March 25, 2015

Ms. Kimberly Bose
Federal Energy Regulatory Commission
Office of the Secretary
888 1st Street, NE
Washington, DC 20428

Re: Docket No. PF14-5: Comments Regarding William's Proposed Atlantic Sunrise Pipeline

Dear Ms. Bose,

The Delaware Riverkeeper Network ("DRN") is providing the following supplemental comments to be considered by the Federal Energy Regulatory Commission ("FERC" or the "Commission") with respect to the proposed Atlantic Sunrise Pipeline project. These comments supplement comments submitted by DRN during the earlier scoping period. The size and scope of the construction activity for this pipeline, stream crossings, and other water resource impacts associated with the project will have a damaging effect on the health and vitality of the habitats and watersheds within the proposed pipeline path. Pipeline projects, such as this, result in significant forest fragmentation, invite and propagate the spread of invasive species, cause degradation of water quality and stream habitats, and degrade the functions and values of the ecosystems traversed. Below, DRN identifies significant concerns related to the cumulative impacts of this project in combination with several other pipeline projects that have been concentrated in the same subwatersheds.

DRN asks that the Commission consider the multitude of environmental impacts associated with this project, including the cumulative impacts of all of the environmental and community harms it will cause. Additionally, we urge that you consider the cumulative impacts associated with existing and other pipeline proposals within the region when reviewing this proposal and drafting the Environmental Impact Statement. And, we urge that you consider the associated and foreseeable impacts that will result from the shale gas extraction the Atlantic Sunrise Pipeline will induce, support and encourage as well as the ramifications of the potential end uses including the LNG exports that are to result given the connection between the Atlantic Sunrise Pipeline and the Cove Point LNG facility approved for foreign export.

Based on information provided by William's Co. in its October 2014 resource reports, the project is designed to be a large scale 42-inch transmission pipeline that will stretch approximately 178 miles. Over 3,507 acres will be impacted during construction of this pipeline, its above ground facilities, and modified above ground facilities. This project will have significant adverse environmental impacts, safety issues (i.e. explosions), economic

DELAWARE RIVERKEEPER NETWORK
925 Canal Street, Suite 3701
Bristol, PA 19007
Office: (215) 369-1188
fax: (215)369-1181
drn@delawareriverkeeper.org
www.delawareriverkeeper.org

ramifications, permanent impacts on scenery, and threaten drinking water sources, groundwater wells, and septic systems.

The Atlantic Sunrise Pipeline, and others like it, fit into a larger picture of exploding shale gas development in the Marcellus Shale region. The increased development is not limited to the drilling of wells. FERC has reported that 5.6 billion cubic feet per day of pipeline capacity was constructed in the Northeast in 2008 and 2009, and an additional 1.2 billion cubic feet per day will have been constructed in the region by January 2011.[1] Thus, the proposed Atlantic Sunrise Project is both a product of the development of the Marcellus Shale and other shales and a catalyst for further gas development. The impacts of the Project cannot be understood apart from the totality of the past, present, and reasonably foreseeable future actions associated with Marcellus Shale development and the development of other shales such as the Utica shale.

The Atlantic Sunrise project threatens to disturb pristine open space, landscapes of contiguous forest and mountain lands, fertile farmland, threatened and endangered species habitat, and breathtaking vistas in Pennsylvania. FERC needs to question the necessity of this project and provide a comprehensive examination of all primary, secondary, temporary, and cumulative impacts of the proposed project. FERC must evaluate all impacts the Project will have on the resources along the ROW, the ROW buffer, access roads, sites of compressor and valve stations and pipe yards and any secondary and cumulative impacts that will result from project construction. The following comments provide important issues that should be addressed in the EIS by FERC as part of the National Environmental Policy Act ("NEPA") review process.

Cumulative Impacts Across the Project and Across Multiple Projects, Including Source and End Use of Gas, Must Be Considered

Cumulative impacts caused by "reasonably foreseeable" future actions are recognizable under NEPA. Additionally, FERC must consider the cumulative effects of actions similar to the proposed action, whether existing or reasonably foreseeable. Cumulative impacts are defined as impact[s] on the environment which result from the incremental impact of the action *when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions*. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.[2] The Council on Environmental Quality has emphasized that cumulative effects analysis includes a "[f]ocus on truly meaningful effects" of "past, present, and future actions" as well as "all federal, nonfederal, and private actions."[3]

FERC cannot frame its cumulative impact analysis too narrowly by considering only the immediate vicinity of the proposed pipeline route. The outer bounds of the environmental review area should extend at least as far as the subwatershed through which the pipeline crosses, as opposed to an arbitrary designation of feet or mileage as FERC has identified in the past review documents. A critical consideration in determining the cumulative environmental effects must be the interaction of runoff with other pollutants from all sources and consideration of the impact of the Project when added to other past, present, and reasonably foreseeable future actions, whether federal, non-federal, or private.[4]

The Atlantic Sunrise Pipeline will further facilitate the development of new gas drilling wells, access roads, gathering lines, compressor stations, and other supporting infrastructure,

[1] Fed. Energy Regulatory Comm'n, Winter 2010-11 Energy Market Assessment 10 (Oct. 21, 2010), http://www.ferc.gov/market-oversight/mkt-views/2010/10-21-10.pdf.
[2] 40 C.F.R.§ 1508.7 (2010).
[3] Council on Envtl. Quality, Considering Cumulative Effects Under the National Environmental Policy Act 11 (1997), available at http://ceq.hss.doe.gov/nepa/ccenepa/sec2.pdf.
[4] 40 C.F.R. §§ 1508.7-8, 1508.27 (2010).

which will further degrade our environment. Therefore, FERC must consider the impacts of the Project in the context of existing and reasonably foreseeable shale development, including the Marcellus Shale and Utica Shale as well as other shales identified by the US Geological Survey, which includes but is not limited to the hundreds of miles of gathering and transportation pipelines and associated infrastructure (such as valves and compressor stations) that have been and will need to be constructed to move the gas from the thousands of wells that have been and will be drilled to interstate markets. For example, the Commission should determine how many wells the capacity of the project supports, and model the environmental impact of the construction and operation of those wells. Such an estimate would also include an examination of the associated infrastructure supporting the identified wells. Additionally, the Commission should consider other induced development such as the development of small-scale power generation facilities being developed along the pipeline.

Additionally, FERC should examine the cumulative impact of the multiple utility and other linear projects that are being proposed or constructed in the Susquehanna watershed and the vicinity. For example, there are significant concerns related to the cumulative impacts of the continuous water crossings and wetlands disturbance that pipeline construction activity has on the health and vitality of the Susquehanna River basin and its tributaries. These projects do not occur in a vacuum. Each project individually depletes the natural and scenic resources of the region, and the combined impact becomes increasingly more severe, unavoidable, unmitigatable, and irreversible. As such, the Commission must carefully examine these projects holistically in order to satisfy the requirements of NEPA.

The direct, cumulative, and foreseeable impacts resulting from the exportation of the Atlantic Sunrise transported gas must also be considered. This pipeline will interconnect with a pipeline system that would transport its shale gas to the recently approved Cove Point LNG export facility. Given that natural gas can sell for as much as four times the price overseas as compared to domestically, it is both reasonable and foreseeable that Atlantic Sunrise transported gas will be transported to Cove Point for export and Williams has stated this point in their own financial projections to their investors.

Furthermore, by creating an entirely new ROW for this Project the Commission is creating a new industrial corridor that will foreseeably be used in future Williams pipeline upgrades. A quick review of other major pipeline corridors in the region support this assertion as natural gas pipeline operators including Columbia, Tennessee Gas Pipeline, Texas Eastern, and Transcontinental have all within the last three years added looping segments to their pipelines. As such, the NEPA document must account for the potential expansion of the ROW to accommodate future upgrades.

Impacts to and Avoidance of Preserved Open Space Must Be Given Full Consideration

The variety of harms that would result from the proposed cuts through preserved open space must be fully and fairly considered – whether the open space is preserved by purchase or conservation easement or programs like the Pennsylvania Clean and Green Program.

FERC must require the applicant to consider alternative routes that do not impact public open space. Companies routinely propose pipeline routes that impact public open space because these lands are valued at a lower rate when compared to non-preserved lands. FERC must not permit this "savings" to the applicant to drive the siting process. Public and preserved lands must be priced according to their value. FERC must deter this strategy for siting the pipeline and consider the distorted pricing of open space as it evaluates alternative routes for this Project and as it considers the cumulative environmental harms of the proposed pipeline expansion. It is DRN's position that FERC's approach to evaluating cumulative impacts gives inadequate consideration to the distorted incentives for pipeline companies to target protected open space –

whether protected through purchase or conservation easements.

The protection of open space is necessary to preserve the remarkable resources of Pennsylvania. Natural areas are critical for water quality, have more stable soils, provide habitat for plants and animal species, and help maintain the value of historical sites. Loss of open space adversely impacts water quality, aquatic habitat, and the intact ecological health that is otherwise benefitted by the preserved open space. Pipeline passage through open space significantly reduces scenic character and recreational opportunities thereby adversely impacting jobs and economic benefits associated with recreation, vacation and other related industries.

Realtors in the region have asserted at public meetings that the presence, or even the potential presence, of an interstate transmission pipeline of the size proposed by Atlantic Sunrise adversely impacts the marketability of nearby homes. FERC must fully and fairly consider these harms and require quantifiable and documented data to support any assertions/findings. Potential impact blast zones (PIRs) and the environmental and property harm it would cause along the entire pipeline corridor if an accident were to happen must also be considered in the analysis.

The impacts to the market value and marketability of homes that will result from the removal of mature vegetation to make way for the pipeline (both permanent ROW and temporary construction areas that will not be fully restored) must also be fully and fairly considered. Healthy, mature, vegetated buffers along waterways are known to enhance property market values. For example, "Pennypack Park in Philadelphia is credited with a 38% increase in the value of a nearby property."[5] In addition, "[t]wo regional economic surveys documented that conserving forests on residential and commercial sites enhanced property values by an average of 6 to 15% and increased the rate at which units were sold or leased."[6] And in a survey conducted by the National Association of Home Builders, 43% of home buyers paid a premium of up to $3,000, 30% paid premiums of $3,000 to $5,000, and 27% paid premiums of over $5,000 for homes with trees.[7] To the extent the Atlantic Sunrise project will be cutting down forests and buffers and replacing them with low growing grasslands, and to the extent that the forest fragmentation caused by pipeline construction and maintenance will result in additional forest degradation as far as 300 feet back on either side of the ROW, the impacts to home market values and marketability must be accounted for.

Water Resources (Including Surface Water and Groundwater) and Wetland Impacts Must be Fully Considered, Including Providing a Full Accounting of the Number of Waterways and Wetlands to be Crossed and Irreparably Altered

Williams company October Resource reports have identified 201 wetlands (44.59 acres of wetlands) and 300 streams that may be affected by the project. It is imperative that these resources are field-truthed and checked by FERC and the required agencies to ensure no waterbodies and wetlands have been omitted. Past review and on the ground field work by DRN on similar large pipeline projects have found waterbody omissions. Project Resource Reports and USGS topographic maps indicate that in some cases, streams will be traversed multiple times. Among the waterways to be crossed are the Swatara Creek, Conestoga River, and Susquehanna Rivers and numerous tributaries to these rivers, many of which are designated as High Quality or Exceptional Value. The Susquehanna also has rare and protected freshwater

[5] Center for Watershed Protection, Better Site Design: A Handbook for Changing Development Rules in Your Community, August, 1998, p. 134

[6] Center for Watershed Protection, Better Site Design: A Handbook for Changing Development Rules in Your Community, August, 1998 Citing two studies by Morales and Weyerhauser

[7] Cheryl Kollin, "Designing with Nature and Showing the Benefits", Land Development, National Association of Home Builders, Winter, 1997

mussels present which must be given the strongest protections. Furthermore, Williams October 2014 resource reports state that at least 11 stream crossings would be located upstream of important potable drinking water sources and at least 18 surface water intakes and 16 groundwater intakes are located less than 3 miles downstream from the potential pipeline cuts. Transco states that these crossings would be protected with E&S controls but its important FERC recognize failure of these BMPs on past similar pipeline projects and consider those impacts in the EIS. Many of the waterbodies proposed to be cut across also are listed with TMDL's for siltation impacts, metals, nutrients. Since pipelines can cause increased siltation especially if open cuts are allowed, these already impaired waterways would be further degraded from this project. CLP South alone has 11 impaired waterbodies that could be further degraded from this project.

Recently identified alternative routes may increase the number of waterways and wetlands; they may also cut through an increased level of forest acreage. The EIS consideration of alternative routes needs to carefully consider the actual number of streams, wetlands, forest acres, preserved lands, conservation easements, and active recreation areas crossed, as well as fully and fairly considering the damages of each route. It appears already that not only is Atlantic Sunrise under-counting and under-valuing the resources harmed, but that it is also proposing alternative routes based on political maneuvering rather than reducing harms.

The proposed Atlantic Sunrise project, as demonstrated by the installation of other pipeline projects in our region and nation, will create new pathways for water flow, thereby altering the hydrologic pattern of the watershed and adversely impacting (in both quantity, quality and seasonal timing) streams, wetlands and drinking water sources.

There is also potential for chemical contamination of water resources. Current practices call for the ROW to be clear of vegetative matter. Herbicides are frequently used to accomplish this task. Creating and maintaining the ROW could result in increased and repeated herbicide use on the federal, state, and county parklands along the ROW and, as run-off capacity will be intensified in the ROW due to lack of vegetation and forest cover and due to increased soil compaction resulting from pipeline construction, there will be an increased level of herbicides discharging directly (or through stormwater systems) into tributary streams, wetlands and the Susquehanna River Basin. In addition, the removal of vegetation and increased soil compaction will create a direct route for stormwater runoff from neighboring lands which may be treated by other property owners with herbicides, pesticides, fertilizers and/or other chemicals that could/would then be transported and discharged into nearby water bodies either directly or through stormwater collection systems. The EIS must consider and question the necessity of the proposed width of permanent clearance considering the harms it poses to the environment. The ease of aerial inspection of the pipeline should not, and cannot, trump the resulting environmental harms associated with gratuitously wide ROW permanent clearings.

Beyond chemical contamination, water quality impacts will also result from an increase in suspended solids in the water due to erosion resulting from the increased volume of stormwater runoff that will result from removal of vegetation and increased soil compaction and from the removal of streamside vegetation thus depriving streams of the natural armoring of vegetative root systems. Upon entering the stream ecosystem, this increase in suspended solids will result in a reduction to the streams' water bearing capacity, in turn reducing oxygen availability and impacting aquatic plant and animal species, including habitat for fish reproduction and macroinvertebrate diversity. Each of these factors must be individually reviewed at all water crossings.

According to expert observation, pipeline trenches can divert groundwater and as a result "permanently alter the hydrologic cycle in the vicinity of the pipeline right-of-way. This alteration will decrease the water resources available to support wetland hydrology and stream

base flow in the summer and fall dry season."[8] The compacted soils resulting from pipeline construction increase rainfall runoff and reduce ground water infiltration. This can cause further negative impacts on wetland hydrology and stream baseflow in the area of the pipeline.[9] "Increased runoff as a result of compacted soils, and increased drainage of shallow ground water" around a pipeline, due to previous and proposed construction practices, can increase "surface water flow and groundwater discharge in the wet winter and spring seasons and decrease summer and fall ground water discharge which supports wetland hydrology and stream base flow."[10] The result of reduced groundwater discharge during the dry summer and fall months can decrease the size of supported wetlands. So the result is too much or too little depending on the time of year. Another result of the altered flows can be to decrease stream baseflow that supports aquatic life and trout habitat in headwater streams in the dry summer and fall period.

Furthermore, the installation of the Project will involve drilling, blasting and digging into the bedrock, the potential effects of this must be considered. If these activities result in interception of the water table, dewatering activities would result in the localized drawdowns of water table elevation and could impact local wells. Construction activities may also result in contamination of groundwater by creating a direct flow of contaminants, including herbicides, into local aquifers. FERC must determine whether any of the aquifers along the ROW are sole-source as this would magnify any negative impacts of construction. Protection of groundwater is a crucial concern for residents being impacted by the gas pipeline, and therefore, the negative impacts to groundwater quality and quantity must be heavily weighted in FERC's review of the public necessity of this Project. This review must also take into account any costs that would be borne by these municipalities if the Project depleted the quality of the water supply and groundwater to a point that water treatment facilities become necessary.

Furthermore, increasing the runoff potential of soils due to compaction will negatively impact groundwater recharge areas surrounding the ROW. By removing the topsoil layer and associated forest litter and humus, runoff will decrease the soil porosity and moisture retention capacity. This will induce even greater levels of runoff and will damage the groundwater recharge capabilities of the ecosystem. The decreased ability to absorb water resulting in runoff and sedimentation severely decreases water quality. Previous FERC jurisdictional projects have resulted in significant soil compaction issues. The EIS must identify ways in which previous soil compaction problems can be avoided or properly remediated. A restatement of previous practices would be unacceptable.

