Decision Rationale
Total Maximum Daily Load
Phosphorus and Sediment
Chickies Creek Watershed
Lancaster County, Pennsylvania

I. Introduction

This document will set forth the Environmental Protection Agency's (EPA) rationale for approving the Total Maximum Daily Load (TMDL) for nutrients and sediment in the Chickies Creek watershed in Lancaster County, Pennsylvania. The document was submitted by the Pennsylvania Department of Environmental Protection (PADEP) for final Agency review, by letter dated March 9, 2001, and received by EPA on March 9, 2001. Our rationale is based on the TMDL document and information contained in Appendices to the document to determine if the TMDL meets the following eight regulatory conditions pursuant to 40 CFR §130.

1) The TMDL is designed to implement applicable water quality standards.
2) The TMDL includes a total allowable load as well as individual waste load allocations (WLA) and load allocations (LA).
3) The TMDL considers the impacts of background pollutant contributions.
4) The TMDL considers critical environmental conditions.
5) The TMDL considers seasonal environmental variations.
6) The TMDL includes a margin of safety.
7) There is reasonable assurance that the TMDL can be met.
8) The TMDL has been subject to public participation.

II. Summary

The Chickies Creek watershed encompasses 65 square miles and is located in Lancaster County, Pennsylvania. Land use in the watershed is dominated by agriculture (73%) with the remainder of the land divided between development and forested land uses. The protected uses of the watershed are water supply, recreation and aquatic life. As listed in the Title 25 PA Code Department of Environmental Protection Chapter 93, Section 93.o (Commonwealth of PA, 1999), the designated aquatic life use for the main stem of Chickies Creek, its tributaries (Boyers Run, Rife Run, and Dellinger Run), and several unnamed tributaries is warm water fishes (WWF). The designated aquatic life use for Shearers Creek, another tributary of Chickies Creek, is cold water fishes. The latter is also specially protected due to the high quality of its waters.

Total Maximum Daily Loads were developed for the Chickies Creek watershed to address the impairments noted on Pennsylvania's 1996 and 1998 Clean Water Act Section 303(d) lists of impaired waterbodies. It was first determined that Chickies Creek was not meeting its designated water quality uses for protection of aquatic life based on a 1994 aquatic biological survey that included kick screen analysis and habitat surveys. In 1997, the Department again

surveyed the stream and found the stream to still be impaired. As a consequence of the surveys, Pennsylvania listed Chickies Creek on the 1996 and 1998 Section 303(d) lists of impaired waterbodies. The 1996 303(d) list reported 10 miles of the main stem (Stream Code 7919) to be impaired by nutrients from agriculture. The 1998 list includes the original main stem impairment (Segment ID 1247 on the 1998 list decreased from 10 to 9.39 miles based on GIS measurement of stream miles) and added 21.2 new miles (Segment IDs 970729-1415-SAW and 970812-1045-SAW). The final impaired stream mile total on the 1998 Section 303(d) list is 30.6 miles. These segments were listed on the 1998 303(d) list because of impacts by nutrients and siltation due to agriculture. The Segment ID 970812-1045-SAW was also listed as impaired by urban runoff/storm sewers but the cause of the impairment was "unknown". Upon field verification, it was acknowledged that there was an industrial site and railroad track in the sub-watershed corresponding to this stream segment. Despite stagnant water due to gentle slopes and algae in the steam near this site, there is no apparent upland runoff and sediment production originating from the industrial site. In addition, stream buffers protect this segment of the stream. Therefore, no TMDL was conducted for "unknown" causes of impairments from urban runoff/storm sewers.

Streams and the impairments addressed by the TMDLs for the Chickies Creek watershed are listed in Table 1.

