CEA Engineers, P.C.
Comments on the *Draft Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program, Well Permit Issuance for Horizontal Drilling and High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and Other Low-Permeability Gas Reservoirs,* (DSGEIS), dated September 2009
Bruce A. Bell, Ph.D., P.E., BCEE
Ralph E. Huddleston, Jr.
December 30, 2009

The New York State Department of Environmental Conservation (NYSDEC) released the *Draft Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program, Well Permit Issuance for Horizontal Drilling and the High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and Other Low-Permeability Gas Reservoirs* (DSGEIS), in September 2009, to assess the environmental impacts of horizontal drilling and high-volume hydraulic fracturing not addressed in the 1992 Generic Environmental Impact Statement for gas drilling and to present practices to mitigate such impacts. CEA Engineers, P.C. (CEA) was retained by Earthjustice, Inc. and Riverkeeper, Inc. to review and analyze NYSDEC's evaluation of environmental impacts to natural resources including surface waters, floodplains, wetlands, waterbodies, and watercourses, as well as the impacts to significant habitats and wildlife, including rare, threatened, and endangered species and associated required mitigation actions.

Wastewater

Chapters 5, 6, and 7 of the DSGEIS, present, among other things, NYSDEC's analysis of environmental impacts and mitigation measures to eliminate adverse environmental impacts resulting from the wastewater generated by horizontal drilling and high-volume hydraulic fracturing in the Marcellus Shale formation in New York State (NYS).

1. ***Comment*: The potential on-site and off-site wastewater treatment alternatives may result in significant adverse environmental impacts, including increased energy usage and increased roadway stormwater pollution from transportation of wastewater. In the DSGEIS, NYSDEC failed to assess and provide mitigation measures for significant adverse environmental impacts, either per well or cumulatively, from wastewater treatment energy use and increased stormwater pollution from transportation of wastewater.**

Discussion: On-site treatment and reuse of flowback water is considered beneficial by NYSDEC as a means of supplying a portion of the large quantities of water required for, and disposing of the voluminous wastes generated by, hydraulic fracturing.[1] Technologies evaluated for on-site treatment of Total Dissolved Solids (TDS) and its constituents include: reverse osmosis, thermal distillation, electrodialysis, and ion exchange.[2] Each of these technologies requires significant energy input and produces liquid or solid waste streams containing concentrated amounts of all pollutants removed from the flowback water. The potential significant adverse environmental impacts associated with on-site energy use, transport, and disposal of highly concentrated liquids, and the required mitigation methods were not evaluated in the DSGEIS.

When wastewater is not treated and reused on site, NYSDEC lists underground injection, treatment and disposal at Publicly Owned Treatment Works (POTWs), and treatment and disposal at private wastewater treatment plants (WWTPs) as available alternatives for treatment or disposal. Underground injection, properly conducted, does not impact surface waters and requires a site-specific evaluation under SEQRA. Treatment at POTWs and private WWTPs involves significant transportation of wastewaters with associated adverse environmental impacts including increased stormwater pollution. NYSDEC estimated that an eight-well pad would require between 1,600 and 2,400 truckloads to haul away flowback water.[3] NYSDEC offers no estimate of truck trips for hauling brines, a fluid produced from the Marcellus Shale formation.[4]

POTWs have limited ability to treat flowback water and brines produced by horizontal drilling and high volume fracturing as the flowback water and brines contain high TDS and individual components of TDS not normally treated by POTWs. As discussed by Dr. Glenn Miller in his comments on the DSGEIS, the produced wastewater also contains high

1 DSGEIS, Section 7.4.1.2.
2 DSGEIS, Section 5.12.2
3 DSGEIS, Section 6.13.1.
4 DSGEIS, Section 6.6.9.

concentrations of radioactivity.[5] POTWs do not typically treat for radioactivity although incidental removal of radioactive metals may impact beneficial reuse of biosolids.. In order to meet SPDES effluent limits required for all POTWs, avoid interference with POTW operation, and maintain the beneficial reuse of biosolids, when treating the flowback and brine, the amount of flowback and brine that can be treated in any POTW is limited.
In addition to the limitations on contaminants contained in flowback waters and brine that a POTW can successfully treat, the flow volume that POTWs can take is also limited. Treatment capacity for both flow and pollutant loading for POTWs are designed based on anticipated population and industrial growth in the areas these POTWs service, and capacity of these POTWs is essential for future population and economic growth in those regions.[6] A POTW's acceptance of flowback water and brine limits its capacity to serve future municipal and industrial/commercial wastewater treatment needs. These inherent limitations are likely to limit the availability of POTWs to treat wastewaters generated during horizontal drilling and high volume fracturing.

