the 33 million gallons per day (MGD) potable water conveyance capacity to the City of Bethlehem and ten other municipalities, should these 75 year facilities be compromised by the PennEast Pipeline during construction, operations, or a catastrophic accident. Therefore, we recommend that PennEast redesign the proposed NG pipeline route to avoid the Bethlehem Authority Watershed, its reservoirs and its water transmission lines to the fullest extents possible and as described further in Recommendation No. 1, listed on Page 7 of this impact study.



### **Background Information:**

On April 17, 2015, Maser Consulting met with representatives from both the Bethlehem Authority and the City of Bethlehem to review the existing maps, plans, and prior reports pertinent to the proposed study area. This meeting was followed by a visit to the Carbon County watershed study area with the Authority and City representatives to observe the site conditions, take photos and gain insight to the potential impacts of the proposed NG pipeline.

Per the PennEast Pipeline Project web-site, the latest proposed pipeline route was last revised March 2015 (<http://penneastpipeline.com/proposed-route/>). We also received individual property aerial photo exhibits which were provided by PennEast to Bethlehem Authority dated January 27, 2015. It is our understanding that the Bethlehem Authority has begun a dialog with PennEast and has requested more detail mapping of the Authority property along the proposed pipeline alignment.

In response to a PennEast invitation letter dated May 19, 2015, the Bethlehem Authority Executive Director and a Maser Consulting representative attended the PennEast property owner information session held at Flagstaff Ballroom in Jim Thorpe, PA on June 3, 2015. A general PennEast power-point presentation was provided, as well as an opportunity to view the PennEast electronic detailed mapping in the area of the Bethlehem Authority Watershed. With the assistance of the PennEast consultants, we were allowed to create detailed map screen-shots. These screen-shot maps were then e-mailed to each of us. The Bethlehem Authority and the City of Bethlehem provided Maser Consulting the following documents as supplemental background resources for our reference and can be provided to both PennEast and FERC:

- 1939 Bethlehem Municipal Water Authority, Wild Creek Gravity Water Supply Construction drawings (partial set, individual sheets enclosed); including reservoir earth fill dam plans, cross-sections, and test pit data; water supply Tunnel #2 (Wire Ridge Tunnel under SR-209) plan and longitudinal section; pipe tunnel portal, pressure tunnel and section details;
- 1996 Final Report, Inspection of the Blue Mountain and Wire Ridge Tunnel Portals – Wild Creek Transmission Main prepared for the City of Bethlehem (Report cover enclosed);
- 2012 Bethlehem Authority, Wild Creek & Tunkhannock Creek Watershed Forest Management Plan (Condensed Version), prepared by Woodland Management Services & The Nature Conservancy (Cover and Three Exhibits enclosed);
- 2014 PADEP Bureau of Waterways Engineering, Division of Dam Safety, Wild creek Dam Inspection Report, City of Bethlehem (Operator) Bethlehem Authority (Owner) (Cover enclosed).
- June 3, 2015 PennEast meeting, fifteen (15) separate screen-shot maps (see Maser Consulting list and description of each screen-shot map enclosed);
- June 30, 2015 Woodland Management Services, Inc. Report entitled “Proposed PennEast Pipeline Footprint Impact on Timber Related Revenue and Costs”.

### **1.0 Initial Kick-off Meeting and Site Visit Areas of Concern:**

Based upon the April kick-off meeting and site tour with representatives of the Bethlehem Authority and the City of Bethlehem, three areas of focus emerged (See Maser Consulting Study Area Exhibit):

- A. Headwaters of Wild Creek: In Penn Forest Township, the proposed NG pipeline is aligned generally north to south, and generally parallel and just east of the PA Turnpike Northeast



Extension I-476. The proposed NG pipeline will traverse the headwaters and cross Wild Creek which is tributary to Penn Forest Reservoir. Penn Forest Reservoir is tributary to the Wild Creek Reservoir. These two impoundments and their entire watershed are the source of the City of Bethlehem potable water supply. This public water system serves the City of Bethlehem and ten other surrounding municipalities with approximately 36,000 billing accounts serving a population of approximately 115,000 people and 1,315 commercial and industrial customers.

- B. Wild Creek Dam: In Towamensing Township, the proposed NG pipeline will traverse Beltzville State Park approximately 2,000 feet southwest of the toe of Wild Creek Dam. This earth fill dam was constructed in 1939. The dam has a top length of 1,076 feet, top width of 30 feet and maximum bottom width of 1,000 feet. The top height is 155 feet above the creek. The reservoir has a capacity of 3.9 billion gallons of water (see attached exhibit plans).
- C. Wire Ridge Tunnel: In Towamensing Township, the proposed NG pipeline will traverse under Beltzville Lake, over Wire Ridge and under PennDOT State Route 209. The NG pipeline will be aligned in close proximity and parallel to the water transmission line from Wild Creek Reservoir to the City of Bethlehem; and then cross the water transmission line. The water transmission line was constructed in 1939 as a 38-inch steel pipe (minimum 2 feet of cover) from the dam control building, under Wild Creek (now Beltzville Lake) to the northern Portal #4. A newer 36-inch transmission line was constructed in parallel from the dam control building to the connection chamber just upstream of Portal #4; both lines are used.

From the northern Portal #4, a single 38-inch steel transmission main rests on concrete cradles within a 6-foot diameter arched concrete lined tunnel, through Wire Ridge for approximately 330 linear feet (LF). The transmission line then transitions to approximately 2,400 LF of a single rock bore, 48-inch concrete lined pressure pipe. The maximum depth of the pressure pipe tunnel below the top of Wire Ridge and PennDOT SR 209 is approximately 225 vertical feet. The southern Portal #3 is again a single 38-inch steel transmission main resting on concrete cradles within a 6-foot diameter arched concrete lined tunnel, approximately 268 LF. The total Wire Ridge Tunnel is approximately 3,000 LF. South of Wire Ridge and Portal #3, the transmission main continues as a 38-inch steel pipe and a newer parallel 42-inch pipe towards the similarly constructed Blue Mountain Tunnel.

## **2.0 Potential Geotechnical Impacts**

To gain an understanding of the potential geotechnical-related impacts that the proposed natural gas pipeline may have on the watershed infrastructure, we researched the regional geology at the Wild Creek Dam and the Wire Ridge Tunnel sites. These areas are located within the Blue Mountain Section of the Ridge and Valley Physiographic Province. Specifically, the regional geology consists of alternating exposed formations of sedimentary rock, (e.g. siltstone, shale, and sandstone), generally striking in a northeast – southwest alignment. These formations are folded over each other forming a syncline or anticline; and weathered to create the observed ridge and valley topography.

- Wild Creek Dam – Locally, the Wild Creek Dam is mapped to be underlain by two bedrock formations. The northern portion and majority of the dam is underlain by the Trimmers Rock Formation consisting of a siltstone and shale, while the southernmost portion is underlain by the



Mahantango Formation consisting of shale and siltstone. The proposed pipeline will cross over four rock formations at its closest proximity the Wild Creek Dam, including in order from north to south the Marcellus Formation (black shale, localized limestone), the Mahantango Formation, the Trimmers Rock Formation, and the Towamensing Member of the Catskill Formation (sandstone, siltstone, shale). Two faults are also mapped between the pipeline alignment and the earthen dam.

- Wire Ridge Tunnel – The Wire Ridge Tunnel crossing is mapped along the contact line between the Towamensing Member of the Catskill Formation and the Trimmers Rock Formation.

Geotechnical concerns may arise during the period of NG pipeline installation, particularly with respect to the potential rock blasting construction techniques. Other concerns may also arise from a potential future NG pipeline failure and resulting catastrophic explosion blast from the high pressure dry gas, that could send a shock wave through rock formations.

- Headwaters of Wild Creek: Provided standard erosion and sedimentation controls, stream crossing details, etc. are implemented during the NG pipeline construction, we believe the risk to the headwaters associated with routine construction can be successfully managed. Similarly, assuming that standard construction protocols for trench rock blasting are implemented (if blasting becomes necessary), we believe the risk associated with this routine construction practice to be low.
- Wild Creek Dam: Wild Creek Dam is an earthen filled dam constructed in 1939 and is supported on the Trimmers Rock Formation and the Mahantango Formation.

Provided that standard protocols for trench rock blasting (pre-blasting plan, vibration monitoring, blasting mats, etc.) are implemented (should blasting become necessary to install the NG pipeline), we believe the risk to the dam associated with this routine construction practice to be low, as the earth filled dam is approximately 1,600 LF from the NG pipeline (See detailed Screen-shot Map BA\_5).

A catastrophic NG pipeline explosion and resulting shockwave could potentially damage (or ultimately cause a breach of) the 1939 earth fill dam. Such an event would likely result in significant environmental impacts, hazards to downstream properties, and human safety. In addition, the loss or partial loss of Wild Creek Reservoir for an extended period of time would have a significant impact upon the Bethlehem Authority Water Supply.

A recent evaluation of the condition of the Wild Creek Dam is provided within the Wild Creek Dam Inspection Report by Cherry, Weber, & Associates, dated October 2014. PennEast should be provided with a copy of this report and prior to NG pipeline construction, conduct an updated survey of the dam to establish the pre-construction condition.

- Wire Ridge Tunnel: Wire Ridge Tunnel is a single water transmission supply line to the City of Bethlehem. From the current NG pipeline mapping provided, the proposed NG pipeline will be installed approximately 67 LF from the shallow (minimum 2' cover) 1939 steel water transmission line north of Wire Ridge Tunnel Portal #4 (See detailed Screen-shot Map BA\_11).



We understand Bethlehem Authority has been informed that PennEast has revised its proposed alignment to cross the Bethlehem transmission line at the top of Wire Ridge (near SR-209) to increase the separation by an approximate vertical 200 feet. We believe this is one positive change (See detailed Screen-shot Map BA\_10).

If blasting is required to permit the NG pipeline installation, we believe the risk to the tunnel associated with this routine construction practice to be low, provided standard protocols for trench rock blasting are implemented (pre-blasting plan, vibration monitoring, blasting mats, etc.).

- D. A catastrophic NG pipeline explosion and resulting shockwave could damage or cause a breach of the 1939 rock bore pressure pipe. The temporary loss of the Wire Ridge transmission tunnel would leave the Bethlehem Authority with no means of supply of potable drinking water for approximately 115,000 people and 1,315 commercial and industrial customers.

The condition of the water transmission tunnel and pipelines are documented in the 1996 Wire Ridge Tunnel Inspection Report, by Gannett Fleming, Inc. PennEast should be provided with a copy of this report and prior to NG pipeline construction, conduct an updated survey of the tunnel and water transmission line to establish the pre-construction condition.

### **3.0 Potential Environmental Impact:**

In the early 1930's, the Bethlehem Authority began purchasing properties for its public water supply. The Bethlehem Authority now owns over 22,000 acres within Carbon and Monroe Counties, with the Wild Creek Watershed comprising almost 14,000 of these acres. The Bethlehem Authority has been good stewards of this land and has teamed with the Woodland Management Service and The Nature Conservancy to use their property assets to be part of the "Working Woodlands" program. These properties have also been included in the Voluntary Carbon Standard (VCS) and provide carbon credits for sale in the marketplace. The 2012 Watershed Forest Management Plan is a comprehensive document and provides a full description of the Bethlehem Authority natural assets (see The Natural Conservancy excerpt map exhibits). The watershed is the primary drinking water supply to over 115,000 people. As such, it is of "high conservation value". In additions, "the mesic till barrens community type of the Pocono Plateau, which dominates several thousand acres of the Bethlehem Authority property, is home to rare and endangered species of plants, birds, and insects and is considered to be the only natural community of its kind in the world." Through the Forest Management Plan, the Bethlehem Authority also gains annual revenue from carefully planned timber harvests.

The proposed PennEast NG pipeline will cross Bethlehem Authority woodland watershed. The anticipated 36-inch pipeline will be installed within a cleared right-of-way, which is proposed to be 50 feet wide. In addition to the watershed and natural habitat, the loss of these woodlands will reduce the Bethlehem Authority annual VCS carbon credits and timber harvest revenues.

- A. Within the Headwaters of Wild Creek Study Area, the same environmental concerns as described above exist. Other petroleum pipelines exist in close proximity to the proposed NG pipeline within the headwaters. A catastrophic NG pipeline explosion and shockwave could rupture or damage the much older nearby liquid petroleum pipelines. Leaks from these pipelines could in



turn cause environmental impacts to the Wild Creek Watershed and the Bethlehem Authority Water Supply.

The construction activities must include strict adherence to the NPDES Permit regulations for erosion and sedimentation control (E&S). The proposed earth disturbance within the watershed would be tributary to the Penn Forest Reservoir and the Bethlehem Authority drinking water supply. Failure of E&S best management practice (BMP) facilities could result in run-off pollution, siltation and construction equipment fuel contamination of the water supply.

Future NG pipeline maintenance activities pose the same disturbance concerns as above. The potential of a NG pipeline explosion could also cause the same pollution in a more catastrophic manner.

- B. The proposed NG pipeline below the Wild Creek Dam would pose minimal environmental concerns for the Bethlehem Authority properties.
- C. Wire Ridge Tunnel itself would have minimal environmental concerns from the proposed NG pipeline with the exception of E&S impacts to the shallow transmission line. It is possible that the steep slopes of Wire Ridge would increase erosion from the NG pipeline construction and could reduce the limited soil cover over the water transmission pipe.

#### **4.0 Potential Utility Operations Impact:**

- A. The headwaters of Wild Creek include the Bethlehem Authority land impacted by the proposed NG pipeline tributary to both the Penn Forest Reservoir and the Wild Creek Reservoir. Any of the above-referenced sources of pollution may negatively impact the drinking water supply for more than 115,000 people. Pollutants that are settleable would be of minimal concern other than long term siltation of the reservoirs. However, soluble and light insoluble pollutants such as oils and/or petroleum products have the potential of passing through the reservoirs and may cause operational problems and/or contamination of the Bethlehem Water Filtration Plant located in Lehigh Township, Northampton County.

The Bethlehem Authority maintains a police force for the protection of the water supply and the watershed assets. The proposed NG Pipeline clear right-of-way will cause increased security challenges both during and after construction. All-terrain vehicles (ATV) are difficult trespassers for the Bethlehem Authority Police to control.

- B. Wild Creek Dam was last inspected in October of 2014 by the PADEP, Division of Dam Safety and was found to be "in very good condition and actively maintained". The reconstructed Penn Forest Reservoir (6.0 billion gallons) provides controlled release to supplement the Wild Creek Reservoir (3.9 billion gallons). There is not a piped connection from the Penn Forest Reservoir to the lower Wild Creek Reservoir intake tower. Therefore, damage to or failure of the Wild Creek Dam caused by the NG pipeline construction or a catastrophic explosion would compromise the water supply of both reservoirs.



The Bethlehem Authority watershed and its transmission mains can convey up to 33 million gallons per day (MGD) to the City of Bethlehem and ten other municipalities. Should this source water be incapacitated, the City has emergency interconnection agreements with five adjacent utilities. However, these emergency interconnections would provide only a total of 5.04 MGD of water supply.

- C. Wire Ridge and Blue Mountain Tunnels are both single rock bores for the water transmission line connecting the Bethlehem Authority Watershed to the Lehigh Township, Northampton County Water Filtration Plant. There is no redundant transmission to replace the Wire Ridge Tunnel. Therefore, damage to or failure of the Wire Ridge Tunnel, caused by the NG pipeline construction or a catastrophic explosion would compromise the water supply of 115,000 people.

### **5.0 Recommendations:**

Maser Consulting recommends that the Bethlehem Authority and the City of Bethlehem continue the dialog with representatives of PennEast and FERC. This dialog should include meetings between PennEast, Bethlehem Authority, and the City of Bethlehem. We recommend that this Preliminary Bethlehem Authority NG Pipeline Impact Study Letter report also be provided to PennEast Pipeline with all of the same background Bethlehem Authority and City of Bethlehem reports and plans referenced herein.

We believe a significant amount of further research is necessary and should be provided by PennEast to evaluate the potential negative impacts to the Bethlehem Authority's infrastructure, and how each impact will be avoided and/or mitigated sufficiently. It is important that PennEast understand that the Bethlehem Authority is steward of more than 22,000 acres of land and the entire drinking water supply to the City of Bethlehem, ten other municipalities, and over 115,000 people. As such, we recommend that the following list of concerns be addressed by PennEast prior to moving forward with the current alignment for the proposed 36-inch natural gas pipeline:

1. Given the scope of the currently proposed 108 mile NG pipeline and the significance of the Bethlehem Authority Watershed as described above, we recommend that PennEast choose an alternate route to the east of the Wild Creek Watershed. This would avoid potential impacts to the Bethlehem Water Supply, Wild Creek Dam, and the need to cross the water transmission main depended upon by over 115,000 people. An example of such an alternate route is provided and would have significantly less impact to the watershed and potentially no impact to the reservoir dams and the water transmission lines (See detailed Screen-shot Map BA\_15). This is a general representation of an alternate eastern NG pipeline route. The eastern side of the Bethlehem Authority Watershed includes existing fire lanes, public and private lanes which could be utilized for NG pipeline right-of way. If PennEast would pursue such an alternate route to the east of the Bethlehem Authority Watershed, the majority of the concerns listed above would be minimized or eliminated.
2. We strongly recommend the above eastern alternative NG pipeline route around the Bethlehem Authority Watershed. Should this not be feasible, we would then recommend a western alternative NG pipeline route which would utilize existing utility easements for co-location west of the Bethlehem Watershed and away from the Wild Creek Dam. The western alternative NG



pipeline route would cross SR 209 approximately 1,000 feet west of the currently proposed NG pipeline crossing, which would better protect the water transmission line and Wire Ridge Tunnel. The western alternative NG pipeline route would maintain the north to south alignment, approximately 1,000 feet west of the water transmission line to the top of Blue Mountain and then turn east to cross over the water transmission line Blue Mountain Tunnel and continue east to the current NG pipeline alignment south of Blue Mountain. This western alternative NG pipeline route would pass in close proximity to Blue Mountain Ski Area and will provide greater vertical distance between the NG pipeline and the water transmission line Blue Mountain Tunnel.