TABLE 1. WATERS FOR WHICH TMDLS WERE DEVELOPED IN THE CHICKIES CREEK WATERSHED

STREAM NAME (STREAM CODE)	SEGMENT ID	MILES	YEAR LISTED	Source	Cause
Chickies Creek (7919)	--	10.0	1996	Agriculture	Nutrients
Chickies Creek (7919)	1247	9.4	1998	Agriculture	Nutrients
Chickies Creek (7919)	970812-1045-SAW	7.7	1998	Agriculture	Nutrients, Siltation
Chickies Creek (7919)	970729-1415-SAW	13.5	1998	Agriculture	Siltation

Section 303(d) of the CWA and its implementing regulations require a TMDL to be developed for those waterbodies identified as impaired by the state where technology-based and other controls did not provide for attainment of water quality standards. These TMDLs were developed to address the impairments caused by excess sediment and nutrients in waters of the Chickies Creek basin. Table 2 summarizes the reductions in sediment and phosphorus required for waters in the Chickies Creek basin as determined by the TMDLs.

According to Federal regulations at 40 CFR §130.2(g), load allocations are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading**.** Table 2 below summarizes the elements of the TMDLs for phosphorus and sediments developed by PADEP. Despite the fact that EPA believes that annual loads are an appropriate measure for these

TMDLs, for the sake of consistency we are breaking the annual TMDL loads down into daily loads. Note that the sediment numbers presented in the TMDL reports submitted by PADEP are slightly off due to the rounding aerial loading rates used in calculating the TMDL. The TMDL, MOS, and LA values in this approval document have been adjusted to reflect more precise values for the TMDL calculation. The revised numbers are within 1 percent of the numbers presented by PADEP and do not change the percent reduction of sediment needed in the watershed.

Table 2. Summary of TMDLs for the Chickies Creek watershed

Watershed	**Pollutant**	LA	WLA	MOS	TMDL		**% Reduction**
		Lbs/yr	lbs/yr	lbs/yr	lbs/yr	lbs/day	
Chickies Creek	Phosphorus	27,151	8,809	3,996	39,956	109	42
	Sediment	7,374,921	-	819,436	8,194,357	22,450	72

The TMDL is a written plan and analysis established to ensure that a waterbody will attain and maintain water quality standards. The TMDL is a scientifically-based strategy which considers current and foreseeable conditions, the best available data, and accounts for uncertainty with the inclusion of a 'margin of safety' value. Conditions, available data, and the understanding of the natural processes can change more than anticipated by the margin of safety. The option is always available to refine the TMDL for re-submittal to EPA for approval. The unassessed waters protocol, a method of conducting biological assessments of Pennsylvania's waters, was developed in 1996 and began implementation in 1997. PADEP's goal is to achieve a comprehensive, statewide assessment of surface waters in Pennsylvania. After completion of the initial assessments, the long-range goal is to reassess all waters on a five-year cycle. Therefore, while the TMDL should not be modified at the expense of achieving water quality standards expeditiously, the TMDL may be modified when warranted.

III. Discussion of Regulatory Conditions

EPA finds that Pennsylvania has provided sufficient information to meet all of the eight basic requirements for establishing phosphorus and sediment TMDLs for tributaries in the Chickies Creek basin. EPA therefore approves the TMDLs and information contained in the appendices for phosphorus and sediment in the Chickies Creek basin. EPA's rationale for approval is set forth according to the regulatory requirements listed below.

1) The TMDLs are designed to implement the applicable water quality standards.

Water Quality Standards consist of three components: designated and existing uses; narrative and/or numerical water quality criteria necessary to support those uses; and an anti-degradation statement. The designated use of the entire Chickies Creek basin, except for Shearers Creek, is warm water fishes (WWF). The designated use for Shearers Creek is cold water fishes. Pennsylvania does not currently have numeric water quality criteria for nutrients (nitrogen or phosphorus) or sediment. Therefore, Pennsylvania utilized its general water quality criteria, which state that "water may not contain substances attributable to point or non-point source waste discharges in concentrations or amounts sufficient to be inimical or harmful to the water

uses to be protected or to human, animal, plant, or aquatic life"[1], to establish an endpoint for phosphorus and sediment such that the designated uses of the Chickies Creek watershed are attained and maintained.