To determine current water quality, the NEPA document must include a survey of the established benthic community in potentially impacted streams. This should include the composition, quantity, and diversity of the community using standardized sampling protocols consistent with the state's assessments. Anti-degradation streams that have special designations warrant special attention and protection, especially when a tributary has Category 1, Exceptional Value or High Quality designation. Furthermore if a stream has an existing TMDL and is not meeting its existing water quality, more attention is also warranted. Potential water quality impacts should also be evaluated including construction related impacts that include the possibility of fuel spills, compaction from parking and staging equipment and contamination of runoff and further erosion and sedimentation. Any potential channel relocations that occur due to construction must be studied as an impact. Installing the Project will require stream diversions that will also impact wetland areas. These areas of stream channel modification must be identified so that the impacts on wildlife resources be can fully examined with the coordination

[8] Affidavit of Peter M. Demicco, DRN v. PA DEP an TGP NEUP, 2012.
[9] Id.
[10] Id.

of NPS, Fish and Wildlife Service, and New Jersey and Pennsylvania environmental agencies.

Adverse impacts to the multiple wetlands to be crossed need greater due care, attention and assessment than we have seen with previous pipeline environmental reviews

Atlantic Sunrise October Resource Reports claim 201 wetlands would be impacted. Of those, 26 are forested wetlands which studies have indicated would lead to permanent detrimental and thermal impacts if mature trees are cut in these wetlands and HDD is not required[11]. Despite their tremendous value, more than half of America's original wetlands have been lost to development, agriculture, mining, hydrology alterations and pollution.[12] And, each year we continue to decimate nearly 500,000 additional acres of wetlands.[13]

Loss of wetlands increases soil erosion, damages water quality and allows increased sedimentation and polluted runoff into streams.[14] Increased stormwater flows can upset the "dynamic equilibrium" that exists between wetlands and the surrounding watershed. Changes in volume or quality of runoff to wetlands can affect the biological community and ecological functions of a wetland. Generally, wetlands work as an integrated system with other wetlands in a watershed. When assessing the value, or lost value, of wetlands, it is important to recognize this critical interrelationship.[15] Below are just some of the benefits of wetlands that FERC must fully assess in its review.

- Wetlands provide productive and diverse ecosystems for both aquatic and terrestrial wildlife[16] and they produce biomass for the base of the food chain.[17] Wetlands of all sizes, both large and small, have been demonstrated to provide important habitat for a wide variety of plants and animals, many of which could not survive without them.[18] Forty-two percent of the "total U.S. threatened and endangered species depend upon wetlands for survival."[19] Wetlands provide a diverse and complex set of ecosystems -- niches that function as an irreplaceable ecological unit.[20]
- Wetlands act as a natural pollution filter thereby providing irreplaceable water quality benefits. The dense vegetation found in wetlands filters out sediment, nutrients and other pollutants.[21] Wetlands can also filter pesticides and heavy metals and can reduce water-borne bacterial contamination through microbial action.[22]

[11] : Schmid and Company Inc. (2014). The effects of converting forest or scrub wetlands to herbaceous wetlands in Pennsylvania. Prepared for the Delaware Riverkeeper Network, Bristol, Pennsylvania.
[12] "America's Wetlands, Our Vital Link Between Land and Water", US EPA Office of Wetlands Protection, Office of Water, Doc. No. OPA-87-016, February 1988, p. 6.
[13] Michael J. Caduto, Pond and Brook, A Guide to Nature in Freshwater Environments, University Press of New England, 1985
[14] Clean Water Network and NRDC, "Wetlands for Clean Water, How Wetlands Protect Rivers, Lakes and Coastal Waters from Pollution", April 1997
[15] *Ibid.* 15, p. 4
[16] National Wildlife Federation Fact Sheet -- nwf.org/wetlands/facts/benefits.html
[17] Michael J. Caduto, Pond and Brook, A Guide to Nature in Freshwater Environments, University Press of New England, 1985, p. 29
[18] National Wildlife Federation, "Status Report of Our Nation's Wetlands", October 1987.
[19] DNREC and Brandywine Conservancy, Conservation Design for Stormwater Management: A Design Approach to Reduce Stormwater Impacts from Land Development and Achieve Multiple Objectives Related to Land Use, September, 1997, p. 2-11.
[20] *Ibid.* 21
[21] Clean Water Network and NRDC, "Wetlands for Clean Water, How Wetlands Protect Rivers, Lakes and Coastal Waters from Pollution", April 1997
[22] *Id.*

- Wetlands provide flood control, erosion control and groundwater recharge. Wetlands are part of nature's sponge, holding water, feeding plants, and slowly recharging aquifers. Wetlands effectively absorb and hold floodwaters thereby protecting adjacent and downstream properties from flood damage.[23] Depending on the soil type, wetlands can contain 1 to 1.5 million gallons of water per acre, thereby alleviating flooding by holding excess water like a sponge.[24] At the same time, wetland vegetation helps to slow the speed of floodwaters - this in combination with the storage capabilities of wetlands can both lower flood heights and reduce the erosive potential of floodwaters.[25] Wetlands can also desynchronize flood peak flows and velocities during small runoff events.[26]

Wetland delineations and assessment of values and functions of wetlands impacted by Atlantic Sunrise directly or indirectly are needed. As part of this analysis, hydrology, vegetation, and soils must be examined. Assessment of function and value should consider all ecosystem services being provided that are listed above, such as groundwater recharge, water quality and sedimentation, wildlife habitat, flood protection, biological diversity, recreation, and aesthetics, so that potential impacts, alternatives, and avoidance of wetlands and their important natural buffers can be properly assessed.[27]

The NEPA document must fully assess impacts to wetlands including, but not limited to changes in water levels, flow characteristics, and circulation patterns, the impacts of temporary and permanent alteration of vegetation in and around wetlands, altered temperatures, changed light, altered humidity, altered groundwater or surface water flows, and/or altered flooding frequencies due to the Project. Changes in substrate conditions may affect the ability of the wetland to sustain vegetation and wildlife populations including sensitive amphibian populations. For example, repeated maintenance and lagging restoration practices that span over multiple seasons/years could impact important amphibian and fish migrations and critical reproduction periods if biological windows are not considered. It has been observed and documented by DRN and Conservation District staff around prior pipeline projects that once the pipeline is moving gas, the final restoration phases by the operator are often not a priority leading to inflicted or unnecessary additional harm to sensitive species, due to improper timing or unnecessary delays. Increased run-off as addressed above may introduce contaminants or more sedimentation to the ecosystem. Increased nutrient loading could produce algal blooms and reduce available oxygen in the water. Any impacts to the physical characteristics of wetlands resulting from the construction and operation of Atlantic Sunrise and any associated appurtenances of land, water, air or light transformations must be included in any analysis.

Adverse Impacts to Floodplains, Including Their Permanent Alteration, Must Be Given Full Consideration

Floodplains vegetated with trees and shrubs can be four times as effective at retarding flood flows as grassy areas.[28] In addition, naturally vegetated floodplains provide breeding and feeding grounds for both fish and wildlife, they "create and enhance waterfowl habitat", and they "protect habitat for rare and endangered species."[29] Naturally vegetated floodplains are generally

[23] *Ibid.* 15, p. 4
[24] Bob Schildgen, "Unnatural Disasters", Sierra, June 1999
[25] *Ibid* 15, p. 4
[26] *Ibid* 22
[27] See attached: Schmid and Company Inc. (2014). The effects of converting forest or scrub wetlands to herbaceous wetlands in Pennsylvania. Prepared for the Delaware Riverkeeper Network, Bristol, Pennsylvania.
[28] *Ibid* 22
[29] *Ibid* 22

layered with leaf and organic matter which result in organic soils with high porosity and a greater capacity for holding water.[30] The floodplain, in this natural state, is a riparian ecosystem that needs the overbank flows that the natural watershed's hydrology provides in order to remain healthy and in balance.[31] According to the U.S. Environmental Protection Agency, the number one source of pollution to our nation's waterways is from nonpoint sources, including pollution from floodwaters, washed from the land in stormwater runoff.[32] About 40% of the nation's waterways are polluted as a result.[33] Floodplains play a key role in reducing stormwater flows and containing floods, filtering out nonpoint source pollution, thereby reducing pollutant loading and protecting water quality.

The benefits of naturally vegetated and healthy floodplains:

- Stores and slows floodwaters;
- Intercepts overland flows, capturing sediment;
- Stabilizes streambanks, preventing erosion;
- Protects wetlands and other critical habitats;
- Replenishes groundwater aquifer;
- Filters out and/or transforms pollution;
- Provides recreation and education;
- Trees and other riparian vegetation: provide wildlife habitat; process nutrients and other would-be pollutants; shade and cool waterways; provide food for wildlife and stream insects (detritus); provide beauty and refuge.

The Susquehanna River health and the health of its tributary streams are threatened by loss of its floodplain's function and the resulting increase in stormwater and floodwater. Adverse impacts to beneficial floodplain values must be considered. These include the accelerated runoff produced along the ROW that will result in more erosion and deposition within streams, increased transport and loading of contaminants, increase in flood peaks due to accelerated runoff (in turn reducing the amount of water entering the ground), decrease in groundwater recharge, blocked or diverted groundwater flow, soil compaction, and the removal of habitat and food sources for wildlife and aquatic life. These impacts can also produce a "ripple" effect by upsetting the balanced ecosystem of the landscape through construction activities. The NEPA document should consider the short term, long-term, and cumulative impacts of these alterations.

Unnatural flood levels and flood damages are experienced by communities where the pipeline would cut. For example, Pine Grove Borough has had substantial flooding damage and any cuts of tributaries in Pine Grove Township must be reviewed for potential increased flooding impacts. In addition, removal of vegetation along water systems removes the natural armoring that helps prevent accelerated erosion from unnaturally high flood flows. The ramifications, individually and cumulatively, of the multitude of proposed stream crossings for flooding, flood peaks, flood damages and erosion must be considered.

The Destruction of Naturally Vegetated Buffers Along All Wetlands and Waterways Must Be Given Full Consideration

Healthy and vegetated streamside buffers serve our communities by:

[30] *Ibid* 22

[31] Poff, Allan, Bain, Karr, Prestergaard, Richter, Sparks, and Stromberg, "The Natural Flow Regime", BioScience, Vol. 47, No. 11

[32] Chester L. Arnold Jr., and C. James Gibbons, "Impervious Surface Coverage, the Emergence of a Key Environmental Indicator", APA Journal, Spring 1996, p. 245

[33] *Id.*

- Providing flood storage,[34] reducing flood peaks, [35] and slowing the velocity of floodwaters,[36] and thereby reducing flooding and damaging flows in downstream and nearby communities;
- Protecting and enhancing water quality by preventing and filtering pollution[37] and enhancing the ability of the neighboring stream to process pollutants,[38] thereby protecting drinking water supplies, recreational uses of our waterways, commercial and recreational fisheries, ecotourism, and business operations that need clean water;
- Recharging aquifers that supply drinking water and base flow to streams;[39]
- Providing and enhancing birding, fishing, hiking and other recreational opportunities that are so critical to our region's aesthetic beauty and community quality of life;
- Providing and enhancing the quantity and quality of habitat[40] to aquatic life, animals, birds and plants that are important to our watershed ecologically, economically, recreationally and psychologically;
- Providing organic matter critical for supporting aquatic organisms; [41]
- Providing shading and thereby providing water temperature control [42] important for the quality of the stream including the health of the habitats and aquatic organisms present;
- Reducing flood damages by ensuring structure-free zones devoid of structures to be harmed;
- Protecting public and private lands from erosion and helping streambanks maintain their integrity in order to prevent/minimize the costs and harms of sedimentation and restoration;[43]
- Increasing the market value and marketability of nearby homes and communities; [44]
- Increasing the opportunity for and success of ecotourism businesses dependent on the aesthetic beauty of the river and its ecological health; and
- Maintaining the unique ecological and historical qualities of our River and region that are an international draw. [45]

---

[34] Tourbier, J. Toby "Open Space Through Stormwater Management, Helping to Structure Growth on the Urban Fringe".

[35] Army Corps of Engineers WRAP, "Technical and Scientific Considerations for Upland and Riparian Buffers Strips in the Section 404 Permit Process", ERDC-WRAP-01-6, May 2002, citing DeBano and Schmidt 1990; O'Laughlin and Belt 1995".

[36] *Id.*

[37] NJAC 7:8 NJDEP Agency Proposal Document at NJAC 7:8-5.5(h), USEPA, "Pesticide Tolerance Reassessment and Re-registration, Terbufos IRED Facts", EPA 738-F-01-015, October 2001; *Id.*

[38] Sweeney & Blaine, "Resurrectingthe In-Stream Side of Riparian Forests", Journal of Contemporary Water Research & Education, Issue 136, June 2007.

[39] Castelle, Johnson, Conolly, "Wetland and Stream Buffer Size Requirements – A Review", J. Environ. Qual. 23:878-882 (1994); NJAC 7:8 NJDEP Agency Proposal Document at NJAC 7:8-5.5(h), page 77; *Ibid. 38*

[40] *Ibid. 38*, citing DeBano and Schmidt 1990; O'Laughlin and Belt 1995"

[41] *Ibid. 38*, citing DeBano and Schmidt 1990; O'Laughlin and Belt 1995".

[42] *Ibid. 38*, citing DeBano and Schmidt 1990; O'Laughlin and Belt 1995".

[43] Water, Science, and Technology Board, Board of Environmental Studies and Technology, "Riparian Areas: Functions and Strategies for Management", 2002, citing Swanson, et al; Center for Watershed Protection, "Impacts of Impervious Cover on Aquatic Systems", Watershed Protection Research Monograph No. 1, March 2003; *Ibid. 38*

[44] Center for Watershed Protection, Better Site Design: A Handbook for Changing Development Rules in Your Community, August, 1998, Pg. 134, Lutzenhiser, M. and N.R. Netusil. "The Effect of Open Spaces on a Home's Sale Price." Contemporary Economic Policy 19.3 (2001): 291-298.

[45] For example, "Pennypack Park in Philadelphia is credited with a 38% increase in the value of a nearby property." Center for Watershed Protection, Better Site Design: A Handbook for Changing Development Rules in Your Community, August, 1998, p. 134

Vegetated buffers and floodplain areas are an important food source for aquatic microorganisms, invertebrates and fish.[46] In small headwater streams, as much as 60 to 90 percent of the organic food base comes from surrounding forests.[47] The life cycles of the aquatic invertebrates and in turn the fish are closely tied to these organic inputs from the forest.[48] In the larger waterbodies the vegetation provides refuge as well as havens where the smaller fish can find food.[49] The roots, fallen logs, pools, overhanging branches and other habitats that vegetation along the banks creates provides important habitat for fish young to old. [50]

Multiple studies have documented that waterways surrounded by mature woodlands provide a greater variety of important aquatic habitat, support a greater diversity of fish species, and support fish in healthier physical condition than waterways where the forest cover has been removed.[51] Forested streams also provide temperature protections important for aquatic life.[52] The overhead cover provided by forested streamside lands provides shading and temperature control – this directly affects the amount of oxygen the water can support.[53] Increased temperatures have been found to alter the release rate of nutrients from suspended sediments.[54] Just small increases in temperature can increase substantially the amount of phosphorous released into water.[55]

Shading from buffers reduces overall temperatures but also reduces the daily and seasonal fluctuations in stream temperature. Moderation of stream temperatures is important for healthy habitat. Studies have concluded that removal of streamside vegetation can result in a stream temperature increase of 6 to 9 degrees Centigrade.[56] Just a 9 degree increase can cause heavy growth of filamentous algae.[57] Growth of parasitic bacteria is also encouraged by warmer temperatures.[58] And some species simply cannot survive in warmer water so even seemingly slight temperature changes (the 6 to 9 degree range) can shift the structure of the aquatic community.[59]

Removal of forests and vegetation results in polluted runoff, which because of the lack of a vegetated buffer, will enter directly the neighboring stream or river. This kind of polluted runoff includes sediment, nutrients, pesticides, animal waste and more. Too many nutrients in a waterbody, including both phosphorous and nitrogen, encourages an overgrowth of algae and other aquatic plants. Buffers are beneficial also for protecting waterways and communities from other pollutants such as herbicides and pesticides.

Vegetation on stream banks can help filter sediment-laden runoff that would otherwise enter a stream and can reduce and prevent non-natural erosion resulting from increasing stormwater runoff levels upstream and introducing more sediment into the water column. Sediment can block the penetration of light in water, affecting the growth and reproduction of

---

[46] J.C. Klapproth & J.E. Johnson, Virginia Cooperative Extension, Understanding the Science Behind Riparian Forest Buffers: Effects on Plan and Animal Communities, October 2000, Publication number 420-152.
[47] *Id.*
[48] *Id.*
[49] *Id.*
[50] *Id.*
[51] *Id.*
[52] *Id.*
[53] *Id.*
[54] *Id.*
[55] *Id.*
[56] Leavitt, J. 1998. The Functions of Riparian Buffers in Urban Watersheds", page 4, Master of Science Degree Report, University of Washington, Seattle, WA.
[57] *Ibid*. 49
[58] *Ibid*. 49
[59] *Ibid*. 49

aquatic plants.[60] When sediment settles it can cover stream bottom habitats interfering with the feeding or reproduction of fish and aquatic insects dependent upon them.[61] Too much sediment can clog the gills of fish and, if at high enough levels, result in fish death.[62]

When reaches of a stream with natural function are intersected with dysfunctional reaches there is a net loss in the ability of the stream to provide their water cleaning and protection benefits including processing of nutrients, pesticides, and organic matter.[63]

Vegetated buffers prevent erosion of stream banks and adjacent lands – including both public lands and private lands. Root systems of woody shrubs and trees do a better job of anchoring these soils — this is a function that turf grass, or low growing vegetation as is often found at pipeline stream crossings, simply cannot do effectively.[64] Stream reaches that are forested "exhibit 20 – 33% slower channel migration and lower floodplain accretion rates of sediment and thereby provide more stability than deforested channels."[65]

Research has concluded that forested buffer systems, as opposed to grassed systems or other herbaceous plants, provide an enhanced ability to sequester contaminants instream and to degrade them; this is primarily due to increased biological activity. Increased nitrogen attenuation and pesticide degradation are particularly associated with forested stream buffers.[66]

The removal of healthy forested buffers along the many stream crossings proposed by Atlantic Sunrise must be assessed – individually and cumulatively. In addition, when the stream crossing includes a cut through a pre-existing mature and healthy forest the degradation of the forest on either side of the Right of Way that results from this forest fragmentation needs also to be considered, both in terms of stream impacts and forest impacts.