3. Should the above alternate routes not be feasible, we recommend that PennEast provide more detailed mapping of the proposed alignment at suitable scale which includes all of the Bethlehem Authority assets including: water shed properties and tributary streams; Wild Creek Dam; and the water transmission lines from the dam to and beyond the Wire Ridge Tunnel. We believe that PennEast will better understand the concerns when they plot the 1939 dam, water transmission main and tunnels alongside their currently proposed NG pipeline route.
4. The Bethlehem Authority Watershed properties include other generally parallel (north-south) petroleum and overhead electric transmission rights-of ways. We recommend that PennEast provide additional investigation of the benefits of co-locating the proposed NG pipeline within these existing rights-of-ways, as well as their concerns (See detailed Screen-shot Map BA\_1, BA\_2 & BA\_3). Such benefits may include less construction and maintenance disturbance of woodlands and natural habitats. Such additional concerns may include the potential of one utility's catastrophic failure causing multiple utility failures. Issues of watershed security and sabotage should be discussed. We believe PennEast should provide a detailed report to address these and other alternative rights-of-way strategies.
5. The preceding discussion explains the significance of the 1939 earth filled Wild Creek Dam. We recommend that PennEast reassess the proposed NG pipeline alignment to increase its distance from the dam (See detailed Screen-shot Map BA\_5 & BA\_12). In addition, PennEast should provide more geotechnical and geophysical investigation (including geologic research) along the proposed NG pipeline, and between it and the Wild Creek Dam. These geologic data should be analyzed to better understand the potential impact that vibrations from construction blasting, or shockwaves from a catastrophic blast, would have on the earth fill dam. For both cases, PennEast should establish maximum allowable threshold vibration levels (frequency, amplitude, and duration) for the dam, provide analytical evidence that the thresholds would not be exceeded during either of these events, and develop monitoring programs for construction. If necessary, PennEast should also provide strategies to mitigate or eliminate such potential negative impacts to the dam.
6. Similarly, the preceding discussion explains the significance of the 1939 Wire Ridge rock bore tunnel and transmission lines from the dam. We recommend that PennEast reassess the proposed NG pipeline alignment to avoid crossing the water transmission lines (See detailed Screen-shot Map BA\_7, through BA\_14). Otherwise, detailed horizontal and vertical profile mapping should be provided for the newly proposed revised alignment for a crossing of the transmission line at SR 209. In addition, PennEast should provide more geotechnical and geophysical investigation (including geologic research) along the proposed NG pipeline and along the tunnel and water transmission lines. These geologic data should be analyzed to better understand the potential



impact that vibrations from construction blasting, or shockwaves from a catastrophic blast, would have on the tunnel and water transmission lines. For both cases, PennEast should establish maximum allowable threshold vibration levels (frequency, amplitude, and duration) for the tunnel and water transmission lines, provide analytical evidence that the thresholds would not be exceeded during either of these events, and develop monitoring programs for construction. If necessary, PennEast should also provide strategies to mitigate or eliminate such potential negative impacts to the tunnel and water transmission lines.

7. We recommend that PennEast address the Bethlehem Authority's potential loss of property management revenue which may be caused by the proposed right-of way; both in terms of VCS carbon credits and timber harvest. Please refer to the Woodland Management Services, Inc. report entitled "Proposed PennEast Pipeline Footprint Impact on Timber Related Revenue and Costs".
8. We recommend that PennEast address the Bethlehem Authority's concerns regarding the proposed right-of-way clearing and the potential increase of trespassers on the Bethlehem Authority watershed property. A specific concern is an increase in all-terrain vehicles (ATV) trespassers. PennEast should work with the Bethlehem Authority Special Police to install suitable gates at strategic access locations along the proposed NG pipeline right-of-way.
9. We recommend that PennEast provide detailed mapping along the proposed NG pipeline route and/or alternate routes. This mapping should include geologic information including formation, age, major and minor lithology, faults, and karst specific features including identification of carbonate bedrock, sinkholes, swallow holes and caves. PennEast should also conduct thorough geophysical investigations along any and all portions of the proposed alignment overlying carbonate based bedrock. The techniques should minimally include 2-dimensional resistivity surveys, ground penetrating radar, and gravity surveys, as appropriate, based on location and potential nearby interferences. This data should be evaluated in order to provide both an assessment and proposed mitigation measures of potential karst specific issues including soil piping, sinkhole formation and aggravation from changes to recharge quantity and location resulting from the pipeline alignment.
10. Given the significance of the potential impairment and/or permanent damage to the Bethlehem Public Water Supply and the lack of redundant equal facilities, we recommend that PennEast provide a study of the feasibility to provide improvements to Bethlehem Authority infrastructure. These improvements may include strengthening the Wild Creek Dam and/or providing a redundant water transmission main tunnel through Wire Ridge. In addition, alternate means of insurances may be viable alternatives to posting of long term bonding.



Please do not hesitate to contact this office should you have any questions with regard to this document.

Very truly yours,  
MASER CONSULTING P.A.

A handwritten signature in black ink, appearing to read "Ronald B. Madison".

Ronald B. Madison, P.E.  
Regional Client Manager

A handwritten signature in black ink, appearing to read "Philip E. Gauffreau".

Philip E. Gauffreau, P.E.  
Discipline Leader, Geotechnical Services

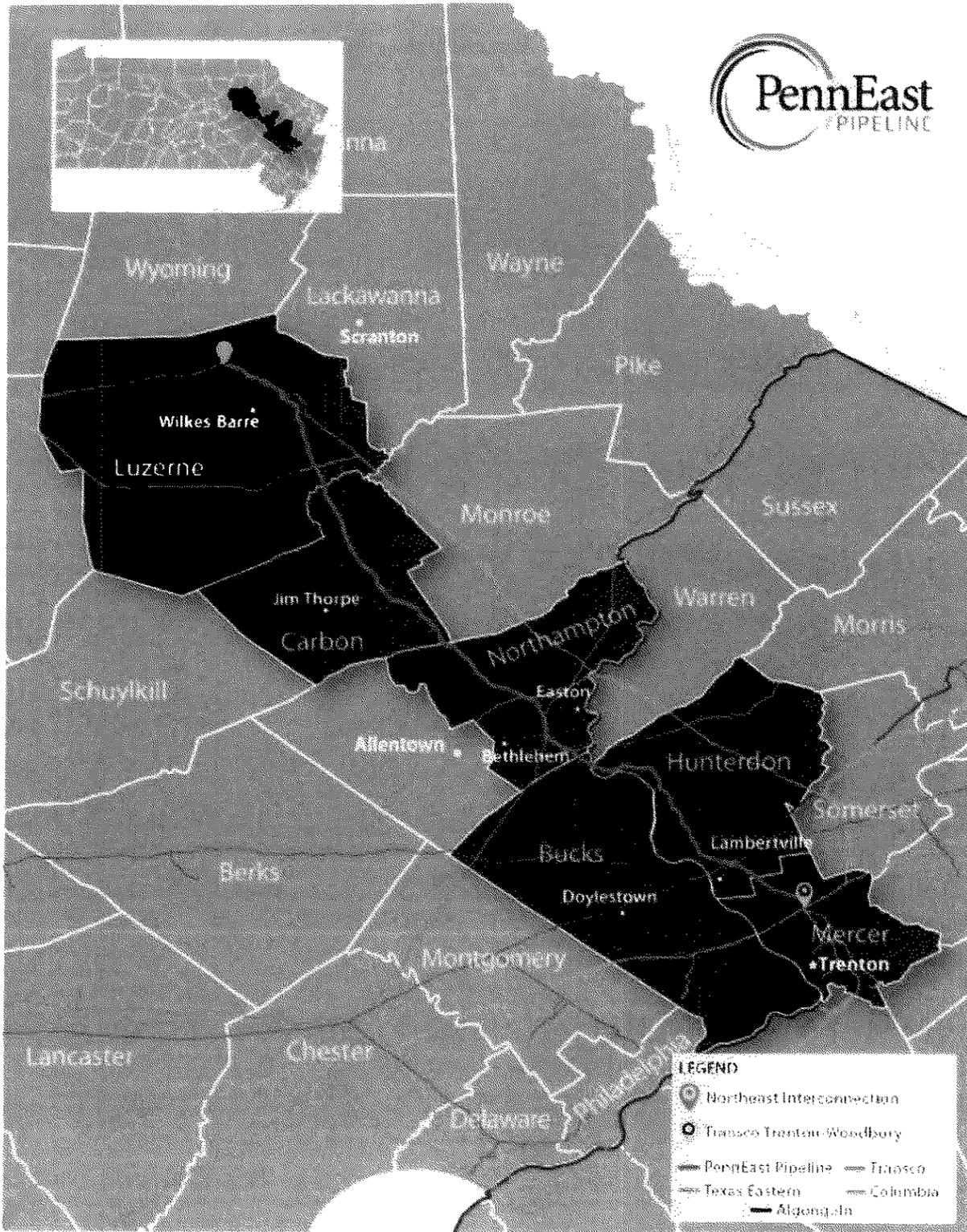
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Robert L. Zelley, P.G.  
Director of Environmental Service

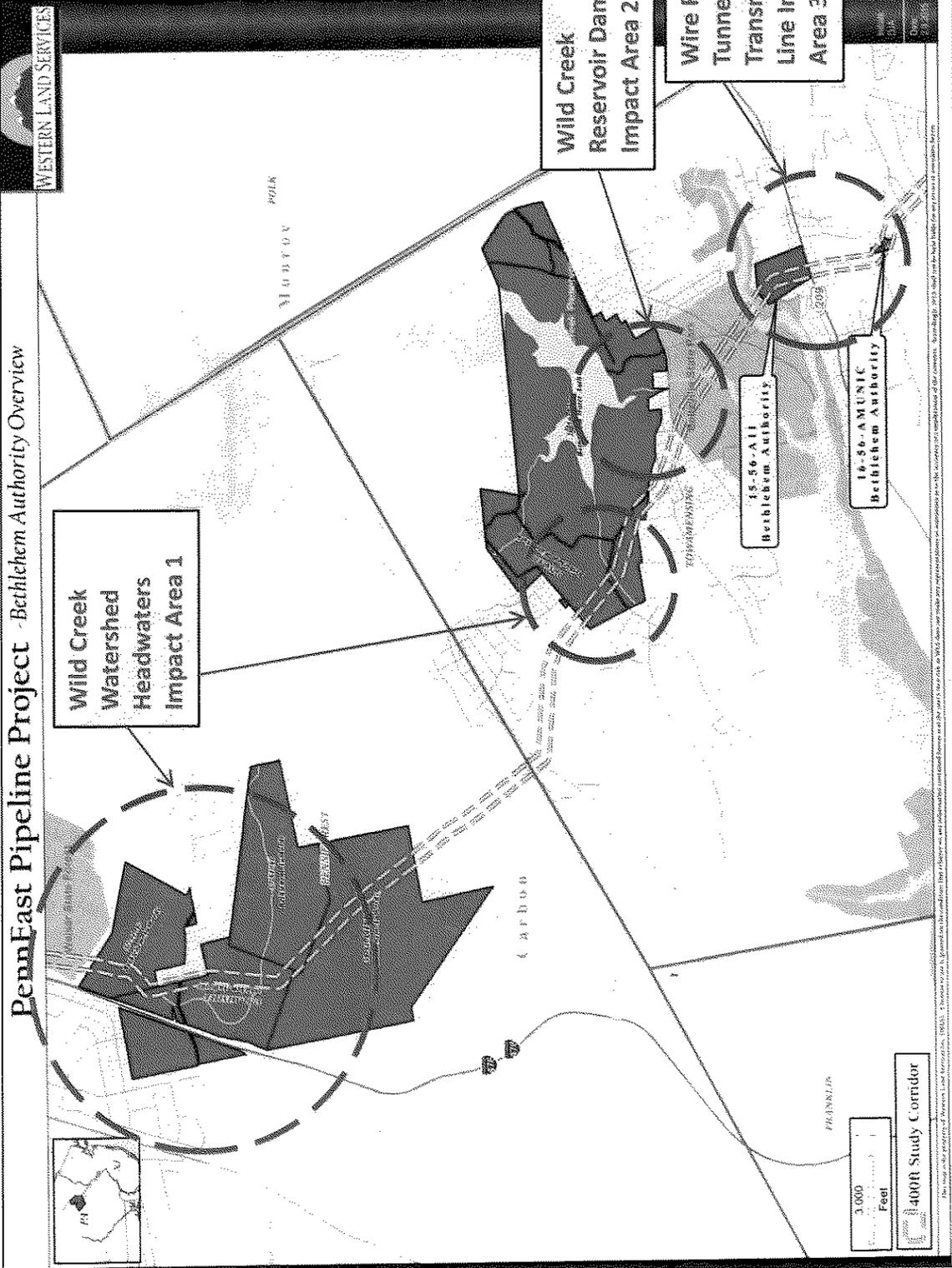
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Enclosures:

1. PennEast Pipeline Overall Map
2. Maser Consulting – Bethlehem Authority Study Area Exhibit
3. BMWA – Wild Creek Dam , 1939 (Partial Set)
4. BMWA – Wire Ridge Tunnel #2, 1939 (Partial Set)
5. Wire Ridge Tunnel 1996 Inspection Report
6. The Nature Conservancy 2012 Cover and 3 Exhibits
7. Wild Creek Dam 2014 Inspection Report Cover and Checklist
8. PennEast Pipeline Detailed Map Descriptions and Screenshot Maps (15)
9. June 30, 2015 Woodland Management Services, Inc. Report entitled “Proposed PennEast Pipeline Footprint Impact on Timber Related Revenue and Costs”.



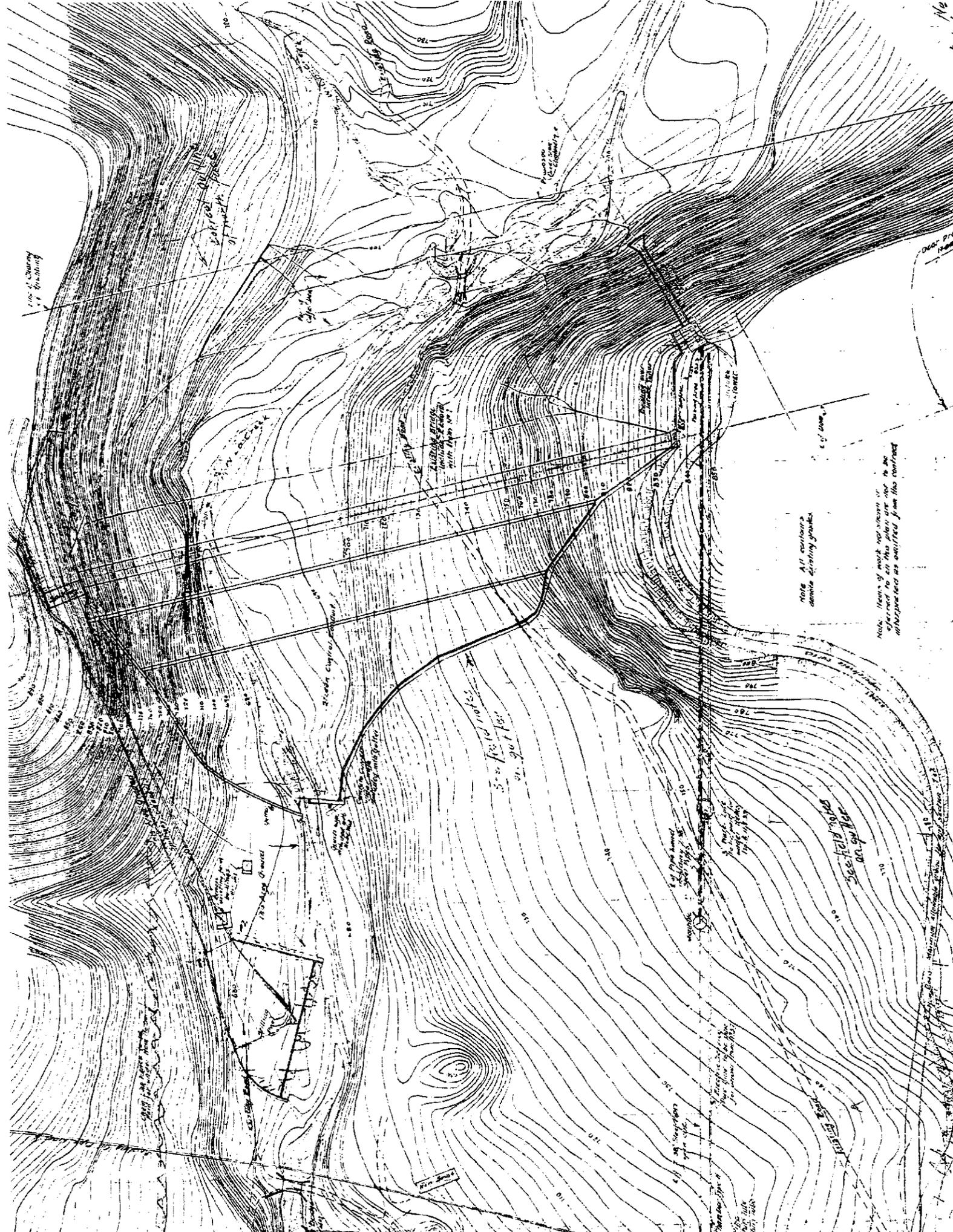
# PennEast Pipeline Project - Bethlehem Authority Overview



## Impact Study Area Map

Not to Scale





Note: All contours assume existing ground.

Note: Items of work not shown or referred to in this plan are not to be interpreted as omitted from the contract.

