

**NOTICE OF FINAL RULEMAKING  
DEPARTMENT OF ENVIRONMENTAL PROTECTION  
ENVIRONMENTAL QUALITY BOARD**

**[25 PA. CODE CH. 95]**

**Wastewater Treatment Requirements**

**Order**

The Environmental Quality Board (Board) by this order amends Chapter 95 (relating to wastewater treatment requirements). The final form rulemaking includes the elimination of a redundant provision, and the establishment of new treatment requirements for new and expanding mass loadings of Total Dissolved Solids (TDS).

This final form rulemaking protects our water resources from new and expanded sources of TDS. Most importantly, the rulemaking guarantees that waters of the Commonwealth will not exceed a threshold of 500 mg/l. In doing so, the rulemaking protects drinking water intakes on streams throughout the Commonwealth and aquatic life resources, as well as maintains continued economic viability of the current water users.

This final form rulemaking differs from the proposed rulemaking in several important respects. The differences are direct reflections of concerns raised by industries that would be impacted by this rulemaking. The rulemaking is responsive to these concerns, resulting in an improved rule.

The changes to the final form rulemaking are protective of our water resources and are appropriately applied by industrial sector, based on the potential impact of the specific sectors to our receiving streams. While many existing industries throughout the Commonwealth are of concern, the lower concentration and total loading of most of those industries does not necessitate treatment below a 2,000 mg/l threshold. A higher standard of 500 mg/l is being applied specifically to the natural gas sector, based on several factors.

The most significant rationale for this industry standard is the fact that wastewaters resulting from the extraction of natural gas are of much higher concentration and represent higher overall loadings when compared to other industries. In other words, the effluent standard does not dictate the treatment technology. Instead, selection of the treatment technology is driven by the raw extraordinarily high wastewater TDS concentration. Second, treatment technologies are currently available and are being employed in Pennsylvania and other states for the treatment of these wastewaters, in contrast to other industries. Regulatory certainty provided with this final rule will drive investment in and development of new technologies. Third, few other states allow the discharge of these treated wastewaters to their surface waters at all, dispelling any argument that Pennsylvania is creating an economic disadvantage for this industry. Fourth, the expansion of the industry into the Marcellus Shale is new to the Commonwealth, and without TDS controls it could impact existing industries, placing them at an economic disadvantage. The potential for growth for Marcellus gas drilling within this sector is enormous and should that growth be realized, the potential impacts are just as enormous. Finally, this industry has shown an ability to

respond appropriately in addressing potential impacts to our natural resources. Options currently exist for other disposal pathways, including non-discharge options, and the creativity of the industry only assures that additional disposal and treatment options will flourish and allow for the continued expansion.

While the intent of both the proposed and final rules is to address new, larger sources of TDS, the proposed rulemaking focused upon controlling new sources of “high-TDS” wastewater through defining these sources in terms of those that were to be regulated (exempting by default those that were not). In order to provide greater clarity to the scope of the regulation, the final rulemaking takes the approach of specifically exempting certain classes of TDS discharges from the application of this rule. This approach is designed to clearly exclude from the scope of this regulation all existing loadings of TDS authorized by the Department prior to the effective date of this regulation, as well as new and expanding TDS sources, which the Department has determined are insignificant from a loading perspective.

In addition, based on Stakeholder comments received during an exhaustive public participation process, the final rulemaking adopts a combination of recommended approaches for addressing these larger loadings of TDS. This combination of approaches includes an industrial sector-based regulation along with a watershed-based analysis. The sector-based piece focuses on the Oil and Gas Industry, mandating the reuse of natural gas well flow back and the treatment of wastewater. Treatment for wastewater that is not recycled or disposed in an approved underground injection well must be performed at a Centralized Wastewater Treatment facility (CWT) to the standards contained in the proposed regulation. This approach sets treatment requirements for natural gas well wastewaters based on available, proven treatment technologies for this industry and takes cost into consideration. These requirements will assure that any threat of water pollution from this rapidly growing industry is prevented in accordance with the mandate of the Clean Streams Law.

Since there are numerous industrial categories and subcategories that include TDS as a pollutant of concern in their wastewater discharges, the watershed-based approach for all industrial sectors other than oil and gas establishes an effluent standard, but also provide a variance option for these discharges. All industries other than Oil and Gas would be subject to this standard, but could be granted a variance, where assimilative capacity exists based on a watershed analysis. Further details on the watershed-based approach adopted by the final regulation are provided below.

This order was adopted by the Board at its meeting of \_\_\_\_\_ 2010.

**A. Effective Date**

These amendments will go into effect upon publication in the *Pennsylvania Bulletin* as final rulemaking.

**B. Contact Persons**

For further information, contact Dana K. Aunkst, Director, Bureau of Water Standards and Facility Regulation, P.O.Box 8774, Rachel Carson State Office Building, Harrisburg, PA 17105-8774, (717) 787-8184 or, or Richard S. Morrison, Assistant Counsel, Bureau of Regulatory Counsel, P.O. Box 8464, Rachel Carson State Office Building, Harrisburg, PA 17105-8464, (717) 787-7060. Persons with a disability may use the AT&T Relay Service, (800) 654-5988 (TDD users) or (800) 654-5988 (voice users). This final-form rulemaking is available on the Department of Environmental Protection (Department) Web site (<http://www.dep.state.pa.us>).

### **C. Statutory Authority**

The final-form rulemaking is adopted under the authority of sections 5 and 402 of the Clean Streams Law (35 P.S. §§ 691.5 and 691.402), which provide for the adoption of regulations implementing the purposes and requirements of the Clean Streams Law and for the regulation of activities which create a danger of pollution to the waters of the Commonwealth, and Section 1920-A of the Administrative Code of 1929 (71 P.S. § 510-20), which authorizes the Board to promulgate rules and regulations necessary to implement the provisions of the Clean Streams Law.

### **D. Background of the Amendments**

#### *Need for the Regulation*

Many rivers and streams in Pennsylvania have remaining assimilative capacity for TDS when compared to a 500 mg/L TDS in-stream limit, but that capacity is limited. To characterize the relationship between in-stream TDS concentrations and stream flows and to predict the effect of additional TDS loadings on water quality in these waterways, regression analyses of stream flow and TDS were performed. Generally, TDS concentrations exhibit an inverse logarithmic or power relationship with stream flow, with higher TDS concentrations observed at lower flows and lower TDS concentrations observed at higher flows. The TDS-flow regression equations were used to estimate the in-stream TDS concentration at the low-flow condition known as the  $Q_{7-10}$  flow, which is defined as the flow below which the annual 7-day minimum flow falls in 1 out of 10 years on the long-term average. The  $Q_{7-10}$  was designed to match the dose-response toxicity profile of most pollutants with the flow profile of natural free-flowing surface waters.

More specifically, the TDS-flow regressions performed by the Department were based on mean daily stream flow as recorded at USGS flow gauging stations and TDS samples collected at long-term monitoring stations near those flow gages. A regression equation was generated from the TDS-flow scatterplots; usually, a logarithmic or power function best fit the observed TDS-flow relationships. The TDS concentration at  $Q_{7-10}$  streamflow was then estimated using the regression equation.

For example, at Water Quality Network Station (WQN) 905 (Beaver River at Beaver Falls, PA) the existing in-stream concentration at the  $Q_{7-10}$  river flow of 530 cubic feet per second is 448 mg/L, based on ten years of data. This means that about 90% of the assimilative capacity already has been consumed, and only about 10% (52 mg/L or 150,000 lb/d) of assimilative capacity remains for the entire Beaver River watershed between the existing concentration and

the water quality criterion of 500 mg/L. This type of water quality analysis shows that available assimilative capacity for TDS is limited in some watersheds, especially considering that the Department should reserve assimilative capacity for future uses, and also maintain a margin of safety. The table attached to this order summarizes the results of these analyses at a number of sites.

In contrast to these analyses, representations of TDS assimilative capacity in surface waters which use a simple plot of TDS versus time tell very little until it is too late, when water quality violations are routine, and no good options remain. The Department is required to prevent violations of water quality standards by planning ahead, and by using available data and good science. Where data are lacking, a conservative approach is warranted. It is incumbent upon the Department, as well as any new proposed sources of loading, to first demonstrate that sufficient assimilative capacity is available before approving any additional sources. The Department has broad experience managing the resource, and is familiar with the minimum requirements that must be achieved.

The Department already has been constrained by the situation. For example, in the West Branch Susquehanna River basin, 8 applications for new treated discharges were submitted for new discharges of high-TDS wastewater, totaling about 2.6 million gallons of flow, or about 3.3 million lb/day of TDS loading. But there is no assimilative capacity available above Karthaus, so no discharges may be approved above Karthaus. Less than 1 million lb/day of assimilative capacity is available between Karthaus and Lewisburg, as compared to the approximately 3.3 million lb/day in requested capacity. Further, the Department must reserve capacity for future use and also provide a margin of safety for pollutants that may be influenced by nonpoint sources; consequently, much less capacity is actually available for allocation. It is unknown how many of these new facilities will be built, but it is clear that there is a large discrepancy between the amount of proposed TDS loading and the amount of TDS loading the resource can safely accommodate. This is true even considering the reduced projections of the volume of wastewater and TDS load that may result from development of the Pennsylvania Marcellus Shale formation.

### TDS

TDS are comprised of inorganic salts, organic matter and other dissolved materials in water. They can be naturally present in water or the result of runoff, mining practices, oil and gas practices or industrial or municipal uses and treatment of water. TDS discharges contain minerals and organic molecules that can provide benefits such as nutrients, when moderately present, but also may contain contaminants such as toxic metals and organic pollutants. The moderate nutrient benefits are not likely in the case of a high TDS discharge. The concentration and composition of TDS in natural waters is determined by the geology of the drainage, atmospheric precipitation and the water balance (evaporation/precipitation).

TDS causes toxicity to water bodies through increases in salinity, changes in the ionic composition of the water, and toxicity of individual ions. The composition of specific ions determines the toxicity of elevated TDS in natural waters. Also, as the hardness increases, TDS

toxicity may decrease<sup>1</sup>. The major concern associated with high TDS concentrations relates mostly to direct effects of increased salinity on the health of aquatic organisms.

Water quality analyses referenced above indicate that the major watersheds of the Commonwealth have a very limited ability to assimilate increased loads of TDS, sulfates and chlorides. This phenomenon was most evident during the fall of 2008, when actual water quality issues related to these parameters emerged in the Monongahela River basin. While river flows reached seasonal lows, the concentrations of TDS and sulfates in the river increased to historic highs, exceeding the water quality standards at all of the 13 Potable Water Supply (PWS) intakes from the border with West Virginia to Pittsburgh. Water quality standards for TDS and Sulfate were consistently exceeded in the river through November and December of 2008. Elevated chloride levels were observed on at least one major tributary – South Fork Tenmile Creek – and for the first time, elevated bromide levels were observed in these streams.

During this period, several environmental agencies performed studies on the effects of TDS, sulfate and chloride discharges on the Monongahela and some of its tributaries. A study<sup>2</sup> conducted by the Environmental Protection Agency (EPA), the Pennsylvania Department of Environmental Protection (DEP) and the Allegheny County Health Department (ACHD) also identified bromides as a key parameter of concern in these waters. The study concluded that a high percentage of the Disinfection By-Products (DBPs) being formed in the drinking water systems were brominated DBPs, which pose a greater health risk than chlorinated DBPs; and, subsequent formation of brominated DBPs increases overall DBP concentrations, specifically trihalomethanes (THMs). The study also concluded that based on the speciation there appears to be a strong correlation between THM formation and elevated source water bromide concentrations in the Monongahela River. As a result, the 17 potable water supply intakes on the Monongahela River are subject to higher levels of the more toxic brominated DBPs, which result in increased risks of bladder cancer to their consumers.

Several studies<sup>3,4</sup> on the potential impacts to aquatic life from these large TDS discharges were also conducted on major tributaries flowing into the Monongahela River in Greene County, Pennsylvania. Each of these studies documents the adverse effects of discharges of TDS, sulfates and chlorides on the aquatic communities in these receiving streams. The former concludes that there is a high abundance of halophilic (salt-loving) organisms downstream from the discharges of TDS and chlorides and a clear transition of fresh water organisms to brackish water organisms in the receiving stream from points above the discharge to points below. It is evident from this study that increases in salinity have caused a shift in biotic communities.

The Monongahela River watershed is being adversely impacted by TDS discharges and many points in the watershed are already impaired, with discharges of TDS, sulfates and chlorides as the leading cause of impairment.