Fishery Impacts Need Full Consideration

Benthic invertebrates are impacted during the construction phase of a pipeline whenever any of the open trench cut methods are used. Changes in downstream diversity and structure of benthic invertebrate communities can result. While, in time, the benthic community generally restores, that does not diminish or negate the ecosystem effects during the time of damage including the other cascading affects to other ecosystem services otherwise provided by the invertebrates – including as food for other dependent species, the water quality benefits provided by invertebrates helping with nutrient breakdown, and the breakdown of instream detritus creating food for other species.[67] These impacts must be thoroughly considered.

Using the open trench cut method of crossing can also affect fish, including direct harm but also by reducing the suitability of habitat including for eggs, juveniles and overwintering.[68] Fish exposed to elevated suspended solids levels can experience reduced feeding rates, physical

[60] David Welsch, Riparian Forest Buffers, US Dept of Agriculture Forest Service, NA-PR-07-91, http://www.na.fs.fed.us/spfo/pubs/n%5Fresource/riparianforests/

[61] David Welsch, Riparian Forest Buffers, US Dept of Agriculture Forest Service, NA-PR-07-91, http://www.na.fs.fed.us/spfo/pubs/n%5Fresource/riparianforests/

[62] *Id.*

[63] B.W. Sweeney, Bott, Jackson, Kaplan, Newbold, Standley, Hession and Horwitz, Riparian deforestation, stream narrowing, and loss of stream ecosystem services, Proceedings of the National Academy of Sciences of the United States of American, Vol 101, No. 39, Sept 28, 2004.

[64] National Research Council. 2002. Riparian Areas: Functions and Strategies for Management. Water, Science, and Technology Board, Board of Environmental Studies and Technology, National Academy Press, Washington, DC. Also see Stroud Water Research Center, Protecting Headwaters: The Scientific Basis for Safeguarding Stream and River Ecosystems, 2008.

[65] Sweeney, et al, Riparian deforestation, stream narrowing, and loss of stream ecosystem services. 2003.

[66] Sweeney, B. W., et al. 2004. Riparian deforestation, stream narrowing, and loss of stream ecosystem services. PNAS, September 2004; 101: 14132–14137.

[67] *Id.*

[68] *Ibid* 1.

discomfort or damage from the abrasive materials on their gills, decreased instream visibility, reduced food supply, and increased competition as fish attempt to move to cleaner waters.[69] For example, the filling of riffles not only can have adverse impacts for invertebrates and fish, in terms of taking important habitat, but it can also diminish the ability of the riffles to help create oxygen important for aquatic life.[70] Over time these impacts can depress the immune system of fish, result in lower growth rates, result in increased stress on individuals and populations, cause damage to the gills – all of which can result in a decline in fish and population health and survival rates.[71] This of course all gets compounded by adverse effects to the suitability of habitat for eggs and juveniles necessary to support the overall community and population.[72] Additionally, downstream sedimentation and also disruption of flows during crossing activities can result in areas of the stream that are shallower or dewatered, thereby taking preferred habitat.[73] These impacts must be thoroughly considered – including both short term and long term impacts.

All of the aquatic, fish, amphibian and invertebrate species located in and/or around the streams, rivers and/or wetlands to be crossed or impacted by the project must be thoroughly catalogued, their population status considered, and the ramifications of the Atlantic Sunrise pipeline construction and operation on aquatic individuals and communities must be analyzed. For example, the headwater streams impacted by the Project must be surveyed for native brook trout. The crossing of multiple streams, including trout waters, will have a large impact on the trout populations and spawning in the region, especially during construction, and will degrade the waterways long after the Project is completed. Not only must the impact on present species be assessed, but the impact on habitat potential for species that once inhabited the area, or could inhabit it in the future if properly protected must also be considered.

Among the impacts resulting from construction of the Project, the NEPA document must also examine impacts to all aquatic ecosystems caused by the channelization of groundwater and surface water to new areas as it runs parallel to the new pipeline. For example, a gas pipeline installation that crossed the Musconetcong River in Asbury, New Jersey resulted in an alteration in the channelization of groundwater running parallel with the pipeline and away from the river, decreasing water levels in the river and negatively impacting trout spawning and macroinvertebrate populations.

Impacts to Vegetated Habitats and Dependent Species Needs Full Cataloguing, Consideration and Review

The Project, as proposed, requires the removal of vegetation from the ROW. This will have a multitude of direct and secondary effects including increased runoff and soil erosion, encroachment and establishment of invasive species, and destruction of wildlife habitat, loss of biodiversity, loss of forest cover and forest edge impacts to the remaining forest, and increased use of herbicides along the ROW that will impact the surrounding ecosystem. The impacts of modifying the various vegetative ecosystems along the length of the project must be assessed, including both direct and indirect effects of project construction and operation. Among the vegetative and ecosystem impacts in need of careful consideration is the impact of forest ecosystems. These impacts must all be identified and accounted for in the EIS.

[69] Pipeline Associated Watercourse Crossings, 3rd Edition, publication prepared for CAPP, CEPA, and CGA by Tera Environmental Consultants
[70] *Ibid* 1.
[71] *Ibid* 1.
[72] *Ibid* 1.
[73] *Ibid* 1.

Pipeline construction results in the loss of riparian (streamside) vegetation.[74] For each of the pipeline construction techniques, there is a resulting loss of vegetation and foliage associated with clearing the stream banks. Riparian vegetation is an important part of a healthy ecosystem and protects the land adjoining a waterway which in turn directly affects water quality, water quantity, and stream ecosystem health. The body of scientific research indicates that stream buffers, particularly those dominated by woody vegetation that are a minimum 100 feet wide, are instrumental in providing numerous ecological and socioeconomic benefits.[75] Simply put, riparian corridors protect and restore the functionality and integrity of streams. A reduction in streamside healthy and mature streamside vegetation reduces stream shading, increases stream temperature and reduces its suitability for incubation, rearing, foraging and escape habitat.[76] While horizontal directional drilling may move the construction footprint further away from the stream, it too results in vegetative losses and soil compaction that can have direct stream impacts.

The loss of vegetation also makes the stream more susceptible to erosion events, exacerbating the sedimentation impacts of construction. In crossings that result in open forest canopies, increases in channel width, reduced water depth, and reduced meanders have persisted in the years after using an open cut method of installation.[77]

Forest fragmentation and habitat loss is a serious consequence of pipeline construction. Damage to a forest ecosystem includes the direct and actual location of the foot print of the ROW, roadways, construction areas, and above ground aperture locations. An additional 300 feet of forest on either side of the ROW is also impacted. "[F]orest clearing creates an associated edge effect" whereby "increased light and wind exposure creates different vegetation dynamics".[78]

The Nature Conservancy has determined that "[t]he expanding pipeline network could eliminate habitat conditions needed by "interior" forest species on between 360,000 and 900,000 acres as new forest edges are created by pipeline right-of-ways."[79]

Wildlife Impacts Must Be Fully Assessed.

All animal species located on or that utilize habitats for any portion of the year and their life cycle in, around and/or impacted by the proposed ROW, construction areas and/or project apertures (such as compressors and valve stations) must be thoroughly catalogued, their population status considered, and the ramifications of the Atlantic Sunrise pipeline construction and operation analyzed. Not only must the impact on present species be assessed, but the impact on habitat potential for species that once inhabited the area, or could inhabit it in the future if properly protected and preserved, must also be considered.

Among the impacts to be considered is the impact to interior forest species, such as black-throated blue warblers, salamanders, and many woodland flowers, that require shade, humidity, and tree canopy protection that only deep forest environments can provide.[80]

A pipeline ROW corridor "inhibits the movement of some species, such as forest interior nesting birds, which are reluctant to cross openings where they are more exposed to predators."[81]

---

[74] James Norman, et al., Utility Stream Crossing Policy, ETOWAH AQUATIC HABITAT CONSERVATION PLAN, July 13, 2008,

[75] See e.g. Newbold et al. 1980, Welsch 1991, Sweeney 1992, Sweeney and Newbold 2014

[76] Canadian Association of Petroleum Producers, Canadian Energy Pipeline Association, and Canadian Gas Association, Pipeline Associated Water Crossings, 1-4 (2005).

[77] Ibid 1.

[78] Cara Lee, Brad Stratton, Rebecca Shirer, Ellen Weiss, *An Assessment of the Potential Impacts of High Volume Hydraulic Fracturing (HVHF) on Forest Resources*, The Nature Conservancy, Dec. 19, 2011.

[79] Nels Johnson, et al., Natural Gas Pipelines, The Nature Conservancy, 1 (December 2011).

[80] *Id.*

While some species may be inhibited from travelling up or across an open pipeline ROW, others will readily travel up and over, increasing the level of harm – this includes all terrain vehicles (ATVs) that continue to impact areas. The clearing of forest for pipelines can also result in the introduction and linear and outward spread of invasive species (such as Japanese knotweed, Japanese stiltgrass, multiflora rose, *Phragmites* and hay scented fern) resulting in further decline of native wildlife species, and the creation of microclimates that degrade forest health through sunscald and wind-throw. For example, the pipeline corridor becomes a path for ATVs, and seeds of invasives can spread along the corridor in vehicular tires. These invasive plants, if tolerant to shade, can also then colonize surrounding woodlands, decreasing habitat and diversity within the adjacent forest habitat.

FERC must use the best available science to ensure protection of wildlife and avoid jeopardy to wildlife habitat. Failure to employ the best available science to determine the biological baseline and evaluate potential impacts would thwart the purposes of NEPA.

The scope of study for impacts to species cannot be limited to the ROW. The ROW forest buffer, access roads, construction areas, staging areas, areas of aperture placement and operation, and buffers must be examined for species and habitat. The effects of increased forest edge and habitat degradation due to the impacts of construction and permanent impairment of resources on these species must be analyzed as well. The ramifications of noise, light, air and heat impacts from operation of the pipeline and associated apertures such as compressor stations must be fully considered.

Endangered and Threatened Plant and Animal Species Must Be Thoroughly Catalogued and Considered

The region where the pipeline would cut is home to a significant number of endangered, threatened, and rare species, including plant, fish, mammal, reptile, and amphibian species. There are additional state threatened and endangered species some of which are included on the List of Threatened and Endangered Species that are Critically Dependent on Regulated Waters for Survival.

Among the federally listed species already identified that could be impacted by the project are the Bog Turtle, the Indiana Bat, the Dwarf Wedge Mussel and the Northern Long-eared Bat and the little brown bat which have been proposed-for-listing.[82] In addition to those directly impacted, numerous other federally listed species that may be impacted by the Project including Striped Bass, New Jersey Chorus Frog, Coastal Plan Leopard Frog, Red-bellied Turtle, Longtail Salamander, Wood Turtle, Eastern Small-footed Bat, Vesper, Cliff, Grasshopper, and Savana Sparrows, Osprey, Peregrine Falcon, Bald Eagle, and Upland Sandpiper.

The NEPA document must assess how the project would affect these species including impacts on habitats, vegetation, reproduction, water quality and other ecological impacts such as increased sedimentation of waterways, increased water temperatures, increased soil temperatures, multiple disturbances over time, mortality due to increased traffic, and impacts to groundwater recharge. All possible impacts to these species resulting from the Project must be studied.

Species monitoring is an extensive process and the timeframe for conducting these

---

[81] *Id.*

[82] See attached: Hein, C. D. 2012. Potential impacts of shale gas development on bat populations in the northeastern United States. An unpublished report submitted to the Delaware Riverkeeper Network, Bristol, Pennsylvania by Bat Conservation International, Austin, Texas.; and Kunz, T. H., & Reichard, J. D. (2010). Status review of the little brown myotis (Myotis lucifugus) and determination that immediate listing under the endangered Species Act is scientifically and legally warranted. Boston University, Boston, MA. Available at: http://httwww.biologicaldiversity.org/campaigns/bat_crisis_white-nose_syndrome/pdfs/Final-Status-Review.pdf

studies must not be cut short simply to satisfy the applicant's desired in-service date. More time may be needed to study the true impacts to these threatened, rare, and endangered species if this Project moves forward. The NEPA document must carefully assess whether this Project can proceed without disrupting this habitat or resulting in the taking of any federal or state protected species. Furthermore, FERC should require Atlantic Sunrise to mitigate for the loss of habitat. FERC must ensure full compliance with the Federal Endangered Species Act. The EIS document should clarify that any disturbed areas that will result in compensation, will involve resources that have substantially the same values and functions as those impacted.

The scope of study for impacts to threatened, endangered, and rare species cannot be limited to the ROW. The ROW forest buffer, access roads, construction areas, staging areas, areas of aperture placement and operation, and buffers must be examined for species and habitat. The effects of increased forest edge and habitat degradation due to the impacts of construction and permanent impairment of resources on these species must be analyzed as well. The ramifications of noise, light, air and heat impacts from operation of the pipeline and associated apertures such as compressor stations must be fully considered.

Invasive Species Impacts Must Be Given Due Attention

Invasive vegetation out-competes native vegetation and spreads rapidly through forest openings.[83] The entire Project would create edge impacts on forest communities that will be disturbed or re-disturbed by the project. The newly-created forest edge will be a direct impact of the Project and will be a prime spot for invasive species infestation on the newly-created edge. Moreover, the Project's disturbance of vegetation in the ROW, access roads, and temporary workspaces will require re-vegetation following construction, which will itself introduce new invasive species.

The damaged and/or changed habitat ecosystems will also be an invitation for invasive wildlife species that can also have near term and long term impacts on the region, all of which must be fully considered.

The spread of invasive species, whether already established and able to find new favorable habitats due to the Project, or resulting from project construction, would have a major impact on the biodiversity of ecosystem through widespread loss of native vegetation and/or native species. The loss of biodiversity is a tragedy in its own right, but it will also affect visitor experience and may result in less utilization of the affected areas by flora enthusiasts, birders, wildlife viewers, hikers, hunters and/or boaters in favor of more biologically diverse sites elsewhere. The reestablishment of native vegetation, especially considering the effects of deer herbivory, will take many years, and until reestablishment is achieved the area will be susceptible to further invasive species infestation. FERC must consider these impacts in the NEPA document.

Moreover, NEPA review must also encompass the impacts of invasive species on groundwater recharge. Invasive species often have shallower root systems than native plants, which allow the soil to erode more readily and to degrade the quality of watersheds by adding to "suspended sediment loads and turbidity."[84]

Finally, the financial impacts of invasive species management must be considered. If the applicant does not commit to conducting permanent invasive species management outside the ROW in the associated forest buffer, the National Park Service, State Park agencies, county park programs, private homeowners and others will be required to fund future eradication programs

[83] New Jersey Audubon Society, Forest Health and Ecological Integrity Stressors and Solutions: Policy White Paper (March, 2005), available at http://www.njaudubon.org/Portals/10/Conservation/PDF/ForestHealthWhitePaper.pdf.
[84] T. Stohlgren, C. Jarnevich & S. Kumar, Forest Legacies, Climate Change, Altered Disturbance Regimes, Invasive Species and Water, Unasylva 229, 2007, at 44, 47-8.

through money or activity. The NEPA document must consider the Project in light of the unavailability of government resources to ensure the applicant's mitigation and restoration projects are successful on public trust lands.

The Atlantic Sunrise Pipeline is likely to result in new and additional encroachment of undesirable invasive vegetation and animals species into forests, park lands, and other publicly or privately preserved areas destroying biodiversity, reducing the effectiveness of groundwater recharge, and driving away recreational visitors. This will in turn result in a loss of the economic values that accompany high recreational and aesthetic values of a region.

Landscape Connectivity Impacts Must Be Fully Considered

The ROW will create fragmentation of the forest, allowing edge species, including white-tail deer and cowbirds, to encroach deeper into the core forest. These edge effects can negatively impact plant and animal species at least 300 feet within the forest boundary.[85] These impacts must be examined to ensure plant and animal species, including but not limited to rare, threatened, and endangered plant species populations can be maintained in the ecosystem surrounding the ROW. Among the issues to be considered is whether any portions of the planned ROW are an essential functional portion of a species' overall habitat requirements, such as nesting or feeding, and therefore could not or would be very difficult to replace. Furthermore, species requiring large integral home ranges will be negatively impacted and coordination with NPS and the U.S. Fish and Wildlife Service is necessary to identify whether such species will be impacted by further forest fragmentation.

Geology and Soil Impacts Could be Significant and Must Be Considered

FERC's analysis should include a full examination of the geological formations that will be impacted by construction activities, such as groundwater aquifers and water table depth, sinkholes, and springs. FERC must disclose how this Project will avoid all negative impacts to these features.

