Current and Emerging Risks to the New York City Department of Environmental Protection Filtration Avoidance Determination (General Comments, Disinfection Byproducts, Emerging Contaminants)

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General Comments

1. Validity of the Risks – Are the risks identified by DEP scientifically sound and consistent with current research and practice? Are any risks overstated or understated in terms of likelihood or severity?

DEP has accurately identified climate change, storm-driven contamination, emerging contaminants, and an unpredictable regulatory landscape as the primary risks to the FAD. In addition to risks to the FAD, these factors also pose risk to compliance with Primary Drinking Water Standards and to the protection of public health. Climate change, specifically in this region of NY, will make extreme precipitation events more likely, lead to an increase in water temperatures, and make drought and wildfire more frequent. All of these consequences of climate change could lead to higher levels of turbidity, fecal bacteria and disinfection byproduct (DBP) precursors entering reservoirs. Emerging contaminants are of concern due to their prevalence and impacts to public health, but they are not specifically stated compliance targets of the FAD. While additional regulatory criteria may be developed in the future, emerging contaminants will not yet directly impact the FAD's preservation. However, new regulations that result in the use of higher chlorine residuals or which create new MCLs for DBPs could also result in failures to comply with regulatory requirements of the FAD. Given recent violations of the Stage 2 DBP rule, DBP compliance should be considered the primary risk to the FAD. While DEP has had turbidity violations in the past, the development of programs for turbidity management have resulted in a lowered risk of new violations. Existing FAD programs that address land protection and wastewater management serve as foundational protection against a range of water quality problems, including emerging contaminants, turbidity, fecal bacteria and DBPs. Removing these programs will only introduce further risks to the FAD and compliance with the Safe Drinking Water Act. Lastly, although not a component of the FAD, increasing salinity poses a threat to the usability of the NYC water supply and, thus, watershed protection programs that aim to reduce anthropogenic salt inputs should be prioritized and expanded in order to reduce that risk. The risks identified by DEP are scientifically sound and consistent with current research and practice, however they are not the only risks.

2. Prioritization of Risks – Rank the identified risks from highest to lowest priority. Provide rationale for the prioritization, including likelihood of occurrence and magnitude of impact.

DEP identified four primary risks to the FAD (climate change, storm-driven contamination, emerging contaminants and a change to regulations.) Beyond these risks, there are certain contaminants or practices that endanger public health, could result in removal of the FAD, or could pose a risk to the usability of the DEP supply that should be considered. These include: DBPs, salinization, and watershed urbanization. Among these risks, the ranking should be as follows: DBPs> changes to regulation> watershed urbanization> storm-driven contamination> climate change> salinization>

emerging contaminants. There have been two violations of the Stage 2 DBP Rule (one in 2021 and one in 2022), these more recent violations suggest the system is currently vulnerable to DBP exceedances. If new federal disinfection rules require higher chlorine residuals, this will make it more difficult for DEP to remain in compliance with this FAD requirement. Climate change will both increase precursor loading and increase the formation rate of DBPs. As such, there should be a serious commitment by DEP to understand the sources of precursors throughout its watershed and to explore a variety of source water protection strategies along with non-filtration infrastructure upgrades (e.g., chlorine injection points in the distribution system, ozone treatment) to reduce DBP formation. Because DBP precursors can form byproducts at various points in the treatment and the distribution system, a whole system approach to managing DBPs must be studied and implemented. Thoughtful improvements to infrastructure and water management practices have been implemented by DEP to deal with turbidity issues and, as such, there have been no violations since 2012. This approach can also be applied to DBPs. DBP-specific source water protection programs must be developed or existing programs must be evaluated and enhanced to improve precursor control. Watershed urbanization poses another significant threat to water quality and to maintenance of the FAD. If land acquisition subsides and more impermeable surfaces populate the watershed, DBP precursor loading, salinity and the introduction of emerging contaminants will all increase. Thus, reduction of these conservation practices, which provide a multi-barrier approach to water quality protection [as noted by NYS Department of Environmental Conservation (DEC)[1]], will result in the increase of a variety of contaminants entering the supply. Lastly, as noted in DEP's 2025 salinity report, salinization poses a large threat to the usability of the current supply. Implementation of large-scale reverse osmosis facilities to treat DEP water will be prohibitive in terms of both cost and energy use. Source protection and the enhancement of current DEP protection programs or the development of new ones is required to meaningfully curb salinization.