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<sup>1</sup> Soucek, D.J. & A.J. Kennedy. 2004. Effects of Hardness, Chloride and Acclimation on the Acute Toxicity of Sulfate to Freshwater Invertebrates.

<sup>2</sup> Handke, Paul. 2009. Trihalomethane Speciation And The Relationship To Elevated Total Dissolved Solid Concentrations Affecting Drinking Water Quality At Systems Utilizing The Monongahela River As A Primary Source During The 3<sup>rd</sup> And 4<sup>th</sup> Quarters Of 2008, PA-DEP,.

<sup>3</sup> Spear, Rick and Kenderes, Gary. February 2009. Cause and Effect Survey, South Fork Tenmile Creek, PA-DEP,.

<sup>4</sup> Milavec, Pamela J. November 2008. Aquatic Survey of Lower Dunkard Creek, PA-DEP.

Although the Monongahela has received the most attention, it is not an anomalous situation. DEP has studied the results of stream monitoring and has conducted an analysis on the water quality of the Beaver River in western Pennsylvania. These results show upward trends in TDS concentrations. DEP has also conducted similar studies on the Shenango and Neshannock Rivers, with similar upward trends in TDS concentrations. Watershed analyses conducted by DEP of the West Branch of the Susquehanna River and the Moshannon Creek watersheds also indicate that these watersheds are limited in the capacity to assimilate new loads of TDS and sulfates.

DEP has received several permit applications for wastewater discharge in these areas with limited assimilative capacity. These permits, if issued, will necessarily have to impose conservative limitations on TDS loadings from the discharge due to the existing high in-stream concentrations of TDS. DEP is constrained from approving any significant portion of pending applications for new discharges of high-TDS wastewater that include sulfates and chlorides because of the threat posed by these proposed discharges to the quality of Pennsylvania's streams.

Existing practices for controlling pollutants in high TDS-containing wastewaters concentrate on the removal of heavy metals, but the processes employed generally do not actually treat for TDS, sulfates and chlorides by removing those pollutants from the wastewater. Instead, control of the effects from high amounts of TDS, chlorides and sulfates currently rely on dilution of the wastewater by the flow of the receiving stream. Dilution is not treatment. As documented by the rising levels of TDS in the waters of the Commonwealth, dilution in and of itself can no longer be considered an adequate practice to control consistently the effects of wastewaters containing substantial loadings of TDS and its components such as sulfates and chlorides. Treatment technologies such as reverse osmosis and evaporation/crystallization will have to be employed to prevent new or expanded loadings of TDS from consuming all of the remaining assimilative capacity in Pennsylvania's waterways. In addition, as the Department moves forward with watershed restoration efforts, such as treatment of abandoned mine drainage discharges and implementation of Total Maximum Daily Loads, treatment of TDS, sulfates and chlorides will be necessary to assure that watershed restoration is accomplished and that the existing and designated uses of our streams are maintained and protected.

#### *Public Response and Public Involvement in Development of the Final Rulemaking*

The proposed rulemaking was published in the *Pa. Bulletin* on November 7, 2009. See 39 Pa.B. 6467 (November 7, 2009). Public comments were accepted from November 5, 2009 and the comment period officially closed on February 12, 2010. In addition, four (4) public hearings were held: December 14, 2009 in Cranberry Township, Butler County; December 15, 2009 in Ebensburg, Cambria County; December 16 in Williamsport, Lycoming County; and December 18, 2009 in Allentown, Lehigh County.

The Department received extensive public comments regarding the proposed effluent standards for high-TDS wastewaters. A summary of the comments and responses to the proposed rulemaking is set forth in Section F.

WRAC Stakeholder process.

Prior to recommending that the proposed regulation be provided to the Environmental Quality Board, the Water Resources Advisory Committee (WRAC) suggested that further examination be made during the comment period to address two critical areas. WRAC suggested that the Department examine the costs of the proposed regulation on the sectors that would be impacted, and the technologies available to treat discharges high in TDS. WRAC created the TDS Stakeholders Subcommittee to work in cooperation with the Department on these issues.

The TDS Stakeholders Subcommittee was tasked with examining the issue of cost and technology, and was to make recommendations to WRAC for submission to the Department in the form of formal comments on the proposed regulation. The subcommittee was made up of members of the various industries impacted as well as members of interested environmental groups. The subcommittee met monthly from August 2009 thru March 2010; members of the Department involved in the development of the regulation attended these meetings. During that timeframe various sector groups, as determined by subcommittee members, presented their findings on the impact of the proposed regulations on their industry or sector. Those sector groups were: Drinking Water, Natural Resources, Utilities, Municipals, Industrial, Mining and Oil and Gas. All sector groups were provided with an opportunity to present their findings to the subcommittee and those presentations are available on the department's website at:

[http://www.portal.state.pa.us/portal/server.pt/community/water\\_resources\\_advisory\\_committee%28wrac%29/14017/wrac\\_taskforce\\_on\\_chapter\\_95/631764](http://www.portal.state.pa.us/portal/server.pt/community/water_resources_advisory_committee%28wrac%29/14017/wrac_taskforce_on_chapter_95/631764)

Following the various sector presentations, the subcommittee debated recommendations for alternative approaches to the draft regulations as proposed by the Department. DEP staff were involved in all of these discussions. The subcommittee provided a summary of the proceedings to WRAC on March 17, 2010. Those comments can be found at:

<http://files.dep.state.pa.us/PublicParticipation/Advisory%20Committees/AdvCommPortalFiles/WRAC/WRAC-%20TDS%20Task%20Force%20Final%20Report%203-12-10.pdf>.

In summary, the subcommittee suggested a watershed based approach that would allow for use of assimilative capacity where it was available. Further, the subcommittee suggested that the Department monitor the TDS loadings in watersheds statewide and only enact effluent limits on dischargers when the loading within the water body was nearing the limit of assimilative capacity. The subcommittee also suggested that the Oil and Gas sector be incentivized or perhaps even required to recycle or reuse some percentage of fluids captured in the initial stages of well development, the flow back water as it is traditionally called. Finally, the subcommittee suggested that what wastewater could not be reused for fracturing other gas wells should be transported to treatment facilities that provide treatment to appropriate standards.

The Department endorsed the process in which these recommendations were developed and has fully considered the recommendations provided by this group. The subcommittee was a broad reflection of impacted stakeholders and has provided invaluable input, much of which the Department applied as it moved forward in revising the proposed rule.

The Department also met individually with representatives of the Pennsylvania Coal Association (PCA), the Marcellus Shale Coalition (MSC), the Pennsylvania Chamber of Business and Industry (Chamber) and the Allegheny Conference. The amendments being made in this final rulemaking directly respond to several of the recommendations made by the TDS Stakeholders Subcommittee, the PCA, and the Chamber. See Summary of Changes to the Proposed Rulemaking in Section E below.

#### *Sector-based Approach for the Oil and Gas Industry*

The Department has reviewed all of the comments received and has determined that a sector-by-sector approach to controlling TDS is appropriate. High-TDS wastewaters from different industries present different treatment challenges. Not all industrial wastewaters containing TDS are consistent. Based on the need for regulation of a rapidly expanding industry which generates wastewaters with extraordinarily high levels of TDS and chlorides, the readily available proven treatment technologies for this wastewater, the low costs associated with treatment, and the overwhelming public comment in favor of a standard for this industry, the proposed regulation has refined its original focus on treatment for oil and gas wastewaters. The final regulation now contains more specific treatment requirements for wastewater generated from all natural gas drilling activities.

This approach is consistent with the federal regulatory approach that separates technology-based, end-of-pipe requirements by industry sectors. Such requirements establish effluent limits based on best available technologies within an industry, and thus encourage the development and spread of such technologies. This approach further accounts for economic impacts by distinguishing between new and existing sources of pollution, recognizing that new sources can plan their operations factoring in the regulatory requirements for wastewater treatment. The Marcellus shale play has resulted in thousands, and will result in tens of thousands, of new sources of natural gas drilling wastewaters. Although the industry has shown some recent success with reduction in volumes of wastewater needing treatment through the recycling and reuse of flowback and production waters, it is clear that the future wastewater return flows and treatment needs will be substantial. It is appropriate to have a regulatory framework in place now that protects Pennsylvania's streams under any future scenario. It is not appropriate to simply "wait and see". The Department believes that this approach will promote the reuse of flow back and production waters thus minimizing the costs of treatment. This approach will also drive methods of treatment and disposal that do not involve stream discharge, thus providing the protection for a valuable resource.

As stated throughout this order, as noted by the TDS Stakeholders Subcommittee, as identified in the Department's Strategy for Addressing High-TDS Wastewater and as recognized by an overwhelming majority of public comments on this regulation, the primary threat to the quality of Pennsylvania's streams from TDS is coming from the development of the Marcellus shale play. This play, estimated to contain as much as a 500 trillion cubic feet of recoverable natural gas, could result in the development of up to 50,000 new, producing gas wells over the next 20 years.



The Department is encouraged that the industry has developed and is implementing recycling and reuse, and that the play is drier than anticipated, together reducing flow back volumes significantly from the original estimates that created the initial urgency for the proposed rule. The Department remains concerned, however, that development of the play is still in its infancy, and as the play matures, these phenomena may change significantly. Evidence from the Barnett shale experience supports this concern. As the play matured, flow back rates increased.

Second, the current Marcellus experience does not provide enough information on the long term rates of produced water to be expected to return from the formation. These wells are anticipated to produce very highly concentrated TDS wastes (over 300,000 mg/l<sup>5</sup>) continuously over the course of 20 to 30 years. For example, if these wells produce an average of 10 barrels per week of produced water over their useful lives, a single average well could produce about 27 tons of salt per year (at 300,000 mg/l). Multiply this amount by tens of thousands of Marcellus gas wells, and the potential pollutional effects from such loadings are tremendous. Finally, not enough is known at this point about whether Marcellus wells may need to be “re-fracked” one or more times in the future, thus providing additional uncertainty regarding treatment and disposal needs for the wastewater.

The Department is responsible for assuring that future generations of Pennsylvanians have the right to clean air, pure water, and to the preservation of the natural, scenic, historic and esthetic values of the environment. This responsibility, along with all of the uncertainty related to the development of the Marcellus play and the potential wastewater generation leads the Department to take a conservative, proactive approach to regulating the treated wastewater discharges from this new production.

#### Available Technologies

Wastewater originating in this formation presents treatment challenges due to the presence of high concentrations of chlorides, barium and strontium, and the presence of naturally-occurring, radioactive radium. It is clear that technology for treating the extraordinarily high TDS wastewater from natural gas well drilling operations is both proven and widely available. The Department has met with over 60 manufacturers and vendors of technologies for treating the very high levels of TDS from the oil and gas industry, and specifically the Marcellus shale formation. While some of these vendors do not have actual facilities in operation and are seeking to get into the business, at least six manufacturers have either piloted the technology at full scale or have facilities currently operating in other states.

Much of the hesitancy on the part of these technology vendors is the result of uncertainty in the current regulatory framework. Companies are reluctant to move forward without a clear direction concerning required treatment levels for TDS. Implementing this regulation will provide regulatory certainty for companies proposing treatment facilities for high TDS wastewaters.

Notably, treatment facilities for wastewater from natural gas well operations will have a positive economic impact. Investment companies have indicated that without clear direction they are less willing to provide capital for financing these types of wastewater treatment facilities. One

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<sup>5</sup> STW Resources, Inc. Presentation to PADEP. August 26, 2008.

company provided information that their treatment plant, if built and operated, could create approximately 70 to 100 short-term jobs during construction and about 12 permanent jobs during operation of their facility. Some companies have also indicated that they may be able to produce a salable salt product after treatment of the high TDS water.

The Department has issued two NPDES permits for facilities to treat these wastewaters to the standards in the proposed regulation, one in the Williamsport area – Terraqua Resource Management<sup>6</sup> – and one in Somerset County – Somerset Regional Water Resources<sup>7</sup>. The Department has at least 29 other permit applications currently under review. In addition, facilities have been constructed and are in operation in other states. AOP Clearwater<sup>8</sup> recently began operation of a Zero Liquid Discharge (ZLD) facility in Fairmont, West Virginia, and 212 Resources<sup>9</sup> operates a treatment facility in Colorado. Integrated Water Technologies<sup>10</sup> has recently completed full-scale pilot studies documenting that their technologies are successful in treating these wastewaters to the proposed standards or better.