Blasting for stream crossings with bedrock can be proposed by pipeline operators. Instream blasting causes direct mortality to fish and aquatic organisms.[86] Trenching and blasting result in short term increases in sediment and turbidity levels that are higher than allowed by most regulatory agencies.[87] Pipeline water crossings have been shown to greatly decrease available fish cover and habitat complexity in the ROW in the longer term. The elimination of pools, riffles, and other stream characteristics caused by pipeline construction can have serious impacts on fish populations by reducing the available area for feeding, breeding, rearing and resting.[88] DRN has also observed and documented short term well water impacts to homeowners located near blasting and trenching operations of a pipeline ROW when turbidity and sediment in the well has made the water unpotable without treatment.

Areas of steep slopes will be traversed by the Project. Steep topography maximizes the potential for erosion, rock slides and even avalanches caused by construction of the Project.

---

[85] Janzen, D.H., The Eternal External Threat, in Conservation Biology, The Science of Scarcity and Diversity (Soulé, M. E., ed. 1986).

[86] Reid S, Jalbert A, Metikosh S, Bender M. 2002. "A performance measurement framework for pipeline water crossing construction". In Environmental Concerns in Rights-of-Way Management: Seventh International Symposium. Elsevier Science Ltd. p.697-703.

[87] Harper, HW and Trettel R. (2002). Theoretical modeling of suspended sediment, turbidity dynamics, and fishery impacts during pipeline construction across streams. In Environmental Concerns in Rights-of-Way Management: Seventh International Symposium. Elsevier Science Ltd. P. 753-763.

[88] Brown, CM, et al. (2002). Effects of pipeline rights-of-way on fish habitat at two Alberta stream crossings. In Environmental Concerns in Rights-of-Way Management: Seventh International Symposium. Elsevier Science Ltd. P. 705-715.

Significant permanent scarring of the geological resources could occur, with geologic impacts far more severe than would occur in level topography. Therefore, the feasibility of erosion control mechanisms in these areas must be evaluated taking into account local topography.

The digging of trenches for the Project will involve excavating tons of soil and requires that soil surveys be conducted in relation to the Project. Construction and re-establishment of vegetation along the ROW provides an opportunity for run-off and the loss of productive soil. Construction activities will change the drainage patterns along the ROW and necessitate detailed studies of impacts to water resources. Expansion of the ROW has the potential to affect the physical properties of the soil along and adjacent to the ROW by clearing land cover, thus changing the sunlight exposure and moisture content of the soil. Reduction in soil moisture increases the risk of wind erosion. ROW expansion will also result in increased use of herbicides for ROW maintenance, which will chemically alter soil composition. Spillage of fuel oil and the creation of trench breakers during construction activities may also result in the chemical alteration of soil. Furthermore, natural gas pipelines increase localized soil temperatures; therefore, the EIS must examine the impact to soils within the vicinity of the pipeline that experience this warming effect. The Commission has previously ignored this issue and cannot continue to do so for this Project.

Construction activities will also necessitate the removal and disposal of material. The NEPA document should address where the removal will be conducted and where the material will be disposed, whether digging to install the pipeline is likely to intercept the water table, and what effects the resultant pumping will have.

It has already been brought to the attention of FERC, via other commenters, that there are abandoned mine areas that could be crossed by the pipeline project and streams with acid mine drainage. The ramifications for these coal extraction impacts, including the increased potential for a pipeline break, sinkholes, release and disturbance of heavy metals, coal fires and hazards associated with having a high pressure line near these areas must all be considered. EPCAMR Eastern Pennsylvania Coalition of Abandoned Mine Reclamation has provided information on the record about these potential hazards[89].

The Proposed Pipeline Will Have Air Quality Impacts That Must Be Considered and Addressed

This Project will have serious impacts on the air quality along the ROW, ROW buffer, access roads, and surrounding landscape. Air quality degradation needs to be examined in relation to its health and safety impacts for nearby, full-time residents as well as for visitors to the region, plant life and wildlife.

Compressors and pipelines associated with shale gas are also sources of air pollution including methane, ethane, benzene, toluene, xylene, carbon monoxide and ozone.[90] Compressor stations have also been found to emit formaldehyde, another known carcinogen.

Diesel emissions during construction will be among the air quality impacts to residents, visitors and wildlife. Further increases in diesel emissions as a result of the Project may lead to a higher level of ozone along the ROW as the cleared ROW provides more sunlight for nitrogen oxides and reactive organic gases to combine.

The cumulative impact analysis should include consideration of the incremental impact of the Project on air quality, added to the air quality impacts of existing and reasonably foreseeable Marcellus Shale development in the region, including other pipeline construction, and the end use of the gas, including potential shipping as LNG. Natural gas and oil production

[89] http://citizensvoice.com/news/river-concerns-surface-about-pipeline-1.1845246.March 9, 2015.
[90] *Ibid*. 82

and transmission emit substantial amounts of air pollution, including volatile organic compounds (VOCs), nitrogen oxides (NOx), and toxic air pollutants. The toxic air pollutants include benzene, a known carcinogen; toluene, nhexane, and xylenes, which can lead to nervous system effects; and ethylbenzene, which can cause blood disorders. VOCs and NOx contribute to local and regional ozone pollution, which has serious impacts on human respiratory and cardiovascular health as well as on vegetation and forest ecosystems. Particulate matter, whether directly emitted from exhaust and fugitive dust during construction, from operation of diesel-fired engines, or indirectly created from interactions of NOx emissions in the atmosphere, also affects respiratory and cardiovascular health.

The NEPA document should assess air emissions and particulate deposition from the construction and operation of the Project and its infrastructure based on the cumulative impact of the proposed line's emissions *together with* air emissions from existing and reasonably foreseeable Marcellus development and end uses of the gas delivered by the pipeline.

Noise Impacts from Pipeline Construction and Operation Need Full and Fair Consideration

FERC must explore the impacts of construction, operation, and maintenance of the Project on residents, wildlife and visitors. Noise associated with construction can have a devastating impact on wildlife. Certain species depend on hearing for courtship and mating behavior, prey location, predator detection, or homing and will suffer serious detrimental impacts from construction and/or ongoing operation of compressor stations. Such impacts must be considered.

Noise impacts to year round residents as well as visitors must also be examined as sensitivity to noise is very variable and these impacts may lead to less utilization of the associated parklands by the public, decreased quality of life by residents, health impacts to those repeatedly exposed, and/or a reduction of nearby wildlife impacting recreation.

FERC must include construction impacts in the scope of its environmental review. To determine these impacts, the applicant must be asked to provide specific details on construction activities, including the type of equipment that will be used and when it will be used, what season and time of day construction activities will occur, and the specific noise-producing attributes of each piece of equipment.

The possibility of ground-borne vibration and noise impacts related to construction activities on habitat, steep slopes, etc. must be studied. Resources near the Project will be especially susceptible to ground-borne vibration as the applicant is proposing to construct an underground pipeline that will require the creation of a trench across an extremely sensitive landscape.

Noise impacts to the landscape will be exacerbated by the creation of the ROW and the removal of vegetation. As the ROW expands, noise from construction, operation, and maintenance of the pipeline will penetrate farther into the forest, affecting additional wildlife. FERC must assess the severity and nature of this impact throughout the different seasons and the overall lifetime of the project.

The movement of construction equipment and long-term maintenance vehicles may impact sensitive receptors in the surrounding local communities along utilized roadways and access roads. Further, if detours are used during the construction project, the roadways that bear the re-directed traffic may be impacted by the increased noise. The NEPA document must address both of these secondary noise impacts.

The ongoing noise at proposed compressor stations must be fully considered as must the ongoing vibration impacts of operation of the pipeline as gas passes through it.

Viewsheds Are an Important Part of The Impacted Community That Must be Considered

Viewshed impacts should be examined in a way that describes any physical changes to the landscape, examines consistency with the objectives of the NPS, and state and county parkland management plans to preserve scenic resources, and considers the ramifications for community planning documents and zoning, compatibility in mass, scale, and prominence, and degree of contrast in line, color, and form.

Viewer sensitivity will be extremely high to viewshed impacts as the lands impacted by the Project are some of the last remaining contiguous forests in New Jersey and Pennsylvania and are preserved lands highly utilized by recreational visitors and highly prized by both residents and potential homebuyers. Altering the natural visual environment on these lands through the construction of a gas pipeline would be adverse to user's expectations that the area will have natural, wild viewsheds. These impacts must be heavily weighted.

To properly assess these impacts, the Commission should consider, but not be limited to, the following issues: probable viewers and their viewer sensitivity, all significant vistas and viewsheds that could be impacted by any of the alternatives, and the dominant elements of the current viewsheds and how each alternative will impact that viewshed or vista. Moreover, the construction activities, the ROW, and clearing of access roads will produce localized scenic resource impacts that must be assessed in the NEPA document. The document should address all foreground, middle-ground, and background vistas in its analysis of impacts.

Climate Change and Greenhouse Gases

Carbon sequestration in forest cover is a critical mechanism in combating climate change. Forests serve as carbon sinks, removing excess carbon dioxide from the atmosphere and storing the compound over several decades. The applicant estimates 3,507.36 acres to be impacted by the project. Some of these areas include mature forest which means clear-cuts for areas like Second Mountain on the CPL South line for example, decreasing the landscape's ability to provide carbon sequestration services. This impact must be addressed in the NEPA document.

The construction of the Project will require a large amount of fossil fuel to power construction equipment. The NEPA document must explore what impact construction vehicle emissions will have on climate change.

Further, FERC should consider the cumulative impacts of the Project's direct and indirect greenhouse gas ("GHG") emissions. Direct emissions may include but are not limited to carbon dioxide (CO_2) and nitrous oxide (N_2O) emissions from compressor engines, line heaters, and generators; fugitive methane emissions from compressors and pipelines; and black carbon emissions from diesel vehicles and equipment. Notably, methane is 84 times and N_2O is 280 times more warming than CO_2 over a twenty-year period, while black carbon is estimated to be 2,200 times more warming than CO_2 over the same period.[91]

Additionally, large amounts of methane leak into the atmosphere during the "transport, storage and distribution" phases of the natural gas delivery process including during transmission through interstate pipelines.[92] Even conservative estimates of leakage during gas transmission,

[91] United Nations Framework Convention on Climate Change, Global Warming Potentials http://unfccc.int/ghg_data/items/3825.php (last visited Nov. 10, 2010). L. Bruce Hill, Clean Air Task Force, The Carbon Dioxide-Equivalent Benefits of Reducing Black Carbon Emissions from U.S. Class 8 Trucks Using Diesel Particulate Filters: A Preliminary Analysis 3

[92] R. Howarth, D Shindell, R. Santoro, A. Ingraffea, N. Phillips, A Townsend-Small, Methane Emissions from Natural Gas Systems, Background Paper Prepared for the National Climate Assessment, Reference number 2011-0003, Feb. 25, 2012.; See also U.S. EPA 1997. Methane Emissions from the Natural Gas Industry. USEPA National Risk Management Research Laboratory, June 1997, EPA-600-SR-96-080.

storage and distribution have given a range of up to 3.6%.[93] If additional processing is required before the gas can be transported through a pipe then as much as 0.19% more of the gas can be lost. [94] The majority of emissions from the transmission segment come from leaks on compressor components. Leaks of methane from the pipelines are also caused by disturbances from earth movement, the breakdown of joints, corrosion, and natural processes that degrade softer elements in the pipe. After the gas moves through transmission lines, underground distribution pipelines move the gas from the local gas utility/ distribution company to the end user, the residential or commercial customers. These greenhouse gas emissions must be fully, fairly and conservatively assessed.

Furthermore, indirect effects of the Project's transportation of natural gas from the Marcellus Shale region should be analyzed including, but not limited to the impact of this gas when combusted for use, releasing GHG that cause climate change. This effect is not only reasonably foreseeable, it is certain. Since NEPA analyses of GHG sources must take into account all phases of the proposed action, such certain downstream effects of a gas pipeline should be assessed. Moreover, cumulative impact analysis requires that these GHG emissions be considered in the context of GHGs emitted from the aggregate of natural gas that have been and will reasonably foreseeably be extracted from the Marcellus Shale region.

The production of the pipes, mining of metal and supplies to manufacture the pipelines, and the transport of those pipes from the production facility to the final pipe destination need also be considered in the impacts as all of these manufacturing processes are labor and fossil fuel dependent.

Exposed Pipelines and Associated Risk of Rupture

Because open trench pipeline installations may unnaturally alter both stream bank and streambed (i.e., channel) stability, there is an increased likelihood of scouring within backfilled pipeline trenches. Flooding rivers can scour river bottoms and expose pipelines to powerful water currents and damaging debris. Additionally, unusually heavy rains possibly associated with climate change, threaten to increase overall stream degradation and channel migration – thereby exposing shallowly buried pipelines. Exposure of the pipeline raises a greater risk of pipeline damage, breakage and pollution; with pipeline breakage resulting in the catastrophic discharge of its contents into the natural stream system. Soil erosion and channel migration reduces the soil cover over a pipeline, resulting in the formation of a scour hole which makes the pipeline vulnerable to rupture. Lateral migration of stream channels can also heighten the risk of pipeline exposure.

Scour hole development proximal to pipelines is well-documented in both stream and seabed settings.[95] Federal regulations require that pipelines crossing rivers be buried at least four feet underneath most riverbeds.[96] An expert at HydroQuest has determined that, at a minimum, any pipeline installed using the open trench cut method needs to be installed at least 24 feet below the stream bed in order to prevent exposure from scour.[97]

---

[93] Howarth, R. W. (2014). A bridge to nowhere: methane emissions and the greenhouse gas footprint of natural gas. Energy Science & Engineering.; *See also* R.W. Howarth, R. Santoro, A. Ingraffea, Methane and the greenhouse-gas footprint of natural gas from shale formations, A letter, Climatic Change, March 13, 2011.

[94] R.W. Howarth, R. Santoro, A. Ingraffea, Methane and the greenhouse-gas footprint of natural gas from shale formations, A letter, Climatic Change, March 13, 2011.

[95] Fogg, J. and Hadley, H., 2007, Hydraulic Considerations for Pipelines Crossing Stream Channels. Technical Note 423. BLM/ST/ST-07/007+2880. U.S. Department of the Interior, Bureau of Land Management, National Science and Technology Center, Denver, CO. 20 pp. http://www.blm.gov/nstc/library/techno2.htm.

[96] Billings Gazette, July 21, 2011: http://billingsgazette.com/news/state-and-regional/montana/article_c8d20d9e-b391-11e0-941f-001cc4c002e0.html

[97] Expert Report from HydroQuest.

Another significant environmental risk associated with both wet and dry trench methods of gas pipeline crossings of rivers and streams is the potential of releasing hydrocarbons or other contaminants directly into surface water and fragile downstream ecosystems, including hydro-carbon laced liquids such as benzene that are part of the gas being delivered by the pipeline. Hydrocarbon-laced condensate or natural gas liquids (NGLs) associated with natural gas (e.g., benzene) pose an environmental risk if pipe rupture occurs (e.g., to potential bog turtle habitat and travel corridors, fisheries, downstream drinking water supplies as well as underlying aquifers recharged by stream water). Clean up associated with pipeline breaks can be extremely expensive.

The potential for scour, pipeline exposure, pipeline rupture and resulting impacts must be full consideration in NEPA review, especially given the high number of stream crossings slated for this project.

Energy Impacts Require Assessment

Energy impacts must also be examined in the NEPA document. Aspects of the Project that should be studied for their energy impact include: all energy-consuming equipment and processes that will be used during the construction and operation of the Project; the energy efficiency of required materials, fuels, and equipment; the number of maintenance trips necessary for maintaining the ROW over its intended life; the mode of transportation and use of fuel for these activities; and an estimate of the total energy requirements for each proposed alternative.

The NEPA documents should also examine the impacts of increased energy consumption that will result from upgrading the natural gas pipeline. Part of this analysis should discuss how bringing more energy to other markets and abroad markets will affect future energy conservation efforts.

Energy consumption impacts should be calculated for the lifetime of the proposed Project and Project alternatives, and should be an aspect of the irreversible commitment of resources section of the NEPA document.

The impacts of this project on clean energy investments as well as the ability of clean energy options to provide the energy needs targeted should also be part of the NEPA assessment.

Impacts to Recreation, Aesthetics, Art and the Resulting Economics Must All be Considered

In studying impacts to water quality, wetlands, parklands, forest land, naturally vegetated areas, and/or any of the landscapes, water resources, open space areas, conserved lands or parklands impacted by Atlantic Sunrise, the ramifications for the beauty of the region and the recreational use and value of the region must also be considered. For example, consideration of the direct and indirect impacts must also be given to how diminished water quality would affect recreational and visitor uses and state and county parklands (e.g., boating, canoeing, aesthetic qualities, and degradation of fisheries), tributaries valued for their birding, boating and fishing. The market value of homes, the success of recreational ventures, the economic success of the many recreationally and aesthetically dependent businesses of the region will all be impacted by the land, water, landscape, aquatic life and wildlife impacts of the project. All of these issues must be considered.

When considering alternative routes the short and long-term implications of disturbing and fragmenting natural areas must be given greater weight than consideration of manicured, active recreation areas.

Additionally, the rural character of the region is highly favored and utilized by artists because of its beauty, its unparalleled ecological values and visuals, and the community it has

attracted and supported. The ramifications for art, artists and art related businesses and nonprofits must also be given due consideration and valuation.

