DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER MONITORING AND STANDARDS

ADOPTED AMENDMENT TO THE UPPER DELAWARE WATER QUALITY MANAGEMENT PLAN AND SUSSEX COUNTY WATER QUALITY MANAGEMENT PLAN

TO ADOPT FOUR TOTAL MAXIMUM DAILY LOADS FOR PHOSPHORUS IN THE PEQUEST RIVER WATERSHED, WATERSHED MANAGEMENT AREA 1, NORTHWEST WATER REGION, AS LISTED IN TABLE 1

Public Notice

Take notice that on May 23, 2011 , pursuant to the provisions of the New Jersey Water Quality Planning Act, N.J.S.A. 58:11A-1 et seq., and the Statewide Water Quality Management Planning rules (N.J.A.C. 7:15-6.4), an amendment to the Upper Delaware and Sussex County Water Quality Management Plans (WQMPs) was adopted by the New Jersey Department of Environmental Protection (Department). The amendment adopts four total maximum daily loads (TMDLs) for phosphorus impairment (as listed in Table 1) located in Warren and Sussex Counties, Watershed Management Area (WMA) 1, Pequest River Watershed in the Northwest Water Region.

Background

A TMDL represents the assimilative or carrying capacity of a waterbody, taking into consideration point and nonpoint sources of pollutants of concern, natural background and surface water withdrawals. A TMDL quantifies the amount of a pollutant a water body can assimilate without violating applicable water quality standards and allocates

that load capacity to known point sources in the form of wasteload allocations (WLAs), nonpoint sources in the form of load allocations (LAs), including a margin of safety. TMDLs are required, under Section 303(d) of the Federal Clean Water Act, 33 U.S.C. 1313(d), to be developed for waterbodies that cannot meet water quality standards after the implementation of technology-based effluent limitations.

Most of the Hydrologic Unit Code 14 (HUC 14) subwatersheds comprising the Pequest River Watershed are classified as Fresh Water 2 (FW2), either Non-trout (NT) or Trout Maintenance (TM). A small portion of the watershed is classified as Fresh Water 1 (FW1) or FW1 TM. In addition, portions of the watershed are classified as Category 1 (C1).

The State of New Jersey's 2008 *Integrated List of Waterbodies* (41 N.J.R. 4321 (a), November 16, 2009) listed the four HUC 14 assessment units in the Pequest River Watershed addressed through this action as being impaired and not meeting the designated use for aquatic life, as indicated by elevated total phosphorus (TP), elevated chlorophyll-a, and/or nuisance macrophyte density. In accordance with the Federal Clean Water Act, the Department biennially develops an Integrated List of waterbodies which includes the list of impaired waterbodies (also known as the 303(d) list) required under 33 USC 1313(d). The *Integrated List of Waterbodies*, assigns waterbodies to one of five categories. Sublists 1 and 2 include waterbodies that are generally unimpaired, Sublist 3 waterbodies have limited assessment or data availability, and Sublist 4 waterbodies are impaired due to pollution rather than pollutants or have had a TMDL or

other enforceable pollutant control measures in place. Sublist 5 constitutes the traditional 303(d) List for waters impaired or threatened by one or more pollutants. These TMDLs were approved by the United States Protection Agency Region 2 on September 29, 2010.

Table 1: Waterbodies listed for Phosphorus Impairment in the Pequest River Watershed upstream of Furnace Brook in WMA 1 as identified on the *2008 Integrated List* for which Phosphorus TMDLs are being adopted

TMDL #	Assessment Unit ID	Assessment Unit Name	Station ID	Designated Use/Pollutant(s) Impairment	HUC size (acres)
1	02040105090030	Pequest R (Furnace Bk to Cemetary Road)	01445500 01445430 1-PEQ-2 HQ Site 5 & 6	Aquatic Life Total phosphorus	5,270
2	02040105090020	Pequest R (Cemetary Road to Drag Strip)	01445500 01445430	Aquatic Life Total phosphorus	4,891
3	02040105090010	Pequest R (Drag Strip-- below Bear Swamp)	HQ Site 4	Aquatic Life Total phosphorus	6,079
4	02040105070060	Pequest R (below Bear Swamp to Trout Bk)	HQ Site 2 HQ Site 3	Aquatic Life Total phosphorus	4,034

The pollutant of concern for these TMDLs is phosphorus. Phosphorus is one of several parameters used to represent Aquatic Life designated use impairment. The TMDL identifies all the sources of phosphorus contribution and establishes wasteload

allocations (WLAs) and Load Allocations (LAs) for phosphorus necessary to meet the surface water quality standards. WLAs were established for point sources of phosphorus. LAs were established for the major categories of nonpoint sources of phosphorus. There are seven permitted wastewater treatment facilities in the Pequest River Watershed addressed in this TMDL. They are: Pequest River Trout Hatchery, Allamuchy Township Municipal Utilities Authority, Warren County Municipal Utilities Authority - Oxford STP, Andover TWP - Long Pond School, Sparta Alpine School, Sussex County Municipal Utilities Authority - Andover Wastewater Treatment Plant and Oxford Textiles, Inc. As discussed in the TMDL document, the first three facilities will be receiving new effluent limits within their New Jersey Pollution Discharge Elimination System permits. The latter two facilities are currently not active; however they will be required to achieve no measurable change in water quality in order to maintain the TMDL boundary conditions. The load from the two permitted schools is *de minimus* and is included in the load allocation portion of the TMDL.

