September 22, 2016

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington D.C. 20426

RE: <u>Comment Letter: Comment of the Delaware Riverkeeper Network and the Delaware Riverkeeper on the Environmental Assessment for Tennessee Gas Pipeline Company L.L.C.'s Orion Project (Docket No. CP16-4).</u>

Dear Secretary Bose:

The Delaware Riverkeeper Network, and the Delaware Riverkeeper, ("DRN") submit the following comment on the issuance of the Environmental Assessment ("Assessment") by the Federal Energy Regulatory Commission ("Commission") with respect to the Orion Project (the "Project") proposed by Tennessee Gas Pipeline Company ("Tennessee"). Tennessee is requesting to construct and operate the Project in order to create a third contagious pipeline ("300-3") alongside the two existing Tennessee pipelines ("300-1" and "300-2"). Tennessee proposes to construct approximately 13 miles of 36-inch diameter pipeline looping, a new pig launcher, crossover and connecting facilities to connect the 300-1 and 300-2 lines, and to restage and modify compressor station 323.

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For the reasons explained below, the Commission's environmental review fails to meet the requirements of the National Environmental Policy Act ("NEPA"), 42 U.S.C. § 4321 *et seq*. (2006), and its implementing regulations, 40 C.F.R. Pts. 1500-08. The Assessment cannot serve as the basis for an adequate hard look at the Project's environmental impacts or support a finding of no significant impact ("FONSI"). Based on this flawed environmental review, the Commission cannot determine that the public benefits of the proposed Project outweigh its adverse impacts, thus violating the Natural Gas Act ("NGA"), 15 U.S.C. §§ 717f (2006) and its implementing regulations, 18 C.F.R. Part 157 (2011).

National Environmental Policy Act ("NEPA") is a planning statute that requires the Commission, prior to undertaking a major federal action such as issuing the Certificate on the Project, to evaluate that project's impacts on the natural environment. 42 U.S.C. § 4332. It emphasizes the importance of a comprehensive environmental analysis to ensure informed decision making and that "the agency will not act on incomplete information, only to regret its decision after it is too late to correct." *Marsh v. Or. Natural Res. Council*, 490 U.S. 360, 371 (1989). The twin goals of NEPA are to 1) obligate federal agencies to consider every significant aspect of the environmental impact of a proposed action and 2) ensure that the agency will inform the public that it has truly considered environmental concerns in its decision-making process. *Balt. Gas & Electric Co. v.*

Natural Res. Def. Council, 462 U.S. 87, 97 (1983). Under NEPA, federal agencies are required to take a "hard look" at environmental consequences prior to a major action in order to integrate environmental consequences into the decision making process. *Kleppe v. Sierra Club*, 427 U.S. 390, 410 n. 21 (1976). NEPA does not mandate that an agency choose a particular alternative course of action. Rather, as a procedural statute, its entire purpose is that the agency – and the public – be informed of an agency's rationale and the environmental impacts the selected alternative will have. *See Marsh*, 490 U.S. at 370-71.

DRN raises here substantial questions, supported by reports from technical experts, as to whether the Project will have significant impacts on the human environment, as well as the safety and viability of the project, which necessitates preparation of an Environmental Impact Statement. *See, e.g., Greenpeace Action v. Franklin*,14 F.3d 1324, 1332 (9th Cir. 1992) ("An agency must prepare an EIS if substantial questions are raised as to whether a project . . . may cause significant degradation of some human environmental factor.") (internal quotation marks omitted; emphasis in original); *see also Nat'l Audubon Soc'y v. Hoffman*, 132 F.3d 7, 13 (2d Cir. 1997) ("When the determination that a significant impact will or will not result from the proposed action is a close call, an EIS should be prepared.") (citations omitted). The adoption and reliance upon the deficient analysis in the Environmental Assessment shows that the Commission failed to take the "hard

look" at the Project's impacts, in violation of NEPA. *See Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989).

DRN asserts that the Project is not required for the public convenience and necessity. Based on its flawed and incomplete Environmental Assessment and unjustified Finding of No Significant Impact, the Commission would violate the Natural Gas Act and its implementing regulations by determining that the public benefits of the Project outweigh its adverse environmental impacts.

1. <u>The Commission Improperly Segmented the Review of Tennessee's 300-3 Pipeline Projects</u>

The Commission has violated its NEPA responsibilities by facilitating the unlawful segmentation of at least three of Tennessee's recently proposed pipeline projects. Tennessee has split the overall expansion of its 300-3 pipeline system into smaller components, which has allowed it to avoid a finding of significant impact. The issue of improper segmentation was clearly flagged for the Commission in DRN's various comments on the Project.

NEPA requires an Environmental Impact Statement for proposed "major Federal actions significantly affecting the quality of the human environment." 42 U.S.C. § 4332(2)(C)(i). When scoping the range of actions to include in an Environmental Impact Statement, agencies must consider whether proposed actions are connected, cumulative, or similar. 40 C.F.R. § 1508.25(a)(1)-(3). An agency may avoid preparation of an Environmental Impact Statement by preparing an Environmental Assessment supporting a finding of no significant impact, or by

determining the proposed action is not a major Federal action significantly affecting the environment. 40 C.F.R. §§ 1501.4(e)(1), 1508.9.

NEPA requires federal agencies to take environmental considerations into account "to the fullest extent possible." 42 U.S.C. § 4332; 40 C.F.R. § 1500.2; *Bentsen*, 94 F.3d at 684. NEPA ensures that a federal agency, "in reaching its decision, will have available, and will carefully consider, detailed information concerning significant environmental impacts" and "guarantee[s] that the relevant information [on impacts] will be made available to the larger audience." *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 349 (1989); 40 C.F.R. § 1500.1(b).

The D.C. Circuit in *Delaware Riverkeeper v. FERC*, identified two tests for evaluating whether an agency has improperly segmented its review of a project. *Delaware Riverkeeper Network, et al. v. Federal Energy Regulatory Commission*, 753 F.3d 1304, at 1314-1315 (D.C. Cir. 2014). In the *Delaware Riverkeeper* case – as here – the Commission failed both tests. First, the Court stated that for the purpose of segmentation review, an agency's consideration of the proper scope of its NEPA analysis must be guided by the "governing regulations," which were 40 C.F.R. § 1508.25(a). *Id*. The same analysis is required in the instant matter. Second, the Court in *Delaware Riverkeeper*, also found that in addition to failing to abide by the "governing regulations," the Commission also failed the test for segmentation articulated in *Taxpayers Watchdog v. Stanley*, 819 F.2d 294 (D.C.

Cir. 1987). *Id*. As shown below, the Commission here similarly fails both tests for improper segmentation review of the proposed Project.

a. The Commission Has Unlawfully Segmented Its Review Of Tennessee's Interconnected And Interdependent Pipeline Upgrade Projects Pursuant to 40 C.F.R. § 1508.25(a).

The Commission violated NEPA by segmenting review of Tennessee's new pipeline upgrade into at least three separate projects. These projects are part of a unified whole with functional interdependence, common timing, and geographic proximity. Tennessee's creation of its 300-3 system – which stretches from central Pennsylvania into New Jersey – is one master project divided into segments that have significant adverse environmental impacts and should be evaluated in a programmatic NEPA document.

An agency must prepare a single programmatic Environmental Impact Statement for actions that are "connected," "cumulative," or "similar," such that their environmental effects are best considered in a single impact statement. *Am. Bird Conservancy, Inc. v. FCC*, 516 F.3d 1027, 1032 (D.C. Cir. 2008); 40 C.F.R. § 1508.25(a). "Actions are 'connected' or 'closely related' if they: '(i) Automatically trigger other actions which may require environmental impact statements; (ii) Cannot or will not proceed unless other actions are taken previously or simultaneously; [or] (iii) Are interdependent parts of a larger action and depend on the larger action for their justification.'" *Hammond v. Norton*, 370 F. Supp. 2d 226, 247 (D.D.C. 2005) (quoting 40 C.F.R. § 1508.25(a)(1)). Similar actions have

similarities that provide a basis for evaluating their environmental consequences together, such as common timing or geography. *Id*. at 246; 40 C.F.R. § 1508.25(a)(3). NEPA requires "agencies to consider the cumulative impacts of proposed actions." *NRDC v. Hodel*, 865 F.2d 288, 297 (D.C. Cir. 1988) ("Hodel"). *See also TOMAC v. Norton*, 433 F.3d 852, 864 (D.C. Cir. 2006). An agency must analyze the impact of a proposed project in light of that project's interaction with the effects of "past, current, and reasonably foreseeable future actions." 40 C.F.R. § 1508.7.

"Piecemealing" or "segmentation" is the unlawful practice whereby a project proponent avoids the NEPA requirement that an EIS be prepared for all major federal actions with significant environmental impacts by dividing an overall plan into component parts, each involving action with less significant environmental effects. *Taxpayers,* 819 F.2d 294, 298 (D.C. Cir. 1987). Federal agencies may not evade their responsibilities under NEPA by "artificially dividing a major federal action into smaller components, each without a 'significant' impact." *Coal. on Sensible Transp. v. Dole*, 826 F. 2d 60, 68 (D.C. Cir. 1987). *See also* 40 C.F.R. § 1508.27(b)(7).

The general rule is that segmentation should be "avoided in order to insure that interrelated projects, the overall effect of which is environmentally significant, not be fractionalized into smaller, less significant actions." *Town of Huntington v. Marsh*, 859 F.2d 1134, 1142 (2d Cir. 1988). Without this rule, developers and

agencies could "unreasonably restrict the scope of environmental review." *Fund for Animals v. Clark*, 27 F. Supp. 2d 9, 16 (D.D.C. 1998) ("Fund").

Tennessee's Line 300 system is currently comprised of two pipelines, the 300-1 pipeline and the 300-2 pipeline. The original Line 300 pipeline, the 300-1 line, consists of a 24-inch-diameter pipeline that starts at the discharge of Compressor Station 219 in Mercer County, Pennsylvania, travels east through Pennsylvania and into New Jersey New Jersey. The 300-2 pipeline is a 30-inch-diameter pipeline that was created by Tennessee's segmented submission and the Commission's unlawful approval of at least four separate smaller projects, which include: the 300 Line Upgrade project, the MPP project, the Northeast Supply Diversification project, and the Northeast Upgrade project. Over the period of four years these four projects filled in separate gaps in the line until a single contiguous pipeline was constructed. The D.C. Circuit found that this piecemeal approach to the review and approval of the pipeline projects violated NEPA. *See Delaware Riverkeeper Network*, 753 F.3d at 1314-1315.

Similar to the 300-2 pipeline, Tennessee has improperly split the overall construction of its 300-3 pipeline into smaller components – the proposed Project, the Triad Expansion project, and the Susquehanna West project – thus avoiding a more rigorous environmental review of its construction activity. The application for the proposed Susquehanna West project was submitted on April 2, 2015 (Docket No. CP15-148-000), and is designed to provide 145,000 dekatherms of

natural gas capacity. The project, located in Tioga County Pennsylvania, includes approximately 8.2 miles of new 36-inch pipeline looping on the Tennessee's Line 300 system. Looping involves the installation of additional pipe adjacent to and connecting with existing pipeline. Piping modifications associated with the pipeline loop would be completed at three existing compressor stations: one in Tioga County and two in Bradford County. Tennessee expects to increase compression capacity and modify piping and other equipment at two existing compressor stations in Bradford County. Specifically, construction of the Susquehanna West pipeline is divided into two separate loops on the Line 300 system: (1) a western loop, approximately 6.2 miles in length, located west of compressor station 315 in Shippen, Middlebury, Delmar and Charleston Townships, Tioga County, Pennsylvania; and (2) an eastern loop, approximately 1.9 miles in length, located immediately east of compressor station 315 in Charleston Township. Tennessee proposes this project to come into service by November 1, 2017.

The application for the Triad Expansion project was submitted on June 19, 2015 (Docket No. CP15-520-000) – roughly two months after the Susquehanna West application – and is designed to provide 180,000 dekatherms of natural gas capacity. The project, located in Susquehanna County Pennsylvania, includes approximately 7 miles of new 36-inch pipeline looping on the Tennessee's Line 300 system, the construction of a new pig launcher, and crossover and connecting

facilities for Tennessee's 300-1 and 300-2 pipelines. Looping involves the installation of additional pipe adjacent to and connecting with existing pipeline. Specifically, the Triad Expansion pipeline is proposed to be constructed in Lenox and Clifford Townships, and start approximately at Tennessee's existing pipeline station number 871+66 on the 300-1 line and station number 872+53 on the 300-2 line, and end at Tennessee's existing compressor station 321 in Susquehanna County, Pennsylvania. Identical to the Susquehanna West project, the Triad Expansion has an anticipated in-service date of November 1, 2017.

The application for the proposed Orion Project (Docket No. CP16-4-000) was submitted on October 9, 2015, and is designed to provide 135,000 dekatherms of natural gas capacity. The Orion Project, located in Wayne and Pike counties of Pennsylvania, includes approximately 13 miles of new 36-inch pipeline looping on the Tennessee's Line 300 system, the construction of a new pig launcher, and crossover and connecting facilities for Tennessee's 300-1 and 300-2 pipelines. Similar to the Susquehanna West and Triad project, the Orion Project proposes to add pipeline segments on Tennessee's 300-3 pipeline. Specifically, construction of the Orion Project pipeline is divided into two separate loops on the Line 300 system: (1) loop 322 is an approximately 8.23 miles of 36-inch-diameter pipeline along Tennessee's existing 300 Line right-of-way starting in Wayne County, east of Honesdale, and crossing into Pike County before it ties in to the station suction piping at compressor station 323; and (2) loop 323 is an approximately 4.68-mile

36-inch-diameter pipeline along Tennessee's existing 300 Line right-of-way in Pike County beginning at existing compressor station 323 and crossing through Pike County until it terminates near Route 590 south of Lackawaxen. The Orion Project has an anticipated in-service date of June 1, 2018, roughly seven months after the in-service dates for the Susquehanna West and Triad Expansion projects. The three 300-3 line Tennessee projects were all proposed within roughly six months.

In *Delaware Riverkeeper, et al. v. FERC*, where the D.C. Circuit Court held that the Commission was required to assess the construction and operational impacts of four natural gas pipeline projects that were designed to upgrade a single pipeline in one environmental review because the projects were "connected, closely related, and interdependent[.]" *Delaware Riverkeeper*, 753 F.3d 1304, 1309 (D.C. Cir. 2014). In that matter, the connected actions rule applied because the D.C. Circuit determined that the Commission had improperly *limited* the scope of the review of the actions. Specifically, the court held that "the agency's determination of the proper scope of its environmental review must train on the governing regulations" which here meant 40 C.F.R. § 1508.25. *Id*. at 1315.

Section 1508.25 defines the scope of actions, alternatives, and impacts to be considered in a NEPA document issued by the Commission. Indeed, courts specifically look to this section to inform NEPA segmentation analysis. *See Delaware Riverkeeper*, 753 F.3d at 1309; *see also, e.g., Am. Bird Conservancy,*

Inc. v. FCC, 516 F.3d 1027, 1032 (D.C. Cir. 2008) (reviewing the agency's application of the regulations in its preparation of an EA); *Allison v. Dep't of Transp.*, 908 F.2d 1024, 1031 (D.C. Cir. 1990) (reviewing the agency's application of the regulations in its preparation of an EIS). In order to determine the scope of environmental review for the purposes of segmentation review, agencies "shall" consider three types of actions: those that are "connected," "cumulative," or "similar." 40 C.F.R. § 1508.25 (a).

These actions are clearly "connected" actions pursuant to NEPA. "Actions are 'connected' or 'closely related' if they: '(i) Automatically trigger other actions which may require environmental impact statements; (ii) Cannot or will not proceed unless other actions are taken previously or simultaneously; [or] (iii) Are interdependent parts of a larger action and depend on the larger action for their justification.'" *Hammond v. Norton*, 370 F. Supp. 2d 226, 247 (D.D.C. 2005) (quoting 40 C.F.R. § 1508.25(a)(1)). The 300-3 projects easily meet all three of these standards for being considered "connected" actions.

First, nowhere in the Environmental Assessment, or anywhere else in the administrative record, does Tennessee contend let alone demonstrate that the Orion Project could operate as designed absent the construction of the Susquehanna West or Triad Expansion projects. Indeed, the operating pressures and flow velocities within the system would be materially different absent these two projects becoming operational prior to the Orion Project becoming operational. As such, the

Orion Project likely cannot "proceed unless other actions are taken previously or simultaneously," and these projects must be considered in a single NEPA review document. 40 C.F.R. § 1508.25(a)(1).

Furthermore, a mere glance at a map showing the leap-frogging segments of pipeline proposed for each project demonstrates that the projects are clearly "interdependent parts of a larger action" – the eventual construction of the 300-3 pipeline. 40 C.F.R. § 1508.25(a)(1). DRN's expert report provides further evidence for this conclusion. For example, the expert report found that the gas velocities in the new 36-inch loops are "unusually" low, which shows that "the 36-inch is greatly oversized for the Orion Project's claimed capacity needs," where a mere "16-inch pipe" would have been sufficient to meet project capacity needs. Exhibit A at 2. The report also detailed how the size and placement of the loops were not rational unless Tennessee was planning future upgrades. *Id*. The expert concluded that "other TGP applications to FERC for this system will be submitted, as the Orion Project proposal appears to be only a segment of an overall project to add 36-inch pipeline along the main TGP system." *Id*. at 3.

Tennessee to this point has failed to disclose the necessary information to both the Commission and the public to determine whether the proposed Orion Project will "automatically trigger other actions which may require environmental impact statements." 40 C.F.R. § 1508.25(a)(1). As described in greater detail below, there are important data missing from the record that would determine

whether the Orion Project requires further pipeline looping in order for the safe operation and viability of the Line 300 system. For example, DRN's expert has identified a number of technical questions that need to be answered by Tennessee to ensure that flow velocities in the system, absent future looping, would not compromise the integrity of the system or force it to operate inefficiently until additional looping is completed. Despite this lack of data, DRN's expert was able to determine that gas velocities in the existing 300 lines (the 300-2 and 300-1 pipelines) will be well above Tennessee's recommended maximum of 40 feet per second after the Project goes into operation. *See* Exhibit A at __. The Commission has explained that gas velocities above 40 feet per second along Tennessee's system are unsafe and inefficient, and have rejected project alternatives that would result in such gas velocities. *See* Tennessee Gas Pipeline Company, Docket No. CP11-161-000, "Northeast Upgrade Project Environmental Assessment," November, 2011, Page 3-3. As such, the high gas velocities in the existing system dictate that the Tennessee would have to add further looping to reduce the gas velocities to safe and efficient levels. As such, the Commission must take into account not only the other proposed 300-3 projects, but the additional looping that this Project will inevitably require in the future.

Even if these three 300-3 line projects are not "connected" actions pursuant to § 1508.25(a)(1), the projects are undoubtedly "similar" actions pursuant to § 1508.25(a)(3). As discussed above, Tennessee's three projects are undoubtedly

"reasonably foreseeable or proposed agency actions, [that] have similarities that provide a basis for evaluating their environmental consequences together, such as common timing or geography." 40 C.F.R. § 1508.25(a)(3). With regard to physical proximity, Tennessee's projects are along the same linear geographic corridor, and impact the same sub-watersheds. The Commission arbitrarily decided that unless a Project is located within the "region of influence" it will not be considered in the Assessment. However, nowhere does the Commission define the "region of influence." Indeed, the Commission does not explain what are the geographic boundaries? What types of impacts are considered? What studies, models, or peer reviewed data were relied upon to develop the "region of influence"? The Commission's reliance on such an amorphous and ultimately meaningless term is, of itself, arbitrary decision making. Functionally, the proposed 300-3 projects will work in concert to increase deliverable gas volumes on Tennessee's Line 300 system. Ultimately the direction the gas flows is irrelevant, just as it was irrelevant in the *Delaware Riverkeeper* case. What matters here is that each of the 300-3 projects is operationally reliant on one another. Lastly, with regard to common timing, similar to the pipeline upgrade projects in *Delaware Riverkeeper*, all three of Tennessee's upgrade projects also been applied for in a much closer time period – roughly seven months. As such, the clear physical, functional, and temporal nexus between Tennessee's interrelated and interconnected pipeline upgrade

projects easily meets the standard for "similar" actions pursuant to 40 C.F.R. § 1508.25(a)(3).

Additionally, a review of the way in which Tennessee has sequenced its projects further evinces the way in which these projects must be considered "similar actions" pursuant to segmentation review. For example, it is clear that it is Tennessee's intention to complete a third contiguous pipeline across the state of Pennsylvania and into New Jersey. In the *Delaware Riverkeeper Network* case both the Commission and Tennessee failed to acknowledge at any point that their true intent was to construct a second contiguous pipeline project, here, Tennessee and the Commission directly admit that it is their objective that these projects will be part of creating a third fully looped 36-inch pipeline – 300-3 line – parallel to the other two pipelines. The only difference between the *Delaware Riverkeeper* case, and the instant matter is that the Commission and Tennessee have been caught at an earlier stage in their process of segmenting the proposed 300-3 projects.

Even if the upgrade projects are not considered "connected actions" or "similar actions," the Commission still improperly segmented its review by failing to provide a meaningful analysis of the "cumulative actions" represented by Tennessee's upgrade projects. "Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." *Id*. A finding of "[s]ignificance cannot be avoided by terming an action temporary." 40

C.F.R. § 1508.27(b)(7). "[A] meaningful cumulative impact analysis must identify (1) the area in which the effects of the proposed project will be felt; (2) the impacts that are expected in that area from the proposed project; (3) other actions--past, present, and proposed, and reasonably foreseeable--that have had or are expected to have impacts in the same area; (4) the impacts or expected impacts from these other actions; and (5) the overall impact that can be expected if the individual impacts are allowed to accumulate." *Grand Canyon Trust v. FAA*, 290 F.3d 339, 345 (D.C. Cir. 2002). NEPA requires such an analysis because "[e]ven a slight increase in adverse conditions . . . may sometimes threaten harm that is significant . . . may represent the straw that breaks the back of the environmental camel." *Id.* at 343.

NEPA's cumulative impact analysis requirement is not satisfied where the "analysis" merely announces that there may be risks or impacts, but does not provide the kind of information about those risks or impacts that would be "useful to a decisionmaker in deciding whether, or how, to alter the program to lessen cumulative environmental impacts." *Hodel*, 865 F.2d at 299 ("perfunctory references" do not constitute "analysis"). A cumulative impact section that merely "recites the history of [project] development" in the area and then offers the "conclusory statement" that "the cumulative direct impacts have been minimal" does not satisfy NEPA requirements. *FOE v. United States Army Corps of Eng'rs*, 109 F. Supp. 2d 30, 42 (D.D.C. 2000) (citing *Hodel*, 865 F.2d at 298). More

generally, an agency must provide a reasoned explanation to support its assertions and conclusions; otherwise, its decision is arbitrary and capricious. *Alpharma, Inc.v. Leavitt*, 460 F.3d 1, 6 (D.C. Cir. 2006) ("Alpharma").

Here, the Commission failed to take a hard look at the cumulative impacts of the interconnected 300-3 projects. The Commission's cursory and truncated review of the proposed impacts of the projects renders its cumulative impacts analysis arbitrary and capricious. Indeed, each of these projects must be evaluated together in a single Environmental Impact Statement, rather than separated into individual environmental assessments.

For example, there is no analysis of the impact of the construction and operation of each of the projects on the same sub-watersheds and tributary basins. Nor is there sufficient evaluation of the impact of construction on the already disturbed right of way resulting from construction of the 300-2 pipeline. At no point does the Environmental Assessment consider or analyze whether the individually insignificant post-mitigation impacts on wetlands from multiple pipeline projects in the same corridor could have a cumulatively significant impact.

In addition to the re-disturbance of wildlife, waterbodies, and wetlands in the same sub-watersheds and abutting construction zones, the Environmental Assessment fails whole-sale to mention any of the numerous violations of permitting conditions, non-compliance issues, failed stormwater controls, failed restoration, and insufficient re-vegetation efforts that plagued the construction of

the 300-2 line. Despite the close physical and temporal relationship of the 300-2 construction, and the fact that the 300-2 line was riddled with documented failures of mitigation measures, the Environmental Assessment of cumulative impacts analysis lacks *any* substantive analysis of the aggregate or synergistic impacts of re-disturbing these areas.

For example, in Pike County alone, the local conservation district issued twenty Notices of Violation to Tennessee for failures to follow the terms and conditions of its permits for the construction of the 300-2 line. Many of those Notices of Violations recorded unpermitted direct discharges from construction sites into waterbodies and wetlands. The impact these unpermitted discharges had on the same sub-watershed as the proposed Project are not analyzed or mentioned anywhere in the record. Moreover, the Commission's docket itself for the 300-2 projects is littered with inspection reports and project status updates that detail numerous non-compliance issues and problem areas. Indeed, none of these reports are analyzed or mentioned in the Environmental Assessment of the proposed Project despite the close geographic proximity of the resulting impacts. More generally, the Environmental Assessment neither included nor incorporated by reference any fact-based analysis of impacts on the individual waterways crossed by the proposed Project. Nothing in the administrative record, acknowledges these issues, and as such the Environmental Assessment is deficient.

The remainder of the cumulative impacts section of the Environmental Assessment merely lumps in the Orion project with other nearby Commission jurisdictional projects, which it discusses summarily and without any of the necessary detail derived from the specific facts of those projects. The Commission's unsubstantiated and abbreviated treatment of cumulative impacts in the Environmental Assessment for the proposed project closely mimics the Commission's truncated, and ultimately unlawful, treatment of cumulative impacts in the *Delaware Riverkeeper* case, where the court found that the Commission failed to provide a sufficient hard look at these issues. The Commission has not learned its lesson that such a truncated and cavalier cumulative impacts review is simply not acceptable pursuant to the requirements of NEPA.

Furthermore, the fact that the impacts of the individual projects may have been "minimized" by imposition of procedures required by the Commission and other agencies does not constitute an analysis of whether the *sum* of the "minimized" impacts from each project is significant. For this reason alone, and for those others articulated above, the NEPA review for the proposed Project is deficient.

b. The Commission Has Unlawfully Segmented Its Review Of Tennessee's Interconnected And Interdependent Pipeline Upgrade Projects Pursuant To The Factors Identified in *Taxpayers Watchdog*.

In addition to failing to meet the requirements of 40 C.F.R. § 1508.25(a), the Commission also fails to satisfy the three of the factor test articulated in

Taxpayers, thus demonstrating that the Commission impermissibly segmented its NEPA analysis. *Taxpayers*, 819 F.2d 294 (D.C. Cir. 1987). To determine whether a project has been unlawfully segmented, "courts have considered such factors as whether the proposed segment (1) has logical termini; (2) has substantial independent utility; (3) does not foreclose the opportunity to consider alternatives[.]" *Taxpayers*, 819 F.2d at 298. In *Delaware Riverkeeper*, the court held that even if the court were to expand its analysis from Section 1508.25(a) to the factors in articulated in *Taxpayers*, the Commission's defense of its action was still deficient. Delaware Riverkeeper, 753 F.3d at 1314-16 (the court held that the projects did not have "(1) has logical termini; [or] (2) . . . substantial independent utility." (the court's examination did not reach the remaining factor)). The Commission failed to satisfy each of the factors identified in the *Taxpayers*' test.

A project lacks "independent utility" if it could not function or would not have been constructed in the absence of another project. *Wetlands Action Network v. U.S. Army Corps of Engineers*, 222 F.3d 1105, 1118 (9th Cir. 2000). *See also W. N.C. Alliance v. N.C. DOT*, 312 F. Supp. 2d 765, 774-775 (E.D.N.C. 2003) (project widening highway section lacked independent utility because it would leave a "bottleneck" of narrow highway to north, such that traffic congestion between the termini of the project would be worsened until construction of later project widening bottleneck section).

As described above, the proposed Project functionally relies on the operation of the Susquehanna West and Triad Expansion projects. In other words, if those two facilities were to be deactivated, the proposed Project would not be able to operate **as designed** and fulfil its contracted-for volumes of gas. Therefore, identical to the projects in the *Delaware Riverkeeper Network* case, the projects here rely on one other to function.

Furthermore, it is undeniable that Tennessee's projects are part of a master plan to incrementally complete a full 36-inch pipeline loop on Tennessee's 300 Line system. Indeed, Tennessee admits this goal in the application itself. Tellingly, the Commission can point to nothing in the administrative record demonstrating its independent analysis of any engineering principles that would show that these projects could operate independently of one another as designed. There is simply no data on the record showing the Commission did any sort of independent work to come to its conclusion.

The Commission has previously relied, and continues to rely, upon the flawed argument that because pipeline upgrade projects are designed to serve different customers, at different points in time, they have independent utility, and thus warrant individual review. However, such an argument improperly rests entirely on the economic independent utility of each project. Taken to its logical conclusion, this argument suggests that if a project sponsor could find individual shippers interested in small volumes of gas that would require only half-mile

stretches of looped pipeline along an existing pipeline, the Commission could certificate each one of those small individual half-mile loops. Thus, under those circumstances, the Commission could theoretically certificate over 400 individual projects along Tennessee's system. Such a result undermines the design, purpose, and intent of NEPA. Indeed, this specious argument was specifically addressed and rejected in *Delaware Riverkeeper Network*, where the court rightly identified that the project sponsor "could have proposed two-mile segments, or one-mile segments, or one-hundred-yard segments for NEPA review, so long as it produced shipping contracts in anticipation of the increased capacity attributable to each of these new segments. To interpret the 'substantial independent utility' factor to allow such fractionalization of interdependent projects would subvert the whole point of the rule against segmentation." *Delaware Riverkeeper*, 753 F.3d. at 1315.

The proposed Project also does not have logical termini. When pipeline operators add new loops along a pipeline corridor to increase gas delivery capacity to the end point of that corridor, the location of the start and end points of individual loops is not fixed by the contracted-for quantity of natural gas. Where the contracted-for quantity of gas could be satisfied by adding new loops and compressors in a variety of configurations, pipeline owners add loops in locations based on factors including cost and difficulty of construction, environmental considerations, short- and long-term safety, and avoiding the need to acquire

additional property rights. This is a critical fact as it shows that the Project simply does not have a logical termini.

In *Delaware Riverkeeper*, the court cited this exact scenario for finding that the projects under review did not have a logical termini. Specifically, the court noted that "[t]o the extent that the [projects are] comparable to a highway, it is more analogous to a highway that connects two major points than one section of a web of metropolitan roadways for which the logical termini criterion loses significance." *Id*. at 1316. The proposed Project presents an identical factual scenario, where a single pipeline corridor, the Line 300 system, is being upgraded piecemeal and avoiding proper environmental scrutiny. Therefore, because the selection of the termini for each segment for upgrading the Line 300 system does not turn on the projects' individual contract, the existence of that separate contract cannot establish the independence of the project from the expansion of capacity on the system as a whole. Furthermore, DRN's expert report shows that the design and location of the loops is entirely irrational for the size and scope of the contracted for volumes of gas. If it were Tennessee's intention only to design its project to create enough capacity to satisfy the shipping contracts, it would have designed smaller sized pipe at different locations. *See* Exhibit A at 2-3.

Lastly, Tennessee's projects have also foreclosed the alternative of leaving the Line 300 system not fully looped. A project may be impermissibly segmented from future projects if it eliminates the "no build" alternatives for those future

projects. *See Alliance*, 312 F. Supp. 2d at 775 (project that would exacerbate traffic due to existing bottleneck foreclosed no build option for future widening of bottleneck). Tennessee's projects have made the **completion of looping the Line 300 system, specifically the 300-3 pipeline, inevitable**. Once Tennessee completes the segments for the proposed Project and begins shipping additional gas under contracts for the Project, gas velocities in the remaining unlooped segments along the 300-3 line will substantially exceed the flow velocity limits for safe and efficient operation of the line, increasing the long-term potential for pipeline failure due to increased internal erosion. This is exactly what was found to occur during the construction of the 300-2 line. Such bottlenecks also create significant pipeline and system inefficiencies which demand future looping to alleviate. By potentially exceeding its own design thresholds, Tennessee risks the long-term safety of its system, and also creates its own emergency by consciously constructing inefficient pipeline systems that will later need to be upgraded.

The Commission should be well aware of gas velocity erosional limit ranges as the Commission rejected a pipeline alternative in an application "where transporting the current and proposed gas volumes through only the existing pipeline would result in gas velocity significantly above TGP's recommended maximum design velocity of approximately 40 feet per second. This increased velocity could compromise the pipeline's integrity and safety." Tennessee Gas

Pipeline Company ("TGP"), "Northeast Upgrade Project (Docket No. CP11-161-000), Environmental Assessment," November 2011, p. 3-3.

Completion of the Project irretrievably commits Tennessee to completing the entire 300-3 line. As in *Alliance*, the Project has eliminated the option of no further future construction by creating safety problems and inefficiencies that necessitate future upgrade projects. Rather than evaluating these projects in isolation, the Commission must initiate a programmatic Environmental Impact Statement that provides a comprehensive **corridor wide** review to examine the impact of constructing the entire 300-3 line. As discussed above, Tennessee's proposed Project necessitates the completion of upgrading the rest of its 300 line system to avoid long-term safety issues related to erosion of the aging pipeline due to unsafe flow velocities, and also to relieve the inefficiencies created by incremental pipeline expansion.

2. The Commission Erred by Failing to Disclose or Verify Flow Velocity and Other Technical Data that was Necessary to Determine the Full Extent of the Project's Inter-relatedness to Previous, Pending, and Future Projects, and also to Determine the Operational Safety of the Project

A pipeline engineering expert has reviewed the Exhibit G flow diagrams that have been included in Commission jurisdictional pipeline projects and has determined that the safety and interconnectedness of the pipeline projects necessitates the disclosure of additional information that does not appear in the flow diagrams submitted to the Commission. *See* Exhibit A. This information

would help determine whether the Commission improperly segmented its review of multiple pipeline projects similar to the way in which the Commission unlawfully reviewed the projects in *Delaware Riverkeeper Network* case.

The information needed to fully determine the interconnectedness of Tennessee's related 300-3 line projects – the Orion Project, the Susquehanna West Project, and the Triad Expansion – does not appear anywhere in the Environmental Assessment or its supporting documents. The Commission's failure to disclose this critical information violates the fundamental precepts of NEPA that demand full disclosure of relevant information, and renders any Order flowing from the Environmental Assessment arbitrary, capricious, or otherwise not in accordance with law.

NEPA procedures emphasize clarity and transparency of process over particular substantive outcomes. *See Dep't of Transp. v. Pub. Citizen*, 541 U.S. 752, 756-57 (2004); *see also Or. Natural Desert Ass'n v. Bureau of Land Mgmt.*, 625 F.3d 1092, 1121 n. 24 (9th Cir. 2010) ("Clarity is at a premium in NEPA because the statute . . . is a democratic decisionmaking tool"). Specifically, NEPA "guarantees" that relevant information "will be made available to the larger [public] audience." *Robertson*, 490 U.S. at 349. NEPA seeks to promote informed agency decision-making by "requiring full disclosure of the basis for agency action." *Grazing Fields Farm v. Goldschmidt*, 626 F.2d 1068, 1073 (1st Cir. 1980); *see also Inland Empire Pub. Lands v. United States Forest Serv.*, 88 F.3d 754, 758

(9th Cir. 1996) (finding that NEPA is concerned with the process of disclosure, not any particular result).

Accordingly, agencies violate NEPA when they fail to disclose that their analysis or the record contains incomplete information. *See N.M. ex rel. Richardson v. Bureau of Land Mgmt.*, 565 F.3d 683, 708 (10th Cir. 2009); *see also Motor Vehicles Mfrs.*, 463 U.S. at 43 (holding that an agency acts arbitrarily and capriciously when it fails to "examine the relevant data and articulate a satisfactory explanation for its action including a rational connection between the facts found and the choice made") (internal quotation marks omitted). Such required "up-front disclosures [include] relevant shortcomings in the data or models." *Lands Council v. Powell*, 395 F.3d 1019, 1032 (9th Cir. 2005); *see also* 40 C.F.R. § 1502.22 (An agency "shall make clear" if there is "incomplete or unavailable information" in an NEPA environmental review document).

The very purpose of public issuance of an Environmental Assessment pursuant to NEPA is to "provid[e] a springboard for public comment." *Public Citizen*, 541 U.S. at 768. It is well established that "where comments from responsible experts [provide] **conflicting data** or opinions that cause concern that the agency may not have fully evaluated the project and its alternatives, these comments may not simply be ignored. There must be good faith, reasoned analysis in response." *Silva v. Lynn*, 482 F.2d 1282, 1285 (1st Cir. 1973) (emphasis added); *see also Friends of the Earth, Inc. v. Hall*, 693 F. Supp. 904, 934 (W.D. Wash.

1988) (A NEPA review that fails to disclose and respond to "the opinions held by well respected scientists concerning the hazards of the proposed action is fatally deficient"); *Pacific Coast Federation of Fisherman's Ass'ns v. U.S. Dept. of the Interior*, 929 F.Supp.2d 1039, 1056 (E.D. Ca. 2013) ("The underlying environmental data relied upon to support the expert conclusions must be made available to the public").

For natural gas transmission pipelines, such as the Project, actual gas velocities are a critical variable that drive pipeline design decisions. *See* Exhibit A at 1. For example gas velocities that exceed the design specifications of a given pipeline can result in internal particulate erosion that threatens the integrity of the pipeline. The Commission is well aware of the issue of gas velocity erosional limit ranges, because the Commission recently rejected a possible pipeline alternative in one of Tennessee own recent projects because "transporting the current and proposed gas volumes through only the existing pipeline would result in gas velocity significantly above TGP's recommended maximum design velocity of approximately 40 feet per second. This increased velocity could compromise the pipeline's integrity and safety." Tennessee Gas Pipeline Company, Docket No. CP11-161-000, "Northeast Upgrade Project Environmental Assessment," November, 2011, Page 3-3. For Tennessee's Northeast Upgrade Project, the Commission already identified that gas velocities above 40 feet per second are beyond Tennessee's standards for pipeline safety. An expert evaluation of gas

velocities as a result of this Project concludes that "[t]he proposed expansion of approximately 135 MDth/d of additional gas downstream of compressor station 321 will increase actual gas velocities on most of the 30-inch segments to station 325 that are not looped by the Orion proposal to gas velocities of approximately 55 to 60 fps." Exhibit A. Such high velocities are both inefficient and, by the Commission's own analysis, dangerous. As such, this Project is entirely improperly designed.

Additionally, accurate gas velocity measurements are necessary to determine the functional independence or dependence of a proposed pipeline project in relation to other pipeline projects. If a pipeline project functionally relies on past or future pipeline projects to operate, those projects must be accounted for in a NEPA review document. *See Delaware Riverkeeper Network*, 753 F.3d at 1304. In order to make an accurate determination regarding gas flow velocities for the Orion Project answers to nine specific questions are needed, these questions include:

1. The pipe diameters and where they change,
2. The pipe grade and where the grade changes,
3. The pipe wall thicknesses,
4. The mileage for each pipe grade along the system,
5. Include the MAOP for each pipe segment and where it changes,
6. Identify for each pipeline segment the location of gas meters (if any) along the Tennessee system Loops that may be used to allocate gas flow between the various pipeline segments
7. Gas flow rates in MMSCF/D, for all stream inputs and deliveries along the systems,
8. Pressures at the respective inlet and delivery points along the system for the peak flow case, and

> 9. At each compressor station, include the compressor HP, fuel usage, compressor suction pressure, compressor discharge pressure, the compression ratio, gas volume compressed in MMSCF/D.