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See field notes on page 39

See field notes on page 40

See field notes on page 41

See field notes on page 42

See field notes on page 43

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See field notes on page 85

See field notes on page 86

See field notes on page 87

See field notes on page 88

See field notes on page 89

See field notes on page 90

See field notes on page 91

See field notes on page 92

See field notes on page 93

See field notes on page 94

See field notes on page 95

See field notes on page 96

See field notes on page 97

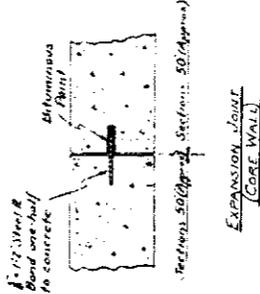
See field notes on page 98

See field notes on page 99

See field notes on page 100



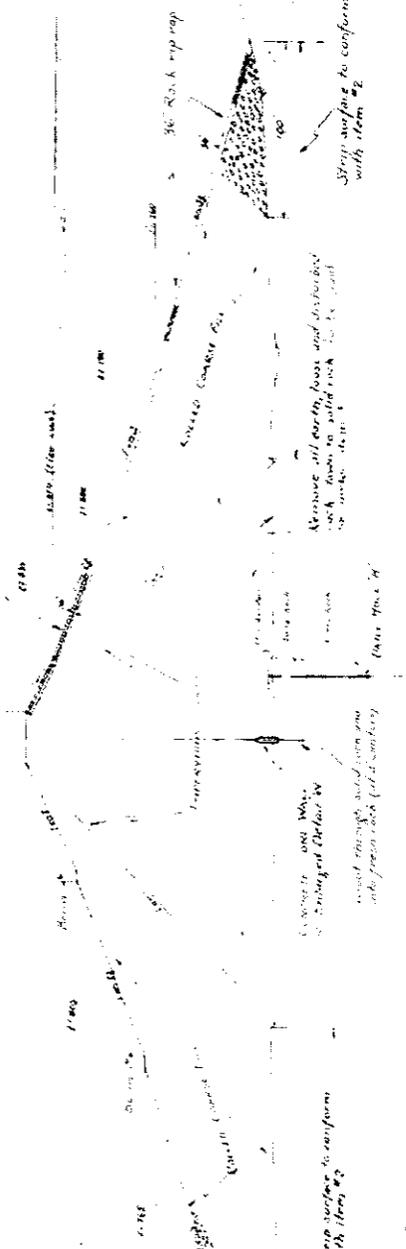
Note: Total height of core wall to vary depending upon nature of rock encountered. Depths may be greater or less than shown.



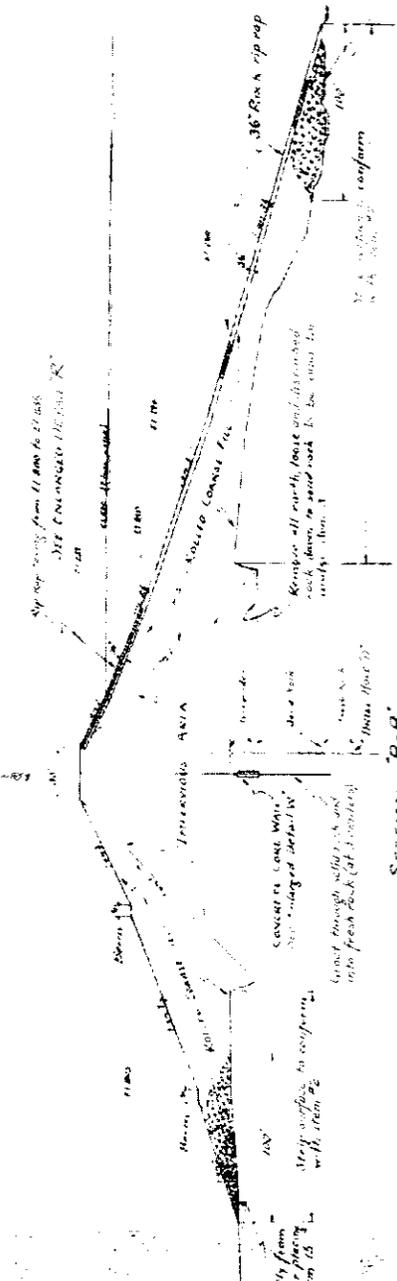
25  
20  
15

15  
10  
5

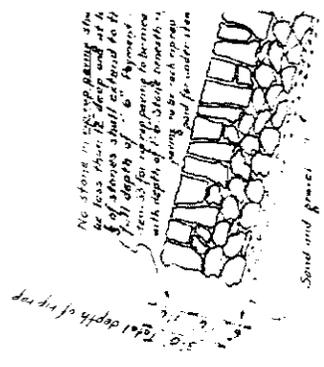
Rock Tee to be built principally from 10, 12, 14, 16 and 18 inch nominal diameters to be situated in portions of Item 15.



SECTION "A-A"  
See Sheet #6, Contract #5  
Scale 1" = 50'



SECTION "B-B"  
See Sheet #6, Contract #5  
Scale 1" = 50'



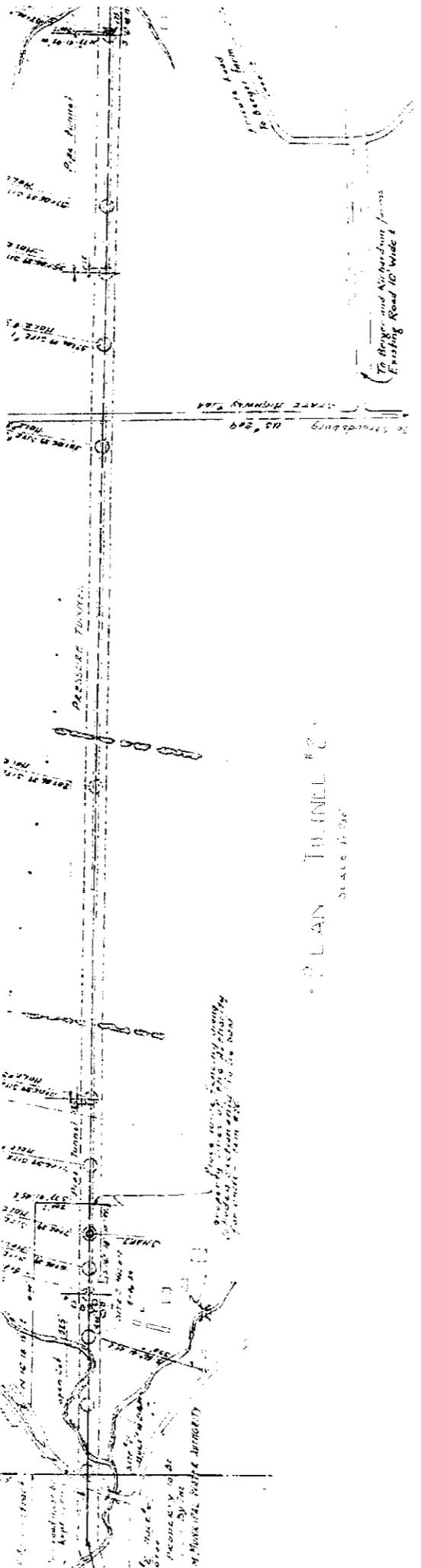
10  
5  
0

Rock Tee to be built principally from Items 10, 11, 12 and payment for placing to be included as portion of Item 15.

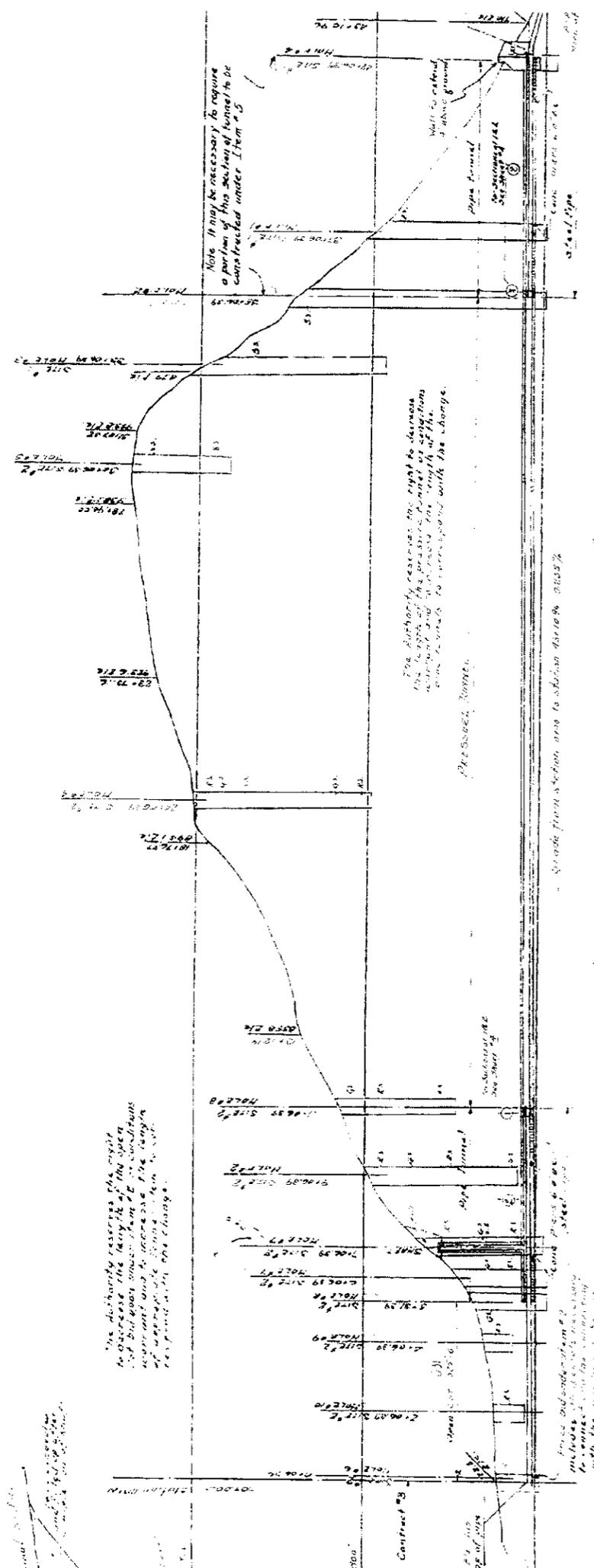
FACING  
P.L.A.  
Scale 1"

PAYMENT

- ITEM 1
  - ITEM 3
  - ITEM 10
  - ITEM 2
  - ITEM 15+16
  - ITEM 19
  - ITEM 21+22
  - ITEM 23
  - ITEM 24, 25, 26, \*27
  - ITEM 32
  - ITEM 33
  - ITEM 30
- CLEARING AND GRUBBING  
EARTH EXCAVATION  
ROCK EXCAVATION  
STRIPPING  
ROLLED FILL INCLUDING ROCK TEE  
CONCRETE CORE WALL  
DRILLING  
GROUT PIPES  
GROUTING  
ROCK RIP RAP  
ROCK RIP RAP PAVING  
EXPANSION JOINTS



PLAN TUNNEL #2  
SCALE 1"=50'



LONGITUDINAL SECTION OF TUNNEL #2  
HORIZONTAL SCALE 1"=200'  
VERTICAL SCALE 1"=40'

The Authority reserves the right to decrease the length of the open cut but may increase the length of pressure tunnel to correspond with the change.

The Authority reserves the right to decrease the length of the open cut but may increase the length of pressure tunnel to correspond with the change.

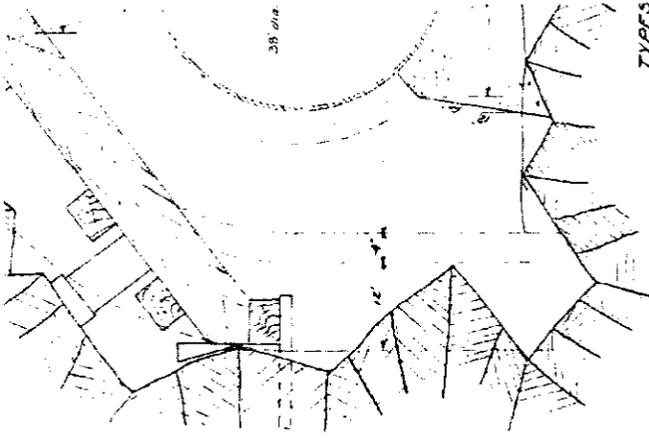
The Authority reserves the right to decrease the length of the open cut but may increase the length of pressure tunnel to correspond with the change.

Note: It may be necessary to require a portion of this section of tunnel to be constructed under Item #5

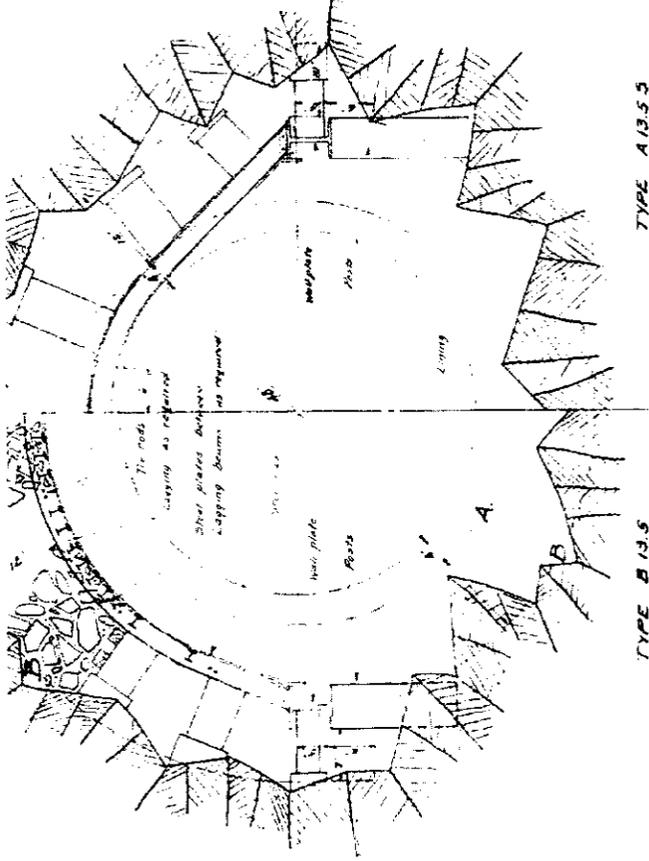
The Authority reserves the right to decrease the length of the pressure tunnel by sections and increase the length of open cut to correspond with the change.