In addition to NJPDES permit requirements for the treatment facilities, implementation strategies have been identified for this TMDL, which include measures required through the municipal stormwater permitting program and encouraging the use of agricultural best management practices.

The adopted amendment, which consists of a TMDL document that provides the technical and regulatory basis for these TMDLs, is available from the Department at www.state.nj.us/dep/wms.

The amendment was noticed in the New Jersey Register on June 7, 2010 at (42 N.J.R. 1089(a)). A public hearing was held on July 15, 2010 with an informal presentation from 3:00 to 4:00 p.m., and the public hearing from 4:00 to 6:00 p.m. at Warren County College, Washington, New Jersey. Comments on the amendment were received during the public comment period.

Summary of Public Comments and the Department's Response

1. Enright, Edward of Cerenzio and Panaro, P.C. for Warren County Municipal Utilities Authority - Oxford STP, Public Hearing, July 15, 2010
2. Kehrberger, Patricia of Hydroqual, Inc. for Warren County Municipal Utilities Authority - Oxford STP, Public Hearing, July 15, 2010 and Letter dated July 30. 2010
3. Sternbenz, Paul M., P.E., Maser Consulting, P.A., Township Engineer for Township of Allamuchy, Letter dated July 30, 2010.
4. Varro, Thomas J., P.E., Chief Engineer, Sussex County Municipal Utilities Authority – Andover STP, Letter dated July 30, 2010.
5. Kratzer, Todd; New Jersey Water Supply Authority, e-mail dated July 15, 2010

A summary of comments on the proposal and the Department's responses to those comments follows. The numbers(s) in brackets at the end of each comment corresponds to the commenter(s) listed above.

Comment 1: Commenter appreciates the TMDL effort to address the phosphorus impairment in the Pequest River. (1, 5)

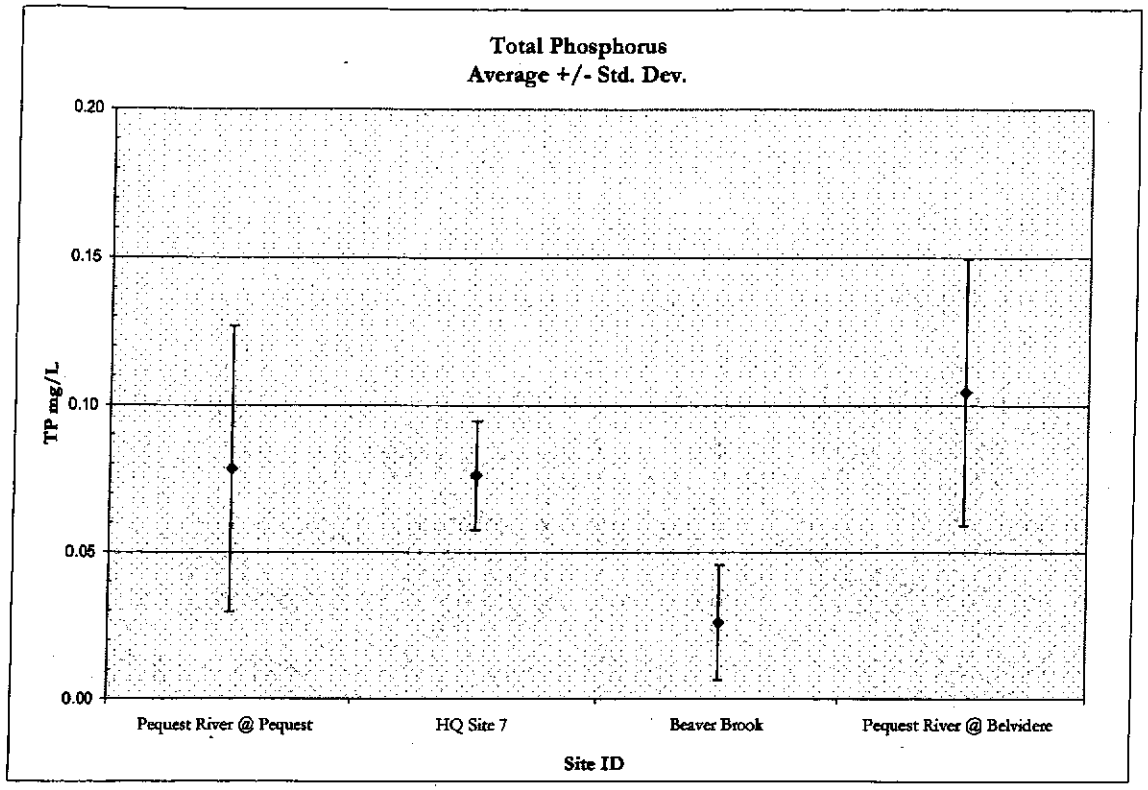
Response to Comment 1: The Department acknowledges the support for the TMDL.