Exhibit A at 3. A simple hydraulic profile is critical to determine if a project is justified on its own and thus not segmented, is safely designed, and is appropriately sized. However, such a hydraulic profile cannot be determined by the information made available by the Commission.

The Commission has failed to disclose information addressing both the safety and independent viability of the Project, which are issues that strike at the core of the Commissions NEPA analysis. The Commission could easily remedy this problem by requiring Tennessee to answer the nine questions posed by DRN here and submit those answers to the Commission docket. By failing to provide or otherwise disclose the information requested the Commission violates NEPA.

3. <u>The Commission Violates the Clean Water Act by Issuing the Certificate Prior to the Finalization of Pennsylvania's Section 401 Water Quality Certification</u>

To the extent the Commission issues its Order prior to Pennsylvania issuing its Section 401 Water Quality Certificate for the Project, the Commission violates the Clean Water Act ("CWA"). Furthermore, the Commission should require a condition in any certificate that is issued that expressly states that no tree felling or any other construction activity may take place prior to Tennessee obtaining all relevant state permits including a Chapter 105 Water Obstruction and Encroachment permit.

Section 401 of the CWA plainly requires "no [federal] license or permit shall be granted until the certification required by this section has been granted or waived." 33 U.S.C. § 1341(a)(1); *City of Tacoma v. FERC*, 460 F.3d 53, 68 (D.C. Cir. 2006) ("without [Section 401] certification, FERC lacks authority to issue a license."). The Supreme Court has stated that, consistent with the State's primary enforcement responsibility under the CWA, Section 401 "requires States to provide a water quality certification *before* a federal license or permit can be issued…." *PUD No. 1 of Jefferson Cnty. v. Wash. Dept. of Ecology*, 511 U.S. 700, 707 (1994) (emphasis added). Likewise, the D.C. Circuit clearly held that "without [Section 401] certification, FERC lacks authority to issue a license." *City of Tacoma v. FERC*, 460 F.3d 53, 68 (D.C. Cir. 2006).

The Commission routinely authorizes construction activity, which includes tree felling activity, to begin once the Certificate has been issued, even where all the necessary federal and state permits – such as a 401 Water Quality Certification – have not yet been obtained. *See e.g.*, Commission Docket Nos. CP11-161-000, CP14-17-000. As such, any authorization by the Commission, which provides the project applicant an opportunity to begin construction activities, is premature under the unambiguous terms of Section 401 as this approval remains outstanding.

The fact that the Order conditions upon the Applicants' ability to commence construction on the future receipt of the Section 401 certification, or state permits, does not cure the Commission's violation of the CWA. The clear language of the

CWA prohibits the granting of *any* license or permit. 33 USC § 1341(a)(1). The statute does not make exceptions for licenses or permits that are conditioned on the subsequent grant of the 401 Certification. Moreover, it is wholly unreasonable to allow some of the activities authorized by the Order to proceed, including eminent domain proceeding, or certain earthmoving or tree clearing activities, when the Project could be prohibited from moving forward if Pennsylvania refuses to give the Applicants a Section 401 certification.

In addition, the Commission's issuance of even a conditional license is incompatible with the design and intent of the CWA, which assigns the States the role of primary regulator under the statute. Section 401 allows states to condition Water Quality Certifications on measures designed to ensure compliance with effluent limitations and other state regulations. *Id.* at § 1341(d). The state's conditions, in turn, are required to "become a condition on any Federal license or permit subject to the provisions of this section." *Id.* In order for Pennsylvania to play this primary role, the Section 401 Certification therefore must come before the Order.

Any terms in the Order to attempt to erode the state's power under the CWA by providing that "[a]ny state or local permits issued with respect to the jurisdictional facilities authorized herein must be consistent with the conditions of this certificate," are unlawful. Such a provision impermissibly curtails Pennsylvania's ability to exercise its authority under Section 401 of the CWA,

including by refusing to grant the Certification if it determines that the Project pose an unacceptable risk to Pennsylvania's water quality. The Commission is therefore prohibited from prematurely issuing its Order. *See City of Tacoma v. Federal Energy Regulatory Commission*, 460 F.3d 53 at 68 (D.C. Cir. 2006) ("The Clean Water Act gives a primary role to states to block… local water projects … FERC's role [under CWA Section 401] is limited to awaiting, and then deferring to, the final decision of the state.") (internal quotations omitted).

4. <u>The Commission Violated NEPA and the NGA by Narrowly Defining the Project's Purpose in Order to Reject All Other Alternatives</u>

The Commission examined neither project system alternatives nor any route or configuration alternatives as required by NEPA. Furthermore, the Commission's overly narrow purpose and need determination render its decision unlawful.

The Commission cannot interpret the Project's purpose and need so narrowly that every conceivable alternative is ruled out by definition. *See Simmons v. U.S. Army Corps of Eng's*, 120 F.3d 664 (7th Cir. 1997) (cautioning agencies not to put forward a purpose and need statement that is so narrow as to "define competing 'reasonable alternatives' out of consideration (and even out of existence)"); *Nat'l Parks & Cons. Ass'n v. Bureau of Land Mgmt.*, 606 F.3d 1058, 1072 (9th Cir. 2009) (finding a purpose and need statement that included the agency's goal to address long-term landfill demand, and the applicant's three private goals was too narrowly drawn and constrained the possible range of

alternatives in violation of NEPA). Only Tennessee's proposed Project offers the means of meeting the Commission's stated requirements, thus all alternatives are preordained to fail in comparison. Such a narrow statement of purpose and need, and failure to examine other system alternatives, undermines the NEPA process and will not be upheld. *Envtl. Prot. Info. Ctr. v. U.S. Forest Serv.*, 234 F. App'x 440, 443 (9th Cir. 2007) (agencies cannot "define[] the objectives of the project so narrowly that the project [is] the only alternative that would serve those objectives").

The Commission's circular logic justifying its failure to examine any system alternatives ultimately render its Environmental Assessment legally deficient. Here, Tennessee defined the receipt point (Williams Field services in Susquehanna County, Pennsylvania) and the delivery point (interconnect with Columbia Gas Transmission in Pike County, Pennsylvania) in its Binding Open Season. The Commission now contends that "because the existing 300 Line already connects to the Project shippers' specified receipt and delivery points, the modification or expansion of another existing or new pipeline system that does not connect at or near the specified receipt and delivery points would require construction with similar or greater environmental impact than TGP's proposal. Therefore, we did not further evaluate the expansion of another existing pipeline system to meet the Project objectives." Environmental Assessment, at 90. In other words, Tennessee asked for offers to ship gas from point A to point B along its existing line, and now

the Commission justifies rejecting all other system alternatives because they are not along Tennessee's line. By the Commission's logic, all possible system alternatives were eliminated the very second that shippers committed to the Binding Open Season. Such predetermination of a Project's alternatives does not comply with NEPA.

Furthermore, the Commission fails to examine whether there are other portions of Tennessee's 300 pipeline where installation of additional pipeline looping would be less environmentally harmful. The Commission justifies not examining any other alternatives by stating that because "construction and operation of the Project would not result in significant environmental impacts . . . we did not consider any specific TGP looping system alternatives." Environmental Assessment at 89. However, Tennessee's 300 line system extends from Potter County Pennsylvania into New Jersey and Tennessee could easily locate the pipeline looping at other locations that would result in fewer stream crossings and fewer impacts to wetlands. The Commission therefore failed to choose not only the least environmentally damaging location for the pipeline looping, but failed to engage in even examining any other locations along Tennessee's system that would result in less impacts to the environment.

The Commission's blind acceptance of the location of this looping is a tacit admission that Tennessee will eventually loop the entire 300 line. The Commission is well aware that the ultimate design of Tennessee's 300-3 line project project is

to create and entirely new third loop, so the Commission also is well aware that it is irrelevant where any of the individually segmented sections are to be sited, because eventually the entire corridor will be subject to pipeline construction.

The Commission expressly admits that it never examined upgrading a competing gas transportation network's system, or other system alternatives. By entirely failing to examine any other competing pipeline system alternatives, and any alternatives along its own 300 line system, the Commission violates the Natural Gas Act's overriding purpose "to protect consumers against exploitation at the hands of natural gas companies." *United Distrib. Co. v. FERC*, 88 F.3d 1105, 1122 (D.C. Cir. 1996) (citation omitted). Neither NEPA nor the Natural Gas Act allows the Commission to reject all alternatives except the Project in order to promote the pecuniary interests of its already identified project shippers. As such, the Environmental Assessment and Order are factually and legally deficient.

5. <u>The Commission Violated NEPA and the NGA by Failing to Provide an Accurate Baseline from which to Conduct its Review</u>

A baseline is not an independent legal requirement, but rather, a practical requirement in environmental analysis often employed to identify the environmental consequences of a proposed agency action. *See* 54 Fed.Reg. 23756 (1989). It has been recognized that "[w]ithout establishing . . . baseline conditions . . . there is simply no way to determine what effect [an action] will have on the environment and, consequently, no way to comply with NEPA." *Half Moon Bay Fishermans' Mktg. Ass'n v. Carlucci*, 857 F.2d 505, 510 (9th Cir.1988); *see*

also Council on Environmental Quality, *Considering Cumulative Effects under the National Environmental Policy Act*(visited May 11, 1999) ("The concept of a baseline against which to compare predictions of the effects of the proposed action and reasonable alternatives is critical to the NEPA process"). NEPA requires that the lead agency provide the data on which it bases its environmental analysis. *See Lands Council*, 537 F.3d at 994 (holding that an agency must support its conclusions with studies that the agency deems reliable). Such analyses must occur before the proposed action is approved, not afterward. *See LaFlamme v. F.E.R.C.*, 852 F.2d 389, 400 (9th Cir.1988) ("[T]he very purpose of NEPA's requirement that an [environmental review] be prepared for all actions that may significantly affect the environment is to obviate the need for speculation by insuring that available data is gathered and analyzed prior to the implementation of the proposed action") (internal citation and quotation marks omitted).

Here the Commission failed to examine any of the functions and values of the wetlands that are to be impacted by the Project. To provide an accurate baseline for NEPA review, and to ensure that mitigation measures accurately account for lost and degraded functions and values of wetlands, the Assessment must include an analysis of the following missing information.

1) The Assessment must provide an evaluation of the functions and values of all wetlands in the project area (for example: wildlife habitat,

groundwater discharge/recharge, flood flow alteration, and nutrient removal, pollution control etc.)

2) The wetlands review must not only include the principle functions and values, but all the functions and values the wetlands provide.
3) For each wetland to be impacted, identify the locations of restrictive layers which contribute to and/or maintain the wetlands' hydrology.
4) Identify and provide a discussion on any potential permanent impacts to wetland hydrology from excavation or alteration from construction of the proposed project. Provide a plan, plan sheets, cross sections, and other details which demonstrate that impacts to the wetlands' hydrology from alteration of restrictive layers have been avoided and minimized.
5) Provide site specific information on the hydrology and soils and data on why the wetlands maintain open water/seasonal inundation and provide site specific construction plans, cross sections, and restoration details to ensure that the hydrology and functions and values of the wetland is not altered and it continues to maintain inundation and seasonal hydrology.
6) Discuss the impacts to each wetland where a vegetative class change is proposed (ex. PFO to PSS). The discussion should be specific to the wetland and its functions and values.

Without accurate data regarding the **quality** of the functions and values of wetlands it was simply not possible for the Commission, or the public, to begin to

assess whether the impacts would rise to the level of "significant" and necessitate further environmental review. *See* 40 C.F.R. § 1501.4 (if significant impacts are found the agency must prepare a more comprehensive Environmental Impact Statement). Furthermore, it is not possible for the Commission to accurately calculate the appropriate size, scope, and ratio of wetland restoration that is proposed for appropriate mitigation.

Data regarding wetland quality is **crucial information** in the context of the Commission's NEPA review because States such as Pennsylvania classify their wetlands in a hierarchy based on the differing functions and values that each of the wetlands provide. Some wetlands are simply more functionally valuable than others, and therefore any resulting harms to those wetlands must necessarily be given greater weight or consideration in a NEPA review. *See, e.g.,* 40 C.F.R. § 1508.27(b)(3). For example, wetlands in Pennsylvania are either classified as "exceptional" or "other" wetlands. *See* 25 Pa. Code §§ 105.17(1)-(2). To be classified as "exceptional," wetlands must meet strict criteria demonstrating that the wetland provides particularly important water quality, wildlife habitat, or other vital ecological services. *See* 25 Pa. Code § 96.3(b); 25 Pa. Code § 93.4a; 25 Pa. Code §§ 105.18a(a)-(1). Degraded wetlands that do not meet any of the criteria are considered "other" wetlands. However, all of this data is entirely missing from the Commission's analysis.

Accurate information regarding the classification of the wetlands is critical to the Commission's understanding of the potential harms caused by the construction and operation of the Project, and ultimately whether they result in a significant impact necessitating further environmental review. *See* 40 C.F.R. § 1508.27(b)(3) ("Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas."); *see also* Exhibit B (expert report detailing the various permanent impacts to wetlands resulting from the permanent conversion of forested wetlands to emergent wetlands, an impact cited in the Environmental Assessment for the Project). For example, if a pipeline project in Pennsylvania proposed to impact forty wetlands that were non-forested "other" wetlands as categorized pursuant the Pennsylvania Code, the environmental impact would be significantly less in the context of a NEPA review than if those same forty wetlands were categorized as high-value forested "exceptional" wetlands that are habitat for endangered species. This is exactly why the Commission usually makes a point of analyzing this type of data in its NEPA reviews, but inexplicably fails to do so here. For example, while the Commission failed to properly categorize the wetlands for Transcontinental Pipeline Company's Leidy Southeast Upgrade Project, at least the Commission attempted to perform the analysis. Transcontinental Gas Pipeline Company, "Leidy Southeast Project (Docket No. CP13-551-000), Environmental Assessment," August 2014, Appendix I

(identifying the "State Wetland Classification" for each wetland in Pennsylvania using criteria "as defined in Pennsylvania Administrative Code 25, Chapter 105.17). Based on the record before the Commission, it simply cannot answer the question of how it can appropriately compensate for wetlands impacts if it does not have an accurate starting point. *See Oregon Natural Desert Association v. Jewell*, 823 F.3d 1258, 1265 (9th Cir. 2016) (finding that the agency had a "duty to assess, in some reasonable way, the actual baseline conditions" and the agency's use of "inaccurate data" rendered its decision "arbitrary and capricious").

Additionally the Commission states that the Project "would cross ephemeral waterbodies and ditches where there is no perceptible flow at the time of crossing using standard upland crossing techniques." However, there is no analysis regarding the impact of crossing these waterbodies. There is no discussion anywhere in the Assessment regarding the impact of the Project on vernal pools, indeed, the term "vernal pools" does not appear anywhere in the analysis.

The environmental assessment also omits a number of state listed Threated and Endangered species that are known to occur in the portions of Wayne and Pike counties where the Project is proposed. For example, in Wayne County, the Assessment left out the osprey (state threatened), northern harrier (state threatened), and northern flying squirrel (state endangered). Also, the American bittern is state endangered but the Assessment only lists it as being protected by the Migratory Bird Treaty Act. The wood turtle is also a species of special concern not

mentioned in the Assessment. In Pike County, the Assessment leaves out several species of special concern, including the eastern hog nosed snake, wood turtle, spotted turtle, smooth green snake, and eastern ribbon snake. The Upland sandpiper is also listed in the Assessment as a bird of conservation concern and protected under the Migratory Bird Treaty Act, but it is also state endangered which is not mentioned. The Commission's failure to account for such a wide variety of threated and endangered species violates NEPA.

Cumulative impacts for stream and wetlands are not calculated, monitored, considered, or adequately represented in the Assessment. According to the Assessment, all of these streams are HQ – CWF watersheds where anti-degradation regulations should apply. However, the Assessment does not evaluate the cumulative impact of multiple cuts across individual sub-watersheds, waterways, or wetlands. For example, West Falls Creek watershed has nine pipeline or access road cuts for the Project that are proposed – this is in addition to the earlier 300-2 and 300-1 cuts that occurred to these same streams and waterbodies. Rattlesnake Creek has four proposed cuts; Wetscolang Creek has three proposed cuts; Indian Brook has three proposed cuts; Swamp Brook has three proposed cuts; Tinkwig Creek has two proposed cuts; O'Donnell Creek has two proposed cuts; and Lords Creek has two proposed cuts according to the Assessment. *See* Environmental Assessment, Table 1. As HQ-CWF in Pennsylvania – these are the top quality streams in the state that remain, yet the

Commission states that these impacts will not be significant and that this level of harm will be mitigated. The Commission states there are vegetation impacts and possible turbidity impacts, but the Commission does not seem to include thermal impacts that ultimately will harm stream both locally as well as regionally with increased climate change impacts. Already Pennsylvania streams are changing due to climate change, and these cuts are adding additional damage.

According to the FBC, Pennsylvania is home to some of the best trout fishing in the world. Surveys by PA Fish and Boat Commission in recent years have been reclassifying streams that meet trout criteria to Class A and Wild Trout streams. Wetlands located in or along the floodplains of wild trout streams are protected as EV wetlands, Pennsylvania's highest level of protection relative to development activities that could impact these wetlands. Stream and wetland encroachment permits issued for development activities that could negatively impact wild trout streams include a seasonal restriction that prohibits work in these streams from October 1 to December 31 to minimize impacts during spawning. It does not appear that wetlands in the Assessment reflect adequate info on whether they are designated as exceptional value or not.

To reduce impacts to these resources the Commission should require the applicant to utilize HDD methods would, at least, not lead to more cuts to the stream bottom and the shading vegetation that keeps the stream channel cooler and more indicative to the temperatures trout and the insects they eat need to thrive. It

does not appear that HDD was even considered by the Commission or Tennessee for these important tributaries and was only considered in the context of the crossing of the Lackawaxen. However, even with regard to the Lackawaxen crossing the information that led the Assessment's conclusion that HDD was not feasible was not made available for the public to review.

West Falls Creek, an existing HQ stream, is an example of stream in Pike County that is currently on the FBC list being considered for Wild Trout designation that could be impacted by the Orion Pipeline, bringing with it thermal impacts and lack of vegetation that ultimately will degrade these resources. West Falls Creek is proposed for Wild Trout designation. Indian Brook is also being considered for Wild Trout waters with the Fish and Boat Commission. The Assessment states that timing restrictions (Jan 1 to Sept 30 work windows) will be put in place "if the designation is reached," but again even the proposed dry cuts are extremely disruptive of the vegetation that surrounds these streams. Furthermore, surveys already conducted by the FBC indicate that the stream has this designation and these important populations of trout streams and the streams are already HQ status, so stating that this work window will only be used **if** designations are met, is not accurate considering both of these streams would be impacted multiple times and have already been impacted in the past by this same pipeline operator. Finally, all of these streams feed into the Delaware River which has Special Protection Waters status under the Delaware River Basin Commission.

Other stocked trout waters that could be impacted by this pipeline include the Lackawaxen River. The Lackawaxen was named Pennsylvania's River of the Year for 2010 by the state Department of Conservation and Natural Resources. The Assessment states the Lackawaxen River may be a dry cut Cofferdam or an open cut depending on conditions. Since Tennessee cut across this stream in 2011, the geologic conditions should be known for this region and Tennessee and the Commission. By simply examining HDD across one river with such narrow scope, rather than examining whether a longer HDD crossing would be feasible the Commission fails consider an option that may avoid numerous impacts to water resources. It is important to note that other pipeline companies have drilled under streams and forests and steep slopes for larger distances – it does not appear that this analysis was considered in this Assessment.

I. COMMUNICATIONS

Communications and correspondence regarding this proceeding should be served upon the following individuals:

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II. CONCLUSION

For the aforementioned reasons, the Commission has failed to meet the requirements of the National Environmental Policy Act and its implementing regulations. The Environmental Assessment cannot serve as the basis for an adequate hard look at the Project's environmental impacts, support a finding of no significant impact, or provide the basis for a certificate Order. The Commission cannot determine that the public benefits of the proposed Project outweigh its adverse impacts be relying on the flawed environmental review, thus violating the Natural Gas Act and its implementing regulations.

Respectfully submitted this 22nd day of September, 2016.

/s/ Aaron Stemplewicz

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Exhibit A

Accufacts Inc.
"Clear Knowledge in the Over Information Age"

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September 19, 2016

To: Aaron Stemplewicz
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Re: Observations Concerning the Tennessee Gas Pipeline (TGP) Orion Project from CEII Confidential Data Supplied to Accufacts

The TGP Orion proposal adds approximately 13 miles of 36-inch gas transmission pipeline to loop or run parallel to an existing 30-inch gas transmission pipeline (about 8 ¼ miles of mainline suction and 4.7 miles of mainline discharge pipe spanning compressor station 323). For the Orion proposal, TGP is claiming that a capacity increase of 135 MDth (about 135 MMSCFD capacity on this pipeline segment merits this looping). Based on a review of the CEII protected Exhibit G submission for this project, Accufacts cannot justify the pipeline proposal especially as the 36-inch is significantly greater than the size needed for the claimed capacity increase justification. The Orion project proposal appears to not be the most efficient way to increase claimed capacity.

Confidential Attachments (CE II protected) No. 1 and No. 2 plot pressure and flow versus milepost between compressor stations 321 and 325 for the base case and the proposed expansion case submitted as the Orion Project proposal. Based on the provided CE II information, for ease of understanding, the milepost of compressor station 321 in the attachments has been set to zero, with compressor station 323 and 325 located at approximately milepost 33.2 and 62.5, respectively. I have also included approximate actual gas velocities (in feet per second, or fps) at various key points along this system based on the Exhibit G confidential information. For the same general flows in MMSCFD, lower pressures usually upstream of compressors increase actual gas velocities, which also increase pressure loss and increase horsepower requirements. Looping is usually most efficient in compressor station upstream pipeline for the same general flow rates. Accufacts finds that:

1) TGP is violating it own recommended maximum design velocities

TGP's has a recommended design standard/limitation of maximum gas velocity of 40 feet/sec that it is already violating in their base case submission (see Confidential Attachment No. 1).[1] Accufacts has calculated and indicated actual gas velocities at several lower pressures, higher flow points indicated in the CE II Protected Exhibit G submitted to FERC along the 30-inch between the compressor stations 321 and 325 for the Orion proposal.

[1] Tennessee Gas Pipeline Company, Docket No. CP11-161-000, "Northeast Upgrade Project Environmental Assessment," November, 2011, Page 3-3.

2) **Orion's proposed 135 MDth/d higher gas movements will increase actual gas velocities on some 30-inch pipeline segments between Station 321 and 325.**

For the pipeline segment between compressor stations 321 and 325, the base case flow with no expansion results in gas velocities exceeding the recommended actual gas velocity limitation of 40 fps, with the greatest velocity of over 59 fps in the 30-inch mainline segment immediately upstream of station 323 (see Confidential Attachment No. 1). The proposed expansion of approximately 135 MDth/d of additional gas downstream of compressor station 321 will increase actual gas velocities on most of the 30-inch segments to station 325 that are not looped by the Orion proposal to gas velocities of approximately 55 to 60 fps (see Confidential Attachment No. 2). The mainline suction pipeline upstream of compressor station 323 is a likely candidate for looping given the high actual gas velocities above 60 fps from the lower pressures and higher gas flows in the mainline inlet piping to compressor station 323 if un-looped. The suggested 36-inch pipeline looping, however, results in gas velocities of approximately 20 to 26 fps in the proposed loop sections indicating significant oversize of the new pipe for the stated expansion case. The 36-inch Orion Project proposed looping is way too large for the claimed capacity increase, the compressor station discharge looping is not placed in the appropriate location to be most efficient, and leaves much of the un-looped 30-inch pipeline segments between compressor stations 321 and 325 with excessively high actual gas velocities (in the high 50 fps range, see Confidential Attachment No. 2).

3) **The Orion proposed 36-inch pipeline looping significantly lowers actual gas velocities in these looped sections.**

Given the unusually low actual gas velocities in the looped segments (see Confidential Attachment No. 2), the 36-inch is greatly oversized for the Orion Project's claimed capacity needs. Quick calculations will show that for the stated needed capacity, expansion looping with 16-inch pipe, instead of the proposed 36-inch, would decrease gas velocities in these segments to below 40 fps for the expansion flow rate case. The low velocities in the 36-inch looped sections in the Orion Project proposal lead me to the logical conclusion that additional expansions and looping upgrades will occur between compressor stations 321 and 325. Such upgrades should not be segmented from a greater overall project consideration.

4) **The proposed 36-inch looping is not the most efficient way to design this proposal.**

Given the high gas velocities from the proposed expanded flow, looping of the compressor suction of station 323 makes sense, albeit that the 36-inch pipeline is way oversized for the Orion project's stated increased capacity claims. The 36-inch loop on the discharge of station 323 is not the most efficient design to transport the stated capacity between these compressor stations. For example, among other designs, TGP could have looped more of the 30-inch between the three compressor stations with smaller diameter pipe that would raise the system's pressure and efficiency to meet the stated needs. FERC needs to pursue additional information as to whether future capacity

demands are anticipated for the TGP system in these pipeline segments. Looping would be most efficient for compressor suction mainline pipeline (or lower pressure segments) experiencing capacity demands, and not most likely for compressor mainline discharge pipeline as indicated in the application. Inappropriate placement and sizing of pipe looping can create serious inefficiencies in other segments of the pipeline system (such as in the remaining 30-inch segments upstream and downstream of the proposed loop sections spanning station 323) that are economically irrational in the long term operation of the gas transmission system. The rational for the Orion Project proposed loop size and placement warrants further explanation and justification from TGP.

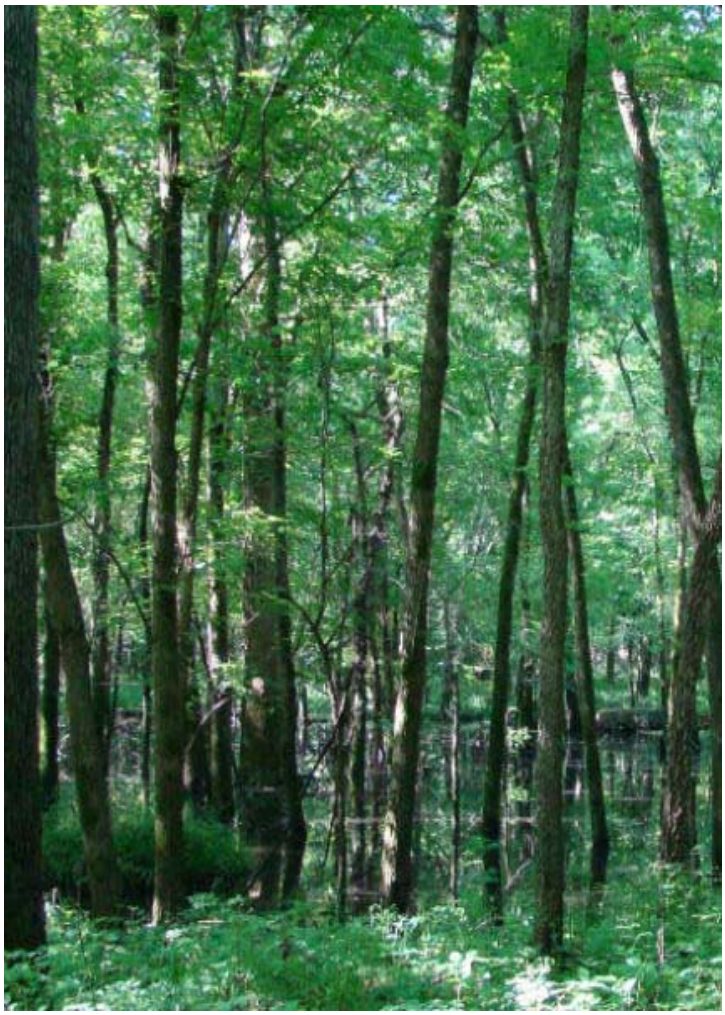
In conclusion, more data must be publically disclosed by the TGP and FERC to provide a complete and accurate hydraulic profile of the Project. Absent this information it is not possible for FERC, or the public, to consider the complete scope of impacts, viability, and interconnectedness of the Project with TGP's other projects. This missing data for the public record includes:

1. clearly indicating why the particular case(s) have been submitted as controlling,
2. the pipe diameters and where they change,
3. the pipe grade and where the grade changes,
4. the pipe wall thicknesses,
5. the mileage for each pipe grade along the system,
6. the MAOP for each pipe segment and where it changes,
7. identifying for each pipeline segment the location of gas meters (if any) along the TGP's system Loops that may be used to allocate gas flow between the various pipeline segments.
8. gas flow rates in MSCFD, for all stream inputs and deliveries along the systems, including expected gas gravity and higher heating value
9. pressures at the respective inlet and delivery points along the system for the peak flow case, and
10. at each compressor station, include the compressor HP, fuel usage, compressor suction pressure, compressor discharge pressure, the compression ratio, gas volume compressed in MSCFD, and clearly identify whether the compressor drivers are electric or gas fired.

While some looping is to be expected to bring actual gas velocities down for the stated capacity cases, the suggest placement and size of the proposed looping leads me to the reasonable conclusion that other TGP applications to FERC for this system will be submitted, as the Orion Project proposal appears to be only a segment of an overall project to add 36-inch pipeline along the main TGP system.

Richard B. Kuprewicz,
President, Accufacts Inc.

Exhibit B



The Effects of Converting Forest or Scrub Wetlands

into Herbaceous Wetlands in Pennsylvania

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A Report to the Delaware Riverkeeper Network

2014

The Effects of Converting Forest or Scrub Wetlands into Herbaceous Wetlands in Pennsylvania

Prepared for: The Delaware Riverkeeper Network

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Note: Appendix A is excerpted from Pennsylvania Department of Environmental Protection. 2010. Riparian Forest Buffer Guidance. Technical Guidance Document 394-5600-001. Harrisburg PA. 107 p.

The Effects of Converting Forest or Scrub Wetlands to Herbaceous Wetlands in Pennsylvania

Wetlands are tracts of land characterized by the recurrent and prolonged presence of surface water and/or near-surface groundwater. Their vegetation, wildlife, and soil properties are greatly influenced by wetness, that is, by their hydrology. Wetness has a profound effect on the biogeochemical reactions that occur in the top foot of wetland soil, allowing bacteria to render such soils anaerobic (oxygen-free) and thereby affecting the chemistry of the soil particles as observed in soil color and organic matter, determining the kinds of microorganisms present, selecting the kinds of rooted plants able to survive and compete, and in turn affecting the quality of habitat for animals including humans. Like streams, ponds, lakes, rivers, and oceans, wetlands today are deemed to be bodies of surface water, peculiar places transitional between (1) permanent open waters and (2) dry lands wet only during precipitation events. Some wetlands are associated with areas where surface waters and groundwater interconnect.

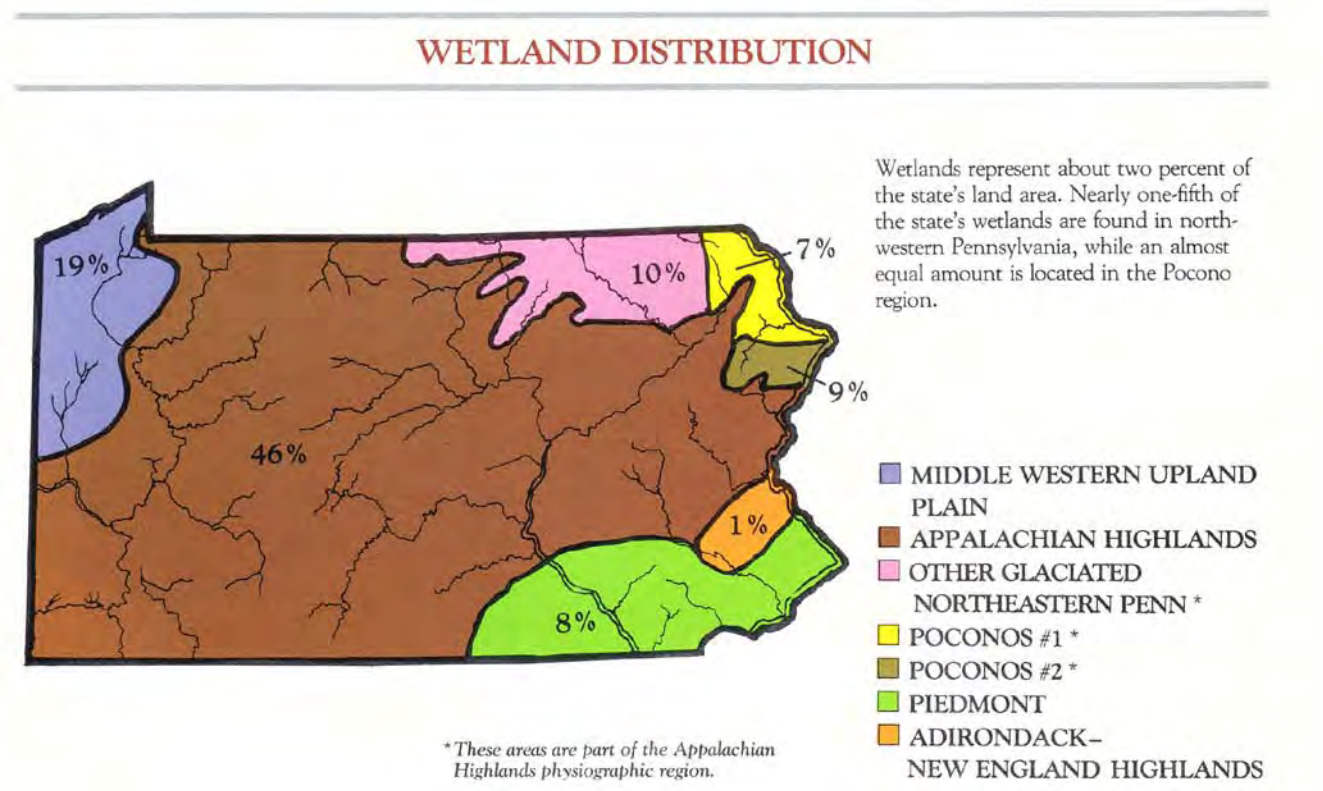
For many years wetlands were regarded as wastelands, and public policy encouraged their physical conversion to accommodate more highly valued land uses of many kinds (farms, cities, roads, residential and commercial development). In response, millions of acres of wetlands were destroyed across the United States, including more than half of Pennsylvania's wetlands (more than 600,000 acres). Not until the latter half of the twentieth century were the environmental and societal values of suddenly scarce wetlands broadly appreciated and subjected to legal protection against unnecessary alteration in the United States (Schmid 2000). Today most construction activities in wetlands are regulated by public agencies concerned with environmental protection. Regulators at the federal, State, and/or municipal level may be involved in permit review and approval. Most construction activities that would affect wetlands are unlawful, unless previously authorized by permit, but the applicable laws vary greatly from place to place in their scope and stringency.

Wetness (above-ground inundation or in-ground saturation within the uppermost foot of topsoil) for periods of two weeks or more, at least seasonally recurrent, is the primary characteristic that locally distinguishes individual wetlands from non-wetland areas that may display similar climate, exposure (aspect), slope, geology (rock type), soils, and biota (plants, animals, bacteria, fungi). The prolonged presence of surface water at relatively shallow depth (< 6 feet) and the presence of emergent vegetation distinguish wetlands from the deep, open waters of lakes and the flowing channels (some with submerged or floating plants) of streams---other bodies of surface water with which wetlands often are closely associated. Wetlands often occupy a landscape zone transitional between open waters and the seldom-wet uplands found at higher elevations. Along with groundwater, surface streams, rivers, lakes, ponds, and wetlands are regulated Waters of the Commonwealth of Pennsylvania. Many, but not all, of the wetlands and other

surface water bodies in Pennsylvania are also Waters of the United States (USEPA and USACE 2014).

In the large and diverse Commonwealth of Pennsylvania there are many kinds of wetlands. Pennsylvania wetlands in the aggregate occupy a small proportion of the land surface, and are most extensive in formerly glaciated areas such as the plateaus of the northeastern and northwestern counties, as shown below in a National Wetland Inventory drawing (from Tiner 1987). Individual wetlands can range in size from a few square feet to many acres. Wetlands today are recognized as contributing to water quality, wildlife habitat, endangered species protection, and the human landscape far out of proportion to their percentage share of the Pennsylvania land surface, and thus warrant stringent protection from human modifications to the extent practicable. These values increase as human population and population density increase. At the same time, the economic value of property where the destruction of wetlands has been authorized can greatly exceed the cash value of that property in its natural condition. Hence the extent to which public agencies can protect wetland resources often conflicts with the desire of private landowners to alter the property which they own.

Pennsylvania Wetlands Are Geographically Concentrated.



Agencies tasked with implementing the federal Clean Water Act (P.L. 92-500, 86 Stat. 816) and the Pennsylvania Dam Safety and Encroachments Act (32 P.S. 693) and Clean Streams Law (35 P.S. 691), long have defined wetlands as

> Areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, including swamps, marshes, bogs and similar areas (25 *Pa. Code* 105.1.)

Accurate wetland identification and delineation depend upon a careful analysis of plants, soils, and hydrology using the best available scientific guidance to apply the official definition in each real situation on the surface of the earth. In the central sections of most wetlands the general public can readily ascertain the distinctive conditions that characterize tree-filled swamps and herb-dominated marshes. Precisely locating the boundaries of a wetland, however, in gently sloping transitional areas where the requisite field indicators gradually drop out, typically requires specialized training in the visual appearance of vegetation, soils, and hydrology as they occur outdoors in all seasons, along with thorough knowledge of relevant agency rules for consistent decisionmaking. The details of scientific knowledge of wetland functions and regulatory adjustments in setting regulatory boundaries and analyzing impacts have changed over recent decades as our understanding of wetlands has increased.

To apply the regulatory definition of wetlands in the field, federal and Pennsylvania regulators (25 *Pa. Code* 105.451) employ the Army Corps of Engineers *Wetland Identification and Delineation Manual* (ERL 1987) in conjunction with its recent regional supplements (for example, USACE 2012) and other technical support documents (including Lichvar *et al*. 2014, Vasilas *et al*. 2010, USACE 2014). These official documents provide the guidance necessary for recognizing the current extent of regulated wetlands under various conditions of season, wetness, and human disturbance, using field indicators of vegetation, soil, and hydrology.