Pre-Subs. Tunnel

Grade from section one to station 41+00 0.00%

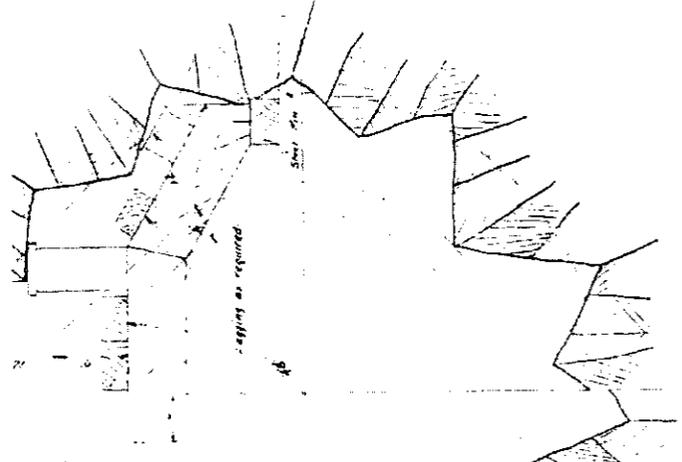


TYPES



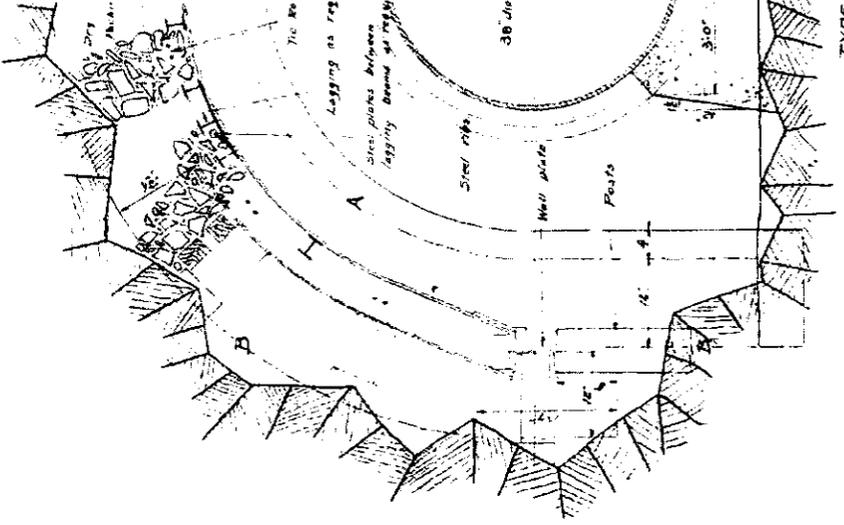
TYPE A1355

TYPES OF PRESSURE TUNNELS



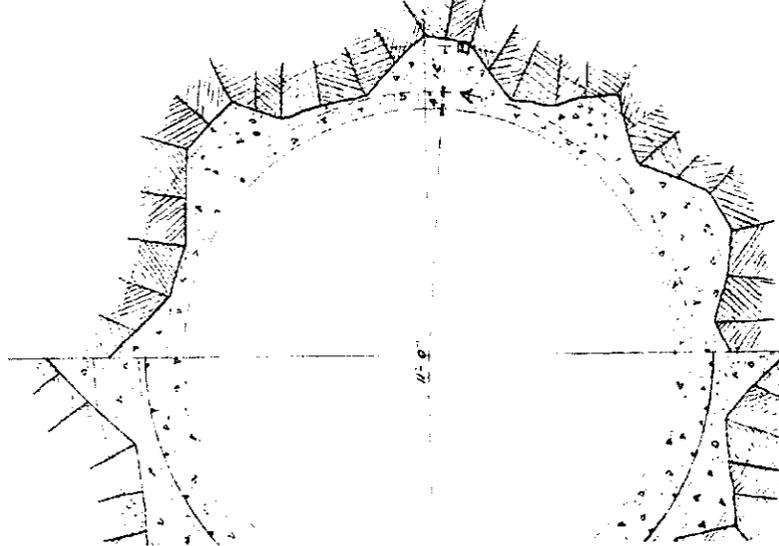
TYPE A1357

TYPES OF PRESSURE TUNNELS



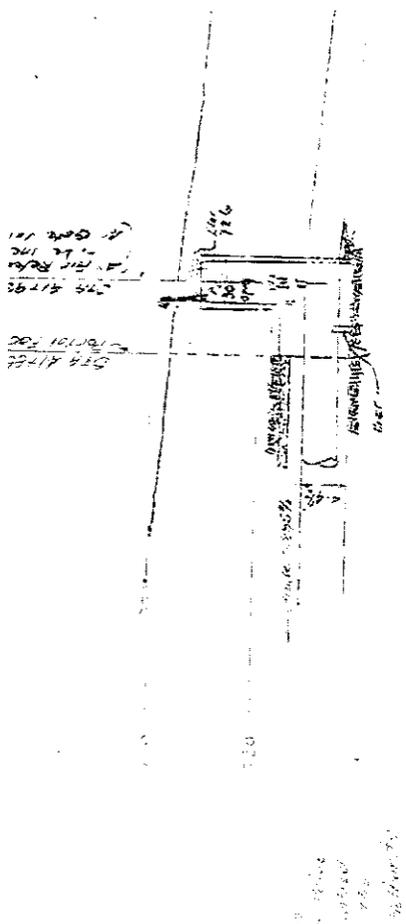
TYPES

NEVER INCLUDED IN  
CONTACT PLANS

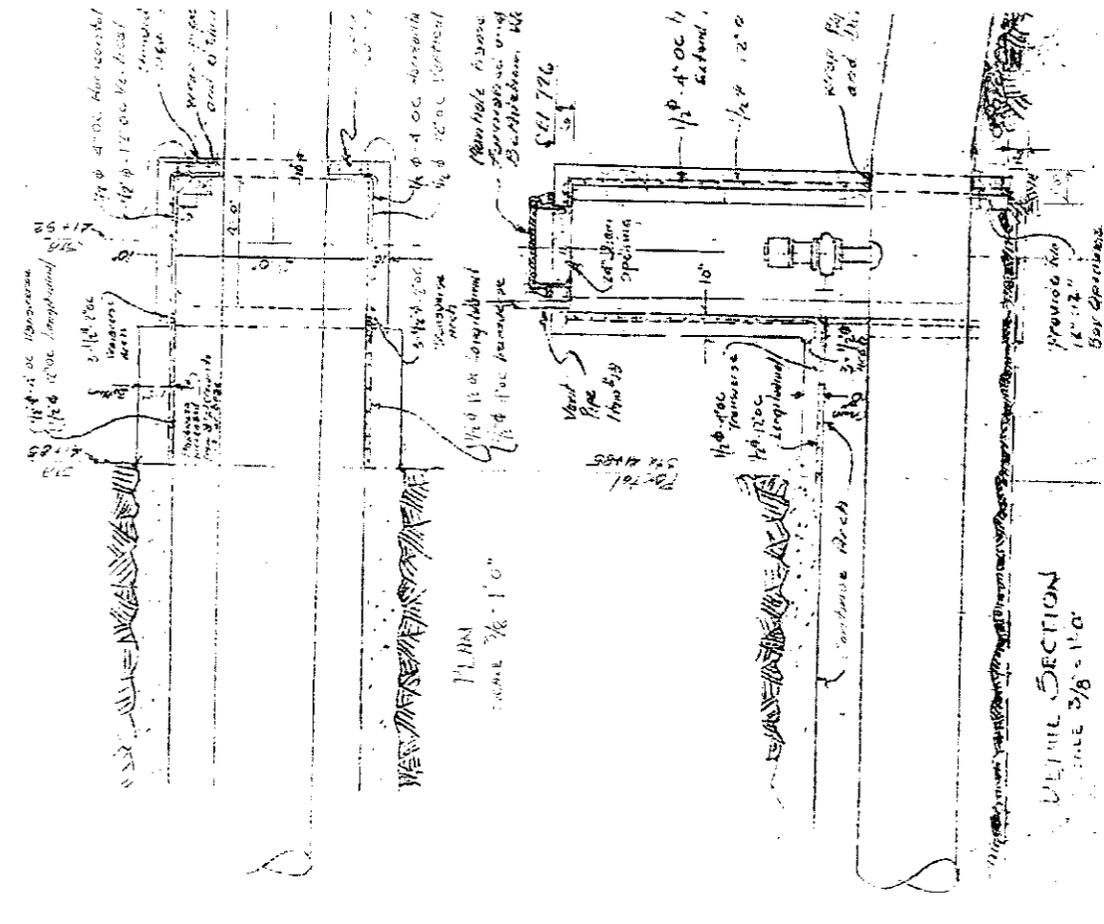


TYPE A1359

TYPES OF PRESSURE TUNNELS



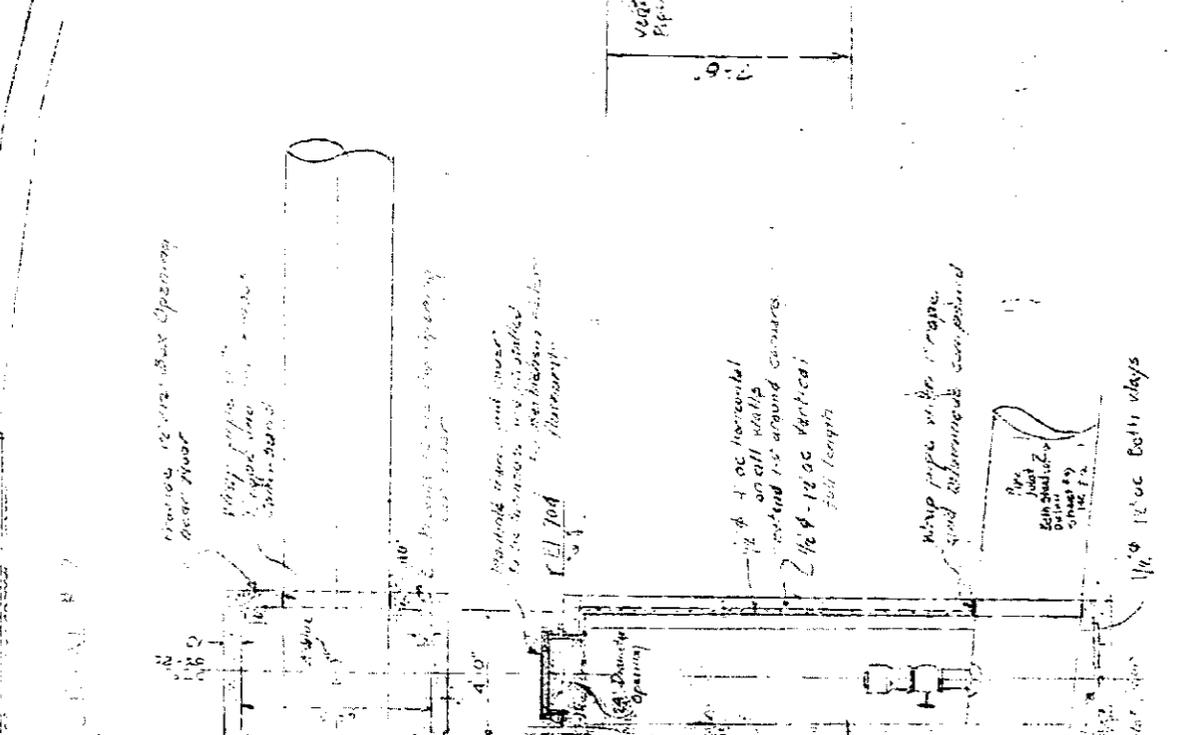
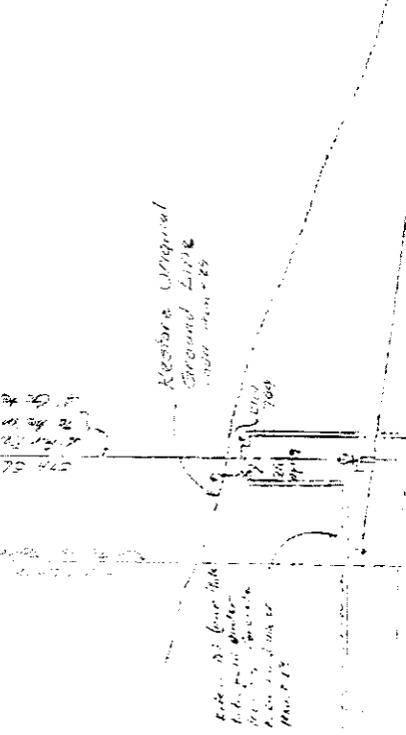
SECTION AT PORTAL #4  
SCALE 1/8" = 1'-0"



DETAIL SECTION  
SCALE 3/8" = 1'-0"

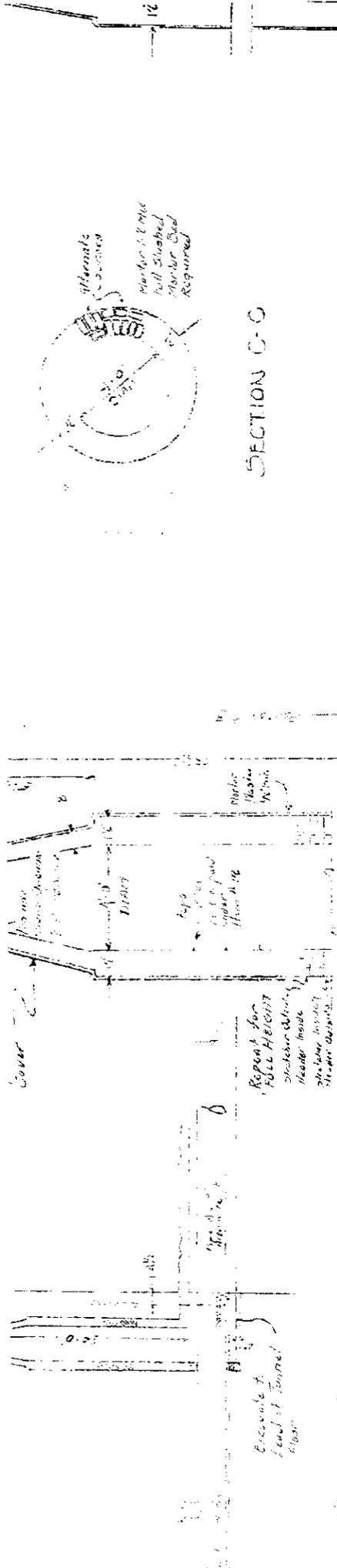
- 1. 1" dia. pipe
- 2. 1" dia. pipe
- 3. 1" dia. pipe
- 4. 1" dia. pipe
- 5. 1" dia. pipe
- 6. 1" dia. pipe
- 7. 1" dia. pipe
- 8. 1" dia. pipe
- 9. 1" dia. pipe
- 10. 1" dia. pipe
- 11. 1" dia. pipe
- 12. 1" dia. pipe
- 13. 1" dia. pipe
- 14. 1" dia. pipe
- 15. 1" dia. pipe
- 16. 1" dia. pipe
- 17. 1" dia. pipe
- 18. 1" dia. pipe
- 19. 1" dia. pipe
- 20. 1" dia. pipe

DO NOT SCALE  
DIMENSIONS



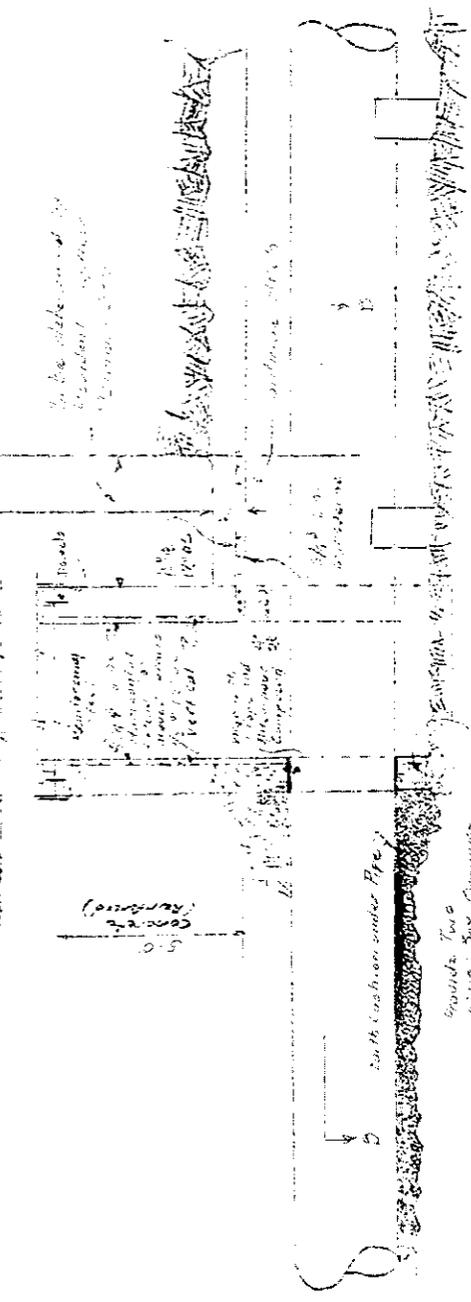
PLAN OF COVER  
Dimensions  
Notwithstanding of it

1/4" 12" OC Both ways



SECTION C-C

Horizontal Bars  
 2/1" @ 6" O.C.  
 Return 1/8" around corners  
 Vertical Bars  
 1/2" @ 12" O.C.  
 No Diagonal Bars



DETAIL OF SECTION  
 Section 36-36

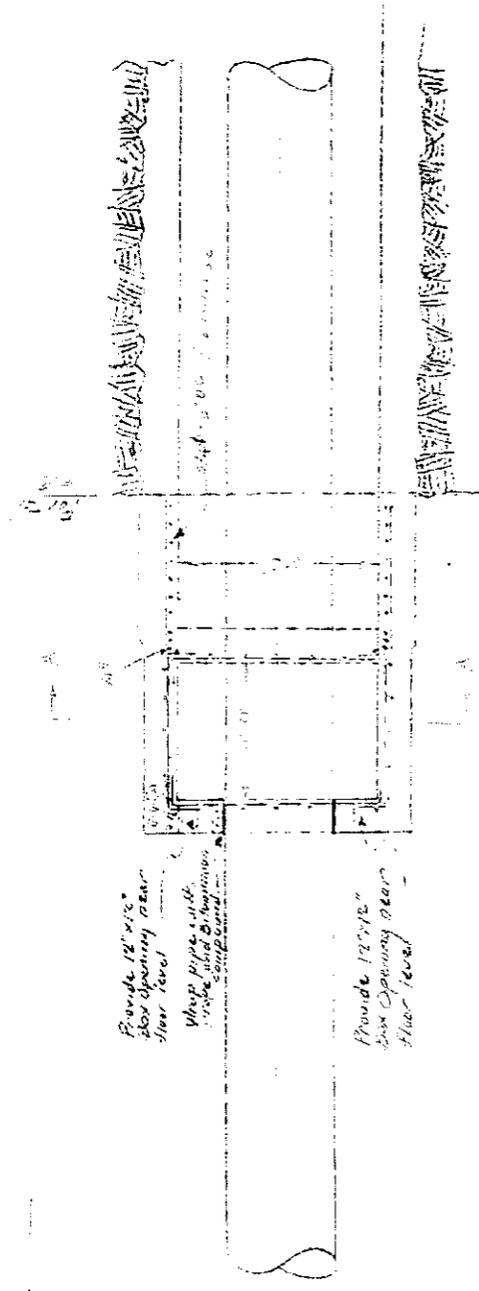
OBJECT

- Rock Excavate
- Reinforcing Sha
- Concrete Hoc
- Earth Excavate
- Brick Masonry

PLAN  
 ACCESS MAN-HOLE R  
 WILD CREEK GRAVITY

CONTRACT

SCALE AS NOTED



Provide 12" x 12" Box Opening near floor level  
 Shop pipe with 1/2" dia. 5' minimum length

Provide 12" x 12" Box Opening near floor level

*The City of Bethlehem,  
Department of Public Works*

**Final Report  
Inspection of The Blue  
Mountain and Wire  
Ridge Tunnel Portals-  
Wild Creek  
Transmission Main**

**September 1996**

**Gannett Fleming, Inc.**



**Harrisburg, Pa.**



# BETHLEHEM AUTHORITY

## Wild Creek & Tunkhannock Creek Watershed Forest Management Plan (Condensed Version)

*prepared by:*

**Woodland Management Services & The Nature Conservancy**

Bethlehem Authority: Stephen Repasch, Dan Meixell, et. al.,  
Woodland Management Services: Robin Wildemuth, Josh Flad  
The Nature Conservancy: Fran Price, Mike Eckley, et. al.,

---

**Owner:** Bethlehem Authority

**Board Members:** John Tallarico – Chairman  
Vaughn Gower – Vice Chairman  
Richard Master – Secretary  
Mark Jobs – Treasurer  
LauraLynne Burtner – Assistant Secretary/Treasurer

**Owner Contact:** 10 E. Church Street, Room B311, Bethlehem, PA 18018  
phone: 610/865-7090; [srepasch@bethlehem-pa.gov](mailto:srepasch@bethlehem-pa.gov)

