

Headwater Stream Restoration

Thomas A. Graupensperger



Dewberry



PENNDOT

District 6-0

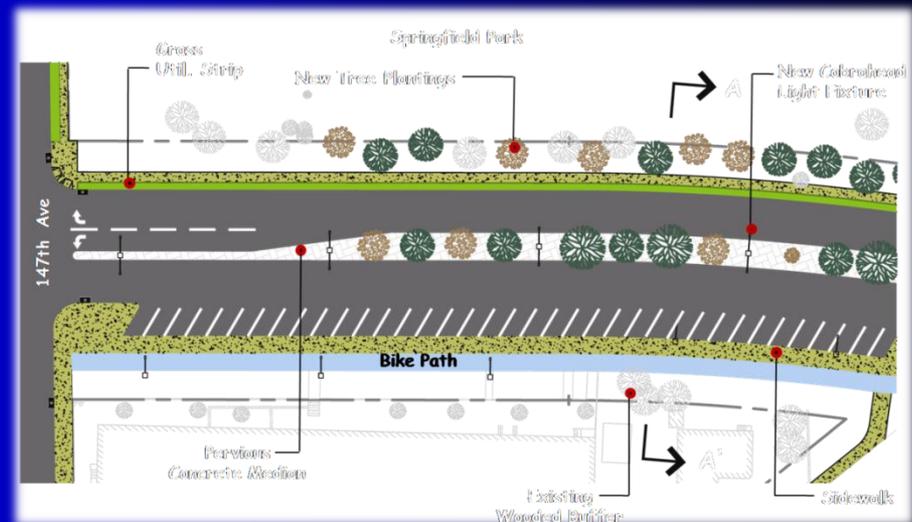
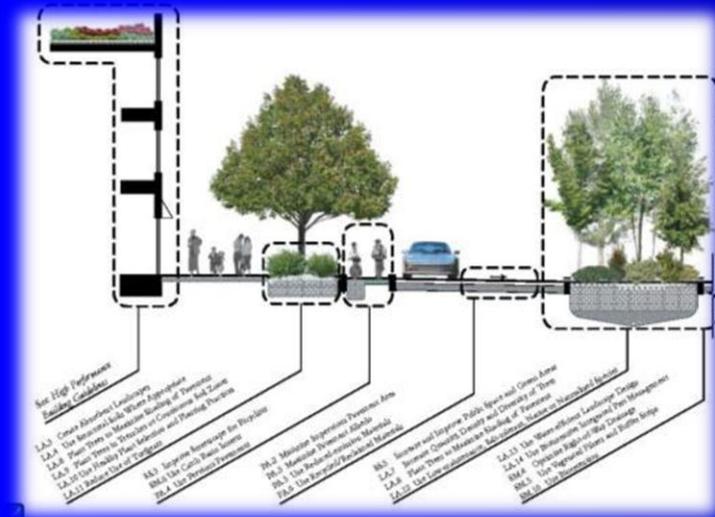


EXTON-PAOLI

Acknowledgements:
Michael Baker Corporation
Jacobs Engineering
GTS Technologies
HRG Inc.

Headwater Systems

- Smaller catchment/drainage areas
- Steeper stream channel gradients (velocity/bedload)
- Direct hydrogeologic connection and response
- More readily impaired by impervious cover changes
- Associated collection and conveyance alternations
- Subject to rapid, high flow stormwater runoff response
- Shorter duration higher intensity events of recent experience



above: NYC's High Performance Infrastructure Guidelines

Watershed and Site Specific Considerations

Man made:

- Historical and recent prior land development and watershed alteration
- Infrastructure (roads, sewers, storm sewers and outfalls, other utilities)
- Park and recreation and trail facilities

Natural:

- Unique or Karst subsurface hydrogeologic conditions
- Deep colluvial soils
- Thick alluvium and legacy sediments
- Protected wetlands, threatened and endangered species habitat
- Site restoration alternatives analysis, design and construction phase evaluations
- Opportunities and Constraints

Green/Sustainable (Site) BMP Strategies

Protect Resources

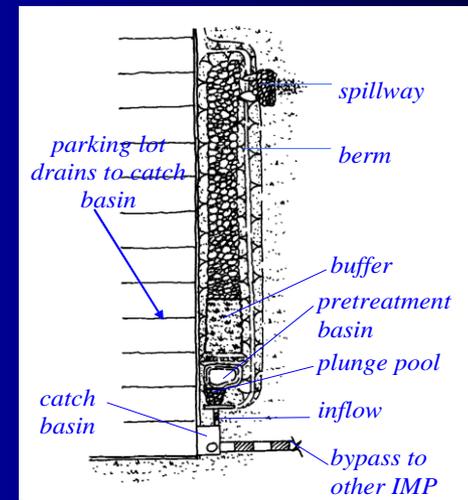
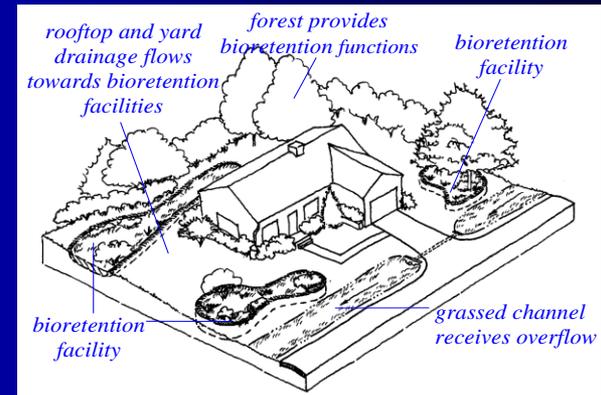
- Site Assessment and Resource Inventory