In order to numerically express this endpoint consistent with the general water quality criteria, PADEP uses a Reference Watershed approach in combination with the AVGWLF[2] watershed loading model. The Reference watershed is representative of the conditions required for the impaired watershed to meet its designated uses. This representative condition is analyzed to determine an appropriate level of nutrient and sediment loading to the waterbody. The Reference Watershed approach consists of comparing the biologically impaired watershed with a reference watershed that is meeting its designated uses for aquatic life to determine an appropriate level of nutrient and sediment loading to the waterbody. The impaired watershed and the reference watershed have similar designated water uses, geology, land uses, physiographic province, land area, soils, and which is within a reasonable proximity to each other for meteorological purposes. The AVGWLF model provides a powerful and accurate means of estimating the dissolved and total nutrient loadings to a stream from complex watersheds with added GIS capabilities. The model provides monthly stream flow, soil erosion, and sediment yield values and includes both surface runoff and groundwater sources as well as nutrient loads from point sources and onsite wastewater disposal (septic) systems[3]. Calibration of this model is not required, however, it has been applied and validated to an 85,000 hectare watershed in upstate New York. The rationale of this method is that achieving nutrient and sediment loadings in the impaired watershed similar to those loadings of the reference watershed will ensure that the impaired watershed will attain and maintain its designated uses and general water quality criteria.

The Conococheague watershed is used as the reference watershed for comparison with the Chickies Creek watershed phosphorus and sediment TMDLs. Further ground truthing of both the Conococheague and the Chickies watersheds in preparation for TMDL development resulted in adjustments of model parameters in the reference watersheds to account for the difference in cropping practices and vegetative cover. Table 3 compares these two watersheds. EPA finds the use of the Conococheague watershed as a reference watershed to be reasonable for these TMDLs.

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[1] Pennsylvania Code, Title 25., Environmental Protection, Chapter 93. Water Quality Standards, Section 93.6(a).

[2] Arcview Generalized Watershed Loading Function model, the Environmental Resources Research Institute of Pennsylvania State University's Arcview based version of the GWLF model developed by Cornell

[3] Haith, D.A., R. Mandel and R.S. Wu, Generalized Watershed Loading Functions, Version 2.0, Cornell University, Dec. 15, 1992.

TABLE 3 - COMPARISON BETWEEN THE IMPAIRED DEEP RUN & THE REFERENCE LICK RUN WATERSHEDS		
ATTRIBUTE	**Chickies Creek Watershed**	**Conococheague Watershed**
Physiographic Province	Piedmont	Ridge and Valley
Area (mi^2)	65.0	62.6
Predominant Land Use	Agriculture (73%)	Agriculture (84%)
Predominant Geology	Carbonate (67%) Conglomerate (25%)	Shale (37%) Carbonate (63%)
Soils	B (60%), C (40%)	B (13%), C (87%)
K Factor	0.30	0.28
20-Year Average Rainfall (in)	42.6	39.3
20-Year Average Runoff (in)	4.1	4.3

Using the continuous simulation AVGWLF model, PADEP modeled the nutrient and sediment loads originating from point and nonpoint sources in the reference watersheds. As previously mentioned, AVGWLF has the ability to estimate dissolved and total monthly nutrient loads to streams from watersheds including surface runoff, groundwater sources, point sources, septic systems, monthly streamflow, soil erosion, and sediment yield values. In order to make these estimates, AVGWLF requires daily precipitation and temperature data, runoff sources and transport and chemical parameters. The AVGWLF model is a combined distributed/lumped parameter watershed model. In terms of surface loading, this means that the model allows the user to distribute multiple land use/cover scenarios in the watershed, however, the loads originating from the watershed are lumped and spatial routing of nutrient and sediment loads is not available. In terms of sub-surface loading, the load contributions from sub-surface areas are not distinct and are considered lumped using a water balance approach. The AVGWLF model relies on the Soil Conservation Service Curve Number (SCS-CN) to estimate surface runoff and the Universal Soil Loss Equation (USLE) to estimate erosion and sediment yield. Monthly estimates of nutrient and sediment loadings, applicable to each watershed, are generated by using watershed specific local daily weather inputs and USLE factors[4].