3. Identification of Additional Risks – Are there significant risks not identified by DEP that could affect the City's ability to maintain the FAD? What scientific regulatory, or environmental developments should DEP anticipate?

New federal disinfection rules designed, in part, to address Legionella risks from cooling towers may also introduce new DBP MCLs or result in the formation of more regulated DBPs if precursors are not reduced in the source water. If alternative strategies such as aggressive cooling tower rule enforcement cannot be employed to reduce Legionella risk, these new rules may constitute a risk to the FAD. Continued development in the watershed could also lead to increased precursor loading and increased turbidity due to hydrological conditions associated with impervious surfaces, such as decreased water transit times and run-off velocities. Increased urbanization of the watershed will only be exacerbated if the FAD is removed and land preservation subsides. As DEP evaluates risks to the FAD, it should also complete a scenario analysis to determine likely changes to the watershed if the FAD source water protection programs are no longer in place. Current water quality problems such as salinization due to road salt overuse, emerging contaminants and taste and odor problems are likely to worsen if land conservation decreases and source water protection programs are weakened. The construction and operation of a treatment plant will be expensive. Given resource constraints, DEP will likely not be able operate all of its source water protection programs to the same degree if a treatment plant is built. This will likely decrease the quality of the source water and

[1] Stainbrook, "Input to support NYCDEP's ongoing efforts to safeguard the drinking water supply" (letter), December 11, 2025

make it more likely that the finished water will contain regulated and non-regulated contaminants of concern associated with anthropogenic inputs. Enhancing and expanding source water protection programs currently operated by DEP is likely to result in better water quality overall as well as provide many co-benefits as identified by DEC in its recent presentation at the Science Advisory Panel meeting on November 5, 2025 and in its analysis of risks to the FAD.[1] They are not the only body who has recognized this. As stated in the 2022 Water Research Foundation DBP Expert Panel Report commissioned by DEP, "A filtration plant would provide a larger margin of safety [for removal of precursors], but is still not as cost effective as other treatment/source control alternatives."[2]

<u>Disinfection Byproducts</u>

1. Given this information, where should DEP realistically focus its efforts in evaluating/researching DBP formation potential?

Understanding where precursors are most prevalent (i.e., sub-watersheds, within certain types of landcover, within certain plant community compositions, specific reservoirs) and identifying "hot spots" throughout the watershed should be a key priority. Additionally, understanding DBP formation potential (FP) variability during different times of year or during weather events is essential to developing interventions. Although UV254 is a useful surrogate, understanding real precursor load is most important, therefore utilizing FP tests should be a priority when possible. Understanding how DEP's current source water protection programs influence precursor loading is also an important next step. Programs could potentially be enhanced or adjusted to more readily remove precursors. Other passive/in-situ precursor removal strategies such as streambank filtration[3], vegetation management[4], and algae control[2] should be considered as possible enhancements to current source water protection programs or as standalone measures.

Attention should also be paid to nutrient loading at reservoirs impacted by algal blooms, which produce algal organic matter (a precursor to DBPs) and DBP FP should be evaluated in watersheds with high nutrient loading/near known sources of nutrients. To that end, chlorophyll and phycocyanin may be useful, easy-to-measure parameters that could be added to regular watershed monitoring to help predict the impact of algal organic matter. These data could be validated by comparing FP at the same locations. Modeling of landcover, residence time and water temperature in various watersheds/reservoirs vs. DBP FP would also be a useful exercise once data are collected. The use of additional analytical methods such as the development of excitation emission matrices (EEMs) to better characterize humic and fulvic substances can be helpful and should be utilized to help DEP understand the character of the NOM, which may help identify both sources and possible remedies. Additionally, because DBPs continue to form in the distribution system, understanding how different disinfection strategies (oxidant dosing regimes) and technologies (chlorine injection sites) can be used to limit formation should be evaluated.