Comment 2: The permit limitations proposed in the TMDL will result in a less costly upgrade for the Warren County Municipal Utilities Authority - Oxford STP compared to that which would have been required to meet the originally proposed phosphorus effluent limitation of 0.1 mg/L, but still represents a major investment that will result in an increased user cost. The TMDL states that the Assessment Unit identified as "Pequest River below Furnace Brook (02040105090060-01)", which is located downstream of the STP, has been deferred because it requires additional study. The completion of a TMDL in the downstream assessment unit may result in greater phosphorus reductions from the STP. Assurance is needed that the investment to achieve the identified limit will not be in vain. (1)

Comment 3: The TMDL is incomplete in that it does not include all total phosphorus impaired waters within the Pequest River watershed. Only 4 out of 5 Assessment Units were addressed. Given the available data, a comprehensive total phosphorus TMDL including all of the total phosphorus impaired Assessment Units appears feasible. The costs for additional data collection may be placed on the Warren County Municipal Utilities Authority. Additionally, the TMDL for the remaining Assessment Unit might result in a more stringent WLA and effluent limits, when it is complete. A more practical procedure would be to complete the TMDL study for the entire Pequest River rather than proceed with the piecemeal approach that the proposed total phosphorus TMDL represents. Based on the amount of available data for the Assessment Unit, there needs to be a credible reason, aside from "needs additional study", to explain why all of the impaired Assessment Units have not been addressed. (2)

Response to Comments 2 and 3: The statement in the TMDL that additional study is required to address the "Pequest River below Furnace Brook (02040105090060-01)" Assessment Unit was based on an evaluation of water quality data sampled within and at the boundary of this assessment unit. The Department found that the data collected to date is insufficient to properly characterize all sources within this assessment unit.

Total phosphorus data was collected under low flow conditions, defined as that flow which is exceeded 70% of the time, at several locations: Pequest River at Pequest (USGS station ID 01445500) located at the boundary of this assessment unit (AU), HydroQual Site 7, Beaver Brook (USGS station ID 01445495), and the most downstream location: Pequest River at Belvidere (USGS station ID 01446400). The graph below shows the total phosphorus concentrations at the sites listed above. Because sampling was done during low flow conditions, storm driven loads can be ignored for this illustration. Starting from the left, with the most upstream location, the total phosphorus concentrations at Pequest River at Pequest were compared to the next downstream location, HydroQual Site 7, and the concentrations were found to be similar, with an average total phosphorus concentration of 0.078 mg/L and 0.076 mg/L, respectively.



Considering the distance of 4.5 miles between these two sites, attenuation of the phosphorus load should result in total phosphorus concentrations at HQ Site 7 that would be notably lower than those at the boundary of this assessment unit. This suggests that there is a source of total phosphorus between these two sites. Proceeding downstream, total phosphorus concentrations from Beaver Brook are quite low; many of the total phosphorus data are below the detection limit. Despite this dilution from a higher quality source, total phosphorus concentrations at Pequest River at Belvidere show an increase, with total phosphorus concentrations exceeding 0.1mg/L. This suggests, again, a source between the confluence of Pequest River and Beaver Brook and the Pequest River at Belvidere site.

The Department concluded that in order to address this remaining impaired assessment unit, additional sampling within this impaired assessment unit is needed to better understand and characterize the sources and the needed reductions. Any additional sampling required to address the remaining impaired assessment unit will not be the obligation of the Warren County MUA. It is not unique to this TMDL to have related downstream impaired assessment units deferred because of a need for further study or to address a downstream assessment unit separately from upstream assessment units. In this latter case, the Department assumes that criteria for the parameter of concern are met at the upstream boundary entering the assessment unit. Because TMDL implementation would attain SWQS, it is expected that no further reduction would be required in upstream areas, particularly since it appears that there is a significant uncharacterized source in the downstream impaired assessment unit. However, no guarantees can be given about future requirements as the Department will need to assess the effectiveness of the TMDL over time and may need to employ adaptive management principles to address lack of success. This could include assigning revised WLAs to upstream sources. In any case, upgrades at this time have value in that they are needed to restore water quality.

Comment 4: The need for applying effluent limits during winter months has not been demonstrated. The Department has demonstrated the applicability of the 0.1 mg/L total phosphorus total phosphorus standard during the summer months, (last 3 paragraphs of Section 4.0). However, during the winter season, it is common science that phosphorus is not limiting biomass growth and that the impairments characterized by exceedance of

the Phosphorus Evaluation Technical Manual criterion, such as high periphyton concentration and diurnal oxygen swings of greater than 3.0 mg/L due to periphyton, will not occur. Periphyton and algae are limited during the winter by low temperature, ice cover, low light and generally higher streamflow. Therefore, the total phosphorus SWQS of 0.1 mg/L should not apply during the winter.