The common thread with these facilities is that all employ a form of evaporation/distillation. Flow back waters from natural gas well drilling activities can generally be recycled until they reach certain very high concentrations of TDS, at which point the wastewater must be disposed because it can no longer be effectively reused. Wastewaters that are extremely high in TDS concentration, i.e., greater than 30,000 mg/l, are generally not amenable to other technologies. Therefore, the very high concentrations of TDS in this industry's wastewater will necessitate treatment by evaporation/distillation technology. For example, reverse osmosis cannot economically treat the extraordinarily high levels of TDS because the membranes foul, and need to be changed too often. It is also important to understand that use of evaporation/distillation technology always results in treated water with TDS concentration levels significantly lower than the 500 mg/l standard for CWT effluent in the final regulation (it can be as low as 10 mg/l). It is the extraordinarily high TDS quality of the raw wastewater that drives the treatment technology, therefore, the specific effluent standards for the natural gas industry in the proposed rule have been retained in the final rule.

### Costs of Treatment

The natural gas well drilling industry in Pennsylvania has a long and notable history. Hydraulic fracturing is not new to the Commonwealth, either. According to Pennsylvania Oil and Gas Association (POGAM), almost every oil and gas well in Pennsylvania since the early 1960s has been hydraulically fractured in some way to enhance recovery. Handling and disposing of fracturing fluids (produced water) is an old practice. Prior to the Marcellus shale activity in Pennsylvania, oil and gas production (and its concomitant generation of produced waters) was

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<sup>6</sup> Terraqua Resource Management, LLC, 1000 Commerce Park Drive, Williamsport, PA 17703. NPDES Permit No. PA0233650.

<sup>7</sup> Somerset Regional Water Resources, Larry Mostoller, 888 Stoystown Road, Somerset PA 15501. NPDES Permit No. PA0253987.

<sup>8</sup> AOP Clearwater, Rob Bealko, Operations Manager, 168 AFR Drive, Fairmont, WV 26554.

<sup>9</sup> 212 Resources. Robert Waits. Executive VP - Business and Government Affairs, 2825 E. Cottonwood Parkway, Suite 180, Salt Lake City, UT 84121.

<sup>10</sup> Wastewater Demonstration Final Report. Integrated Water Technologies. 150 Clove Road. Little Falls, NJ 07424. Mavickar Environmental Consultants. January 2010.

gradually diminishing. The old practice common to this industry of addressing TDS through dilution thus posed a retreating threat to the water quality of Pennsylvania streams. The arrival of the Marcellus play has drastically changed that paradigm.

In the order for the proposed rule, the Department referred to estimated costs for treating this wastewater at approximately \$0.25 per gallon. Each of the manufacturers cited above that has technology operating has verified that the true costs for treatment of this wastewater range between \$0.12 and \$0.25 per gallon.

The MSC provided the TDS Stakeholders Subcommittee with revised estimates of the anticipated treatment and disposal capacity need through a presentation at the November 10, 2009 subcommittee meeting. Their estimate of 2 million gallons per day is based on current flow back rates. The Department believes that this estimate may be low at this point in time, because of the infancy of Marcellus well development in Pennsylvania (see above). If the estimate were to be doubled, the annual cost of treatment for the industry statewide could be as high as \$364 million (4 million gal/day \* \$0.25 / gal.)

The cost of wastewater treatment, when compared with estimates of the annual revenue from Marcellus Shale gas extraction, is minuscule. Using industry projections, if there are indeed 500 trillion cubic feet of gas recoverable over the next 50 years, and if the price per 1000 cubic feet were to hold at today's levels (about \$5 which is an extremely conservative assumption), the annual revenue industry-wide could be \$50 billion. Based on the treatment needs estimates by the industry and this analysis, the cost of treatment would be 0.4% to 0.8% of annual revenue, an insignificant percentage. Moreover, this industry has shown an ability to quickly adjust and develop cost effective solutions, as evidenced by the development and embrace of techniques for reuse of fracturing fluids. Treatment to levels in the final regulation clearly can be achieved at a reasonable cost to the Pennsylvania natural gas industry. On the other side, the benefits from preventing the rise of TDS and chloride pollution levels in the Commonwealth's water resources are significant. For example, in economic terms, the TDS Stakeholders Subcommittee noted that stream-related tourism and recreation in Pennsylvania brings in an estimated \$28 million annually.

The Marcellus Shale play is in its infancy, but the industry is clearly growing and will continue to grow for at least the next ten years throughout the Pennsylvania Marcellus Shale formation. The Department's aim is to ensure that future growth of this industry is considered in the rules and regulations it puts in place.

Other industries potentially impacted are not in such a growth stage, nor on a scale as large. Part of the Department's mission is to consider the cost effectiveness of our rules, their impact on the regulated community, and whether the regulated community can continue to operate should rules be enacted. This evaluation has led us to recognize that other industries throughout the state could not effectively adapt to broad-based required end-of-pipe load reductions in TDS, therefore the watershed based approach was selected for these other industries.

The Department received 4,221 separate sets of comments on the proposed regulation. It is important to recognize that over 90% of those comments supported the proposed regulation, and

that the overwhelming majority of the supporting comments either assumed the proposed effluent standards were for the oil and gas industry or supported the effluent standards applying only to the oil and gas industry. The Department cannot simply discount this tremendous degree of public direction.

Effective and responsible management of the very real environmental challenges involved with the natural gas industry in Pennsylvania are needed to move forward with its development. The Department must address these challenges now to provide the public and the industry with the regulatory framework to assure that the Pennsylvania Marcellus Shale formation can be developed safely and rapidly, while protecting and preserving our other natural resources. The wealth and promise of the resource is indisputable, and appropriate environmental management will promote the development of the formation, not hinder it. This proposed revision to Chapter 95, *Wastewater Treatment Requirements*, is essential to providing needed regulatory certainty.

#### *Watershed-based Approach for Industries Other than Oil and Gas*

The Department agrees with the comments that were received by various industries pointing out that the proposed rule is a one-size-fits-all approach that may not be appropriate. Different industries have very different wastewaters, even in the composition of the TDS. There are many different technologies that would be necessary to treat these different wastewaters, and the costs of treatment to a given standard could create an inequitable economic problem. For example, achieving a 500 mg/l standard for two different industries could require two different technologies, based on the type of TDS, with one technology being much more expensive than the other.

At the same time, allowing TDS discharges from all of these industrial sectors based only upon dilution, i.e. controlling TDS based on water quality-based effluent limitations alone (as recommended by the Chamber), also creates an un-level playing field. Effluent limitations would then be based on location only, and could give some competing businesses an advantage for simply being located in a watershed without a Potable Water Supply (PWS) intake.

TDS is known as a conservative parameter, meaning that TDS is not subject to fate during transport in the water column. These solids are dissolved, and will stay dissolved barring huge changes in stream pH. This means that a pound of TDS discharged in the headwaters of a watershed is still a pound of TDS at the mouth of the watershed, or of more concern, at the location of the PWS intake. Cumulative loadings of TDS from multiple discharges upstream of these intakes can cause violations of water quality criteria at design conditions and result in the need for an allocation strategy. Such allocation strategies are inequitable unless the same requirements apply to all contributing discharges, independent of the location of each discharge in the watershed.

The Department has addressed this issue and the comments received from the various potentially-affected industries in this final rule. The approach establishes an effluent standard for sectors (other than natural gas well operations) at 2,000 mg/l, and allows a variance from this standard under certain conditions specific to the watershed in which the discharge is located. The 2,000 mg/l as a monthly average standard was selected for several reasons. First, it is the

bar set in the proposed regulation for a high-TDS discharge, meaning that TDS-containing discharges from most industrial sectors and POTWs do not contain more than 2,000 mg/l TDS and thus would not be subject to this rule. Moreover, (unless the discharge flow volume is quite low) a discharge containing greater than 2,000 mg/l will have a TDS loading rate that significantly impacts the assimilative capacity of the receiving stream, even if that stream has substantial flow volume. Second, the rule applies only to new and expanding loads of TDS, not the existing loads, making it more easily achieved and enabling industries that will be affected to plan their operations to meet the new standard. Finally, while the end-of-pipe 2,000 mg/l standard is less stringent than the instream water quality criterion, it is within 4 to 5 times that value, and in the Department's Best Professional Judgment assures that adequate instream dilution will be available to prevent exceeding the water quality standard.

Variances to this standard can be approved by the Department provided that the applicant can demonstrate the need for such a variance. Such a demonstration must be based on the character of the wastewater, the availability of treatment technologies and the costs associated with meeting the standard. Such variances are not without limitations. The Department will develop guidance materials to assist applicants in the completion of requests for variances prior to the effective date of this regulation.

Under the rule, an upper bound that limits the degree a discharge can vary from the standard will be established based on water quality considerations. This upper bound is set in a manner similar to the approach that the Delaware River Basin Commission (DRBC) currently regulates. The Department, through this rule, is setting an upper bound such that the resulting instream concentration of TDS, assuming complete mixing, does not exceed 133% of the natural stream quality for the specific watershed. This is to be determined by the Department using ambient Water Quality Network (WQN) stations. In addition, the watershed analysis must assure that the cumulative load from all sources at the next downstream Potable Water Supply (PWS) intake does not exceed 75% of the water quality-based assimilative capacity at design stream flow conditions, as required in § 96.3, i.e.  $Q_{7-10}$ .

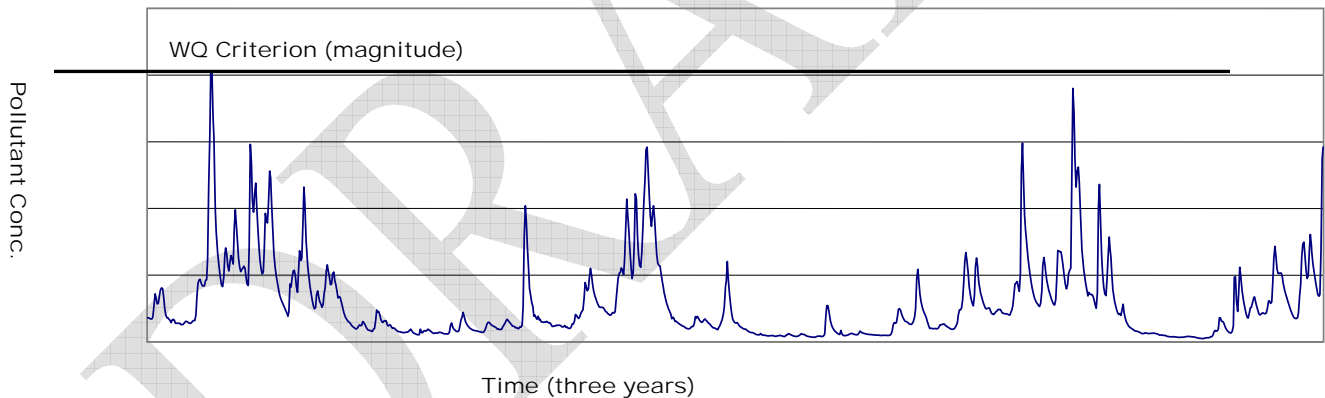
The Department will closely monitor TDS levels and take steps necessary to limit increased or future discharges and prevent water quality criteria violations. Where the remaining assimilative capacity of a receiving stream falls below twenty-five percent (25%), based on analysis at design stream flow conditions, the Department will develop a wasteload allocation for all discharges of TDS that contribute to the specific water quality standards compliance point.

#### *Real-Time Management – a.k.a. Flow Management*

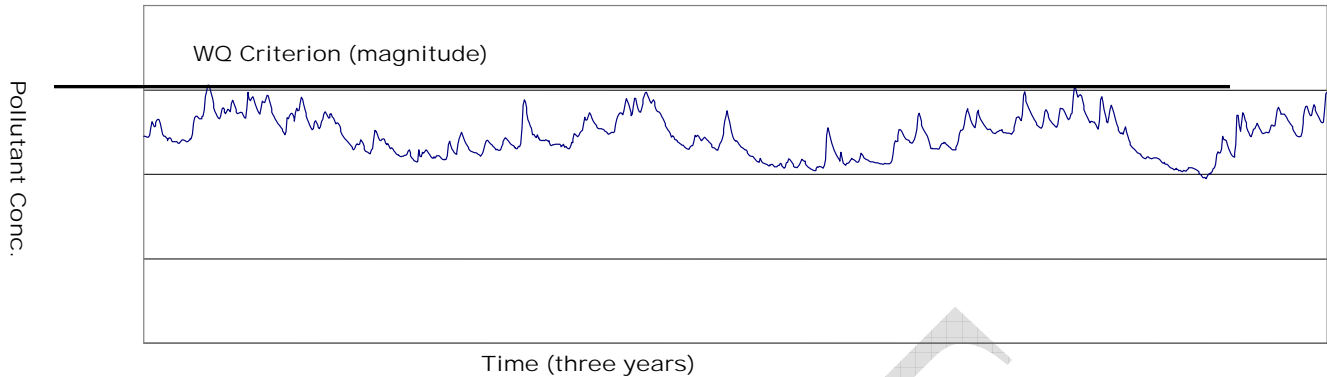
Throughout the comment period, the Department received recommendations that a real-time, or flow management approach to controlling TDS should be implemented by the Department, in place of imposing treatment requirements. Specifically, the recommendation was that the Department should set aside the Chapter 96 requirement that allocations be based on the  $Q_{7-10}$  design low-flow condition in the receiving water. Support for this position relies on a rationale that does not reflect real-world considerations or good science. This method of managing flows on a real-time basis presents many problems, most notably compliance with federal and state regulatory water quality standards.