In Pennsylvania the Army Corps of Engineers provides, in response to landowner requests, formal written Jurisdictional Determinations (JDs) that confirm the accurately mapped extent of wetlands and bodies of surface water eligible for regulation at the federal, State, and municipal level on specific tracts of land. Absent the issuance of a valid JD, there is no way for a landowner or the public to ascertain accurately the limits of a regulated wetland. Topographic maps, National Wetland Inventory maps, floodplain maps, soil survey maps, and planning maps of many kinds can provide useful technical information, but do not identify in detail the limits of regulated wetlands (or streams) that need to be considered by the sponsors of construction projects. Consultants typically document sites on behalf of landowners and prepare paperwork for agency review. Careful documentation of wetlands whose proffered boundaries are superimposed onto a land ownership survey is required as part of a request for a

JD, and Corps staff typically inspect each property in the field prior to approving a JD. JDs remain valid for five years, in recognition of the fact that wetland boundaries can change over time as a result of natural changes as well as unregulated human activities nearby. Only the Natural Resources Conservation Service (NRCS), an arm of the US Department of Agriculture, issues permanent wetland identifications for purposes of eligibility for federal programs that support crop production. Such NRCS determinations apply only to farming, not to general construction activities.

Delineated wetlands are best avoided when new construction projects are proposed, and permit applicants are expected to minimize unavoidable impacts insofar as practicable. The JD forms the informational basis for permit calculations and for designing compensatory mitigation to offset agency-approved impacts to the extent practicable.

Recent experience confirms that applicant-proffered wetland boundaries continue to warrant detailed scrutiny by the Army Corps of Engineers and other regulators. In one 2010 mining application in Greene County, National Wetland Inventory maps disclosed 4 wetlands on a 642-acre site. The applicant's consultant submitted a proposed delineation to PADEP showing 10 wetlands. After field inspection by the Corps, the JD drawing of the same tract of land showed 27 wetlands (Schmid & Co., Inc. 2013). In Sullivan County a gas company consultant delineated streams and wetlands in a 50-foot wide right-of-way along some 4,000 feet of unpaved township road. After the adjoining landowners secured Corps JDs, the square footage of regulated streams and wetlands increased to 700% of that flagged for the gas company within the same 4-acre strip of land (Schmid & Co., Inc. 2011b). The Corps field representative commented that significant under-identification of wetlands had occurred at several recent gas well installations where he had been involved with enforcement actions. None of those permittees had secured a Corps JD, and PADEP as usual had approved their permits without questioning the accuracy of information in the applications. It is not possible to overemphasize the necessity for JD applications followed by field-checking by Corps staff of proffered delineations as critical to the identification of wetlands in Pennsylvania prior to permit approval. Unidentified wetlands are not protected at all.

Wetland Permits

Regulated activities in Pennsylvania wetlands and other bodies of water cannot legally be initiated prior to permit approval by the Department of Environmental Protection (PADEP), except for waivered activities (25 *Pa. Code* 105.12) and registered activities that conform to the requirements of pre-approved general permits (25 *Pa. Code* 105.441 *et seq*.). Above established minimum thresholds of impact, regulated activities in federally regulated wetlands and waters also require approval from the Army Corps of Engineers. Except for those areas and

activities excluded from regulation by waiver or authorized via general permits, wetland functions by regulation must be identified by an applicant when permit approval is sought for activities that will encroach upon wetlands and other bodies of water in Pennsylvania (25 *Pa. Code* 105.13). Permit applications for relatively small encroachments may be reviewed only by State agencies; larger or more damaging activities must be considered independently also by federal agencies. Few of the more than 2,500 Pennsylvania municipalities have adopted any ordinances protective of wetlands, but some have included wetlands as among resources to be reviewed at the local level, and their wetlands may be protected over and above what State and federal agencies require. Like PADEP, local agencies generally lack the staff resources to identify jurisdictional boundaries for wetlands.

After wetlands have been identified, permit applicants are expected to avoid impacts, and where unavoidable, to make every practicable effort to minimize impacts when planning their construction projects; PADEP is to review such efforts to avoid and minimize impacts [25 *Pa. Code* 105.14(b)(7)]. Where encroachments are proposed into wetlands, it is the responsibility of the permit applicant to identify onsite conditions in every affected wetland as a basis for ascertaining the probable alteration of functions when analyzing unavoidable adverse impacts and providing appropriate compensatory mitigation (25 *Pa. Code* 105.14, .15, and .18a). Impacts are to be analyzed in an Environmental Assessment (§105.15). The extent and nature of unavoidable impacts become the basis for developing the applicant's proposal for site restoration and compensatory mitigation. The quality of wetland assessment depends on the thoroughness and accuracy of underlying wetland inventory as well as the professional competence of the delineator and agency reviewer. Wetland functions form a principal aspect of the environmental assessment.

PADEP and district offices of the Army Corps of Engineers have adopted a joint permit application (Form 3150-PM-BWEW0036A, March 2013) and related forms that solicit the minimum information needed for agency decisionmaking regarding affected wetlands and other bodies of water on properties where construction is planned that may damage these resources. Public notice is required for individual joint permit applications, but not for waivered activities or for registrations of applicant intent to rely upon general permits. PADEP staffers are charged with reviewing each application to insure its completeness, its accuracy, and the applicant's proposed compliance with applicable regulations. Permit files, application data, and related correspondence are public records and can be examined by persons concerned about wetland protection through the procedures of Pennsylvania's Right to Know Law (Act 3 of 2008) and the federal Freedom of Information Act (5 USC 552 *et seq*.). Upon approval of a PADEP permit, the window for filing appeals to the Pennsylvania Environmental Hearing Board by any aggrieved party remains open for thirty days. Applicants are required to conform to the conditions and limitations set forth in general and individual permits. All recipients of individual permits by regulation are required

to file a statement of compliance with permit requirements within 30 days of work completion and to file final as-built plans within 90 days showing any changes from original plans and specifications (25 *Pa. Code* 105.107).

In Pennsylvania some wetlands are deemed more valuable than others. Exceptional Value wetlands deserve *specia*l protection. Such wetlands exhibit one or more of the following characteristics (25 *Pa. Code* 105.17):

1. Serve as habitat for fauna or flora listed as threatened or endangered under federal or Pennsylvania law.
2. Are hydrologically connected to or located within 0.5 mile of the above and maintain the habitat of the endangered species.
3. Are located in or along the floodplain of the reach of a wild trout stream or waters listed as having Exceptional Value and the floodplain of their tributary streams, or within the corridor of a federal or Pennsylvania designated Wild or Scenic River.
4. Are located along an existing public or private drinking water supply and maintain the quantity or quality of that surface water or groundwater supply.
5. Are located in State-designated natural or wild areas within State parks or forests, in federally designated Wilderness Areas or National Natural Landmarks.

Wetlands that qualify as having Exceptional Value are defined as surface waters of Exceptional Ecological Significance (25 *Pa. Code* 93.1), and thus (like Pennsylvania streams that have been designated or have attained Exceptional Value uses) are to be treated as Tier 3 Outstanding National Resource Waters in the language of the Clean Water Act of 1972 (as amended, 33 *USC* §1251 *et seq*.; *US Environmental Protection Agency Water Quality Handbook* - Chapter 4: Antidegradation [40 *CFR* 131.12]). These highest-quality resources are to be protected from degradation. Wetlands that do not exhibit any of the above-listed characteristics are deemed “Other” wetlands.

Permits for structures and activities in Exceptional Value wetlands are not to be approved unless PADEP finds that: the dam, water obstruction, or encroachment will not have an adverse impact on the wetland, as determined in accordance with §§ 105.14(b) and 105.15; the project is water dependent, requiring access to, proximity to, or siting within the wetland to fulfill its basic purpose; there is no practicable alternative that would not involve a wetland or that would have less adverse effect on the wetland and not have other significant adverse effects on the environment; the project will not cause or contribute to a violation of an applicable State water quality standard; the project will not cause or contribute to pollution of groundwater or surface water resources or diminution of resources sufficient to interfere with their uses; and the applicant replaces the affected wetland in accordance with criteria at § 105.20a [25 *Pa. Code* 105.18a(a)]. Yet Corps Jurisdictional Determinations are not required for Exceptional Value wetlands in Pennsylvania, so these wetlands are equally likely to be overlooked as those lacking exceptional value.

“Other” wetlands also are deemed “a valuable public natural resource” (25 *Pa. Code* 105.17) that is to be protected from significant impacts in similar fashion to

Exceptional Value wetlands. Permits are to be granted to dams, water obstructions, or encroachments affecting Other wetlands only when PADEP finds that: the project will not have a significant adverse impact considering the areal extent of the impacts, values, and functions of the wetlands, the uniqueness of the wetland functions and values in the area or region; comments from environmental agencies have been addressed; adverse impacts on the wetland are to be avoided or reduced to the maximum extent possible; there is no practicable non-wetland impacting alternative; the applicant has convincingly demonstrated that non water-dependent projects have no practicable alternative, overcoming the rebuttable presumption that such alternatives exist; the project will not cause or contribute to violation of an applicable State water quality standard; the project will not cause or contribute to pollution of groundwater or surface water resources or diminution of resources sufficient to interfere with their uses; the cumulative effect of this project and other projects will not result in a major impairment of the Commonwealth's wetland resources; and the applicant replaces the affected wetland in accordance with criteria at § 105.20a [25 *Pa. Code* 18a(b)]. On paper, Pennsylvania offers stringent protection to its wetlands.

Wetland Functions

Nine wetland functions are specifically identified in the definitions section of Pennsylvania's Dam Safety and Encroachments regulations (25 *Pa. Code* 25.1). By regulation, these functions are the minimum that require consideration as PADEP evaluates every encroachment permit affecting 1 acre or less of wetlands. Larger wetlands, as well as Exceptional Value wetlands smaller than 1 acre may require more complex assessment of additional functions and values in addition to these [25 *Pa. Code* 105.13(d)(3)]:

Wetland Functions Requiring Analysis in PADEP Permits

1. Serving natural biological functions, including food chain production; general habitat; and nesting, spawning, rearing and resting sites for aquatic or land species.
2. Providing areas for study of the environment or as sanctuaries or refuges.
3. Maintaining natural drainage characteristics, sedimentation patterns, salinity distribution, flushing characteristics, natural water filtration processes, current patterns or other environmental characteristics.
4. Shielding other areas from wave action, erosion, or storm damage.
5. Serving as a storage area for storm and flood waters.
6. Providing a groundwater discharge area that maintains minimum baseflows.
7. Serving as a prime natural recharge area where surface water and groundwater are directly interconnected.
8. Preventing pollution.
9. Providing recreation.

Different wetlands exhibit different combinations of functions. Some mutually exclusive functions (for example, groundwater recharge and groundwater

discharge) can alternate over time within a single wetland. The functions performed by a wetland may vary over seasons and from year to year. The functions that any given wetland is capable of performing result from both the internal characteristics of the wetland itself and the surrounding context in which that wetland exists, including its connection with other natural areas and with watercourses. Corridors for wildlife movement, for example, are important to allow populations of animals to move between areas of wetland habitat, and many streams function as wildlife corridors. Similarly, only a wetland located on the shore of an open water body can shield other areas from wave action. The success of a wetland in performing functions can be affected greatly by past or ongoing human activity. Most wetland functions are disrupted permanently or temporarily by construction activities that impinge upon the wetland vegetation, soils, or hydrology directly. Human activities that increase performance of one function can accompany decreasing performance of other functions by that wetland.

Wetland functions also can be affected by construction outside the wetland itself out to a distance of 1,500 feet or more (Houlahan *et al*. 2006). For example, wildlife that breed in wetlands, such as reptiles and amphibians including frogs and salamanders, normally range into the adjoining uplands for distances of many hundreds of feet in eastern North America during the course of an annual cycle. If the adjacent lands are deforested or paved, or the wetland isolated by an intervening road or fence, the wetland habitat can be rendered useless to such creatures. By way of further example, altering the light and wind by removing the surrounding forest can cause a major change in the plants and animals that can survive in a wetland. Surface disturbances outside a wetland also can have major impact on the hydrology of the wetland, profoundly altering its ecosystem by draining or flooding it.

There is no State-regulated wetland buffer in Pennsylvania, such as exists in New Jersey or New York. Those States have expressed concern for the variable boundaries of wetlands that result from differing weather conditions year to year. They wisely recognize that the associated transitional areas adjacent to wetlands comprise essential parts of the functioning ecosystem of each wetland. Hence they long have considered the preservation of ecosystems adjacent to a wetland to be an essential part of protecting that wetland's functions and values. The absence of regulated buffers around wetlands in Pennsylvania renders its wetlands at risk of unavoidable degradation, especially in areas of concentrated human populations. A few Pennsylvania municipalities have recognized or sought to remedy this environmental risk through local ordinances that provide for maintenance of some amount of undeveloped protective buffer outside the wetland. The functions of forested riparian buffers are reviewed in Appendix A.
.

Wetland Classification

The functions and values of a wetland differ according to the placement of the wetland in the landscape and the manner in which it gains its wetness.

Functional analysis logically addresses different classes of wetlands differently when addressing their potential for damage or rehabilitation. Wetlands and shallow water bodies are usefully categorized at the most basic level by general hydrogeomorphic system. Across most of the Pennsylvania landscape, wetlands and small ponds are assigned to the Palustrine (P) system, which is distinguished from tidal estuarine and marine classes, lakes, and large rivers. Wetlands along the boundaries of water bodies are assigned to the Riverine (R) or Lacustrine (L) systems, although many floodplain wetlands are labeled as Palustrine. Marine (M) and Estuarine (E) classes are of limited extent in Pennsylvania.

The following table identifies the most recent hydrogeomorphic classifications under development by the PADEP (draft Technical Guidance Document 310-2137-002, 7 March 2014, p. 27). The classification is significant as it affects the functional analysis of all water bodies including wetlands.

Mid-Atlantic HGM Wetland Classification:

- Classes
  - Subclasses
    - Modifiers
- Marine
  - subtidal
  - intertidal
- Estuarine
  - subtidal
  - lunar intertidal
  - wind intertidal
  - impounded
- Riverine
  - lower perennial
  - floodplain complex
  - upper perennial
  - headwater complex
  - intermittent
    - beaver impounded
    - human impounded
- Lacustrine (fringe)
  - permanently flooded
  - semipermanently flooded
  - intermittently flooded
  - artificially flooded
- Palustrine
  - Flat
    - Flat mineral soil
    - Flat organic soil
  - Slope
    - Stratigraphic
    - Topographic
      - mineral soil
      - organic soil
  - Depression
    - perennial
    - seasonal
    - temporary
      - human impounded
      - human excavated
      - beaver impounded

PADEP goes on to offer additional detail on the principal kinds of wetlands in Pennsylvania classed by location associated with hydrology that require consideration during functional assessments. The modifiers give an idea of the variability of the basic types (draft Technical Guidance Document 310-2137-002, 7 March 2014, p. 24-25). Once these distinctions have been formally adopted by PADEP for consideration in each permit application, the precision and quality of data provided by applicants' consultants should improve, along with the quality of impact analysis.

Pennsylvania Hydrogeomorphic Wetland Classification Key.

1.	Wetland found along tidal fringe of a marine ecosystem (ocean, beach, rocky shore)	2
1.	Wetland not associated with marine ecosystem	3
2.	Continuously submerged littoral zone	**Marine subtidal** (MF1)
2.	Alternately flooded and exposed to air	**Marine intertidal** (MF2)
3.	Wetland associated with shallow estuarine ecosystem (Mixture of saline and freshwater)	4
3.	Wetland not associated with shallow estuarine ecosystem	7
4.	Wetland not impounded	5
4.	Wetland impounded	**Estuarine impounded** (EFh)
5.	Wetland continuously submerged	**Estuarine subtidal** (EF1)
5.	Wetland alternately flooded and exposed to air	6
6.	Wetland regularly or irregularly flooded by semidiurnal, storm, or spring tides	**Estuarine lunar intertidal** (EF2l)
6.	Wetland flooding induced by wind	**Estuarine wind intertidal** (EF2w)
7.	Wetland associated with freshwater stream or river	8
7.	Wetland not associated with freshwater stream or river	11
8.	Wetland associated with permanent flowing water from surface sources	9
8.	Wetland dominated by ground water or intermittent flows	10
9.	Wetland associated with low gradient tidal creek (see Estuarine types 3)	
9.	Wetland associated with low gradient and low velocities, within a well-developed floodplain (typically >3rd order)	**Riverine lower perennial** (R2)
9.	Wetland part of a mosaic dominated by floodplain features (former channels, depressions) that may include slope wetlands supported by ground water (see Slope 17)	**Riverine floodplain complex** (R2c)
9.	Wetland associated with high gradient and high velocities with relatively straight channel, with or without a floodplain (typically 1st - 3rd order)	**Riverine upper perennial** (R3)
10.	Wetland part of a mosaic of small streams, depressions, and slope wetlands generally supported by ground water	**Riverine headwater complex** (R3c)
10.	Wetland associated with intermittent hydroperiod	**Riverine intermittent** (R4)

Note:	For any riverine type that is impounded, distinguish between:	
	Wetland impounded by beaver activity	**Riverine...beaver impounded** (R...b)
	Wetland impounded by human activity	**Riverine...human impounded** (R...h)
11.	Wetland fringing on a lake or reservoir	**12**
11.	Wetland not fringing on lake or reservoir	**14**
12.	Wetland inundation controlled by relatively natural hydroperiod	**13**
13.	Wetland inundation is permanent with minor fluctuations (year round)	**Lacustrine permanently flooded** (LFH)
13.	Wetland inundation is semipermanent (growing season)	**Lacustrine semipermanently flooded** (LFF)
13.	Wetland inundation is intermittent (substrate exposed often)	**Lacustrine intermittently flooded** (LFJ)
12.	Wetland inundation controlled by dam releases	**Lacustrine artificially flooded** (LFK)
14.	Wetland water source dominated by precipitation and vertical fluctuations of the water table due to low topographic relief	**15**
14.	Wetland differs from above	**16**
15.	Wetland substrate is primarily of mineral origin	**Flat mineral soil** (FLn)
15.	Wetland substrate is primarily of organic origin	**Flat organic soil** (FLg)
16.	Wetland water source is primarily ground water and has unidirectional and horizontal flows	**17**
16.	Wetland forms a depression	**18**
17.	Water source for wetland derived from structural geologic discontinuities resulting in discharge of groundwater from distinct point(s) on slope	**Stratigraphic slope** (SLs)
17.	Water source for wetland accumulates at toe-of-slope before discharging	**Topographic slope** (SLt)
Note:	For any slope type, distinguish between: Wetland substrate is primarily of mineral origin	**...slope mineral soil** (SL...n)
	Wetland substrate is primarily of organic origin	**...slope organic soil** (SL...g)
18.	Wetland with frequent surface connections conveying channelized flow	**Depression perennial** (DFH)
18.	Wetland with infrequent surface water connections conveying channelized flow	**Depression seasonal** (DFC)
18.	Wetland with no surface outlet, often perched above water table	**Depression temporary** (DFA)
Note:	For any depression type that is impounded or excavated distinguish between:	
	Wetland is impounded by human activities	**Depression...human impounded** (DPh)
	Wetland is excavated by human activities	**Depression...human excavated** (DPx)
	Wetland is impounded by beaver activities	**Depression...beaver impounded** (DPb)

Another of the basic classifications of wetlands derived from their appearance and germane to assessing their functions is their vegetation type. The descriptive framework for vegetation structure was devised by the US Fish and Wildlife Service (Cowardin *et al*. 1979) and is used for small-scale mapping by the National Wetlands Inventory. Vegetation and hydrogeomorphic location are combined to identify the principal habitat types identified by PADEP in Pennsylvania (Draft Technical Guidance Document 310-2137-001, March 2014,

p. 7). Notably, PADEP to date has not identified any nontidal Riverine wetland habitat types:

Some Pennsylvania Wetland Habitat Types.

LAB	Lacustrine Aquatic Bed
LEM	Lacustrine Emergent
LFL	Lacustrine Flat
PAB	Palustrine Aquatic Bed
PEM	Palustrine Emergent
PFL	Palustrine Flat
PFO	Palustrine Forested
PSS	Palustrine Scrub/Shrub

Lacustrine Emergent Wetland and Lacustrine Aquatic Bed.

Palustrine wetlands are the most numerous and widespread kinds in Pennsylvania, accounting for 97% of the wetlands mapped in the Commonwealth by the National Wetland Inventory from high-elevation aerial photos taken during the late1970s and early 1980s (Tiner 1990). National Wetland Inventory mapping is a useful tool whose results are valuable for regional wildlife resource management, but it significantly omits many forested wetlands in Pennsylvania and is not a reliable guide to regulated wetland locations or boundaries.

Nevertheless, its incomplete and approximate data are readily available online and often are displayed on maps generated by geographical information systems. Hydric soil map units in county soil maps and wetland patterns on US Geological Survey topographic quadrangles also offer clues to wetland locations. But the actual extent of wetlands and streams can be determined only by field delineation of specific properties when construction activities are proposed.

The principal kinds of vegetation found in Palustrine wetlands are classed as forest (PFO), scrub (PSS), and herbland (PEM) based on visual observation and/or aerial photographs. Available statistics probably underestimate the proportion of forested wetlands in Pennsylvania, inasmuch as they are based on aerial photographs rather than field investigation and omit forested wetlands not distinguishable remotely. Palustrine flats (FL) devoid of vegetation are not common. The focus of vegetation classification is on the size and structure of the general mass of vegetation present in the landscape. An individual plant, depending on species, can pass through the structural stages of herb, shrub, and tree as it grows in wetlands or uplands. The US Fish and Wildlife Service has reported their estimate of cover types of National Wetland Inventory wetlands in Pennsylvania based on 1975-1985 aerial photographs (Tiner 1990):

Palustrine Forests.

Delhaas Woods, Bucks County. Photograph by Roger Earl Latham.

Columbus Bog, State Game Lands 197, Warren County. Photograph by Paul Wiegman.

Acres of National Wetland Inventory Wetlands in Pennsylvania, 1975-1985.

Palustrine Wetlands	
Emergent	*52,338 a*
Deciduous Forested	*146,715 a*
Evergreen Forested	*31,204 a*
Deciduous Scrub-Shrub	*47,539 a*
Evergreen Scrub-Shrub	*1,849 a*
Mixed Deciduous Shrub-Emergent	*25,000 a*
Open Water	*61,841 a*
Other Mixed Types	*26,242 a*
Total Palustrine Wetlands	*392,728 a*
Lacustrine Wetlands	*8,521 a*
Riverine Wetlands	*2,675 a*
PENNSYLVANIA WETLANDS	***403,924 a***

Forest vegetation (FO) is dominated by trees at least 3 inches in minimum trunk diameter measured 4.5 feet above the ground and at least 20 feet tall. Shrubs and herbs can grow beneath the canopy trees, or the forest floor can be essentially bare. Scrub (SS) is dominated by shrubs with multiple stems less than 3 inches in diameter and rarely taller than 20 feet. Herbs can be abundant beneath the shrubs but trees are few; light tends to reach the land surface to a much greater degree than in forests. Herblands (EM) are generally devoid of woody plants but instead support various kinds of non-woody, herbaceous higher plants that emerge from the soil surface. Their plant cover can be sparse or dense. Tracts of land that qualify as forest, scrub, or herbland may intergrade and are mapped as mixed types (for example, FO/SS). The forest, scrub, and herbland categories each can be subdivided into numerous subtypes, depending on the purpose of such classification and appropriate level of detail. For example, Palustrine forest and scrub polygons on maps can be broadleaf deciduous (assigned the modifier “1” by the National Wetland Inventory, as in “PFO1”) or needleaf evergreen (“PFO4”); emergent herbs can be persistent year-round (“1” as in “PEM1”) or nonpersistent (“PEM2”), and any of these modifiers

can be further supplemented by codes for dominant plant genus or species or for other ecosystem attributes where more precise distinctions are needed.

In Pennsylvania Palustrine ecosystems, forested wetlands are more extensive than scrub and herbaceous wetlands. Natural plant succession generally trends toward forest conditions in eastern North America (Braun 1950, Küchler 1964), and thus herbaceous and scrub wetlands tend to reflect earlier stages of natural post-disturbance succession than forested wetlands. The first-approximation airphoto mapping of Pennsylvania wetlands by the US Fish and Wildlife Service reported deciduous forests making up 37% of Palustrine wetlands; evergreen forest, 8%; deciduous scrub, 12%; evergreen scrub, <0.1%; mixed deciduous scrub-herbland, 6%; herbland, 13%; open water (including farm ponds), 16%; and other mixed types, 7% based on 1975-1985 aerial photographs (Tiner 1990). Under natural conditions the forest community is disrupted occasionally by storms, fire, and beaver activity. Human activities today are a much more common source of forest removal. Not all herblands, however, are rapidly changing categories of plant succession on their way to becoming forests; some can persist naturally for long periods of time as viewed by humans. The plants found in particular wetland communities can range from diverse species to almost monotypic where invasives have become established.

State and federal agencies that keep records of wetlands and wetland modifications use these vegetation types for data collection and analysis. Each distinctive vegetation type also is associated with characteristic functions. Herbaceous wetland vegetation is capable of being reestablished relatively quickly following temporary disturbance, within only a few growing seasons, if soil and hydrologic conditions are favorable. Shrubs require additional years to reach full size, and forest trees require decades for canopy closure, even where soil disturbance has not been severe. Diverse populations of desirable native species can require long periods of time to become established in disturbed or newly created wetlands.

Functions of Pennsylvania Wetlands

This section discusses the functions listed above (as set forth in 25 *Pa. Code* 105.1) that are typically associated with Palustrine forested (PFO) wetlands and compares them with similar functions in scrub (PSS) and herbaceous (PEM) wetlands. These functions are subject to disruption by human activities as well as by catastrophic occurrences of weather (hurricanes, tornadoes), ice storms, landslides, floods, and fires. Reductions in some functions may accompany increases in others.

The PADEP list of nine wetland functions in Chapter 105 regulations is reasonably comprehensive and suited to project-scale analysis based on the specific acreage of wetlands affected by an individual permittee. Current regulations do not focus on quantitative annual productivity of timber or wildlife, removal of air pollutants, carbon sequestration, or less tangible functions such as

aesthetic or historic/cultural appreciation. Nor do they require measurement of the values of any identified functions to individuals or groups. They do not specify how to compare the relative values of different functions, how to index current, past, or future functions of specific wetlands to generally accepted "reference" natural wetlands, call attention to the context of land surrounding a wetland, address the scarcity of a vegetation type, or provide for actual consideration of cumulative wetland impacts beyond an individual permit. PADEP long has found it virtually impossible to consider cumulative impacts, even for a single large project, because of its longstanding willingness to consider permits for fragments of a project on a piecemeal basis independently. PADEP does not expect an applicant to address its entire single project in a joint permit submission, much less analyze its proposed impacts cumulatively with those of other permittees over large areas. PADEP also does not focus on the uniqueness or heritage value of specific wetlands (aside from their potential for classing a wetland as having Exceptional Value) or a wetland's actual replaceability or irreplaceability, should damage be authorized.

1. Natural Biological Functions and General Habitat

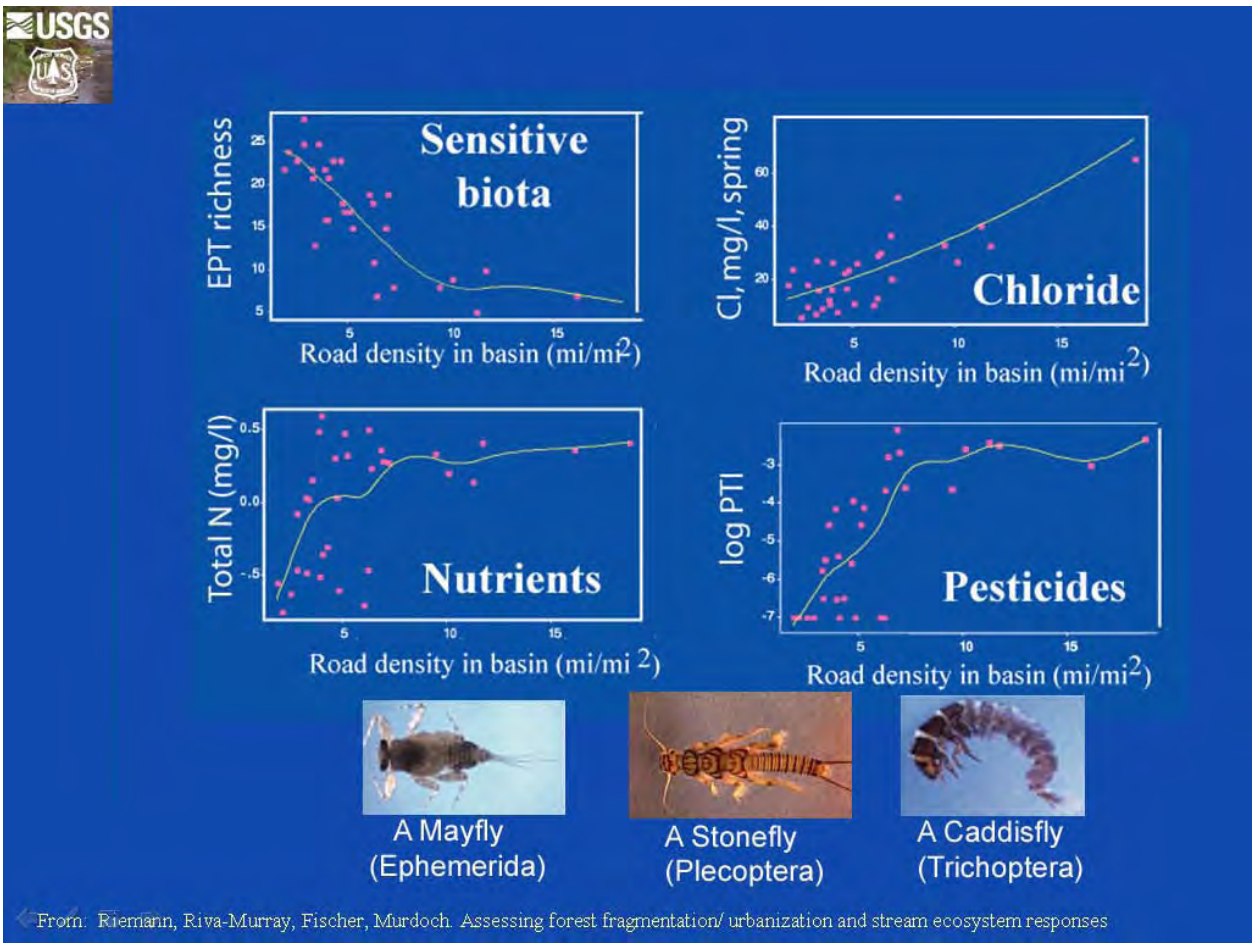
Natural biological functions of all wetlands include food chain production, general habitat, and resting-nesting-spawning-rearing sites for animals and fish. Many rare species of plants and animals are directly dependent on wetland habitats. Trees are the largest kinds of plants and have the greatest ability to modify the environmental effects of solar radiation, precipitation, temperature, humidity, and air quality as a result of their above-ground biomass. These natural, localized environmental modifications are of vital importance to the other plants and to the animals that live within and beneath forest cover. Tree leaves produce more tons of biomass per acre than shrubs for consumption by grazers and accumulate larger standing crops of organic material above ground. Tree trunks and limbs provide food for some animals and homes for many, with more complex structure than scrubs or herblands.

Pennsylvania forests consist of a wide variety of broadleaf deciduous trees, each species of which provides a somewhat different diet to the consumers that depend on it (Zimmerman *et al*. 2012; McShea & Healy 2002). Oaks, maples, ashes, elms, cherries, birches, and beech reflect the ancient geological history of Appalachia, and they returned to glaciated regions when the Pleistocene ice sheets melted. Pennsylvania forests also support many needleaf evergreen trees such as pines, hemlocks, and spruces. Very few stands of unharvested primeval forest remain in Pennsylvania; most of its forests have regrown following two or more episodes of intensive logging, burning, and other human disturbance during the past four centuries---episodes that have greatly affected the streams of the Commonwealth. Closed canopy forest consisting of mature trees requires about a century to recover to a recognizable mature forest structure after fire or clearcutting. About one third of Pennsylvania's forest stands are 80 years old or more; only 7%, 100 years old or more (McCaskill *et al*.

2013). Regenerated forest stands may or may not resemble their predecessors in their species composition when examined in detail, and the largest regrown individual trees are significantly smaller than historic records document as inherited by European colonists. Selective harvesting can remove key forest constituents, thereby reducing habitat value, and the forest canopy is further disrupted by logging roads, well pads, pipeline rights-of-way, borrow areas, and spills of fuel, brine, and other pollutants. Various kinds of shrubs and herbs grow only beneath a mature forest canopy. Wood ducks (*Aix sponsa*), a particularly handsome native species of waterfowl, require tree cavities for nesting as well as nearby water.

Trees growing in adjacent wetlands and streambanks are the major source of food for aquatic organisms in small, headwater streams. The intensity of ongoing human disturbance on the streams of forested areas can be estimated by the linear extent of roads per unit area. As summarized graphically by the United States Forest Service and US Geological Survey, human activity as approximated by road density has a dramatic effect on the quality of streams for sensitive aquatic insects that form the base of the aquatic food chain:

Road Density and Aquatic Parameters.



Both broadleaf and evergreen trees can dominate Pennsylvania wetlands, although broadleaf trees remain much more abundant (McCaskill *et al*. 2013). The value of forested wetlands to wildlife and to landowners is affected by the number of kinds of trees and other plants present (species diversity), their density and biomass (timber volume), the amount of dead timber standing and on the ground, the amount of grazing by domestic livestock and browsing by white-tailed deer, and the proportion of non-natives present. Diverse, high-quality vegetation is at greatest risk of human degradation and is the most difficult to restore (Olson and Doherty 2011). Wetland forests provide nesting, rearing, resting, and feeding sites for birds and mammals. One third of the bird species in the United States depend on wetlands (230 of 636; Welsch *et al*. 1995). Bears spend 60% of their time in forested wetlands during spring and summer (Newton 1988).

Unfragmented wetland forests are of great importance to many declining species of migratory songbirds. Wet forest floors are attractive wintering areas in which endangered bog turtles hibernate, and thick stands of evergreens shelter wintering deer and other animals. As already noted, the nutrients derived from tree leaves and twigs are vital to the macroinvertebrates and fish of Pennsylvania streams. Forest ecosystems are limited in their growth capability and affected in species composition by the availability of nutrients provided by the weathering of rock and transported in by air masses. The carbon from tree litter in turn can make up 99% of the total dissolved organic carbon at the base of the aquatic food web in forested streams (Stoler and Relyea 2011). Isolated vernal pools free of predatory fish are critically important to many uncommon reptiles and amphibians whose populations are dwindling. Discharges of stormwater, waste chemicals, and rubbish can degrade general habitat functions in forest and other wetlands.

Permanent forest disruption across Pennsylvania wetlands and uplands.

Scrub wetlands accumulate less standing biomass than mature forests. Hence any of the functions that derive from quantity of biomass are reduced in scrub as compared with forest wetlands, such as influence on microclimate, the amount of organic matter available for consumers of plant biomass, or the protection offered to soil from erosion. Some herbaceous wetlands can produce biomass in quantities rivaling forests above and below ground, but they lack the structural diversification of above-ground biomass of the woody wetlands. For animals adapted to herbaceous wetlands, such ecosystems provide important general habitat, nesting, resting, and rearing sites. The microtopography of hummocks provides habitat diversity critical to many species. Temporarily or permanently inundated herbaceous wetlands linked to streams and lakes have key importance as spawning and nursery grounds for fish, and inundated scrub wetlands are more common than inundated forests in Pennsylvania. The scrubs and sedge meadows with deep organic deposits associated with very wet herbaceous wetlands are prime spring and summer areas for various reptiles including the endangered bog turtle (*Glyptemys muehlenbergii*). Bog turtles prefer to overwinter in mats of tree roots where emerging groundwater warms near-surface temperatures. Herbaceous wetlands are of special importance to migrating waterfowl.

2. Environmental Study Areas and Refuges

Forested wetlands can serve as environmental study areas, particularly when located near schools, in public parks, and on other sites available to the public. Because natural plant succession in Pennsylvania normally trends toward forest vegetation, forests usually characterize refuges and sanctuaries relatively undisturbed by people, and forested wetlands typically provide high quality habitat to wildlife. The significance of forest cover to wetland wildlife increases as the size of wetlands decreases, particularly in landscapes with intensive human activity.

Scrub and herbaceous wetlands also can serve as study areas and biological refuges. They are less screened visually and aurally from adjacent human activities by their relatively lower quantities of biomass. They provide key habitat for wetland plants and animals that require open sun reaching the soil surface. Herbaceous wetlands are prime locations for birders.

3. Water Quality and Quantity Protection and Drainage Patterns

Forest wetland vegetation has maximal effect on processes affecting water movement and interaction with the land. By their mass, trees are able to slow the energy of falling raindrops and thereby limit soil erosion. Similarly, their mass and shade render the affected ground beneath the trees moister and cooler than nearby areas open to the sun. Decaying leaves provide a surface that readily accepts precipitation and allows it to infiltrate soil rather than quickly running off the surface.

The interflow through soils in turn contributes to natural extended flow of streams, minimizing both flooding and stream dryup. Nutrients can be bound up in tree trunks for centuries, and thereby kept out of waterways. The complex chemical reactions in wetland soils allow bacterial denitrification fostered by the carbon from leaves and vital to preventing excess nitrate-nitrogen from reaching streams. Wetland tree roots also can help anchor banks of streams against erosion. Forest loss to other land uses in Pennsylvania occurs at the rate of about 150 acres per day (McCaskill *et al*. 2013). Presumably most of these converted lands are not wetland forests, inasmuch as PADEP acknowledges the loss of less than 100 acres of all wetlands annually via individual permits, including forested wetlands.

Scrub and nonpersistent herbaceous wetlands stockpile less biomass on the land surface year-round than forested wetlands. They may offer less protection to the soil than forested wetlands, and their smaller roots may provide less resistance to physical erosion of streambanks.

Discharges of wastewater can contain pollutants at sufficient concentrations to overwhelm the ability of natural wetland systems to accommodate the pollutants, resulting in severe damage to the wetland ecosystems by manure, sewage, spilled brine, oil, and other chemicals. Rubbish also can degrade general habitat functions in forest and other wetlands.

4. Shoreline Protection and Stormwater Shielding

Aside from those on the banks of lakes and large rivers, forested wetlands in Pennsylvania generally have limited opportunity to shield other areas from wave and storm damage. Tree roots can stabilize streambanks large and small against stormwater erosion. To a lesser degree scrub wetlands can function similarly. Shrub willows often are planted to stabilize shorelines.

Some herbaceous wetlands occupy the shallow fringes of large water bodies, where they serve to reduce wave action and encourage sedimentation (thereby protecting water quality).

5. Flood Storage

Forested wetlands often serve as temporary storage areas for storm and flood waters. The economic value of such storage increases annually as flood damages rise in response to increased runoff from a growing human population, impervious surfaces from ever-expanding land development, and storm events of increasing severity driven by global warming in response to the burning of fossil fuels. Many forest ecosystems are adjusted to and dependent upon seasonal flooding, unlike most human structures that are easily damaged even by short-term inundation during flood peaks. Scrub and herbaceous wetlands, provided that they are suitably located, can function equally as well as forested wetlands for temporary

stormwater storage, although they may not shade the stored water so effectively and therefore not keep its temperature so low as a dense forest cover.