Total phosphorus removal at the Warren County MUA-Oxford STP during the winter months for no corresponding environmental benefit is a wasteful use of Authority resources and actually results in negative environmental impacts (increased sludge, higher effluent TDS, larger carbon footprint, etc.). It is therefore recommended that the winter total phosphorus SWQS in the TMDL be a site-specific total phosphorus winter concentration based on existing water quality with the effluent total phosphorus limit for Oxford Area STP be set at existing effluent quality once the facility is upgraded to meet its appropriately established summer total phosphorus limit. (2)

Comment 5: The use of a total phosphorus goal irrespective of phosphorus availability as a nutrient (organic versus inorganic fraction) might be overly restrictive at the 0.1 mg/l total phosphorus level that the NJDEP is requiring to eliminate stream impairment, and it's possible that this fraction varies with land usage type. (4)

Response to Comments 4 and 5: The Department selected a mass balance approach, coupled with the Flow-Integrated Reduction of Exceedances (FIRE) method, as a cost effective means to provide a science-based outcome that would limit phosphorus

removal to that which is needed to meet SWQS, which are expressed as total phosphorus. The approach used in this TMDL cannot be used to substitute an endpoint expressed as various fractions of phosphorus, which would differ from the adopted SWQS. Completion of the TMDL study allows the Department to substitute a TMDL-based water quality based effluent limit in place of the 0.1 mg/L end-of-pipe criterion that would be required for a discharge to an impaired water, absent a TMDL. This was the limit initially applied to the Allamuchy Township, Pequest Fish Hatchery and Warren County MUA—Oxford facilities. This limit was adjudicated and the limit stayed pending completion of this TMDL. The Department is mindful of the need to align requirements for treatment with an associated environmental benefit. To that end, this TMDL provides substantial relief from the initially imposed permit limit and incorporates additional seasonal relief in recognition of the higher 7Q10 flows that occur in winter months. The effects in terms of TDS and additional sludge generation that were cited are associated with selecting chemical precipitation as the phosphorus removal method. These impacts can largely be avoided by selecting biological nutrient removal.

With regard to the water quality endpoint, the TMDL makes clear that the applicable numeric criterion is 0.1 mg/L, which applies year round as long as flows are at the 7Q10 level or higher, in accordance with the Department's promulgated and EPA-approved SWQS. The numeric and narrative criterion are cited in the TMDL at Section 3.2. To define the load reduction to attain the SWQS, a mass balance approach similar to that which was submitted by the Warren County MUA was used. This approach includes data collected by the MUA. As noted above, the Department used season-specific

7Q10 flows to refine the load reductions needed to attain standards. Beyond this, a dynamic water quality model, where model runs can demonstrate the effect of sedimentation, re-suspension and storage of phosphorus and its impact on the water quality during winter months, would be required to demonstrate that it was not necessary to maintain the numeric criterion year round. Absent such a study, it cannot be stated that there would be no environmental benefit to reduction year round nor can it be certain that a site specific criterion would not be more, rather than less, conservative than the default criterion. In fact, the commenter's statement "during the winter season, it is common science that phosphorus is not limiting biomass growth" is in conflict with the current state of knowledge regarding nutrient dynamics and algal growth. There are studies based on actual data that show significant algal growth during February through early spring. For example, the Department is studying a site (USGS 01400500 Raritan River at Manville NJ) with real-time, continuous monitoring of surface water quality data, including dissolved oxygen as percent saturation. The data from February through March in 2009 and 2010 indicate significant algal productivity. Therefore, it is not appropriate to forego phosphorus reduction in winter months as suggested.

Comment 6: Appendix D. The proposed total phosphorus TMDL includes a mass balance calculation for the winter wasteload allocation that takes into account the higher winter low flow that characterizes the Pequest River. The commenter supports the use of seasonal low flow statistics as a calculation procedure utilized by the Department. (2)

Response to Comment 6: The Department acknowledges the support. Because seasonal statistics were available for 7Q10 in the Pequest River, the Department was able to set loading limits that required a smaller phosphorus reduction in the winter, thereby meeting the surface water quality standard while avoiding unnecessary expenditures for phosphorus removal.

Comment 7: Summer effluent limits should be based on meeting the total phosphorus stream standard of 0.1 mg/L over an appropriate time frame for realizing biological benefits. The 0.1 mg/L total phosphorus surface water quality standard is applied at 7Q10 in the proposed TMDL, Appendix D. The criteria that are to be achieved in the Pequest River are a lowering of seasonally averaged periphyton and a corresponding decrease in diurnal dissolved oxygen. A seasonal low flow condition is the appropriate, site-specific time frame for use in the Pequest Total phosphorus TMDL. A low flow stream condition such as 7Q10 should be used. It is recommended that the Oxford Area total phosphorus limit be based on the summer seasonal low flow, 27 cfs (7Q10, supplied by USGS). The Mass Balance Calculation using 7Q10 results in a summer total phosphorus effluent limit of 1.0 mg/L. See attached Mass Balance Table for the calculation that includes Allamuchy Township Municipal Utilities Authority and the determination of the Pequest total phosphorus downstream of the Pequest River Trout Hatchery. (2)

Response to Comment 7: The criteria described by the commenter are some of those used to determine if the surface water quality standard numeric criterion of 0.1 mg/L is

applicable. Reducing the concentration of phosphorus to meet the numeric criterion is expected to address excessive productivity and its associated water quality effects. An appropriate, scientifically determined alternative site specific criterion that would ensure primary productivity is controlled, whenever it may occur, has not been defined. Therefore, the numeric criterion in the surface water quality standard applies and was used to calculate wasteload allocations and load allocations. The TMDL calculations were based on N.J.A.C. 7:14A-13 and are consistent with the Surface Water Quality Standards, N.J.A.C. 7:9B, which require that the numeric criterion of 0.1 mg/L be met at flows of 7Q10 and above. There has been no scientific demonstration by the commenter that the alternative flow condition is an appropriate basis for a site specific criterion that would achieve the narrative component of New Jersey's surface water quality standard for total phosphorus.