Total phosphorus point source contributions to the watershed for use in determining the loading rate in the Conococheague (reference) watershed, and serving as the target loading rate for the Chickies Creek watershed, were determined using the Discharge Monitoring Reports (DMR) data for each facility. DMR data were also used in assessing the existing point source contributions to the impaired watershed. Since there is no in-stream module in the GWLF model, in-stream phosphorus losses must be accounted for externally in order to accurately represent the load at the watershed outlet. In-stream phosphorus losses from point sources were estimated according to an algorithm available in the USGS SPARROW (SPAtially Referenced

[4] Local daily weather inputs include temperature and precipitation. The USLE factors are KLSCP; K=changes in soil loss erosion, LS=length slope factor, C=vegetation cover factor, P=conservation practices factor.

Regressions on Watershed Attributes) model. SPARROW estimates in-stream nutrient losses using a decay function based on travel time and stream flow. Travel time to the watershed outlet is calculated for each facility using flow velocity, as determined by flow volume and a representative cross-sectional area of the stream based on field measurements at several sites along the reach, and distance traveled.

The following average existing load values for sediment, illustrated in Table 4, were determined for Conococheague and the Chickies Creek watersheds using watershed specific data**.**

Table 4. Existing sediment loading values for Conococheague watershed and Chickies Creek watershed

	Area (Acres)	Sediment Load lbs/yr	Unit Area Sediment Loading Rate lbs/acre/yr
Conococheague Watershed	39,316	7,901,478	200.98
Chickies Creek Watershed	40,772	26,093,711	640.00

Table 5 illustrates the average existing load values for phosphorus as determined for the Chickies Creek watershed using watershed specific data.

Table 5. Existing phosphorus load values for the Chickies Creek watershed

	Area (Acres)	Total Phosphorus lbs/year	Unit Area P Loading Rate lbs/acre/yr
Conococheague Watershed	39,316	38,549	0.98
Chickies Creek Watershed	40,772	61,030	1.50

Although both nutrients (phosphorus and nitrogen) are listed as the causes of impairment and are subsequently modeled, only a TMDL for phosphorus is being established to help restore the designated uses of the Chickies Creek basin. This is due to PADEP's finding that phosphorus is the limiting nutrient in all waters of the Chickies Creek basin. Phosphorus is often the major nutrient in shortest supply and is frequently a prime determinant of the total biomass[5]. It is also the most effectively controlled using existing engineering technology and land use management[6]. EPA finds this to be a reasonable determination.

[5] U.S. EPA. 1980. Modeling Phosphorus Loading and Lake Response under Uncertainty: A Manual and Compilation of Export Coefficients. EPA 440/5-80-011.

[6] Id.

The final step in the process is to determine the appropriate pollutant loading for each water. For the entire Chickies Creek watershed the values generated for phosphorus and sediment loading were based on those found in the reference Conococheague watershed.

In the process of determining the total phosphorus and sediment loadings in the reference watersheds, a unit area loading coefficient for the parameter of concern was calculated. Those areal loading coefficients were applied to the Chickies Creek watershed to determine the allowable (TMDL) sediment and phosphorus loadings, respectively. EPA finds this application reasonable to implement the applicable water quality standards.

Table 6 illustrates the sediment TMDL calculations. The target TMDL value for sediment is determined by multiplying the unit area loading value of the reference watershed by the total area in acreage of the impaired watershed.