6. Groundwater Discharge

Spring seep areas are characteristic along the base of slopes in Pennsylvania forested wetlands. The forest shade keeps summer temperatures low as groundwater travels over the land surface toward headwater streams. Trout are a major feature of Pennsylvania streams and much sought-after by anglers. Many Pennsylvania streams have water near the limit of summer warmth that trout can tolerate. Forested wetlands along watercourses are essential to maintaining temperatures low enough for trout to survive and reproduce as global warming continues in response primarily to the burning of fossil fuels. Conversely, because of the warmth of groundwater, spring seeps may become snow-free earlier than dry uplands, and thereby attract feeding turkeys and other wildlife.

Shrub and herbaceous wetlands also can be associated with seeps flowing toward small streams. They are less able to keep surface water temperatures low than forests because of their lesser shade, but they may transpire fewer gallons of water during the course of a hot day. As mentioned previously, groundwater seeps closely associated with masses of tree roots are especially attractive areas for overwintering bog turtles.

Forested Wetland with Seeping Groundwater Discharge.

7. Groundwater Recharge

Countless local topographic depressions in forested wetlands store precipitation, slow its movement toward streams during periods of flood, and enable it to recharge local groundwater during wet seasons. Recharged groundwater, in turn, typically finds outlets to local streams. Recharge can be greater in scrub and herbaceous wetland depressions, because their plant cover transpires less water into the atmosphere than large trees.

8. Pollution Prevention and Sediment Control

Forested wetlands prevent pollution of water bodies by reducing the erosive force of rainstorms. Their trees break the fall of droplets hitting leaves and branches; they anchor the soil with roots and cover it with absorptive leaf litter; their roots bind streambank soils against erosion. Forested wetland soils enable sedimentation, denitrification, and other biogeochemical processing as surface waters pass through. Scrub and herbaceous wetlands can function comparably, but provide less physical protection against soil erosion by precipitation. Forested buffers surrounding wetlands can provide the most effective long-term protection of wetlands from sediment influx originating in disturbed lands.

9. Human Recreation

Wetland forests provide recreational opportunities for Pennsylvania citizens and visitors, calling forth significant contributions to the economy of the Commonwealth on a sustainable basis by those who use the outdoors. Great numbers of people find the seasonally changing display of blooms and colored leaves highly attractive and a sharp contrast to landscapes in urban centers. Recreational hunters seek the game animals---deer, bear, squirrels, waterfowl, and other game birds---that depend on wetland as well as upland forests. Anglers depend on riparian forests to keep the Pennsylvania streams cool enough and to supply food for salmonids. Forested wetlands are especially effective in providing humans with natural landscapes contrasting sharply with urban commercial and industrial environments.

Scrub and herbaceous wetlands also provide recreational opportunities for hiking and for game habitat. Herbaceous wetlands often attract spectacular flocks of migratory waterfowl.

Palustrine Deciduous Scrub Opening in Needleaf-Dominated Bog on Peat.

Rosencrans Bog Natural Area, Clinton County. Photograph by Staff of The Western Pennsylvania Conservancy.

Through its recent draft technical guidance documents PADEP appears to be seeking to expand from a strictly acreage-based evaluation of wetland impacts and working instead toward a weighting of functions, indexing to reference ecosystems, and consideration of conditions adjacent to the affected wetland. State methodology also is just beginning to consider cumulative effects on a watershed basis, which is essential for rationally offsetting the negative side effects (externalities) of construction in wetlands. The proposed technical guidance draws conceptually on federally sponsored work on wetland functions that has been underway for twenty years (Smith *et al*., 1995) as well as the more recent work by Robert Brooks and his coworkers at Riparia, the Cooperative Wetlands Research Center at Pennsylvania State University. PADEP's current list of functions is displayed below.

Table 2
Wetland Functions and Their Value

Functions Related to Hydrologic Processes	Benefits, Products, and Services Resulting from the Wetland Function
Short-Term Storage of Surface Water: the temporary storage of surface water for short periods.	Onsite: Replenish soil moisture, import/export materials, conduit for organisms. Offsite: Reduce downstream peak discharge and volume and help maintain and improve water quality.
Long-Term Storage of Surface Water: the temporary storage of surface water for long periods.	Onsite: Provide habitat and maintain physical and biogeochemical processes. Offsite: Reduce dissolved and particulate loading and help maintain and improve surface water quality.
Storage of Subsurface Water: the storage of subsurface water.	Onsite: Maintain biogeochemical processes. Offsite: Recharge surficial aquifers and maintain baseflow and seasonal flow in streams.
Moderation of Groundwater Flow or Discharge: the moderation of groundwater flow or groundwater discharge.	Onsite: Maintain habitat. Offsite: Maintain groundwater storage, baseflow, seasonal flows, and surface water temperatures.
Dissipation of Energy: the reduction of energy in moving water at the land/water interface.	Onsite: Contribute to nutrient capital of ecosystem Offsite: Reduced downstream particulate loading helps to maintain or improve surface water quality
Functions Related to Biogeochemical Processes	**Benefits, Products, and Services Resulting from the Wetland Function**
Cycling of Nutrients: the conversion of elements from one form to another through abiotic and biotic processes.	Onsite: Contributes to nutrient capital of ecosystem. Offsite: Reduced downstream particulate loading helps to maintain or improve surface water quality.
Removal of Elements and Compounds: the removal of nutrients, contaminants, or other elements and compounds on a short-term or long-term basis through burial, incorporation into biomass, or biochemical reactions.	Onsite: Contributes to nutrients capital of ecosystem. Contaminants are removed, or rendered innocuous. Offsite: Reduced downstream loading helps to maintain or improve surface water quality.
Retention of Particulates: the retention of organic and inorganic particulates on a short-term or long-term basis through physical processes.	Onsite: Contributes to nutrient capital of ecosystem. Offsite: Reduced downstream particulate loading helps to maintain or improve surface water quality.
Export of Organic Carbon: the export of dissolved or particulate organic carbon.	Onsite: Enhances decomposition and mobilization of metals. Offsite: Supports aquatic food webs and downstream biogeochemical processes.
Functions Related to Habitat	**Benefits, Goods and Services Resulting from the Wetland Function**
Maintenance of Plant and Animal Communities: the maintenance of plant and animal community that is characteristic with respect to species composition, abundance, and age structure.	Onsite: Maintain habitat for plants and animals (e.g., endangered species and critical habitats), for rest and agriculture products, and aesthetic, recreational, and educational opportunities. Offsite: Maintain corridors between habitat islands and landscape/regional biodiversity.

Stressors

The functional values of wetlands can be reduced by many stressors, most of which are directly or indirectly the result of human activity and also are more intense and persistent than natural disruptive forces. The evolving PADEP list of stressors lists 37 kinds that are readily observable in the field, grouped into five categories (Draft Technical Guidance Document 310-2137-002, March 2014, p. 33). They prudently have left a blank for other, unlisted stressors in each of the five categories, for less commonly encountered conditions.

PADEP-listed Wetland Stressors.

Vegetation Alteration
Mowing
Moderate livestock grazing (within one year)
Crops (annual row crops, within one year)
Selective tree harvesting/cutting (>50% removal, within 5 years)
Right-of-way clearing (mechanical or chemical)
Clear cutting or Brush cutting (mechanized removal of shrubs and saplings)
Removal of woody debris
Aquatic weed control (mechanical or herbicide)
Excessive herbivory (deer, muskrat, nutria, carp, insects, etc.)
Plantation (conversion from typical natural tree species, including orchards)
Other:
Total Number:
Hydrologic Modification
Ditching, tile draining, or other dewatering methods
Dike/weir/dam
Filling/grading
Dredging/excavation
Stormwater inputs (culvert or similar concentrated urban runoff)
Microtopographic alterations (e.g., plowing, forestry bedding, skidder/ATV tracks)
Dead or dying trees (trunks still standing)
Thermal alteration (power plant or industrial discharges with evidence of high temperatures)
Stream alteration (channelization or incision)
Other:
Total Number:
Sedimentation
Sediment deposits/plumes
Eroding banks/slopes
Active construction (earth disturbance for development)
Active plowing (plowing for crop planting in past year)
Intensive livestock grazing (in one year, ground is >50% bare)
Active selective forestry harvesting (within one year)
Active forest harvesting (within two years, includes roads, borrow areas, pads, etc.)
Turbidity (moderate concentration of suspended solids in the water column, obvious sediment discharges)
Other:
Total Number:

Eutrophication
Direct discharges from agricultural feedlots, manure pits, etc.
Direct discharges from septic or sewage treatment plants, fish hatcheries, etc.
Heavy or moderately heavy formation of algal mats
Other:
Total Number:
Contaminant/Toxicity
Severe vegetation stress (source unknown or suspected)
Obvious spills, discharges, plumes, odors, etc.
Acidic drainages (mined sites, quarries, road cuts)
Point discharges from adjacent industrial facilities, landfills, railroad yards, or comparable sites
Chemical defoliation (majority of herbaceous and woody plants affected, within one year)
Fish or wildlife kills or obvious disease or abnormalities observed
Excessive garbage/dumping
Other:
Total Number:

The more numerous the stressors affecting a wetland, the lower its value. When rating the value of wetland conditions, the proposed PADEP scoring also assigns higher value to wetlands surrounded by forests than to those surrounded by scrub, and assigns higher value to those wetlands surrounded by scrub than to those surrounded by herblands or ponds. Managed wetland buffers are scored lower than wild, unmanaged buffers (Draft Technical Guidance Document 310-2137-002, March 2014, p. 33).

In 2006 PADEP sampled 204 wetlands and used their evolving protocols to rank the condition of those wetlands (PADEP 2014c). How representative the sampled wetlands might be of Pennsylvania wetlands as a whole was not stated, but the rankings from their protocol testing were reported as follows:

Condition Category	Number of Wetlands	Total Acreage	Percent of Resource
Highest	13	127.74	6.10%
High	59	556.19	26.70%
Medium	41	468.89	22.50%
Low	91	930.07	44.70%
Totals	**204**	**2082.88**	**100.00%**

Conversion of Woody Wetlands to Herbaceous Wetlands

Forest and scrub wetlands can be converted to herbaceous wetlands in various ways with effects more or less catastrophic, even if wetland conditions are not intentionally obliterated permanently to enable the construction of roads, buildings, or farm fields. Woody stems can be cut at the ground surface and merely the aboveground trees and shrubs removed, if the goal is to reduce disruption of the soil. More invasively, tree stumps and shrub roots can be grubbed. Biologically active soils can be removed entirely. Hydrology can be diverted or impounded. The amounts and kinds of functions lost and gained will be determined by what conditions previously existed in the wetland as well as the nature and extent of disturbance. If any one of the three major wetland characteristics (hydrophytic vegetation, hydric soils, or hydrology) is not or cannot be restored to natural conditions, then the conversion of wetland to non-wetland will be permanent. The conversion of forested wetlands to scrub or herbaceous wetlands is not readily reversible, inasmuch as forest regrowth at best requires many decades, and may be intentionally prevented by repeated cutting or by spraying herbicides.

When wetland vegetation is changed by people from forest or scrub to herbaceous, many of the wetland's functions can be altered. Detailed study is necessary in order to predict accurately the probable changes and compose plans for appropriate mitigation, because the affected functions will vary at each location supporting a natural wetland.

Where naturally variable wetland hydrology has been restored, some generalist wetland plants usually will follow quickly unless toxic substances also have been introduced, and hydric soils eventually will become recognizable after many years of weathering have elapsed. Pennsylvania wetlands evolved after the retreat of glacial ice, and their biota retains the ability to recover following natural disturbances that are less drastic than those of current technology. Unless artificial plantings are made to accelerate the establishment of desirable species, however, invasives that thrive in human-disturbed wetlands are likely to invade and crowd out preferred species of native plants. Construction activities usually provide ample opportunities for invasive plants and animals to arrive at construction sites. Various online sources provide links to information on invasive species, including those of the Governor's Invasive Species Council of Pennsylvania (www.invasivespeciescouncil.com), the Pennsylvania Department of Conservation and Natural Resources (www.dcnr.state.pa.us/conservationscience/), and the US Forest Service (www.fs.fed.us/invasivespecies).

If the objective is to restore pre-disturbance native wetland vegetation, then near-replacement of pre-disturbance hydrology and soils is most likely to yield the desired plant community. Such replacement only succeeds where careful investigation of plants, soils, and hydrology preceded the wetland disturbance, so that mitigation site modification effectively can mimic the structure of the lost

wetland. Light-tolerant herbaceous and scrub wetland plants can be restored more rapidly than forest vegetation, which takes many years for trees to reach mature size and natural diversity even where maximally successful. Protection of new plantings of native woody species from browsing deer and rabbits often is critical for the survival of the plants during the early years after wetland creation or restoration, and supplemental watering may be necessary during unusually dry years while root systems are being formed. Plantings of herbaceous wetlands can be devastated by migrating waterfowl. Moreover, the early-succession trees which will thrive in an open wetland only slowly are replaced by shade-tolerant species of late forest succession. Late-succession native herbs characteristic of mature Pennsylvania forested wetlands would not be expected to grow until the forest canopy has become reestablished and soil formation has proceeded to approximate natural conditions.

Compensatory mitigation in the form of replacement wetland creation or degraded wetland restoration is intended to result in functioning wetlands that do not require ongoing human intervention. Pennsylvania permit conditions long have required five years of monitoring for wetland restoration and creation projects along with written reports to PADEP, but post-construction monitoring has been sporadic at best and approved wetland restoration plans often have been unsuccessful in execution. Ponds are much easier and quicker to build than forested wetlands, but do not provide mitigation for various wetland functions. Similarly, basins engineered to detain stormwater flows from developed areas seldom result in high-value wetlands.

As one illustrative example of the conversion of woody wetlands to herbaceous cover, pipelines can be considered. The excavation of trenches for miles uphill, downhill, and across streams and wetlands is a catastrophic event followed by some measure of soil cover replacement on top of the pipes. But few pipeline operators

Pipeline construction through Pennsylvania wetlands. The corridor will be maintained free of woody vegetation after the pipe is buried.

Herbaceous Wetland 40 Years after Pipeline Installation.

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are prepared to allow reforestation to obscure right-of-way conditions. Thus pipelines are likely to involve vegetation stressors such as right-of-way clearing, clear-cutting of brush, and removal of woody debris both prior to and for the long term subsequent to pipeline installation. Mechanical clearing using equipment occurs, as does spraying with non-selective chemical herbicides to prevent the reestablishment of trees and shrubs so that rights-of-way can be quickly inspected on the ground and from the air.

In summary, the most probable, usually adverse effects of human conversion of forest or scrub to herbaceous wetlands on PADEP-listed wetland functions, the following would be expected and should be considered carefully:

1. **General Habitat and Natural Biological Functions**
   Aboveground biomass: decrease
   Forest interior habitat: loss
   Structural diversity: decrease within converted wetland
   Visual and aural screening from human activity: loss
   Local climate amelioration: decrease
   Evergreen winter cover for wildlife: loss
   Suitability for shade-loving species of plants: loss
   Production of mast (such as acorns) for wildlife: loss

Exposure to harsh wind, ice, sun: increase
Localized effects of global warming on biota: increase

2. **Study Areas and Refuges**
   Structural diversity of ecosystem: decrease within converted wetland
   Species diversity of plants and animals: decrease within converted wetland
   Visual and aural screening from human activity: loss
   Rare, ancient trees: loss

3. **Drainage Patterns, Water Quantity, and Water Quality**
   Streambank anchoring against erosion: decrease
   Soil stabilization: decrease
   Erosion and sedimentation: increase
   Nutrient storage in ecosystem: decrease
   Maintenance of cold water temperature for trout: decrease

4. **Storm Damage Shielding and Shoreline Protection**
   Streambank stabilization: decrease

5. **Flood Storage**
   Storage volume: no significant change

6. **Groundwater Discharge**
   Volume discharged: increase (reduced transpiration)

7. **Groundwater Recharge**
   Volume recharged: increase (if soil not disrupted)

8. **Pollution Prevention and Sediment Control**
   Erosion and sedimentation control: decrease

9. **Human Recreation**
   Landscape aesthetics: disruption
   Species composition, plants and animals: change
   Forest interior species: loss
   Maintenance of cold water temperature for trout: decrease
   View and hiking corridors: increase

How much functional loss will occur as a result of authorized conversion from forest or scrub to herbland at any wetland location will depend on the functions initially present in the forested wetland, the severity of the disruption to the elements of the environment such as its soil and surface elevation, the location of the converted area in the landscape, and its connection with other wetlands, especially along stream corridors. As some functions decrease, others may increase. Given the complexity of the natural world, under some sets of circumstances an anticipated negative change actually could prove beneficial.

The degree to which impacts are negative also depends on the context of reference: "edge" species such as whitetailed deer, for example, benefit from forest fragmentation. The functional loss of forested wetland is never quickly reversible, even if active maintenance were to stop, nor is it capable of offsite mitigation except, at best, after long time delays.

Not currently identified by PADEP in its list of functions, conversion of forest to herbaceous wetland also entails a reduction in the ability of the wetland to affect human climate and to reduce air pollution. Herbaceous wetlands cannot rival forests in providing shade and screening people from wind. Likewise, they cannot promote the deposition of airborne pollutant particles or take up as much gaseous pollution as wetland forest trees.

In principle, some of the functional losses of vegetation conversion eventually can be replaced by successful wetland mitigation onsite or offsite. But the actual substitution of lost functions by compensatory wetlands is not routine.

Wetland Compensatory Restoration and Creation

Because wetland damage and destruction routinely are authorized by permits, agencies by regulation are to require the restoration of temporary damage and the offsetting replacement of permanent loss of natural wetlands. A plan for the mitigation of unavoidable impacts by regulation is required as part of every individual joint permit application for wetland encroachments in Pennsylvania, other than "small" projects deemed by PADEP to have no significant impact on safety or protection of life, health, or the environment [25 *Pa. Code* 105.13(d)(1)(ix)]. Mitigation is defined (at 25 *Pa. Code* 105.1) as

> An action undertaken to accomplish one or more of the following:
>
> Avoid and minimize impacts by limiting the degree or magnitude of the action and its implementation.
>
> Rectify the impact by repairing, rehabilitating or restoring the impacted environment.
>
> Reduce or eliminate the impact over time by preservation and maintenance operations during the life of the action.
>
> If the impact cannot be eliminated by [the foregoing measures], compensate for the impact by replacing the environment impacted by the project or by providing substitute resources or environments.

PADEP records fewer than 100 acres of wetlands authorized for damage annually under individual permits during recent years, along with about 40 miles of streams (PADEP 2014c). These wetland statistics do not include losses through construction authorized by general permits. The statistics also do not include enforcement against unauthorized encroachments into streams and wetlands. (These stream statistics omit altogether about half of the land area of

the Commonwealth that occupies small watersheds where stream, but not wetland, destruction is authorized automatically by waiver.)

Since the 1990s PADEP has sought 1:1 minimum replacement for wetland acreage and functions, with a preference for mitigation adjacent to the loss and on the same property. Mitigation has been designed on an acreage replacement basis, typically with no allowance for less than complete success or the time during which wetland functions are absent. Functional replacement itself has seldom if ever been mandated. For enforcement cases, PADEP policy long has sought to require 2:1 acreage mitigation (PADEP 1992, 1997a). PADEP's stated preference has been for onsite mitigation close to the allowed wetland destruction rather than for remote offsite mitigation. Such mitigation would be undertaken by the permittee, who seldom is expert in wetland mitigation.

Because less intervention is required, the restoration of wetlands previously converted to agricultural uses typically is easier and less uncertain than conversion of uplands to wetlands. Wetland hydrology, for example, sometimes can be restored simply by crushing the drainage tiles installed by farmers in order to dry fields sufficiently for commercial crops. To the extent hydrology is removed temporarily, but then restored, wetland vegetation and some semblance of a wetland ecosystem can be recovered onsite where care is taken to reconstruct natural conditions insofar as practicable. Habitat functions often can be attained more readily in rural mitigation areas than adjacent to urban development sites where the restored or created wetlands are isolated from other areas of comparable habitat. Areas amenable to wetland restoration, however, often are located offsite at considerable distance from impacted areas and affected watersheds. Wetlands in stream valleys and floodplains do not necessarily substitute functionally for wetlands along headwater streams.

Successful wetland creation from dry land, even more than restoration, depends on careful identification of water budgets pre-construction to guide attempted restoration. Abundant field experience has demonstrated that small inaccuracies in analyzing or reconstructing hydrology will result either in dry non-wetlands or in open water ponds rather than vegetated wetlands.

Hydrology normally is removed by blocking the movement of water into a wetland (1) by diking or channelizing and diverting its flow and/or (2) by expediting the removal of water from a wetland by drainage pipes or pumps. Restoration of hydrology may require detailed attention to creating almost flat slopes, and often requires design for seasonal variability in wetness. Most natural wetlands, unlike typical farm ponds and detention basins, have very gently sloping land surfaces rather than abrupt banks. Effective wetness of surface soils within a wetland can be reduced by removal of natural vegetation on and adjacent to the mitigation area, impeding the recovery of wild plants and affecting the survival of replacement plantings. Hydrology derived from channelized stormwater can be toxic to wetland plants, if the stormwater brings in road salts, oil, excessive

nutrients, and other pollutants. Trees typically are less tolerant of salinity change than herbaceous plants (Adamus & Brandt 1990). Where urban runoff is the source of wetland hydrology, functional mitigation may be difficult to achieve.

Timely restoration of near-surface hydric soils that have wetland characteristics depends on the successful removal and segregation of topsoil, and then its replacement above the subsoil. By keeping holding time for stockpiled topsoil to a minimum, some of the natural seed bank can be salvaged to aid in wetland revegetation. Where the structure of the soil layers has been drastically altered, years are required for horizontal layering to become restored by natural weathering. If wetland hydrology was caused by impermeable subsurface layers such as clay lenses, and those are disrupted by excavation, capturing sufficient hydrology for wetland restoration may be impossible. If surface soil density is compacted, additional years are required for natural porosity to return along with the ability for water to penetrate (Stoler and Relyea 2011). The placement of only a few inches of soil on wetland trees and shrubs, as well as herbs, can be fatal to the disturbed plants. Mulch and short-lived cover crops can help stabilize soils without offering severe competition to desirable native wetland plants. A natural balance of groundwater recharge and discharge in constructed or restored wetlands is not easily achieved.

Given these technical considerations and the historical fact that practical humans long focused on draining and converting rather than restoring wetlands and wetland functions, the actual mitigation of wetland impacts has proved generally unsuccessful in Pennsylvania for many decades (*see*, for example, McCoy 1987, 1992; Kline 1991) and has not improved recently (Campbell *et al*. 2002, Cole & Shaffer 2002, Gebo & Brooks 2012, Hoeltje & Cole 2007, Kislinger 2008, PADEP 2014c). Seldom has mitigation created the same kind of wetlands as those damaged. Most attempted mitigation that succeeded in creating wet areas resulted in open water ponds rather than forested or scrub wetlands (Cole and Shaffer 2002). Monitoring and reporting on mitigation success on paper is required of applicants, but often not performed. PADEP staff seldom monitor wetland mitigation sites or require remedial measures of permittees.

PADEP has found that the ability of permittee-constructed mitigation

> to address the needs of a watershed is limited at best. Applicants generally do not have adequate resources to identify watershed needs, plan for and identify high value project sites, and/or secure rights to and produce significant restoration activities. (PADEP 2014c)

69 Permit Wetland Mitigations Scored by PADEP Interns, 1992-1995

Size (acres)	Success	Failure	Not Rated	% Success
0-.10	5	3	1	62.5
.10-.25	8	6	1	57.1
.25-.50	9	7	0	56.3
.50-1.0	11	3	0	78.6
1.0->	13	2	0	86.7
Total	46	21	2	68.7

Most Pennsylvania wetland impacts authorized by individual permit, after avoidance and minimization have been addressed, affect small acreages. Thus PADEP has implemented an acreage-based fee-in-lieu program to enable most permittees affecting small (0.5 acre or less) areas of wetland to substitute a one-time cash payment instead of undertaking their own construction of mitigation wetlands (PADEP 1997b). The half-acre "allowance" for cash contributions was deemed sufficient to allow any landowner enough wetland impact to build a house. Fees were set by PADEP based on its expectation that willing landowners across the Commonwealth would allow conversion of uplands to wetlands or restoration of wetlands with higher quality through voluntary cooperation with PADEP and the National Fish and Wildlife Foundation. This program has greatly assisted permittees, but it has not demonstrably resulted in compensatory wetland mitigation similar in kind or location to wetlands destroyed.

Contributions to the Washington, D.C.-based National Fish and Wildlife Foundation's Pennsylvania Wetland Replacement Project ID 95-096 became routine across the Commonwealth beginning in the 1990s. According to its web page, as of May 2014 this Foundation had sponsored 486 environmental enhancement projects of various kinds in Pennsylvania. Locational and descriptive information for these projects are displayed on an interactive map. But no data apparently exist comparing wetland acreage or functions lost to mitigation accomplished under the Pennsylvania in-lieu-fee program or identifying the geographical proximity of wetland losses versus gains on a watershed basis. Only first-time readers of PADEP regulations might expect any applicant eligible to use the Fund even to consider undertaking onsite mitigation, which is always far more expensive than scheduled contributions to the State's

Fund. The in-lieu fees long have represented a major subsidy to permittees from Pennsylvania residents and their environment (Schmid 1996a, b). Pennsylvania mitigation fees have been the same for Exceptional Value as for Other wetlands, and the acreage-based fees have been presumed to compensate for any and all wetland functions associated with the wetlands lost.

Pennsylvania Wetland Mitigation Replacement Fees (1997-2013).

De minimis impact less than or equal to .05 acre	$ 0.00
Greater than .05 acre to .10 acre	$ 500.00
Greater than .10 acre to .20 acre	$ 1,000.00
Greater than .20 acre to .30 acre	$ 2,500.00
Greater than .30 acre to .40 acre	$ 5,000.00
Greater than .40 acre to .50 acre	$ 7,500.00

Contributions to the Fund relieve permittees of any followup responsibility for mitigation monitoring or success. Between 1997 and 2013 the buying power of cash contributions to the Fund dwindled by about 30% due to inflation, while the market costs of wetland creation can be $100,000 per acre in some locations, according to the Pennsylvania Department of Transportation. Costs are less where free land and prison labor can be obtained (FHWA 2011). Moreover, the success of the wetland mitigation work done under PADEP's Replacement Project apparently has been limited and certainly has been sparsely reported. Pennsylvania's in-lieu-fee program was deemed unacceptable for use to satisfy federal wetland mitigation requirements in 2008, and its "grandfathering" expired in 2013 (33 CFR 332.8). Hence the PADEP currently is seeking federal approval for a new in-lieu-fee program (PADEP 2014c).

The generally laudable goals of the new program include (1) high quality mitigation addressing wetland functions as well as acreage, (2) ecologically based mitigation site selection, (3) efficiencies of scale in constructing, monitoring, and administering a few large mitigation projects instead of many small ones, (4) streamlined federal and State permit approvals, and (5) more effective accounting and compliance reporting (PADEP 2014c). PADEP claims that it has the expertise and staff to run an in-lieu-fee program effectively. As has been repeatedly demonstrated by PADEP staff and by independent academics, mitigation to date by permittees affecting more than the half acre of wetlands to which Fund contributions are limited typically has been of poor quality in Pennsylvania and has failed altogether in replacing the functions of wetlands lost.

The new PADEP technical guidance potentially represents an opportunity to have those who hope to benefit from damaging wetlands more effectively internalize the negative externalities of their conduct, a goal consistent with both Pennsylvania and federal law. It is not self-evident that the functions of multiple small, scattered wetlands high in the landscape can be replaced effectively by

larger wetlands in floodplains, and PADEP may be asked to address this issue, as well as many other technical details, prior to gaining federal approval for its proposed in-lieu-fee program. Unquestionably, more information will need to be generated during preparation and review of each application to damage wetlands, if new PADEP technical guidance is adopted along the lines of its current draft. A significant outcome should be the more effective tailoring of compensatory mitigation to the amount and type of wetland impacts. The full costs of mitigation should include both the risk of mitigation failure and the temporal lag between impacts and restoration of functions---which, for forested wetlands can be immense.

Only if this opportunity is fully exploited will future mitigation begin to compensate for permitted impacts in Pennsylvania. The new guidance also can provide a corrective to the mitigation failures and lack of accountability long prevalent in Pennsylvania, while reducing the previous economic subsidies encouraging private destruction of wetland resources. The new information available also should allow better public understanding of the external costs of development and the benefits of successful mitigation, particularly if public access to permit records is made electronically available.

It is high time that human behaviors with harmful side effects in Pennsylvania be mitigated more effectively to enable continued prosperity for its residents and the planet's survival, as well as compliance with Article 1, Section 27, of the Pennsylvania Constitution:

> The people have a right to clean air, pure water, and to the preservation of the natural, scenic, historic and esthetic values of the environment. Pennsylvania's public natural resources are the common property of all the people, including generations yet to come. As trustee of these resources, the Commonwealth shall conserve and maintain them for the benefit of all the people.

When completed, the new PADEP technical guidance may make possible the actual functional mitigation for conversion of forest and scrub wetlands to herbaceous wetlands. If effective, it also should help reduce so-called "natural" hazards from waters---hazards which are in fact failures of human design, construction, planning, and community development in areas subject to natural processes of stormwater movement. If the opportunity is missed, the alternative includes increased environmental plundering of remaining wetland resources, high costs for disaster survivors, especially the most vulnerable, as well as harm to communities and ever growing costs to taxpayers.

Completion of public review, PADEP revision, and implementation of the new technical guidance for wetland assessment and mitigation may take considerable time. Pennsylvania wetlands only slowly have begun to receive some attention from regulators in the context of damage by longwall (that is, high-extraction underground) bituminous coal mining, which was first allowed by Act 54 of 1994. PADEP long refused to recognize even the possibility of damage to wetlands from

longwall mining, but gradually has been implementing more thorough data collection for mine applications (Schmid & Co., Inc. 2000, 2010a, 2011a, 2012, 2013).

The minimal current PADEP information and review requirements for oil and gas permits provide virtually no assurance that wetlands will be identified and protected from this extractive industry, which currently is experiencing a boom across much of the Commonwealth. Similarly, PADEP has failed to protect too many streams, particularly those streams of highest ecological value (Van Rossum *et al*. 2011; Kunz 2011; Schmid & Co., Inc. 2010b). Oil and gas permit applications generate far less environmental information than coal mining applications. Proposed regulations governing surface oil and gas activities currently are under review (25 *Pa. Code* 78, Subchapter C). PADEP and the Environmental Quality Board are preparing responses to the 24,000 comments received on their proposed oil and gas regulations. New Chapter 78 regulations could specify protection for streams and wetlands far more effectively than the regulations they are replacing.

Whether the proposed wetland analysis and mitigation technical guidance will receive similar public attention remains to be seen. Its comment period is still open and likely to be extended.

Authorship

This report was prepared by James A. Schmid, a biogeographer and plant ecologist. Dr. Schmid received his BA from Columbia College and his MA and PhD from the University of Chicago. After serving as Instructor and Assistant Professor in the Department of Biological Sciences at Columbia University and Barnard College, he joined the environmental consulting firm of Jack McCormick & Associates of Devon, Pennsylvania. Since 1980 he has headed Schmid & Company of Media, Pennsylvania.

Dr. Schmid has analyzed and secured permits for some of the largest wetland mitigation projects in the mid Atlantic States, as well as a myriad of smaller projects. He is certified as a Senior Ecologist by the Ecological Society of America, as a Professional Wetland Scientist by the Society of Wetland Scientists, and as a Wetland Delineator by the Baltimore District, Army Corps of Engineers. He has served on the professional certification committees of the Ecological Society and the Society of Wetland Scientists.

When the US Fish & Wildlife Service Pleasantville Office evaluated actual compliance with approval conditions requiring mitigation by about 100 of the Clean Water Act Section 404 fill permits issued by the Corps of Engineers in the State of New Jersey during the period 1985-1992, every Schmid & Company mitigation project was judged in the field to exhibit full compliance with all permit requirements and mitigation goals. Schmid & Company mitigation projects

represented 21% of all the mitigation projects judged fully successful in New Jersey by USFWS in its written report to USEPA. Dr. Schmid analyzed and secured Wetland Mitigation Council approval for the first major freshwater mitigation bank in New Jersey on behalf of DuPont. That bank was donated to The Nature Conservancy.

Dr. Schmid has often analyzed environmental regulatory programs and commented on proposed regulations. His clients continue to include the construction industry, conservation groups, and government agencies, including the Pennsylvania Department of Environmental Protection.

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APPENDIX A
Functions and Benefits of Riparian Forest Buffers

Riparian forest buffers serve many functions and provide many benefits including:

1. Protection and Enhancement of Water Quality

a. **Filtration of pollutants in runoff:** Mature riparian forest buffers can slow overland runoff from any source by increasing the water's contact time with the spongy forest floor. Runoff containing pollutants such as sediments, nutrients, pathogens, and toxics from rooftops, streets, lawns, farm fields, and parking lots can flow into a riparian forest buffer from the area up grade and be considerably cleaner when it enters the perennial or intermittent stream, lake, pond, or reservoir. The forest floor of the riparian forest buffer soaks up the water and makes pollutants contained in it available for processing into less harmful forms. The tree roots can also remove pollutants from shallow groundwater flowing beneath the forest floor to the waterbody.

b. **Light control and water temperature moderation:** A mature riparian forest buffer that is at least 100 feet in width lowers light levels in the streambank or shoreline area of a waterbody that inhibits the growth and production of harmful algae and helps maximize stream width by shading out grasses. The shading that a riparian forest buffer provides helps to lower water temperatures in summer and moderates harsh winter temperatures by trapping back-radiation (Beschta et al., *Stream*). Both light control and water temperature moderation maximize dissolved oxygen content in lake and stream waters and increase the amount of instream pollutant processing.

c. **Pollutant processing:** Trees in a mature riparian forest buffer, their fallen leaves and the plants and animals that live on, in, and under the trees form an ecosystem that is capable of processing pollutants such as sediments, nutrients, and toxics in the water that passes through the riparian forest buffer as sheet flow. The leaves of native trees in the riparian forest buffer that wash into the stream serve as a rich food source for benthic macroinvertebrates which are capable of instream pollutant processing.

d. **Infiltration and maintenance of streamflow**: Riparian forest buffers slow overland runoff allowing for infiltration of surface water that helps to maintain base flow in streams and rivers.

e. **Channel and shoreline stability/decrease in erosion:** The canopy of a mature riparian forest buffer collects water and protects the ground below in storm events. The rain water also tracks along the trunk of the large trees before reaching the ground. The root network of the riparian forest buffer is tightly intertwined and holds soil particles together keeping them securely in place against the forces of both direct precipitation and stormwater runoff from areas surrounding the riparian forest buffer. This reduces the force of the water as it reaches the waterbody. In this way, riparian forest buffers minimize shoreline and streambank erosion, instream scour, and sedimentation associated with channel instability.

2. **Protection and Enhancement of Aquatic Habitat**

a. **Water quality:** The water quality functions described in Section 1 of this appendix are crucial to the protection of aquatic habitat. Moderating water temperatures and light levels in both summer and winter and maintaining sufficient dissolved oxygen levels and stream width are essential to a healthy ecosystem. Removing pollutants from runoff helps to ensure clean water and oxygen for aquatic organisms. Maintaining stream volume ensures flowing water even during the driest months to provide habitat for aquatic biota. Reducing the amount of sediment entering a perennial or intermittent stream, river, or lake protects the eggs and young fish, amphibians, and benthic macroinvertebrates from suffocation. This also helps increase the epifaunal substrate and cover, which provide important habitat for benthic macroinvertebrates and other aquatic organisms.

b. **Shoreline and streambank stability:** Tree roots in the mature riparian forest buffer stabilize shorelines and streambanks. They also allow for undercut banks that provide cover and cool water refuge for fish, reptiles, and amphibians.

c. **Stream width:** The shading associated with mature riparian forest buffers along the banks of rivers and streams prevents channel narrowing due to riparian grasses.

d. **Food supply:** Organic detritus (leaves, twigs, and other materials) derived from riparian forest buffers is a critical source of the energy for supporting aquatic food chains in most aquatic ecosystems.

e. **Woody debris:** Large woody debris (LWD) from the riparian forest buffer enters the aquatic ecosystem as trees fall into the perennial or intermittent stream, river, lake, pond, or reservoir or are delivered to the waterbody through floodwaters. LWD provides: refuge from high flows for aquatic biota; overhead cover for fish; substrate and food for benthic macroinvertebrates; and substrate for plants. LWD influences the formation of pools, backwaters, and shallow slack water, increasing the complexity of aquatic habitat and influencing the storage and transport of aquatic food sources. During high flows, LWD traps sediments and retards scouring of the channel bed and banks. This reduces the affects of wave action on lake shorelines, maintaining habitat for aquatic biota.

f. **Lakeshore, channel, and floodplain stability:** Attenuating floodwater is as important for aquatic biota as it is for the channel or lake shoreline itself. Floodwaters that are not allowed to dissipate horizontally over a floodplain build up energy within the channel, often causing excessive scour of the channel bed that can cause fish kills and amphibian mortality due to mobilization of large substrates in the channel bed. The mature trees of the riparian forest buffer stabilize both streambanks and lake shorelines preventing the collapse of undercut banks that provide cover and cool water refuge for fish, reptiles, and amphibians.

3. **Moderation of the Effects of Climate Change**

a. **Aquatic ecosystem adaptation:** Riparian forest buffers maintain or enhance instream ecological health. Keeping the aquatic system as healthy as possible will help to keep the ecosystem stable and better able to adapt to a changing climate. Mature riparian forest

buffers contribute significantly to the energy source for the ecosystem and provide habitat and ecological niches leading to a diverse and stable aquatic community (Seavy, N.E. et al., *Why)*.

b. **Temperature moderation:** Mature riparian forest buffers, properly sized, provide a significant temperature moderating effect, keeping water and riparian temperatures cooler and diurnal temperature fluctuations less extreme (Jones et al, *Quantifying*).

c. **Reduction in suspended sediment:** Riparian forest buffers stabilize streambanks leading to less suspended sediment entering the water column. Suspended sediment will lead to increased stream temperatures and a depressed aquatic community.

d. **Reduction of carbon source (footprint):** Riparian forest buffers reduce the carbon source of the ecosystem due to their fallow nature. Also carbon sequestration values could be attributed to the mature trees within a riparian forest buffer.