Maintain /Restore pre-development hydrologic conditions

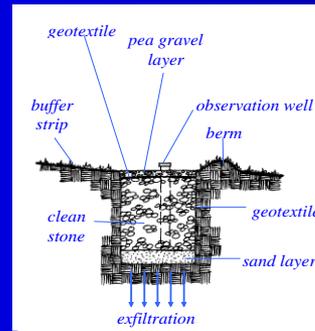
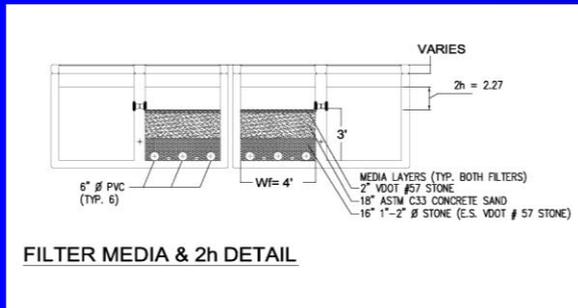
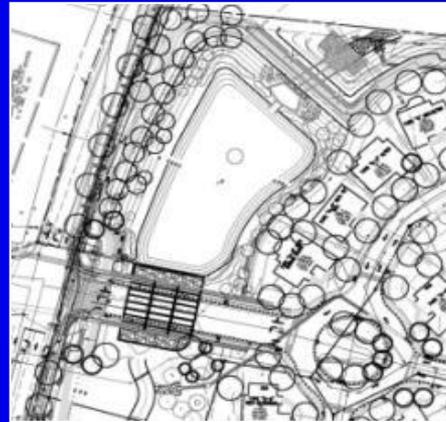
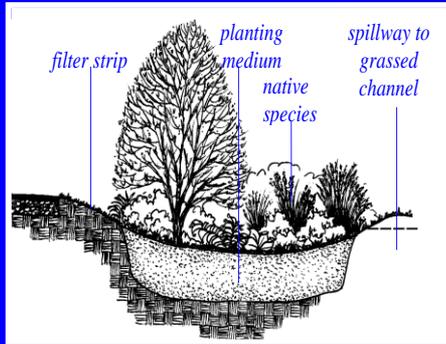
- Conservation and Minimization: Limit Disturbance, Impervious
- Pollution Prevention: E&S Control; SWM Quantity, Quality

Enhance Design

- Encourage energy efficiency through well designed site features
- Smart Material Selection
- Explore innovative alternatives
- Create design synergies



Green/LID Stormwater (BMPs)



Quantity Control

- Rate= Detention/Retention
- Volume= Infiltration or Reuse

Quality Control

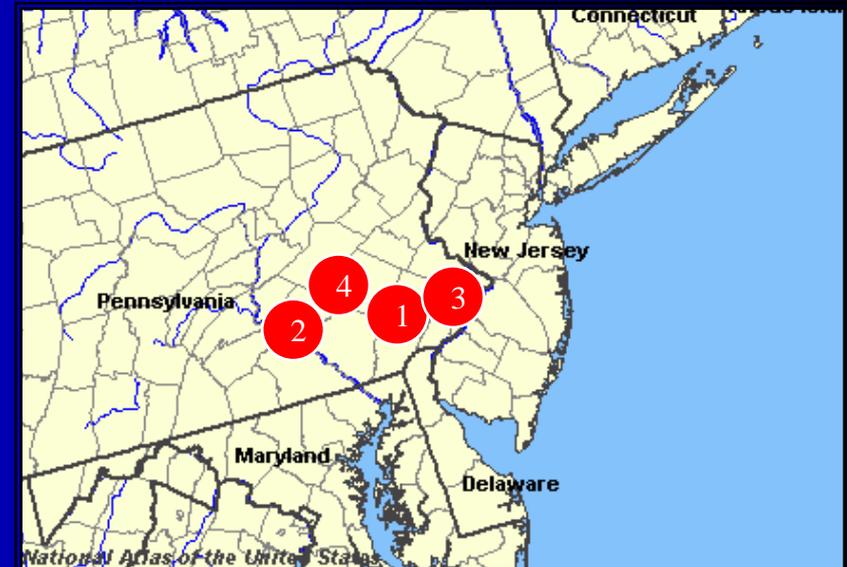
- Filtration
- Sedimentation

Integrated Management Practices (IMPs)

- encourage infiltration
- interact with other site systems and runoff sources

Headwater Stream Restoration

1. Mill Lane Tributary to Valley Creek, Chester County, PA: Lower Piedmont, Legacy sediments over karst drainage, sanitary sewer conflicts. Location: Ecology Park, East Whiteland Township, PA
2. Bullfrog Valley Road, Mill Creek Tributary, Hershey, PA: Upper Piedmont, Colluvium over karst terrain, gas line conflicts. Location: Millpond Park, Derry Township, PA
3. Bells Mill Run Tributary to Wissahickon Creek, Philadelphia, PA: Upper Coastal Plain, Metamorphosed Schist, Stormwater outfalls and sanitary sewer lines. Location: Fairmount Park, Philadelphia, PA
4. Tributary to Quittapahilla Creek, Annville, Lebanon County, PA: Upper Piedmont, Limey shale with Swallow holes, stormwater pond, dam and bridge. Lebanon Valley College Campus Natural Area, Annville, PA



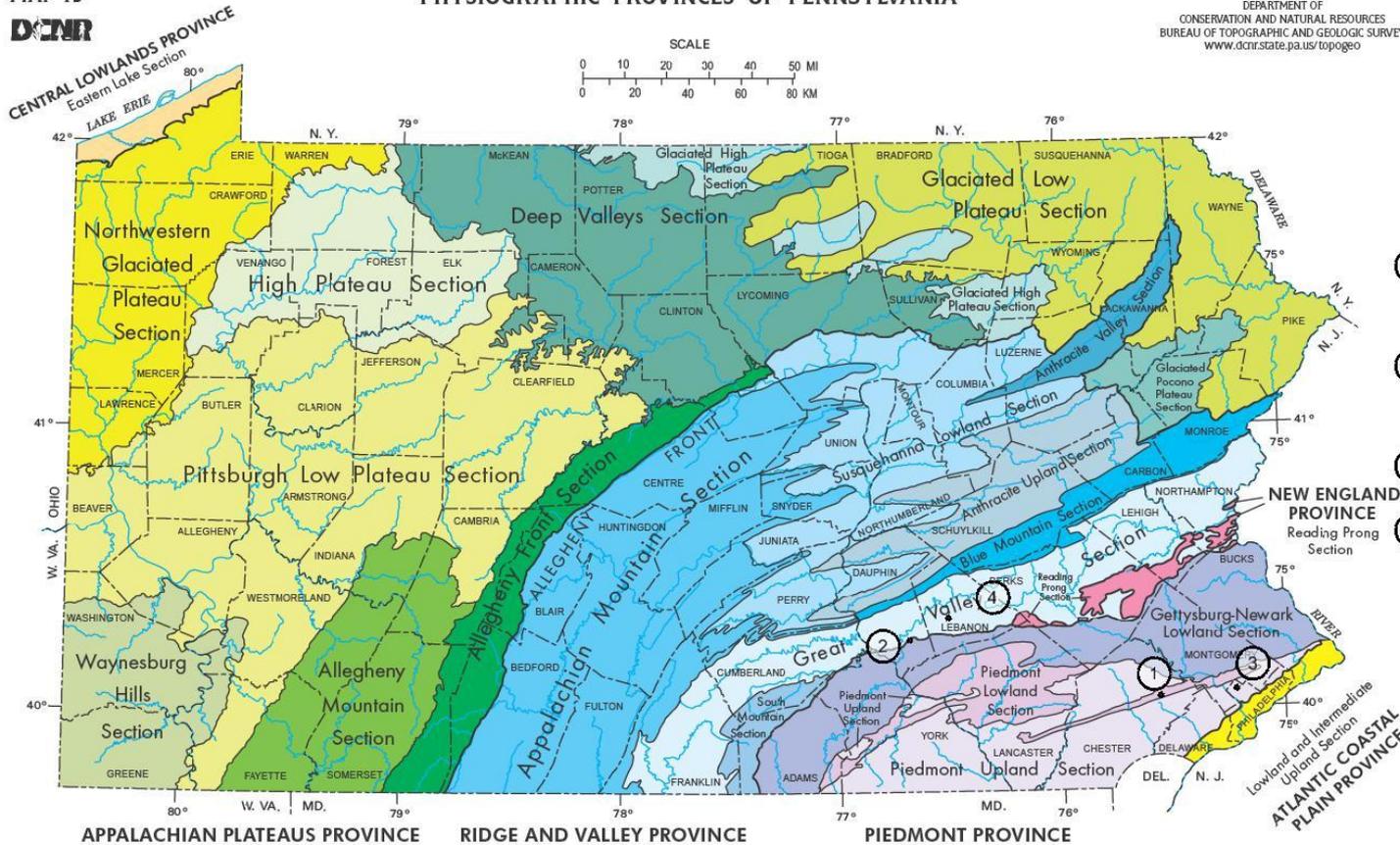
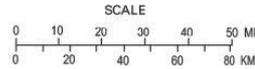
Physiographic Map of PA