Table 6. Sediment TMDL calculations

Watershed	Unit area loading rate in Reference Conococheague Run (lbs/acre/year)	Total watershed area in Impaired Chickies Creek basin (acres)	TMDL value for sediment (lbs/year)
Chickies Creek Watershed	200.98	40,772	8,194,278

Table 7 illustrates the phosphorus TMDL calculations. The target TMDL value for phosphorus is determined by multiplying the unit area loading value of the reference watershed by the total area in acreage of the impaired watershed.

Table 7. Phosphorus TMDL calculations

Watershed	Unit area loading rate in Reference Conococheague Run (lbs/acre/year)	Total watershed area in Impaired Chickies Creek Watershed (acres)	TMDL value for phosphorus (lbs/year)
Chickies Creek Watershed	0.98	40,772	39,956

2) The TMDLs include a total allowable load as well as individual waste load allocations and load allocation.

Tables 2, 6, and 7 indicate the total allowable loads for phosphorus and sediment as determined using the Reference Watershed approach and the AVGWLF model.

A. Waste Load Allocations

Pennsylvania indicates that there are no known point source discharges of sediment in the Chickies Creek watershed. Therefore, the WLA is set at zero for the sediment TMDL.

Pennsylvania indicates that there are five point source discharges of phosphorus in the Chickies Creek watershed.

The phosphorus contributions from the five facilities were considered in determining the existing conditions in the watershed. In determining the current contribution of phosphorus loading from these point sources to the Chickies Creek watershed, the model parameters were adjusted to account for existing contributions based on current discharge monitoring reports. This allows the model to determine the contributions from the sources of the pollutants based on actual current conditions. In determining the WLA, however, the maximum permitted load for the point source discharger is used. This ensures that the TMDL can still be met even if the discharger increases his load from the current levels to the permit levels. The WLA for the Chickies Creek watershed is set to equal the maximum permit limit of the dischargers, with no reductions assigned. EPA finds that point source discharges have been adequately accounted for in these TMDLs.

B. Load Allocations

The TMDLs include LAs for nonpoint sources. According to federal regulations, 40 CFR §130.2(g), load allocations are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. The AVGWLF process enables the LA to be distributed to sources based on land use type.

The process of allocating phosphorus and sediment loads to distinct land uses in the Chickies Creek watershed begins by subtracting 10% from the TMDL value for the margin of safety. For example, the allocable load for sediment in the Chickies Creek watershed of 8,194,357 lbs/year is reduced by 819,436 lbs/year to 7,374,921 lbs/year (8,194,357 lbs/year x 0.1 = 819,436 lbs/year). The allocable load of phosphorus for the Chickies Creek watershed is also reduced by 10% to allow for a margin of safety. See below for further discussion on the application of a margin of safety in TMDLs.

As discussed earlier, load allocations for phosphorus were determined by multiplying the unit area loading rate for phosphorus of the reference Conococheaugue watershed by the total area in the Chickies Creek watershed. These reductions were then applied and distributed individually to each of the three subwatersheds within the Chickies Creek watershed. Load allocations for sediment were determined by multiplying the unit-area loading rate of the reference Conococheague basin by the total area the impaired Chickies Creek watershed. These reductions were then applied and distributed individually to each of the three subwatersheds within the Chickies Creek watershed.

To determine the distribution of the sediment and/or phosphorus load allocation between contributing land based sources, PADEP uses a method called the Equal Marginal Percent Reduction (EMPR)[7]. This method equitably assigns the greater reduction requirements to the

[7] Pennsylvania Department of Environmental Protection. June 1986. Implementation Guidance for the Water Quality Analysis Model 6.3. Document 391-2000-007.

largest contributing source. Table 8 shows the load allocations of sediment in the Chickies Creek watershed. The table shows the overall average reductions in sediment for each land use and is useful in demonstrating the EMPR method employed by PADEP to distribute the allocable loads of phosphorus and sediment in these TMDLs.