4. **Protection and Enhancement of Terrestrial Habitat**

a. **Habitat for wildlife and vegetation:** The vertical and horizontal dimensions of riparian forest buffers provide multiple habitat benefits. The trees provide cavities for birds and small mammals to rest, nest, and breed. The native trees and shrubs of the riparian forest buffer also provide fruits, nuts, and seed for a diverse population of native wildlife. A large part of the life cycles of amphibians and reptiles occur in mature riparian forest buffers. The same is true for many aquatic insects, which use riparian vegetation as reproductive swarming sites, nymph emergence sites, and food. In addition, many species of native forbs can survive only in areas near water.

b. **Support of aquatic food chains and webs as they relate to terrestrial food webs:** The vertical and horizontal dimensions of riparian forest buffers provide multiple habitat benefits. Vegetation, such as fallen leaves and branches, are important in providing food and cover for benthic macroinvertebrates and fish. These macroinvertebrates and small fish, in turn, provide food for many larger fish, reptiles, amphibians, mammals, and birds.

c. **Habitat for rare, threatened, and endangered species:** Many of Pennsylvania's rare species of plants and animals are dependent on riparian forest buffers for at least a part of their life cycle.

d. **Preventing the spread of exotic or invasive species:** Nonnative invasive or exotic species and noxious weeds can easily establish in disturbed areas that were historically riparian forest buffers. These plants can significantly disrupt natural communities. Maintaining and restoring riparian forest buffers that are composed of predominantly native species is a key component in controlling the spread of these species.

e. **Travel corridors for migration and dispersal:** Many wildlife species in Pennsylvania are dependent on riparian forest buffers that act as corridors for safe travel for a wide array of wildlife. They also provide for wildlife passage through otherwise uninhabitable regions during periods of food shortage, for seasonal or diurnal movements within home ranges, and dispersal routes for juveniles of many species.

f. **Breeding habitat:** Many wildlife species, especially waterfowl, shore birds, many songbirds, and most amphibians and reptiles require the habitat provided by mature riparian forest buffers as conditions for breeding and for raising their young. Vernal pools found in many riparian forest buffers in Pennsylvania are critical habitat for breeding reptiles and amphibians.

g. **Genetic interchange:** Riparian forest buffers around Pennsylvania's streams, rivers, lakes, ponds, and reservoirs provide important dispersal routes for juveniles and breeding adults of some wildlife species. In this way the riparian forest buffers assist in genetic interchange with other local populations.

5. **Protection of Channel and Lake Shoreline Stability**

a. **Flood attenuation:** Riparian forest buffers that are a minimum of 100 feet wide provide space for channel meanders, stream movement, and floodwaters to spread out horizontally. This dissipates stream energy and protects channel stability and shoreline integrity in receiving waterbodies. The spongy floor of a riparian forest buffer along a pond, lake, or reservoir slows the affect of direct precipitation and runoff from areas adjacent to the riparian forest buffers and protects shorelines during floods.

b. **Reduced effects of storm events:** Mature riparian forest buffers that are sufficiently wide can slow the speed and reduce the volume of surface runoff from upland areas. The spongy floor of a riparian forest buffer along a pond, lake, or reservoir slows the affect of direct precipitation and runoff from areas adjacent to the riparian forest buffers. This protects stream channel beds and banks from powerful flash flooding that can scour and erode the channel. It also protects lake shorelines from erosive forces during large storms events and flooding.

c. **Streambank and shoreline stabilization:** The trees and shrubs in riparian forest buffers bind soil and increase the strength of the soil matrix. This enhances streambank and lake shoreline stability, which are important for reducing soil and property loss from the bank or shore, reducing sediment input to the waterbody, and maintaining overall channel stability. Mature trees also protect lakeshores from wave action.

d. **Ice damage control:** Riparian forest buffers along streams and rivers trap ice slabs during spring breakup, reducing the potential of jamming at downstream constrictions. Jamming can result in backwater and flooding upstream, which can lead to channel instability. Mature riparian forest lakeshore buffer zones are able to absorb the pressures of mid-winter ice push, protecting upland development from ice damage (Northwest Regional Planning Commission, *The Shoreline*).

6. **Social and Economic Benefits**

a. **Flood control:** Riparian forest buffers moderate floodwaters and protect human land use and investments from hazards associated with stream dynamics and shore erosion.

b. **Ice damage control:** The trees in Zone 1 of a mature riparian forest buffer insulate and warm the waters on the near shoreline/streambank area. This protects human land use

and investments from ice damage on the near shoreline/streambank and from affects of ice jamming and subsequent upstream flooding.

c. **Maintenance of optimal water quality for drinking water and recreation:** This would include protection of water quality for activities such as boating, swimming, fishing, and wildlife viewing.

d. **Maintenance of wastewater assimilation capacity of streams for reducing wastewater treatment costs:** Mature riparian forest buffers that are properly sized lower water temperature thereby increasing dissolved oxygen. This increases the waterbody's capacity to assimilate organic wastes, such as from wastewater treatment plants, and can greatly lower the cost of wastewater treatment (Ernst, *Protecting*).

e. **Passive recreational activities:** Riparian forest buffers provide natural surroundings for relaxation, observation of wildlife, photography, hunting, fishing, and other activities important to the people of Pennsylvania. Frequently pervious paths are cut through riparian areas and are used for hiking, bicycling, jogging, bird watching, and leisurely walks.

f. **Intrinsic values:** Mature riparian forest buffers composed of predominantly native vegetation enhances the preservation of natural functioning ecosystems and biological diversity.

Analysis of Impacts on Wetlands and Buffers

Proposed Leidy Southeast Franklin Loop D Pipeline

Monroe and Luzerne Counties, Pennsylvania

Analysis of Impacts on Wetlands and Buffers Proposed Williams Transco Leidy Southeast Franklin Loop D Pipeline

Monroe and Luzerne Counties, Pennsylvania

Prepared for: Delaware Riverkeeper Network
Bristol, Pennsylvania

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June 2014

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INTRODUCTION

The proposed 42-inch diameter natural gas pipeline D of the Franklin Loop is to extend for 11.5 miles across rural sections of Monroe and Luzerne Counties, Pennsylvania, alongside other buried pipelines in the right-of-way (ROW) of the Transco Williams Leidy Southeast pipeline (Figure 1). The existing, maintained ROW has a variable width footprint 100 to 125 feet wide, which is proposed to be expanded to construct the new pipeline. Installation of the proposed pipeline will occur within a 105-foot wide construction corridor that partially overlaps the existing ROW by varying distances. The Applicant states that a 90-foot wide construction corridor is needed through some of the wetlands encountered by the new pipeline, but it will try to limit the corridor to 75 feet (Figure 2).

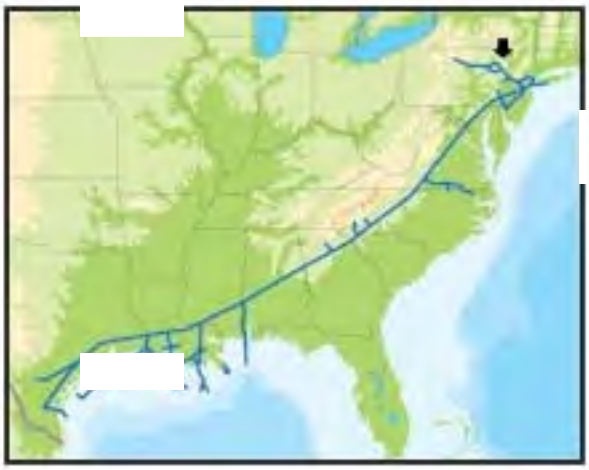


FIGURE 1. Arrow shows location of proposed Franklin Loop along the Leidy Southeast section of the Williams Transcontinental Pipeline in northern Pennsylvania. The system extends to the Gulf Coast.

SUMMARY OF PROPOSED IMPACTS ON WETLANDS, STREAMS, AND BUFFERS

The study corridor for the Franklin Loop occupies a 300-foot wide study corridor and includes about 420 acres. The Applicant currently lists 49 numbered wetlands (58 separate polygons) encompassing 61.81 total wetland acres within the corridor (Table A). The Applicant's data continue to change as plans are revised. For this discussion its 2013 application statements have been updated from its early 2014 data to the extent that such data were available. Figures 2 through 7 provide information on proposed typical construction and restoration procedures for the Franklin Loop.

The Franklin Loop construction also will require construction or improvement of several access roads, which will entail unavoidable stream crossings but apparently no wetland impacts. All access roads are to be removed and their disturbed areas restored following Franklin Loop construction, according to the application text. In the event that approvals are granted for Franklin Loop construction, the permanent retention of any roadway improvements presumably would have to be authorized by permit modification.

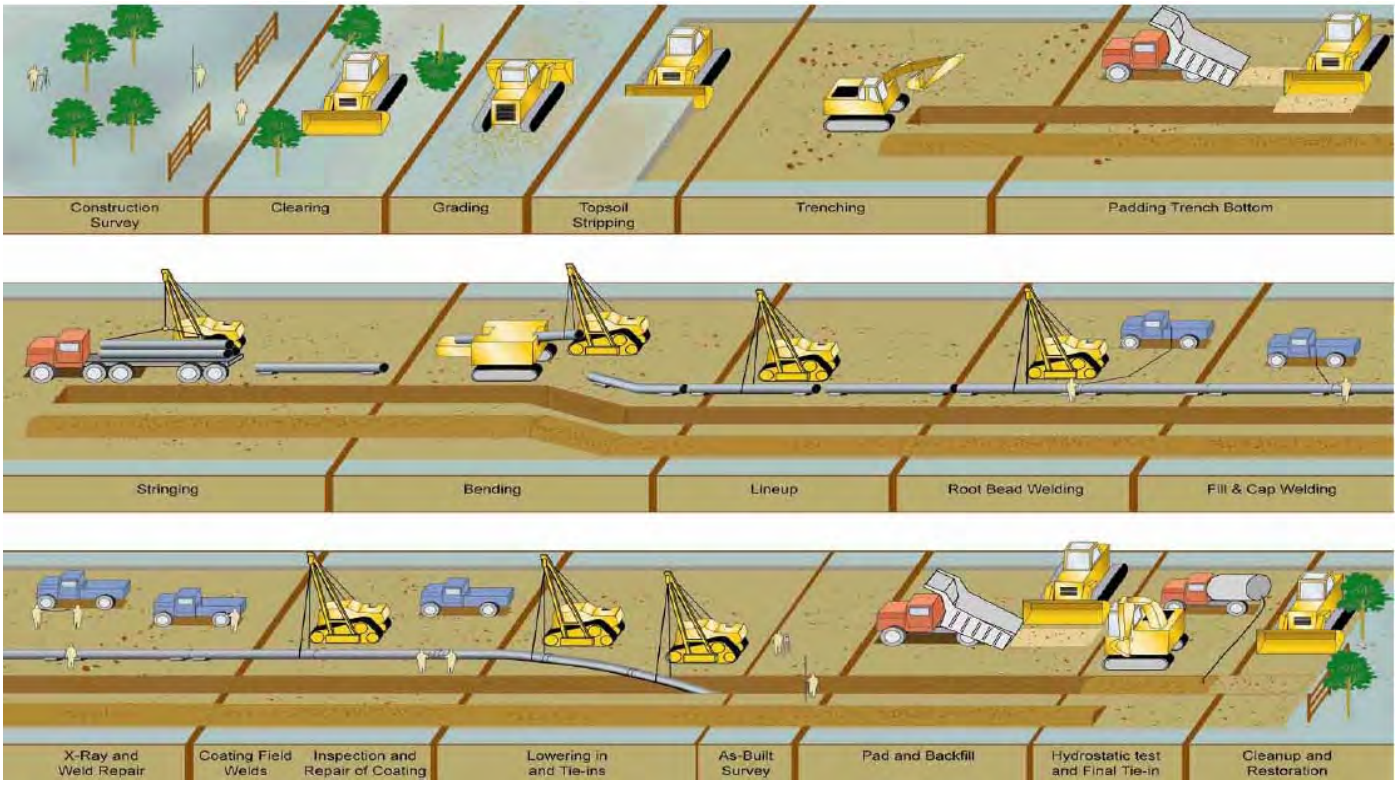
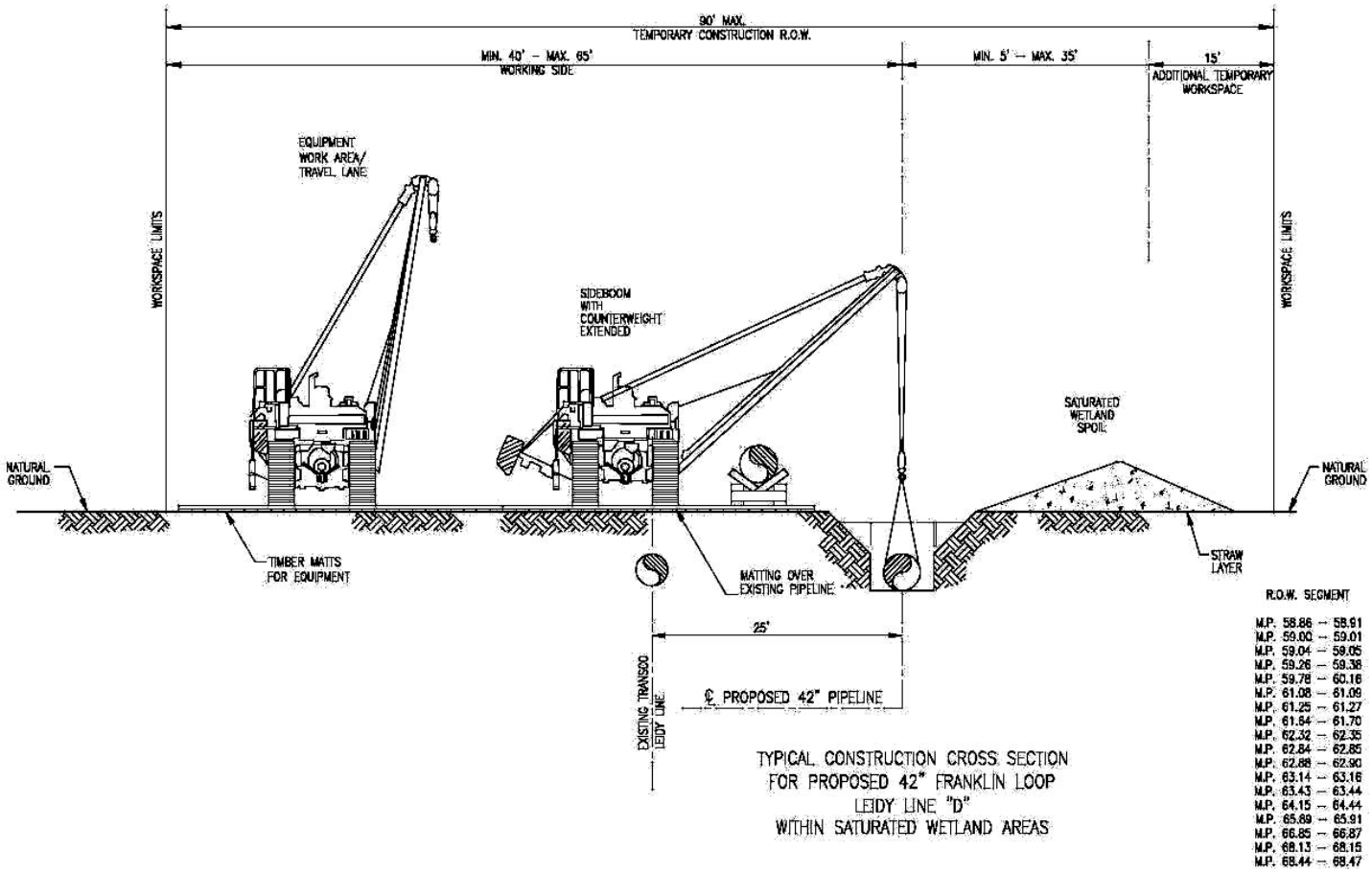
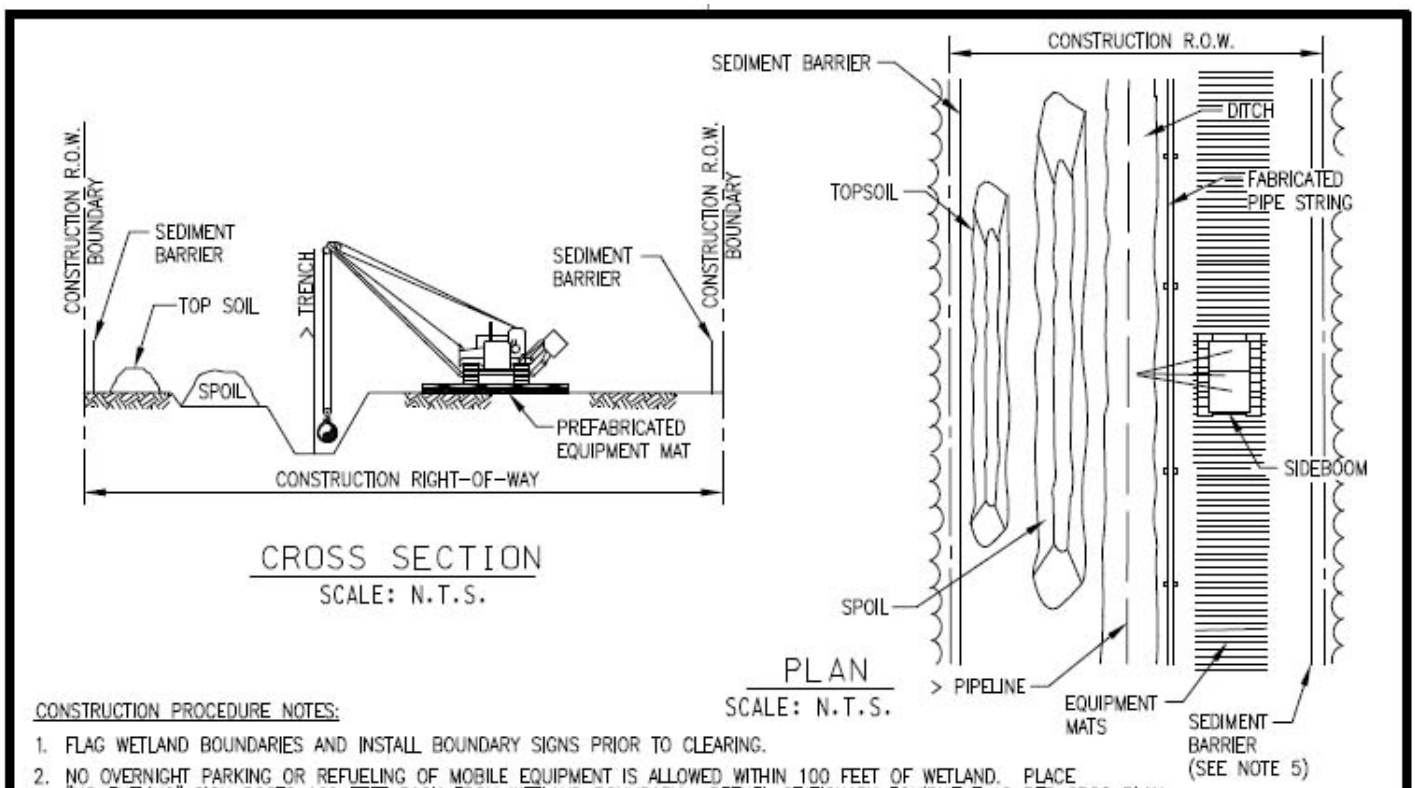


FIGURE 2. Typical construction sequence (above) and saturated wetland section (below) along the Franklin Loop pipeline.



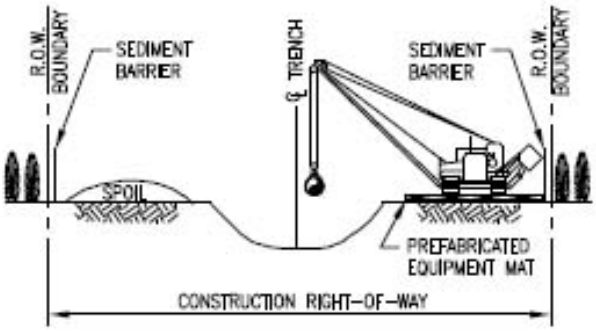


CONSTRUCTION PROCEDURE NOTES:

1. FLAG WETLAND BOUNDARIES AND INSTALL BOUNDARY SIGNS PRIOR TO CLEARING.
2. NO OVERNIGHT PARKING OR REFUELING OF MOBILE EQUIPMENT IS ALLOWED WITHIN 100 FEET OF WETLAND. PLACE "NO FUELING" SIGN POSTS 100 FEET BACK FROM WETLAND BOUNDARY. REFUEL STATIONARY EQUIPMENT AS PER SPCC PLAN.
3. INSTALL TEMPORARY SLOPE BREAKERS UPSLOPE OF WETLAND BOUNDARIES AS SHOWN ON DRAWINGS AND SPECIFICATIONS.
4. INSTALL PREFABRICATED EQUIPMENT MATS THROUGH ENTIRE WETLAND AREA ON THE WORKING SIDE OF THE CONSTRUCTION CORRIDOR.
5. AVOID ADJACENT WETLANDS. INSTALL SEDIMENT BARRIERS AT OUTER BOUNDARIES OF THE WETLAND. INSTALL SEDIMENT BARRIERS ALONG THE EDGE OF THE SPOIL SIDE OF THE CONSTRUCTION CORRIDOR THROUGH THE WETLAND AND ALONG THE DOWN SLOPE EDGE OF THE WETLAND. IF THE DOWN SLOPE EDGE OF THE WETLAND IS THE SPOIL SIDE, THEN SEDIMENT BARRIERS ARE NOT REQUIRED ON THE WORKING SIDE OF THE CORRIDOR UNLESS EQUIPMENT TRAVERSING THROUGH THE WETLAND CAUSES SPOIL AND SEDIMENT TO EXIT THE CONSTRUCTION CORRIDOR.
6. LIMIT PULLING OF TREE STUMPS AND GRADING ACTIVITIES TO DIRECTLY OVER THE TRENCH LINE. DO NOT GRADE OR REMOVE STUMPS OR ROOT SYSTEMS FROM THE REST OF THE RIGHT-OF-WAY IN WETLANDS UNLESS THE CHIEF INSPECTOR AND COMPANY ENVIRONMENTAL INSPECTOR DETERMINE THAT SAFETY RELATED CONSTRUCTION CONSTRAINTS REQUIRE REMOVAL OF TREE STUMPS FROM UNDER THE WORKING SIDE OF THE RIGHT-OF-WAY.
7. CONDUCT TRENCH LINE TOPSOIL STRIPPING (IF TOPSOIL IS NOT SATURATED). SALVAGE TOPSOIL TO ACTUAL DEPTH OR A MAXIMUM DEPTH OF 12 INCHES, AS DETERMINED BY THE COMPANY ENVIRONMENTAL INSPECTOR. SEGREGATED TOPSOIL PILE MAY BE LOCATED ON SPOIL SIDE, AS REQUIRED.
8. LEAVE HARD PLUGS AT THE EDGES OF WETLAND UNTIL JUST PRIOR TO TRENCHING.
9. TRENCHING THROUGH WETLANDS MAY PROCEED WHEN THE PIPE SECTION IS FABRICATED AND READY TO LAY. ONCE TRENCHING COMMENCES, CONSTRUCTION THROUGH THE WETLAND IS TO PROCEED CONTINUOUSLY UNTIL THE CROSSING IS COMPLETED, BACK FILLED AND RESTORED IN ORDER TO MINIMIZE THE LENGTH OF TIME THE TRENCH IS OPEN.
10. PIPE SECTION MAY BE FABRICATED WITHIN THE WETLAND ADJACENT TO PIPE TRENCH, OR IN STAGING AREA OUTSIDE THE WETLAND AND WALKED IN. NO CONCRETE COATING ACTIVITY WITHIN 100 FEET OF WETLAND BOUNDARY UNLESS APPROVED BY COMPANY ENVIRONMENTAL INSPECTOR.
11. LOWER-IN PIPE. PRIOR TO BACK FILLING TRENCH, INSTALL TRENCH PLUGS IN ACCORDANCE WITH DRAWINGS AND SPECIFICATIONS.
12. RESTORE GRADE TO NEAR PRE-CONSTRUCTION TOPOGRAPHY, REPLACE TOPSOIL AND INSTALL PERMANENT EROSION CONTROL.
13. REMOVE PREFABRICATED MATS FROM WETLANDS UPON COMPLETION.
14. SEED DISTURBED WETLANDS AREA AS DETERMINED BY THE ENVIRONMENTAL INSPECTOR AND AS SHOWN ON DRAWINGS.

PENNSYLVANIA

FIGURE 3. Construction detail for “unsaturated wetland” pipeline installation.



CROSS SECTION
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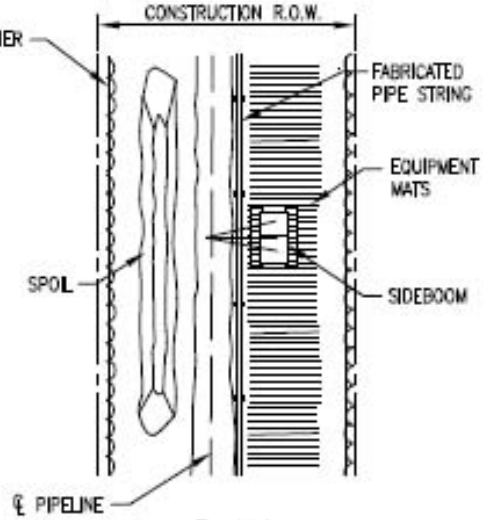


PLAN
SCALE: N.T.S.

CONSTRUCTION PROCEDURE NOTES:

1. FLAG WETLAND BOUNDARIES AND INSTALL BOUNDARY SIGNS PRIOR TO CLEARING.
2. NO OVERNIGHT PARKING OR REFUELING OF MOBILE EQUIPMENT IS ALLOWED WITHIN 100 FEET OF WETLAND. PLACE "NO FUELING" SIGN POSTS 100 FEET BACK FROM WETLAND BOUNDARY. REFUEL STATIONARY EQUIPMENT AS PER SPCC PLAN.
3. INSTALL TEMPORARY SLOPE BREAKERS UP SLOPE OF WETLAND BOUNDARIES AS SHOWN ON DRAWINGS AND SPECIFICATIONS.
4. INSTALL PREFABRICATED EQUIPMENT MATS THROUGH ENTIRE WETLAND AREA ON THE WORKING SIDE OF THE CONSTRUCTION CORRIDOR.
5. AVOID ADJACENT WETLANDS. INSTALL SEDIMENT BARRIERS AT OUTER BOUNDARIES OF WETLAND AND ALONG BOTH WETLAND EDGES.
6. LIMIT PULLING OF TREE STUMPS AND GRADING ACTIVITIES TO DIRECTLY OVER THE TRENCH LINE. DO NOT GRADE OR REMOVE STUMPS OR ROOT SYSTEMS FROM THE REST OF THE RIGHT-OF-WAY IN WETLANDS UNLESS THE CHIEF INSPECTOR AND COMPANY ENVIRONMENTAL INSPECTOR DETERMINE THAT SAFETY RELATED CONSTRUCTION CONSTRAINTS REQUIRE REMOVAL OF TREE STUMPS FROM UNDER THE WORKING SIDE OF THE RIGHT-OF-WAY.
7. TOPSOIL STRIPPING SHALL NOT BE REQUIRED IN SATURATED SOIL CONDITIONS.
8. LEAVE HARD PLUGS AT THE EDGES OF WETLAND UNTIL JUST PRIOR TO TRENCHING.
9. TRENCHING THROUGH WETLANDS MAY PROCEED WHEN THE PIPE SECTION IS FABRICATED AND READY TO LAY. ONCE TRENCHING COMMENCES, CONSTRUCTION THROUGH THE WETLAND IS TO PROCEED CONTINUOUSLY UNTIL THE CROSSING IS COMPLETED, BACK FILLED AND RESTORED IN ORDER TO MINIMIZE THE LENGTH OF TIME THE TRENCH IS OPEN.
10. PIPE SECTION MAY BE FABRICATED WITHIN THE WETLAND ADJACENT TO PIPE TRENCH, OR IN STAGING AREA OUTSIDE THE WETLAND AND WALKED IN. NO CONCRETE COATING ACTIVITY WITHIN 100 FEET OF WETLAND BOUNDARY, UNLESS APPROVED BY COMPANY ENVIRONMENTAL INSPECTOR.
11. LOWER-IN PIPE. PRIOR TO BACKFILLING, INSTALL TRENCH PLUGS IN ACCORDANCE WITH DRAWINGS AND SPECIFICATIONS.
12. RESTORE GRADE TO NEAR PRE-CONSTRUCTION TOPOGRAPHY AND INSTALL PERMANENT EROSION CONTROL.
13. REMOVE PREFABRICATED MATS FROM WETLANDS UPON COMPLETION.
14. SEED DISTURBED WETLAND AREA AS DETERMINED BY THE ENVIRONMENTAL INSPECTOR AND AS SHOWN ON DRAWINGS.

PENNSYLVANIA

DRAWING NO.	REFERENCE TITLE

TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC LEIDY SOUTHEAST PROJECT
STANDARD ENVIRONMENTAL DETAIL
TYPE II "SATURATED WETLAND"
INSTALLATION PROCEDURE

Williams GAS PIPELINE

NO.	DATE	BY	REVISION DESCRIPTION	W.O. NO.	CHK.	APP.
0	9/3/2013		ISSUED FOR SUBMITTAL		BB	MJH
1	9/18/2013		ISSUED FOR FILING		BB	MJH

DRAWN BY: WGMI	DATE: 8/8/13	ISSUED FOR BID:	SCALE: N.T.S.
CHECKED BY: BB	DATE: 9/18/13	ISSUED FOR CONSTRUCTION:	
APPROVED BY: MJH	DATE: 9/18/13	DRAWING NUMBER: LS-TYP-0009PA	SHEET 1 OF 2

FIGURE 4. Construction detail for "saturated wetland" pipeline installation.

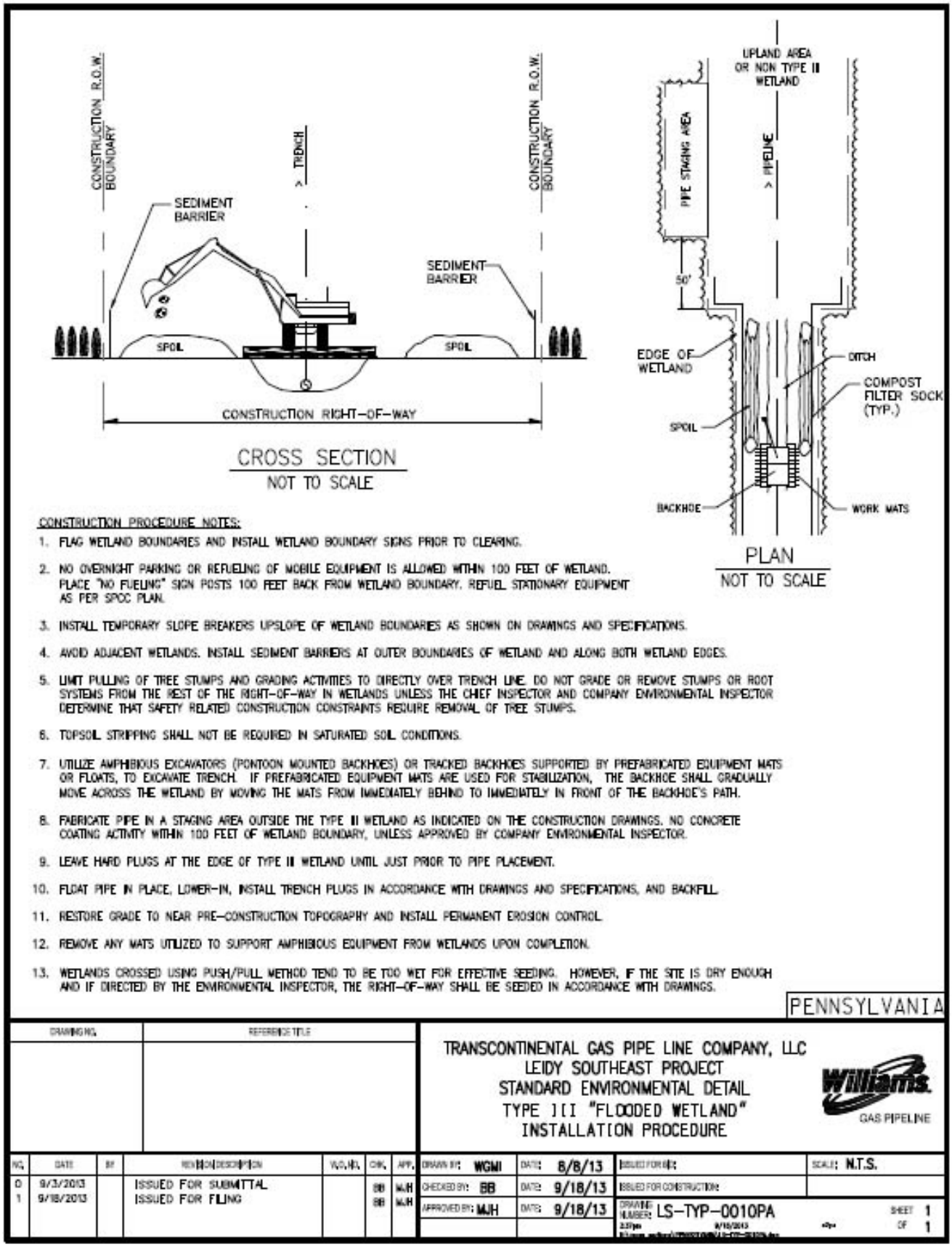


FIGURE 5. Construction detail for "flooded wetland" pipeline installation.

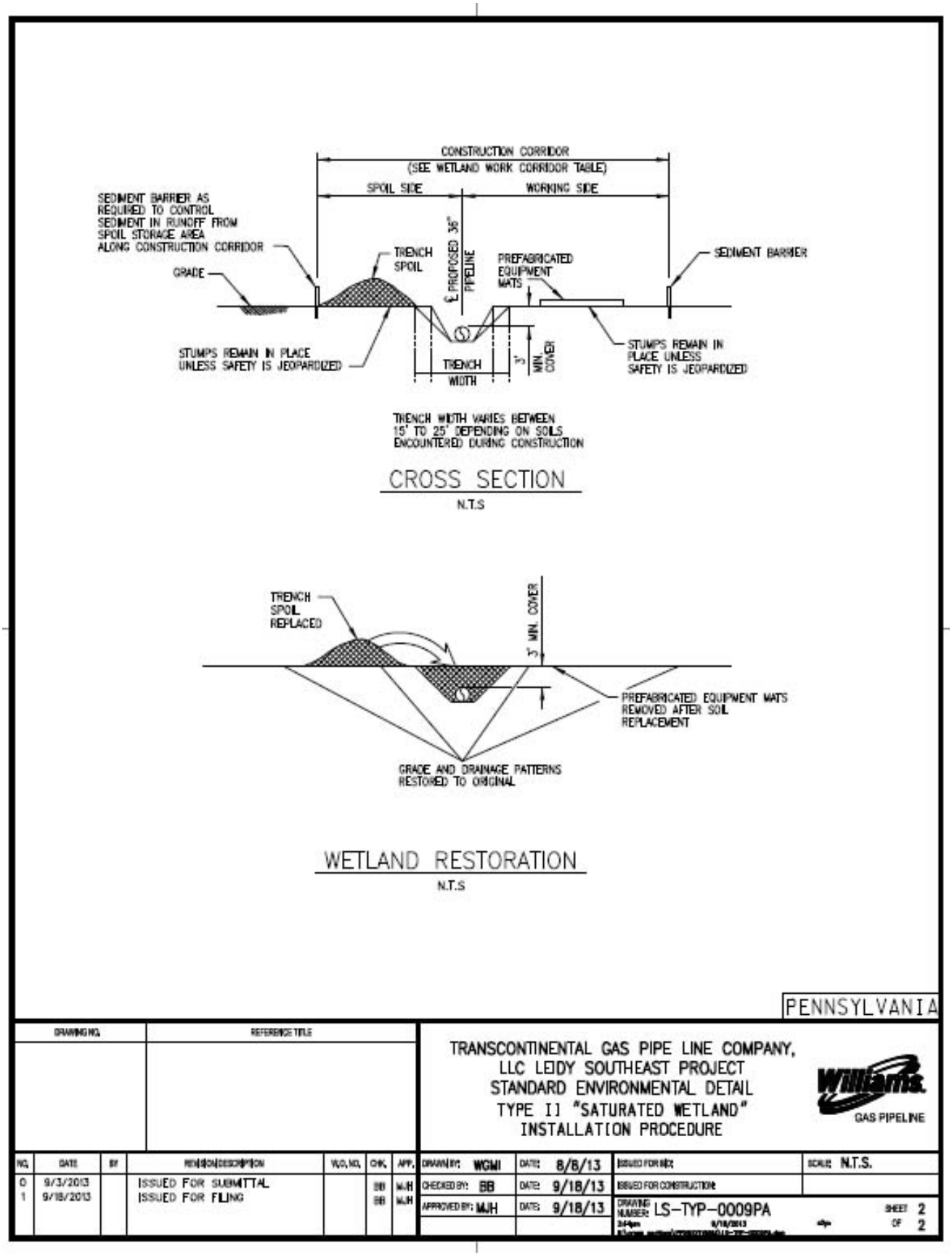


FIGURE 6. Construction detail for restoration of “saturated wetland” after pipeline installation.

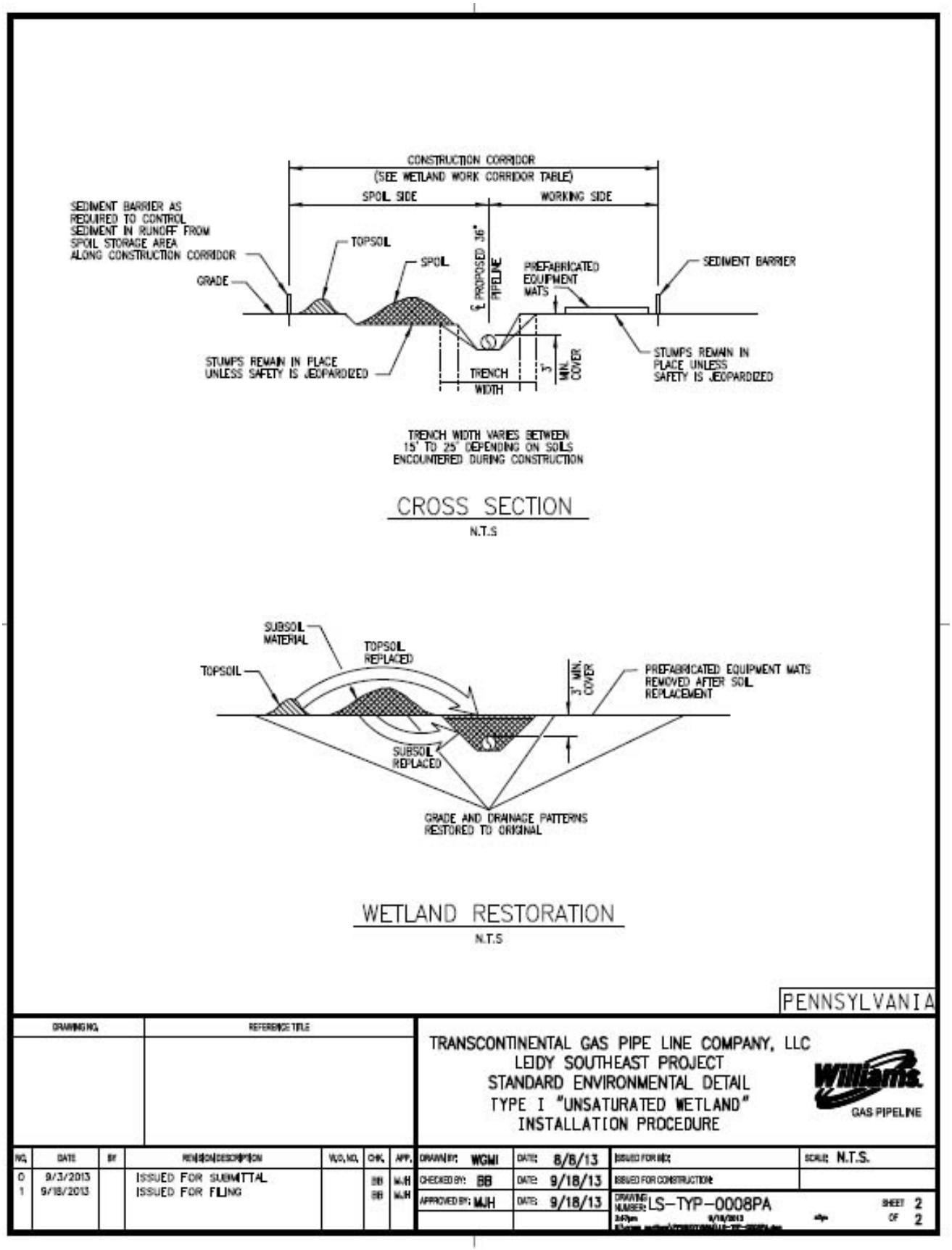


FIGURE 7. Restoration of "unsaturated wetland" after pipeline installation. No restoration drawing was provided for "flooded wetland" areas.