**Land Manager:** 308 Egypt Road, Tafton, PA 18464  
phone: 570/857-1072; [wmsl@hughes.net](mailto:wmsl@hughes.net)

**Tract Location:** Tunkhannock - Latitude 41° 03' 00"N / Longitude 75° 27' 05"W

**Tract Location:** Wild Creek - Latitude 40° 56' 00"N / Longitude 75° 35' 00"W

**County/State:** Carbon & Monroe County, Pennsylvania

**Township:** Tunkhannock, Chestnut Hill, Jackson, Polk, Tobyhanna, Penn Forest, &  
Towamensing

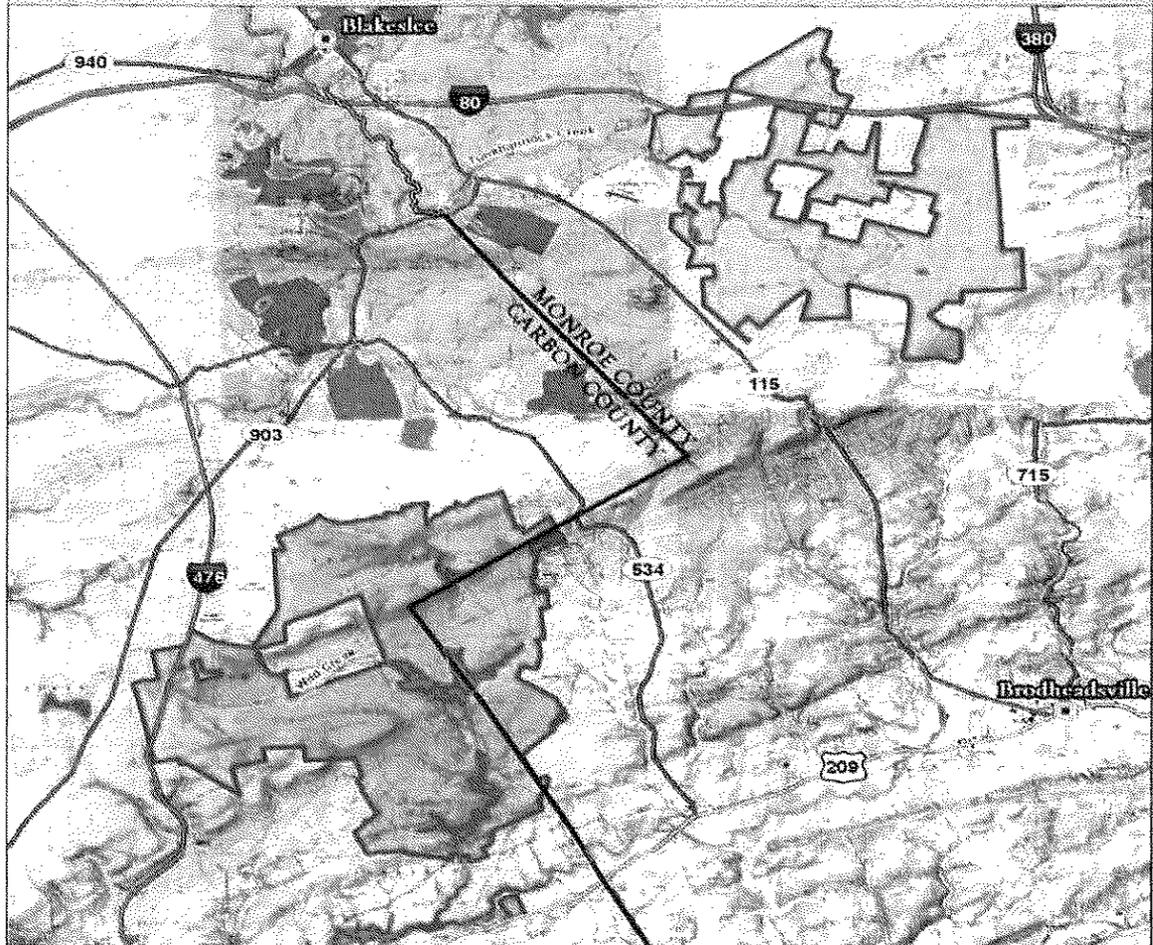
**Tract Size:** Wild Creek – 13,799 acres; Tunkhannock – 8,578 acres

**FSC Certification:** TNC PA Forest Conservation Program: Certified Resource Manager  
FSC Certificate Number: SW-FM/CoC-000238

**Implemented:** 2012

**FSC Audited:** 2012

# BETHLEHEM AUTHORITY WORKING WOODLANDS PROJECT

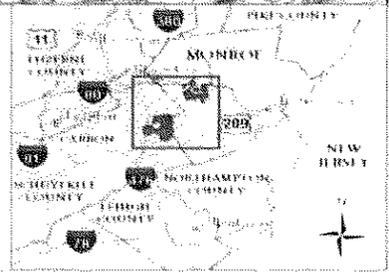


- Bethlehem Authority Property
- Lakes & Ponds
- Rivers & Streams
- Interstates
- U.S. Routes
- State Roads
- Towns

March 2011

0 1 2  
Miles

Data Sources:  
Bethlehem Authority lands from Carbon County (2011) and Monroe County (2009) parcel datasets.





# Management Zones

## Bethlehem Authority - Wild Creek Property



<ul style="list-style-type: none"> <li> Bethlehem Authority</li> <li> Management boundaries</li> <li> Map Roads</li> <li> County Boundaries</li> <li> Municipal Boundaries</li> <li><b>Wildwood Areas</b></li> <li> S-1 End</li> <li> Other Private Non-Forest</li> <li> Rivers &amp; Streams</li> <li> Bodies of Water</li> </ul>	<p><b>Management Zones</b></p> <ul style="list-style-type: none"> <li> Reserves</li> <li> Conservation Management</li> <li> Managed Forest</li> </ul> <p>Scale: 1:50,000 (1 inch = 0.833 miles) 1:100,000 (1 inch = 1.667 miles) 1:200,000 (1 inch = 3.333 miles)</p>	<p>Scale: 0 100 200 Meters</p> <p>Scale: 0 1 2 Miles</p> <p>North Arrow</p> <p>Location: 40° 50' 00" N 75° 25' 00" W</p>	<p>Bethlehem Authority - Wild Creek Property</p> <p>Lehigh &amp; Monroe Counties, Pennsylvania</p>
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DELAWARE RIVER BASIN  
TOWAMENSING TOWNSHIP, CARBON COUNTY  
PENNSYLVANIA

# WILD CREEK DAM

NDI ID No. PA-00609  
DEP ID No. 13-083

# INSPECTION REPORT

Prepared For

**CITY of BETHLEHEM (Operator)**  
**BETHLEHEM AUTHORITY (Owner)**

Bethlehem, Pennsylvania

October 2014

S. Repasch  
J.A. Andrews  
M. Pennella

**DAM INSPECTION CHECKLIST**  
**Department of Environmental Protection**  
**Bureau of Waterways Engineering**  
**Division of Dam Safety**

NAME OF DAM: Wild Creek Dam

DEF DAM NO.: 13-083

LOCATION: Municipality: Towamensing

County: Carbon

DEP CLASSIFICATION DATA: Size: Class A

Hazard: Category 1

**PHYSICAL DATA:**

Type of Dam: Zoned Earthfill

Height of Dam: 135 feet

Normal Pool Storage Capacity: 17,143 ac-ft

**ELEVATIONS:**

Normal Pool: 820 feet msl

Pool at Inspection: 820.14 feet msl

Tailwater at Inspection: flowing

DAM OWNER: Bethlehem Authority

OPERATOR: City of Bethlehem

ADDRESS: 10 East Church Street

Bethlehem, PA

PHONE: (610)-865-7090

FAX NO.: (610)-865-7042

E-MAIL ADDRESS: srepasch@bethlehem-pa.gov

**A completed and signed Dam Owners Notice Checklist is to accompany this Inspection Checklist.**

**PERSONS PRESENT AT INSPECTION:**

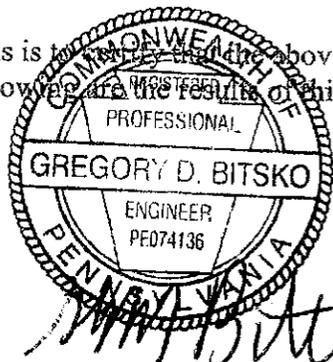
<u>Name</u>	<u>Title/Position</u>	<u>Representing</u>
<u>Michael Pennella</u>	<u>Chief Watershed Operator</u>	<u>City of Bethlehem</u>
<u>Eric T. DeRicco, C.E.T.</u>	<u>Engineering Geologist</u>	<u>Cherry Weber &amp; Associates</u>
<u>Larry Clevinger, M.E.C.I.</u>	<u>Field Inspector</u>	<u>Cherry Weber &amp; Associates</u>

DATE OF INSPECTION: 10/03/2014

WEATHER: Mostly Cloudy, Breezy

TEMPERATURE: 60°F

This is to certify that the above dam has been inspected and the following are the results of this inspection.



*Gregory D. Bitsko*

Signature of Registered Professional Engineer  
(P.E. Seal Required)

12/15/14  
Date

**PennEast Pipeline Information Session held June 3, 2015**  
**Bethlehem Authority Detailed Mapping Screen-Shot Maps**

Maser Consulting, P.A. received the 15 PennEast NG Pipeline - Screen-Shot Maps on June 5, 2015. The description of each screen-shot map (attached) is listed below:

**BA\_1:** This area is within Penn Forest Township Bethlehem Authority (BA) watershed headwaters, along Reservoir Road, west of Penn Forest Reservoir. North is at top of all screen-shot maps. The PennEast mile post markers run from north of Wilkes-Barre south to Trenton (MP-37 is thirty-seven miles south from the proposed NG pipeline origin). The lime green line with mile post markers is the proposed NG pipeline route. The red shaded area on either side is the 50' wide permanent right-of-way. The shaded yellow area is the temporary 100' wide construction easement. The brown shaded areas are anticipated additional construction easements. The orange lines are the limit of the 400' wide environmental study corridor. The purple lines are other existing liquid petroleum pipelines. The yellow lines are existing over-head electrical transmission lines.

**BA\_2:** This area is within the Penn Forest Twp. BA watershed headwaters and the proposed crossing of Wild Creek, west of and tributary to Penn Forest Reservoir.

**BA\_3:** This area is within the Towamensing Twp. BA watershed headwaters and the proposed crossing of a creek, along Lovitt Road, west of and tributary to Wild Creek Reservoir.

**BA\_4:** This area is similar to BA\_3 along Lovitt Road, west of and tributary to Wild Creek Reservoir.

**BA\_5:** This area is within BA and Beltzville State Park land, south and west of Wild Creek Dam, crossing Pohopoco Drive. Here the proposed NG Pipeline MP 42.8 was measured 1600 feet from the toe of the Wild Creek earth fill dam.

**BA\_6:** This area is south of the Pohopoco Drive, crossing Penn Forest Road and under Beltzville Lake at MP 43.5.

**BA\_7:** This area is south of Beltzville Lake, north of SR 209. The NG pipeline pivots very near the Wire Ridge Tunnel northern Portal #4 (square concrete slab near MP 43.8).

**BA\_8:** This is a zoomed-in screen-shot of the Wire Ridge Tunnel northern Portal #4 (square concrete slab near MP 43.8).

**BA\_9:** This area is south of SR 209. The Wire Ridge Tunnel southern Portal #3 is located between Strohl's Valley Rd and Spruce Hollow Rd (square concrete slab just west of blue shaded pond).

**BA\_10:** This screen-shot includes a red line drawn from portal to portal along the Wire Ridge Tunnel water transmission line and the proposed SR 209 crossing.

**BA\_11:** This zoomed-in screen-shot shows the red line as the BA water transmission line is extended along the tree-cut easement, north towards Wild Creek Dam. The pinch point near MP 43.7 was measured only 67 feet from the red water transmission line.

**BA\_12:** This screen-shot shows the red line as the BA water transmission line from the Wild Creek Dam treatment building to Wire Ridge Portal #3. The green NG line runs parallel and close to the red water transmission line.

**BA\_13:** This area is south of Wire Ridge Portal #3. The water transmission line continues southward, west of Spruce Hollow Road.

**BA\_14:** This screen-shot shows a brown shaded construction easement line under the green NG pipeline, with brown squares at either end. This represents the NG pipeline proposed horizontal directional drilling route to cross under Beltzville Lake.

**BA\_15:** This screen-shot shows the entire BA Watershed region. The PennEast NG pipeline route appears blue along the MP markers. The route travels north to south around the west side of the BA water supply reservoirs and crosses the water transmission line. We drew the green line which represents an alternate NG pipeline route east of the BA watershed. This alternate route would not cross the water transmission line.



BA\_1

MP 37

MP 37.1

MP 37.2

MP 37.3

Reservoir Rd

435 ft

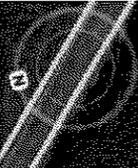
© 2015 Google

1992

Tour Guide

Google earth

Imagery Date: 5/19/2012 lat: 40.940383° lon: -75.633451° elev: 0 ft eye alt: 1936 ft