MAP 13



PHYSIOGRAPHIC PROVINCES OF PENNSYLVANIA

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF
CONSERVATION AND NATURAL RESOURCES
BUREAU OF TOPOGRAPHIC AND GEOLOGIC SURVEY
www.dcnr.state.pa.us/topogeo



- 1 Valley Creek Mill
Lane Tributary
East Whiteland Township
Chest County
- 2 Mill Pond Tributary
Bullfrog Valley Road
Derry Township
Dauphin County
- 3 Bells Mill Run
Philadelphia, PA
- 4 Unnamed Tributary
to Quitapahilla Creek
Lebanon Valley College
Anneville, PA

EXPLANATION

<p>CENTRAL LOWLANDS PROVINCE</p> <ul style="list-style-type: none"> Eastern Lake Section Northwestern Glaciated Plateau Section High Plateau Section Pittsburgh Low Plateau Section 	<p>APPALACHIAN PLATEAUS PROVINCE</p> <ul style="list-style-type: none"> Waynesburg Hills Section Allegheny Mountain Section Allegheny Front Section Deep Valleys Section Glaciated High Plateau Section Glaciated Low Plateau Section Glaciated Pocono Plateau Section 	<p>EDGE AND VALLEY PROVINCE</p> <ul style="list-style-type: none"> Appalachian Mountain Section Susquehanna Lowland Section Anthracte Valley Section Anthracte Upland Section Blue Mountain Section Great Valley Section South Mountain Section 	<p>NEW ENGLAND PROVINCE</p> <ul style="list-style-type: none"> Reading Prong Section 	<p>PIEDMONT PROVINCE</p> <ul style="list-style-type: none"> Gettysburg-Newark Lowland Section Piedmont Lowland Section Piedmont Upland Section 	<p>ATLANTIC COASTAL PLAIN PROVINCE</p> <ul style="list-style-type: none"> Lowland and Intermediate Upland Section 	<p>SYMBOLS</p> <ul style="list-style-type: none"> Approximate boundary between physiographic provinces Approximate boundary between physiographic sections
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compiled by W. D. Sevon, Fourth Edition, 2000.

Geologic Map of PA

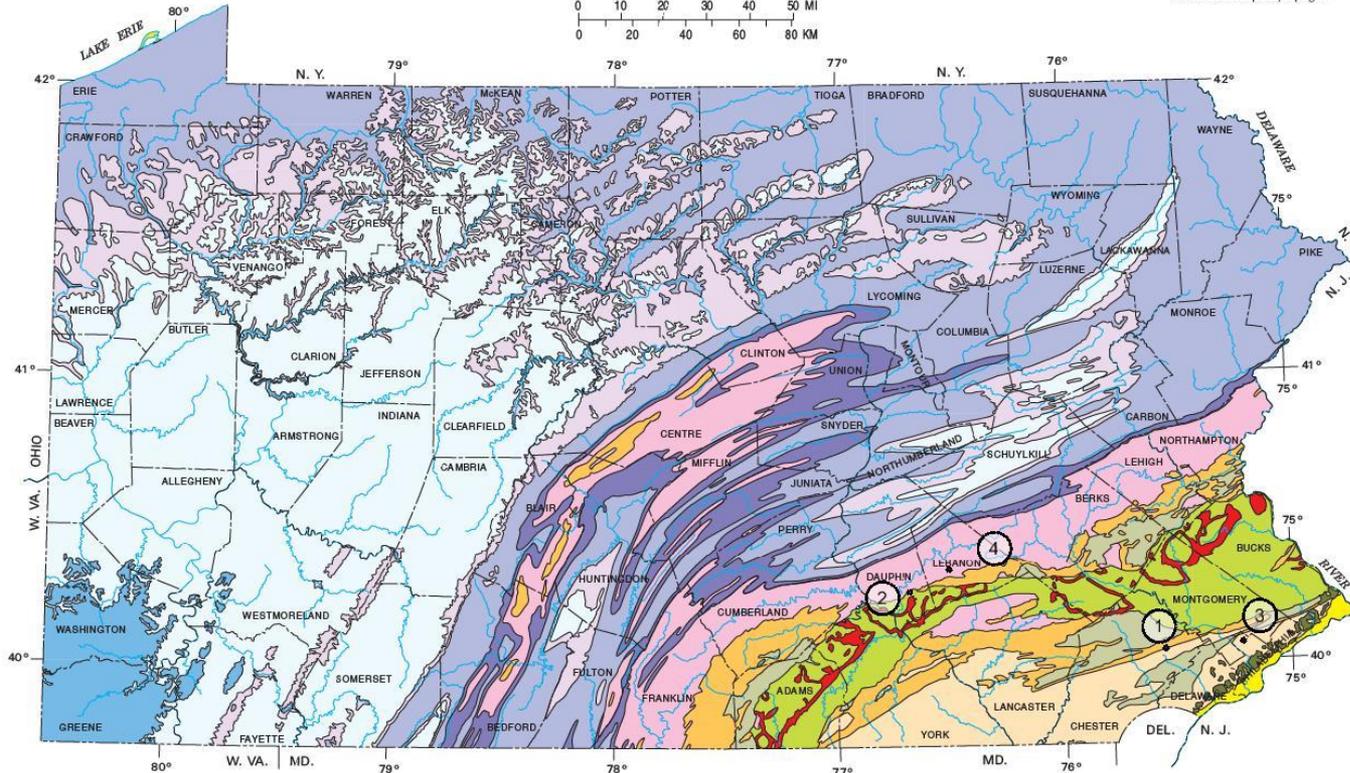
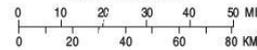
MAP 7