The Franklin Loop is to be constructed in accordance with some (but not all) of the Federal Energy Regulatory Commission's (FERC) May 2013 guidelines for wetland protection during the construction of regulated interstate pipelines. The 42-inch D pipe generally is to be placed no more than 25 feet from existing Leidy pipelines. The Applicant expects to need an extra 15 feet of Additional Temporary Work Space beyond the normally allowed FERC limit of 75 feet through wetlands for installation of the 42-inch pipeline in 7-foot deep trenches. It expects not to maintain the FERC-specified 15 feet of vegetation between the construction ROW and any adjacent wetland or waterbody, and it intends to install the D pipeline parallel to five stream segments (rather than perpendicular, as per FERC standards) along the Franklin Loop.

Disturbance is proposed on 59.66 acres of land within the existing maintained easement and 144.58 new acres outside the existing maintained easement, for a total disturbance of 204.24 acres of land for the Franklin Loop. Stream crossings are planned as temporary disturbance at 33 currently acknowledged locations (plus at least two additional headwater streams), all in Special Protection waters having uses designated as Exceptional Value (EV) or High Quality-Cold Water Fishery, Migratory Fishery (HQ-CWF, MF). Waters in Pennsylvania with Exceptional Value designated uses are equivalent to Outstanding National Resource Waters in the language of the federal Clean Water Act (33 USC § 1251 ***et seq***.; 40 CFR 131.12). Such waters are to receive the most stringent protection against degradation. High Quality waters also are to receive Special Protection.

The Applicant identifies direct impacts to 17.37 acres (28% of all the wetland acres it delineated in the study corridor, Table B) by intended construction within 36 numbered wetlands (some consisting of multiple polygons). The 2013 FERC guidelines call for onsite restoration, following the conclusion of interstate pipeline installation, of topography, drainage patterns, soil, and native wetland vegetation comparable to that impacted. The Applicant appears prepared to comply by restoring only about 11.5 acres of what it labels "temporary" wetland disturbance along the pipeline.

VEGETATION CONVERSION

Based on remeasurement of the Applicant's February 2014 FERC alignment drawings (Figure 8), enlarged to a scale of 1:480 (1" = 40') for this assessment, the Applicant appears to propose permanent conversion from woody to herbaceous vegetation in 12 numbered wetlands totaling 6 acres (about 1 ac of Palustrine Forest [PFO] plus 5 ac of Palustrine Scrub [PSS] to become herbaceous vegetation [PEM], Table B). These totals contrast with the Applicant's statement in its 2013 Mitigation Plan (FERC Application Requirement T) that there would be only 3.84 acres of total conversion from woody to herbaceous vegetation in the Franklin Loop wetlands post-construction. The Applicant's "tree lines" on stream and wetland encroachment drawings, along with photographs and limited field inspection, were used to ascertain the extent of existing forest and scrub wetlands within proposed limits of disturbance by construction (Figures 8 and 9). The revised tallies of vegetation conversion are consistent with data recorded by the Applicant's bog turtle consultant during 2013. The most detailed description of existing vegetation at each wetland in Monroe County is provided by the Applicant's bog turtle consultant, which is more accurate than that of the Applicant's summary impact tables.

The permanent conversion of forest and scrub vegetation to herbaceous cover in wetlands along the pipeline is necessary because the Applicant plans to maintain a corridor centered on the new pipeline free of woody vegetation and extending 25 feet in each direction to facilitate ongoing inspection. The new pipeline is to be installed alongside the existing pipelines, with several crossovers from one side of the existing ROW to the other. By measurement, the Applicant's plans would "allow" 5 acres of

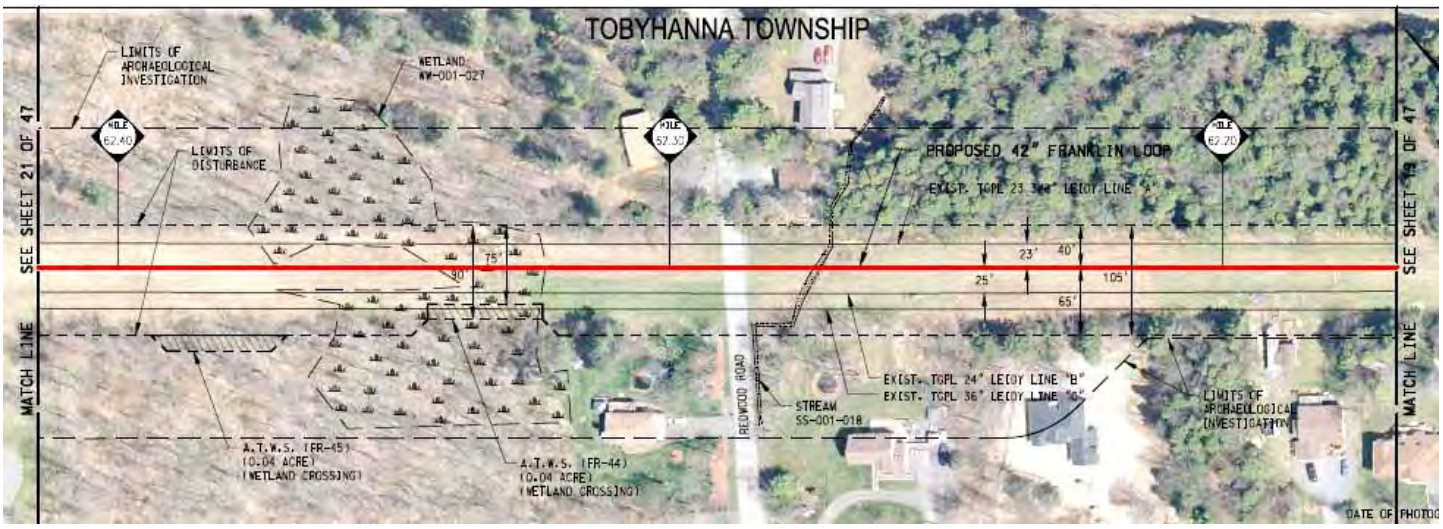


FIGURE 8. Sample from a February 2014 FERC alignment plan drawing from which vegetation impact was remeasured after enlargement.

"temporarily disturbed" wetland forest and 1 acre of wetland scrub to revegetate, along with 5.5 acres of "temporary disturbance" in emergent herbaceous vegetation along the Franklin Loop. That adds up to 17.4 acres of direct impact on existing wetlands, including the nearly 6 acres of permanent woody wetland vegetation conversion to herbaceous cover.

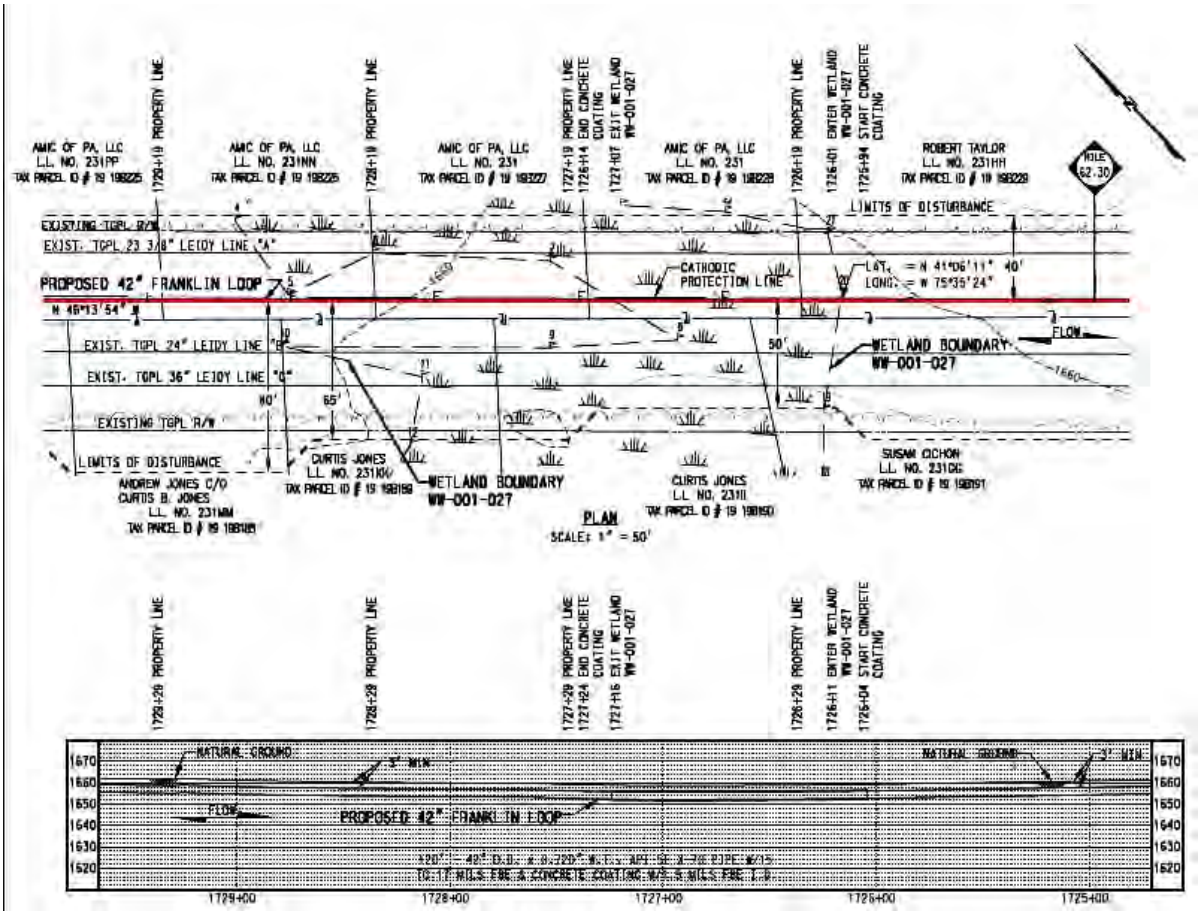


FIGURE 9. Sample from a wetland obstruction plan drawing showing tree lines.

Such changes in vegetation, whether “temporary” or permanent, will constitute a profound change of habitat for wildlife in natural areas such as occupy much of the surroundings of the Franklin Loop. Surface runoff from vegetated land disturbed by construction typically increases. Compaction of soils by construction equipment also can alter its permeability, reducing both the amount of groundwater infiltration and the capacity of plants to establish roots. As a result, current groundwater recharge and discharge can be altered. The Applicant proposes to install trench plugs along the pipeline to prevent the pipeline from forming a drainage route. When the species of wetland plants are altered, the chemistry of leaf litter changes, its mass and volume decrease, and these changes alter the food webs that can be supported (Stoler & Relyea 2011). Denitrification, the conversion of nitrogen compounds to inert nitrogen gas, is a major natural process that takes place in wetland soils. Beneath forests, denitrification apparently occurs primarily in patches of accumulated organic matter, often in depressions associated with wind throw of trees, at rates that vary with tree species (***e.g***., Rotkin-Ellman ***et al***. 2004, Jacinthe ***et al***. 2003, Gold ***et al***. 1998). The conversion of forest or scrub to herbaceous wetlands can affect the denitrification function in complex ways, thereby affecting the quality of groundwater and surface waters. If herbicides are used for vegetation maintenance, they may directly affect wetland plants and animals other than the target species. The Applicant has not detailed the functions of individual wetlands along the Franklin Loop or explained how mitigation for what it considers unavoidable disruption will be accomplished except by gross quantitative ratios mentioned in its plan for offsite wetland mitigation.

DAMAGE TO BUFFERS

The Applicant quantifies the extent of its proposed construction within bordering uplands (non-wetlands) adjacent to the directly disturbed wetlands and streams that comes closer than the 50-foot wide undisturbed buffer anticipated by FERC around all such features. The Applicant’s Table A-2 in Appendix A1 lists 43 proposed encroachments ranging from 10 to 50 feet into standard FERC non-wetland buffers around delineated wetlands. These encroachments will occupy 7.31 acres. Table A-1 in Appendix A1 lists 17 additional encroachments into FERC stream buffers ranging from 15 to 50 feet into riparian setbacks around streams. These encroachments will occupy 3.99 acres adjacent to the 1.1 acres of directly impacted stream channels at the 33 of the 35 proposed stream crossings along more than 4,128 linear feet of streams. It is not clear that all of these proposed encroachments into buffers are unavoidable. The Applicant states that it plans to preserve 15 feet of vegetation along streambanks where possible, but it does not indicate the locations of such areas on its drawings. It also plans to stockpile excavated materials no closer than 10 feet to the water’s edge of streams. It is difficult to understand why the applicant proposes additional temporary workspace next to EV streams even where there appears to be ample already disturbed land available within the existing ROW, as for example along the east bank of the Lehigh River (northwest of Mile Post 65.40; Figure 10). Concrete coatings are not to be applied to pipes within 100 feet of streams or wetlands, and vehicle parking and refueling also are to be kept back 100 feet per FERC guidelines.

Pennsylvania now requires that mandatory riparian buffers be deed-restricted and maintained or (if lacking) installed by planting native trees and shrubs along Special Protection rivers, streams, lakes, and ponds (those designated for either Exceptional Value or High Quality uses) wherever construction activities are proposed that need Erosion and Sediment Control plan approval for earth disturbance within 150 feet of those watercourses (25 ***Pa. Code*** 102.14). Forested riparian buffers are identified by PADEP (2010) as the single most important and effective Best Management Practice that can be provided for streams and other watercourses throughout the Commonwealth. The 150-foot wide buffer limit is shown around all Applicant-recognized streams (but no ponds, inexplicably) on the Applicant’s draft soil erosion and sediment control drawings (for example, the dashed line around the affected segment of the Lehigh River in Figure 10). There are no drawings showing

permanent post-construction stormwater management features at all, as required in Pennsylvania Chapter 102 permit applications. No measures are shown to make certain that surface runoff entering riparian buffers will consist solely of non-erosive sheet flow post-construction.

Within Special Protection watersheds such as all the land crossed by the Franklin Loop, the restricted riparian buffers are required to be 150 feet wide as measured horizontally from the stream bank or normal pool edge. In the 50 feet closest to the watercourse (Zone 1), the native trees, shrubs, and herbaceous forbs must remain undisturbed; management such as sustainable timber harvest may be conducted within the outer 100 feet of the forest buffer (Zone 2) in accordance with an approved buffer management plan. The riparian buffers are to be established by easement, deed restriction, or other enforceable measure reciting the future human and livestock activities prohibited, authorized, or requiring specific PADEP management plan approval. The management measures and responsible parties that will ensure buffer integrity and long-term functioning also must be identified. No such information appears in the current application. It is unlikely that riparian buffers can be maintained where the pipeline permanently is to be kept free of woody vegetation. No buffer restoration narrative was provided.

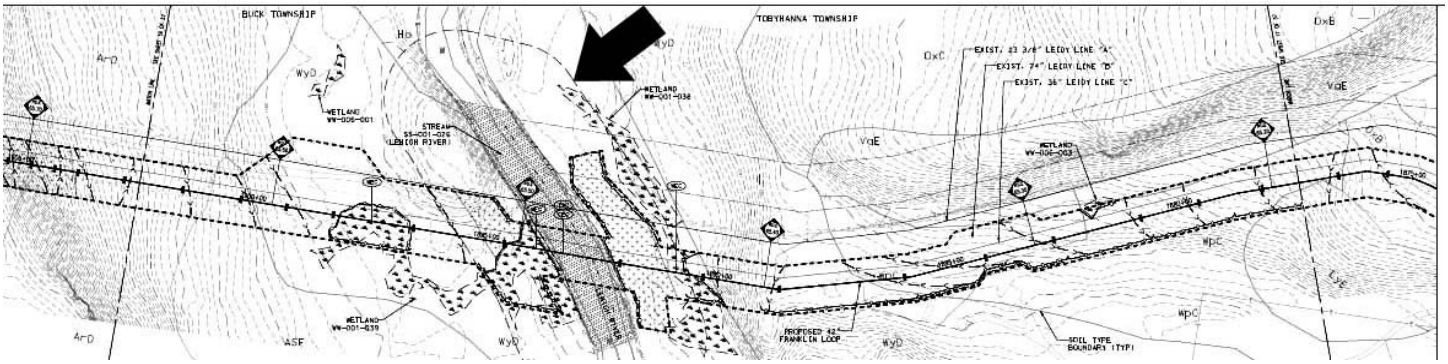
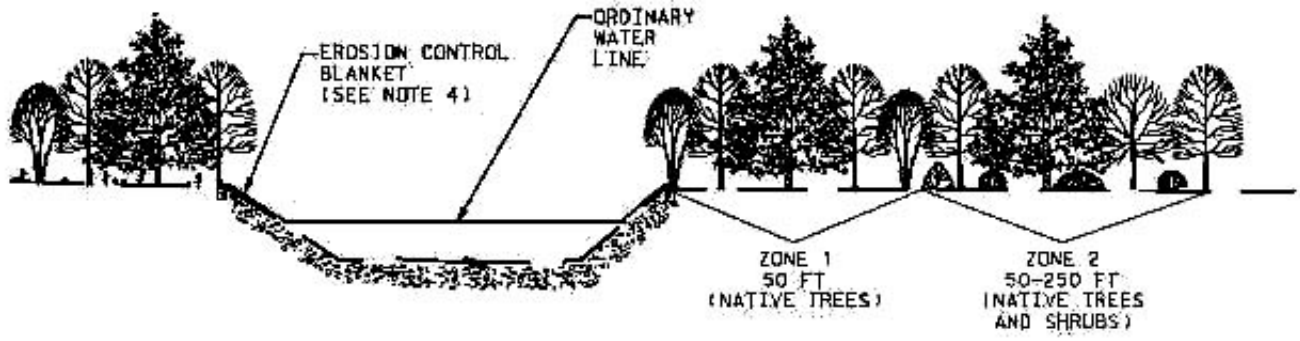


FIGURE 10. Excerpt from soil erosion and sediment control plan showing proposed measures for use during construction. No post construction stormwater management plan has been submitted. Applicant's dashed 150-foot wide forest riparian buffer around disturbed stream segment is indicated by arrow.

In order to comply with the Chapter 102 buffer requirements, the 33 acknowledged stream crossings that will directly affect 8,276 feet of streambanks would require conservation easements for 28.5 acres of permanently protected, forested riparian buffers at the minimum width of 150 feet. Buffer establishment will be needed for other riparian lands wherever earth disturbance is planned for this pipeline within 150 feet of streams or ponds. Typical details for buffer restoration are provided in Figures 11 through 15, but no plan is provided showing where these buffers will be placed post-construction. PADEP regulations anticipate the possibility of approving offsite riparian buffers, which possibly might prove practicable for at least some of the mandatory stream buffer mitigation needed for new pipelines such as the Franklin Loop.

Existing ponds along the ROW have not been identified on the Applicant's drawings and also will require riparian buffer replacement for any earth disturbance within 150 feet. (The Applicant's definition of waterbodies includes only streams.) These additional earth disturbances will require several more acres of additional easements and riparian buffer establishment beyond the 28.5 acres of mitigation for direct riparian buffer impact at stream crossings. PADEP (2010) has prepared technical guidance for both legal protection and landscape planting to establish the mandatory riparian buffers where earth disturbance is authorized within 150 feet of Special Protection



NOTES:

1. RESTORE IMPACTED FOREST BUFFER FOR:
   150 FT (HIGH QUALITY WATERS – PA)
   100 FT (OTHER WATERS – PA)

OR EXISTING WIDTH OF FOREST BUFFER IF LESS THAN THESE MINIMUM REQUIREMENTS.

2. ZONE 1 AND ZONE 2 PLANTING AREAS ARE RECOMMENDED FROM PADEP RIPARIAN FOREST BUFFER GUIDANCE (DOCUMENT NUMBER 394-5600-001, NOVEMBER 27, 2010).

3. NATIVE TREES AND/OR SHRUBS IN ZONE 1 AND ZONE 2 SHOULD BE PLACED 12' APART.

4. EROSION CONTROL BLANKETS SHALL BE PLACED ON RESTORED BANKS TO THE ORDINARY WATER LINE AND IN UPLAND AREAS SHOULD BE INSTALLED A MINIMUM OF 50 FT BEYOND THE TOP OF BANK (MORE AS NEEDED DEPENDING ON SLOPES). EROSION CONTROL BLANKETS SHALL NOT BE PLACED IN WETLANDS. SEE DETAIL ON SHEET 22.

5. ERNST MIX 178 (RIPARIAN BUFFER MIX) OR SIMILAR TO BE APPLIED AT 20 LBS PER ACRE OR 1/2 LB PER 1,000 SQ. FT. ON RESTORED BANKS AND IN ZONE 1 AND ZONE 2.

6. FOR DETAILS REGARDING RECOMMENDED TREES, SHRUBS, LIVE STAKES AND SEED MIX SEE TABLES 1 AND 2 ON THIS SHEET.

7. LIVE STAKES SHOULD BE PLANTED ALONG WATER BODY BANKS WITH EXISTING WOODY VEGETATION.

8. NO TREES ARE TO BE PLANTED IN AN AREA 10 FEET WIDE CENTERED OVER THE PIPE LINE.

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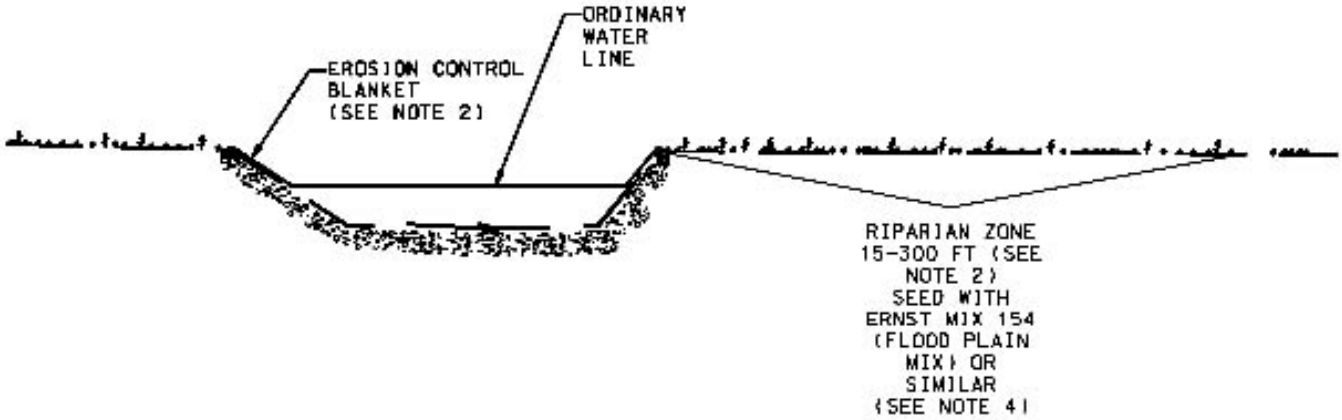
FIGURE 11. Detail for typical restoration of native forest riparian buffers along streams. No drawing shows where such buffers will be installed along the Franklin Loop. There are no “other waters” along the Franklin Loop. The drawings apply also to the Dorrance Loop of the Leidy Southeast pipeline.

watercourses. The Applicant does not mention any plans for 5-year minimum monitoring and reporting of buffer restoration success as required by Pennsylvania regulations.



NOTES:

1. RESTORE IMPACTED RIPARIAN ZONE FOR A MINIMUM OF 15 FEET LANDWARD OF THE TOP OF BANK. IF THE PRE-IMPACT RIPARIAN BUFFER OF NATIVE HERBACEOUS AND SHRUB VEGETATION EXCEEDS 15 FEET BEYOND THE TOP OF BANK, THE AREA TO BE SEEDED SHOULD BE AS FOLLOWS:

   150 FT (HIGH QUALITY WATERS – PA)
   100 FT (OTHER WATERS – PA)

   OR EXISTING WIDTH OF RIPARIAN ZONE IF LESS THAN THESE MINIMUM REQUIREMENTS.

2. EROSION CONTROL BLANKETS SHALL BE PLACED ON RESTORED BANKS TO THE ORDINARY WATER LINE AND UPLAND AREAS SHOULD BE INSTALLED A MINIMUM OF 50 FT BEYOND THE TOP OF BANK (MORE AS NEEDED DEPENDING ON SLOPES). EROSION CONTROL BLANKETS SHALL NOT BE PLACED IN WETLANDS. SEE DETAIL ON SHEET 22.

3. ERNST MIX 154 (FLOOD PLAIN MIX) OR SIMILAR TO BE APPLIED AT 15 LBS PER ACRE OR 1/3-1/2 LB PER 1,000 SQ. FT. ON RESTORED BANKS AND IN RIPARIAN ZONE.

4. FOR DETAILS REGARDING RECOMMENDED SEED MIX, SEE TABLE 1 ON THIS SHEET.

5. LIVE STAKES SHOULD BE PLANTED ALONG WATER BODY BANKS WITH EXISTING WOODY VEGETATION.

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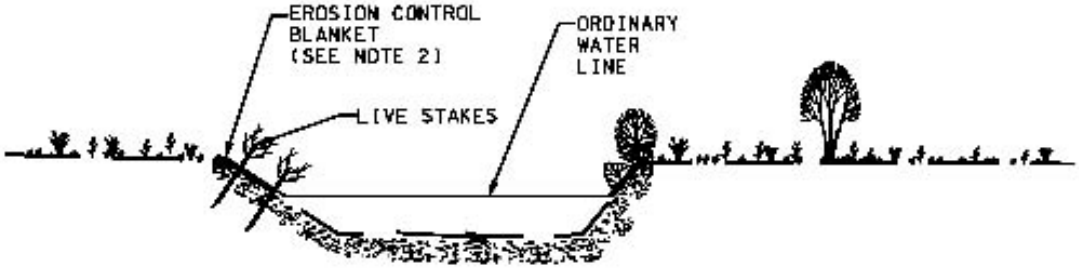
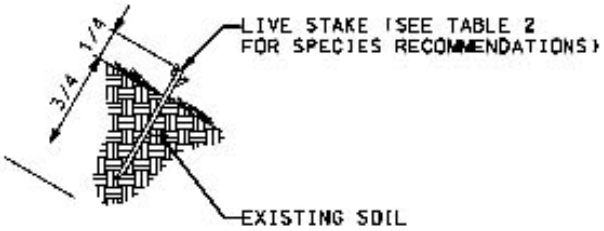
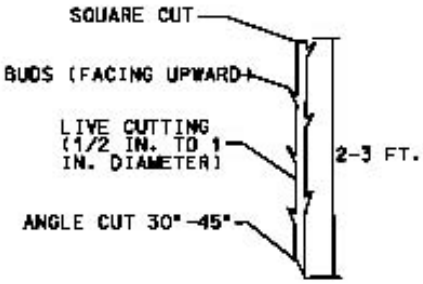
FIGURE 12. Detail for typical non-forest riparian buffer to be installed along the Franklin Loop. Pennsylvania regulations call for installation of forest in riparian zones wherever they currently are lacking (25 ***Pa. Code*** 102.14). The relevance of this detail to the Franklin Loop is not clear. No drawing shows where such buffers will be located





LIVE STAKE INSTALLATION
NOT TO SCALE



LIVE STAKE DETAIL
NOT TO SCALE

NOTES:

1. THIS DETAIL IS FOR THE STABILIZATION OF WATER BODIES WITH EXISTING WOODY VEGETATION ALONG THE BANKS AND SHOULD BE COMBINED AS NEEDED WITH THE OTHER VEGETATION RESTORATION OPTIONS.
2. EROSION CONTROL BLANKETS SHALL BE PLACED ON RESTORED BANKS TO THE ORDINARY WATER LINE AND IN UPLAND AREAS SHOULD BE INSTALLED A MINIMUM OF 50 FT BEYOND THE TOP OF BANK (MORE AS NEEDED DEPENDING ON SLOPES). EROSION CONTROL BLANKETS SHALL NOT BE PLACED IN WETLANDS. SEE DETAIL ON SHEET 22.
3. TWO ROWS OF LIVE STAKES SHALL BE EVENLY SPACED 2 FEET APART.
4. LIVE STAKES SHALL BE DRIVEN UNTIL APPROXIMATELY 3/4 OF THE LIVE STAKE IS WITHIN THE GROUND.
5. IF STARTER HOLE IS NEEDED, MINIMIZE AIR POCKET.
6. AVOID STRIPPING THE BARK OR BRUISING OF STAKES DURING INSTALLATION. DO NOT USE AXE OR SLEDGE FOR DRIVING STAKES. IN HARD GROUND USE AN IRON BAR OR STAR DRILL TO PREPARE HOLES FOR THE STAKES.

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FIGURE 13. Detail for typical live stake installation in buffers along streams. No drawing shows where such buffers will be installed along the Franklin Loop.

TABLE 2 - RECOMMENDED NATIVE TREE, SHRUB AND LIVE STAKE SPECIES

ZONE 1 (50 FEET WIDE)

SCIENTIFIC NAME	COMMON NAME	PLANT FORM	SPACING (FEET)	SIZE / CONTAINER
ACER SACCHARUM	SUGAR MAPLE	TREE	12	#1
BETULA ALLEGHANIENSIS	YELLOW BIRCH	TREE	12	#1
BETULA LENTA	BLACK BIRCH	TREE	12	#1
LIRIODENDRON TULIPIFERA	TULIP POPLAR	TREE	12	#1
QUERCUS ALBA	WHITE OAK	TREE	12	#1
QUERCUS RUBRA	RED OAK	TREE	12	#1
QUERCUS VELUTINA	BLACK OAK	TREE	12	#1
PINUS STROBUS	WHITE PINE	TREE	12	#1
TSUGA CANADENSIS	EASTERN HEMLOCK	TREE	12	#1

NOTES:
1. IF EXISTING FORESTED RIPARIAN BUFFER IS LESS THAN 50 FEET WIDE, NATIVE TREES SHOULD BE PLANTED TO THE EXTENT OF THE EXISTING FORESTED RIPARIAN BUFFER.
2. USE 12-FOOT SPACING FOR ALL TREES AND SHRUBS.

ZONE 2 (50 TO 250 FEET WIDE)

SCIENTIFIC NAME	COMMON NAME	PLANT FORM	SPACING (FEET)	SIZE / CONTAINER
ACER SACCHARUM	SUGAR MAPLE	TREE	12	#1
BETULA ALLEGHANIENSIS	YELLOW BIRCH	TREE	12	#1
BETULA LENTA	BLACK BIRCH	TREE	12	#1
LIRIODENDRON TULIPIFERA	TULIP POPLAR	TREE	12	#1
QUERCUS ALBA	WHITE OAK	TREE	12	#1
QUERCUS RUBRA	RED OAK	TREE	12	#1
QUERCUS VELUTINA	BLACK OAK	TREE	12	#1
PINUS STROBUS	WHITE PINE	TREE	12	#1
TSUGA CANADENSIS	EASTERN HEMLOCK	TREE	12	#1
CORNUS SP.	DOGWOOD	SHRUB	12	#1
GAYLUSSACIA SP.	HUCKLEBERRY	SHRUB	12	#1
KALMIA LATIFOLIA	MOUNTAIN LAUREL	SHRUB	12	#1
LINDERA BENZOIN	SPICEBUSH	SHRUB	12	#1
RHODODENDRON SP.	RHODODENDRON	SHRUB	12	#1
VACINIUM SP.	BLUEBERRY	SHRUB	12	#1
VIBURNUM SP.	ARROWWOOD	SHRUB	12	#1

NOTES:
1. THE WIDTH OF ZONE 2 WILL VARY DEPENDING ON THE LOCATION OF THE WATER BODY (PA VS. NJ), THE SURFACE WATER CLASSIFICATION (SEE TABLE II.1 IN RESTORATION NARRATIVE) AND THE WIDTH OF THE EXISTING FORESTED RIPARIAN BUFFER.
2. IF THE EXISTING FORESTED RIPARIAN BUFFER IS LESS THAN THE MINIMUM REQUIRED WIDTH BASED ON TABLE II.1, NATIVE TREES AND SHRUBS SHOULD BE PLANTED TO THE EXTENT OF THE EXISTING FORESTED RIPARIAN BUFFER.

LIVE STAKES

SCIENTIFIC NAME	COMMON NAME	PLANT FORM	SPACING (FEET)
SALIX SP.	WILLOW	LIVE STAKE	2
CORNUS SP.	DOGWOOD	LIVE STAKE	2

NOTES:
1. LIVE STAKES SHOULD BE PLANTED ONLY ALONG WATER BODY BANKS WITH EXISTING WOODY VEGETATION.
2. LIVE STAKES SHOULD BE PLANTED IN THE DORMANT SEASON BETWEEN NOVEMBER AND APRIL. ROOTED CUTTINGS OR CONTAINERIZED PLANTS OF SALIX AND CORNUS SPECIES SHOULD BE PLANTED IN PLACE OF LIVE STAKES BETWEEN MAY AND OCTOBER.

FIGURE 14. Kinds and density of trees and shrubs to be planted in Franklin Loop buffers. Only container size (#1 = 1 gallon) is indicated; size of plants is not specified as required by ANSI Z60.1-2004. PADEP (2010) recommends planting hardwood trees (not conifers) and shrubs on 10-foot centers, 435 per acre, in riparian buffers.

TABLE A – PERMANENT VEGETATION		
SPECIES	APPLICATION RATES (LBS/AC)	RECOMMENDED APPLICATION DATES
BIRDSFOOT TREFOIL, PLUS TALL FESCUE	8 39	MARCH 1 – NOVEMBER 15
FERTILIZER / SOIL SUPPLEMENT:		
AGRICULTURAL GRADE LIMESTONE	2,000	PRIOR TO SEEDING
FERTILIZER	100-200-200	PRIOR TO SEEDING

TABLE B – TEMPORARY VEGETATION		
SPECIES	APPLICATION RATES (LBS/AC)	RECOMMENDED APPLICATION DATES
ANNUAL RYEGRASS	40	MARCH 1 – NOVEMBER 15
WINTER RYE	168	NOVEMBER 16 – FEBRUARY 28
FERTILIZER / SOIL SUPPLEMENT:		
AGRICULTURAL GRADE LIMESTONE	2,000	PRIOR TO SEEDING
FERTILIZER	100-200-200	PRIOR TO SEEDING

FIGURE 15. Proposed measures for soil stabilization along the Franklin Loop.

WETLAND FUNCTIONS

The Applicant does not specifically identify any significant reduction of wetland functions expected to result from its construction activity in close proximity to the wetlands, as well as from the work within the wetlands themselves along the Franklin Loop, except for reduction of infiltration to groundwater and increased sedimentation of surface waters. The Applicant deems the potential for soil compaction here as insignificant, and offers no mitigation for it. It does not, however, propose any post-construction soil density testing to assure favorable density for revegetation. The Applicant lists certain Best Management Practices it intends to use to reduce erosion and sedimentation into buffers and remaining wetlands during pipeline construction and shows them on its draft drawings. There are no drawings in this application, however, that show (1) post-construction conditions in the ROW, or (2) where the minimum permanently clear zones recommended by FERC or those currently proposed would be located for the Franklin Loop D and other Leidy Southeast pipelines in this ROW, or (3) where the mandatory riparian buffers will be established.

The Applicant did not address wetland functions as specified in 25 ***Pa. Code*** 105.13(d)(3). From careful examination of the locations and reported characteristics of wetlands proposed for impact, Table C was prepared to classify the significance of proposed impacts on wetland functions. The seriousness of the impacts appears to differ from wetland to wetland along the ROW. On the basis of available information, six classes of impact were distinguished to identify the severity of proposed damage. The following paragraphs discuss each class of proposed impact, and to the extent possible from limited available information, the basis for determining the probable severity of impacts on each wetland. The success of functional recovery will depend on the ability of the Applicant to reestablish pre-construction conditions within the ROW. The minimum time required for recovery of functions will depend in part on the size and quantity of any plant materials installed by the Applicant. No time estimates were provided by the Applicant for anticipated natural revegetation by wild scrub and forest vegetation in the restored wetlands, where the Applicant proposes no plantings beyond soil stabilization seeding.

FUNCTIONAL DAMAGE SIGNIFICANCE, BY WETLAND

Wetlands in the Franklin Loop are grouped here into six categories to facilitate concise discussion. The groups range from least significant to most significant according to apparent damages that will result to wetland functions. This discussion of impacts is based on the Applicant's FERC alignment drawings and tables dated February 2014, supplemented by other information in its 2013 application to PADEP.

In general, the Applicant has provided no wetland-by-wetland justification text that demonstrates avoidance or minimization of proposed impacts. It is evident that the Applicant has sought to reduce in various places the extent of clearing additional ROW so as to confine direct wetland impacts of the Franklin Loop in various places to a construction corridor no wider than 75 feet. The new Franklin Loop pipe D is to cross from one side of existing Leidy pipelines to the other and in places to run between the existing Leidy Southeast pipelines to reduce its proximity to existing residences. No additional engineering assessment of possible further reduction of impacts has been made for this discussion. No horizontal directional drilling currently is proposed to minimize potential damages to major streams or large wetlands along the Franklin Loop.

The Applicant included no wetland-by-wetland analysis of wetland functions in its application, only tabulated acreages of anticipated damage. About 15 of the delineated wetlands, representing about 3.5 acres of direct wetland impact along the Franklin Loop ROW, appear already to have reduced ability to perform natural habitat functions because of adjacent human disturbance such as industrial (pipeline) installation and maintenance activities or nearby residential development, chiefly in the community of Blakeslee.

The following discussion assumes that all wetlands have been delineated accurately by the Applicant's consultant. A request for preliminary Jurisdictional Determination (JD) was to have been sought by the Applicant from the Philadelphia District of the Army Corps of Engineers during 2013, but there is no reference to any issued JD, and no revision of wetland boundaries was noted in the February 2014 revision of alignment drawings. Several ponds along the ROW have not been identified as such on the Applicant's drawings. At least two streams are not shown on the Applicant's drawings. One is an unnamed tributary to Two Mile Run about 300 feet northwest of SS-001-018 within WW-001-027; the other stream is adjacent to WW-007-007. Two very small wetlands near WW-001-031 were omitted from the Applicant's drawings.