BA\_2

MP 37.7

MP 37.8

MP 37.9

© 2015 Google

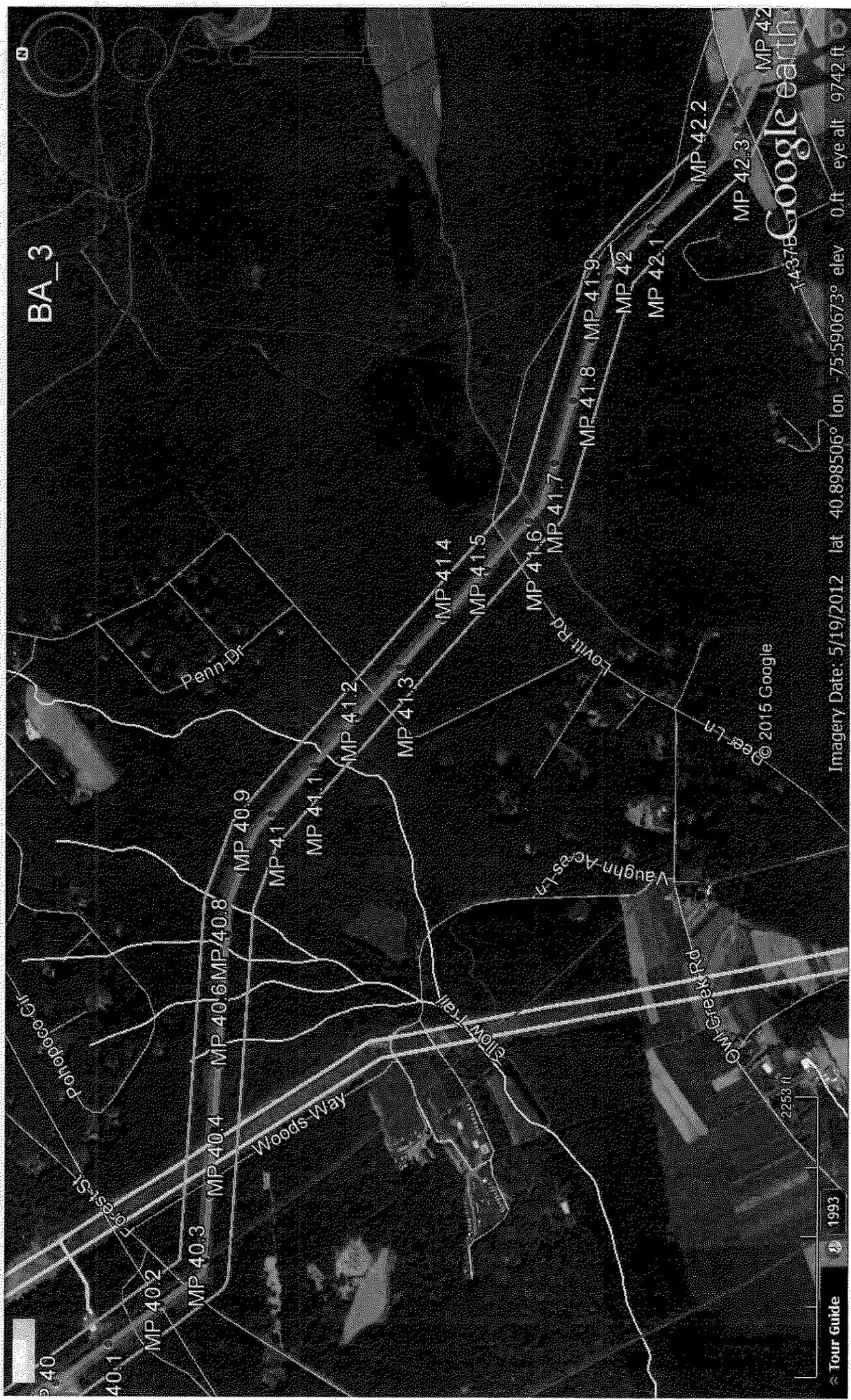
Google earth

Imagery Date: 5/19/2012 lat 40.931735° lon -75.633821° elev 0 ft eye alt 1747 ft

393 ft

1992

Tour Guide



BA\_3

0 2253 ft

Tour Guide

1993

Google earth

Imagery Date: 5/19/2012 lat 40.898506° lon -75.590673° elev 0 ft eye alt 9742 ft

40.1

MP 40.2

MP 40.3

MP 40.4

MP 40.6

MP 40.8

MP 40.9

MP 41

MP 41.1

MP 41.2

MP 41.3

MP 41.4

MP 41.5

MP 41.6

MP 41.7

MP 41.8

MP 41.9

MP 42

MP 42.1

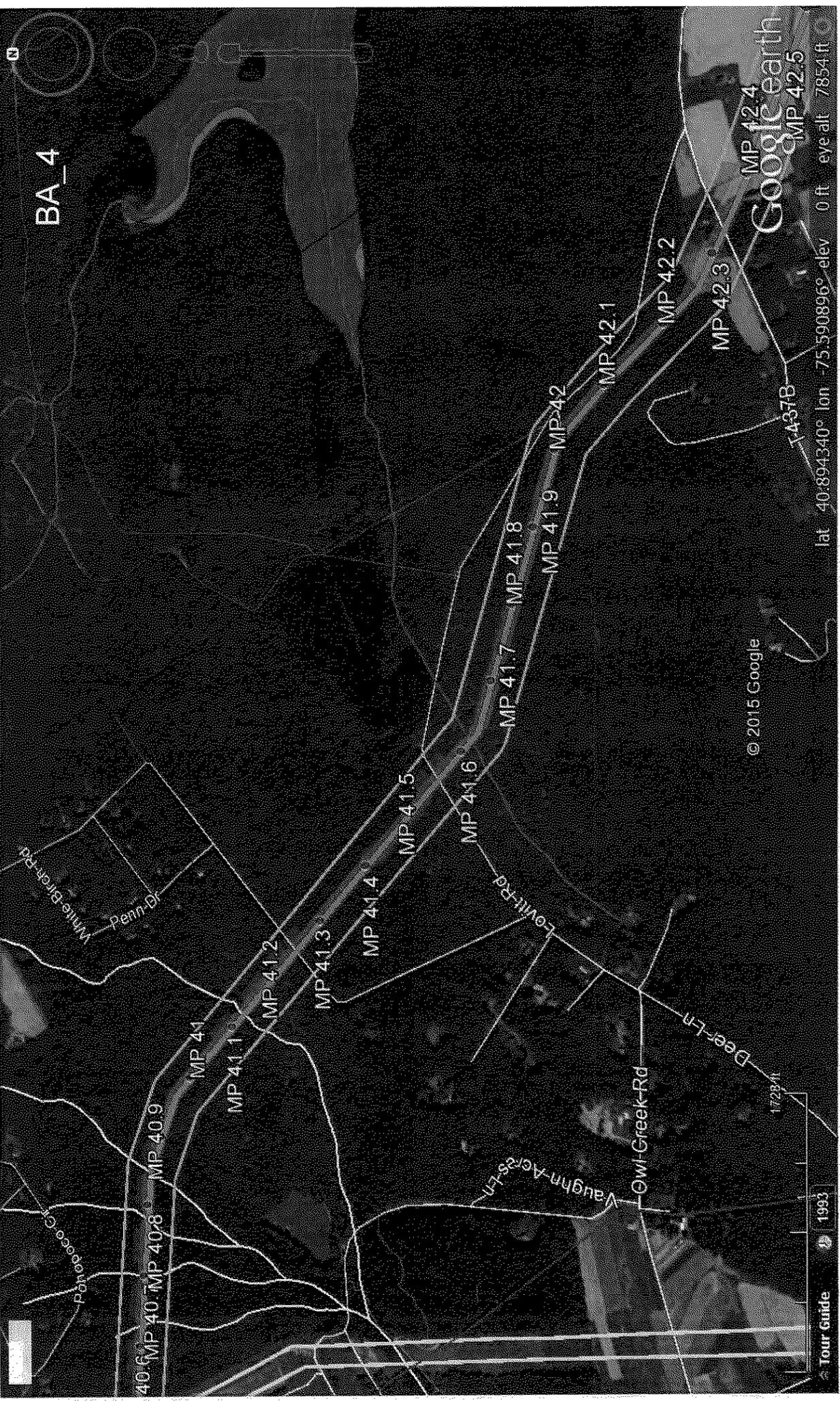
MP 42.2

MP 42.3

MP 42

MP 42.1

MP 42.2



BA\_4

40.6 MP 40 MP 40.8 MP 40.9

MP 41

MP 41.1

MP 41.2

MP 41.3

MP 41.4

MP 41.5

MP 41.6

MP 41.7

MP 41.8

MP 41.9

MP 42

MP 42.1

MP 42.2

MP 42.3

MP 42.4

MP 42.5

White Birch Rd  
Penn Dr  
Louth Rd  
Deer Ln  
Owl Creek Rd  
Vaughn Acres Ln

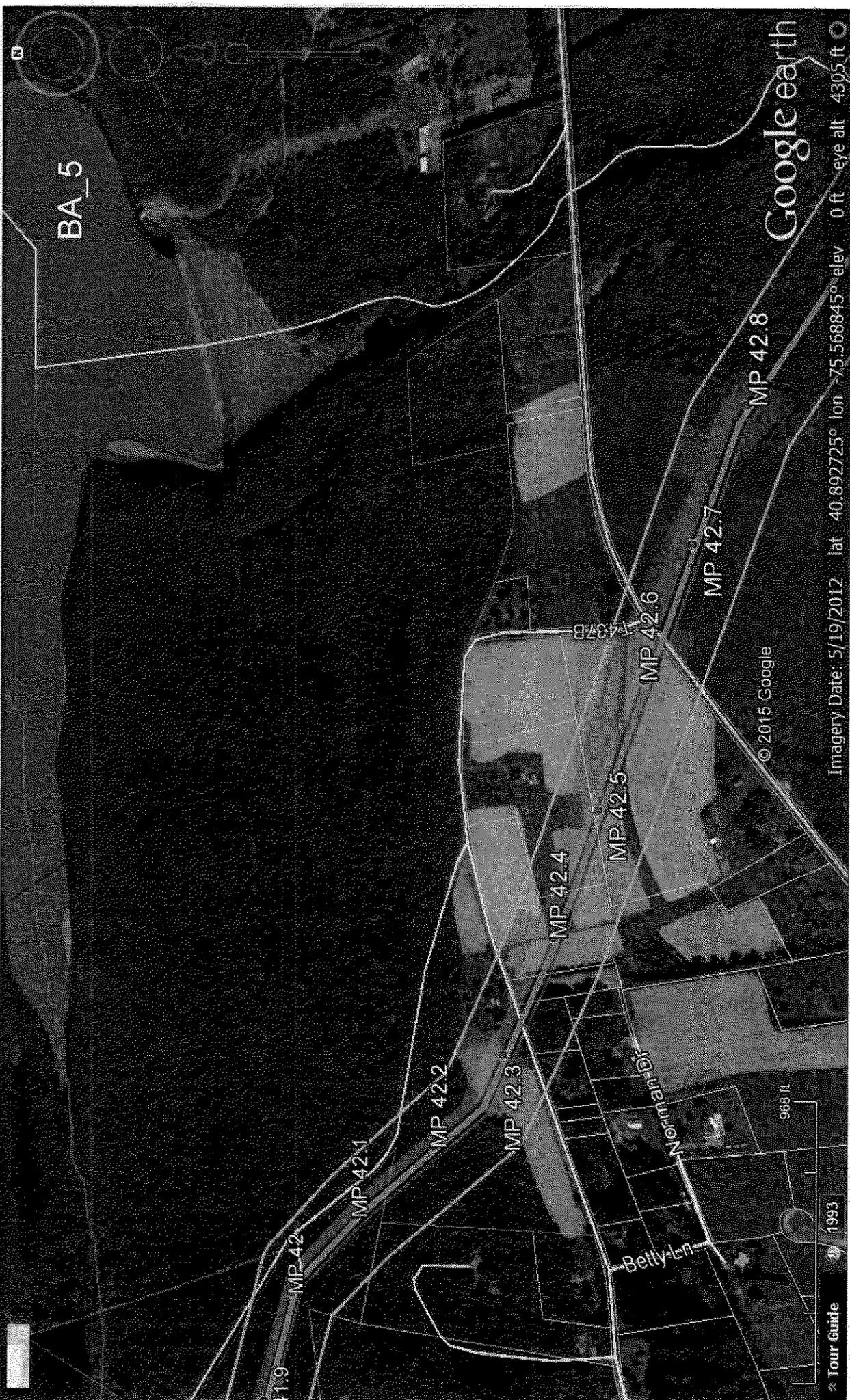
© 2015 Google

lat 40.894340° lon -75.590896° elev 0 ft eye alt 7854 ft

Tour Guide

1993

Google earth



BA\_5

MP 41.9

MP 42

MP 42.1

MP 42.2

MP 42.3

MP 42.4

MP 42.5

MP 42.6

MP 42.7

MP 42.8

Betty Ln

Northmount Dr

968 ft

1993

Tour Guide

Google earth

Imagery Date: 5/19/2012 lat: 40.892725° lon: -75.568845° elev: 0 ft eye alt: 4305 ft



BA\_6

Google earth

lat 40.889905° lon -75.554975° elev 0 ft eye alt 51.17 ft

MP 43.6

© 2015 Google

MP 43.5

MP 43.4

MP 43.3

MP 43.2

MP 43.1

MP 43

MP 42.9

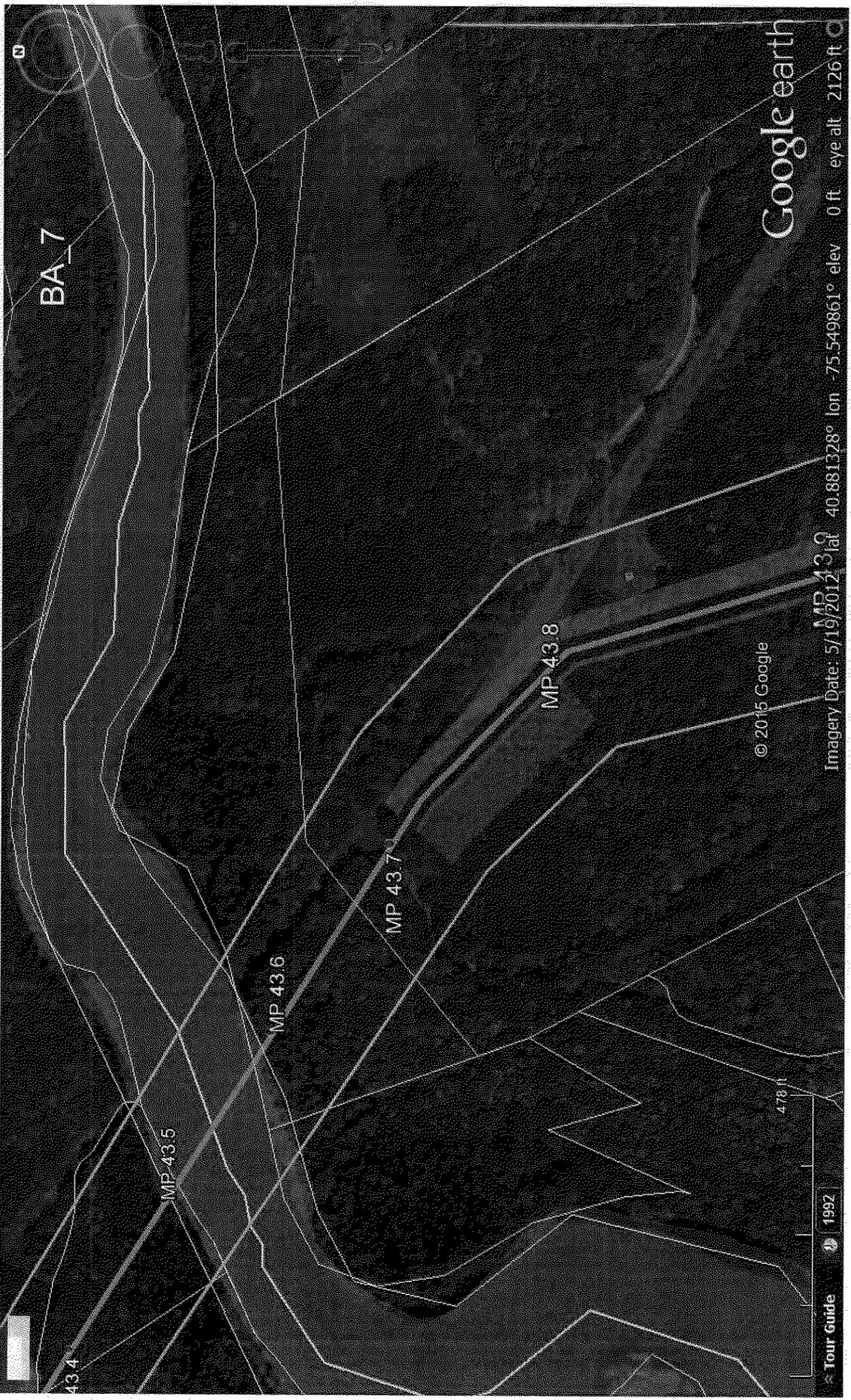
MP 42.8

MP 42.7

1145 ft

1993

Tour Guide



BA\_7

MP 43.5

MP 43.6

MP 43.7

MP 43.8

43.4

478 ft

1992

Tour Guide

© 2015 Google

MP 43.9

Imagery Date: 5/19/2012 lat 40.881328° lon -75.549861° elev 0 ft eye alt 2126 ft

Google earth



BA\_8

MP 43.8

© 2015 Google

Google earth

Imagery Date: 5/19/2012 lat: 40.880350° lon: -75.549003° elev: 0 ft eye alt: 493 ft