Comment 8: The TMDL is incomplete if wasteload allocations for commercial, industrial, and various residential land use acres within each municipality tabulated in Appendix C and listed in Section 3.3 are not calculated and included in the TMDL. Similarly, load allocations for Agriculture Land Use within each municipality tabulated in Appendix C and listed in Section 3.3 should be calculated and included in the TMDL. (2)

Response to Comment 8: The TMDL calculations assigned the allowable total phosphorus loading capacity for each of the land uses at an appropriate level of detail for the TMDL as set forth in Table 9. Refinement in terms of the precise locations and

types of best management practices that will serve to implement the TMDL will occur as the Department continues to work with partners to effect watershed restoration.

Comment 9: The Department should keep the phosphorus discharge limit for the Allamuchy Township STP at the interim NJPDES permit limit of 1.5 mg/l and enforce compliance in the summer months only. The chemical treatment cost and changes to the treatment process will be significant and result in increased sewer usage charges to the residents. (3)

Response to Comment 9: The Clean Water Act requires that a TMDL be prepared for each water that is listed as impaired on a state's 303(d) list, which for New Jersey, is Sublist 5 of Integrated List of Waterbodies. The Clean Water Act also requires that the TMDL quantify the amount of a pollutant a waterbody can assimilate without violating a state's water quality standards. This TMDL has calculated what reductions would be needed in order to attain the State's SWQS. The WLAs assigned to each discharger allow for a significantly less stringent effluent limit than was applied in the NJPDES permit (0.1 mg/L end-of-pipe). This revised load reduction was made possible by looking at the system as a whole, factoring in higher 7Q10 flows in winter months and requiring reasonable reduction from stormwater point sources and nonpoint sources in order to attain SWQS. If, despite the significant relief already provided, the reductions required are believed to result in substantial and widespread social and economic impact, the Department provides a mechanism for the regulated entity to pursue relief

from the required reduction in the form of a variance, as set forth in the SWQS at N.J.A.C. 7:9B-1.8 and 1.9 (see also N.J.A.C. 7:14A-11.8).

Comment 10: The SCMUA - Andover STP has not been built to date, but, was issued a discharge permit by the Department as a result of water quality analyses submitted to and reviewed by the Department. The commenter expects that the SCMUA - Andover STP will be evaluated in a manner similar to the Andover BOE and Sparta Twp BOE wastewater treatment facilities, wherein the existing total phosphorus load was implicitly included as part of the "boundary condition", such that they can continue to discharge their current total phosphorus load under the TMDL. The "boundary condition" and boundary total phosphorus load measured at the Pequest River at Huntsville station is variable and not a single value. The total phosphorus at Huntsville ranges from 0.02 mg/L to 0.07 mg/L and averages 0.03 mg/L with a standard deviation of +/- 0.012 mg/L. It is requested that the Department consider these statistics when evaluating the SCMUA - Andover STP as to water quality to "preserve the boundary load." The Department's TMDL (See TMDL Figure 3), discusses and uses attenuation in calculations in the development of wasteload allocations for the wastewater treatment facilities discharging to the impaired waters. Attenuation of the Allamuchy STP load is supported with analyses and discussion in Section 6.2 Point Source Assessment. It is anticipated that the Department will use total phosphorus attenuation when assessing the SCMUA - Andover STP discharge of total phosphorus at the "boundary location". (4)

Response to Comment 10: The TMDL requires no measurable change in the water quality at the boundary to the TMDL area, as measured at Huntsville from all upstream dischargers. Because there is no current loading reflected in that boundary condition from the SCMUA - Andover STP, any new load would have to comply with this requirement. It should be noted that this facility proposes to discharge to a C1 water and will also need to comply with antidegradation requirements that apply, which may be more stringent than those of the TMDL. The Department acknowledges the commenter's statements regarding the variability of the boundary concentration and applicability of attenuation. When calculating the WQBELs for this discharge, the requirements for doing so that are applicable at the time will be applied.

Comment 11: The Andover Planned Unit Development (PUD) will change the land use from agriculture to residential. Will this land use change be taken into account as the nonpoint source reductions required to be accomplished by Andover Township (Tier A Municipality under NJDEP stormwater regulations) and/or Andover Borough (Tier B Municipality) are calculated? Will the Andover PUD's stormwater best management practices that are already a feature of the project be given proper NPS reduction credit? The Department should devise a method of crediting for BMPs that already reduce their runoff load instead of asking them to further reduce their loads when other nonpoint source dischargers with the same land use have not reduced their loads at all. (4)

Response to Comment 11: As stated in the TMDL, the contribution of total phosphorus associated with residential development is less than that associated with agricultural land use. Therefore, it is reasonable to expect that a reduction in land use load will result with this conversion. However, it is important to note the effect of assignment of WLAs and LAs to various land uses in terms of TMDL implementation. The WLAs and LAs are overall reductions needed from the total area of each of the land uses, expected to be attained as described in the implementation section. Of note, there are no new permit requirements identified in the implementation plan with respect to stormwater point sources. Rather, the TMDL states that the existing measures required under the Municipal Stormwater permits, along with implementation of BMPs in agricultural areas to be achieved by working with farmers using various funding sources, are expected to achieve the noted reductions.