Proposed Mitigation and Co-Location Measures Must Be Considered in Context and Effectiveness

As with all mitigation measures, to determine a proposed mitigation measures' efficacy FERC must examine the effectiveness of proposed mitigation that has been implemented for other FERC jurisdictional projects around the area where the proposed Project will be constructed and operated. Such a comparison is necessary in any environmental review document produced by the Commission.

It must also be honestly recognized that co-location of a project with existing ROWs, as is being considered for a portion of the project, does not avoid the forest fragmentation, waterway, wetland, habitat, soil compaction, increased runoff, air pollution, invasive species or other harms that pipeline construction and operation bring. So to the extent there is any co-location there must be full consideration of the impacts.

Infrastructure, Access, and Circulation

FERC must examine the potential degradation of roadways due to utilization by construction vehicles. The heavy construction machinery and high traffic volumes associated with Project construction activities ruins roads, leaving taxpayers to pay for repairs, particularly given that PA exempts pipeline companies from taxation. FERC should consider this eventual tax burden as it weighs alternatives during the NEPA process.

Moreover, construction traffic will impact visitor experience at federal, state, and county parklands as portions of these parks will be completely inaccessible or will require detours. Visitors will have to fight congestion to access the parks, and the messy sight of construction activity will greet them once they arrive. Park visitation may well decrease, causing an adverse impact on the local economy.

FERC must also address localized impacts along access roads arising from the removal of vegetation, which will in turn lead to loss of forest connectivity, increased edge effects on the core forest, and increased erosion. The heavy construction equipment utilizing these roads will compact the soil, leading to a degradation of groundwater recharge capabilities. Finally, the installation of fill materials along these roads will also import invasive species to the ROW. The NEPA document must examine these long-term effects.

The impacts to roadways and residents from roadway collapse due to pipeline construction must also be assessed. For example, construction of the Northeast Upgrade project resulted in a roadway cave in during HDD activities, and the threat of sinkholes, has even greater potential to impact roads and traffic.

Ongoing Impacts of Pipelines

The ongoing impacts of the pipeline ROW and operation of the pipeline for transporting natural gas must be assessed. As proposed, the ROW will be kept clear of vegetation. This ongoing absence of healthy vegetation and the methods used for maintenance, including the use of herbicides, has ongoing adverse impacts on the community and ecosystem.

The air quality impacts associated with methane leakage, the stormwater runoff and loss of groundwater recharge associated with vegetation loss and soil compaction, the impacts of forest fragmentation and invasive species are also enduring.

There are reports that farmers have reduced crop yields in the areas where their properties are crossed by pipelines – the cause and size of the food and economic impact of this affect must be thoroughly assessed. In public meetings regarding Atlantic Sunrise one farmer said an

existing pipeline crossing on his farm reduced his crop yield by 30% with measurements and data to support his assertion – these farming impacts must be considered for Atlantic Sunrise as well.

Conclusion

FERC's EIS must analyze the extensive and egregious impacts the Project threatens on water resources, forest ecosystems, habitats, air quality, and parks and open space. The NEPA document must also assess cumulative and secondary impacts. To do so, the analysis must be thorough and objective. Given the dramatic growth of natural gas development in the Marcellus Shale, and the significant environmental degradation resulting from that development, FERC has an obligation to consider the cumulative impacts of this Project across the length of the project itself but also in conjunction with other known and planned projects advertised for this region. Furthermore, the alternatives analysis must include alternative construction practices that can greatly avoid and minimize community and environmental harm.[98]

Thank you for the opportunity to comment on the proposed project. We look forward to full participation in the forthcoming environmental review process.

Respectfully,

Maya K. van Rossum
the Delaware Riverkeeper

Christine M. Arnott, Ph.D.
Research Associate

Aaron Stemplewicz
Staff Attorney

Faith Zerbe
Water Watch Director

Enclosures:

Sauer, L. (2014). An Overview of Pipeline Construction Impacts with Recommendations for Reducing Environmental Damage. An Expert Report Prepared for the Delaware Riverkeeper Network, May 2014, Bristol, Pennsylvania

[98] See attached report entitled "Achieving Higher Quality Restoration Along Pipeline Rights-of-Way: An Overview of Pipeline Construction Impacts with Recommendations for Reducing Environmental Damage

Achieving Higher Quality Restoration Along Pipeline Rights-of-Way

An Overview of Pipeline Construction Impacts with Recommendations for Reducing Environmental Damage

Principal Author
Leslie Sauer

An Expert Report Prepared for
the Delaware Riverkeeper Network

May 2014
Bristol, Pennsylvania

DELAWARE RIVERKEEPER NETWORK
925 Canal Street, Suite 3701
Bristol, PA 19007
215-369-1188
www.delawareriverkeeper.org

The Delaware Riverkeeper Network champions the rights of our communities to a Delaware River and tributary streams that are free-flowing, clean and healthy.

The Delaware Riverkeeper Network gives voice, strength and protection to the communities and waterways of the Delaware River. Through independent advocacy, and the use of accurate facts, science and law, DRN works to ensure the rich and healthy future that can only exist with a clean, healthy and free flowing river system.

The Delaware Riverkeeper Network is unique in that it is founded upon the expectation of personal and community responsibility for river protection, as personified by the Delaware Riverkeeper. DRN is the only grassroots advocacy organization that operates watershed-wide and empowers communities with the engaged interaction and information needed to succeed in protecting our River and region now and into the future.

Achieving Higher Quality Restoration Along Pipeline Rights-of-Way

An Overview of Pipeline Construction Impacts with Recommendations for Reducing Environmental Damage

Principal Author
Leslie Sauer

An Expert Report Prepared for
the Delaware Riverkeeper Network

May 2014
Bristol, Pennsylvania

Acknowledgements

Photographs and illustrations for this report were provided by:

Tracy Carluccio

Frank Foley

Scott Rando

Leslie Sauer

Maya van Rossum

Jerome Wagner

Faith Zerbe

Joe Zenes

Layout and Design: Chari Towne

Front cover photo: Leslie Sauer

Back cover photos (clockwise from top): M. van Rossum, J. Zenes, F. Zerbe, F. Zerbe, J. Zenes

Foreword

Even though shale gas development is currently prohibited within the boundaries of the Delaware River watershed, the explosive growth of shale gas infrastructure is still impacting the communities of the watershed profoundly—a watershed that provides drinking water to 17 million people living in New York (including residents of New York City), Pennsylvania, New Jersey and Delaware. Pipelines, compressor stations and liquefied natural gas facilities intended to take shale gas to new markets in the United States and abroad are being proposed and pursued rapidly within the watershed's boundaries. These projects illustrate the many harms this infrastructure imposes upon human and natural communities as well as the many deficiencies of current law associated with their proposal, review and construction.

Top to bottom: Right-of-way clearing for expansion of the Tennessee Gas Company's pipeline, J. Zenes; Pipeline under construction in Pike County, PA, T. Carluccio; Greenlick compressor station in Susquehannock State Forest; PAForestCoalition.org.

Deficiencies include, but are not limited to, a lack of any rational planning; the failure to apply for and comply with reviews mandated by the National Environmental Policy Act; the failure of both federal and state agencies to implement water, air and wildlife protection laws in a way that genuinely achieves real protection; the lack of the political will and resources at the state, regional and federal level to fully implement and enforce community protection laws; and an absence of state laws necessary to protect habitats, waterbodies, and forests of public and private landscapes. These lands serve as the critical natural green infrastructure that protects communities from environmental harm. These habitats underpin the region's economic development and ensure the health, safety and quality of life of our communities. And yet it is these habitats that are so cavalierly ruined by pipeline development.

Four pipelines expansion projects have already cut through the Delaware River watershed since 2011. These projects have left permanent scars across communities, created pollution, increased stormwater runoff, and damaged natural areas important to wildlife, recreation and ecotourism as well as damaging the economic values that each of these brings.

In addition, eight new and/or expanding interstate pipeline projects are proposed for the Delaware River watershed. New pipelines and pipeline expansions are proposed to cut through:

- Broome, Delaware, Orange and Sullivan Counties in New York
- Berks, Chester, Delaware, Lebanon, Monroe, Montgomery, Pike, Schuylkill and Wayne Counties in Pennsylvania;
- Gloucester, Hunterdon and Sussex Counties in New Jersey; and

- New Castle and Kent Counties in Delaware.

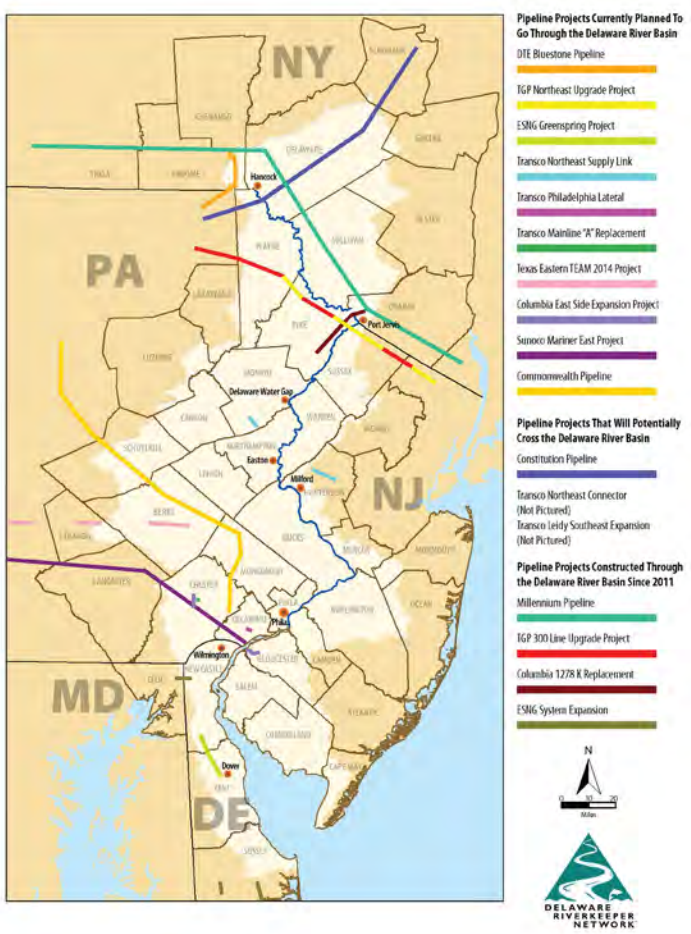
These pipeline projects will be cutting through communities, residential neighborhoods, mature and pristine forests and habitats, and through our highest quality and most valued streams and wetlands. Pipeline cuts are invasive, damaging and permanent.

Due to the irreparable harms shale gas development inflicts on communities and the environment, the Delaware Riverkeeper Network is opposed to all shale gas development and its associated infrastructure. Instead, the Delaware Riverkeeper Network supports sustainable energy as a focus of present and future energy investment and development. But, to the extent that there are pipeline projects now planned for our watershed and beyond, there are ways to dramatically reduce the harms they inflict when they do get through.

The recent frenzy of pipeline construction has highlighted many areas where current practices need significant improvement. To prepare this report, we started from the assumption that—in order to minimize harmful impacts on our environment and communities—we all want the best science and best technology to be used when pipelines pass through our neighborhoods, farmland and natural areas. The Delaware Riverkeeper Network turned to Leslie Sauer, an author and leader in ecological restoration, for insight into how harms from pipeline construction could be minimized or avoided. Ms. Sauer is a founder and former principal of the Philadelphia-based ecological planning and design firm, Andropogon Associates, Ltd.

This report complements a video lecture presented by Ms. Sauer. In both the lecture and this report, she discusses the harms that current pipeline construction practices cause, but she also provides recommendations that, if implemented, would avoid, minimize or at least dramatically reduce many of these harms. This expert report has been prepared to advise legislators, government bodies, regulators, decision-makers, and the public to encourage better practices, laws, and regulations should the proposed pipelines be permitted.

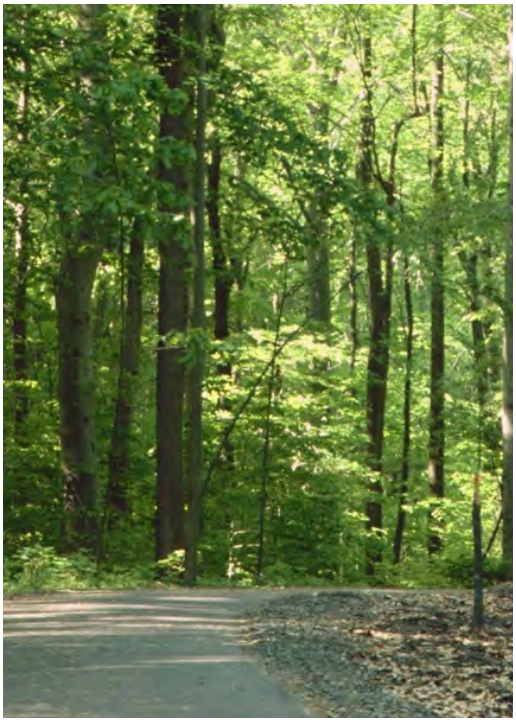
Maya K. van Rossum
the Delaware Riverkeeper



Pipeline projects currently planned to pass through the Delaware River watershed. Map prepared by the Delaware Riverkeeper Network.

This is a bad way to build a pipeline.

Below left, an open cut in-stream water crossing



There is a better way.

Above right, a pipeline was rerouted through a park to follow an existing trail wherever possible to limit the creation of new edge.

Above left: Cutting through the Lackawaxen River in Pike County, PA, for a pipeline ROW, A. Stemplewicz
Above right: ROW through a protected forest in Morris County in New Jersey, L. Sauer
Opposite page: the Delaware Riverkeeper, Maya van Rossum, F. Zerbe

Clockwise from top left: Columbia Gas Company's pipeline ROW carving across Pike County, PA, F. Zerbe; Construction of the Tennessee Gas Pipeline Company's North East Upgrade project, F. Zerbe; Removing sediment from Cummins Creek, Pike County, PA, after a rain event, J. Zenes

Achieving Higher Quality Restoration Along Pipeline Rights-of-Way: An Overview of Pipeline Construction Impacts with Recommendations for Reducing Environmental Damage

Leslie Sauer

Summary

For decades, pipeline construction has received limited oversight with minimal demands on construction practices, except at a few sites such as wetlands. Regulation is inadequate and, unfortunately, government agencies, in an effort to foster infrastructure development, have often reduced permitting requirements and costs without considering the environmental and community impacts of these decisions. Pipeline routes often intentionally target natural areas, such as state parks, forests and other wildlands. Over time, pipeline rights-of-way have become wider which magnifies the harms inflicted on both ecological and human communities. With no federal, state, or local regulatory agency tasked with evaluating the full impact of individual pipeline projects or the additive effect of multiple pipeline projects, cumulative impacts of pipeline projects are largely ignored. Also, the opportunity for public participation occurs long after the time when proposed pipeline routes or proposed construction can be affected.

Current pipeline construction practices, as well as longer term right-of-way management, impact both terrestrial and aquatic ecosystems and can result in impacts to surface water and ground water quality. The pipeline construction process often entails unnecessary environmental damage. Loss of vegetation and soil compaction are more obvious, but landscape-scale changes to the watershed are occurring without acknowledgement or mitigation. Moreover, forest fragmentation and edge effect are being ignored. Seven key changes could dramatically reduce the damage to forests and watersheds from pipeline construction: Better enforcement and compliance; More comprehensive baseline assessment; Higher compensation for damages; Narrower rights-of-way; Better methods to reduce compaction; More effective stabilization and restoration; and Better monitoring and management.

Introduction

The network of underground gas pipelines in this country is extensive and growing, especially with the energy industry pushing to move more gas from unconventional drilling wells to market. Pipeline siting, construction and management threaten both the ecological and human communities that they pass through, over and under, yet regulation of pipelines is limited with little opportunity for public input as to the paths they take or how they will be constructed. Currently, no federal, state, or local regulatory agency is tasked with evaluating the cumulative impacts of natural gas pipeline projects and associated infrastructure construction. Furthermore, the common practice by pipeline companies of segmenting large interstate pipeline projects into smaller projects allows them to avoid more thorough review and controls. However, simple changes in pipeline siting and construction practices could dramatically reduce the damage to forests and watersheds from pipeline construction. In the Delaware River watershed, the Delaware River Basin Commission (DRBC) has the power to conduct cumulative reviews for pipeline projects, at least for that portion of the project that is within the boundaries of the Delaware River watershed. This paper provides an overview of the impacts of pipeline construction, examines the changes in pipeline construction and management that could lessen impacts, and identifies the regulations that could be adopted by a government body like the DRBC to better protect both our ecological and human communities.

Unnecessary Harms Caused by Insufficient Regulation, Poor Right-of-Way Planning, and Failure to Consider Cumulative Impacts

The demands of pipeline construction and operation influence selection of pipeline right-of-way planning, but the selection process often fails to consider the full cost of individual pipelines or the additive effect of multiple pipelines. Moreover, opportunities for the public to influence pipeline selection in order to protect ecological or human communities are limited.

Pipeline routes often intentionally target natural areas

Cost is always a significant factor in pipeline route selection. Publicly protected open space is often a first target when pipeline routes are being selected because the cost to acquire access to construct a pipeline through public lands is typically less and often brings with it less opposition (when taken on the whole).