2. What are the limitations of relying solely on formation potential for DBP risk management?

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[2] Water Research Foundation, DBP Expert Panel Workshop Report, 2022

[3] Weiss, W. Joshua, et al. "Riverbank filtration—fate of DBP precursors and selected microorganisms." *Journal-American Water Works Association* 95.10 (2003): 68-81.

[4] 2022 Disinfection By-Products: Water Research Foundation Expert Panel Workshop.

DBP FP is the most accurate method of accounting for precursors. However, depending on the test conditions, it can overestimate the precursor load. Simulated distribution system (SDS) tests could be used instead with pH, temperature, residence time and chlorine concentration conditions that more closely mimic the DEP distribution system. Additionally, if only THMs and HAAs are measured at the conclusion of the test, the presence of other more-toxic DBPs will not be known. The 2022 WRF Expert Panel convened by DEP to evaluate disinfection byproduct challenges states that customers of a large utility such as DEP expect some action (monitoring) on unregulated DBPs. Lastly, although SDS tests could more accurately estimate likely formation of DBPs in DEPs system, using FP in order to identify hot spots, hot times, and the efficacy of in-situ removal of precursors is more useful as it allows for a higher degree of variation to make itself evident due to the likely higher concentrations of DBPs that will be formed.

Additionally, DBP FP testing can be time consuming and expensive. Relying on surrogate measures such as UV254 and potentially chlorophyll/phycocyanin allows for near-real time/continuous data collection. Therefore, a mix of both laboratory and field/sensor-based measurements is best.

3. What emerging DBPs should be prioritized for study?

Over 600 DBPs have been characterized, yet this only accounts for approximately 30% of the total organic halogen (TOX) in chlorinated waters on a median basis. The DBPs currently regulated by EPA, four trihalomethanes (THM4) and five haloacetic acids (HAA5), each account for approximately 10% of TOX. Many utilities are transitioning from a sole reliance on chlorine disinfection to combinations of primary disinfectants (ozone, UV, or chlorine) with chloramines as secondary disinfectants, driven at least in part by more stringent limits on regulated DBPs. However, each disinfectant promotes different DBP classes. For example, chloramination promotes N-nitrosamines and iodinated DBPs, while ozone promotes bromate, haloacetaldehydes, and halonitromethanes. Unregulated nitrogen-containing DBPs are more cytotoxic and genotoxic than THM4 and HAA5. N-nitrosodimethylamine (NDMA) is a nitrogenous DBP of particular concern due to its toxicity. The U.S. Environmental Protection Agency (EPA) Integrated Risk Information System (IRIS) database attributes a 0.69 ng/L NDMA concentration in drinking water to a 10^{6} lifetime cancer risk. In addition to NDMA, haloacetonitriles (HANs) and haloketones (HKs) are currently unregulated DBP groups commonly found in disinfected water that have been shown to be more cyto- and genotoxic than regulated DBPs. N-nitrosamines, including NDMA, can be measured using EPA Method 521. HANs and HKs can be measured using EPA Method 551.1.

4. How can NYC leverage new analytical tools to better understand DBP profiles?

As mentioned previously, EEMs are a good tool for understanding the character of natural organic matter (NOM). This character can both help to identify potential sources and fate and transport routes and to provide insight into possible removal mechanisms. Remote sensing may also be used to estimate DOM/NOM/DOC/TOC variability and even model THM FP.[5] Online/near-real-time sensors for precursor surrogates such as UV254, chlorophyll, phycocyanin and fDOM can be used throughout the watershed. Lastly, laboratory methods such as measuring TOC and DOC may be

[5] Awad, John, et al. "Modelling of THM formation potential and DOM removal based on drinking water catchment characteristics." *Science of the Total Environment* 635 (2018): 761-768.

useful complements to data collected by sensors and FP tests. Measuring bromide, iodide and TON could provide useful information on relationships between these parameters and DBPs, especially unregulated DBPs.

5. Given the timeframe for building a filtration plant, what additional measures should DEP take to reduce DBP levels in the distribution system?