**Water Quality Standards:** The fundamental characteristic of numeric water quality criteria is that they include three components: magnitude, frequency, and duration. This is especially true of water quality criteria designed to protect aquatic life. Each criterion has been substantiated and advanced based on underlying limitations and conditions that have been specified in the criteria development documentation. Implementation of these criteria is invalid unless the underlying limitations and conditions are preserved. If there is a 230 mg/L water quality criterion for chloride designed to protect aquatic life, the criterion magnitude is advanced on the basis that exposure to concentrations that high will occur rarely (in this case, a frequency of no more than once every three years), and for limited periods of time (a duration of no more than four days). For the rest of the time, the underlying requirement is that the target organism is not stressed by exposure to chloride at any significant level, i.e., that exposure to elevated concentrations of chloride is a rare and isolated event. In order to achieve the underlying frequency and duration components of the water quality criterion, Water Quality Based Effluent Limitations (WQBELs) must be developed that limit the frequency and duration of instream concentrations of the pollutant of concern.

An example of a target distribution that would achieve the magnitude, frequency, and duration components of the water quality criteria looks something like that presented below. The criterion magnitude is challenged only rarely with near-background concentrations existing most of the time.



The effect of using real-time flow management is to allow instream concentrations to approach the criterion magnitude value more often and for longer periods of time. An example of real-time flow management, a target distribution that would achieve the magnitude component but not achieve the frequency and duration components of the water quality criterion, might look more like that presented below. The criterion magnitude is challenged continually, and concentrations essentially never drop to near-background levels. The WQBEL has not been designed to achieve the frequency and duration components of the water quality criterion, even if the criterion magnitude has not been exceeded.



The  $Q_{7-10}$  design flow condition was not arbitrarily selected. It was designed to match the flow profile of natural free-flowing surface waters with the dose-response toxicity profile of the pollutant, and thereby achieve the underlying frequency and duration components of the water quality criteria. Use of the steady-state  $Q_{7-10}$  design flow condition is the standard in NPDES permitting at both the state and federal level for most pollutants. Real-time flow management is inconsistent with the underlying frequency and duration components of the water quality criteria, and violates the criterion as surely as if the instream concentration exceeds the criterion magnitude. Failure to achieve the frequency and duration components of the water quality criteria has real-world consequences in terms of biological and other impacts.

***Reliance on the Dose-Response Relationship:*** There are limitations inherent in the methods employed to produce water quality criteria. The normal objective is to define the dose-response relationship using one or more sensitive species. The organisms are exposed to different concentrations of the toxicant for different time periods, and the resulting adverse effects are used to define the dose-response relationship. There are two important limitations of the methods. First, for practical reasons where three major variables (species, concentration, and exposure time) are involved, there are limits to the number and time-length of these exposure tests. For instance, laboratory analyses may be able to expose sensitive organisms to calibrated concentrations of the pollutant for days or weeks, but not months or years. Hence, the long-term effects of continuous exposure to most toxicants typically are largely unknown. Second, there are limits to measuring toxicity, and third toxicity alone is not necessarily the only issue. For instance, changing the hardness of water, independent of any toxic effects, may have significant impacts on aquatic life. Native species that are acclimated and thrive in soft water may be at a disadvantage to species that perform better in hard water. The hard water is not toxic to the native soft-water species, they just lose out in the competition to better adapted species in the same or similar ecological niche.

The  $Q_{7-10}$  design flow reflects the limitations of laboratory dose-response toxicity testing and the underlying bases. New criteria are developed with the same underlying limitations and conditions. The  $Q_{7-10}$  design flow prevents any non-toxicity effects from manifesting, because it assures that the fundamental nature of the receiving water is not changed. Reliance on other methods that allow for higher discharge loading rates moves away from the dose-response model, and may pose altering the fundamental nature of the receiving water.

Pennsylvania Marcellus Shale-related solids will be present in massive quantities. The constituents of greatest concern, especially chloride, do not volatilize or degrade, and would remain mostly in the dissolved, bioavailable phase. The sequential loadings of the conservative solids discharged from multiple facilities would accumulate in the receiving water, with dilution the only mitigating factor. The Q<sub>7-10</sub> design flow condition is more important than ever, given the nature of TDS and its component solids, in order to preserve the fundamental nature of the receiving waters as freshwater streams and rivers typical of Pennsylvania.

### Protection of Drinking Water

Water suppliers were generally supportive of the intent of the regulation because it will provide more assurance that levels of TDS, a secondary maximum contaminant for drinking water, are not exceeded at the point of intake. Commentors recognized the benefits of the regulation, but did offer suggested revisions. Those suggestions included support for a watershed based approach. In addition, comments from some water suppliers also included support for technology based limits targeted toward new sources of high-TDS discharges.

Water suppliers noted that the cost of removal of TDS by water suppliers should be considered as well as additional costs such as notification requirements when secondary maximum contaminant levels (MCLs) are exceeded. Pennsylvania has 349 drinking water suppliers that rely on surface water or groundwater under the direct influence of surface water as their primary sources. The impact of not implementing a discharge standard that provides adequate protection to streams and downstream water suppliers would necessitate many of those suppliers to install treatment technologies for TDS removal. While it is true that this treatment may not be necessary at all times, installation for cases in which it is warranted would still be necessary, and costly. These costs would be borne by the rate-payers of these water systems.

As the Department examined the cost-effectiveness of the regulation, it was clear that good public policy dictates that the responsibility for the treatment and removal of TDS should not fall to the water suppliers and their customers. The approach the Department has taken ensures that this cost will not be borne by these end users.

## **E. Summary of Changes to the Proposed Rulemaking**

### **§ 95.10(a) - Existing versus New and Expanding – De minimis**

This final rulemaking differs from the proposed rulemaking at § 95.10(a). Specifically, this section of the proposed rulemaking defined “high-TDS” discharges as those discharges that did not exist on April 1, 2009 and that contain TDS concentrations greater than 2,000 mg/l or TDS loads of more than 100,000 lbs/day. The intent was to only regulate these discharges under the effluent standards proposed in § 95.10(b).

The approach in the proposed rule resulted in a great deal of confusion on the part of regulated dischargers. The Department received numerous telephone calls and comments from dischargers who assumed they would be subject to the effluent standards but who had discharges that would not have been. These dischargers knew their effluent concentrations were greater than 500 mg/l



and thus assumed they would have to provide treatment, when in fact the discharge did not exceed 2,000 mg/l and the discharge would have been exempt from the rule.

Further, many existing dischargers assumed this exemption would only apply until the next time their permit was to be renewed. They assumed they would then be subject to the requirements for new and expanding discharges, even though they were not expanding. In addition, many dischargers assumed that moving their existing discharge from one location to another, without changing the actual TDS loading, would result in a new discharge, thus invoking the effluent standards. This was most noted by the mining industry.

From the inception of the rule, the intent of the Board was to exempt existing discharges, and insignificant discharges, from the effluent standards aimed at controlling the new, larger source of TDS. The majority of Pennsylvania's watersheds did not exhibit violations of water quality criteria, and Department analyses showed that even with these existing discharges assimilative capacity remained. It was the threat to this available assimilative capacity from new loads of TDS, most notably from the new Marcellus shale gas operations (see § 95.10(b) below), that prompted the Department to take a proactive step to prevent future compromises to our water quality standards through proposal of this regulation.

Therefore, the final rulemaking changes the approach for identifying those larger, new and expanding loads of TDS to be subject to this regulation. Instead of defining those discharges that are to be included by defining "high-TDS", this final rule specifically identifies those existing and smaller discharges of TDS that are not subject to this regulation. The Board believes that this approach provides clarity and improves the regulation.

#### § 95.10(a)(1)

This section makes it clear that discharge loads of TDS authorized by the Department, under NPDES permits which were issued or re-issued prior to the effective date of this regulation, are exempt from the regulation until such time as the load authorization is to be increased. Currently, authorized loadings of TDS, (and its components such as sulfates and chlorides) are considered to be the existing discharge loads, even if the facility has in fact typically discharged at a lower load than that authorized by its permit. If a facility applies for an increase in its authorized TDS loading rate, only the amount of the increase in its authorized TDS loading will be considered as a new and expanding discharge of TDS subject to the requirements in this rule. The section also clarifies that authorized loads are not subject to the rule if they are merely being combined or relocated from one point in a watershed to another, so long as total mass loadings are not increased by the combination or relocation activity.

#### § 95.10(a)(2)

This section clarifies that abandoned mine sites eligible for funding pursuant to Title IV of the federal Surface Mining Control and Reclamation Act (SMCRA), 30 U.S.C. §§ 1201-1244 are not considered new and expanding loadings of TDS. Sections 1234 and 1232(g)(4) of federal SMCRA describe eligible abandoned mine lands; these include lands and water affected by mining and abandoned or left in an inadequate reclamation status prior to August 1977 when

federal SMCRA was enacted, and sites for which an inadequate bond was forfeited after 1977 and prior to July 1982 when Pennsylvania obtained primary jurisdiction over surface coal mining operations within the Commonwealth. These discharges are clearly not new or expanding loadings of TDS. Moreover, while the Board recognizes that existing discharges from abandoned mine lands substantially contribute to TDS loadings in surface waters, treatment facilities for these discharges are constructed, operated and maintained by the Department itself or by non-profit watershed groups working in conjunction with the Department. Title IV grants, and other grant funds, are used for this purpose, and the remediation of the legacy of abandoned mine drainage in the Commonwealth is an enormous project which will take many years to accomplish. The Department must retain flexibility to direct scarce Commonwealth resources to treat abandoned mine discharges in a manner which is both cost-effective and achieves the best overall pollution prevention within a watershed.

#### § 95.10(a)(3)

This section clarifies that surface coal mining operations engaged in re-mining, with pre-existing discharges of TDS covered by the re-mining regulations in Chapters 87 and 88, are not considered new and expanding sources of TDS. Based on sampling data, the Board generally expects that discharges of TDS from erosion and sediment control facilities at surface mining operations will be de minimis. However, pre-existing abandoned discharges can contain somewhat higher loadings of TDS. An exception for pre-existing discharges covered by re-mining regulatory requirements is being included to assure that re-mining operations are not discouraged by this regulation. Because these are pre-existing discharges of abandoned mine drainage, they are already contributing TDS and sulfates to the receiving stream. More importantly, the re-mining operation is expected to abate or reduce the pollutant load of these existing abandoned discharges, thereby resulting in an overall improvement to water quality in the watershed. The mining regulations in Chapter 87 Subchapter F, and Chapter 88, Subchapter G will continue to provide the applicable criteria for permitting pre-existing discharges on re-mining areas.

#### § 95.10(a)(4)

This section establishes a de minimis loading for new and expanding discharges, exempting small discharges and small increases in discharges from this regulation. New or increased loads of TDS that total less than 5,000 lbs/day are considered to be de minimis, and exempt.

#### § 95.10(a)(5)

This section exempts those dischargers of TDS for which federal regulations have already established Effluent Limitation Guidelines (ELGs) for TDS, Chlorides or Sulfates. This regulation is not intended to supersede requirements where the Environmental Protection Agency (EPA) has established Best Available Treatment Technology that is economically achievable (BAT) for a specific industrial subcategory for any of these three parameters. These discharges are exempt from this regulation.

### **§ 95.10(b) - Sector-based Approach for the Oil and Gas Industry**

§ 95.10(b)(1)

This section prohibits discharges to waters of this Commonwealth of wastewater resulting from fracturing, production, field exploration, drilling, or well completion of natural gas wells. This section is consistent with the federal ELG for the on-shore oil and gas industrial subcategory found at 40 CFR Part 435.

§ 95.10(b)(2)

As recommended by the TDS Stakeholder Subcommittee, this section requires recycling and reuse of flow back waters with TDS concentrations less than 30,000 mg/l. The purpose of this requirement is to drive maximum recycling and reuse of these wastewaters to reduce treatment and disposal threats to streams, treatment and disposal costs to the industry and costs to the industry and taxpayers in the form of wear and tear on state and local highways.