All streams and wetlands in Pennsylvania are regulated in accordance with the Clean Streams Law, whether or not they are subject to federal jurisdiction as Waters of the United States. Complete soil erosion and sediment control plans were not available for this review, although draft plans were provided with the application. This discussion assumes that the Applicant plans to maintain a 25-foot wide corridor free of woody plants on each side of the proposed Franklin Loop 42" pipe although there is no drawing that shows these clear zone limits, post-construction reclamation or stormwater management plans, or mandatory riparian buffer establishment locations.

Category 1. Unjustified Damage

It is reasonable to expect that the new pipeline itself will encounter some wetlands and wetland buffers, given the number and extent of wetlands along the existing Leidy pipelines ROW. It clearly is impossible both to site the new line alongside the existing lines, as preferred by FERC, and to avoid the existing wetlands that exist there, unless the entire pipeline were to be installed beneath the wetlands by horizontal boring. Boring beneath wetlands and streams has been rejected by the Applicant as a construction practice along the Franklin Loop, although it would appear most appropriate for forested WW-001-036, for WW-001-028 (especially considering the planned boring beneath adjacent Interstate 80), for WW-001-020 and 001-019, for WW-001-016 and 001-014, and for the Lehigh River (SS-001-026).

The Applicant has listed some justification for expanded temporary work areas within FERC buffers to facilitate practical construction activities in its Tables A-1 and A-2 in Appendix A. The Applicant failed, however, to provide any justification for what appears to be permanent encroachment into four small wetlands at the extreme edges of its property at compressor stations (Figure 16).and a pipe storage yard away from the new pipeline itself: **WW-007-006, 007-007, 006-004,** and **013-001**. Three of these wetlands appear to be hydrologically isolated from surface watercourses by intervening uplands (all but WW-007-007).

It would appear that these four wetlands could be avoided entirely, rather than converted permanently to uplands with complete destruction of their wetland functions. The draft soil erosion control plan in fact shows sediment controls around WW-006-004, SS-009-002, and SS-009-001, as if these features were to remain undisturbed. It is difficult to envision successful restoration of functions in these wetlands following pipeline construction. Three would be isolated from natural vegetation and other wetlands. Instead, three of them probably could be surrounded by a 50-foot wide setback against new construction activities as advocated in the FERC guidelines, with no significant impediment to the proposed construction. (At WW-007-006 the adjacent land already is being used for pipe laydown and for roadways at the Applicant's Mount Effort Pipe Storage Yard, Figure 17, but this wetland is outside the proposed limit of disturbance.) Wetland WW-007-007 is adjacent to an unrecognized streamcourse (Figure 18).

Eliminating encroachment into these four wetlands would eliminate the probable direct permanent conversion of wetlands to uplands by a total of 0.20 acre. Preservation of buffers would further reduce the indirect impacts of nearby construction on these wetlands. There is no basis for permit approval to destroy these wetlands in the current application.

FIGURE 16. Compressor Station 515 at northwest end of proposed Franklin Loop. WW-006-004 and WW-013-001 are shown in the corners of the existing cleared area.

FIGURE 17. WW-007-006 in Mount Effort pipe storage yard beyond southeast end of Franklin Loop.

FIGURE 18. Wetland 007-007 near Long Point Road, adjacent to an unrecognized stream at the beginning of the Franklin Loop. This stream has no designated 150-foot wide riparian buffer and was not assigned a segment number.

Category 2. No Direct Damage Expected

Five wetlands appear unlikely to experience direct damage from Franklin Loop construction and will retain some buffering against indirect impacts. These wetlands will experience indirect impacts from nearby construction and ongoing long-term impacts from ongoing pipeline maintenance. Biological habitat functions in these wetlands have been reduced by past Leidy pipeline construction and operation and will be further reduced permanently by the ongoing industrial activity nearby. **WW-001-017** is a small, herbaceous wetland within the cleared ROW of the existing Leidy pipelines, and it is connected with HQ-CWF, MF Tunkhannock Creek. Its proposed minimum buffer is 50 feet wide.

WW-001-033 is a small, mostly herbaceous wetland with localized drainage in an area subject to substantial human disturbance and activity connected with an unnamed tributary of HQ-CWF, MF Stony Run. A 50-foot wide buffer from Franklin Loop construction will be maintained adjacent to it. For isolated 0.05-acre **WW-006-001** the mostly forested buffer will be 250 feet wide. This buffer will be maintained intact.

WW-001-042 is a 0.31-acre, forested wetland currently buffered from the maintained ROW by 30 feet of upland forest. It is connected with an unnamed EV tributary of EV Kendall Creek. Its existing forest buffer will be undisturbed, with no new construction within 75 feet.

WW-001-048 is a very small, herbaceous wetland connected with an unnamed tributary of HQ-CWF, MF Stony Run within a maintained golf course. No pipeline disturbance is proposed within 120 feet of this wetland.

These five wetlands total 0.47 acre. Their general habitat values and recreational value to humans will be reduced during Franklin Loop construction by the general disturbance and human activities nearby. Other likely functional values will be unaffected, if construction ROW conditions are restored post-construction in accordance with FERC guidelines.

Category 3. Setback Damage Expected

Eight numbered wetlands are proposed to have no direct surface disturbance to their total of 1.67 acres, but Franklin Loop construction will occur closer than 50 feet to their Applicant-delineated boundaries. In consequence, several of their current functions will be reduced during pipeline construction---particularly natural biological habitat and recreational values. No information is provided by the Applicant that would allow appraisal of baseline conditions or potential changes in their current functions such as natural drainage, groundwater discharge and recharge, or pollution prevention. The post-construction values of these eight wetlands may be reduced also for decades, depending on the time required for, and eventual success of, any restoration within the buffers performed successfully in accordance with FERC guidelines. Where trees will be replanted in the any currently forested buffers following Franklin Loop construction is not shown by the Applicant. **WW-001-015** is a small, somewhat isolated, herbaceous and scrub wetland within the existing Leidy pipelines ROW, but is only 50 feet from the large and high value WW-001-014. It is to have 20 feet of separation from new construction. **WW-001-018** is a small, forested wetland connected with an unnamed tributary of HQ-CWF, MF Tunkhannock Creek that will have 20 feet of forest buffer separation from new construction instead of its current 85 feet of forest buffer from the existing cleared ROW.

WW-001-023 is a manmade detention basin that extends beyond the Franklin Loop study area and drains to an unnamed tributary of HQ-CWF, MF Tobyhanna Creek (Figure 19). It currently has no

FIGURE 19. WW-001-023 is a manmade detention basin.

separation from maintained parts of the existing pipelines ROW. Construction is proposed within 30 feet of this wetland. Its current stormwater storage functions probably will not be affected.
WW-001-029 is an isolated, emergent herbaceous wetland within the existing pipelines ROW. New construction will encroach within 5 feet of its limits.

WW-001-034 is the lowermost section of an unvegetated artificial impoundment on HQ-CWF, MF Stony Run close to the spillway. It is separated from construction work areas by a minimum of 20 feet consisting largely of existing driveways. The open water of the pond extends for several hundred feet north of the existing Leidy pipelines ROW and is bounded offsite to the north by an extensive scrub wetland complex.

WW-001-037 and WW-001-044 are mostly forested riparian wetlands extending offsite north of the Leidy pipelines ROW and beyond the Franklin Loop study area (Figure 20). Proposed new pipeline work areas will extend up to the limits of the herbaceous margin of WW-001-037 along the already cleared ROW. This wetland was found by the Applicant's consultant to exhibit suitable habitat for bog turtles during 2013, and it directly abuts an EV unnamed tributary of the Lehigh River. Whether WW-007-002 will be surveyed for turtle populations using the Phase 2 protocol of the US Fish and Wildlife Service when Phase 2 surveys are performed during 2014 is not known.

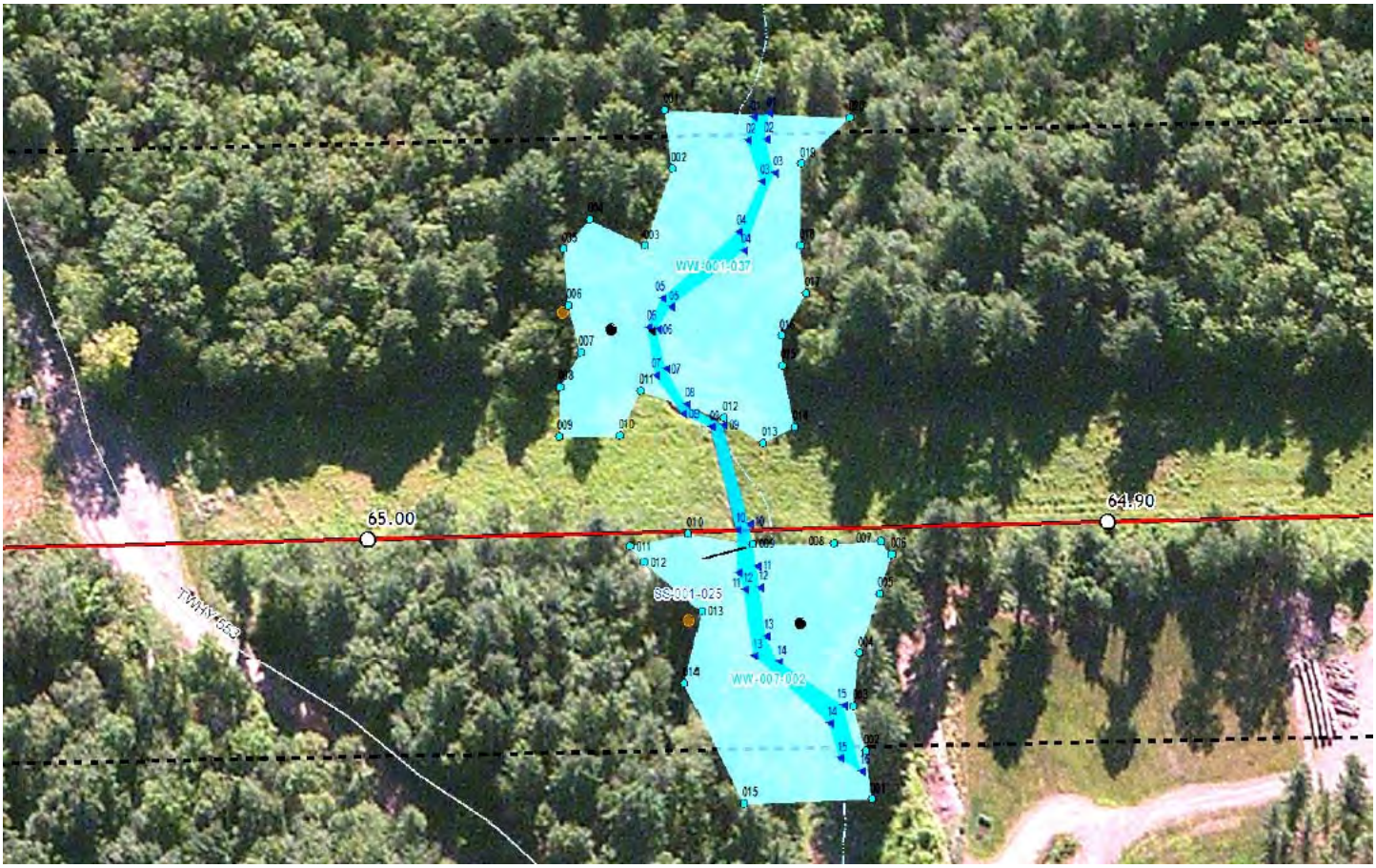

FIGURE 20. Bog turtle habitat exists in WW-001-037 (upper wetland), but WW-007-002 (lower wetland) was not examined in 2013.

At apparently isolated **WW-001-044**, proposed new construction will reduce the forested buffer (currently 30 to 140 feet wide from the maintained ROW) to at minimum 20 feet. Where trees will be replanted in the currently forested buffers following construction is not shown on drawings. **WW-001-049** consists of two small parcels in a maintained golf course. The larger parcel is an artificial pond. These directly abut an unnamed tributary of HQ-CWF, MF Stony Run. New construction will extend up to the delineated wetland margins.

The 36 wetlands where direct impact is proposed (23 in Monroe County, 13 in Luzerne County) all will have construction within their surrounding margins as a result of Franklin Loop construction. The Applicant does not plan to maintain a 50-foot wide setback from these wetland boundaries as specified by FERC. For these 36 wetlands the following paragraphs focus on direct impacts, exacerbated in each case by construction within the adjacent lands outside the delineated wetland boundaries. The Applicant's plans for restoration of forested areas adjacent to directly impacted wetlands are not clearly described.

Category 4. Direct Damage of Minor Concern

Eight wetlands totaling 1.80 acres of damage where probably unavoidable direct construction is proposed for the Franklin Loop appear likely to experience relatively minor damage to their existing functions. That disturbance represents 59% of the combined total area of these eight numbered wetlands within the Applicant's 300-foot wide study corridor. The eight minor-concern wetlands share the characteristics of small size and longtime ongoing maintenance in primarily herbaceous vegetation along the existing pipelines. These include 0.47-acre **WW-001-022** with surface connection to Tobyhanna Creek (where forested segments have been avoided); 0.35-acre **WW-001-024**, which directly abuts an unnamed tributary to Tobyhanna Creek; 0.31-acre **WW-001-035**, which directly abuts Stony Run; and isolated wetlands **WW-006-003** (0.02 acre) and **WW-001-045** (0.24 acre).

WW-001-025 is a 1.05-acre actively farmed, isolated wetland in the community of Blakeslee, partly within the Leidy ROW and partly on private land. The natural habitat functions of this wetland at present are minimal. Similarly, nearby **WW-001-026** is a small, isolated emergent herbaceous wetland in the existing ROW. The adjacent residences reduce the natural habitat functions of which this wetland is capable.

Much farther northwest, **WW-001-050** is an apparently isolated 0.45-acre emergent herbaceous wetland in the existing Leidy pipelines corridor. The Applicant's information suggests that it is 90 feet from a private water supply well, which could place it in the Exceptional Value class. The Applicant has submitted no water quantity or quality testing data for wells along the ROW.

Several of the presumably relatively minor current functions of these wetlands will be reduced during pipeline construction---particularly any natural biological habitat and recreational values that they presently exhibit. No information is provided by the Applicant that would allow appraisal of baseline conditions or potential changes in their current functions such as natural drainage, groundwater discharge and recharge, or pollution prevention. The existing level of functions is likely to be recoverable in these eight wetlands, provided topography, drainage, soils, and native vegetation are replaced as per FERC guidelines. Restoration of their herbaceous wetland vegetation should be relatively rapid (less than 5 years), especially if native plants are installed similar to those lost. The Applicant's plans for restoration of forested areas adjacent to directly impacted wetlands are not clearly described.

Category 5. Intermediate Damage Expected

The eight wetlands where proposed direct damage is expected to be of intermediate significance share several characteristics. They tend to involve proposed wetland forest destruction in relatively small segments of larger wetland corridors that extend outside the Applicant's inventoried Franklin Loop study area. Some are along streams. The natural biological habitat and recreational values of their combined 1.15 acres will be eliminated directly during Franklin Loop construction (40% of their total delineated area) and for many decades thereafter unless and until forest cover is reestablished. The functional values of the 1.26 remaining wetland acres in these parcels outside the limits of direct Franklin Loop construction activities will be reduced by the adjacent encroachment into wetlands and FERC buffers. The Applicant has not shown where it may replant native wetland trees or shrubs. No information is provided by the Applicant that would allow appraisal of baseline conditions or potential changes in the current functions of these wetlands such as natural drainage, groundwater discharge and recharge, or pollution prevention.

WW-001-012 consists of two small parcels (0.09 acre) of riparian wetlands with trees along the banks of Tunkhannock Creek. Trees here apparently are not proposed for destruction, but they are provided no buffers. The forested riparian corridor along the Creek was unbroken prior to construction of the Leidy pipelines.

WW-001-013 is currently completely forested and extends northeast off the Franklin Loop study area. It is buffered from the existing ROW by 25 feet of upland forest. **WW-001-027** (1.21 acres) is mostly forested and has surface connection with Tobyhanna Creek. It was segmented by past Leidy pipeline construction. Isolated **WW-001-030** (0.34 acre) also is forested. There could be no more than 25 feet of ultimate buffer for the remaining forests of these wetlands after construction, if wetland and/or upland trees were planted outside the 25-foot wide clear corridor along each side of the Franklin Loop D pipeline. Reestablishment of a forest canopy will take decades at minimum, and this Applicant has no drawing that shows replanting of disturbed wetlands or buffers outside its required 25-foot clear corridor.

WW-001-032 (0.55 acre) has surface connection with HQ-CWF, MF Two Mile Creek. It is part of a forested wetland extending a few feet offsite into a red spruce palustrine swamp forest, which is a scarce and highly valued ecosystem confined to the Pocono Plateau in Pennsylvania. This ecosystem type is classified as a Special Concern resource by the Pennsylvania Department of Conservation and Natural Resources. This forested wetland was disrupted by prior Leidy pipeline construction. Some wetland forest will be lost here, and the upland forest buffer of the remaining wetland will be reduced substantially. Only 15 feet of buffer upland forest could be established here post-construction outside the 25-foot wide Franklin Loop clear corridor and would require decades to form a forest cover. The Applicant has shown no plan for replanting trees or shrubs here.

WW-007-009 is a topographically isolated, 0.32-acre to the northwest of the cleared ROW. It contains a natural pond and many downed trees.

WW-001-047 (0.35 acre) is another forested riparian wetland extending across and beyond the maintained Leidy ROW abutting both sides of a High Quality perennial unnamed tributary of Stony Run (HQ-CWF, MF). Prior construction has disrupted some of the forest cover here along the existing pipelines. No more than 15 feet of wetland forest could be reestablished here outside the Franklin Loop clear zone, if trees were to be planted post-construction.

Isolated **WW-001-046** (0.11 acre) is currently all forested and buffered by 30 feet of upland forest from the Leidy pipeline ROW. It would be possible to replant 25 feet of wetland forest post-construction, but forest in the adjacent buffer would be precluded by the Franklin Loop clear zone.

Category 6. High Concern Wetland Impacts

Direct impacts proposed to at least sixteen and possibly seventeen directly disrupted wetlands along the proposed Franklin Loop warrant identification as 13.92 acres of damages of high concern. As reported by the Applicant, most of these wetlands exhibit one or more of the criteria identifying wetlands as Exceptional Value in Pennsylvania (25 ***Pa. Code*** 105.17)---criteria which few of the previously discussed wetlands satisfy. The high-concern wetlands tend to be the largest delineated wetlands in the Franklin Loop study corridor, and together they occupy 51.84 acres. Many of them are part of much larger wetland complexes that extend far outside the pipeline study area, as shown by National Wetland Inventory maps and Monroe and Luzerne County soil survey maps. Many of these wetlands have been found by the Applicant's consultant to provide habitat suitable for the Pennsylvania Endangered and Federal Threatened bog turtle (***Glyptemys muhlenbergii***).

Past disturbance of the Leidy Southeast pipelines ROW may have reduced some of the functional values of wetland segments that were cleared for pipeline construction, but the adjacent forested wetlands and even some of the wetlands within the ROW should be at or near the optimal for biological functioning as wetland habitat. No information is provided by the Applicant that would allow a detailed appraisal of baseline conditions or potential changes in their current functions such as natural drainage, groundwater discharge and recharge, or pollution prevention. The high-concern wetlands are discussed in sequence from southeast to northwest along the proposed Franklin Loop, which follows the course of earlier Leidy pipelines and is to encroach outward from the existing ROW.

From developed lands near the Pocono Raceway the Leidy Southeast pipelines extend across 30-foot wide Tunkhannock Creek and through almost unbroken forest in Tunkhannock Township for 3 miles to Tobyhanna Creek and the community of Blakeslee (Figure 21). Interstate 80 crosses this section of the pipeline corridor. The Nature Conservancy and Tunkhannock Township Fern Ridge Bog Preserve lands comprise 7.86 acres along 0.6 mile within the Franklin Loop ROW. But for the prior disturbance by the Leidy pipelines, the four numbered wetlands (5 delineated parcels**:** WW-001-014, WW-001-016, WW-001-019, and WW-001-020) within the Preserve section of ROW would be expected to exhibit the maximal functions of high-elevation, unfragmented forest wetlands. (WW-001-015 and 001-018, also within the Fern Ridge Bog Preserve, were discussed above in the section on Setback Damage Concerns.)

Between this Nature Conservancy Preserve and Interstate 80, **WW-001-014** (2.35 acres) and **WW-001-016** (1.11 acres) are mostly forested wetlands extending beyond the Franklin Loop study corridor in both directions. The former abuts an unnamed tributary of Tunkhannock Creek directly, and the latter probably has surface connection to a Tunkhannock tributary offsite. The Leidy pipelines ROW here was disturbed for prior pipeline construction for a width of about 125 feet. The wetland vegetation within the ROW of WW-001-014 has begun to recover as palustrine scrub (PSS). It is part of a corridor of at least 20 acres of forested wetland extending mainly to the east of the pipeline corridor within the 1,200-acre Fern Ridge Bog Preserve at Adams Swamp property of The Nature Conservancy. This relatively undisturbed example of boreal conifer and acidic shrub swamp occupies a glacial kettle lake which gradually filled after the ice sheet melted but still supports plants typical of more northern habitats. The Applicant's consultant found habitat suitable for bog turtles in the onsite section of this wetland and classified WW-001-014 as having Exceptional Value (Figures

FIGURE 21. Southern section of Franklin Loop corridor. Pocono Raceway at extreme right.

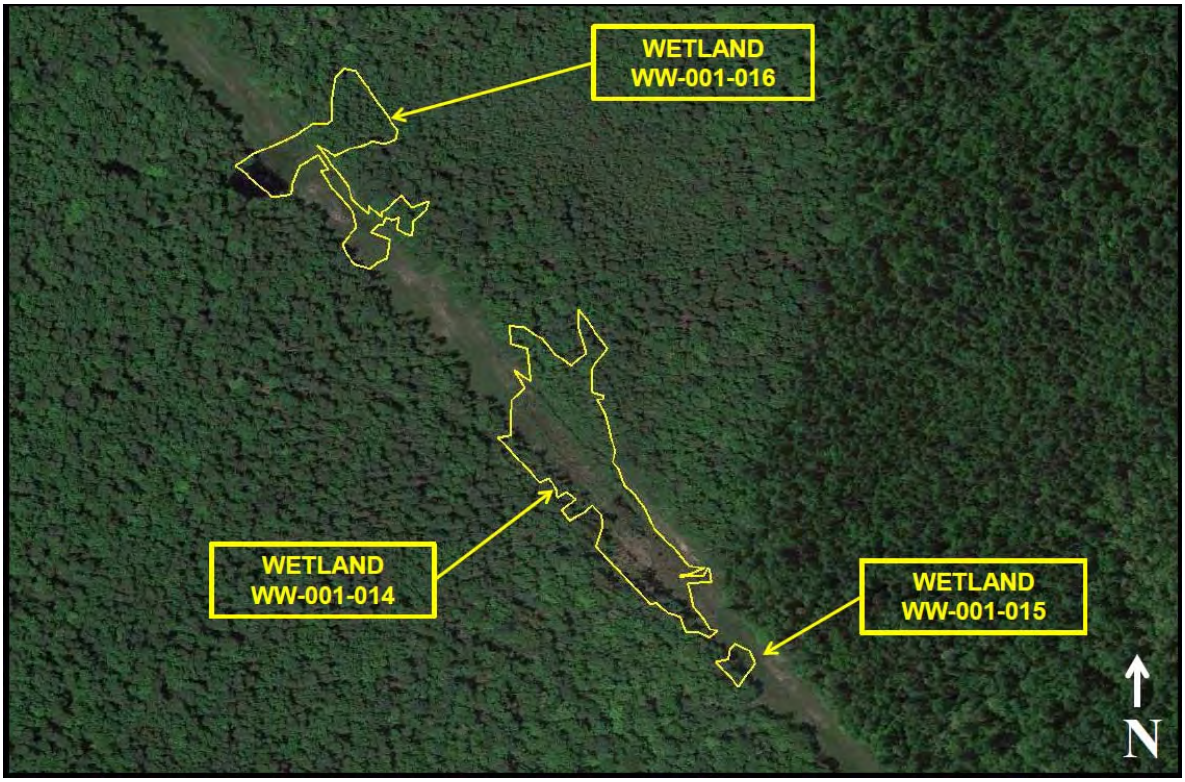

FIGURE 22. Aerial view of WW-001-014, -015, and -016.

FIGURE 23. PSS/PEM (left) and PFO (right) in WW-001-014.

22 and 23). The corridor of which WW-001-016 is a part extends across the pipeline study corridor and continues to the north as another major forested wetland within the Fern Ridge Bog Preserve. There are unrecognized ponds along the southwestern margin of the study area in WW-001-016 and 001-017 (Figures 22 and 24).

WW-001-019 is a 0.4-acre emergent wetland abutting an unnamed tributary of Tunkhannock Creek within the cleared Leidy Southeast pipelines ROW. It drains to the north through SS-001-049, and there is an unrecognized pond along the southwestern margin of the study area in WW-001-019.

FIGURE 24. Unbuffered pond at WW-001-016 in the Fern Ridge Preserve, as photographed by Applicant's bog turtle consultant.

WW-001-020 (3.71 acres) is part of a much larger scrub and emergent wetland that forms a major forested wetland corridor abutting an unnamed tributary of Tunkhannock Creek. Both these wetlands also are within The Nature Conservancy's Fern Ridge Bog Preserve and were reported by the Applicant's consultant to provide habitat suitable for bog turtles in 2013. The Applicant classified WW-001-020 as Exceptional Value (Figure 25).

WW-001-021 consists of three parcels (0.81 acre) within the Leidy pipelines ROW northwest of the Fern Ridge Bog Preserve and southeast of Interstate 80. This is a forested landscape unbroken but for the ROW. This wetland complex supports emergent herbaceous vegetation and abuts an unnamed tributary of Tunkhannock Creek. It was described by the Applicant's consultant as providing suitable bog turtle habitat in 2013.

WW-001-028 (14.45 acres) is to undergo the largest single expanse of direct wetland damage (4.27 acres) along the proposed Franklin Loop. This wetland abuts an unnamed tributary of Tobyhanna Creek. It begins just north of Interstate 80 and extends for about 2,000 feet along the ROW (Figure 26). A mixture of scrub and emergent herbaceous vegetation has occupied virtually the entire cleared ROW of the Leidy pipelines. The forested wetland corridor crossed by the ROW extends

FIGURE 25. Applicant's Exceptional Value Wetland WW-001-020 in the Fern Ridge Preserve, as photographed by the Applicant's wetland consultant.

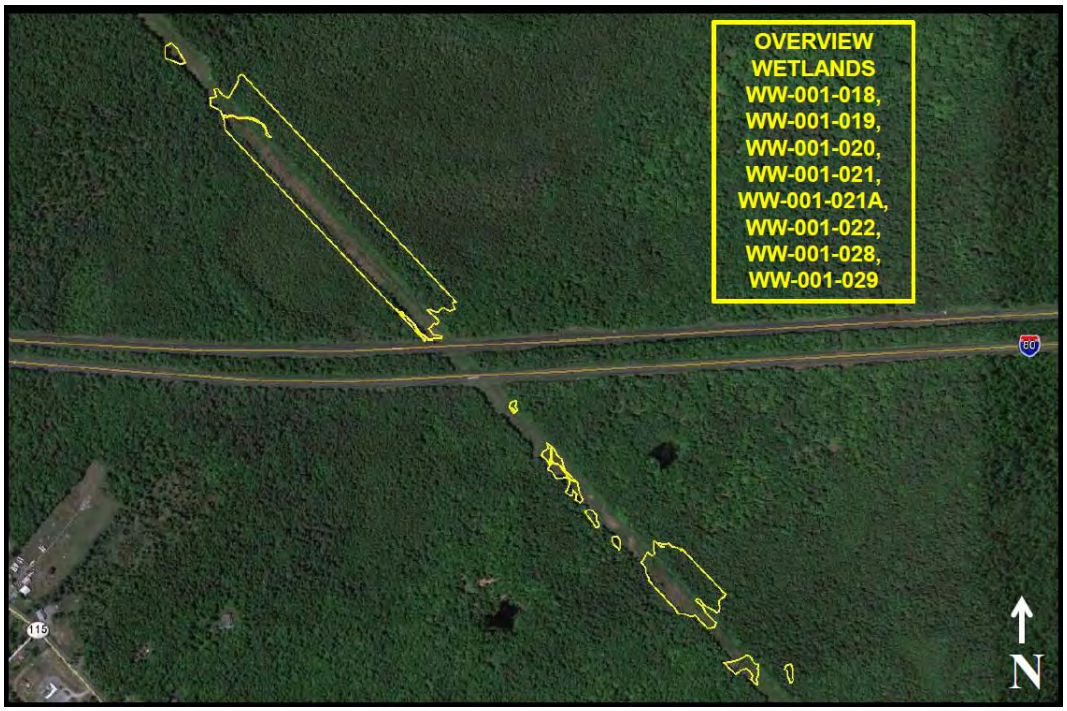

FIGURE 26. Wetlands along the Franklin Loop corridor near Interstate 80.

offsite in both directions and occupies more than 70 acres. The pipeline study area wetlands were described by the Applicant's consultant as habitat suitable for bog turtle in 2013. The Applicant classified WW-001-028 as Exceptional Value. The unbroken forest (save for the pipeline ROW) continues northeast beyond WW-001-028 about 0.8 mile to 70-foot wide Tobyhanna Creek.

FIGURE 27. Wetlands along Franklin Loop corridor in Blakeslee, Tobyhanna Township, Monroe County, Pennsylvania.

FIGURE 28. View northwest into WW-001-036. The corridor has been reoccupied by closed canopy wetland forest beyond the investigators (May 2014). Forest apparently can be tolerated on the ROW.

Northwest of Tobyhanna Creek the pipeline ROW passes through the community of Blakeslee, where there are numerous residences within 200 feet of the existing and proposed pipelines in Tobyhanna Township (Figure 27). The ROW then passes through the edge of another mostly forested wetland complex that extends offsite to the north and east. Here the Applicant's consultants delineated four parcels of **WW-001-031** (3.13 acres), through which passes Two Mile Run (SS-001-021), an HQ-CWF, MF stream. This delineated wetland supports emergent herbaceous vegetation and is within a game propagation and protection area registered by the Pennsylvania Game Commission. Small areas of existing wetland were omitted from the Applicant's drawings just south of boundary flags 0039 and 0040 as well as flags 065 and 066.

WW-001-036 is the largest existing wetland (17.27 acres) in the Applicant's Franklin Loop study corridor. The 2,000-foot long wetland section of 100-foot wide ROW of Leidy pipelines is largely continuous forest, with only small areas of scrub (Figure 28). It is surrounded on both sides by primarily wetland forest beyond the study corridor limits forming a forested wetland area of at least 30 acres. It may be connected with surface watercourses outside the Franklin Loop study corridor. The Applicant's consultant found habitat suitable for bog turtles here during 2013, and the Applicant listed this wetland as Exceptional Value.

WW-007-002 (0.45 acre) and **WW-001-037** (0.66 acre) occupy the forested banks of an unnamed EV tributary to the Lehigh River. This forested riparian wetland corridor was severed by the Leidy pipelines to form these two numbered wetlands. Some emergent herbaceous vegetation has become reestablished, and there is some non-wetland in the associated section of ROW. As riparian wetlands within the default 100-foot wide floodplain along an EV Pennsylvania stream not mapped by the Federal Emergency Management Agency (FEMA), these are EV wetlands. The Applicant's herpetological consultant found habitat suitable for bog turtles in WW-001-037 during 2013, but did not examine WW-007-002 just downstream to the west (Figures 20 and 29). The February 2014 drawings show direct impact proposed in WW-007-002, but not in 001-037. (The latter wetland would be affected by loss of buffer, as discussed above.)

WW-001-038 (0.65 acre) is an elongate wetland that parallels the Lehigh River within its FEMA-mapped floodplain (Figures 29 and 30). It is forested, except where emergent herbaceous vegetation has become reestablished after pipeline construction. Situated within the floodplain of an EV watercourse (the Lehigh River), this is an Exceptional Value wetland. Its functional values can be presumed to be high. The adjacent Lehigh River is a 55-foot wide, EV stream that hosts wild trout populations. It forms the boundary between Monroe and Luzerne Counties.

Across the Lehigh River in Buck Township, Luzerne County, the Leidy pipelines ROW extends westward from the bank of the Lehigh River for about 3 miles through almost unbroken forest. **WW-001-039** (0.94 acre) is forested, except where emergent herbaceous vegetation has established after pipeline construction. The eastern section of this wetland, within the floodplain of an EV stream (the Lehigh River), is an EV wetland (Figure 30). Its functional values can be presumed to be high.

FIGURE 29. WW-01-036 is at lower right; Lehigh River and WW-001-038 are at upper left. WW-001-037 is in center, south of Township Route 553. The adjacent WW-007-002 is not shown on this graphic from the Applicant's 2013 bog turtle survey report.

WW-001-040 is another riparian wetland delineated by the Applicant as 2.56 acres along both sides of an unnamed EV tributary of the Lehigh River (Figure 31). It continues offsite to the south of the Franklin Loop study corridor. This wetland is forested except where prior pipeline construction has resulted in emergent herbaceous and scrub vegetation. Its functional values can be presumed to be high.

WW-001-041 is a 1.05-acre forested wetland abutting an EV tributary of EV Kendall Creek. It is forested, except for the 100-foot wide corridor that supports emergent herbaceous vegetation as a result of past pipeline construction. Its functional values can be presumed to be high, and it qualifies as an EV wetland.

FIGURE 30. View northwest across WW-001-038, the Lehigh River, and WW-001-039. Bluff in foreground drops steeply; Franklin Loop D pipeline stakes at left. The hillside rises steeply in Luzerne County (background) beyond wetlands in the Lehigh River floodplain (May 2014).

WW-009-002 is another completely forested EV wetland of 1.99 acres, which extends for several hundred feet offsite to the south from the Franklin Loop study corridor. This wetland extends along both sides of upper Kendall Creek, an EV stream that flows to the Lehigh River. It is separated from 1.39-acre **WW-001-043** only by the 20-foot wide road through the center of the Leidy pipelines ROW (Figure 32). WW-001-043 also is forested except for land maintained as emergent herbaceous vegetation in the existing pipelines corridor. The functional values of these wetlands can be presumed to be high.

WW-009-001 is 1 acre delineated at the northern end of a major wetland extending hundreds of feet to the south of the Franklin Loop study corridor. It is crossed by several tributaries of Stony Run, an HQ-CWF, MF stream (Figure 33). Its vegetation is primarily scrub, and it was classified as an Exceptional Value wetland by the Applicant. Its functional values can be presumed to be high.

The Applicant did not provide any assessment of the Franklin Loop construction as a cumulative whole on wetland resources in the extraordinarily sensitive ecosystems that surround this ROW. activities many hundreds of feet away (Houlahan ***et al***. 2006). Impacts on streams were not detailed, although many feet of streamcourse likely will be permanently impacted like SS-001-016 was by earlier Leidy pipelines along the Franklin Loop (Figure 34).

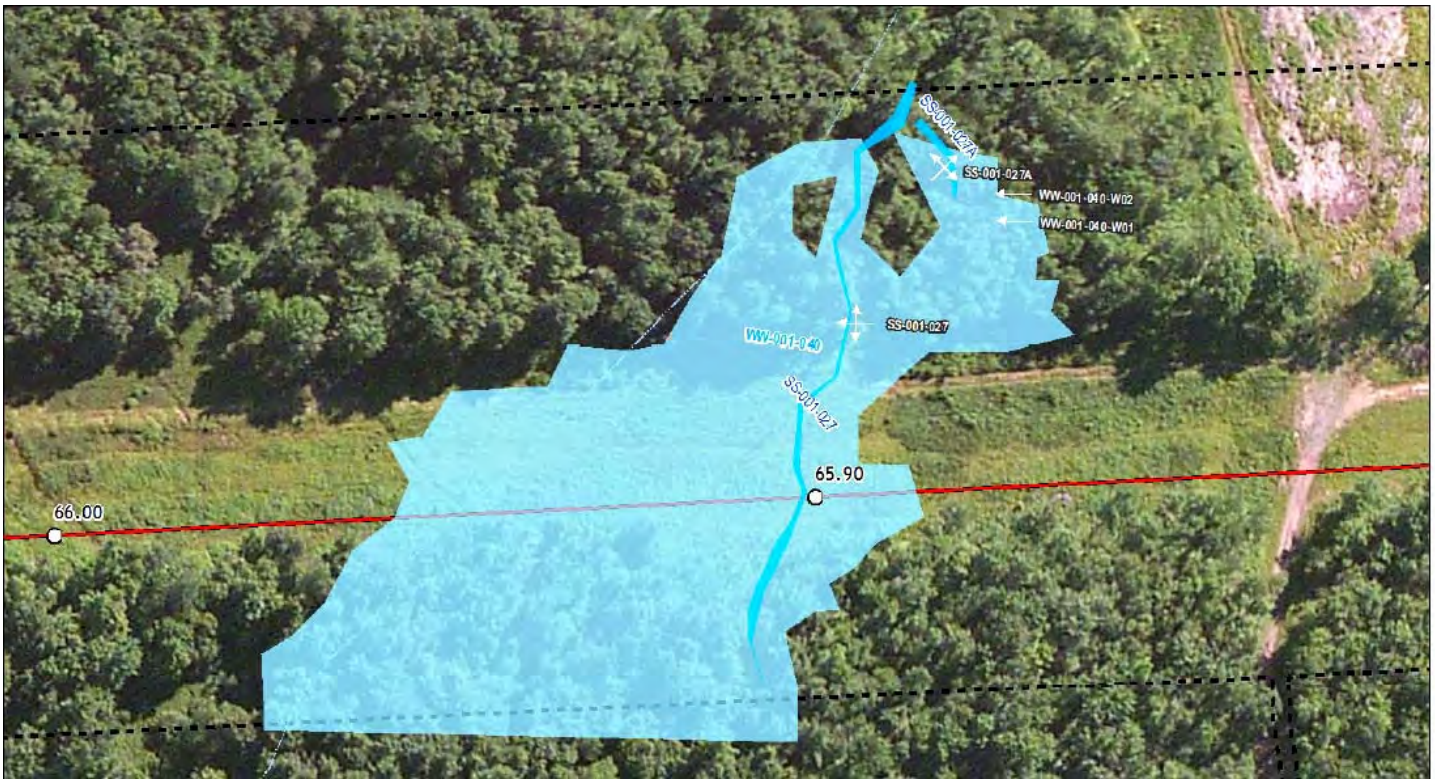

FIGURE 31. Wetland WW-001-040 along EV tributary (SS-001-027) to the Lehigh River.

FIGURE 32. Wetlands WW-001-043 (above) and WW-009-002 (below) with EV tributary SS-001-029 to Kendall Creek.