GEOLOGIC MAP OF PENNSYLVANIA

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF
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www.dcnr.state.pa.us/topogeo

SCALE 1:2,000,000



- 1 Valley Creek Mill Lane Tributary
East Whiteland Township
Chest County
- 2 Mill Pond Tributary
Bullfrog Valley Road
Derry Township
Dauphin County
- 3 Bells Mill Run
Philadelphia, PA
- 4 Unnamed Tributary
to Quitapahilla Creek
Lebanon Valley College
Anneville, PA

EXPLANATION

QUATERNARY (0-1.8 mil. yrs.) Sand, gravel, and silt. Sand and gravel.	TERTIARY (1.8-65 mil. yrs.) Sand, gravel, silt, and clay. Sand and gravel.	JURASSIC AND TRIASSIC (144-248 mil. yrs.) Red sandstone, shale, and conglomerate (green), intruded by diabase (red). Building stone, iron.	PERMIAN (249-290 mil. yrs.) Cyclic sequences of shale, sandstone, and limestone, and coal. Lime, clay.	PENNSYLVANIAN (290-323 mil. yrs.) Cyclic sequences of sandstone, red and gray shale, conglomerate, clay, coal, and limestone. Coal, clay, lime, building stone.	MISSISSIPPIAN (323-354 mil. yrs.) Red and gray sandstone, shale, and limestone. Flagstone, limestone, clay.	DEVONIAN (354-417 mil. yrs.) Red sandstone, gray shale, black shale, limestone, and chert. Flagstone, silica sand, clay, lime.	SILURIAN (417-443 mil. yrs.) Red and gray sandstone, conglomerate, shale, and limestone. Lime, building stone.	ORDOVICIAN (443-490 mil. yrs.) Shale, limestone, dolomite, and sandstone. Slate, limestone, zinc, clay.	CAMBRIAN (490-570 mil. yrs.) Limestone, dolomite, sandstone, shale, quartzite, and phyllite. Lime, building stone.	LOWER PALEOZOIC (413-570 mil. yrs.) Metamorphic rocks (metasedimentary and meta-igneous); schist, gneiss, quartzite, serpentine, slate, and marble. Building stone, talc.	PRECAMBRIAN (older than 570 mil. yrs.) Gneiss, granite, anorthosite, metabasalt, metabasite, and marble. Building stone, graphite, sericite.

*Oretaceous rocks, which are present in small areas of southern Montgomery County, cannot be shown at the scale of this map.
Prepared by Bureau of Topographic and Geologic Survey, Third Edition, 1990; Fourth Printing, Slightly Revised, 2007.

Mill Lane Tributary to Valley Creek, Chester County, PA

Lower Piedmont, Metamorphosed (Schist)/Limestone
Legacy sediments over karst drainage, sanitary sewer conflicts.
Location: Ecology Park, East Whiteland Township, PA



Historic Development



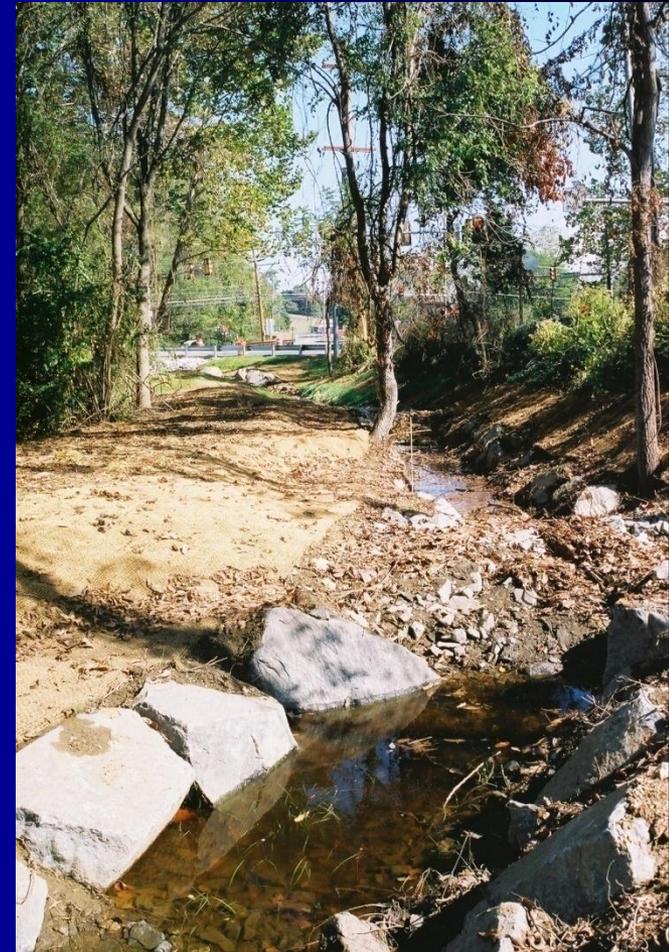
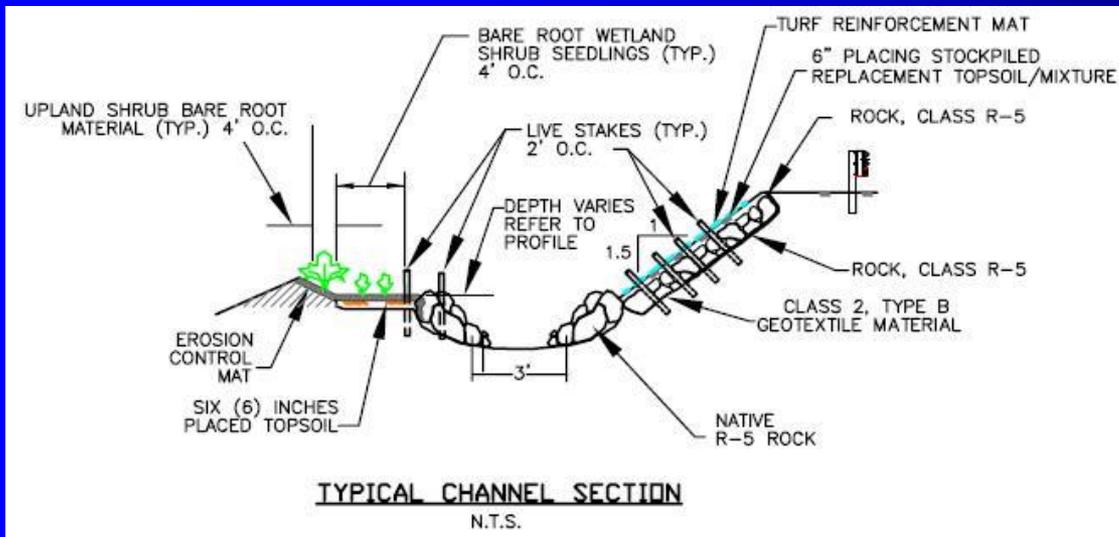
Valley Creek – Exceptional Value Waters