It is generally known that TDS concentrations of less than 30,000 mg/l can be blended with fresh water or treated using available technology, e.g. reverse osmosis, to achieve a quality that can be used for additional fracturing. Wastewaters with higher TDS concentrations may be recycled at the industry's choice, but they are not required to be.

The section contains an optional provision that would waive the requirement under certain conditions. The Board recognizes that there may be circumstances that preclude the full recycling and reuse of flow back from certain wells for technological or economic reasons. Therefore, upon written request and justification of such infeasibility, the Department may grant a site-specific waiver to this requirement.

§ 95.10(b)(3)

This section provides that treated discharges of wastewaters resulting from natural gas well operations may be authorized under a National Pollutant Discharge Elimination System (NPDES) permit under specific conditions:

§ 95.10(b)(3)(i)

The wastewater is hauled to and treated at a permitted Centralized Waste Treatment facility (CWT). This term is defined in the federal regulations at 40 CFR Part 437.2(c).

§ 95.10(b)(3)(ii)

The wastewater may not be discharged directly to a POTW without first receiving pretreatment at a permitted CWT.

§§ 95.10(b)(3)(iii) – (vii)

CWTs treating this wastewater must meet the effluent requirements contained in these sections.

#### § 95.10(b)(4)

This section specifies that when these wastewaters are hauled to sites for deep underground injection these sites must comply not only with the federal Underground Injection Control requirements but also with § 78.18 of the Department's rules and regulations, where applicable.

#### **§ 95.10(c) – Effluent Standard for Other than Oil and Gas**

This section establishes the effluent standard of 2,000 mg/l for TDS for all industrial sectors other than oil and gas, and provides an optional variance provision, which is detailed in the following section.

#### **§ 95.10(d) – Variance Provision**

Variances to this standard can be approved by the Department provided that the applicant can demonstrate the need for such a variance. Such a demonstration must be based on the character of the wastewater, the availability of treatment technologies and the costs associated with meeting the standard. Such variances are not without limitations. The Department will develop guidance materials to assist applicants in the completion of requests for variances prior to the effective date of this regulation.

#### **§ 95.10(e) – Department Approval of Variances**

Under the rule, an upper bound that limits the degree a discharge can vary from the standard will be established based on water quality considerations. This upper bound is set in a manner similar to the approach that the Delaware River Basin Commission (DRBC) currently regulates. The Department, through this rule, is setting an upper bound such that the resulting instream concentration of TDS, assuming complete mixing, from a discharge not addressed by §§ 95.10(a) or 95.10(b) does not exceed 133% of the natural stream quality for the specific watershed. This is to be determined by the Department using ambient Water Quality Network (WQN) stations. In addition, the watershed analysis must assure that the cumulative load from all sources at the next downstream Potable Water Supply (PWS) intake does not exceed 75% of the water quality-based assimilative capacity at design stream flow conditions, as required in § 96.3, i.e. Q7-10.

The Department will closely monitor TDS levels and take steps necessary to limit increased or future discharges and prevent water quality criteria violations. Where the remaining assimilative capacity of a receiving stream falls below twenty-five percent (25%), based on analysis at design stream flow conditions, the Department will develop a wasteload allocation for all discharges of TDS that contribute to the specific water quality standards compliance point.

#### **F. Summary of Comments and Responses on the Proposed Rulemaking**

The Board approved publication of the proposed amendments at its meeting on August 18, 2009. The proposed amendments were published at 39 Pa.B. 6467 (November 7, 2009). Public comments were accepted from November 5, 2009 and the comment period officially closed on

February 12, 2010. In addition, four (4) public hearings were held: December 14, 2009 in Cranberry Township, Butler County; December 15, 2009 in Ebensburg, Cambria County; December 16 in Williamsport, Lycoming County; and December 18, 2009 in Allentown, Lehigh County.

Note that the Allegheny Conference, the Pennsylvania Coal Association, the Marcellus Shale Coalition and the Pennsylvania Chamber of Business and Industry all questioned the need for the regulation based on their review of watershed data. The Department's response to these comments is found below, and in the Background Section of this order.

### Allegheny Conference

The Allegheny Conference provided two major comments:

- There was an absence of scientific data to support the regulation
- There was the potential for the proposed rule to seriously damage the economy of southwestern Pennsylvania and the state.

The final rule has been modified to address many of the issues identified in relation to economic effects by clarifying the misunderstanding of many industries as to how this rule would impact them, especially in the Monongahela River watershed. In the Monongahela, TDS levels have already exceeded water quality criteria. This means that allocations of TDS loads must be made for all dischargers in the watershed, to bring the river back to compliance. The Department will be listing the Monongahela as impaired on its upcoming impaired waters list as required by the federal Clean Water Act.

In other watersheds, the Board recognizes that high-TDS wastewaters from different industries present different treatment challenges. Not all industrial wastewaters containing TDS are consistent. Based on the need for regulation of a rapidly expanding industry which generates wastewaters with extraordinarily high levels of TDS and chlorides, the readily available proven treatment technologies for this wastewater, the low costs associated with treatment, and the overwhelming public comment in favor of a standard for this industry, the proposed regulation has refined its original focus on treatment for oil and gas wastewaters. The final regulation now contains more specific treatment requirements for wastewater generated from all natural gas drilling activities, and provides exemptions and an option variance provision for non-natural gas industries designed in part to address economic issues identified.

With regard to the absence of science comment, Allegheny Conference is ignoring important evidence. Their analysis used a simple frequency analysis, but the Department's WQN data set contains an adequate number of independent observations that allow more powerful statistical distribution tests, as outlined in the 2009 Assessment and Listing Methodology ([http://www.portal.state.pa.us/portal/server.pt/community/water\\_quality\\_standards/10556/2009\\_assessment\\_methodology/666876](http://www.portal.state.pa.us/portal/server.pt/community/water_quality_standards/10556/2009_assessment_methodology/666876)). The Department's analyses of watersheds across the Commonwealth were conducted using these more rigorous more rigorous methods. Where the Department's analyses of WQN data showed the potential for water quality criteria violations, detailed studies were conducted in those watersheds.

First, conductivity is highly correlated with TDS and conductivity can be monitored continuously using probes. Although discrete TDS samples at the WQN sites in the Monongahela River may not fully elucidate the problem of increasing TDS, the continuous monitoring of conductivity is convincing. This increase in conductivity prompted the Department to conduct chemical grab sampling in various pools in the Monongahela in 2008 and 2009. Careful analysis of these samples, taking into consideration both the frequency and duration components of water quality criteria, showed they exceeded the 500 mg/l potable water supply TDS criteria in pools with drinking water intakes.

Allegheny Conference comments that “The spikes recorded in 2007-2009, after a decade of readings below 500 parts per million, indicate a condition worth studying to understand its nature and severity, but a handful of samples is not enough to justify a new set of regulations for the entire state.” The spikes in fact did elicit more study as the Department began systematically collecting additional grab samples in the Monongahela. The result was the discovery of a severe TDS problem in the river leading to an impairment listing. Uncovering the severity of this problem prompted the Department to recognize the need to deploy more continuous conductivity probes in other waters in order to learn whether the TDS problem is more widespread than just the Monongahela.

The assessment process by the Department in the Beaver River watershed is the same as occurred in the Monongahela. The potential for a TDS problem has been identified from WQN data, and the Department is responding by collecting grab samples and deploying conductivity probes. It takes time to collect the data, but when an adequate number of samples become available the Department will not simply rely upon a WQN frequency analysis, as suggested, but must consider the entire weight of evidence. Similar assessments of WQN data were made for the West and North Branches of the Susquehanna River, the Clarion River and Moshannon Creek, which are discussed above.

Allegheny Conference omits any mention of the environmental disaster in Dunkard Creek that wiped out 26 miles of stream. The problem was high TDS concentrations leading to colonization and growth of golden algae, as well as osmotic pressure exceeding the regulatory numeric criterion. Dunkard Creek is a good example of what can happen if TDS is not controlled, and the loss of this important public resource was an environmental tragedy, documented by the loss of aquatic life, including endangered mussels.

Allegheny Conference’s analysis of the WQN data can in no way be considered a risk assessment with any merit. Based on their simple frequency analysis the Conference suggests that the Board should delay any regulations because their analysis does not show many 500 mg/l exceedance at WQN sites. As documented above, the WQN data can be used to calculate the background TDS concentration at each site and from that determine how much additional TDS load can be added before there is environmental harm. This is done by computing the assimilative capacity at Q7-10 design flow, and is a much more robust risk assessment.

*Pennsylvania Coal Association*

The Board received significant comments from the Pennsylvania Coal Association (PCA). In addition, the PCA participated in the TDS Stakeholders Subcommittee and provided a detailed presentation of how the PCA believed this regulation would affect their industry. Finally, the PCA also submitted comments to the Independent Regulatory Review Committee (IRRC), which were in turn submitted to the Board.

The PCA comments opposed the regulation for several reasons. First, the PCA assumed that at some point in time, the Board would regulate all sources of high-TDS as new or expanding discharges, thus negating any exemptions. Second, the large volumes of mine drainage would be considered high-TDS, not because of their concentrations but because of the TDS loadings, and that all discharges from mining activities would eventually be regulated. The PCA added together the cumulative costs across the industry for treating TDS for all of its activities and discharges, including legacy operations for which their membership is currently responsible, and developed an estimate of the total industry costs to comply. Needless to say, when estimated in this manner, that cost was astronomical.

Upon Board review of the PCA comments, the IRRC comments and the PCA presentation to the TDS Stakeholders Subcommittee, it was apparent that the Board's intent to exempt existing loads of TDS from mining activities was not clearly discernable in the proposed rule as written. It was never the intention of the Board to capture these existing discharge loads of TDS from this industry in this regulation. The regulation was intended only to capture new loadings of high-TDS wastewater.

Therefore, in this final rulemaking the Board has restructured the proposed rule to include a subsection, §95.10(a), intended to more clearly define those existing sources of TDS that are not subject to the rule. Specific concerns identified by the PCA are addressed in §§ 95.10(a)(1) – (4). Further details on the intent of these sections are described later in this order.

#### Marcellus Shale Coalition

The Board also received comments from the Marcellus Shale Coalition (MSC). In addition, the MSC and the POGAM were represented on the TDS Stakeholders Subcommittee. The new Marcellus shale play in Pennsylvania and the projected wastewater treatment and disposal need from that new industry was the primary impetus for the Board's proposing this new rule.

In these Subcommittee meetings, the MSC and POGAM provided data, arguments and a presentation aimed at convincing the Board that, with a drier Marcellus formation than anticipated and new recycle and reuse practices, the projected need for treatment and disposal was an order of magnitude less than original projections. These groups representing the Oil and Gas industry in Pennsylvania argued that there was no need for this regulation, and that real-time flow management practices, which simply allow dilution of TDS loads in our streams, were adequate to manage these new loads. They also proposed that increased energy demand from the limited treatment technologies would create worse pollution effects in media other than water, e.g. air.

Further, the industry argues both that technology has not been fully developed to treat these wastes, and that the “significant” costs associated with the technology may inhibit the development of the new Marcellus gas play in Pennsylvania. The industry disputes the Board’s treatment cost estimate, provided in the order for the proposed rule at approximately \$0.25 per gallon, saying that the actual costs will be much higher.

The MSC is opposed to the proposed regulation as unnecessary. After a thorough review of the information and the data: presented by this industry, presented by treatment manufacturers and vendors, from existing treatment operations in Pennsylvania and other states and from full-scale pilot treatment studies; the Board does not agree that: real-time flow management complies with water quality standards requirements, there is no longer a need for this regulation, that technology has yet to be developed and that its original cost estimate of approximately \$0.25 per gallon is either inaccurate or prohibitive.

This final rulemaking includes a new subsection, § 95.10(b), that is specific to the Oil and Gas industrial category, which continues to include effluent standards designed to drive treatment of the wastewater to be disposed by this industry. At the recommendation of the TDS Stakeholders Subcommittee, this final rulemaking also includes a requirement for recycling and reuse of these flow back wastewaters intended to minimize the amount of wastewater to be disposed. Further discussion on real-time flow management, wastewater treatment and disposal needs, potential multi-media pollution, treatment technologies and treatment costs can be found in this order.