Treatment of wastewaters generated during horizontal drilling and high volume fracturing wastewaters at private WWTPs involves transportation issues similar to those associated with treatment at POTWs and the same issues of transportation and disposal of highly concentrated residuals from TDS removal as discussed above for on-site treatment.

2. *Comment*: NYSDEC fails to evaluate the significant environmental impacts of treatment and disposal of flowback and brine wastewaters in the DSGEIS, including: energy usage; increased roadway stormwater pollution from transportation of wastewater. NYSDEC must assess the regional cumulative impacts from horizontal drilling and high volume fracturing.

Discussion*:* The DSGEIS states that: "The level of impact on a regional basis will be determined by the amount of development and the rate at which it occurs."[7] NYSDEC states that the rate of development of gas wells will, in great part, be determined by economic

5 Miller, Glenn, Ph.D., "Review of the DRAFT Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program, Toxicity and Exposure to Substances in Fracturing Fluids and in the Wastewater Associated with the Hydrocarbon-Bearing Shale," December 21, 2009.

6 Water Environment Federation, American Society of Civil Engineers, *Design Manual of Municipal Wastewater Treatment Plants, Fourth Edition, MOP 8*, 1998.

7 DSGEIS Section 6.13.2.

factors that are not easily forecasted.[8] The DSGEIS acknowledges that cumulative impacts will occur, but provides no basis for limiting shale gas development to avoid those impacts or for designing appropriate mitigation if development is not limited. NYSDEC must provide a cumulative impact analysis of wastewater generated by the gas development operations, and the treatment of that wastewater if the agency is to identify adequate regulations for mitigation of environmental impacts from the transportation and treatment of wastewater.

The large volume of flowback water and other gas development wastewaters potentially generated mandates the evaluation of regional cumulative impacts. One estimate from the drilling industry contained in the Section 6.13.2.1 of the DSGEIS is that from 1,500 to 2,500 wells per year could be developed in Marcellus Shale in New York. Using the average flowback water volume of 1.5 million gallons per well, based on the range provided in Section 5.11 of the DSGEIS of 216,000 gallons to 2,700,000 gallons, and an average of 2,000 wells per year (the midpoint of the industry estimate), 3 billion gallons per year of flowback water could be generated. If all of that water were to be transported for treatment, assuming 9,000 gallons per tanker truck, it would require 913 trucks per day, 365 days per year. The additional trucks add to the environmental impacts associated with energy use, air pollution, and stormwater pollutant runoff. The amount of pollutants, including sediment, metals, oils and greases, etc, discharged in stormwater from roads increases as traffic increases. No evaluation of the cumulative impact of the pollutants generated by additional truck traffic on water bodies and other environmentally sensitive areas is included in the DSGEIS. Mitigation methods to minimize or eliminate the cumulative environmental impacts are not included in the DSGEIS.

3. ***Comment*: In the DSGEIS, NYSDEC fails to evaluate the cumulative volume and rate of production of gas wastewater requiring treatment; fails to verify whether identified POTWs or private wastewater treatment plants have adequate capacity to accept the generated wastewater; and fails to require that Applicants for well drilling permits have a contract to dispose of flowback water to be treated off-site at a POTW or other permitted WWTP.**

[8] DSGEIS Section 6.13.2.1.

Discussion: As much as 3 billion gallons of flowback water may require treatment per year (see previous comment) in addition to other wastewater such as production brines. Appendix 21 of the DSGEIS contains a list of POTWs with approved pretreatment programs but does not identify which of the POTWs are willing and capable of receiving and adequately treating flowback water and brines. Similarly, available capacity to accept wastewater at private wastewater treatment plants was not evaluated in the DSGEIS.

In the DSGEIS, NYSDEC appears to simply assume, without basis, that sufficient wastewater treatment capacity will be available in New York and other states, including Pennsylvania.[9] In Pennsylvania, Marcellus Shale development wastewater disposal is considered a significant water issue.[10] Because POTWs in Pennsylvania do not treat TDS, the State has been required to cap acceptance of gas drilling wastewater at many POTWs at 1% of total annual flows significantly reducing the ability of POTWs in Pennsylvania to handle the wastewater from its own gas development operations much less the volumes to be produced in New York State.[11,12]

The proposed Environmental Assessment Form (EAF) Addendum Requirements for High-Volume Hydraulic Fracturing (DSGEIS Appendix 6) requires that the Applicant identify the planned disposition of flowback water and brines and if water will be disposed of at a POTW or WWTP; and provide a copy of NYSDEC's approval of that POTW or WWTP to receive flowback water. Neither the application nor proposed EAF Addendum requires that the Applicant have a contract to dispose of flowback water at a POTW or WWTP nor do they require proof that the POTW has the available capacity to treat the flowback water at the time that treatment capacity is needed. Without a contract, there is no documentation that the POTW or WWTP actually has the treatment technologies and available capacity to accept the

---

9 New York City, "New York City Comments on: Draft Supplemental Generic Environmental Impact Statement (dSGEIS) on the Oil, Gas and Solu7tion Mining Regulatory Program – Well Permit Issuance for Horizontal Drilling and High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and Other Low-Permeability Gas Reservoirs," December 22, 2009. [NYC Comments]

10 Pennsylvania State University, "Shaping Proposed Changes to Pennsylvania's Total Dissolved Solids Standard, A Guide to the Proposal and the Commenting Process," 2009.