Valley Creek – Exceptional Value Waters



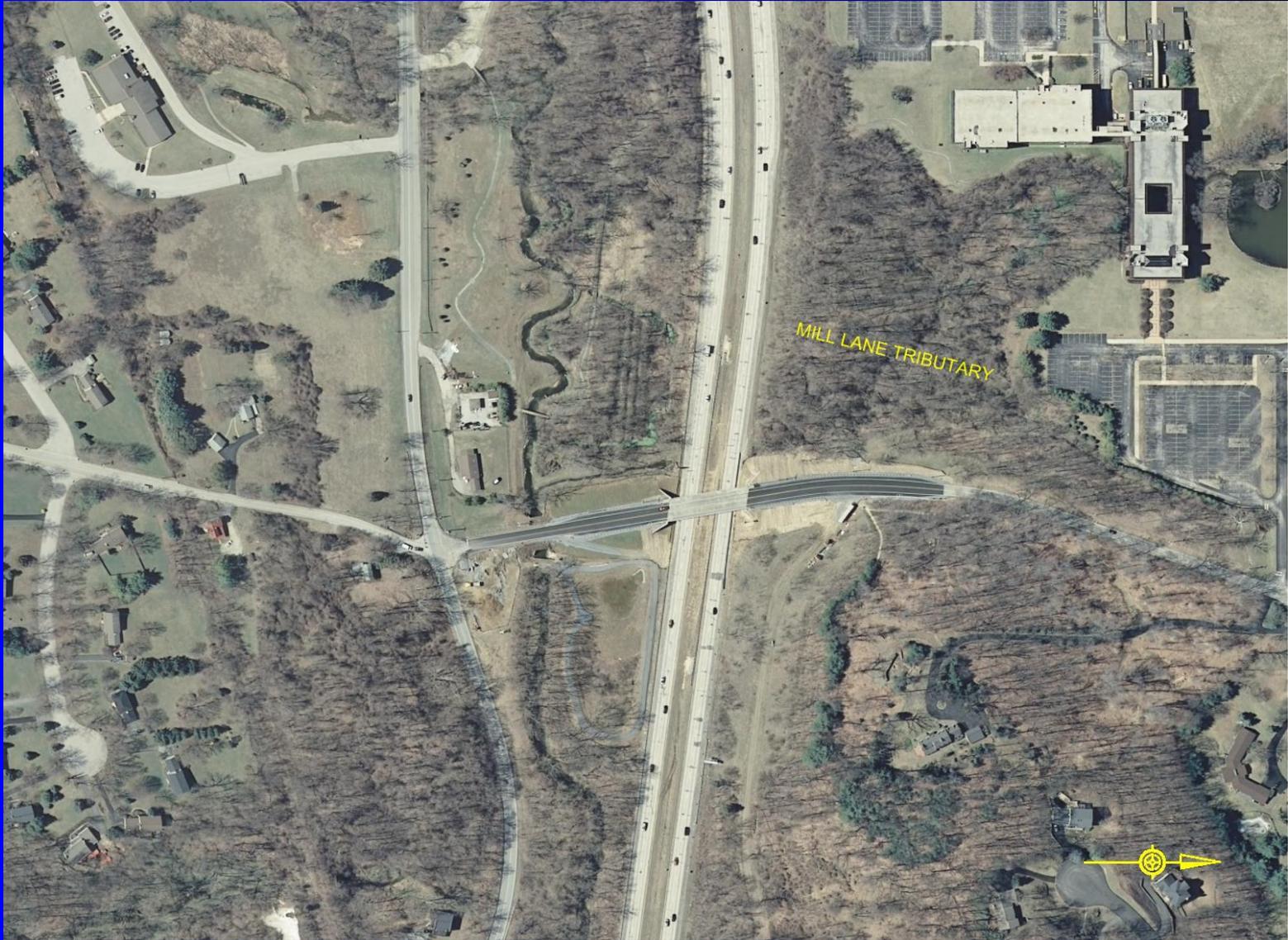
Mitigation Site 5: Stream Stabilization



Valley Creek/Mill Lane Tributary



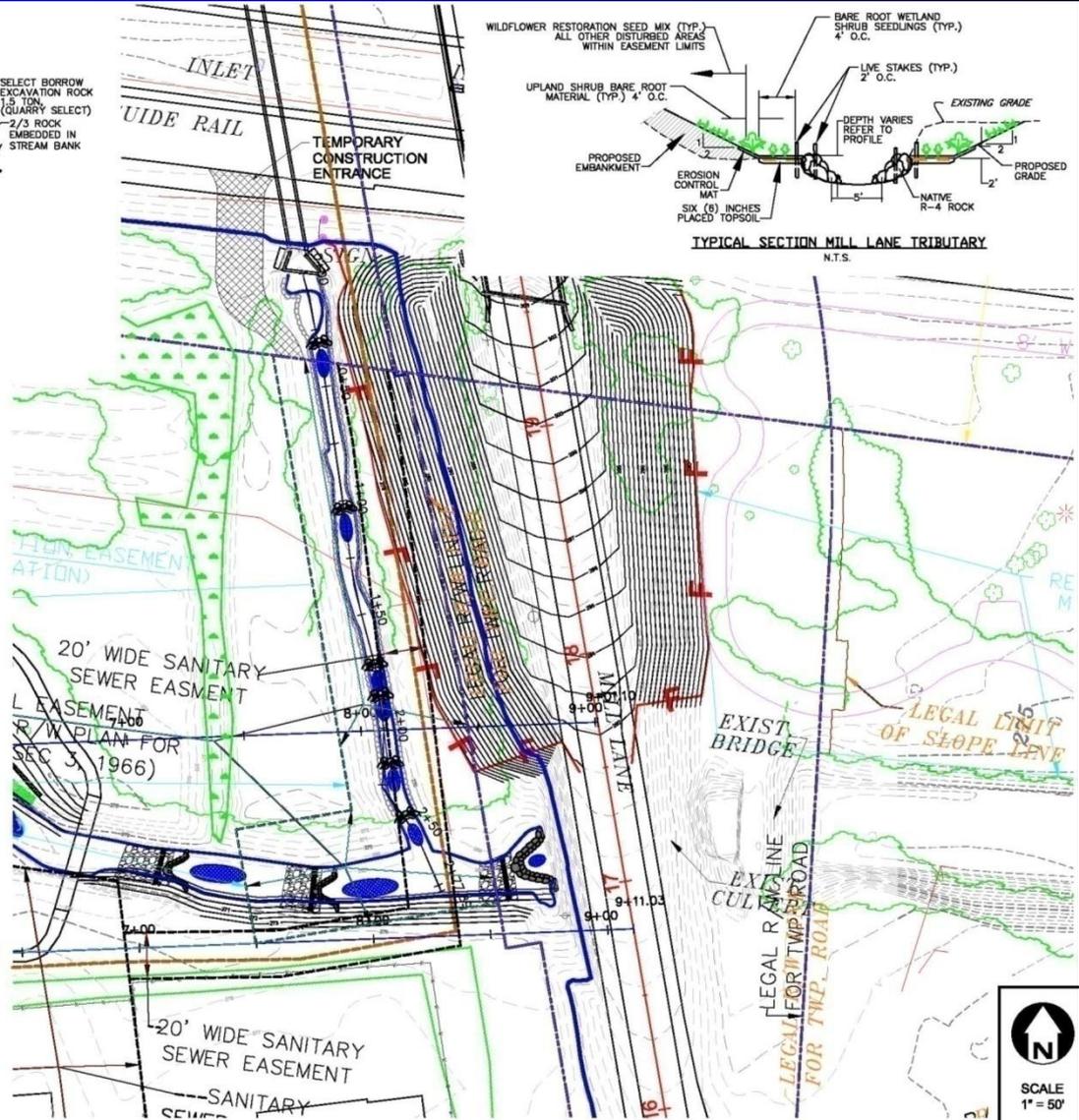
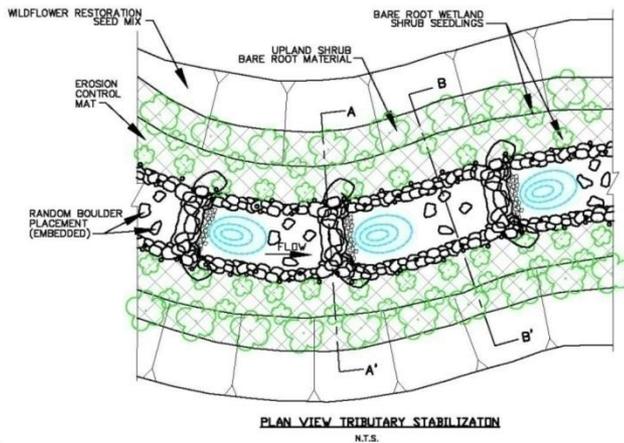
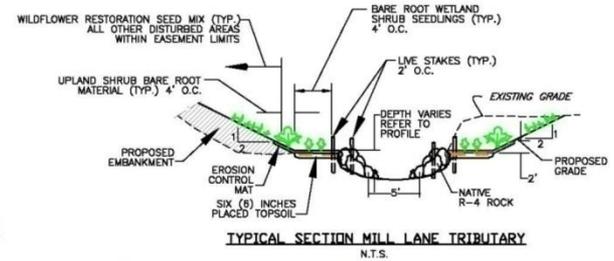
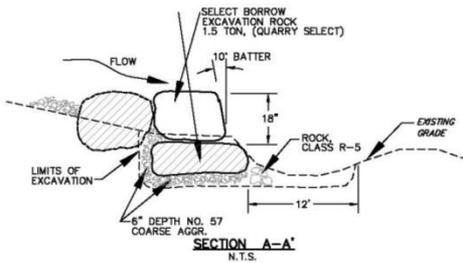