*Pennsylvania Chamber of Business and Industry (Chamber)*

After considerable review of the comments from the Chamber, the Board agrees that a different path forward is warranted. The Chamber has accurately pointed out that the rule as proposed captures a very broad and varied spectrum of industries across Pennsylvania. As noted by the Chamber, these industries produce a wide array of different wastewaters containing TDS, and that a sector-by-sector approach to controlling TDS is likely the best option. The Department has heeded that recommendation and the final rule reflects such a change in approach.

In addition, the Chamber also noted that TDS cannot simply be ignored, recognizing that if not addressed or controlled in some manner, certain watersheds could exceed water quality standards, adversely affecting drinking water supplies and aquatic life. The Chamber recommends a watershed-by-watershed approach be pursued by the Board to avoid this potential problem.

The Chamber provided comments similar to the Allegheny Conference, PCA and the MSC regarding the degree to which our watersheds are in jeopardy from TDS. In addition, the Chamber recommends a form of flow management as a potential solution for controlling TDS. Analyses by the Department, addressed in this order, are real, accurate and based on compliance with state and federal standards. These analyses document that in many watersheds we are much closer to exceeding assimilative capacity, at design stream flow conditions, than is evidenced by a simplistic plot of monthly sample results and spikes over time. Further, at the initial meeting of the TDS Stakeholders Subcommittee, the Department presented statistical and scientific reasoning rejecting flow management as an option.



In this final rulemaking the Department has restructured the proposed rule to include a subsection, §95.10(a), intended to more clearly define those existing sources of TDS that are not subject to the rule. Specific concerns identified by the PCA are addressed in §§ 95.10(a)(1) – (4). In addition, the Board has recognized that different industries have different wastewaters. However, as described in the discussion below related to § 95.10(c), not establishing some level of performance for addressing TDS from these industries (other than oil and gas) results in significant economic inequities between industrial sectors. The final rule proposes a statewide standard of 2,000 mg/l for these industries, with a variance provision that is based on a watershed assimilative capacity analysis. Further details on the intent of these sections are described in this order.

The following is a summary of other comments received, during the public comment period, organized according to subject matter.

#### Drilling-Related Comments

Drilling-related comments are those comments that seemed to be targeted at the natural gas industry and in some cases, more specifically the drilling and hydraulic fracturing of gas wells. Since this rulemaking is primarily to establish wastewater treatment requirements for wastewaters containing TDS, many of the comments in this category were not applicable to the rule. They are listed here to demonstrate that much of the public comment focused on regulating the natural gas industry.

*Comment: The fracking industry uses poisonous cocktails of contaminants. The commonwealth and its citizens have a right to know and the drilling companies have an obligation to tell us what they are putting into the ground when they perform hydrofrack activities regardless of whether the chemicals are corporate secrets. Our groundwater and streams need to be protected from these chemicals. Set health-based standards for all contaminants that may be found in wastewater gas drilling including arsenic, benzene, radium, magnesium, volatile organic compounds, and radioactivity. The proposed standards are not stringent enough to protect our streams and additional steps need to be taken by PADEP now to prevent further degradation of the State's waterways and water resources.*

Response: The Department knows what additives are used in the fracturing process, and has sampled flow back waters to determine the relative quantities of these constituents. We have posted a list of these chemicals on our web site at:  
<http://www.dep.state.pa.us/dep/deputate/minres/oilgas/FractListing.pdf>

Our current wells construction standards are designed to protect groundwater resources from any contamination that could result from drilling and fracturing wells and we have recently taken step though new regulations to make those standards even more protective.

The Commonwealth currently has health-based standards in place for arsenic, benzene, radium exposure to radiation and VOCs. These standards are found in our drinking water MCLs and our

water quality standards for our surface waters. These standards are based on sound science and are as stringent as they need to be to protect the public health and our streams.

*Comment: The high pressure hydraulic fracturing technology invented by Halliburton [now located in Dubai] has been used in TX, WY, western PA, and CO with disastrous consequences. There have been fires, explosions, and other "accidents" in all of these other places around the country, making many farms, ranches, and homesteads uninhabitable. There should be mandated buffer zones between well site and drinking water sources, wetlands, or streams.*

Response: This rulemaking addresses effluent standards for the treatment of wastewaters containing TDS. This comment is not applicable to this rulemaking.

*Comment: Opening land to drilling has the potential to pollute surface and ground water resources. Enact a moratorium on leasing public land for gas drilling until an impact analysis can be done. Severely limit the number of wells in one area. Drilling the number of wells that they are drilling significantly dilutes the environmental quality of these pristine lands. Once damaged, it may take decades or centuries for them to return to their former state, if ever.*

Response: This rulemaking addresses effluent standards for the treatment of wastewaters containing TDS. This comment is not applicable to this rulemaking.

*Comment: We need to make sure especially that our very best waterways, those designated as Exceptional Value or High Quality, as well as all sources of our public and private drinking water, are fully protected. Prohibit O&D drilling in EV watersheds. Testing water quality before, during, and after drilling should be mandatory, not voluntary. Require individual permits for gas development in HQ watersheds. Inspect each well during each phase – siting, drilling, casing, connecting, altering, and stimulating. Must consider cumulative impacts of drilling in watersheds.*

Response: This rulemaking addresses effluent standards for the treatment of wastewaters containing TDS. This comment is not applicable to this rulemaking.

*Comment: Demand safe and biodegradable fracking chemicals in PA. Many people in Dimrock have already had their wells contaminated. Use the methods of the offshore oil and gas drilling in European waters where chemicals must be nontoxic in case of spills into the waters. Use less toxic "fracing" chemicals by implementing best practices identified by researchers at Texas A&M University's Global Petroleum Research Institute, as a start.*

Response: The final rule mandates reuse of fracturing fluids as suggested.

*Comment: Require recycling and reuse of hydrofracking wastewater. Create regulations to oversee the reuse of drilling wastewater. There is little oversight over the reuse of drilling wastewater and whether in fact this is a waste disposal method as opposed to closed loop water recycling. Mandate closed-loop systems for managing wastewater, as well as steel tanks to contain the concentrated leftovers.*

Response: The final rule mandates reuse of fracturing fluids as suggested.

Comment: *Require “cradle-to-grave” tracking of wastewater from drilling sites from generation through treatment and disposal. Do not allow the use of brine for dust control on dirt roads, since many of these roads are used for recreational purposes. No frackwater treated or untreated should go into our streams. Marcellus “frackwater” should not be left in lined lagoons during any stage of the process.*

Response: This type of tracking is already required under the Department’s Residual Waste Regulations at §§ 287 – 299. The final rule establishes treatment standards for this wastewater that must be met, which are protective of the uses of our receiving streams, prior to any discharge to surface water, as suggested.

Comment: *We should be ever vigilant to threats to the quality of our waters. We also should learn from past mistakes: we are still paying to clean up acid mine drainage and other water pollution left as a legacy of lax regulation of the coal industry in times past. With the expansion of Marcellus gas drilling in Pennsylvania, we need to have strong protective measures in place before another disaster like the 2009 Dunkard Creek incident occurs.*

Response: The final rule establishes treatment standards for this wastewater that must be met, which are protective of the uses of our receiving streams, prior to any discharge to surface water, as suggested.

Comment: *The proposed new regulations on TDS have already had a very positive result. The gas drilling industry has quickly moved to develop wastewater management strategies that rely on recycling. The gas exploration industry is very well funded and technically based. They have the means, as they already have proven, to respond to the challenges of their own wastewater. Put to the task, this industry is developing strategies that other industries can follow. These new technologies will translate into good, home grown jobs. Please hold the line on the proposed new standards. They are not perfect, but they are a very good start.*

Response: The Department agrees with this comment.

Comment: *These drillers need to be strictly regulated and they need to be taxed. This is no fledgling industry. With the good people of Pennsylvania already taxed to the gills, it makes no sense to have these well-organized predatory energy companies lobbying themselves into a free ride.*

Response: This rulemaking addresses effluent standards for the treatment of wastewaters containing TDS. This comment is not applicable to this rulemaking.

Comment: *We are concerned that that the projected discharges from drilling operations are greatly overstated and the ability to reuse flow back water has been underestimated.*

Response: The Department agrees, and this final rule takes a proactive approach to controlling TDS from the natural gas industry. The Marcellus Shale play is indeed in its infancy. The

industry does not yet know answers to most of the questions about the play and in particular, about the impacts the play could have on the waters of this Commonwealth. The Department's aim is to ensure that future growth of this industry is considered in the rules and regulations it puts in place now.

*Comment: Streamline residual waste regs for the handling of brines after they have left a production site. Allow the ability for brine transfer stations or transfer operations to operate with streamlined regulations.*

Response: This rulemaking addresses effluent standards for the treatment of wastewaters containing TDS. This comment is not applicable to this rulemaking.

*Comment: The targets of this regulation appear to be one-time dischargers, such as the hydrofacking industry. Refocus the regulation to apply to the oil and gas industry only.*

Response: Based on Stakeholder comments received during an exhaustive public participation process, the final rulemaking adopts a combination of recommended approaches for addressing these larger loadings of TDS. This combination of approaches includes an industrial sector-based regulation along with a watershed-based analysis. The sector-based piece focuses on the natural gas industry.

*Comments: After four decades of demonstrable improvement in water quality, the US Army Corps of Engineer's data shows that conditions are reversing on Pennsylvania's rivers. It is becoming apparent that the assimilative capacity of some rivers to receive total dissolved solids, if not already exceeded, is close to being exceeded, and simply cannot sustain the additional loading projected as a result of natural gas exploration activities. In the last two years, evidence of degradation, based on elevated specific conductivity readings recorded at water quality monitors located on the Monongahela River at Elizabeth, OA, the Casselman River at Markelton, PA, and the Conemaugh Dam, in addition to the recent Dunkard Creek aquatic kill, demonstrates that high TDS wastewaters threaten to undermine historical water quality improvements, posing a genuine and extreme threat to regional water quality.*

Response: The Department agrees, and these facts are what drive the need for this regulation.

#### Mining-Related Comments

Mining-related comments are those comments that were from the mining industry, or were in support of the mining industry. This rulemaking is primarily to establish wastewater treatment requirements for wastewaters containing TDS, many believed that it could affect mining operations. The rule has been revised to make it clear that it does not apply to most mining operations.

*Comment: The lack of regulation and insufficient bonding in the early years of coal mining have caused major environmental damage, requiring years and much money to clean up. Over 3,000 miles of streams are still impaired from that irresponsible behavior. We need to prevent this from happening in the future by regulating discharges of high TDS wastewater.*

Response: The Department agrees, and this final rule takes a proactive approach to controlling TDS from the natural gas industry.

Comment: *The proposed standards are not based on sound science, are costly, burdensome, unworkable and therefore, threaten the vitality of the mining industry. Placing obstacles such as this does nothing to retain the jobs we have.*

Response: The final rule makes it clear that the mining industry and its existing operations are for the most part exempt. From the inception of the rule, the intent of the Department was to exempt existing discharges, and insignificant discharges, from the effluent standards aimed at controlling the new, larger source of TDS. The provisions specifically allow for continued discharges of TDS wastewaters at current loads and are designed to lessen the affects on existing and small discharges of TDS in Pennsylvania through the exemption and variance provisions. This new regulation will not impact reclamation activities at abandoned mines frequently operated by local watershed groups.

Comment: *Current discharges from existing waste coal sites that are conducted in an environmentally sound manner should continue to be regulated under existing requirements. We believe that the proposed regulations could prevent remining and reclamation of waste coal sites.*

Response: The final rule exempts these discharges.

Comment: Revise 95.10(b)(5) to exempt discharges into mine pools that are permitted under Chapters 87, 88, 89, or 90.

Response: These discharges cannot be completely exempted, as there are still concerns related to the quality of any discharge to a mine pool. Mine pools are still waters of this Commonwealth under the Clean Stream Law, and are regulated as such.

### Health Based Comments

These were comments that related to the effects on public health that could be impacted by the rulemaking. Most of the comments related to the protection of drinking water. Most relate to fracking chemicals, but others related to the brominated disinfection byproducts that occurred in the Monongahela River.

Comment: *There are no currently operating facilities capable of removing TDS. Since public water suppliers cannot treat this type of polluted water, the wastewater should be treated to a degree that would be protective of drinking water prior to discharge. Maintain the proposed treatment standards of 500 mg/L for TDS, and 250 mg/L for sulfates and chlorides.*

Response: There are technologies that are capable of meeting these standards as noted in this order. The standards referenced were maintained for high-TDS wastewaters associated with the natural gas industry. For all other industries, a different standard was set, but a variance from

that standard can be granted where local streams are able to assimilate the loads without violating water quality standards.