FIGURE 33. Wetland WW-009-001 extends offsite to the southwest of the Franklin Loop study area.

FIGURE 34. Part of a 1,700-foot long watercourse labeled SS-001-016 by the Applicant's wetland consultant. This channelized feature is not discussed in the application, but is labeled an unnamed tributary to Tobyhanna Creek and assigned a riparian buffer on the soil erosion drawings. View across existing Leidy pipeline ROW is toward embankment of WW-001-023.

The Applicant also did not address any additional impacts that would be induced by the Franklin Loop, which is intended to receive gas from new shale gas wells by way of new gathering pipelines.

PROPOSED MITIGATION

The Applicant has proposed offsite mitigation for its intended damage of wetlands during construction of the Franklin Loop. The mitigation also could be proffered to serve as partial compensation for proposed construction with earth disturbance within the 150-foot wide riparian corridor at 33 (actually at least 35) Special Protection streams, but apparently is not. It is not possible to ascertain whether the Applicant plans to maximize restoration of wetland functions along the Franklin Loop ROW post-construction. Wetland areas outside the clear zone are to be “allowed” to revegetate naturally. Some buffer areas apparently are to be replanted with forest trees, but parts of the riparian areas are proposed to be kept free of trees and shrubs permanently. No post-construction stormwater management plan shows where these measures will be employed. The application states that the Applicant plans to remove and restore its proposed access roads following Franklin Loop construction.

The planned disturbance to 33 Special Protection streams will destroy 4,138 linear feet of streambed (1.20 acres per mitigation plan narrative; 1.1 acres per Applicant’s Table A-1 of Appendix A1) plus virtually all the existing vegetation along 8,276 linear feet of Special Protection (EV and HQ) stream banks. This would represent 9.5 acres of 50-foot wide FERC buffer along the banks of Special Protection streams. The streambeds are to be returned to some semblance of their original physical condition per FERC drawing details. No mitigation is proposed for these construction activities in waters of the United States. No preconstruction stream inventory was made, and there is no proposed monitoring to demonstrate the successful restoration of the streambeds post construction.

The Applicant states that five of its affected wetlands and nine affected streams are designated Exceptional Value, the highest use category in Pennsylvania and the equivalent of Tier 3 Outstanding National Resource Waters in the language of the federal Clean Water Act. As indicated in Table B, 15 of the directly affected wetlands meet one or more PADEP EV criteria. Nine of these EV wetlands will experience permanent loss of existing forest and/or scrub vegetation. At least 3 “other” wetlands will have permanent conversion of woody vegetation.

The Applicant’s mitigation plan appears to have been prepared independently of any analysis of the damages to wetland functions along the Franklin Loop. It appears to be premised on acres of wetlands disturbed “temporarily” and acres of offsite wetlands to be “enhanced”.

The proposed mitigation site is 30 miles from the Franklin Loop on the Bleiler Farm in a rural section of Lehigh County (Figure 35). The plan proposes to dedicate a 16.44-acre riparian zone permanently to conservation uses (Figure 36). The width of the conservation area varies from about 30 to 340 feet along 1,500 linear feet of Switzer Creek plus 3,000 linear feet of two unnamed tributaries, all designated HQ-CWF, MF streams. Within the conservation easement the Applicant proposes to plant 56 trees and 104 shrubs in clumps along approximately 2,000 linear feet of streambank on one side of the watercourses where there currently are wetlands (Figure 37). The plantings are to affect 7.99 acres of existing "degraded floodplain wetlands" already reverting to scrub through natural succession (Figure 38). The mitigation report narrative addresses only wetlands, not stream buffers.

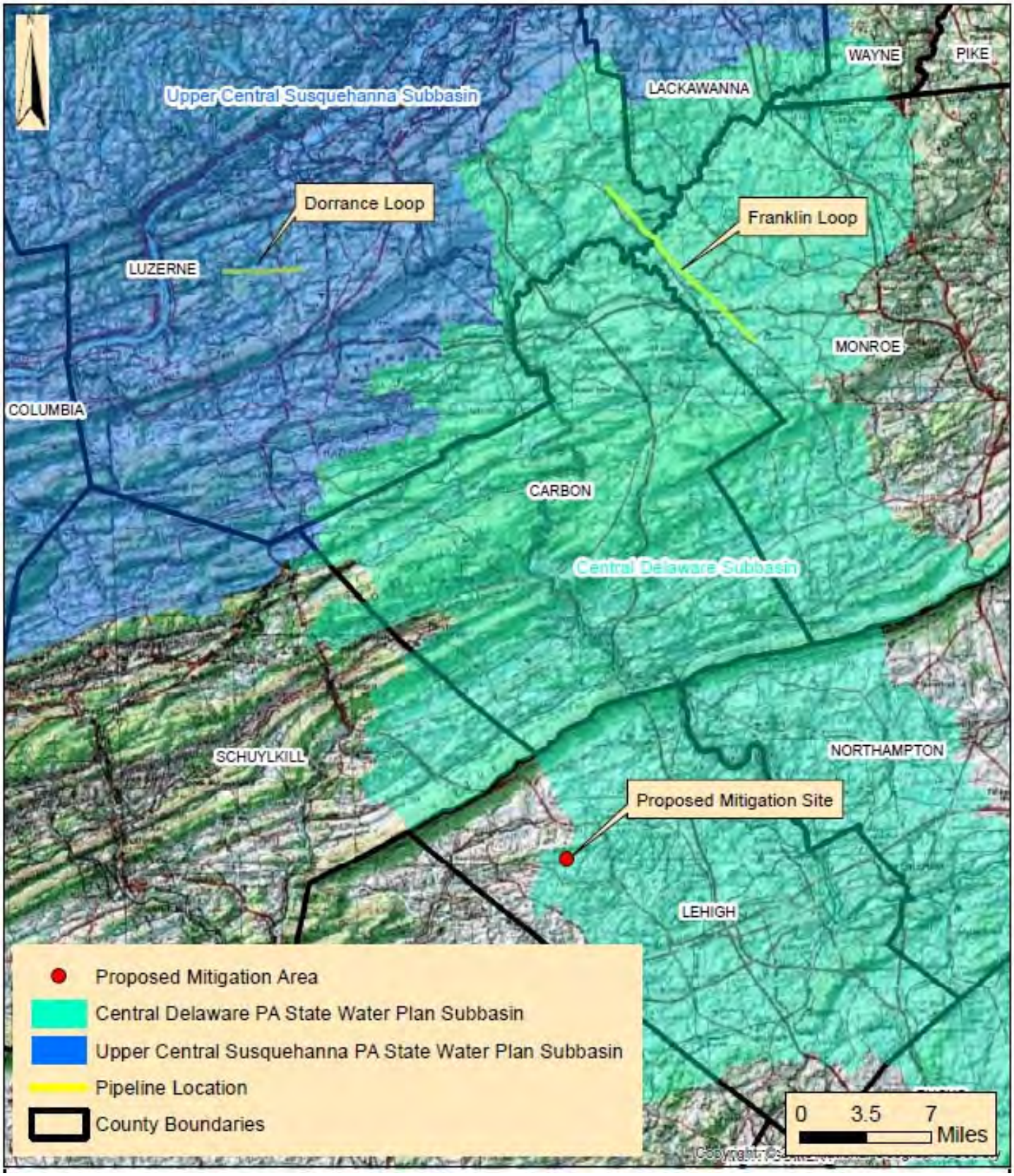

FIGURE 35. Location of Applicant's proposed mitigation site in Lehigh County for damage along the proposed Franklin and Dorrance Loops of the Leidy Southeast pipeline expansion in relation to the pipeline corridors in Monroe and Luzerne Counties.

FIGURE 36. Extent of proposed conservation easement for Franklin and Dorrance Loops mitigation during Leidy Southeast pipeline extension, Bleiler Farm, Lynn and Weisenberg Townships, Lehigh County, Pennsylvania. Switzer Creek flows from southwest to northeast across the central section of the photograph.

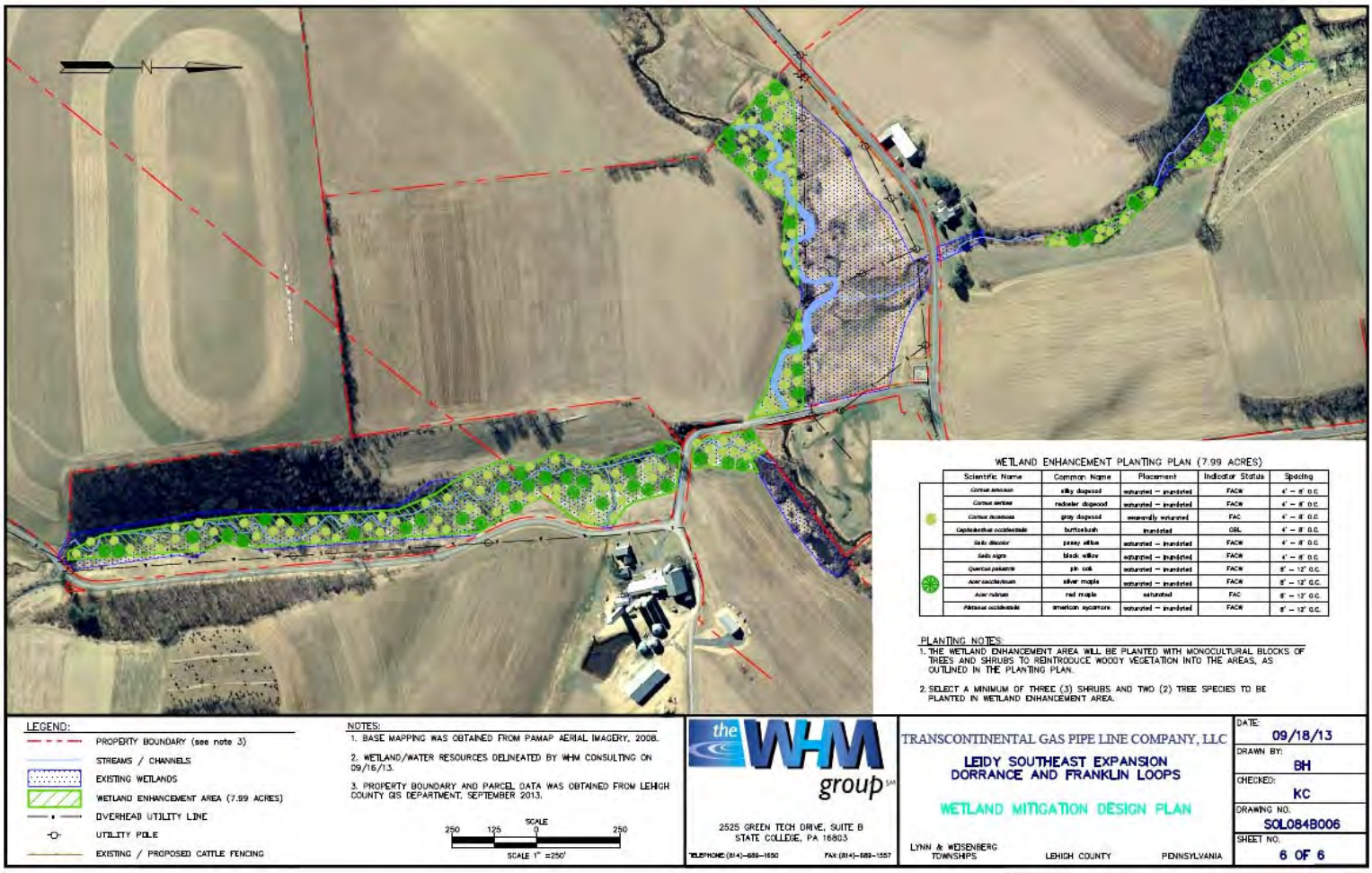

FIGURE 37. Applicant's proposed wetland mitigation plan, Bleiler Farm, Lehigh County, Pennsylvania. Ross Valley Road is at left; Bausch Road parallels Switzer Creek in the center of the view in the upper section of the drawing. Homestead Road is at the center bottom.

The plan claims to convert sufficient existing offsite herbaceous wetland vegetation at the Bleiler Farm eventually into scrub and forest wetland vegetation to provide 2:1 acreage for scrub wetlands converted permanently to herbaceous and 3:1 acreage for forest converted to herbaceous vegetation along the Franklin Loop. In addition, about 11.37 acres of "temporary" destruction of pipeline wetlands will continue for an indefinite period until the unassisted but "allowed" natural revegetation of these areas occurs.

The measurements reported in Table B suggest that the proffered 8 acres of offsite herbaceous wetland "conversion" at the Bleiler Farm would be 5 acres "short" of achieving the Applicant's claimed ratios (3 x 1 ac = 3 ac PFO converted + 2 x 5 ac = 10 ac PSS converted = 13 ac total needed). The Bleiler Farm conservation easement is to be fenced against entry by livestock. There is no mention of a Jurisdictional Determination having been sought or secured for the mitigation area. All of the existing mitigation area wetlands apparently are "other" wetlands (not Exceptional Value), as defined by PADEP. No wetland expansion is proposed at the Bleiler Farm by either wetland restoration or creation.

If the mandatory 150-foot wide Chapter 102 riparian buffer along Special Protection waters were considered, the direct riparian buffer would incur at least 28.5 acres of impact. The Applicant does not show where any wetland or upland riparian buffers are to be dedicated or replanted along the

streams of the Franklin Loop ROW. The opportunity to plant and dedicate stream buffers onsite---everywhere except within the approximately 50-foot wide clear zone for the D pipeline and whatever clear zones are needed for the older Leidy pipelines---appears not to have been taken.

The Applicant's photos and airphotos show no apparent degradation in the existing wetlands on the Bleiler Farm north of Werleys Corner apart from a few invasive autumn olive (***Elaeagnus umbellata***) shrubs needing removal. According to PADEP (2014) 1.9 miles of Switzer Creek and both its onsite Unnamed Tributaries 26291865 and 26292199 generally attain at least one designated use. A Total Maximum Daily Load limitation was listed in 2011as necessary for 3.64 miles of Switzer Creek currently degraded by habitat alteration and agricultural siltation affecting aquatic life. No data were provided in the mitigation report on the existing (attained) use of these waterways within the conservation easement. The mitigation report says the wetlands on the Bleiler Farm already are reverting to scrub with dogwoods and willows as a result of natural succession (Figures 38 and 39). The southernmost Bleiler wetland (#4) along the road where 2013 data were collected is said to have a 20% cover of purple loosestrife (***Lythrum salicaria***), a pretty but invasive non-native herbaceous plant, which is to be removed.

FIGURE 38. Proposed riparian wetland enhancement area along Switzer Creek on the Bleiler Farm.

FIGURE 39. View north along Ross Valley Road in 19 May 2012 photograph from Google Earth. Wetlands in Applicant's Wetland 4 are beginning to attract shrubs and trees along Unnamed Tributary 26292199. The riparian forest at far left is not to be protected by conservation easement, which also does not include the cultivated field between the road and the wetland. A 150-foot wide riparian buffer would extend to the roadway.

The Applicant does not identify any specific wetland functions that will be enhanced at the mitigation site or compare them with functions lost along the Franklin Loop. About 4,350 linear feet of Lehigh County streambanks appear to be slated for "improvement" by planting the 56 trees and 104 shrubs in existing wetlands, counting each side of the streams separately. The breakdown is 375' along one side of a Switzer Creek segment in Wetland 1; 1,050' along both sides of a segment of UNT 03529 (Applicant's UNT #1) in Wetlands 2 and 3 north of Switzer Run; and 2,100' of UNT 03530 (Applicant's UNT #1) south of Switzer Run (Figures 37 and 39). No plantings are proposed by the Applicant in

most of Wetland 1 or in Wetland 5 at the Bleiler Farm. At the PADEP-recommended riparian forest planting rate of one tree or shrub per 100 square feet, the Applicant's proposed planting of 160 individual trees and shrubs would revegetate about 0.4 acre of streambank buffer (107 linear feet or 54 feet if along both sides of the stream).

Switzer Creek water flows into Jordan Creek, whose waters join Little Lehigh Creek briefly before entering the lower Lehigh River en route to the Delaware River. The two unnamed tributaries within the conservation easement are small-watershed headwater streams, but (like Switzer Creek itself here) are over the 100-acre drainage area waiver threshold [25 ***Pa. Code*** 105.12(a)(2)] and thus theoretically subject to PADEP protection from unauthorized alteration by future obstructions and encroachments into the watercourses. To the extent that a conservation easement would be beneficial in preserving the stream corridors here against further narrowing in the future, downstream water quality may benefit in the lower Lehigh and Delaware Rivers. As currently proposed, the easement would protect very little of the existing riparian forest on the Bleiler Farm.

If stream protection at the Bleiler Farm locally, as well as in the Lehigh/Delaware River watershed, were a primary objective of proposed mitigation, it would appear preferable to dedicate, fence, and plant new wetland or upland forest buffers outside the existing wetlands on the Bleiler Farm. Such measures could yield a minimum 150-foot wide wooded strip between the active cornfields and any adjacent wetlands and streambanks on both sides of the streams (as mandated by Chapter 102 regulations) and demonstrate a serious effort to mitigate Franklin Loop damages and maximize water resource protection at the Farm to the benefit of Switzer Creek and its tributaries. Instead, seedling trees and shrubs of unspecified, presumably small size chosen from a list of several native species are to be inserted into the herbaceous wetlands that have been protecting the streams here already for many decades.

There is no proposed expansion of forested riparian buffers along the cultivated fields at the Bleiler Farm---where row crop farming comes as close as 10 feet to the stream channels (as can be seen in Figures 36 and 37). If the conservation easement were widened to encompass 150 feet minimum along both sides of the identified segments of the Bleiler Farm streams, its area would be more than doubled. The existing riparian forest areas here could be afforded easement and maintenance protection, which the current plan does not, and the missing forest could be planted and maintained along currently barren segments of stream bank. There appears to be considerable opportunity to expand the easement along Switzer Creek, if additional wetland impacts or riparian buffer from the Franklin Loop were to be mitigated here. Substantial additional planting of trees and shrubs would be necessary, at the PADEP (2010) recommended rates of 435 trees per acre on 10-foot centers in 50-foot wide Zone 1 (directly next to the stream) and 435 trees and shrubs per acre on 10-foot centers in 100-foot wide Zone 2, to provide eventual functioning forested riparian buffers for the streams of the Bleiler Farm.

Mitigation here in the Great Valley farmlands of Lehigh County will do nothing for the Pocono Plateau resources of Monroe and Luzerne Counties, which not only are 30 miles away, but are in forested high-elevation headwaters at 900 to 1,400 feet higher elevation than the proposed mitigation site (Figure 40). The Bleiler Farm is at about 575 feet elevation and is 6 miles south of Blue Mountain, in a very different physiographic region than the Franklin Loop. UNT 03529 (Applicant's #1) drains a small watershed, of which more than half supports forest on Shochary Ridge (Figure 40). Neither UNT 03530 (Applicant's #2) nor the Switzer Creek watershed today has as much as 20% forest cover. The damaged high-elevation headwaters include 7 Exceptional Value streams, of which there

FIGURE 40. Context of the proposed mitigation area at the Bleiler Farm on US Geological Survey topographic basemap. The conservation easement is outlined in red.

are none at the Bleiler Farm site; all the rest of the streams are designated HQ-CWF, MF in both the impact and mitigation areas.

No mention of any biological resources appeared in the Pennsylvania Natural Diversity Inventory database query results for 24 acres of the Bleiler Farm that were checked by the Applicant's consultant. No claim of existing bog turtle habitat or potential habitat for bog turtles to be created is made for the Bleiler Farm easement. The proposed plant species for installation here are not those unique to the Pocono plateau. It will take close to a century for planted trees to offer habitat for Indiana bats whose forested habitat is being lost along the pipeline.

The Applicant could be putting back wetlands onsite where they previously were destroyed when constructing the poorly sited earlier Leidy pipelines, and then planting shrubs and trees not only where they were removed to install the new Franklin Loop pipe D, but also for land previously damaged for other pipes outside the minimum areas that must be kept open for pipeline maintenance. Already some scrub and herbaceous revegetation has been allowed within the Leidy pipelines ROW, much of which will be disrupted again during Franklin Loop D line construction (Figure 28).

Given the extraordinary natural resources proposed for damage, it would be wise to restore maximally what was damaged, putting land back into wetlands and reconnecting now-fragmented wetland parcels in the Pocono ecosystem traversed by the Franklin Loop. There is no offer to plant any native wetland or upland vegetation along the Franklin Loop, but only to "allow" revegetation by wild plants naturally. So why not also "allow" easement-protected Bleiler Farm wetlands also to continue to revegetate naturally? They already are well on their way toward natural succession to woody vegetation and are protecting the streams a bit in the process. To mitigate water quality damage, the Applicant needs at minimum to plant new riparian forest buffers along both the Franklin Loop pipeline streams and wetlands and along streams at the Bleiler Farm---permanently dedicated areas of existing or future forest land along the streambanks.

ACKNOWLEDGMENTS AND AUTHORSHIP

The authors express appreciation to several landowners along the Franklin Loop ROW who allowed us to inspect site conditions. Many of the drawings and photographs presented here are excerpted from the Williams Transco Franklin Loop 2013 and 2014 documents submitted to PADEP: Figures 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 ,13, 14, and 15 from application drawings; Figures 16, 17, 18, 19, 20, 23, 25, 31, 32, 33, and 34 from the wetland and stream delineation report; Figures 21, 22, 24, 26, 27, and 29 from the bog turtle consultant Phase 1 report; and Figures 35, 36, 37, 38, and 40 from the wetland mitigation report. Figure 39 is from Google Earth.

This report was prepared by James A. Schmid, a biogeographer and plant ecologist, with the assistance of Stephen P. Kunz. Dr. Schmid received his BA from Columbia College and his MA and PhD from the University of Chicago. After serving as Instructor and Assistant Professor in the Department of Biological Sciences at Columbia University and Barnard College, he joined the environmental consulting firm of Jack McCormick & Associates of Devon, Pennsylvania. Since 1980 he has headed Schmid & Company of Media, Pennsylvania.

Dr. Schmid has analyzed and secured permits for some of the largest wetland mitigation projects in the mid Atlantic States, as well as a myriad of smaller projects. He is certified as a Senior Ecologist by the Ecological Society of America, as a Professional Wetland Scientist by the Society of Wetland Scientists, and as a Wetland Delineator by the Baltimore District, Army Corps of Engineers. He has

served on the professional certification committees of the Ecological Society and the Society of Wetland Scientists.

When the US Fish & Wildlife Service Pleasantville Office evaluated actual compliance with approval conditions requiring mitigation by about 100 of the Clean Water Act Section 404 fill permits issued by the Corps of Engineers in the State of New Jersey during the period 1985-1992, every Schmid & Company mitigation project was judged in the field to exhibit full compliance with all permit requirements and mitigation goals. Schmid & Company mitigation projects represented 21% of all the mitigation projects judged fully successful in New Jersey by USFWS in its written report to USEPA. Dr. Schmid analyzed and secured Wetland Mitigation Council approval for the first major freshwater mitigation bank in New Jersey on behalf of DuPont. That bank was donated to The Nature Conservancy. Dr. Schmid often lectures and publishes on environmental assessment and mitigation, drawing on examples from his continuing practice when securing permit approvals.

Dr. Schmid has often analyzed environmental regulatory programs and commented on proposed regulations. His clients continue to include the construction industry, conservation groups, and government agencies, including the Pennsylvania Department of Environmental Protection.

Mr. Kunz has been employed as an environmental consultant since receiving his bachelor's degree in human ecology from Cook College, Rutgers University. He is certified as a Senior Ecologist by the Ecological Society of America, as a Professional Wetland Scientist by the Society of Wetland Scientists, and as a Wetland Delineator by the Baltimore District, Army Corps of Engineers. Mr. Kunz has worked with Dr. Schmid on many projects for more than 35 years.

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Table B. Wetlands Impacted Directly by Proposed Franklin Loop 42" D Pipeline, Transco Williams Leidy Southeast Expansion, Monroe and Luzerne Counties, Pennsylvania

Wetland ID No.	Mile Post	Applicant Claimed NWI Class	Schmid NWI Class (Existing)	Applicant PA Wetland Class	PA Wetland EV Criteria Met	Applicant Total Wet. Disturbance (acres)	Applicant's Claimed Direct Impacts: Applicant Tree Line	PEM (acres)	PFO Perm. (acres)	PFO Temp. (acres)	PSS Temp. (acres)	Schmid Estimated Direct Impacts: PEM (acres)	PFO Perm. (acres)	PFO Temp.(?) (acres)	PSS T & P. (acres)	
Monroe County (23 numbered wetlands)																
007-006	54.55	PEM	PEM	O		0.08		0.08				0.08				
007-007	57.48	PEM	PEM	O		0.01		0.01				0.01				
001-012	58.41	PEM	PFO, PEM	O		0.01		0.01				0.01				
001-013	58.54	PFO	PFO/PSS/PEM	O		0.06	Tree Line		0.02	0.04				0.06		
001-014	58.86	PSS	PFO/PSS/PEM	**EV**	BT, P	**0.78**	Tree Line				0.78		0.06	0.23	0.49	
001-016	58.99	PEM	PFO/PSS/PEM	O	BT, P	0.36	Tree Line	0.36				0.2	0.04	0.12		
001-019	59.18	PEM	PFO/PSS/PEM/POW	O	BT	0.13	Tree Line	0.13				0.13				
001-020	59.29	PSS	PFO/PSS/PEM	**EV**	BT, WS	**1.16**	Tree Line				1.16	0.53	0.11	0.52		
001-021	59.63	PEM	PSS/PEM/PFO	O	BT	0.17	Tree Line	0.17				0.16	0.01			
001-028	59.76	PSS	PFO/PSS/PEM	**EV**	BT	**4.27**	Tree Line				4.27		0.47	1.89	1.91	
001-030	60.54	PEM/PFO	PFO/PSS/PEM	O		0.17	Tree Line	0.02	0.04	0.11		0.01	0.03	0.13		
001-022	61.07	PEM	PFO/PSS/PEM	O		0.22	Tree Line	0.22				0.22				
001-024	61.25	PEM	PEM	O		0.28		0.28				0.28				
001-025	61.64	PEM	PEM	O		0.49		0.49				0.49				
001-026	62.11	PEM	PEM	O		0.17		0.17				0.17				
001-027	62.32	PEM/PFO	PFO/PSS/PEM	O		0.39	Tree Line	0.36		0.03		0.34		0.05		
001-031	62.83	PEM	PFO/PSS/PEM	O		**1.1**	Tree Line	1.1				0.7	0.08	0.32		
001-032	63.43	PEM/PFO	PFO/PSS/PEM	O		0.2	Tree Line	0.18		0.02		0.1		0.08	0.02	
001-035	63.74	PEM	PSS/PEM	O		0.08		0.08				0.04			0.04	
001-036	64.14	PSS	PFO/PSS/PEM	**EV**	BT	**3.24**	Tree Line				3.24				3.24	(0.74 Perm.)
007-002	64.93	PEM	PFO	O	BT?, S	0.16	Tree Line	0.16				0.02		0.14		
006-003	65.26	PEM	PEM	O		0.01		0.01				0.01				
001-038	65.43	PEM	PFO/PSS/PEM	O	S	0.11	Tree Line	0.11				0.08		0.03		
Luzerne County (13 numbered wetlands)																
001-039	65.49	PEM	PFO/PEM	O	S	**0.59**	Tree Line	**0.59**				0.14	0.02	0.33	0.1	
001-040	65.89	PEM/PFO	PFO/PEM	O	S	**0.73**	Tree Line	0.5	0.03	0.2		0.32	0.03	0.38		
001-041	66.81	PEM	PEM/PFO/PSS	O	S	0.35	Tree Line	0.35				0.29		0.06		
007-009	66.95	PEM	POW/PEM	O		0.12	Tree Line	0.12						0.03	0.09	
009-002	67.05	PEM	PFO	O	S	**0.56**	Tree Line	0.56				0.06		0.5		
001-043	67.06	PEM	PFO/PEM	O		**0.26**		0.26				0.26				
009-001	67.85	PEM	PEM/PSS	**EV**	S	0.21	Tree Line	0.21				0.1		0.11		
001-047	68.12	PEM	PEM/PFO	O		0.21		0.21				0.21				
001-050	68.45	PEM	PEM	O	WS?	0.33		0.33				0.33				
001-046	68.72	PSS	PFO	O		0.03	Tree Line				0.03			0.03		
001-045	68.82	PEM	PEM	O		0.22		0.22				0.22				
006-004	68.83	PEM	PEM/PFO	O		0.04		0.04					0.04			
013-001	68.95	PEM/PFO	PEM/PFO	O		0.07		0.01	0.06			0.01	0.06			
Total 36 numbered wetlands directly impacted						**17.37**		**7.34**	**0.15**	**0.4**	**9.48**	**5.52**	**0.95**	**5.01**	**5.89**	**17.37**
				5 EV	**15 EV**		21 forest or scrub wetlands disturbed	42%	1%	2%	55%	75% of Applicant's total	633%	1275%	62%	100%

58 discrete wetland parcels mapped by applicant

BT = bog turtle potential; S = floodplain of EV stream; WS = water supply protection; P = preserve or sanctuary

9% of ROW total 183.89 acres disturbed

Applicant claims 11 forest or scrub wetlands disturbed

13 numbered wetlands in ROW not directly disturbed, per Applicant

Construction extends to edge of several "undisturbed" wetlands but damage not mentioned (no buffers)

Wetland Classes: EV = Exceptional Value; O = Other

Table A. Wetlands Within 150 Feet of Proposed Franklin Loop 42" D Pipeline, Transco Williams Leidy S						
Wetland ID No.	**Mile Post**	**Corridor Area (acres)**	**Direct Impact (acres)**	**Significant Segment Outside ROW**	**NWI Vegetation Class per NWI (existing conditions, mapped types)**	**NWI Class per Schmid (existing conditions, whole wetland)**
Monroe County (31 numbered wetlands)						
007-006	54.55	0.08	0.08		ns	PEM
007-007	57.48	0.01	0.01		ns	PEM
001-012	58.4	0.09	0.01	?	ns	PFO, PEM
001-013	58.53	0.21	0.06		ns	PFO/PSS/PEM
001-017	58.66	0.05			ns	PSS/PEM/POW
001-015	58.76	0.1			ns	PSS/PEM
001-014	58.86	2.35	0.78	X	PSS1E	PFO/PSS/PEM
001-016	59.05	1.11	0.36	X	ns	PFO/PSS/PEM/POW
001-018	59.14	0.08			ns	PFO/PSS/PEM
001-019	59.18	0.4	0.13	X	ns	PFO/PSS/PEM/POW
001-020	59.29	3.71	1.16	X	PFO41E, PSS1/EM5E	PFO/PSS/PEM
001-021	59.63	0.81	0.17		ns	PSS/PEM/PFO
001-028	59.77	14.45	4.27	X	PFO4BA, PSS1/EM5BA	PFO/PSS/PEM
001-029	60.23	0.26			ns	PSS/PEM
001-030	60.54	0.34	0.17		ns	PFO/PSS/PEM
001-022	61.07	0.47	0.22		PFO1E	PFO/PSS/PEM
001-023	61.17	0.18			ns	PEM/POW
001-024	61.24	0.35	0.28		ns	PEM
001-025	61.64	1.05	0.49		ns	PEM
001-026	62.11	0.17	0.17		ns	PEM
001-027	62.32	1.21	0.39		ns	PFO/PSS/PEM
001-031	62.83	3.13	1.1	X	PSS1E, PFO4E	PFO/PSS/PEM
001-032	63.43	0.55	0.2		ns	PFO/PSS/PEM
001-033	63.56	0.04			ns	POW
001-034	63.67	0.12		X	PUBHh	POW
001-035	63.78	0.31	0.08		ns	PSS/PEM
001-036	64.14	17.27	3.24	X	PFO4E, PEM5E, PFO1E, PSS1E, PFO4/SS1E	PFO/PSS/PEM

007-002	64.93	0.45	0.16	X	ns	PFO
001-037	64.94	0.66		X	ns	PFO/PSS/PEM
006-003	65.26	0.02	0.01		ns	PEM
001-038	65.43	0.65	0.11		ns	PFO/PSS/PEM
Luzerne County (18 numbered wetlands)						
001-039	65.49	0.94	0.59		ns	PFO, PEM
006-001	65.58	0.05			ns	PFO
001-040	65.89	2.56	0.73	X	ns	PFO, PEM
001-041	66.81	1.02	0.35		ns	PFO, PSS/PEM
001-042	66.87	0.31		X	PFO1E	PFO
007-009	66.95	0.32	0.12		ns	PEM/POW
009-002	67.05	1.99	0.56	X	PFO1E	PFO
001-043	67.06	1.39	0.26	X	PFO1E	PFO, PEM
009-001	67.85	1	0.21	X	PSS1E	PSS, PFO
001-044	68.08	0.14			ns	PFO
001-047	68.12	0.35	0.21		ns	PEM, PFO
001-048	68.24	0.02			ns	PEM
001-049	68.35	0.13			ns	POW, PFO
001-050	68.45	0.45	0.33		ns	PEM
001-046	68.72	0.11	0.03		ns	PFO
001-045	68.82	0.24	0.22		ns	PEM
006-004	68.83	0.04	0.04		ns	PEM, PFO
013-001	68.95	0.07	0.07		ns	PEM, PFO
Total 49		**61.81**	**17.37**			
Boldface = Proposed Direct Disturbance > 0.5 acre						
ns = Not Shown by National Wetland Inventory						
(X) = Wetland to be Completely Disturbed as Well as Surroundings or Isolated but not determined by Applicant						
? = Probably Isolated or significant segment outside ROW, but no information from Applicant						

outheast, Monroe and Luzerne Counties, Pennsylvania						
NWI Class per Applicant (all existing or only disturbed part?)	Isolated per Applicant	Abutting Stream Directly per Applicant	Surface Connection to Stream per Applicant	Work < 50 feet of Remainder	Tiny Fragments Left Uncounted	Maintain Only Wet Herbs <25 feet (Conversion)
PEM	X			(X)		
PEM	(X)			(X)		
PEM		Tunk.Ck.		X	X	
PFO	X			X		0.01
PEM			Tunk.Ck.			
PEM	X			X		
PSS		Tunk.UNT		X		0.31
PEM	?	?	?	X		0.17
PEM			Tunk.UNT	X		
PEM		Tunk.UNT		X		
PSS		Tunk.UNT		X		0.56
PEM		Tunk.UNT		X		0.05
PSS		Tob.UNT		X		2.37
PEM	X			X		
PEM,PFO	X			X		0.06
PEM			Tob.Ck.	X		
PEM		Tob.UNT		X		
PEM		Tob.UNT		X		
PEM		Tob.UNT		X		
PEM	X			(X)		
PEM,PFO			Tob.UNT	X		
PEM		Two Mile Ck.		X	X	0.21
PEM,PFO			Two Mile	X		0.07
PEM		Sto.UNT		X		
PEM		Stony Run				
PEM		Stony Run		X		
PSS	?	?	?	X		1.6

PEM		Leh.UNT		X		0.06
PSS		Leh.UNT		X		
PEM	X			X	X	
PEM			Lehigh R.	X		
PEM	?	?	?	X	X	0.15
PFO	X					
PEM, PFO		Leh.UNT		X	X	0.22
PEM		Kend.UNT		X		
PFO			Kend.UNT			
PEM	X			X		
PEM		Kendall Ck.		X		0.16
PEM	X			X		
PEM		Sto.UNT		X		
PEM	?	?	?	X		
PEM		Sto.UNT		X	X	
PEM			Sto.UNT			
PEM			Sto.UNT	X		
PEM	?	?	?	X		
PSS	X			X		
PEM	X			X	X	
PEM	X			X		
PEM, PFO	(X)			X	X	
				44 (90%)		**6**

Table C. Significance of Impacts by Wetland, Proposed Franklin Loop, 42" Pipeline D, Williams Transco Leidy Southeast					
Wetland ID No.	Mile Post	In-Corri-dor Area (acres)	Direct Impact (acres)	Unjus-tified Damage	No Direct Damage Expected
Monroe County (31 numbered wetlands)					
007-006	54.55	0.08	0.08	X	
007-007	57.48	0.01	0.01	X	
001-012	58.4	0.09	0.01		
001-013	58.53	0.21	0.06		
001-017	58.66	0.05			X
001-015	58.76	0.1			
001-014	58.86	2.35	0.78		
001-016	59.05	1.11	0.36		
001-018	59.14	0.08			
001-019	59.18	0.4	0.13		
001-020	59.29	3.71	1.16		
001-021	59.63	0.81	0.17		
001-028	59.77	14.45	4.27		
001-029	60.23	0.26			
001-030	60.54	0.34	0.17		
001-022	61.07	0.47	0.22		
001-023	61.17	0.18			
001-024	61.24	0.35	0.28		
001-025	61.64	1.05	0.49		
001-026	62.11	0.17	0.17		
001-027	62.32	1.21	0.39		
001-031	62.83	3.13	1.1		
001-032	63.43	0.55	0.2		
001-033	63.56	0.04			X
001-034	63.67	0.12			
001-035	63.78	0.31	0.08		
001-036	64.14	17.27	3.24		
007-002	64.93	0.45	0.16		

001-037	64.94	0.66			
006-003	65.26	0.02	0.01		
001-038	65.43	0.65	0.11		
Luzerne County (18 numbered wetlands)					
006-001	65.58	0.05			X
001-039	65.49	0.94	0.59		
001-040	65.89	2.56	0.73		
001-041	66.81	1.02	0.35		
001-042	66.87	0.31			X
007-009	66.95	0.32	0.12		
009-002	67.05	1.99	0.56		
001-043	67.06	1.39	0.26		
009-001	67.85	1	0.21		
001-044	68.08	0.14			
001-047	68.12	0.35	0.21		
001-048	68.24	0.02			X
001-049	68.35	0.13			
001-050	68.45	0.45	0.33		
001-046	68.72	0.11	0.03		
001-045	68.82	0.24	0.22		
006-004	68.83	0.04	0.04	X	
013-001	68.95	0.07	0.07	X	
Total 49		**61.81**	**17.37**	4	5
17 potential EV wetlands in red (e.g., Applicant's 009-001)				8%	10%
Area of Direct Wetland Disturbance					
58 discrete wetland polygons delineated by Applicant					
Applicant tallied only direct damage					
Wetland Area Direct Disturbance					
Total Wetland Area in Corridor				0.2	0.47
(X) = possible high concern area, currently claimed to be affected					
only by construction in FERC setback					

Expansion, Pennsylvania					
Setback Damage (only)	Minor Concern Damage	Inter-mediate Damage	High Concern Damage		
		X			
		X			
X					
			X		
			X		
X					
			X		
			X		
			X		
			X		
X					
		X			
	X				
X					
	X				
	X				
	X				
		X			
			X		
		X			
X					
	X				
			X		
			X		

X			(X)		
	X				
			X		
			X		
			X		
			X		
			X		
			X		
			X		
X					
		X			
X					
	X				
		X			
	X				
8	**8**	**8**	**16**		
16%	16%	16%	34%		
	10%	7%	83%		
	1.64	1.07	14.46		
1.67	3.42	2.86	53.19		