Table 8. Summary of load allocations for sediment in the Chickies Creek watershed

Land Use	Sediment (lbs/yr)						
	Acres	Existing Load	Baseline Reduction	Baseline Load	EMPR Reduction	TMDL Load allocation	% Reduction
Hay/pasture	9,027	1,278,781	0	1,278,781	197,818	1,080,963	15
Cropland	20,598	24,356,865	17,369,052	6,987,813	1,080,963	5,906,850	76
Coniferous	341	1,733	0	0	0	1,733	0
Mixed Forest	585	3,915	0	0	0	3,915	0
Deciduous	8,363	357,347	0	0	0	357,347	0
Transition	3	0	0	0	0	0	0
Low Intensity Development	1,195	13,962	0	0	0	13,962	0
High Intensity Development	661	10,080	0	0	0	10,080	0
Total	40,772	26,093,711	17,369,052	8,266,594	1,278,781	7,374,850	72

The total allocable load of sediment is 7,374,850 lbs/year after subtracting the margin of safety value. The EMPR method is then used to distribute the remaining sediment load and works in the following manner. PADEP allocated certain land use loadings the same as their existing loads. In the Chickies Creek watershed, those land uses are forested, transitional lands, low intensity development, and high intensity development. The reasons that the loads for these land use types remain constant include an extremely limited ability to affect the sediment loading processes, insufficient reasonable assurance to make substantial reductions, or the previous designation as forested. This is appropriate because sediment loading from forested lands represents the natural condition that would be expected to exist. It was appropriate to make these allocations for transitional lands, low intensity development, and high intensity development because these loads are small in comparison to the total loading and would not significantly improve water quality even if completely eliminated. Therefore, the allocable load for sediment of 7,374,850 lbs/yr is further reduced by 387,037 lbs/yr to 6,987,813 lbs/yr. The value of 387,037 lbs/yr is the sum of the sediment load from low intensity development (13,962 lbs/yr), high intensity development (10,080 lbs/yr), transitional lands (0 lbs/yr), deciduous forest (357,347 lbs/yr), mixed forest (3,915 lbs/yr) and coniferous forest (1,733 lbs/yr). The remaining "active land use" current loads (hay/pasture and cropland) are then compared with the remaining allocable load of 6,987,813 lbs/yr to determine if any one contributor would exceed this load by itself. If the remaining allocable load is exceeded by any land use, that land use will be reduced to the allocable load value of 6,987,813 lbs/yr. If the allocable load is not exceeded, the existing load becomes the baseline load. In Table 7, only the 'cropland' land use with an existing load of

24,356,865 lbs/yr exceeds this value. Therefore, 'cropland' is reduced to 6,987,813 lbs/yr, which becomes the baseline load. The actual value of the reduction is represented in the 'Baseline Reduction' column of Table 7. The baseline loads are then summed to determine the equal percent reduction that must occur in the "active land uses" to achieve the allocable load value of 6,987,813 lbs/yr. The total baseline load is 8,266,594 lbs/yr, which must be reduced approximately 15.5 percent to equal 6,987,813 lbs/yr. This reduction can be seen in the 'EMPR Reduction' column of Table 7, which is then subtracted from the baseline load value to determine the TMDL load allocation value for each land use.

This same method was used to determine the phosphorus reductions in each of the sub-watersheds. EPA finds that PADEP appropriately applied the EMPR method for phosphorus and sediment in the Chickies Creek watershed TMDLs. According to federal regulations at 40 CFR §130.2(g), load allocations are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. While it is not necessary to specifically approve an allocation method, EPA believes that the EMPR method used by PADEP is acceptable because it supports three main objectives; 1) to assure compliance with the applicable water quality standard, 2) to minimize the overall cost of compliance and, 3) to provide maximum equity among competing discharges.

3) The TMDLs consider the impacts of background pollutant contributions.