Comment 12: The FIRE technique is attractive because of its computational simplicity and its minimal data requirements; however, the simplifying assumptions might not be applicable in every circumstance. In the general sense, the FIRE technique makes several simplifying assumptions that are not always applicable, including:

- fate and transport mechanisms are excluded. In many cases, time of travel and physical/chemical/biological transformations of a constituent significantly influence its impact on the environment. For example, eutrophication is affected by ambient temperature. If all of the exceedance occurred when the temperature was low, algal growth could have a far less significant impact on

dissolved oxygen levels than it would if they occurred under higher temperature conditions;

- the load versus flow relationship is assumed to be linear, and the reduction percentage necessary to attain water quality goals is independent of stream flow. Even if this is true, the impairment/flow relationship is often not linear, and the TMDL process is meant to remediate impairment. Again, using eutrophication as an example, higher stream flows often result in increased turbidity, decreased detention time, and increased re-aeration. If the impairment is low dissolved oxygen, higher flows often allow for greater surface transfer of oxygen and reduce the potential for algal growth;
- segregation by land use type is not attempted, and the resulting reductions are applied uniformly independent of land use. The TMDL states that, "since best management practices (BMPs) for nutrients have a wide range of removal efficiencies, a more complex modeling technique would likely not provide a more effective result for implementation of the TMDL than a less-sophisticated approach such as FIRE." The analysis is independent of cost/benefit concerns and assumes that it's equally likely that disparate sources of runoff all have BMPs that allow for the target percent reduction in each water body; and
- the regression line of the exceedance relationship to flow is assumed to pass through the origin of the load versus flow axes. This assumption attributes any deviation from zero nonpoint source load at zero flow to the uncertainty around the slope of the regression line associated with small sample sets.

Because the nonpoint source component of the stream data is often derived by subtracting out the estimated point source component (this is the case in the Pequest total phosphorus TMDL), the differences could be attributable to improper point source load assumptions as well. For example, if the intercept is greater than zero, it might be the case that there is more point source load that needs to be removed, and that the original data need to be adjusted to reflect this prior to determination of exceedance. (4)

Response to Comment 12: As the commenter stated, the FIRE method is a simple, cost-effective mathematical approach that allows calculation of the needed reduction to meet the SWQS 0.1 mg/L of total phosphorus in the river system. It can be used when there is a clear numeric objective, without the need for time consuming and costly monitoring and modeling. Once it was established that the numeric criterion is applicable in the Pequest system, a more complex approach that determines fate and transport and the dynamic relationship between nutrient loads and response indicators such as dissolved oxygen and algal density was not needed or required to restore water quality. Attainment of the SWQS numeric criterion of 0.1 mg/L of total phosphorus at 7Q10 is the only target of this TMDL. A linear relationship between impairment and flow was not assumed in this approach. Using this method, a reduction in stormwater associated loads from land uses (stormwater point sources and nonpoint sources) is determined and then is applied to the land uses contributing those loads within the drainage area. The resulting load allocation becomes part of the TMDL. There is no assumption that the required percent reduction will be uniform across all areas within a land use

category. Rather, it is expected that the load attributed to a land use category will be achieved by evaluating the land uses in a more specific manner through follow up implementation activities, such as development of watershed restoration plans by the Department or stakeholders using 319(h) and other funding sources. Under such plans, specific areas are aligned with specific BMPs intended to achieve load reductions in a cost effective manner. The sum of the individual reductions is expected to realize the overall load reduction required and, in conjunction with reductions required of traditional point sources (STPs), lead to attainment of the SWQS. This will be evaluated through follow-up monitoring.

The FIRE method is designed to be used in a NPS dominated system. In this TMDL, the adjacency of the point source to the sampling location allows the use of FIRE method by subtracting the point source load from the river load observed. Assuming a zero intercept on the regression line is justified by the fact that the NPS would be zero when the flow is zero. The validity of this assumption, that the origin point falls within the 95th percentile bounds of the regression line's intercept, was checked, successfully, and then a regression line with a zero intercept was developed. The slope of the regression line was compared to the slope corresponding to the standard level to calculate the required reduction on the NPS. The required reduction is determined by the slope of the regression line, not the intercept of the regression line.

Comment 13: The State will do a TMDL implementation for phosphorus with as few as eight samples of flow and total phosphorus. In the case of the Pequest TMDL,

one station analyzed has only four samples (see Table E-2-3, Pequest at Townsbury) (4)

Response to Comment 13: The FIRE method result at Pequest at Townsbury is presented only for comparison to the Pequest at Pequest result, because both stations occur within the same assessment unit and the SWQS would need to be met at each in order to establish an effective TMDL. The analysis for the station Pequest at Townsbury was not used to determine the required load reduction included in the TMDL. Instead, because the data available demonstrated that this site would drive a less stringent reduction than the Pequest at Pequest station, it was the analysis of the downstream station, Pequest at Pequest that was used to set the load reduction. Clearly, if the more stringent reductions are met, the SWQS will be met at the Pequest at Townsbury location as well. As discussed, more detailed identification of implementation measures will be able to pinpoint the location and type of activities needed to achieve the required load reductions.