111 ft

1992

Tour Guide





BA\_9

MP 44.5

MP 44.6

MP 44.7

201

SenPike-Ln

Spruce-Hollow-Rd

Spruce-Hollow-Rd

Stroh-Valley-Rd

235 ft

© 2015 Google

Google earth

1992

Tour Guide

Imagery Date: 5/19/2012 lat 40.870707° lon -75.544051° elev 0 ft eye alt 1489 ft



BA\_10

MP 43.7

MP 43.8

MP 43.9

MP 44

MP 44.1

MP 44.2

MP 44.3

MP 44.4

MP 44.5

MP 44.6

MP 44.7

Firehouse Rd

209

209

201

Sleepy Hollow Rd

Interchange Rd

Anderson Dr

Barbara Ave

Beers-Country Rd

Spruce Hollow Rd

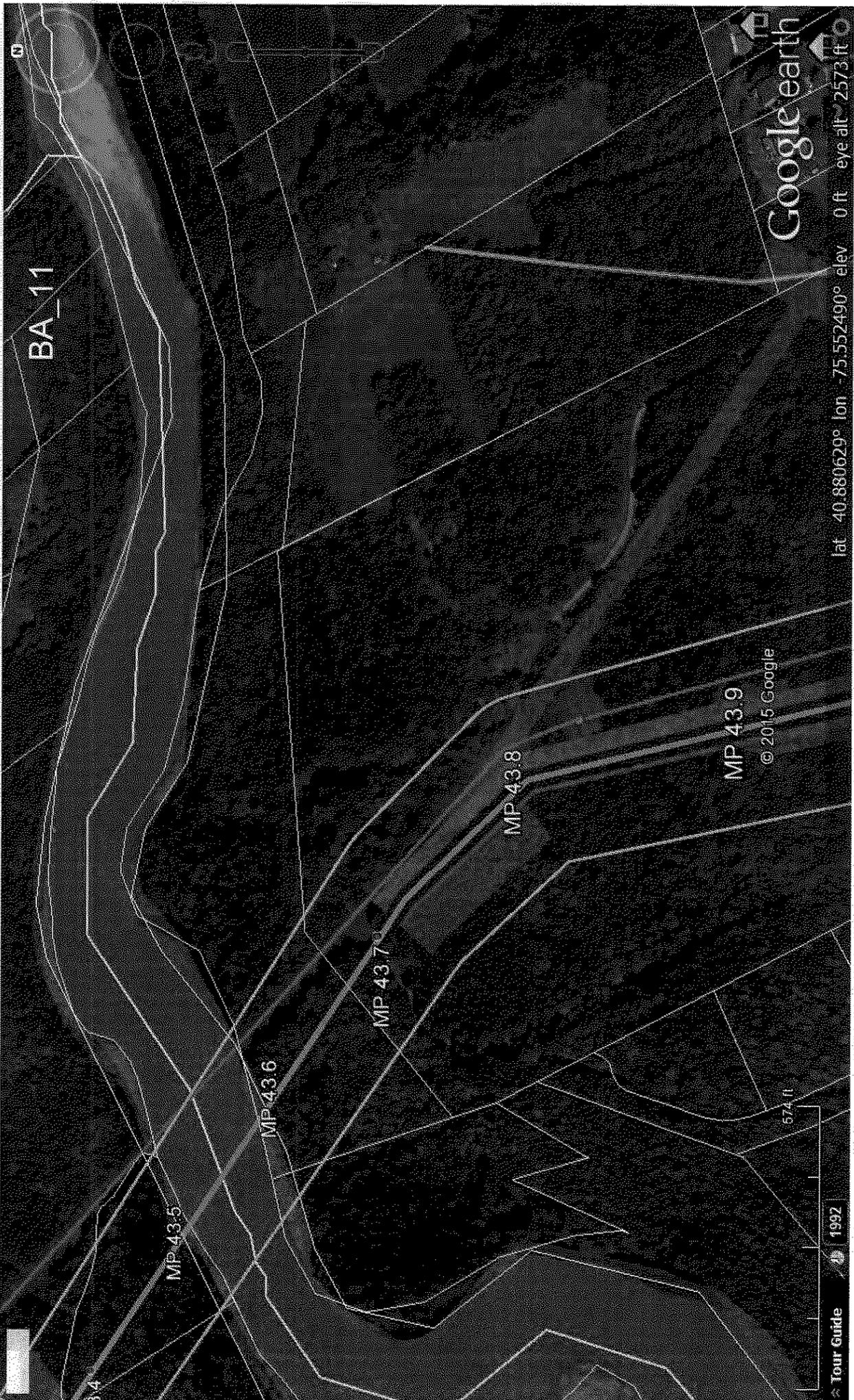
1423 ft

1992

Tour Guide

Google earth

lat: 40.873929° lon: -75.550862° elev: 0 ft eye alt: 6436 ft



BA\_11

MP 43.5

MP 43.6

MP 43.7

MP 43.8

MP 43.9

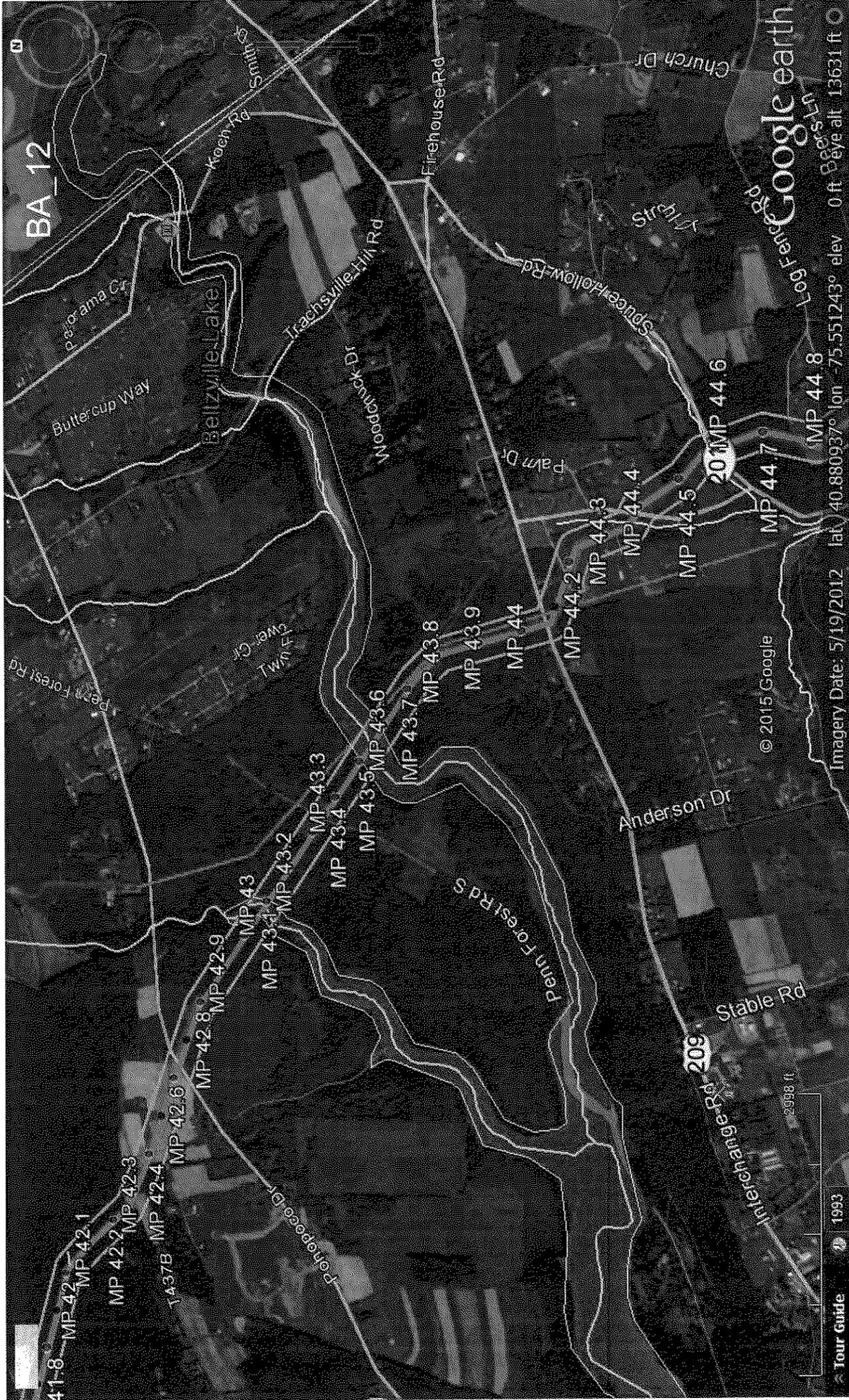
© 2015 Google

1992

Tour Guide

Google earth

lat 40.880629° lon -75.552490° elev 0 ft eye alt 2573 ft



BA\_12

Buttercup Way  
Asoroma Cr

Bellzville Lake

Trachsville Hill Rd  
Woodmark Dr

Firehouse Rd

Church Dr  
Stables

Spore Hollow Rd

Penn Forest Rd

Swet Cr  
Twin Fl

Palm Dr

MP 44.3  
MP 44.4  
MP 44.5

MP 44.6

MP 44.7

MP 44.8

MP 42.8  
MP 42.9  
MP 43.1  
MP 43.2

MP 43

MP 43.3

MP 43.4

MP 43.5

MP 43.6

MP 43.7

MP 43.8

MP 43.9

MP 44

Penn Forest Rd S

Anderson Dr

Stable Rd

209

Interchange Rd

2998 ft

41-8  
MP 42  
MP 42.1

MP 42.2  
MP 42.3  
MP 42.4  
T437B

MP 42.6

MP 43.1  
MP 43.2

MP 43.3  
MP 43.4

MP 43.5  
MP 43.6

MP 43.7  
MP 43.8

MP 43.9  
MP 44

MP 44.2  
MP 44.3

MP 44.4  
MP 44.5

MP 44.6

MP 44.7

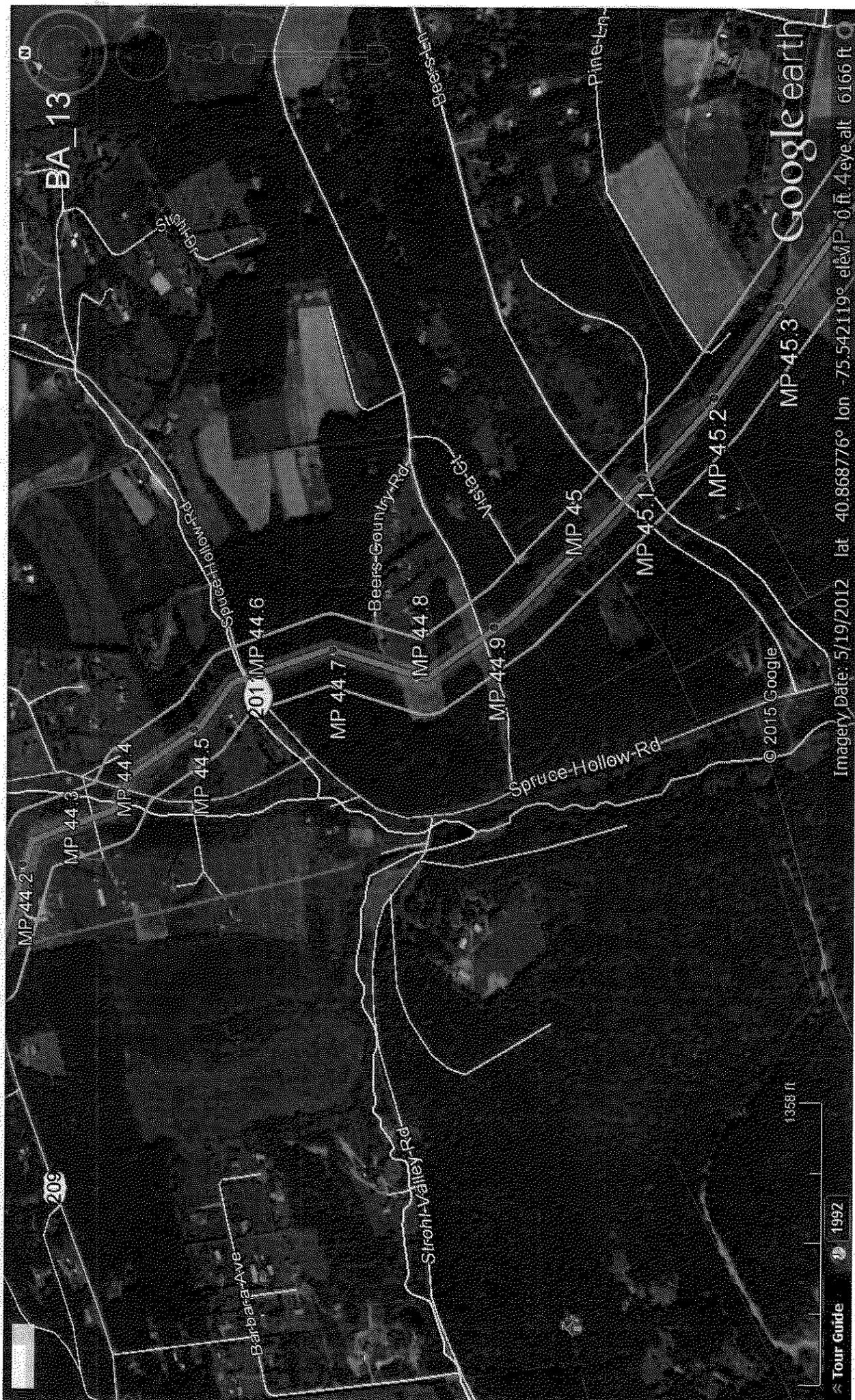
MP 44.8

Imagery Date: 5/19/2012

lat: 40.880937° lon: -75.551243° elev: 0 ft

Google earth

Tour Guide 1993



BA\_13

209

Barbara Ave

Strohi-Valley Rd

Spruce-Hollow-Rd

Beers-Country-Rd

Beers-Ln

Pine-Ln

MP 44.2

MP 44.3

MP 44.4

MP 44.5

MP 44.6

MP 44.7

MP 44.8

MP 44.9

MP 45

MP 45.1

MP 45.2

MP 45.3

© 2015 Google

1992

Tour Guide

1358 ft

Google earth

Imagery Date: 5/19/2012 lat: 40.868776° lon: -75.542119° elev: 0 ft. 4 eye alt: 6166 ft



BA\_14

Google earth

lat 40.885003° lon -75.555777° elev 0 ft eye alt 3931 ft

MP 43.2

MP 43.3

MP 43.4

MP 43.5

MP 43.6

MP 43.7

MP 43.8

MP 43.9

Penn-Fresh Rd

© 2015 Google

872ft

1992

Tour Guide



BA 15

Toll Rd 5007

Jonas

Effort

Gilbert

Kregeville

Google earth

MP 32.7  
MP 33.1  
MP 33.5  
MP 33.6  
MP 33.7  
MP 34.2

MP 34.5  
MP 34.6  
MP 35  
MP 35.4  
MP 35.8

MP 36.2  
MP 36.3  
MP 36.4  
MP 36.8

MP 37.2  
MP 37.6  
MP 38

MP 38.4  
MP 38.8  
MP 38.9  
MP 39.5  
MP 39.4  
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MP 40.3  
MP 40.7  
MP 41.1  
MP 41.6

MP 41.3  
MP 42  
MP 42.3  
MP 42.6  
MP 42.9  
MP 43.4

MP 43.8  
MP 43.9  
MP 44  
MP 44.6  
MP 44.8  
MP 45  
MP 45.2  
MP 45.7  
MP 46.1

© 2015 Google  
209  
lat 40.9185148 lon -75.677339° elev 0 ft eye alt -15.03 mi

Carbon

Jim Thorpe

3.48 mi

Tour Guide



308 Egypt Road Tafton, PA 18464  
570-390-4286  
email: rrwilderemuth@gmail.com

**Proposed Penn East Pipeline Footprint  
Impact on Timber Related Revenue and Costs**

*on Bethlehem Authority Lands in Penn Forest & Towamensing Twps., Carbon County*

**PURPOSE OF APPRAISAL**

The purpose of this report is to estimate the current market value of timber, associated costs and loss of timber related revenue including carbon credit revenue on the footprint of approximately 44 acres proposed for clearing as part of the Penn East Pipeline Project.

**INTENDED USER/FUNCTION OF APPRAISAL**

The client and intended user of this report is Bethlehem Authority, 10 East Church Street, Bethlehem, PA 18018 and any designee. The function of this report is restricted to the parties referenced for their use in valuing the timber and timber related impacts on the subject property for planning purposes.

**PROPERTY RIGHTS APPRISED**

The purpose of this report is to establish an estimate of timber related fair market value and potential damages from the proposed subject project. Rights include impacts on a Carbon Trading Contract currently in place and intended to be extended through the Working Woodlands Program for the foreseeable future under a 60 year Conservation Easement on the Bethlehem Authority lands.

**DATE OF VALUE ESTIMATE**

The report establishes an estimate of timber related revenue and cost impacts as of June 29, 2015.

**CERTIFICATION:**

I certify that to the best of my knowledge:

- The statements of fact contained in this report are true and correct.
- The report, analysis, opinions, and conclusions are limited only by the reported assumptions and limiting conditions, and are based on my professional experience and unbiased analysis, opinions, and conclusions (including other timber valuations of this type and purpose).
- My engagement for this assignment was not contingent on reporting predetermined results and my compensation for completing this project is not contingent on reporting a predetermined value that favors the cause of a client.
- I have personally inspected the subject property.

## BACKGROUND

The Bethlehem Authority (BA) owns approximately 13,800 acres in Carbon County and the western corner of Monroe County known as the Wild Creek Tract. This property is the location of the two reservoirs, namely the Wild Creek and Penn Forest, and the associated watersheds which supply high quality drinking water to the City of Bethlehem. In 2012 the BA entered the Working Woodlands Program through the Nature Conservancy (TNC) which included a Forest Stewardship Council (FSC) approved Forest Management Plan on the property, a 60 year Conservation Easement to protect the watershed, and development of carbon trading projects which integrate with the FSC Management Plan on the property's timber resources. Woodland Management Services, Inc. (WMS) completed two forest inventories in cooperation with TNC foresters, the first in 2011 which served as a basis for the FSC Management Plan and a second in 2013 which served as a basis for the Carbon Trading Contracts which have ensued. WMS has continued to implement the FSC Management Plan with ongoing budgeted timber harvests which are limited under the carbon trading contracts to a fraction of the net forest growth on the property in order to fulfill requirements for carbon capture by the forest.

Over the past 3 years, the BA Forest Management Plan has generated timber revenue of approximately \$124,000/yr while pursuing silvicultural management to increase the growth rates and health of the forest in pursuit of increased carbon capture and carbon trading revenues. Each year, budgeted harvests are verified through a third party audit process and calculations are completed on projected growth, removals, and associated carbon credits as VCU's (Voluntary Carbon Units). The proposed pipeline project will clear forestland on the subject property with loss of the value of the forest products and prevent use of the footprint for future value growth of forest products. The removal of the tons of wood fiber will result in an initial debit against the calculated VCU's, costing the BA revenue in year one of the carbon contract and also the loss of future carbon capture credits with the acres removed from the carbon project. In addition, the episode of conversion from forest timber types to pipeline land use will require mapping, acreage adjustments and verification during the following audit period which will add to verification costs in the year following construction. The following assessment will estimate the combined timber revenue and cost impacts of the Penn East Pipeline Proposal on the BA forest resource.

## PROCEDURES

To calculate the acres affected by the Penn East Proposal and the associated standing timber volumes, we used one of the screen shots provided by the company of the current approximate path of the proposed pipeline to digitize a 100 foot wide pipeline shapefile within ArcGIS software to represent the permanent and temporary construction footprint that would be cleared. This shapefile was then overlaid on the forest stands layer created during the past forest inventory efforts on the property to allow estimates of each forest type affected and the standing timber volumes estimated for each from those datasets. This allowed a calculation of the total sawtimber volume in units of thousand board feet (Mbf) and pulpwood in units of green tons. To assign values to the forest products, we used the price index published in the *PA Timber Market Report, Northeast Region, by the Penn State Cooperative Extension for the 1<sup>st</sup> quarter of 2015*. This index is based on survey data collected from sawmills, consulting foresters and Bureau of Forestry timber sales by time period and region of the state and is published at <http://extension.psu.edu/natural-resources/forests/timber-market-report>.

In addition to the loss of value in the current standing timber volumes, BA will also experience a loss in value of the future growth of the forest as it continues to grow toward a final harvest at maturity. To calculate this loss in value, it was assumed that the current management plan would preserve and manage the affected acres for an additional 20 years before the final harvest through a sequence of periodic thinnings and shelterwood cuts to withdraw some of the accumulated value of the stands. During this time period, biological growth is estimated to be 2% per year and sawtimber prices were escalated at 1.5% per year (based on 10 year price trends reported in Penn State Timber Market Report) to model annual increases in value over the 20 year period and the results discounted at 5% to arrive at a NPV (net present value) of this future value stream. The estimated value of the standing timber on the footprint of the proposed pipeline along with the NPV of the lost future growth is \$63,195. Results of this analysis are included in the Appendices.

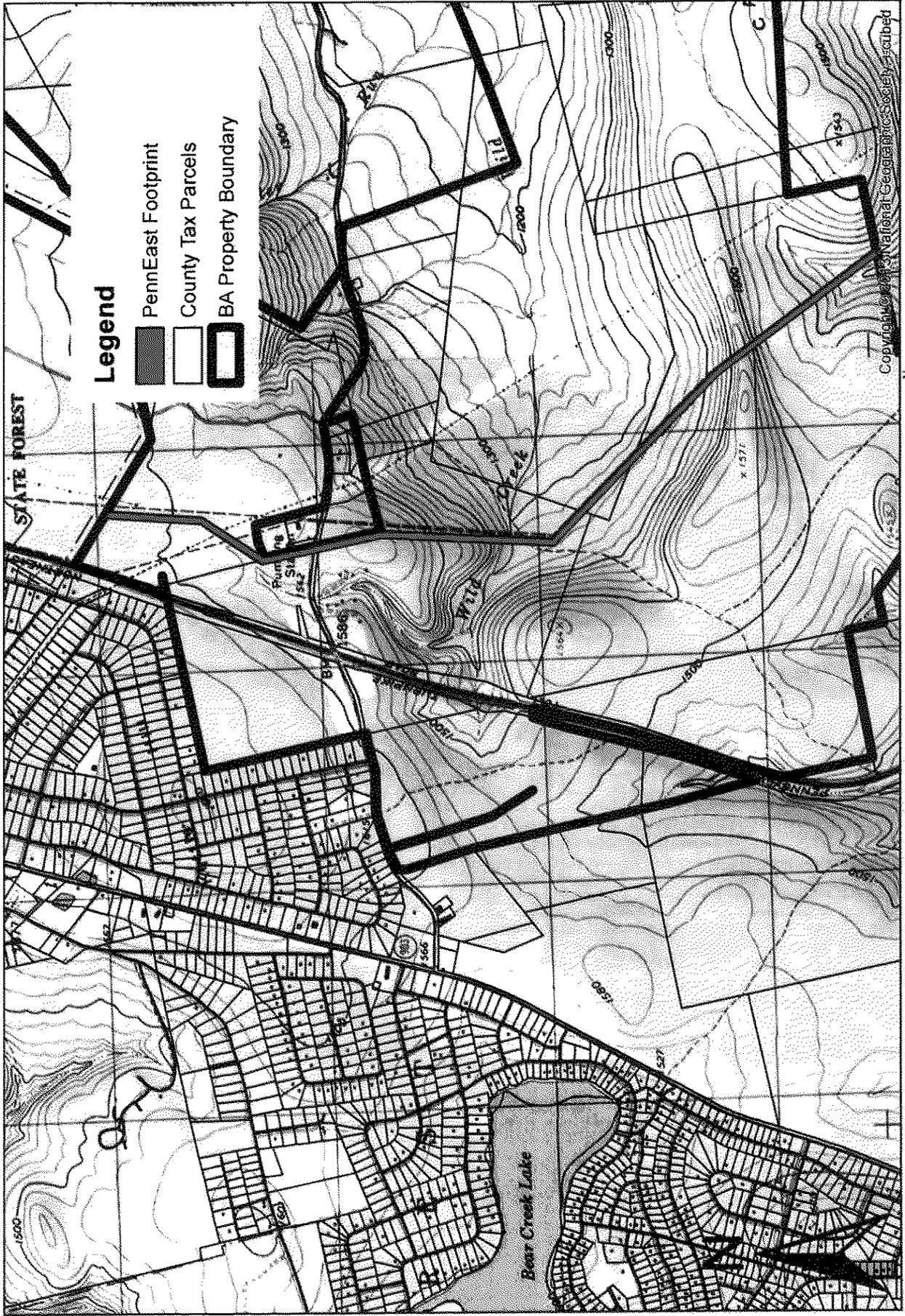
To estimate the impact on the carbon trading contracts from the conversion of the affected acres to non-forested land use, we used the estimated total green tons on the footprint of the pipeline to anticipate the impact on Voluntary Carbon Units (VCU's) and total revenue through consultations with Blue Source, the Carbon Project developer. The largest impact would be in the year the pipeline was cleared, as any removals would be deducted from annual credits. Market value of the VCU's varies year to year based on negotiations with markets and contract valuations. For this analysis we assumed \$11/VCU with an annual escalation of 3% in the market value based on recent trends. This event of pipeline construction would also require detailed mapping and reporting of the change in total standing tons, the adjustments to forest type acres in the carbon model, and audit and verification of the activities and calculations. This was estimated at an incremental project cost of \$3,000 during the first year following construction. The project developer also estimated that there would be a net loss of 80 VCU's per year based on the loss of acreage going forward and BA would see reduced revenues over an extended time period. We used a 30 year analysis period and a 5% discount rate to calculate the NPV of this lost future revenue. Total lost revenue/costs estimated for the carbon trading contracts for the proposed pipeline clearing are estimated at \$88,289. Results of this analysis are included in the Appendices.