The state has included natural background as a component of the load allocations, as required by 40 CFR §130.2(g). There are two separate considerations of background pollutants within the context of these TMDLs. First, there is the inherent assumption of the Reference Watershed Approach that, because of the similarities between the reference and impaired watershed, will have similar background pollutant contributions. Therefore, the background pollutant contributions will be considered when determining the loads for the impaired watershed, which are consistent with the loads from the reference watershed. Secondly, the AVGWLF model implicitly considers background pollutant contributions through the groundwater component of the model process.

4) The TMDLs consider critical environmental conditions.

EPA regulations at 40 CFR §130.7(c)(1) require TMDLs to take into account critical conditions for streamflow, loading, and water quality parameters. The intent of this requirement is to ensure that the water quality of Chickies Creek is protected during times when it is most vulnerable.

Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards.[8] In specifying critical conditions in the waterbody,

[8] EPA Memorandum regarding EPA Actions to Support High Quality TMDLS from Robert H. Wayland III, Director, Office of Wetlands, Oceans, and Watersheds to the Regional Water Management Division Directors, August 9, 1999.

an attempt is made to use a reasonable "worst-case" scenario condition. Critical conditions are the combination of environmental factors (e.g., flow, temperature) that results in attaining and maintaining the water quality criterion and has an acceptably low frequency of occurrence. For example, stream analysis often uses a low-flow (7Q10) design condition as critical because the ability of the waterbody to assimilate pollutants without exhibiting adverse impacts is at a minimum.

Within the context of the Reference Watershed approach, the assumption is that the reference watershed is achieving its designated use even during critical environmental conditions. Thus, achieving sediment and/or phosphorus loadings in the impaired watershed consistent with that of the reference watershed will effectively consider critical conditions. To account for different flow conditions, the AVGWLF model uses daily average temperature, daily time step and total precipitation values for each year simulated. PADEP modeled each watershed for a period of up to 20 years to develop the existing loading values for each watershed. The length of the model time period will also effectively consider critical environmental conditions. EPA finds that Pennsylvania adequately considered critical conditions in the TMDL analysis of the Chickies Creek watershed.

5) The TMDLs consider seasonal environmental variations.

Seasonal variations involve changes in streamflow as a result of hydrologic and climatological patterns. In the continental United States, seasonally high flow normally occurs during the colder period of winter and in early spring from snowmelt and spring rain, while seasonally low flow typically occurs during the warmer summer and early fall drought periods[9]. The model considers seasonal changes requiring specifications of the growing season, hours of daylight for each month, the months in which manure is applied to the land and by using daily time steps for weather data and water balance calculations. EPA finds that both the AVGWLF model and the assumptions of the Reference Watershed approach effectively consider seasonal environmental variations.

6) The TMDLs include a margin of safety.

This requirement is intended to add a level of safety to the modeling process to account for any uncertainty. Margins of safety (MOS) may be implicit, built into the modeling process, or explicit, taken as a percentage of the wasteload allocation, load allocation, or TMDL.

PADEP reserves 10 percent of the TMDL value for both phosphorus and sediments as the margin of safety. This accounts for uncertainty in the data and computational methodology used in the analysis. Table 2 indicates the actual value of the MOS for each TMDL. EPA finds this explicit MOS acceptable.

7) There is reasonable assurance that the TMDLs can be met.

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[9] U.S. EPA. 1997. Technical Guidance Manual for Developing Total Maximum Daily Loads, Book 2, Part 1, Section 2.3.3. EPA 823-B-97-002.

The proposed reductions in phosphorus and sediment loadings all come from agricultural areas. PADEP believes that the implementation of BMPs throughout the Chickies Creek watershed will allow the TMDL to be achieved.