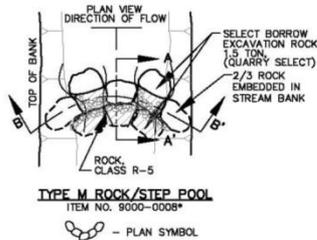
Valley Creek/Mill Lane Tributary



Mill Lane: Tributary Stabilization

LEGEND

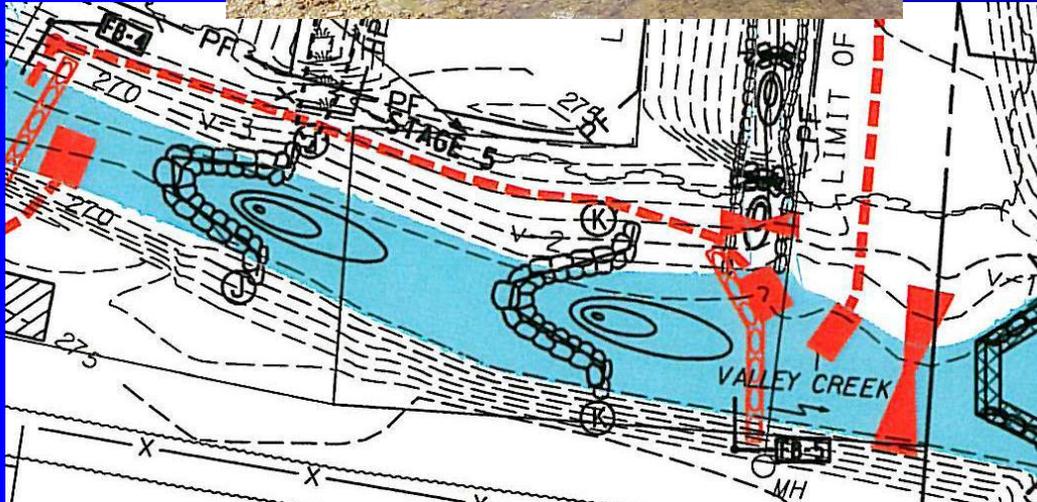
- EXISTING EDGE OF STREAM
- PROPOSED EDGE OF STREAM
- CONTOUR
- EXISTING TREE OR SHRUB
- LIMIT OF VEGETATION
- RIFFLE
- EXISTING POOL
- PROPOSED POOL
- VANE