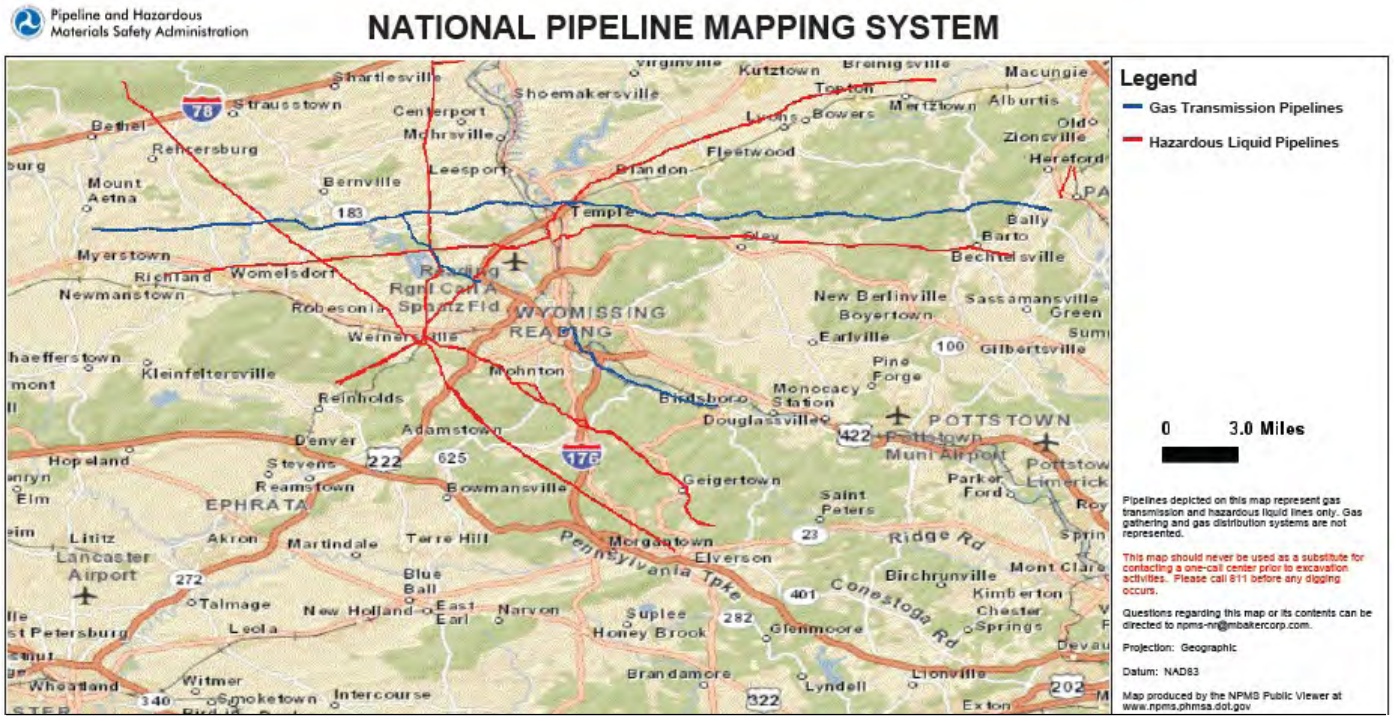
Access to land for pipeline construction is usually acquired through an easement from the landowner providing a right to pass, or right-of-way (ROW), to the pipeline company. Many older ROWs cross landscapes that would receive preferential protection today, just as other pipelines now are often embedded in suburbs that did not exist when they were first built. Yet because it is automatically assumed that expanding an existing line will do less harm than a wholly new ROW, the mistakes of the past are sometimes compounded. At the same time it is also easy to understand why it might be difficult to suggest a new ROW through a built-up landscape in order to avoid expansion in a natural area, regardless of what the actual impacts might be.

A surprisingly difficult consideration when picking a new pipeline route is avoiding other lines already in place. There is an amazing array of pipelines criss-crossing our landscape already. More should be required of the pipeline project planners to cooperate with other pipelines and the existing network already in place to share in efficient transport of gas rather than build new lines. This problem is aggravated by the complete lack of comprehensive planning for this infrastructure. Piecemeal permitting further fractures a process that is already atomized by different ownerships and jurisdictions. Cumulative impacts are ignored altogether.

Pipeline ROW work on Kittatinny Ridge in New Jersey's High Point State Park, M. van Rossum

State forests and other wildlands need a higher degree of protection

The open space taxpayers have bought to protect watersheds and conserve local biodiversity is improperly treated as a convenient reserve for gas production and transmission as well as road construction and other infrastructure. Although protected from residential and commercial development, these lands are being increasingly compromised by pipeline and power line infrastructure projects. State and federal governments have failed to put in place the needed legal protections for our large-scale public landscapes and



A map of the Reading, PA, area created using the National Pipeline Mapping System (NPMS) Public Map Viewer online. Users can view NPMS data one county at a time. The pipelines shown include gas transmission pipelines (blue) and hazardous liquid trunklines (red). Data for gathering or distribution pipelines is not available through the NPMS Public Map Viewer.

their ecological integrity. In addition, there is a body of laws related to power project infrastructure that in fact undermines preservation of lands at the local level—interstate pipelines are exclusively under the jurisdiction of the Federal Energy Regulatory Commission (FERC)—and makes public lands among the most vulnerable areas for infrastructure routes.

Because intact public lands often have important habitats, state and federal reviews are done to identify possible locations of threatened and endangered plants and animals. Agencies identify sites associated with rare, threatened and endangered species and make recommendations along the entire route of every pipeline to avoid harming these species. Examples of recommendations can include relocation of a proposed route or a reduced ROW width. But such adjustments are limited to known sightings of threatened and endangered species. Species that are considered to be rare or of conservation concern, but do not have threatened or endangered status, are not protected.

This effort to respond to known sightings of threatened and endangered species is not an adequate substitute for a broader consideration of the cumulative pipeline route and ROW impacts. In many instances, more could be done to minimize harm, especially for state listed species which appear to get less protection than federally listed species. For example, in one case in Pennsylvania, a pipeline company was required to collect seed from an endangered state plant located in the ROW corridor. Scattering that seed after the ROW was installed was a requirement of the permit, but stronger protections and measures could have been required to either avoid this area entirely or, at a minimum, ensure that the endangered plant was able to re-establish after the ROW was completed, demonstrating performance as well as compliance.

An overly wide pipeline ROW, M. van Rossum

Overly wide ROWs magnify the level of harm

The width of ROWs has incrementally widened over time as larger equipment is used despite the fact that there are many options for significantly narrowing down a ROW to minimize vegetation clearance and reduce damage to soils. Today ROWs are kept minimally vegetated, dependent on herbicides and intensive mowing, but in the past pipelines and other ROWs often supported successional native species. The combination of a wider ROW and management strategies focused on minimizing healthy regrowth compounds the ecological harms. FERC currently recommends a 75 foot ROW, but the 100 foot ROW has become routine, and with no strong pressure to minimize damage, thousands of acres that once were field or forest are now maintained as relatively barren. Safety concerns, the scale of construction and increased security have contributed to the current overwide ROWs. Narrower ROW's could greatly reduce overall impacts and permanent cuts in the landscape.

Local residents protest the Tennessee Gas Pipeline Co.'s North East Upgrade project, F. Zerbe

Public involvement often comes too late

Selection of the pipeline route is the first concern and often is decided upon well before opportunities for the public to participate in the planning process are provided. By the time pipeline permit applications are made public, it is generally considered too late to make any modifications to many aspects of the pipeline. The decision-making process should engage communities early on and in multiple ways and venues as well as throughout the process to ensure community concerns and local resources are identified, addressed and protected. However, in the current system, those interested in influencing pipeline routes must pro-actively seek out information early in the planning process, stay informed about decisions re-

garding new and expanded routes, and educate themselves about opportunities to make comment. And the reality is that often the site design is done before the public has any fair opportunity to become aware or to be heard.

Pipeline cuts are invasive, damaging and permanent. Looking west from Kittatinny Ridge towards Pennsylvania, J. Zenes

Cumulative impacts are ignored

Pipelines, both at the individual project level and when considered cumulatively, have a substantial effect on water resources as well as both the ecological and human communities that they pass through, over and under. Current pipeline construction practices, as well as longer term ROW management, impact both terrestrial and aquatic ecosystems resulting in impacts to surface water and ground water quality. Impacts include, but are not limited to:

- Sediment pollution,
- Exacerbated erosion,
- Loss of macroinvertebrate and fish spawning habitats,
- Adverse affects to wetlands and marshes,
- Permanent removal of riparian vegetation,
- Loss of forest lands, forest fragmentation, changes in forest ecology and increased edge effect,
- Increased surface water runoff,
- Thermal impacts,
- Redirection of groundwater and surface water flows.
- Releases of drilling muds,
- Creation of sinkholes due to drilling, and
- Air pollution resulting from methane and other air contaminants.

As long as this list is, there are still many more impacts which are both individual and cumulative.

Cumulative impacts may span the length of each individual pipeline project, but cumulative impacts can also result from the expanding array and numbers of pipelines across a watershed, region, state and the nation. The sheer number of pipeline ROWs is growing, but the cumulative impacts continue to be ignored.

Currently, no federal, state, or local regulatory agency in the Delaware River watershed is tasked with evaluating the cumulative impacts of natural gas pipeline projects and their associated infrastructure, which can include access roads and compressor stations. In fact, pipeline companies intentionally segment large pipeline projects into smaller projects to avoid more thorough review and controls. While the DRBC has the power to conduct cumulative reviews, at least for that portion of a pipeline project that is within the boundaries of the Delaware River watershed, it has refused to fully exercise that legal authority.

In 2013, the DRBC agreed to partially examine pipelines passing through locations included in the agency's Comprehensive Plan, but for all other pipelines, the DRBC is taking no action other than regulating water withdrawals for hydrostatic testing to check for leaks in pipelines.

Construction of a natural gas gathering line pipeline, T. Carluccio

Impacts of Pipelines Constructed Today

We focus here on the landscape-scale impacts of pipelines, however, all of these consequences are relevant at the local level as well.

The construction process often entails unnecessary watershed impacts

The construction process for a pipeline is fairly simple and entails digging a ditch to accommodate the pipe. Before digging, the vegetation is cleared along the whole ROW and the top soil is reserved, either beside the trench or in a work area. The pipe itself is brought to wooden cradles along side the trench where segments are bent as needed, coated and welded before being placed in the trench by a side boom. The side boom, a piece of equipment that lifts and handles the pipe, is typically the heaviest piece of equipment on site. Once the pipe is laid and the trench refilled, the whole process just moves on up the route. It may take only a few days to complete a given stretch.

A side boom preparing to lower pipe into a trench, J. Zenes

After the pipe is laid and the trench filled, the site is reseeded and stabilization matting is used in areas where erosion is a probability. The landscape is often seeded with non-native plants in an attempt to stabilize soils quickly, then "allowed to revegetate naturally," except that today any plant growth is regularly mowed or herbicided to maintain a relative wasteland across a pipeline ROW that may be 100 feet wide or wider.

The state specifies what techniques should be used at wetlands and stream crossings, including the appropriate ROW widths. All of these terms and conditions are incorporated in permits issued for a pipeline. During construction, a log of site work is posted online to insure compliance with permit requirements that were agreed to with the state, FERC and other regulatory agencies.

Heavy construction equipment backfilling a trench along a pipeline ROW, F. Zerbe

The loss of vegetation may be the most apparent impact, but soil changes are the most pernicious. The single biggest problem is soil compaction, which may be as high as 98%, the same as concrete. Rainwater often runs off the ROW like a stream, creating gullies in the adjacent landscape, which leads to erosion and sedimentation locally.

Failure of erosion controls at pipeline construction site Mountain Road Montague, New Jersey, J. Zenes

Once soil has been disturbed and compacted, it is very difficult to restore its capacity for water infiltration. Re-ripping the soil with a chisel plow is a partial solution to surface compaction, but it leaves

behind an exceedingly erodible surface and does not address the issue of recharge. Ripping deep enough to effect recharge would destabilize large areas of the landscape and be almost impossible to re-stabilize. The damage from soil compaction, loss of vegetation, increased runoff, erosion, and resulting pollution has effects well beyond the boundaries of the ROW where it originates. Sensitive agricultural lands crossed by pipelines are also harmed by soil disturbance and compaction.

Clearing forested wetlands in Montague, New Jersey, in advance of pipeline construction, J. Zenes

Current pipeline construction restoration requirements are very low; they rely primarily on cool grass seeding and erosion blankets and often have poor long term results after the two required maintenance and monitoring seasons for the agencies. Even with such low stabilization standards, the rate of compliance is abysmal. For example, between June 2011 and October 2011, in just two counties in Pennsylvania there were 32 documented sediment discharge violations along the route of the Tennessee Gas Pipeline Company's 300 Line project. Imagine how many such violations go unobserved.

Sediment pollution overwhelms controls and floods wetlands, F. Zerbe

Pipelines can also dewater the headwater areas through which they pass and change the hydrology of wetlands areas along the route. Taken with the loss of vegetation and soil compaction, these impacts cause landscape-scale changes to the watershed yet they are neither acknowledged nor mitigated.

Forest fragmentation and edge effect are ignored

Like the watershed, the forest is also impacted well beyond ROW boundaries. The creation or expansion of a ROW through forest creates a continuous open wound called the 'edge effect.' While the edge effect can be positive when confined to small canopy gaps in a closed forest, edge effects are detrimental when they occur along a continuous seam of fragmentation. Increased wind movement facilitates movement of weedy propagules and invasive species deep into the forest where they find the way suddenly wide open for them with abundant new ground to colonize. Predators and parasitic birds like cowbirds use these corridors to access otherwise difficult to find prey.

A continuous scar fragmenting both forest and waterway, F. Foley

ROWs are like highways bringing the elements of the developed world into otherwise undisturbed areas. Increased windthrow during storms often creates further loss of more mature trees in the forest area adjacent to the ROW. With the repeated and continuous forest fragmentation that results from pipeline construction and maintenance, the species of the forest interior decline, something that has already happened to 90% of forest interior birds. This effect often extends up to 300 feet from the actual edge of the disturbance (i.e.,

the ROW clearing), making a corridor of at least 700 feet wide of disturbance with every 100 foot ROW.

Often a new pipeline uses and expands an existing corridor that may have multiple pre-existing lines. The amount of new edge may be halved using this approach when compared to a new ROW corridor, but this practice has resulted in some ROW corridors becoming, unnecessarily, hundreds of feet wide—this amounts to large habitat losses and a boundary that is increasingly capable of blocking the movement of some species of plants and animals. The existing requirements to protect a few very rare species is insufficient to prevent the general degradation of the forest from this kind of fragmentation. Interior forest is imperiled and cannot be replicated on small-scale sites or over short periods of time. Once lost, forest interior is gone and cannot be restored. Lost with it are those plants and animals that are restricted to the forest interior.

Pipe for the 325 Loop of Tennessee Gas Pipeline Co.'s 300 Line project in cradles in the New Jersey Highlands, J. Wagner

Changes That Could Make a Difference

Current FERC and erosion and sediment control guidelines are inadequate to meeting the challenges of the current pipeline construction boom. State and other federal agencies aren't filling the regulation gap. Unfortunately in an effort to foster infrastructure development, government agencies often seek to reduce permitting requirements and costs without adequately counting the environmental and community impacts of these decisions.

It is increasingly apparent that serious effort with companies and agencies is required to develop new construction strategies and Best Management Practices (BMPs) that better protect our ecological and human communities. A more coordinated approach by regulators is needed to change a process that has for decades received limited oversight and upon which limited demands have been made, except at a few sites such as wetlands. The potential role for FERC, the U.S. Department of Transportation (USDOT) and state environmental agencies in a new pipeline construction paradigm cannot be overstated.

Seven key changes could dramatically reduce damage to forests and watersheds from pipeline construction:

1. Better enforcement and compliance,
2. More comprehensive baseline assessment,
3. Higher compensation for damages,
4. Narrower ROWs,
5. Better methods to reduce compaction,
6. More effective stabilization and restoration, and
7. Better monitoring and management.

Key changes could reduce harms resulting from pipeline construction, M. van Rossum

1. Better enforcement and compliance is vital

The primary regulations pertinent to pipeline construction are the same that apply to new development and road construction. For example, erosion and sediment control regulations for pipelines employ many of the same techniques used with other construction projects. Required techniques may be as simple as reseeding and mulching or as complex as horizontal directional drilling under a river. Regulatory require-

ments vary somewhat from state to state and individual agreements between the pipeline company and the landowner may modify or expand requirements. These regulations are, however, only as good as the extent to which there is full compliance. Unfortunately, the Delaware Riverkeeper Network (DRN) has documented numerous failures in both compliance and performance.

In 2012, DRN staff and trained volunteers monitored pipeline construction activities along the Tennessee Gas Pipeline Company's 300 Line project and documented unstabilized sediment, damaging wetland crossings, scant mulch, and mediocre vegetation growth at many rights-of-way. DRN also logged and responded to pollution report calls from citizens documenting pipeline pollution. As a result of DRN's work, over 17 notices of violation were issued for the 300 Line project in Pike County during Spring 2012 alone. Wayne County also found violations along this pipeline project during the same time period.

According to the Tennessee Gas Pipeline Company's own estimates, the 300 Line project "temporarily" disturbed 108 wetland acres and permanently destroyed 22.9 wetland acres within the Delaware River watershed. The company was required to restore the temporarily disturbed wetlands, but delayed these activities until amphibian populations were already present in these areas for breeding. DRN notified state and local agencies to request that the invasive wetlands work be delayed until the young amphibians present could grow to adulthood and move on, but the agencies allowed the Tennessee Gas Pipeline Company to go forward.