First and foremost, a comprehensive evaluation of precursor loading to each reservoir needs to be completed. Using surrogate sensors and DBP FP tests, areas of high loading need to be identified. Associations with various landcover types, weather patterns, allochthonous or autochthonous, nutrient loading, and NOM character need to be elucidated. Any spatial or temporal patterns need to be identified and the primary sources of NOM in each reservoir watershed need to be characterized. Once this is known, the efficacy of existing source water programs for removing NOM needs to be evaluated. Specific programs have been developed by DEP to minimize turbidity and fecal bacteria. Some of these programs may also help to reduce precursors. However, that evaluation needs to be completed. Existing programs may be able to be enhanced or altered to reduce precursor loading or new programs may have to be developed. New source water protection/in-situ treatment should also be evaluated including, but not limited to: algae control, land use change/plant species composition alteration, enhanced stream back filtration, diversions of areas with known high FP, and vegetation management. Additionally, because algal organic matter is a known precursor in this system and because nutrient enrichment can enhance algal growth, nutrient management programs should be evaluated and improved. This includes completing TMDLs – or the equivalent holistic pollution reduction strategy – for the entire reservoir system for both nitrate and phosphorus. In terms of distribution system improvements, DEP should evaluate the feasibility of adding chlorine injection points within the distribution system to reduce higher dosing at the plant effluent, and it should evaluate additional regulation and enforcement of cooling systems to develop alternatives to residual chlorination as the sole strategy for reducing risks associated with Legionella.

6. DEP has conducted bench testing that shows that alum addition can significantly reduce DBP formation potential (DBPfp) and is planning to follow up with a full-scale pilot. Are there additional treatment options that DEP should consider?

DEP can consider non-filtration treatment systems that will allow it to maintain the FAD. This includes the use of ozonation, pre-chlorination, or enhanced coagulation. Additionally, DEP could consider building a treatment plant with filtration that operates seasonally or only treats water from reservoirs that are significantly impacted by DBP precursors. Any of these options would allow DEP to continue the FAD and maintain the source water protection programs that are both effective at improving water quality and more cost-effective than building and maintaining a large treatment plant. Additionally, DEP should consider infrastructure upgrades that allow for the dosing of chlorine throughout the distribution system to reduce the amount applied earlier in the process in order to minimize DBP formation.

<u>Emerging Contaminants</u>

1. What are the most concerning emerging contaminants that DEP should be aware of, and how might these contaminants affect New York City's ability to maintain the FAD?

Cyanobacteria blooms are already impacting NYC reservoirs. As climate change progresses, blooms will become more common and severe. Cyanotoxins will pose human health risks and taste and odor compounds produced by cyanobacteria will increase the likelihood of customer complaints. Therefore, identifying strategies for bloom control will be important even if cyanotoxins and taste and odor complaints are not required compliance targets of the FAD.

New DBPs may be regulated as part of future updates to federal disinfection rules. DBPs such as NDMA or other brominated/iodinated DBPs are more toxic than regulated THMs and HAAs. Therefore, DEP should be regularly monitoring DBPs with established analytical methods as well as determining precursor sources within the watershed. DBP FP tests can be easily adapted to measure a suite of DBPs beyond THMs and HAAs by simply applying additional analytical methods when measuring FP water.

DEP has already evaluated the significant impacts of road salt contamination and increasing salinity in its reservoir system. One implication of the inability to maintain the FAD is that areas previously protected from development will become susceptible to urbanization. This would increase the amount of impervious surfaces and lead to the use of more road salt. Due to the fact that salt is so difficult to remove from water, this possibility should be strongly avoided. It is unlikely that DEP will invest in reverse osmosis treatment to deal with salinity. It would be both cost and energy prohibitive to do so. Therefore, the most economical solution is to avoid additional watershed development with impervious surfaces and roadways, and promote best management road salting practices for existing road networks.