11 Swistock Bryan, School of Forest Resources, Pennsylvania State University, "Wastewater Issues and Technologies," Pennsylvania Gas Drilling Summit: Challenges and Opportunities, December 10th - 11th, 2008.

12 NYC Comments.

generated wastewater volumes upon actual generation as opposed to when the permit is approved.

In the absence of a cumulative impact analysis demonstrating that wastewater treatment capacity would actually be available for all of the wastewaters generated by horizontal drilling and high volume fracturing, At a minimum, NYSDEC must require a contract verifying that the POTW or WWTP proposed by the applicant to accept the wastewater has the existing capacity and the technology/capability to treat the water at the time drilling is to be performed to avoid or minimize significant adverse impacts resulting from a dearth of certified treatment capacity..

4. *Comment:* The minimum list of pollutants required by the DSGEIS in a headworks analysis must include barium and iron.

Discussion: Table 6-2 of the DSGEIS shows that barium concentration in flowback water from Pennsylvania and West Virginia averages over 600 mg/l with a maximum measured concentration of 15,500 mg/l. The safe drinking water standard maximum contaminant level (MCL) for barium is 2.0 mg/l.[13]

Table 6-2 of the DSGEIS also shows that iron averages almost 48 mg/l with a maximum of 810 mg/l. The secondary drinking water standard for iron is 0.3 mg/l.[14]

For class A and AA surface waters the water quality standard for barium is 1.0 mg/l and the water quality standard for iron is 0.3 mg/l.[15] The Pennsylvania Department of Environmental Protection's Bureau of Oil and Gas Management explicitly requires the analysis of barium and iron among other constituents in wastewater produced from the Marcellus Shale drilling

[13] 40 CFR 141.51.
[14] 40 CFR 141.3.
[15] ECL §703.5 Table 1.

operations.[16] These contaminants are not included in the "minimum analysis list" in the DSGEIS.[17]

The minimum analysis list refers to the types of constituents required to be evaluated to meet the headworks analysis requirements. The minimum analysis list relies on the Priority Pollutant list to analyze for and limit all of the contaminants. Neither barium nor iron are included in the Priority Pollutant Metals list.[18] The fact that NYSDEC has failed to include required analysis of the flowback water for at least these two parameters, shows that NYSDEC has failed to evaluate or propose flowback water analysis requirements capable of detecting all of the potential contaminants. Without knowing the concentrations of all of the contaminants in the flow back water, NYSDEC cannot demonstrate the ability of wastewater treatment plants to treat the generated wastewaters to SPDES permit effluent limits without interfering with beneficial use of biosolids.

Stormwater

Chapter 5, 6, and 7 of the DSGEIS, present, among other things, NYSDEC's analysis of impacts and recommended mitigation measures to eliminate adverse environmental impacts resulting from the discharge of stormwater generated by horizontal drilling and high-volume hydraulic fracturing operations and associated activities in NYS.

Section 6.1.2 of the DSGEIS provides a general description of beneficial and adverse environmental impacts from stormwater runoff. NYSDEC did not assess the adverse environmental impacts potentially caused by stormwater runoff from well pad site development and construction, as well as during hydraulic fracturing and other gas development operations, including soil erosion, increased stream erosion, and discharge of pollutants. Section 7.1.2 addresses mitigation consisting of Stormwater Pollution Prevention Plans (SWPPP).

---

16 The Commonwealth of Pennsylvania, Department of Environmental Protection, Bureau of Oil and Gas Management, Bureau of Water Standards and Facility Regulation, Oil and Gas Wastewater Manifest Instructions, December 2008.

17 DSGEIS, Section 7.1.8.1.

18 40 CFR 401.5.

In Section 7.1.2.1, NYSDEC states that it plans to incorporate the General Permit for Stormwater Discharges Associated with Construction Activities (Construction General Permit) into Sector AD of the Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity (MSGP). NYSDEC also proposed the option of revising the MSGP to incorporate a required SWPPP for industrial activities that may reasonably be expected to affect the quality of stormwater discharges associated with hydraulic fracturing operations.