Tennessee Gas Pipeline Company's crossing of Shimers Brook, a trout stream in New Jersey, J. Zenes

Nor does compliance with permit requirements guarantee that the erosion and sediment controls employed will perform as anticipated on site. A real problem is the underlying assumption that the standards are met automatically when regulations are complied with. Often, this is not the case, in part because the techniques recommended are inadequate to the task.

The purpose of environmental regulations may be to protect native species and watersheds, but the actions taken to implement those regulations are not achieving their goal. Looking just at regulations intended to protect rare, threatened and endangered species, no new baseline studies are required before construction, and existing records as to the presence of these species along proposed pipeline routes are incomplete, leaving these species unprotected.

DRN staff document an old growth forest in the path of pipeline construction, J. Zenes

Many natural areas currently being targeted for pipeline construction are on soils, or rock, and difficult to stabilize, resulting in erosion. Severe compaction often disrupts water patterns and further contributes to erosion and sedimentation. DRN has documented many examples of failed stabilization efforts for new pipeline construction with serious and on-going deleterious impacts to the surrounding habitats, demonstrating the need for better enforcement by regulators. Like DRN, regulators could work with trained local volunteers to better ensure that violations do not go unobserved.

We must also look at failures of compliance and performance and prevent them in the future with expanded BMP's mandating better performance on the

ground. Some examples of better construction and management are described below. None are untested. All have been implemented with success on a pipeline in Pennsylvania or New Jersey. All require more effective oversight by agencies as well as expanded jurisdictions and better BMPs.

Attempted stabilization of a pipeline ROW on steep slopes, J. Zenes

2. Better baseline assessment is important

The purpose of baseline monitoring is to inform route selection and the determination of appropriate methods for construction, restoration and management for various segments of the route. Baseline monitoring can help to customize a process that is otherwise a one-size-fits-all approach.

In addition, more complete baseline monitoring would help make up for our currently incomplete records for rare, threatened and endangered species of plants and animals. In preserved lands and healthy ecosystems, full on-the-ground monitoring is vital and should not be sacrificed to speedy construction. Cultural and historic resources should be monitored in much the same way.

Construction documents detailing trees to be removed as well as trees to be saved, L. Sauer

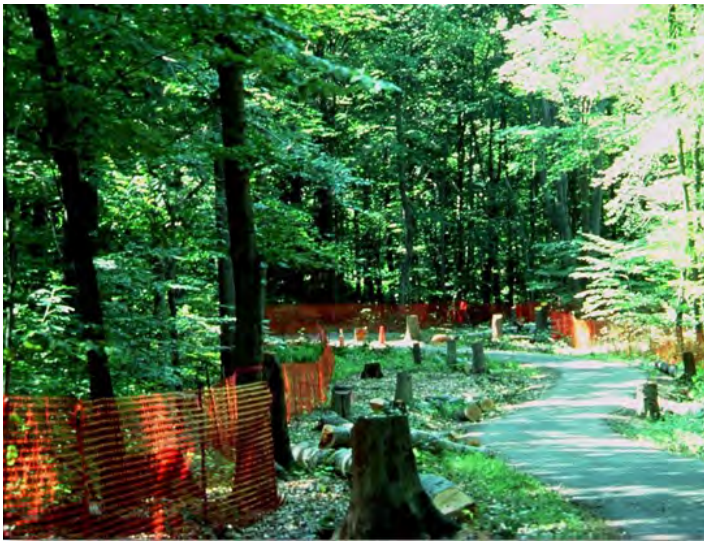
Problems such as excessive herbivory and the extent of exotic invasives species should also be documented as part of the monitoring. Knowledge of exotic and invasive species should be used to develop and carry out ROW management prescriptions. Specific actions could include treatment prior to tree clearance, treatment for up to five years after construction, and requirements to wash equipment coming from areas with invasive species present before entering less disturbed landscapes along the construction route.

With no cost associated with lost ecological functions and values, natural areas are targeted for pipeline construction, F. Foley

3. Natural area impacts need greater compensation

The cost of crossing natural areas is under-compensated. Typically there is no payment made for lost ecological functions and values when interior forest is damaged by fragmentation or disturbance. Without recognition of the damage being caused, no dollar value is associated with the loss of interior forest and there is no incentive to reduce forest impacts. This failure makes natural areas artificially cheap to cross, shifting real costs and losses to taxpayers, effectively subsidizing the pipeline.

The thorough assessment of site conditions, called for above, will be a vital component of the negotiation of the true cost of crossing publicly owned and preserved landscapes. Compensation should reflect the damages to a site's function as a natural landscape and recreation area as well as the need to effect high quality stabilization and habitat establishment.



Narrowed pipeline ROW with fencing to protect trees, L. Sauer

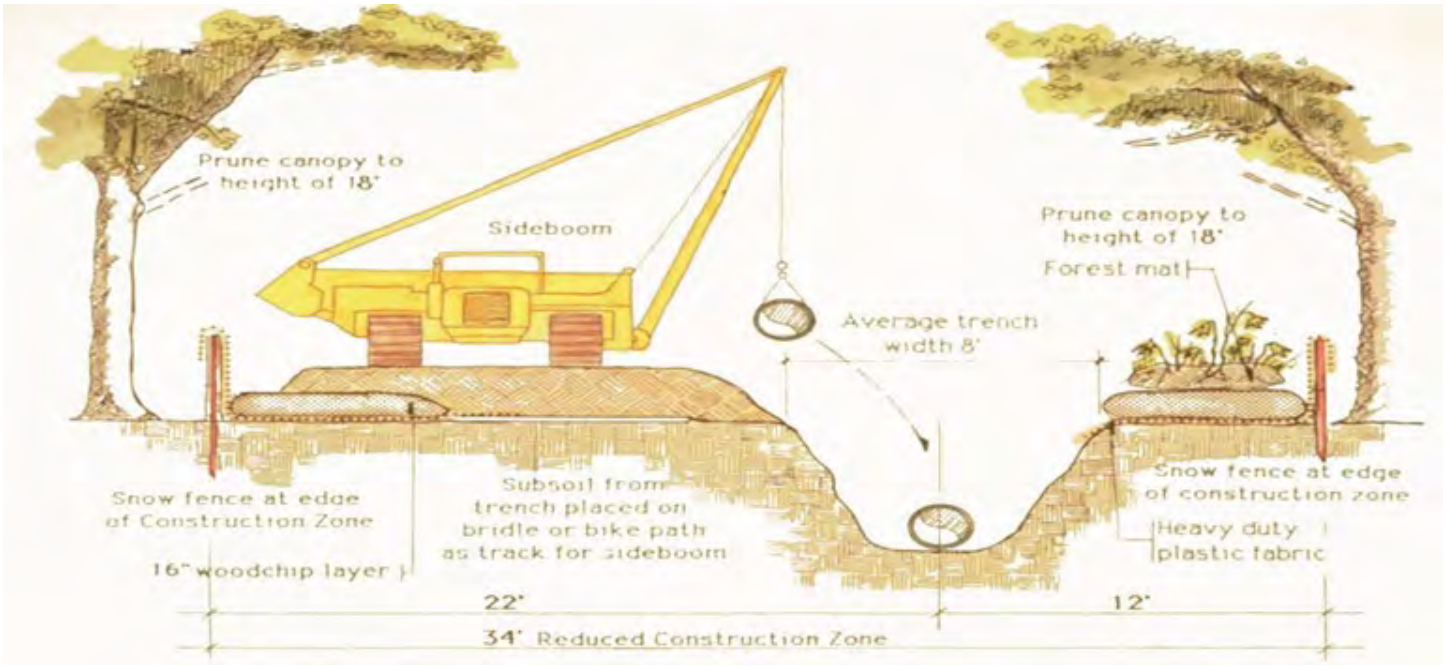
4. Narrower ROWs need to be applied more widely

ROWs must be narrowed to the greatest degree possible. In short, every foot matters. While 100 foot ROWs are now the norm, 30 to 50 foot ROWs were commonplace in the past. Not only were narrower ROWs commonplace, but they can be mandated today when there is a need to protect habitat for a rare plant or animal, or a wetland or other special ecosystem. FERC's *Upland Erosion Control, Revegetation, and Maintenance Plan* and *Wetland and Waterbody Construction and Mitigation Procedures* recommend limiting pipeline construction ROWs to 75 feet. There is no reason that narrower ROWs should be limited to exceptionally sensitive ecosystems; they should be the norm, not the exception.

When there is a need for modification, even in today's pipeline construction projects, flexibility is common and many alternatives to conventional construction techniques may be employed. This includes methods such as 'stove-piping' where the pipe is welded in the trench eliminating the need for a cradle, which in turn reduces the width of the ROW needed. In another method, called 'dragging,' the pipe is welded in a work area and then literally dragged through the trench. Many streams are crossed with horizontal directional drilling (HDD) and have no above ground trench at all, except at either end of the drill.

Typically where alternative methods, such as HDD are employed, additional work area is required at either end of that section of pipe. Additional work areas, when designated, represent another area for serious negotiation concerning need for and the size of the area to be disturbed. Clearing for HDD landing pads and other work areas should be minimized to keep the ROW narrow.

Whenever a ROW is narrowed, safety becomes more of a concern. Additionally, not all methods are applicable everywhere and flexibility may be required. Even the rather proscribed system currently employed recognizes that adaptive methods and construction practices may need to be modified based on field conditions at the time. However, alternatives are currently restricted to a very few sites today. It is essential that pipeline companies and regulators begin viewing for-



Habitat protection measures that can be used during pipeline construction including working a side boom over a cushion of mulch, L. Sauer

Pipeline construction practices can result in tree death even for trees outside the disturbance zone, J. Zenes

ests and other natural landscapes as worthy of the increased protection that can come from reduced ROWs and more flexible construction strategies. Less impactful construction practices should not be the exception; they should become the norm as these methods are technologically feasible and are cost competitive.

In addition to the use of alternative construction methods, the use of smaller and lighter construction equipment could also be used to reduce the ROW width as well as soil impacts. The size of the pipe is obviously a limiting factor here. Nonetheless one pipeline company, Napp Greco, installed a three foot diameter pipe in a 34 foot-wide ROW through a protected forest in Morris County, New Jersey. Imagine how much less damage there would be with 34 foot ROWs. Simply reducing the 100 foot ROW, a size that is routinely used in this area, to 75 feet would result in a 25% reduction in the direct damage to vegetation, habitat and soils.

5. Post-construction compaction needs to be reduced

Even within a narrowed ROW, compaction can be reduced significantly. One opportunity to minimize compaction is by working heavy equipment on top of a cushion made of the wood chips generated on site during the removal and chipping of trees and the subsoil from the excavation of the pipeline trench.

Along the Tennessee Gas Pipeline Company's 300 Line and Northeast Upgrade (NEUP) projects, mulch from the chipping of removed vegetation was blown into the adjacent forest, in some instances, to a depth of over three feet, which causes unnecessary impacts to areas outside of the ROW. In some areas, this deep mulch has caused bark rot, and mature trees buried in the mulch are showing signs of stress (groundcover

Mulch blown into state forest land adjacent to the route of the Tennessee Gas Pipeline Company's Northeast Upgrade project, J. Zenes

Deep piles of mulch caused bark rot and tree death, S. Rando

plants were also buried). Instead, these reserved materials could have been used to reduce harm rather than create more harm.

Compaction rarely reaches more than 12 to 18 inches below the surface. A cushion of wood chips and sub-soil can completely protect the topsoil and plant propagules beneath this layer. Contractors can also use wood chips and sub-soil to add depth over an existing pipeline if the current soil cover is insufficient to allow equipment to work over it.

This practice would allow for narrower ROWs by making it possible for the side boom to work over an existing pipeline along a shared pipeline corridor. Working over a cushion of wood chips and soil also eliminates the need to find land elsewhere for stockpiling or disposal of these materials, further reducing the size of work space requirements and the associat-

A side boom working on a cushion of soil in a narrowed ROW, L. Sauer

ed disturbance. Various commercial mats are another option, but are costly. Using soil from the site eliminates or reduces the need to stockpile this material.

A fabric layer over the natural ground prior to woodchip stockpiling can be used to delineate the original grade and protect herbaceous species and the rootstocks of woody vegetation that has been cut for construction purposes. These areas can rebound very quickly with original vegetation back in place only days after the trench is refilled as the over-burden is removed. When combined with the use of smaller equipment, this can meet the goal of no loss of infiltration. Soil disturbance can be limited to the ground cover over the trench and any areas actually graded during construction for access which, in turn, could reduce the amount of soil compaction along the ROW by as much as 90% in places.

In areas where reseeding is needed, stabilization with locally native grasses and sedges would also maintain and increase infiltration rates over time. One third of the roots of woodland sedges die each year creating continuous openings deep into the soil to help with infiltration. Cool season grasses currently used for revegetation do not, especially when mowed which produces shallow root systems.

Independent third party certification should be required to evaluate and verify infiltration rates along the route of the completed pipeline to ensure actual compliance with the requirement not to increase runoff. FERC guidelines call for the use of penetrometers or other such equipment to evaluate and compare compaction along the construction route and adjacent undisturbed areas. This work should be completed and the results posted online. Remedial work should be undertaken where necessary.

Soil compaction can further be reduced by using narrower access ways, which by definition results in a smaller area of compacted soil. FERC currently recommends that only a 10 foot wide strip be maintained with annual mowing for access. There are three foot diameter pipes in the region with eight foot-wide access ways with occasional wider areas, or passing sites, along the pipeline route that can accommodate a wide range of equipment.

6. Stabilization and restoration goals need to be met more effectively

When the area of disturbance has been reduced, stabilization becomes easier. Where a wood chip and soil cushion has been used beneath heavy equipment, the land beneath this cushion should need little or no further stabilization once that cushion is removed. The area over the trench may be the only ground requiring planting. One innovative strategy used in Morris County, New Jersey, was to lift the sections of soil and vegetation over the trench, just like sod is lifted, and stockpile them on the side of the trench opposite the side boom. This eliminated the need to segregate and stockpile topsoil and avoided destroying the propagules of existing plants. When these sods of forest soil and roots were replaced over the trench, no further stabilization was required.

Where the original vegetation cannot be replaced over the trench, permanent stabilization BMPs should be

Stockpiling of forest soil and roots for later replacement over the pipeline trench, L. Sauer

developed using species native to each section of the route. The same native grasses and sedges that promote rainwater infiltration also sequester up to a ton of carbon yearly per acre. This is a small but important step toward mitigating the impacts of the clearance of trees from the ROW and providing a better habitat than the typical cold season grasses that are often used currently. Only locally native stone should be used and only organic stabilization products should be used, including mulch and soil blankets.

7. Management and access need to be reevaluated and modified

Recent management practices for pipelines have dramatically reduced the habitat values of ROWs. Once ROWs provided habitat for many early successional species, but today they are more like wastelands, or worse, sources of invasives into the forest interior.

Security concerns that arose after the terrorist attacks of September 11th, 2001 are in part responsible for current management practices. However, security can be addressed while still providing for more ecologically sound management. New management guidelines need to be developed. Some pipelines could have additional surveillance provided by the landowner in the form of management and/or recreational use in the vicinity of the pipeline. Pipeline companies should also anticipate providing long-term protection along a ROW from the ATV use that often begins after a pipeline cuts through an area. These vehicles cause even more soil disturbance, erosion and impacts to waterbodies.

If the ROW is narrowed and the existing soil and vegetation have been protected, and sods have been lifted and replaced over the trench, no further management is required after the trench is refilled as long as invasives are absent. In some forest interior areas, narrow ROWs may permit closed canopy management which would dramatically reduce edge effect and could, in fact, eliminate it over time.

Currently post-construction pipeline revegetation efforts are often sparse or fail completely. Reseeding and additional management may need to be undertaken, but often are not. Poorly stabilized ROWs are rapidly colonized by exotic, invasive vegetation, which can invade previously undisturbed natural areas nearby. Permits typically state that invasive vegetation will be managed, but ROWs all across the Delaware Valley are nonetheless overwhelmed by invasive plants.

DRN staff lead a ROW tour after pipeline construction, S. Rando

Until we have more effective BMP's that truly replace lost ecological values, monitoring and maintenance over a longer term than the two years that is typically required is greatly needed. This is especially important concerning soil stabilization and invasives management. Better stabilization BMPs are needed to address often extreme conditions. Solutions from the developed landscape, such as bringing in topsoil, are not suitable for natural areas.

With more extreme drought and large rainfalls due to climate change, maintenance plans, measures and windows are more important than ever. After all, the regulations presume that the site will be restored to its previous condition. However, ongoing management may be threatened by plummeting natural gas prices and tighter budgets, so additional bonding should be considered to ensure adequate stabilization over time.

Regulations to Protect the Forest and Watershed

As the current pipeline construction process is not without regulation now, many of the key changes recommended here can be incorporated into permitting by simply shifting focus or expanding available options. However, new regulation is needed to require that cumulative impacts are documented, addressed, and avoided or mitigated. Without additional protection, preserved lands are likely to be encroached upon little by little, with devastating cumulative impacts.