Microplastics are ubiquitous in the environment. As noted in DEP's 2023 Watershed Water Quality Annual Report, microplastics are currently being monitored in California drinking water supplies following establishment of a standard method being utilized by participating utilities. Microplastics such as those measured in Kensico and Croton reservoirs, are also likely to be found in other reservoirs. While this is not unexpected, it does confirm that microplastic contamination should be of concern to DEP. Similar to road salt, microplastic contamination is likely to increase if watersheds urbanize due to anthropogenic inputs from improper waste handling and via wastewater discharges from increasing populations. So, while microplastics are not regulated via the FAD, losing the FAD would likely increase microplastic contamination in DEP reservoirs.

Non-regulated biocides may also pose risks to the NYC water supply. In particular, three types of biocides are currently in widespread use across New York. Neonicotinoid insecticides have become the fastest growing class of insecticides over the past few decades, accounting for more than 25% of the global insecticide market in 2014.[6] Fipronil is another of the most widely used pesticides in the world.[7] Fipronil can be degraded into metabolites in the environment, mainly including fipronil

[6] C. Bass, I. Denholm, M.S. Williamson, R. Nauen, The global status of insect resistance to neonicotinoid insecticides, Pesticide Biochem. Physiol., 121 (2015), pp. 78-87

[7] Bonmatin, JM., Giorio, C., Girolami, V. *et al.* Environmental fate and exposure; neonicotinoids and fipronil. *Environ Sci Pollut Res* 22, 35–67 (2015). https://doi.org/10.1007/s11356-014-3332-7

desulfinyl, fipronil sulfone, and fipronil sulfide.[8] Finally, Aminomethylphosphonic acid (AMPA) is one of the primary degradation products of the herbicide, glyphosate. Glyphosate is the most used herbicide in the US[9] and worldwide.[10] In vitro and in vivo lab studies have shown the potential toxic effects of neonicotinoids, including reproductive toxicology, neurotoxicity, hepatotoxicity/ hepatocarcinogenicity, immunotoxicity, genetic toxicity.[11] Thiacloprid is classified as "Likely to be Carcinogenic to Humans" by IARC with a reference dose 0.004 mg/kg/day for human intake derived from U.S. Environmental Protection Agency (EPA) and the tumors observed in rats and mice.[12] Additionally, imidacloprid (which will be banned from use on ornamental plants and turf in NY state starting in 2026) can form two metabolites, desnitro-imidacloprid and imidacloprid-urea, that are significantly more toxic than the parent compound.[13] These metabolites can further be transformed to create novel disinfection byproducts.[31] Fipronil and its metabolites have been found in environmental samples, such as surface water and drinking water, as well as biological samples such as urine, serum, and hair where they have shown to be correlated with negative health effects.[14] Certain fipronil metabolites have been shown to be significantly more toxic than the parent compound.[15,] AMPA has been associated with negative health effects, including metabolic syndrome and liver disorders in children.[16] In New York State, imidacloprid, an insecticide in the class of neonicotinoids, has been detected in as high as 50% of yearly surface water monitoring samples.[17] Water sampling for other neonicotinoids has been sparse, but clothianidin and thiamethoxam are used agriculturally in New York and have a high run-off potential. No neonicotinoids have been included in UCMR monitoring or been included on EPA's Contaminant Candidate Lists (CCLs). Fipronil metabolites and AMPA are expected to be ubiquitous in water and the environment given

[8] Fang, W.; Peng, Y.; Muir, D.; Lin, J.; Zhang, X. A critical review of synthetic chemicals in surface waters of the US, the EU and China. *Environ. Int.* 2019, *131*, 104994, DOI: 10.1016/j.envint.2019.104994 3A critical review of synthetic chemicals in surface waters of the US, the EU and ChinaFang, Wendi; Peng, Ying; Muir, Derek; Lin, Jun; Zhang, XiaoweiEnvironment International (2019), 131 (), 104994CODEN: ENVIDV; ISSN:0160-4120

[9] Memorandum from Caleb Hawkins, Biologist Biological Analysis Branch EPA, et al. to Khue Nguyen, Chemical Review Manager, Pesticide Re-evaluation Division, EPA (Apr. 18, 2019) https://www.epa.gov/sites/default/files/2019-04/documents/glyphosate-response-comments-usage-benefits-final.pdf.