Comment 14: The FIRE analysis was performed at more than one site, each with limited exceedance data, and the more stringent reduction percentage was applied to the entire river. While the reduction percentages were not terribly different (46.02% for Pequest at Pequest versus 43.7% for Pequest at Townsbury), it might have been better to combine the exceedance data to tighten the 95 percent confidence bounds if it can be assumed that all exceedance data from both sites are from the same population.

This can be determined by a statistical comparison of means and standard deviations. (4)

Response to Comment 14: There are two significant point sources located between the Pequest at Townsbury and Pequest at Pequest stations. Therefore, the Department determined that it was not appropriate to combine the data from these two stations' for application of the FIRE method. Using the higher percentage reduction required to attain SWQS at the downstream station is the appropriate approach to insure SWQS are attained at both stations used to assess water quality within this assessment unit.

Comment 15: For watershed areas upstream of Huntsville and in the Furnace Brook watershed, there is no exceedance of the SWQS of 0.1 mg/L in-stream total phosphorus. Since these waters are not impaired for total phosphorus, why must NPS reduction be required of these areas? The required NPS reductions should only be assigned to agriculture, commercial, industrial, and residential land use areas that are impaired for total phosphorus. (4)

Response to Comment 15: The upstream land use from unimpaired assessment units contributes to the load at the downstream impaired locations. It is reasonable to require reductions from anthropogenic sources located outside the impaired area because, if these loadings from the unimpaired watershed were not there, the impairment in downstream locations may be absent or less substantial. Therefore, the FIRE method reduction is applied to all upstream load contribution areas. More detailed

implementation planning will establish efficient total phosphorus reductions on a site specific basis.

Comment 16: Based on Table 4, which presents the summary of NJPDES Discharges located within impaired assessment unit, the DMR data for Pequest State Fish Hatchery was accessed through February 2010. Allamuchy and Oxford DMR data were accessed through July 2007. More recent data from the treatment plants should be included in the summary. (2)

Response to Comment 16: The Department designed the DMR query to obtain the effluent quality during the timeframe for the collected in-stream water quality data. Data outside this timeframe would not be reflective of the loadings present at the time stream quality observations were made. For the Pequest Hatchery, the quality of the effluent is nearly at the in-stream numeric criterion, unlike the other wastewater treatment discharges. As a result, it was determined that the WLA for the hatchery should be based on the long term average effluent quality, without requiring further treatment. To do so, a longer-term data base, including data through February 2010, was appropriate.

Comment 17: As reflected in Section 5.2. Assessment of Nonpoint Sources in the TMDL document, the Unit Area Load (UAL) method is used to calculate existing annual total phosphorus nonpoint source load. Additional detail is needed as to how flow and concentration data at Pequest at Pequest were used to develop an "annual" non-point source load to check the UAL result of 14,326 kg/yr total phosphorus. Was a flow

duration curve (data available on USGS web-site) used to weight data based on flow? The available flow and concentration data from Huntsville could also be used to develop annual nonpoint source load for comparison to UAL annual load at that location. Similarly, flow and concentration data at Townsbury would provide insight because Huntsville is not impaired and impairment is noted at Townsbury. Just as there is a "wealth of in-stream data" (Paragraph 3) at Pequest at Pequest, there is similar abundance at Belvidere (USGS, NJDEP and HydroQual). The UAL approach could/should be checked at this location because an additional 36.7 sq. mi. of drainage area adds non-impaired flow to the Pequest according to the data summary in Table 3. (EWQ 01445495 Furnace Brook at Pequest 2005-2009 and EWQ0047 Beaver Brook at Rt. 618 in Sarepta 2000-2002). (2)

Response to Comment 17: Flow and concentration were used to compare to the results from the UAL analysis as follows: the total phosphorus concentration collected at the river station was multiplied by the flow collected at the same time to calculate the river load for that specific observation. The point source loads were subtracted from the river load to quantify the NPS load. DMR data for the time frame when the river samples were collected were used to calculate the PS load for each observation. When subtracting the PS load from the river load, zero attenuation was assumed for the load coming out from Hatchery and Oxford and 30 percent attenuation was assumed for the load from Allamuchy given the travel distance. The final NPS load was determined by taking the average of all the "calculated" NPS loads corresponding to each pair of river flow and concentration observations.

All the data collected at all the stations within the watershed, including Pequest at Belvidere, were carefully reviewed when determining the approach for this TMDL development. The Department determined that checking the correspondence with measured and estimated loads at the Pequest at Pequest location was appropriate because of the significant amount of data available and the relative location compared to the drainage area being studied.

Comment 18: In reviewing Appendix G: Pequest Data, HydroQual Site 7 data should be included in Appendix G. Data from NJDEP/USGS at Belvidere and the other sites summarized on Table 3 should also be included in Appendix G. These data are all readily available. (2)

Response to Comment 18: Data from the Department and USGS at Belvidere is outside the TMDL and was not initially included in the document. Please refer to comment/response 3 above. The Department did review the data in making the determination not to address the impairment at Belvidere, pending additional study. This data has been added to the TMDL document as an aid to review by others.