*Comment: Studies have shown that disinfection byproducts resulting from chemical reactions between disinfectants and organic materials present health risks to humans. The worst of these is brominated water, which has been shown to cause bladder cancer in humans. At present, the Monongahela River, with high concentrations of TDS presents higher levels of several of these contaminants.*

Response: The Department agrees and cites one of these studies as a reference.

### *Environmental Comments*

These were comments that related to the effects on the environment that could be impacted by the rulemaking. Many related to harmful effects from an inadequately regulated mining industry. Others are concerned about the quality of Pennsylvania's streams, and with aquatic life protection.

*Comment: The Dunkard Creek tragedy is a good indicator of the consequences of high TDS wastewater discharges into our fresh water streams. The discharge of high TDS wastewater into the stream completely damaged the biological community in the stream by allowing the growth of toxic algae, which can only survive in salt water. The algae was responsible for the destruction of 43 miles of stream, including 161 species of fish, 14 species of freshwater mussels, and other aquatic creatures such as salamanders by dissolving exposed cells, including gills.*

Response: The Department agrees, and this incident was considered in the analysis and the need for the regulation.

*Comment: Watershed analyses conducted by the PA DEP indicate that several rivers are severely limited in their capacity to assimilate new loads of TDS and sulfates - primarily due to acid mine drainage from long-abandoned coal mines--a legacy of Pennsylvania's last energy rush. Increased TDS and sulfate loading would reverse years of hard-won progress by Pa DEP in improving water quality in these watersheds.*

Response: The Department agrees, and these facts formed the basis for the rule.

*Comment: DEP has not shown, by monitoring or sampling data, that water resources are at any sustainable risk from TDS concentrations.*

Response: The Department does not agree. Studies described and others cited in this order provide more than a sufficient basis for this rule.

*Comment: Research in 1997 states that TDS over 400 mg/L has a direct negative affect on the diversity of fish populations. Additional research in 2007 confirms this. It is recommended that the TDS standard be lowered to 400 gm/L.*

Response: The recommended 400 mg/l standard is an “instream” number that would have to be achieved after mixing and dilution of the discharge with the receiving stream. The Department has reviewed the relevant data and determined that the current osmotic pressure criterion in our water quality standards regulations provide a sufficient degree of protection for aquatic life at the point of discharge. The 500 mg/l standard proposed for the natural gas industry wastewaters is more stringent, as it would be applied at the end of the discharge pipe.

### Economic Comments

These were comments that related to the effects on the economy that could be impacted by the rulemaking, whether large-scale or small-scale. There were comments that DEP did not understand the economic impact of the regulation, that small oil and gas producers would be the hardest hit, and that the regulation would discourage investment in Pennsylvania.

*Comment: DEP does not fully understand, and has not evaluated, the economic impact this regulation has on industries in PA. The statewide impact will be in the billions of dollars to comply and will put companies of the Commonwealth at a disadvantage with its competitors.*

Response: The Department does understand and has evaluated, through the TDS Stakeholders Subcommittee process, that the proposed rule affected a very large cross section of Pennsylvania industries. In order to provide greater clarity to the scope of the regulation, the final rulemaking takes the approach of specifically exempting certain classes of TDS discharges from the application of this rule. This approach is designed to clearly exclude from the scope of this regulation all existing loadings of TDS authorized by the Department prior to the effective date of this regulation, as well as new and expanding TDS sources, which the Department has determined are insignificant from a loading perspective.

Further, the Department agrees with the comments that were received by industries other than the oil and gas sector that point out that the proposed rule is a one-size-fits-all approach that may not be appropriate. Different industries have vastly different wastewaters, even in the composition of the TDS. There are many different technologies that would be necessary to treat these different wastewaters, and the costs of treatment to a given standard could create an inequitable economic problem.

The Department has addressed this issue and the comments received from the industries other than oil and gas in this final rule. The approach establishes an effluent standard for these sectors at 2,000 mg/l, and allows a variance from this standard under certain conditions specific to the watershed in which the discharge is located. The rule applies only to new and expanding loads of TDS, not the existing loads, making it more easily achieved.

*Comment: The proposed regulations will limit the availability of commercial treatment of brine. The proposed regulations will essentially eliminate much of the current capacity to take brines to municipal treatment plants for disposal.*

Response: The Department does not agree. Instead, we believe the final rule will provide regulatory certainty. The Department has met with over 60 manufacturers and vendors of

technologies for treating the very high levels of TDS from the natural gas industry, and specifically the Marcellus shale formation. While many of these vendors do not have actual facilities in operation and are seeking to get into the business, at least six manufacturers have either piloted the technology at full scale or have facilities currently operating in other states.

Much of the hesitancy on the part of these technology vendors is the uncertainty regarding this rule. The companies are reluctant to move forward without a clear direction in regulation concerning what levels they will need to treat to for TDS. Implementing this regulation will provide certainty to the companies proposing treatment facilities and give a clear guidance on what their facility will need to treat to regarding high TDS wastewaters.

In addition, investment companies have indicated that without clear direction they are less willing to provide capital for financing these types of wastewater treatment facilities. One company provided information that their treatment plant, if built and operated, could create approximately 70 to 100 short-term jobs during construction and about 12 permanent jobs during operation of their facility.

Finally, these highly-concentrated TDS wastewaters pose a great threat to the biological treatment processes at municipal sewage treatment plants, and the final rule prohibits that without adequate pretreatment facilities.

*Comment: Each treatment option leaves a residual waste product which required further disposal adding to the cost of treatment for an issue that has not been identified as a statewide or even prevalent concern. In addition, other environmental concerns associated with TDS reduction, such as energy consumption, air emissions, landfill capacity, and disposal costs have not been addressed.*

Response: The Department has reviewed all of the comments received and has determined that a sector-by-sector approach to controlling TDS is appropriate. High-TDS wastewaters from different industries present different treatment challenges. Not all industrial wastewaters containing TDS are consistent. Based on the need for regulation of a rapidly expanding industry which generates wastewaters with extraordinarily high levels of TDS and chlorides, the readily available proven treatment technologies for this wastewater, the low costs associated with treatment, and the overwhelming public comment in favor of a standard for this industry, the final rule focuses on treatment for oil and gas wastewaters. The final rule now contains more specific treatment requirements for wastewater generated from all natural gas drilling activities.

New technologies are being developed that treat this wastewater without using large amounts of energy or emitting large quantities of air pollutants, and the Department believes that this regulation will continue to move that industry in that direction. In fact, the Department believes that the certainty provided by this rule will accelerate the development of more efficient treatment technologies, zero discharge technologies and also drive conservation and pollution prevention through reuse of the wastewater.



This industry will generate the residual solids as suggested. The Department continues to work with treatment technology providers to develop reusable end products from these materials to reduce waste and costs associated with this treatment.

*Comment: The concerns of industry and environment are not mutually exclusive. Industry should be held to a high standard. Well run businesses know that it is much easier and less expensive to do job right first time, rather than clean up mistakes later.*

Response: The Department agrees.

### Legal Comments

These were comments that related to the legal concerns of the rulemaking. For example, some stated that DEP failed to adequately consider statutory elements for rulemaking.

*Comment: Environmental justice communities have been targeted for disposal of toxic wastewater. DELCORA had been permitted to receive, treat, and dispose of toxic wastewater into the Delaware River, even though the sewage treatment plant would not adequately treat the wastewater. Although the permit was rescinded due to community outrage, significant concern exists that it will happen in the future.*

Response: DELCORA's permit to receive this wastewater was rescinded at the request of DELCORA. Regardless, all permit applications for treatment of this type of wastewater will be reviewed in accordance with existing Department regulations, and when effective, this final rule. This rule requires adequate pretreatment of the natural gas wastewater to the specified standards.

*Comment: The proposed rulemaking fails to adequately consider statutory elements, including the consideration of water quality management and pollution control in the watershed as a whole and the immediate and long-range economic impact upon the Commonwealth and its citizens.*

Response: As stated in this order, this final rulemaking differs from the proposed rulemaking in several important respects. To provide greater clarity to the scope of the regulation, the final rulemaking takes the approach of specifically exempting certain classes of TDS discharges from the application of this rule. In addition, based on Stakeholder comments received, the final rulemaking adopts a combination of recommended approaches for addressing these larger loadings of TDS. This combination of approaches includes an industrial sector-based regulation along with a watershed-based analysis. Since there are numerous industrial categories and subcategories that include TDS as a pollutant of concern in their wastewater discharges, the watershed-based approach for all industrial sectors other than oil and gas establishes an effluent standard, but also provide a variance option for these discharges. Further, the combination of these approaches does indeed consider the long-term economic impacts, as discussed throughout this order.

*Comment: Definitions are overbroad and vague, and do not identify who is covered by the regulation and who is not.*

Response: The Department agrees. In order to provide greater clarity to the scope of the regulation, the final rulemaking takes the approach of specifically exempting certain classes of TDS discharges from the application of this rule. This approach is designed to clearly exclude from the scope of this regulation all existing loadings of TDS authorized by the Department prior to the effective date of this regulation, as well as new and expanding TDS sources, which the Department has determined are insignificant from a loading perspective.

Comment: *Chapter 95 should not replace Effluent Limitation Guidelines or Best Professional Judgment in the writing of permits.*

Response: The final rule does not do either. Where ELGs exist, they are used to set effluent limitations. Best Professional Judgment (BPJ) is used by Department staff as a general rule in writing permits.

Comment: *DEP authority under state law is unclear or not clearly stated.*

Response: The final-form rulemaking is adopted under the authority of sections 5 and 402 of the Clean Streams Law (35 P.S. §§ 691.5 and 691.402), which provide for the adoption of regulations implementing the purposes and requirements of the Clean Streams Law and for the regulation of activities which create a danger of pollution to the waters of the Commonwealth, and Section 1920-A of the Administrative Code of 1929 (71 P.S. § 510-20), which authorizes the Board to promulgate rules and regulations necessary to implement the provisions of the Clean Streams Law.

#### Technical Comments

These were comments that related to the technical aspects of the proposed rulemaking. Some were concerned with the perceived limited technical justification of the rulemaking, and others state that the regulation does not offer a solution that addresses the problem.

Comment: *The proposed rulemaking does not explain the problem nor does it offer a solution that addresses the problem. This proposed rulemaking has offered no scientific data or justification for imposing such severe limits. The proposed rulemaking is predicated on very limited sampling in the Monongahela River between October and December 2008 when river levels were at historical lows and there were high dissolved solids concentrations entering the Commonwealth from West Virginia.*

Response: This comment is not correct. Neither the proposed rule nor the final rule is based on the conditions that are occurring in the Monongahela watershed. In the Monongahela, TDS levels have already exceeded water quality criteria. This means that allocations of TDS loads must be made for all dischargers in the watershed, to bring the river back to compliance. The Department will be listing the Monongahela as impaired on its upcoming impaired waters list as required by the federal Clean Water Act. The final rule is intended to prevent other watersheds from becoming impaired, like the Monongahela.

With regard to the absence of science comment, it either fails to understand or is ignoring important evidence. The Department's analyses of watersheds across this Commonwealth were conducted using rigorous statistical methods. Where the Department's analyses of WQN data showed the potential for water quality criteria violations, detailed studies were conducted in those watersheds.

The assessment process by the Department in the Beaver River watershed is the same as occurred in the Monongahela. The potential for a TDS problem has been identified from WQN data, and the Department is responding by collecting grab samples and deploying conductivity probes. It takes time to collect the data, but when an adequate number of samples become available the Department will not simply rely upon a WQN frequency analysis, as suggested, but must consider the entire weight of evidence. Similar assessments of WQN data were made for the West and North Branches of the Susquehanna River, the Clarion River and Moshannon Creek, which are discussed above.

A glaring omission by those who question the scientific need for the rule is any mention of the environmental disaster in Dunkard Creek that wiped out 26 miles of stream. The problem was high TDS concentrations leading to colonization and growth of golden algae, as well as osmotic pressure exceeding the regulatory numeric criterion. Dunkard Creek is a good example of what can happen if TDS is not controlled, and the loss of this important public resource was an environmental tragedy, documented by the loss of aquatic life, including endangered mussels.

*Comment: The fact that the proposed rule focuses on a statewide limit, as opposed to being imposed on a watershed specific basis like other wastewater discharge requirements, will not result in an efficient use of resources.*

Response: The Department has revised its approach in the final rule to include a watershed-by-watershed analysis as suggested, to more efficiently use its limited resources.