[10] Soares D, Silva L, Duarte S, Pena A, Pereira A. Glyphosate Use, Toxicity and Occurrence in Food. Foods. 2021 Nov 12;10(11):2785. doi: 10.3390/foods10112785. PMID: 34829065; PMCID: PMC8622992.

[11] Wenchao Han, Ying Tian, Xiaoming Shen, Human exposure to neonicotinoid insecticides and the evaluation of their potential toxicity: An overview, Chemosphere, Volume 192, 2018, Pages 59-65, ISSN 0045-6535

[12] Zhang, Chao, et al. "Contamination of drinking water by neonicotinoid insecticides in China: Human exposure potential through drinking water consumption and percutaneous penetration." *Environment International* 156 (2021): 106650.

[13] Klarich Wong, Kathryn L., et al. "Chlorinated byproducts of neonicotinoids and their metabolites: an unrecognized human exposure potential?." *Environmental science & technology letters* 6.2 (2019): 98-105.

[14] Kim, Y. A.; Yoon, Y. S.; Kim, H. S.; Jeon, S. J.; Cole, E.; Lee, J.; Kho, Y.; Cho, Y. H. Distribution of fipronil in humans, and adverse health outcomes of in utero fipronil sulfone exposure in newborns. *Int. J. Hyg. Envir. Heal.* 2019, *222* (3), 524– 532, DOI: 10.1016/j.ijheh.2019.01.009 There is no corresponding record for this reference.

[15] National Pesticide Information Center, Fact Sheet: Fipronil, http://npic.orst.edu/factsheets/archive/fiptech.html.

[16] Eskenazi B, Gunier RB, Rauch S, Kogut K, Perito ER, Mendez X, Limbach C, Holland N, Bradman A, Harley KG, Mills PJ, Mora AM. Association of Lifetime Exposure to Glyphosate and Aminomethylphosphonic Acid (AMPA) with Liver Inflammation and Metabolic Syndrome at Young Adulthood: Findings from the CHAMACOS Study. Environ Health Perspect. 2023 Mar;131(3):37001. doi: 10.1289/EHP11721. Epub 2023 Mar 1. PMID: 36856429; PMCID: PMC9976611.

[17] Pierre Mineau, Impacts of Neonics in New York Water Their Use and Threats to the State's Aquatic Ecosystems Pierre Mineau, https://www.nrdc.org/sites/default/files/impacts-neonics-in-ny-water-report.pdf.

the massive uses of their parent compounds.[18] Fipronil is included on EPA's CCL 5, but neither fipronil nor AMPA has yet been selected for UCMR testing.

2. Are current monitoring technologies and protocols sufficient to detect and quantify emerging contaminants at levels relevant to public health and regulatory thresholds?

Aside from microplastics, most of the above listed emerging contaminants have established standard analytical methods that can be used to detect them at concentrations relevant to public health and regulatory thresholds. Those that do not have standard methods, can be measured using common laboratory techniques.

3. How might anticipated changes to federal or state drinking water regulations such as updates to the SDWA or SWTR affect NYC's eligibility for filtration avoidance?

New disinfection rules that require a higher chlorine residual or enact new MCLs for DBPs may make it more difficult for DEP to comply with DBP requirements in the FAD. The higher chlorine residual will likely result in higher THMs and HAAs in the distribution system potentially causing exceedances of locational or system-wide averages. In order to avoid this, it is essential that DEP better understand the efficacy of its source water protection programs for reducing DBP precursors and implement strategies to enhance these programs. Additionally, exploring infrastructure upgrades to the distribution system to allow for multiple points of chlorine injection at low concentrations will allow DEP to maintain the required residual while limiting high chlorine dosing at the end of the treatment train.

4. DEP has never detected PFAS compounds at the CAT-DEL source water, and a recent evaluation of risks in the Kensico watershed concluded that there is no risk of non-compliance with upcoming federal and proposed State regulations. Are there additional risks related to PFAS that DEP should be considering?