Comment 19: The commenter provided an erratum on the New Jersey Surface Water Quality Standard citation stated in Section 3.2 of the TMDL document (2)

Response to Comment 19: The Department has corrected the citation in the TMDL document to reflect New Jersey's current SWQS

Comment 20: The commenter noted that in the TMDL document that in Table 1 Locations of Stations with Assessment Units that there is a slight misunderstanding as to where the HydroQual stations are relative to Pequest features. The commenter suggested the following language: Going from upstream to downstream are HQI 5, Oxford Area STP discharge, HQI 6, then Furnace Brook, then USGS 01445500 (Pequest at Pequest), HQI 7, and then Beaver Brook. Therefore, USGS 0144550 is downstream of Furnace Brook and technically downstream of the AU (Furnace Brook to Cemetary Road). HQI 6 should be added to the Furnace Brook to Cemetery Rd AU. USGS 01445500 should be removed from the AU (Cemetary Rd to Drag Strip). (2)

Response to Comment 20: The TMDL document was modified as suggested to improve clarity as to location of the stations.

Comment 21: Figure 1, the Pequest River Location Map is unclear regarding locations of data stations. This is partly due to unclear or unreadable labels. In addition, it would be helpful for all of the HUC 14s shown to be identified, not just the impaired ones. It would also be helpful if the Pequest main stem could be highlighted. (2)

Response to Comment 21: A revised Figure 1 has been included in the TMDL document to address the comment.

Comment 22: Section 4.0, Paragraph 2, HQI 6 is not coincident with the USGS gage. It is located upstream of the gage with Furnace Brook (small drainage area) entering the Pequest in between the two locations. (2)

Response to Comment 22: A clarification was made in the TMDL document to acknowledge the slight separation in the sites.

Comment 23: Table 3 in the TMDL document needs clarification of Station Names regarding location with respect to Pequest, tributary streams and the USGS gages. The commenter suggests the following changes: HQI Site 6 add "upstream of Furnace Bk", USGS 01445500 and EWQ 01445500 add "downstream of Furnace Bk", HQI 7 add "upstream of Beaver Bk" and USGS 01446400 add "downstream of Beaver Bk". (2)

Response to Comment 23: Recommended changes were made to Table 3 to clarify station locations.

Comment 24: The commenter suggests that Figure 3 summarizing the HydroQual data is not clear. The commenter submitted a substitute plot for the Department's consideration. (2)

Response to Comment 24: Figure 3 was revised in the TMDL document to be more clear. It is comparable to the commenter's provided figure and the offered assistance is acknowledged.

Comment 25: The Equations at the top of page 53 that represent the loading capacity (LC), allocable loading, and percentage of Margin of Safety (MOS) representing part of the loading capacity could be somewhat confusing and could be reduced to, and presented as only the simpler forms of the equations (i.e., LC = (Slope C/Slope B) x Existing Load; Allocable Loading = (Slope C/Slope A) x Existing Load; and %MOS = (Slope A – Slope B)/Slope A). (5)

Response to Comment 25: From the mathematical calculation perspective, those three equations can be simplified in the way as suggested. But for the reader to understand the physical meaning of each term clearly, the Department believes it is more helpful to present the information step by step as provided.

Comment 26: Figure 1 could provide some clarity to the equations by displaying the areas on the graph represented by Overall Percentage Reduction, Required Percentage Reduction, and MOS. (5)

Response to Comment 26: The Overall Percentage Reduction and Required Percentage Reduction are calculated as the percentages relative to the existing load. MOS is expressed as the percentage of the loading capacity. Since the basis for the percentage is not the same, displaying all three on Figure 1 may cause confusion for the reader in trying to understand the physical meaning of these terms. For this reason, Figure 2 was developed and included in the Appendix. Figure 1 illustrates the slopes that were used to determine the percentage reductions and Figure 2 illustrates how the

different percent reductions were used to calculate the loading capacity, the allocable load and the MOS.

Comment 27: Figure 2 should provide a definition for Y_I and Y_{II}. If the areas of each graphic in Figure 2 were displayed on Figure 1 (as suggested above in comments 25, 26 and 27), the second figure may not be necessary. (5)

Response to Comment 27: As indicated in Figure 2,

$$X_I + Y_I = 1$$

$$X_{II} + Y_{II} = 1.$$

In addition,

$$\text{Loading capacity} = \text{Existing Load} * Y_I$$

$$\text{Allocable Load} = \text{Existing Load} * Y_{II}$$

As mentioned above in response to comment 26, Figure 2 was included to provide a clear illustration of how the load capacity, allocable load and MOS were calculated based on the percent reductions derived from the slopes. Since Figure 1 and Figure 2 serve different purposes, both are needed.

Comment 28: Was the Delaware River Basin Commission data collected from 2000 through 2004 for total phosphorus at Orchard Street Bridge in Belvidere (42 data with 17 total phosphorus exceedances) considered for the TMDL? (5)

Response to Comment 28: The Department evaluates all the available relevant data when developing a TMDL. Delaware River Basin Commission data collected at Belvidere was not used in this TMDL since this TMDL addresses the impairments upstream of Oxford and Belvidere is located downstream of Oxford. However, the data was considered in the decision to defer TMDL development in the most downstream assessment unit, pending better characterization of sources above Belvidere.

Jill A. Lipoti, Ph.D., Director

Division of Water Monitoring and Standards

Department of Environmental Protection

5/23/11

Date