The pollutant reductions in the TMDLs are allocated entirely to agricultural activities in the watershed. Implementation of best management practices (BMPs) in the affected areas should achieve the loading reduction goals established in the TMDLs. Substantial reductions in the amount of sediment reaching the streams can be made through the planting of riparian buffer zones, contour strips, and cover crops. These BMPs range in efficiency from 20% to 70% for sediment reduction. Implementation of BMPs aimed at sediment reduction will also assist in the reduction of phosphorus. Additional phosphorus reductions can be achieved through the installation of more effective animal waste management systems and stone ford cattle crossings. Other possibilities for attaining the desired reductions in phosphorus and sediment include streambank stabilization and fencing. Further field inspection should be performed in order to assess both the extent of existing BMPs, and to determine the most cost-effective and environmentally protective combination of BMPs required to meet the nutrient and sediment reductions needed in the Chickees Watershed.

The PADEP Non-point Source Pollution Program is in the process of developing a Watershed Restoration Action Strategy (WRAS) in Sub-basin 07G which includes the Chickies Creek and East Conewago Creek Watersheds in Lancaster, Dauphin, and Lebanon Counties. The WRAS has assimilated information regarding general restoration needs in the watershed, as well as ongoing projects and stakeholder involvement. According to the WRAS, several watershed restoration projects are ongoing in the watershed, including a 1999 section 319 grant of $102,000 to Ducks Unlimited (DU) for the installation of livestock fencing to exclude livestock from 15 miles of streambank, to establish 12 miles of streambank planting of native woody vegetation, and to install 30 livestock stream crossings. DU and its partner in the project, the Chesapeake Bay Foundation, are providing an additional $44,500 for the project. Through this project, a new incentive will be initiated to allow landowners to earn cost-share credits by agreeing to fence streams with a wider than the minimum 12-foot buffer. The US Natural Resource Conservation Service (NRCS) Environmental Quality Incentive program (EQIP) Grants are funding a $1.5 million grant for agricultural best management practices (BMP) cost shares in the Chickees Creek Watershed. The focus will be on installing agricultural BMPs. Another project involves the US Fish and Wildlife Service under their Partners for Fish and Wildlife Program in stream bank restoration and fencing efforts.

A watershed assessment conducted under the Chesapeake Bay program in 1987 for the Chickies Creek watershed estimated a cost of $3.25 million for BMPs for nutrient management on 39 farms and erosion controls on 11,500 acres. The Lancaster County Conservation District is continuing their efforts to install agricultural BMPs and to provide public education and awareness through programs funded through EQIP, Nutrient Management Act 6, and Chesapeake Bay Foundation. The US Fish and Wildlife Service, Ducks Unlimited, Trout Unlimited, Chesapeake Bay Foundation, and Alliance for the Chesapeake Bay are continuing their public awareness, streambank reforestation and fencing, and habitat improvement efforts in Chickies Creek basin.

Additional funding assistance for the types of projects described above includes Pennsylvania's Growing Greener funding which has provided more than $65 million dollars to environmental initiatives through out the Commonwealth. Additionally, annual Section 319 grant funding, supported by the Unified Watershed Assessment and the Watershed Restoration Action Strategies, is designed to focus resources towards the implementation of Best Management Practices for non-point source pollutants. Pennsylvania has staffed watershed coordinators in each Regional office who are available to provide grant application assistance to stakeholders as well as technical assistance on the installation of management practices.

8) The TMDLs have been subject to public participation.

Pennsylvania published a notice of availability for the Chickies Creek Basin TMDLs for public review and comment in the Pennsylvania Bulletin and in local newspapers. A public meeting was held on January 25, 2001 at the Farm and Home Center in Lancaster.

Comments were received during the public meeting and in writing. The organizations that submitted written comments include U.S. EPA, the Mid-Atlantic Environmental Law Center, the Pennsylvania Builders Association, and U.S. Fish and Wildlife Service. Responses from PADEP to those comments were provided in the TMDL submittal. EPA finds that PADEP conducted adequate public participation.