Mill Lane: Tributary Stabilization



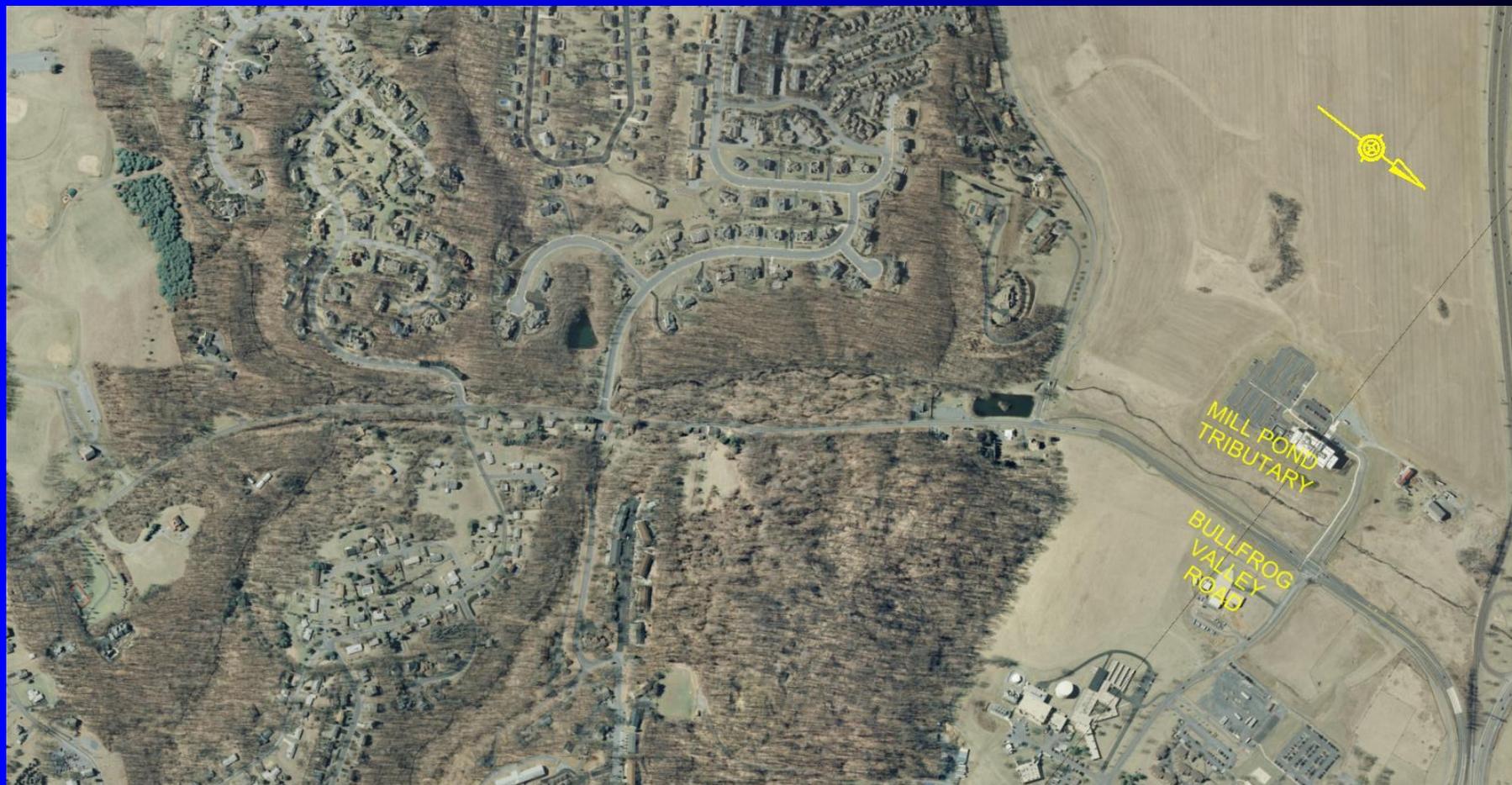
Ecology Park: Stream Stabilization



Bullfrog Valley Road, Mill Creek Tributary, Hershey, PA (Stream Daylighting)

- Location: Millpond Park, Derry Township, PA
- Upper Piedmont, Colluvium over karst terrain
- Gettysburg/Great Valley (Red Sandstone/Limestone)
- Utility gas line conflicts (upstream control)
- Upstream Development – Hydrologic Impact
- Existing floodplain encroachment
 - Utilities (8" gas line)
 - Stormwater Basin/Pond/Bridges
 - Downstream Crossing

Bullfrog Valley Road, Mill Creek Tributary, Hershey, PA (Stream Daylighting)



Bullfrog Valley Road, Mill Creek Tributary, Hershey, PA (Stream Daylighting)