Landscape-scale forest and watershed protection are needed

Better protection is needed for lands we consider already protected. Giveaways of public land for pipe-

line ROWs should be avoided if at all possible. To safeguard the most sensitive lands, zones should be established within protected lands where roads, ROWs, etc., are prohibited. Stream and wetland crossings should be avoided as should routes through steep slopes, since these slopes are often problem areas.

Given the region-wide impacts of pipeline construction, we need regional-scale forest protection as well as state-level forest protection. In addition to creating sanctuaries, we need to regulate improved forest protection in all contexts, including greater protection for high quality landscapes, limits on permitted vegetation clearance and grading, restrictions on increasing runoff, recharge requirements, and banning the use of invasive species. Cumulative impacts need to be recognized and monitored with effective metrics on the ground, rather than on paper. Requiring inventories of plant and animal species and establishing costs for loss of mature trees would go a long way to encouraging pipelines to be sited in areas where mature forests do not exist.

As they are maintained today, pipeline ROWs are sources of invasives into the forest interior, F. Foley

Expanded assessment and monitoring are essential

You cannot avoid damaging valued resources if you don't know where they are. You cannot defend your management if you don't monitor its effects. You cannot claim that compaction has not changed if you do not measure it. And so expanded requirements for assessment before construction and monitoring both during and after construction are essential regulatory requirements. Better mapping is also needed, especially of sensitive wetland and waterbodies.

Where community watchdog groups and non-profits organizations are active, as is the case in Pennsylvania, where the development of shale gas infrastructure has become a big concern for communities, pipeline companies should value public input, and encourage safe participation and vigilance by citizen monitors. Unfortunately, this is not often the case. During work on NEUP, the Tennessee Gas Pipeline Company hired private security to deter and harass trained pipeline watch volunteers. Such practices should be forbidden.

DRN staff monitoring a construction crossing of Big Flat Brook, a trout stream, in High Point State Park, New Jersey, F. Zerbe

Alternative construction methods are needed

Agencies should encourage collaboration among contractors, community organizations and non-profits to creatively tackle the need to cushion heavy vehicles, to reduce soil compaction, to remove vegetation, and to restore ROW vegetation. Wherever possible, trees should replace trees. Efforts should be made by the pipeline company to plant larger native tree species stock versus bare root seedlings. As much of Pennsylvania has large deer populations that browse on young shoots, deer exclosures and tree shelters should be installed. In rocky landscapes, excavated boulders and stone can be arrayed to protect new plantings. These measures will increase the rate of recovery.

Current stabilization BMP's are inadequate and need to be expanded

Instead of close cropped landscapes, we need restoration BMPs centered on diverse native species, native grasslands, wildflower meadows, young woodlands and shrublands designed to provide permanent sta-

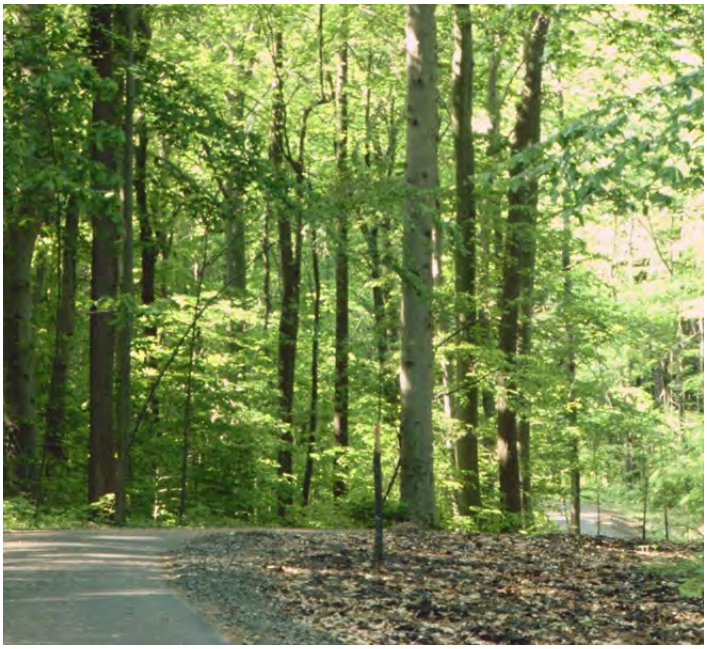
bilization. In forested landscapes cut by pipelines, efforts should be made to require understory, groundcover, midlayer and canopy layer native species to reflect the vertical diversity important in thriving forested areas and needed for forest interior birds.

Pipeline ROW fenced immediately after construction to protect newly replaced forest sods and to define long-term access routes, L. Sauer

Alternative management strategies need to be developed and implemented

The dialogue on ROW management must include not only concerns for safety and terrorism but also ecological concerns. Current application of the USDOT's Pipeline and Hazardous Safety Administration rules maximizes negative impacts to forests and watersheds. The 30 feet of a ROW over a pipeline is required to be tree-free; a 10 foot access way must be kept even more closely cropped, but close mowing creates shallow ineffective root systems, especially on steep slopes and poor soils.

One alternative is maintaining native grasslands and sedge meadows within the tree-free portion of a ROW. In an emergency, any vehicle needing the 30 feet will not be deterred by tall grasses. Beyond the 30 feet, successional woody forest vegetation could be re-established. Maintaining successional woodlands in part of the ROW could provide habitat for many declining species. Some closed-canopy options would help address the consequences of fragmentation.



An exemplary pipeline installation at Loantoka Park, Morris County, New Jersey, L. Sauer

FERC's wetland guidelines also call for re-establishing riparian vegetation for 25 feet into the ROW on either side of the stream.

Compliance requires improved oversight

The failure rate for compliance with even the current minimal standards illustrates a failure of oversight. In addition to regulatory compliance, we need to include in-the-field evaluation of actual performance of critical factors, in particular infiltration and recharge with independent, third-party verifications and input from the community and watchdog organizations. Additional bonding may be needed to improve compliance. New legislative efforts should not allow for circumventing important existing regulatory protections.

Red spotted newt from wetland in the path of a pipeline ROW, F. Zerbe


STOP
THE
FRACKING
PIPELINES

Opposite page, clockwise from top: Looking east toward the Kittatinny Ridge from Ridge Road in High Point State Park, New Jersey, J. Zenes; DRN staff person documents construction of a pipeline ROW where pipes have been bent to go under Sawmill Road in High Point State Park, J. Zenes; A stream in the upper Delaware River watershed, F. Zerbe; Protest displaying wood from mature trees cut for a pipeline ROW, F. Zerbe; Sediment overwhelms erosion controls, J. Zenes

DELAWARE RIVERKEEPER NETWORK
925 Canal Street, Suite 3701
Bristol, PA 19007
215-369-1188
www.delawareriverkeeper.org

2014 Field Observations of Tennessee Gas Pipeline, Northeast Upgrade Project
By Nicole Zenes, Delaware Riverkeeper Network

Preliminary Findings and Excerpt for FERC To Consider in Review of Atlantic Sunrise Pipeline

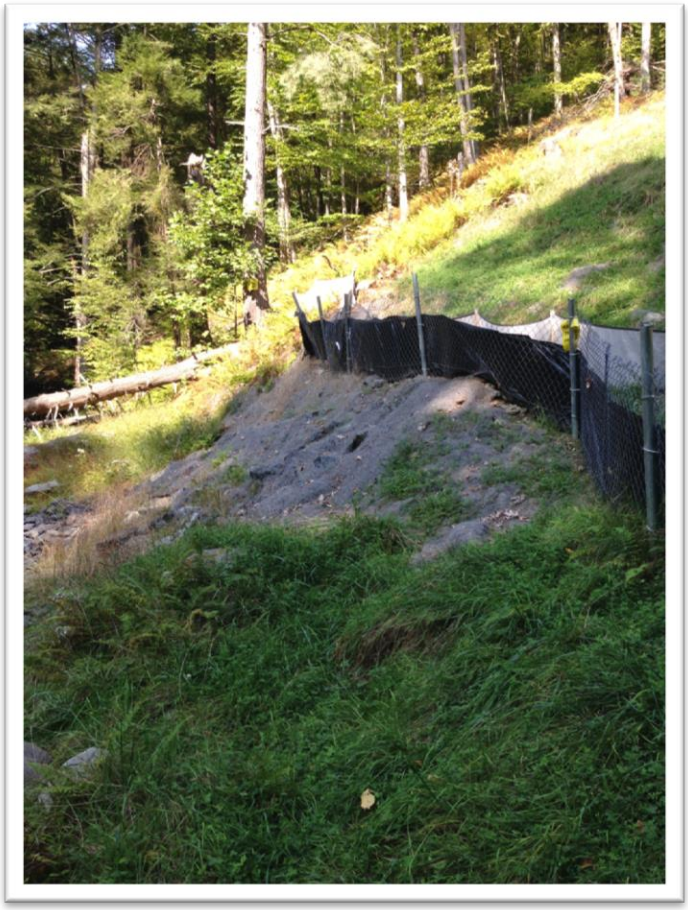
Overview of Study

The fall and summer of 2014 I conducted field work and research under the guidance of Delaware Riverkeeper Network and Princeton University on the effects of clear cutting to build an intrastate natural gas pipeline. I specifically was interested in studying nutrient leaching and loading in streams in Pennsylvania and New Jersey. I conducted 34 field visits at 22 streams that were cut across by the Tennessee Gas Pipeline Northeast Upgrade Project (TGP NEUP). This particular pipeline began tree cutting in mid-February 2013 and construction followed in the spring and summer of 2013. TGP NEUP had constructed and installed the new pipeline and was running natural gas through the new line as of November 2013. Lagging remediation practices and repeated maintenance activities occurred through 2014.

I collected water samples at each pipeline crossing location, recorded stream flow and temperature data, and recorded visual observations. My data and the water samples I collected are still being analyzed at the Princeton University laboratory but I share preliminary observations below for the purposes of the Atlantic Sunrise EIS review in the hope that FERC examines the full and repeated environmental impacts that could very well occur along this proposed 178 mile pipeline route that is mostly a greenfield project, if approved.

Impacts to Special Protection Streams Along Denuded Steep Slopes

Of the sampled, the section of pipeline that was constructed over Cummins Hill and across Cummins Creek saw the most impact from erosion. The steep slopes that were cleared of mature trees still showed little sign of herbaceous growth on 7/11, 7/14, and 8/14, 2014 during field visits. The slope breakers on the ROW surrounding Cummins Creek were eroding along the perimeter. The water running down the slope breakers pushed the runoff to the side of the ROW creating gullies and stormwater runoff off the ROW and down into the stream. As a result of this erosion and increased stormwater runoff, sediment was observed in riffle habitat of Cummins Creek, which likely impaired aquatic life by smothering the habitat of these animals. This stormwater runoff and lack of regrowth indicates permanent soil compaction on the ROW. Similar locations along temporary work spaces and additional temporary work spaces also had sparse regrowth and soil compaction. The pipeline cut steep mature forested slopes, which has major implications for pollution to the receiving streams at the bottom of such steep slopes. FERC needs to address and evaluate these severe impacts that occur on steep slopes and the resultant pollution that can impact the adjacent streams downslope. Wind throw and damage to adjacent mature trees off the ROW was also observed during these field visits.



Sparse herbaceous growth, soil compaction, evidence of runoff and gullies, and sediment escaping the silt fences and traveling into adjacent Cummins Creek, an Exceptional Value Stream in Pike County, PA.

The steep slopes adjacent locally named Evergreen Stream (UNT to the Delaware River) were also bare during July and August field visits. There was erosion that could be clearly seen along the sides of the ROW here as well. There were uprooted trees from wind throw or erosion or both impacted off the ROW.

Conditions of steep slope adjacent Evergreen Stream, July and August 2014.

Repeated Pipeline Activity Impacts Over Several Seasons Cause Persistent Harm

Continued construction, maintenance, and remediation work at New Road in Montague NJ and other locations resulted in muddy runoff into streams and sediment pollution discharging into nearby streams repeatedly. During the summer of 2014, construction bridges were reinstalled off of New Road resulting in a muddied pit and sediment runoff into the two nearby tributaries of Shimer Brook. The bridges were reinstalled for tree planting resulting in additional and repeated impacts. Below is the link to pictures taken by Joe Zenes on October 29th, 2014, almost year after the pipeline had begun carrying gas.
https://picasaweb.google.com/lh/sredir?uname=105703332397473503863&target=ALBUM&id=6076465536169873505&authkey=Gv1sRgCIn6nOGO1rvHYg&feat=email

Its important to note that these maintenance activities often are added to an existing permit and as far as we can tell the public is not given an opportunity to comment nor are they adverstised in the PA Bulletin.

Lagging tree planting and remediation practices lead to repeated harm over several seasons. This picture was taken Summer of 2014 – almost a year after the new pipeline had been constructed and demonstrates repeated harm due to pipeline timelines and lagging efforts to restore the ROW shortly after its completion in November 2013.

Dewatering and Changes in Hydrology

Streams S002 and S003 at High Point State Park were completely dry by July 23rd whereas on July 9th there was water present. Although rain was sparse in the summer, the streams crossed by the pipeline appeared to have extra impacts. This is most likely due to the slope breakers diverting the natural path of the runoff and the severe soil compaction that limited infiltration. The slope breakers diverted water into the woods where it eroded along the edge of the pipeline. I also documented low streams levels in S004 and S005 at High Point State Park. Herbaceous regrowth in this section was patchy and sparse leaving bare soil. The soil had been compacted to the point where the ground was solid dirt and that vegetation could not colonize. On August 2nd, 2014, I recorded that two streams on the pipeline section from Evergreen to Cummins Creek went dry both of which had been previously flowing. Also August 7th, 2014 observations included a stream drying up off of New Road as well, seen in the picture below.

Dry stream off of New Road along pipeline ROW.

Temperature Impacts

The temperature data collected over the summer was variable. Not all of the streams appeared to have significant changes in the upstream and downstream ROW temperatures that were collected. However, in the streams that had a slower flow rate there was consistently a noticeable difference with warmer temperatures downstream of the ROW. This difference was present even in the mornings, not long after the sunrise. On August 27th, 2014 I collected samples in the afternoon at the Dimmick Creek and East Branch of the Dimmick Creek. There was a 10 degree Fahrenheit difference at the East Branch and 4 degree difference at Dimmick Creek. This indicates that there is a larger effect throughout the day, due to increased sun exposure from the open pipeline ROW cut where trees were removed. Wetlands within the ROW that were monitored for temperature also yielded much hotter temperatures than wetlands not in the ROW.

Nutrient Analysis

My nutrient analysis at this point is incomplete, I have collected approximately 250 samples from July 1st, 2014 to December 26th, 2014 to date. However, I have looked at the data enough to see that there is a difference in some of the streams in terms of their above and below levels of phosphates, nitrates, and sulfates. The differences were found in some streams, which may be correlated to the types of trees that were removed by the pipeline. Some of the streams had very high levels of nitrates in general which could be cause for concern, although I am unsure if they are related to the pipeline construction and more analysis is needed. The Evergreen Stream was the stream where we documented the most dramatic change in nitrate levels. Above the ROW the average nitrate levels were .0638ppm while below the ROW there were average levels of 0.3315ppm. The three tributaries to the Evergreen Stream that were uncut by the pipeline and located upstream of the pipeline ROW had substantially lower nitrate levels than the Evergreen stream cut by the pipeline.

One area in particular that had water chemistry results that stood out was behind Mountain Road. S111F and S111A both showed sulfate levels that were an order of magnitude greater than those present in the majority of the other streams. This may be a result of the blasting that was done in this area during pipeline construction. Literature has shown that blasting of rock that contains sulfates can cause their release into water sources. I would need to confirm the type of rock present in this area before making any conclusions. These samples were taken on July 2nd, 2014.

Below are links to albums showing before and after impacts of the blasting through the stream and pipeline construction behind Mountain Road where overwhelmed BMPs led to sediment leaving the ROW. Sediment-laden water proceeded to flow down the slope and into a stormdrain into a nearby stream. Photos were taken on June 11 and June 22, 2013.

https://picasaweb.google.com/lh/sredir?uname=105703332397473503863&target=ALBUM&id=5888575113132039073&authkey=Gv1sRgCN-Itvynnv3W0QE&feat=email

https://picasaweb.google.com/lh/sredir?uname=105703332397473503863&target=ALBUM&id=5892704912210291553&authkey=Gv1sRgCL6v5Iuw9ty4ngE&feat=email

The albums below include photos on various dates for the two streams that were observed to have high sulfate levels.

https://picasaweb.google.com/lh/sredir?uname=105703332397473503863&target=ALBUM&id=5966886951232696113&authkey=Gv1sRgCNiTnKO7l9_5pQE&feat=email

https://picasaweb.google.com/lh/sredir?uname=105703332397473503863&target=ALBUM&id=5966906652401281905&authkey=Gv1sRgCMzc85n8_saJEA&feat=email

Thermal Heat Impacts from Buried Pipeline & Maintenance Process

Various observers have noted melted snow over the buried pipelines even on very cold days. See the picture below taken west off of Rt 590 at the Lackawaxen River crossing 2-18-15 after a -12 degree day. The snow melt is over the new 30" pipeline which I suspect that the 24" line is now dependent from the 30" line. TGP now comes in and works on the older 24" line as maintenance projects which requires minimal approval usually under an existing PADEP permit and only gets reported the following May as I was told by David Hanobic FERC project manager NEUP.

Winter snow melt over 30 inch buried pipeline, February 18, 2015. Photo by J. Zenes

Maintenance work conducted by TGP on the old 24 inch line in the Fall, 2014. Photo by J. Zenes