## CONCLUSIONS

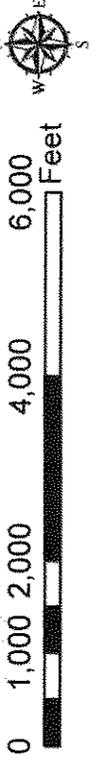
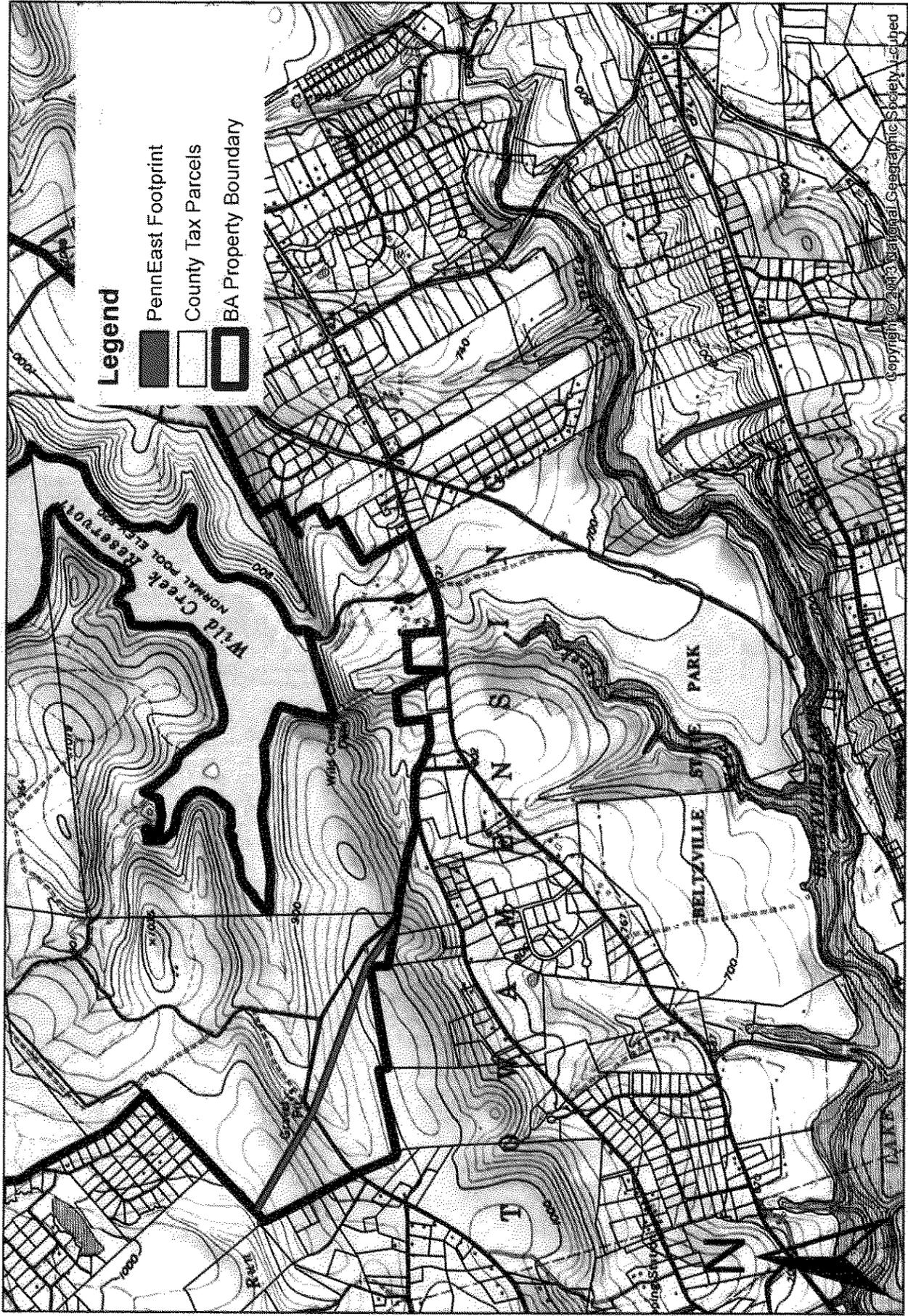
We examined the anticipated loss of forest cover and value, both current and future for the anticipated footprint of the proposed Penn East Pipeline across the BA Wild Creek property. We estimated approximately 40 acres of mixed oak and red maple forests would be cleared with impacts on current standing timber value, future timber growth, carbon credit payments both current and future, and carbon reporting/auditing costs. The total NPV of these combined impacts is estimated at \$151,484.

## APPENDICES

# BA - Penn East Pipeline Footprint Wild Creek NW



# BA - Penn East Pipeline Footprint Wild Creek South



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**Penn East Proposed Footprint - Timber Appraisal**  
**Forest Product Component**

6/29/2015

*Current Standing Volume Estimates*

Forest Type	Acres	Estimated Mbf Sawtimber	Estimated \$/Mbf #	Estimated Tons Pulpwood	Estimated \$/Ton	Total Value
Dry Oak	31	71.9	\$358	1147	\$4.00	\$30,328
Mixed Oak	8	26.1	\$358	406	\$4.00	\$10,968
Red Maple	1	2.7	\$257	28	\$4.00	\$806
<b>TOTALS</b>	<b>40</b>	<b>100.7</b>		<b>1581</b>		<b>\$42,102</b>

# - Timber Prices from PA Timber Market Report, 1st Quarter 2015, Penn State Coop Extension

*NPV of Loss of Timber Growing Potential on 40 Acres of Maturing Forestland*

- Assume:
- 2% Growth Rate of Current Standing Timber Volumes
  - 1.5% Escalation Rate of Sawtimber Prices (Avg 10 year escalation Mixed Oak and Soft Maple )
  - 5% Discount Rate in Calculation of NPV of Future Growth
  - Growth Period of 20 Years to Timber Maturity and Regeneration of Forest

NPV of 40 Acres of Timber Growth over 20 Years: \$21,093

Total Timber Value **\$63,195**

**Penn East Proposed Footprint - Timber Appraisal**  
**Carbon Revenue Component**

Initial Conversion of 42 Acres to Pipeline Use

Green Tons of wood cleared and removed would be a debit against Carbon Storage Credits on Property

Project Loss Year 1      6,000 VCU's      \$11/VCU      Total      **\$66,000**

Incremental reporting/auditing costs of the land clearing activity through      **\$3,000**

Project Loss Future Years (based on 30 year revenue stream)

80 VCUs/yr      \$11/VCU escalating at 3% per year

NPV of 30yr Cashflow      Total      **\$19,288.99**

Carbon Credit Revenue Loss TOTALS      **\$88,288.99**

**Timber Growth NPV**

**Incremental Value Growth**

Year	MBF	Price	Value
Year 0	100.7	\$355	\$35,748.50
1	102.714	\$360	\$37,010.42
2	104.7683	\$366	\$38,316.89
3	106.8636	\$371	\$39,669.48
4	109.0009	\$377	\$41,069.81
5	111.1809	\$382	\$42,519.57
6	113.4046	\$388	\$44,020.51
7	115.6726	\$394	\$45,574.44
8	117.9861	\$400	\$47,183.22
9	120.3458	\$406	\$48,848.78
10	122.7527	\$412	\$50,573.15
11	125.2078	\$418	\$52,358.38
12	127.7119	\$424	\$54,206.63
13	130.2662	\$431	\$56,120.12
14	132.8715	\$437	\$58,101.16
15	135.5289	\$444	\$60,152.13
16	138.2395	\$450	\$62,275.50
17	141.0043	\$457	\$64,473.83
18	143.8244	\$464	\$66,749.75
19	146.7009	\$471	\$69,106.02
20	149.6349	\$478	\$71,545.46

NPV @5% = \$21,092.99

**Carbon Credit Loss**

Year	VCU's	Price	Revenue
1	80	\$11.00	\$880
2	80	\$11.33	\$906
3	80	\$11.67	\$934
4	80	\$12.02	\$962
5	80	\$12.38	\$990
6	80	\$12.75	\$1,020
7	80	\$13.13	\$1,051
8	80	\$13.53	\$1,082
9	80	\$13.93	\$1,115
10	80	\$14.35	\$1,148
11	80	\$14.78	\$1,183
12	80	\$15.23	\$1,218
13	80	\$15.68	\$1,255
14	80	\$16.15	\$1,292
15	80	\$16.64	\$1,331
16	80	\$17.14	\$1,371
17	80	\$17.65	\$1,412
18	80	\$18.18	\$1,455
19	80	\$18.73	\$1,498
20	80	\$19.29	\$1,543
21	80	\$19.87	\$1,589
22	80	\$20.46	\$1,637
23	80	\$21.08	\$1,686
24	80	\$21.71	\$1,737
25	80	\$22.36	\$1,789
26	80	\$23.03	\$1,843
27	80	\$23.72	\$1,898
28	80	\$24.43	\$1,955
29	80	\$25.17	\$2,013
30	80	\$25.92	\$2,074

NPV @ 5% for 30 yrs \$19,288.99

Pennsylvania Woodlands  
**TIMBER MARKET REPORT**

*January-March 2015*

Stumpage Prices

(\$ per MBF International 1/4")

Species by Region	Minus 1 Std Dev	Average	Plus 1 Std Dev	N#
<b>NORTHEAST</b>				
Northern Red Oak	\$377	\$483	\$588	12
White Oak	\$285	\$407	\$529	11
Mixed Oak	\$277	\$358	\$439	11
Black Cherry	\$146	\$659	\$1,173	4
White Ash	\$189	\$280	\$370	5
Hard Maple	\$340	\$428	\$516	3
Soft Maple	\$171	\$257	\$343	13
Yellow-Poplar	\$196	\$259	\$321	4
Misc. Hardwoods	\$39	\$53	\$66	2
White Pine	\$62	\$181	\$300	2
Hemlock	\$24	\$137	\$250	3
<b>SOUTHEAST</b>				
Northern Red Oak	\$480	\$584	\$688	6
White Oak	\$368	\$464	\$561	6
Mixed Oak	\$344	\$445	\$546	6
Black Cherry	\$674	\$695	\$715	2
White Ash	\$356	\$370	\$384	2
Hard Maple	\$0	\$560	\$0	1
Soft Maple	\$210	\$262	\$314	3
Yellow-poplar	\$303	\$360	\$417	2
Misc. Hardwoods	\$192	\$226	\$260	6
White Pine	\$0	\$0	\$0	0
Hemlock	\$0	\$0	\$0	0
<b>NORTHWEST</b>				
Northern Red Oak	\$273	\$450	\$627	14
White Oak	\$237	\$383	\$529	8
Mixed Oak	\$0	\$506	\$1,171	11
Black Cherry	\$443	\$745	\$1,047	19
White Ash	\$209	\$286	\$364	11
Hard Maple	\$223	\$354	\$486	12
Soft Maple	\$176	\$263	\$350	19
Yellow-poplar	\$74	\$124	\$173	10
Misc. Hardwoods	\$21	\$80	\$140	14
White Pine	\$25	\$57	\$89	5
Hemlock	\$2	\$67	\$133	7
<b>SOUTHWEST</b>				
Northern Red Oak	\$359	\$479	\$599	8
White Oak	\$359	\$451	\$542	6
Mixed Oak	\$188	\$321	\$454	8
Black Cherry	\$256	\$416	\$576	6
White Ash	\$80	\$219	\$358	4
Hard Maple	\$123	\$303	\$484	4
Soft Maple	\$122	\$227	\$333	7
Yellow-poplar	\$131	\$221	\$312	6
Misc. Hardwoods	\$9	\$97	\$186	4
White Pine	\$13	\$64	\$115	2
Hemlock	\$23	\$39	\$55	2

#n is the number of responses used to calculate the price statistics.

Conversion Factors:

Doyle Price = 1.695 x International 1/4" Price | Scribner Price = 1.159 x International 1/4" Price



# Pennsylvania Woodlands

## TIMBER MARKET REPORT

Courtesy of The Pennsylvania State University  
Cooperative Extension

1st Quarter  
2015  
January-March

### Pulpwood Stumpage...

#### Private and Other Public Pulpwood Stumpage

Region	Hardwood Pulp (\$/ton)			
	Low	Avg	High	(n)#
Northeast	*	\$4.13	*	2
Southeast	*	\$3.25	*	2
Northwest	\$0.83	\$2.15	\$4.50	13
Southwest	*	\$4.00	*	2

	Softwood Pulp (\$/ton)			
	Low	Avg	High	(n)#
Northeast	^	^	^	1
Southeast	^	^	^	1
Northwest	\$0.83	\$4.25	\$10.00	6
Southwest	^	^	^	1

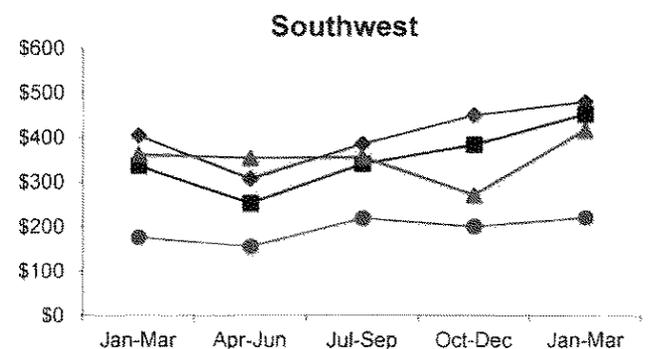
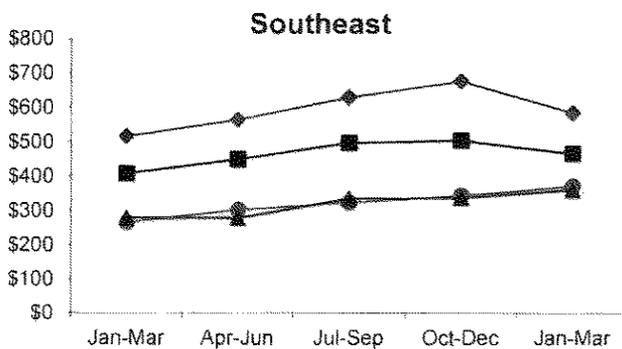
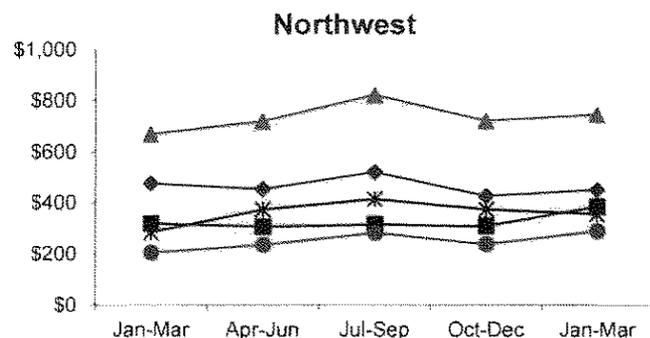
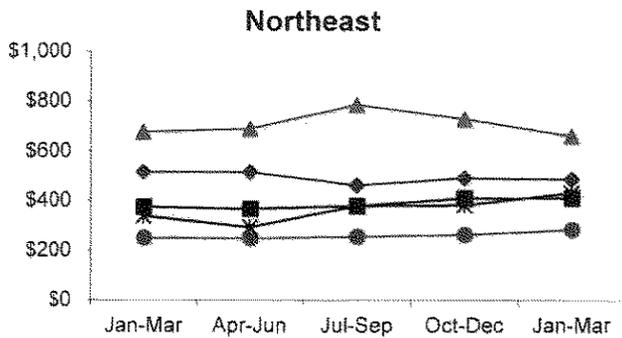
#### Bureau of Forestry Pulpwood Stumpage

Region	Hardwood Pulp (\$/ton)			
	Low	Avg	High	(n)#
Northeast	\$1.62	\$4.64	\$13.29	9
Southeast				0
Northwest	\$7.28	\$7.92	\$8.57	3
Southwest	\$1.73	\$4.85	\$6.24	5

	Softwood Pulp (\$/ton)			
	Low	Avg	High	(n)#
Northeast	\$2.14	\$6.71	\$17.51	9
Southeast				0
Northwest	\$9.59	\$10.44	\$11.30	3
Southwest	\$2.28	\$6.28	\$8.23	5

^ No prices are reported for samples with only a single respondent.

\* Ranges are not reported for samples with fewer than three respondents.



◆ No. Red Oak    ■ White Oak    ▲ Black Cherry    ● White Ash    ✱ Hard Maple