Per-and-polyfluoroalkyl substances (PFAS) are of concern in many water supplies and are of particular importance to DEP due to their occurrence in Croton reservoir and in a number of streams in the Catskill watershed (according to the 2019 Emerging Contaminant Monitoring Project Report.) Although PFAS are currently below regulatory levels, they could become a concern in the future via a variety of scenarios. These include: lowering of PFOA/PFOS state MCLs, new state or federal PFAS MCLs, an increase in PFAS manufacturing/use, climatological conditions that increase PFAS loading. Additionally, while EPA proposed MCLs or a Hazard Index for six PFAS last year, only one was a short-chain PFAS. Given this sub-group is becoming more prevalent for use in manufacturing and is being detected more frequently in the environment[19], new PFAS MCLs may be created in the future to address these compounds. However, because PFAS are not compliance targets of the FAD, at the current time they do not pose a risk to its elimination.

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[18] Alexis Grandcoin, Stéphanie Piel, Estelle Baurès, AminoMethylPhosphonic acid (AMPA) in natural waters: Its sources, behavior and environmental fate, Water Research, Volume 117, 2017, Pages 187-197, ISSN 0043-1354.

[19] Liu, Juhe, and Joseph A. Charbonnet. "A Critical Review of PFAS Analysis, Occurrence, and Fate in Wastewater Treatment Plants." *Environmental Science & Technology* (2025).

5. Should DEP align its Watershed Regulations with State standards for wastewater and stormwater or maintain its current incremental provisions (i.e., microfiltration requirement for wastewater treatment plants or 1-year storm volume for stormwater pollution prevention plans)?

DEP's Watershed Rules and Regulations (WRR) are an important component of its source control strategy. Rules that allow for increased oversight of pollution sources, the required use of advanced wastewater treatment technologies and prohibition on development that may lead to an influx of pollutants are particularly important. They are the first line in a multibarrier approach to pollutant control. DEP should be commended for the strong rules developed to reduce the impacts of wastewater effluent, and it should retain those provisions. In order to continue to improve water quality and mitigate the effects of climate change, additional provisions may be warranted. Effluent organic matter (EfOM) is a component of wastewater effluent comprised of a variety of anthropogenic and naturally-occurring substances. These substances can serve as precursors to both regulated and non-regulated DBPs. EfOM can be reduced using a variety of treatment techniques including membrane bioreactors (MBR) (as proposed for DEP's Renewable Rikers design), use of activated carbon (PAC or GAC) or more advanced technologies such as nanofiltration and reverse osmosis. While some of these technologies are not economically feasible to implement at all wastewater treatment plants (WWTPs) in the watershed, the use of MBR or even enhancing the efficiency of nitrification[20] can produce significant reductions in precursor load. MBR can produce other water quality benefits such as reducing nutrient concentrations. As such, DEP should consider updating its WRRs to require use of MBR or an equivalent technology/technique for reduction of EfOM.

While upgrading WWTPs to remove other emerging contaminants such as PFAS is likely not feasible, DEP can require WWTPs to monitor for PFAS (using EPA method 1633) in the WWTP influent and effluent to better understand sources of PFAS in the watershed. If PFAS are detected, source investigation should be initiated. Additionally, DEP's WRRs may be able to be used to limit the use or sale of PFAS-containing products within the watershed that are being considered for bans as part of pending state bills. This type of source control can be both highly effective and less costly than removing PFAS from contaminated source waters.

Continued DEP oversight of WWTP operations/permitting is advantageous and likely results in improved source water quality. As such, it is important that this oversight remain in place and that technical documents used to guide review of treatment schemes include the current best available technology for wastewater treatment. Oversight and enforcement of storm water inputs also remains critical. The prohibition on development of impervious surfaces within 100 feet of a watercourse or 300 feet of a wetland reduces impacts to water quality and exceptions to that rule should be minimized to ensure source water protection. Additionally, using a one-year storm metric is appropriate and will only become more appropriate as climate change progresses and storms become more frequent and severe.

[20] Krasner, Stuart W., et al. "Impact of wastewater treatment processes on organic carbon, organic nitrogen, and DBP precursors in effluent organic matter." *Environmental science & technology* 43.8 (2009): 2911-2918.