Bullfrog Valley Road, Mill Creek Tributary



Bullfrog Valley Road, Mill Creek Tributary



Bullfrog Valley Road, Mill Creek Tributary

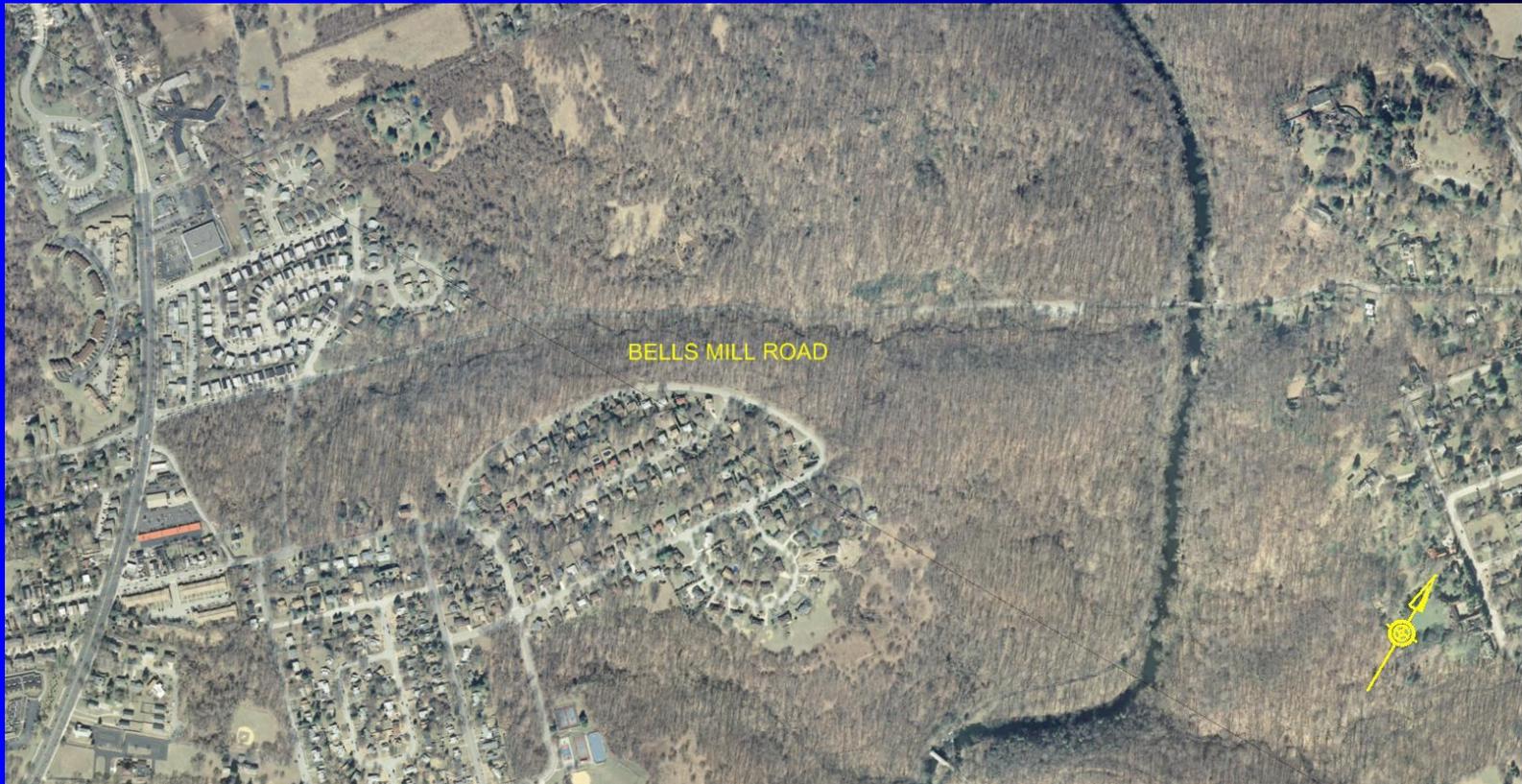


Bullfrog Valley Road, Mill Creek Tributary



Bells Mill Run Tributary to Wissahickon Creek, Philadelphia, PA

- Piedmont Upland/Upper Coastal Plain, Metamorphosed Schist/Gneiss, Stormwater outfalls, sanitary sewerlines, roads, and trails.
- Location: Fairmount Park, Philadelphia, PA



Bells Mill Run Tributary to Wissahickon Creek, Philadelphia, PA



Bells Mill Run Tributary



Bells Mill Run Tributary



Bells Mill Run Tributary



Bells Mill Run Tributary



Bells Mill Run Tributary



Bells Mill Run Tributary



Bells Mill Run Tributary



Bells Mill Run Tributary



Bells Mill Run Tributary



Tributary to Quittapahilla Creek, Annville, Lebanon County, PA

- Great Valley/Upper Piedmont, Limey shale with Swallow holes, stormwater pond, dam and bridge.
- Location: Lebanon Valley College Campus Natural Area, Annville, PA



Tributary to Quittapahilla Creek, Annville, Lebanon County, PA



Tributary to Quittapahilla Creek



Tributary to Quittapahilla Creek



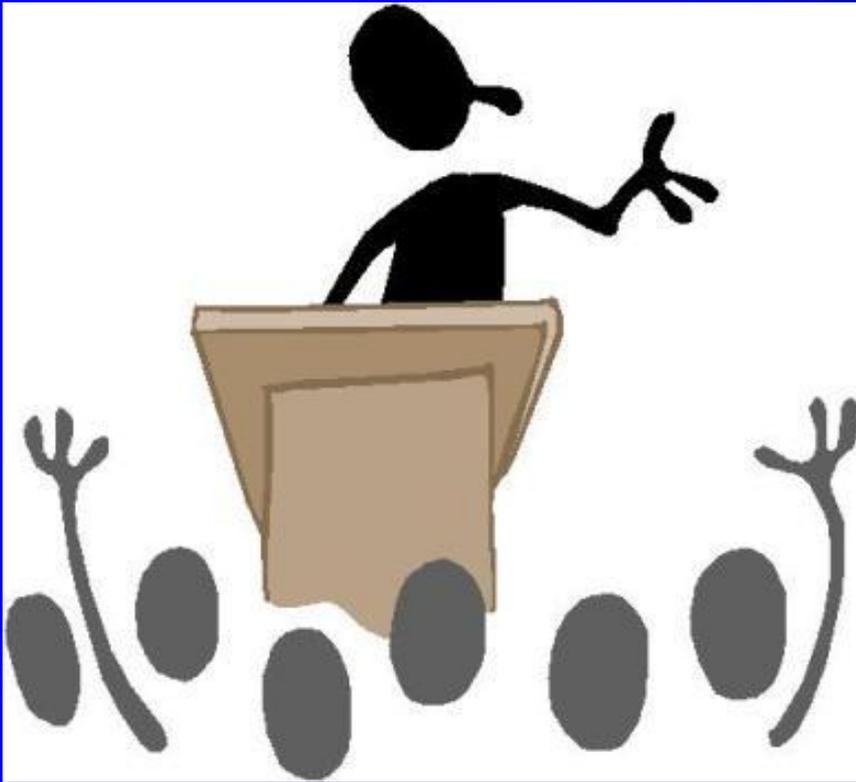
Tributary to Quittapahilla Creek



Tributary to Quittapahilla Creek



Questions or Comments?



Thomas A. Graupensperger
tgraupensperger@dewberry.com

717.961.5098