*Comment: The health of aquatic organisms is protected by the current osmotic pressure water quality standard.*

Response: The Department agrees to the extent that the effects of individual discharges on receiving streams are evaluated at the point of discharge; however, TDS is a conservative parameter, meaning that TDS is not subject to fate during transport in the water column. This means that a pound of TDS discharged in the headwaters of a watershed is still a pound of TDS at the mouth of the watershed. Osmotic pressure is not an effective measure of water quality from cumulative loadings of TDS from multiple discharges that can cause violations of water quality criteria at design conditions.

*Comment: The number of NPDES permit applications should not be used as a basis for further regulation since these applications are speculative in nature.*

Response: The Department must treat these applications as authentic, each requesting a part of any available assimilative capacity, unless they would be formally withdrawn.

Comment: *The criteria for TDS, sulfates & chlorides are based on secondary maximum contaminant levels and are not a risk to human health.*

Response: The Department does not necessarily agree. While TDS and sulfate concentrations manifest as secondary contaminants at the levels established as MCLs, they are toxic to both humans and aquatic life at higher concentrations. For example, sulfates begin to exhibit a laxative effect on humans at concentrations between 500 mg/l and 750 mg/l, while the secondary MCL is 250 mg/l.

#### Administrative Comments

These were comments that related to administrative aspects of the rulemaking, especially as it relates to the scope of the regulation. Many comments stated that the regulation should be implemented immediately, some wanted elimination of the threshold for large sources, others wanted whole effluent toxicity requirements, and others wanted regulation of the reuse of fracking wastewater.

Comment: *Implement these proposed standards immediately. Do not postpone the effective date until 2011.*

Response: The final rule will become effective upon publication in the PA Bulletin.

Comment: *The time frame of January 1, 2011 is an unrealistic goal for the implementation of this proposed rulemaking. The time required for design, permitting, ordering, construction, and final testing will not be possible sooner than 30-36 months.*

Response: Both April 1, 2009 and January 1, 2011 have been changed to the effective date of the regulation. Prior to this date, facilities are existing. After this date, they are new or expanding. The regulation only applies to new and expanding facilities, meaning facilities that will not have been constructed on the effective date. These new facilities literally will not be able to accept wastewater and discharge until they are constructed. Therefore, it appears that this argument is without merit.

Comment: *The limits should be applicable to all treatment plants. New sources should be covered immediately, and existing sources of large TDS discharges should be covered through the NPDES renewal process.*

Response: From the inception of the rule, the intent of the Department was to exempt existing discharges, and insignificant discharges, from the effluent standards aimed at controlling the new, larger source of TDS. The provisions specifically allow for continued discharges of TDS wastewaters at current loads and are designed to lessen the affects on existing and small discharges of TDS in Pennsylvania through the exemption and variance provisions.

Comment: *Minimize impacts to existing operating facilities; including POTWs which receive trucked in wastewaters and septage, which often contains in excess of 2,000 mg/L.*

Response: From the inception of the rule, the intent of the Department was to exempt existing discharges, and insignificant discharges, from the effluent standards aimed at controlling the new, larger source of TDS. The provisions specifically allow for continued discharges of TDS wastewaters at current loads and are designed to lessen the affects on existing and small discharges of TDS in Pennsylvania through the exemption and variance provisions.

Comment: *The standards for TDS and the threshold concentration should be stated as daily maximum, not a monthly average.*

Response: The Department does not agree. The 500 mg/l standard as a monthly average allows for effluent variability from treatment facility operations, and is more in line with the instream standard and MCL for TDS, which are both monthly averages.

Comment: *There should be a minimum requirement that all discharges not cause background in-stream concentrations of TDS to rise above 133% of background levels (the Delaware River Basin Commission standard).*

Response: The Department has included this provision in the final rule.

Comment: *Due to the highly varying toxicity of both TDS discharges and especially Marcellus wastewater, Whole Effluent Toxicity (WET) testing should be required utilizing both an acute and chronic toxicity standard.*

Response: If TDS are controlled to less than 500 mg/l, no WETT is necessary.

Comment: *Consideration should be given for the implementation of seasonal or flow-based TDS limits, with the intent of restricting TDS mass discharges during periods of low flow. Consideration should be given to the implementation of a TDS trading system, which could effectively address legacy TDS contributors in return for higher discharge limits for municipalities and industry.*

Response: Real-time Management is discussed in great detail in this order. Support for this position relies on a certain rationale that does not reflect real-world considerations or good science. This method of managing flows on a real-time basis presents many problems, most notably compliance with federal and state regulatory water quality standards.

Comment: *The regulation penalizes water reuse and recycling. Reduction in water use will result in a higher concentration for the same mass loading. Change “2000 mg/L or 100,000 lbs/day” to “100,000 lbs/day and 2000 mg/L” in applicability criteria.*

Response: The final rule requires reuse of natural gas industry wastewater. The final rule no longer defines high-TDS wastewater in the manner cited.

Comment: *Sampling done by the Department and posted on the SWRO web site used an inappropriate testing method, drying the samples at 105 Deg, rather than at 180, which is*

*required by EPA and USGS test methods, which could result in higher TDS concentrations due to the inclusion of water in the results.*

Response: This is not correct. Both methods are correct. In fact, the method used by the Department may be “more correct” in measuring “total” dissolved solids, as it measures both the organic and inorganic components of the TDS.

Comment: *Since changes are inevitable, you should republish as proposed or advanced notice of final rulemaking.*

Response: The Department will not be publishing an advanced notice of final rule making. Issuing an advanced notice of final rulemaking is discretionary and, given the extensive public outreach for this regulation, including the cooperative work by the Department with the TDS Subcommittee, and the fact that the final regulation incorporates many of the recommendations of the stakeholders, the Department does not believe an advanced notice of final rulemaking is appropriate, but rather would only lead to unnecessary delay.

Comment: *Consider separate standards for estuaries and other high naturally-occurring TDS waters.*

Response: The watershed-based approach contained in the final rule accomplishes this.

## **G. Benefits, Costs and Compliance**

Executive Order 1996-1, “Regulatory Review and Promulgation” requires a cost/benefit analysis of the proposed regulation.

### *Benefits*

- Watersheds will not go above 500 mg/l of TDS in stream, protecting aquatic life and drinking water.
- Exempts many small dischargers that are not a part of the projected problem, such as: Sewage Treatment Plants, Abandoned Mine discharge treatment plants, Surface Mining, Small Food Processors, etc. Allows existing dischargers to continue operating under current scenarios.
- Addresses the overwhelming public comments in support of a 500 mg/l standard
- Focuses more precisely on the specific pollution prevention problem that needs to be addressed so that the regulatory requirement is reasonable.
- Would be consistent with the federal approach by separating industry sectors and requirements for “new” versus “existing” sources.
- Assures the public that the Pennsylvania Marcellus Industry will not harm our streams.
- Requires treatment and encourages treatment technology expansion and development for future sources of high TDS, creating new jobs.
- Promotes the reuse of flowback and production waters.
- Drives methods of treatment and disposal that do not involve stream discharge.
- Approach preferred by most members of industry.

- Addresses the difficulty from setting an end-of-pipe effluent limitation applicable to numerous industry sectors because of differences in feasible technology and costs across industries affected.
- Fair to existing operations and industries.

#### *Compliance Costs*

- Could present new costs for treatment if an existing industrial facility wishes to expand, or a new industry wishes to start, and is unable to obtain a variance.
- Will present treatment costs to the oil and gas industry, but which may be minimized through recycling and reuse, zero discharge treatment technologies or underground injection options. However, this industry should be very capable of absorbing these costs as minimal when compared to the expected revenues from the Pennsylvania Marcellus shale formation.

#### *Compliance Assistance Plan*

The Department will provide written notification of the changes to the industrial categories that may be affected.

#### *Paperwork Requirements*

There are no paperwork requirements imposed by this final form rulemaking.

### **H. Pollution Prevention**

The matters affected by this final-form regulation promote pollution prevention and control.

### **I. Sunset Review**

This regulation will be reviewed in accordance with the sunset review schedule published by the Department to determine whether the regulation effectively fulfills the goals for which it was intended.

### **J. Regulatory Review**

Under Section 5(a) of the Regulatory Review Act (71 P.S. §§ 745.5(a)), the Department submitted a copy of this proposed amendment on \_\_\_\_\_ to the Independent Regulatory Review Commission (IRRC) and the Chairpersons of the Senate and House Environmental Resources and Energy Committees. In compliance with Section 5(b.1) of the Regulatory Review Act, the Department also provided IRRC and the Committees with copies of the comments, as well as other documentation.

In preparing this final-form regulation, the Department has considered the comments by the public that it has received. These comments are addressed in the comment and response

document and in Section F of this order. The IRRC and the Committees did not provide comments on the proposed rulemaking.

This final-form regulation was deemed approved by the House Environmental Resources and Energy Committee on \_\_\_\_\_ and was deemed approved by the Senate Environmental Resources and Energy Committee on \_\_\_\_\_. The IRRC met on \_\_\_\_\_ and approved the regulation in accordance with Section 5(c) of the Act.

#### **K. Findings of the Board**

The Board finds that:

- (1) Public notice of proposed rulemaking was given under sections 201 and 202 of the act of July 31, 1968 P.L. 769, No. 240) (45 P.S. §§ 1201 and 1202) and regulations promulgated thereunder at *1 Pennsylvania Code* §§ 7.1 and 7.2.
- (2) A public comment period was provided as required by law, and all comments were considered.
- (3) The regulations do not enlarge the purpose of the proposal published at 39 *Pennsylvania Bulletin* 6467 (November 7, 2009), with a correction notice at 39 *Pennsylvania Bulletin* 6547 (November 14, 2009).
- (4) These regulations are necessary and appropriate for administration and enforcement of the authorizing acts identified in Section C of this order.

#### **L. Order of the Board**

The Board, acting under the authorizing statutes, orders that:

- (1) The regulations of the Department of Environmental Protection, *25 Pennsylvania Code*, Chapter 95, are amended by amending § 95.2, and by adding § 95.10 to read as set forth in Annex A, with ellipses referring to the existing text of the regulations.
- (2) The Chairperson of the Board shall submit this order and Annex A to the Office of General Counsel and the Office of Attorney General for review and approval as to legality and form, as required by law.
- (3) The Chairperson of the Board shall submit this order and Annex A to the Independent Regulatory Review Commission and the Senate and House Environmental Resources and Energy Committees as required by the Regulatory Review Act.
- (4) The Chairperson of the Board shall certify this order and Annex A and deposit them with the Legislative Reference Bureau, as required by law.
- (5) This order shall take effect immediately.



By:

JOHN HANGER

Chairperson

Environmental Quality Board

DRAFT

Table – Results of TDS Assimilative Capacity Analyses

<b>WQN Station #</b>	<b>Stream Name</b>	<b>Location</b>	<b>Q<sub>7-10</sub> flow estimate (ft<sup>3</sup> / sec)</b>	<b>Period of record for regression</b>	<b>n</b>	<b>TDS concentration estimate (mg/L) at Q<sub>7-10</sub> flow</b>
301	Susquehanna River	Danville	1,130	1998 – 2007	95	<b>255</b>
302	Susquehanna River	Retreat	1,003	1998 – 2008	97	<b>271</b>
305	Susquehanna River	Towanda	585	1998 – 2008	104	<b>211</b>
306	Susquehanna River	Conklin, NY	178	1998 – 2008	55	<b>162</b>
323	Susquehanna River	Wilkes-Barre	748	1998 – 2008	57	<b>242</b>
401	West Branch Susquehanna River	Lewisburg	764	1998 – 2007	94	<b>259</b>
402	West Branch Susquehanna River	Williamsport	575	1998 – 2007	51	<b>302</b>
404	West Branch Susquehanna River	Karthaus	222	2004 – 2007	52	<b>542</b>
406	West Branch Susquehanna River	Bower	43	1998 – 2008	60	<b>533</b>
422	Clearfield Creek	Dimeling	42	1998 – 2008	60	<b>769</b>
448	West Branch Susquehanna River	Jersey Shore	463	2004 – 2008	68	<b>319</b>
701	Monongahela River	Braddock	905	1998 – 2004	33	<b>360</b>
702	Monongahela River	Elizabeth	651	1998 – 2008	60	<b>403</b>
714	Dunkard Creek	Shannopin	3	1998 – 2008	61	<b>2,667</b>
725	Monongahela River	Point Marion	353	1998 – 2008	58	<b>346</b>
822	Clarion River	Cooksburg	105	1998 – 2009	58	<b>255</b>
867	Allegheny River	Franklin	1,770	1998 – 2008	54	<b>159</b>
903	Raccoon Creek	Moffatts Mill	8	1998 – 2010	68	<b>1,396</b>
905	Beaver River	Beaver Falls	530	1985 – 2009	58	<b>448</b>