5. ***Comment*: In the DSGEIS, NYSDEC failed to account for the cumulative impact of multiple stormwater discharges to a stream or river that may result in higher than pre-construction stream flow and higher in-stream velocities. Increased in-stream velocities increase the risk of in-stream erosion. Increased in-stream erosion results in increased total suspended solids (TSS) and turbidity in receiving waters. In the DSGEIS, NYSDEC failed to evaluate adverse environmental impacts on faunal utilization of watercourses and waterbodies as a result of increased turbidity from the increased stormwater volume and failed to provide mitigation for such adverse impacts.**

Discussion: Increased impervious area created by well pads and access roads will generate greater stormwater discharge rates and volumes to the receiving streams as compared to undisturbed, pre-construction conditions. The Construction General Permit limits maximum post-construction flow rates to maximum pre-construction flow rates to protect the receiving streams from in-stream erosion.[19] The most commonly used stormwater best management practice (BMP) for matching pre- and post-development flow rates is detention basins. The Construction General Permit does not require that pre- and post-development stormwater discharge volumes match. Limiting the maximum post-construction flow rate does not prevent an increase in the total volume discharged to receiving water. An increased stormwater discharge volume results in a longer period of peak stormwater discharge flow rates to the water body.

When post-construction peak discharge flow rates occur over a longer period of time than pre-construction peak flow rates, and there are multiple discharges, higher in-stream velocities and in-stream erosion may result. Increased in-stream erosion in turn causes higher in-stream TSS and turbidity which has been shown to have a negative effect on fish species, such as trout and bass.

[19] NYSDEC, *New York State Storm Water Management Design Manual,* August 2003.

Many studies have been conducted which demonstrate that high turbidity decreases reaction time and feeding rates among fish species, such as the rainbow trout, and the largemouth bass.[20,21] These studies indicate that high sediment-producing activities, such as road building associated with gas well drilling, have the potential to reduce foraging success among trout and bass species, and as a result, decrease growth rates.[22,23] Slower growth rates as a result of decreased forage efficiency may lead to a decrease in spawning potential, which could result in significant effects on population dynamics among fish populations.[24] Additionally, increased turbidity levels have the potential to cause an increase in the migration of fish species to less turbid waters, and result in the absence of fish for long stretches of streams, rivers, or watercourses affected by sedimentation.[25] In the past, NYSDEC has recommended maintaining a 50-foot wide vegetated corridor on each side of protected streams in order to maintain stable embankments and water quality.[26] Adopting this recommendation for Marcellus drilling activities would assist in preventing erosion and maintaining natural levels of turbidity within watercourses and waterbodies.

According to the New York City Department of Environmental Protection (NYCDEP) "Catskill Mountain stream bottoms and banks provide source areas that contribute to high suspended sediment loads and turbid stream water to reservoirs."[27] Stream bank erosion of Schoharie Creek, which supplies the Schoharie Reservoir serving New York City, has been

---

20 Barrett, Jeffrey C., et. al. *Turbidity-Induced Changes in Reactive Distance of Rainbow Trout.* Transactions of American Fisheries Society, 1992.

21 Shoup, Daniel E., and David H. Wahl. *The Effects of Turbidity on Prey Selection by Piscivorous Largemouth Bass*. Transactions of American Fisheries Society, 2009.

22 Barrett, Jeffrey C., et. al. *Turbidity-Induced Changes in Reactive Distance of Rainbow Trout.* Transactions of American Fisheries Society. 1992.

23 Shoup, Daniel E., and David H. Wahl. *The Effects of Turbidity on Prey Selection by Piscivorous Largemouth Bass*. Transactions of American Fisheries Society, 2009.

24 Sweka, John A. *Effects of Turbidity on the Foraging Abilities of Brook Trout (*Salvelinus fontinalis*) and Smallmouth Bass (*Micropterus dolomieu), 1999.

25 Sweka, John A. *Effects of Turbidity on the Foraging Abilities of Brook Trout (*Salvelinus fontinalis*) and Smallmouth Bass (*Micropterus dolomieu), 1999.

26 NYSDEC Region 3, Comments on Draft Environmental Impact Statement, July 3, 2009.

27 New York City Department of Environmental Protection, *Turbidity in the Catskill Watershed, Preliminary Report,* April 2002.

identified as a source of high turbidity in the Schoharie Watershed.[28] In reference to streams in the Catskill Mountains, NYCDEP reported: "High total suspended solids concentrations and elevated turbidity values are associated with exposed and shallow buried clay sources…both increase as a function of stream discharge, velocity, and power."[29] In the DSGEIS, NYSDEC has failed to analyze the impact of increased velocity in streams and to provide mitigation measures to prevent adverse environmental impacts such as those discussed with regard to trout and bass.

Erosion of the stream banks is of particular concern in the New York City Watershed.[30] Erosion of stream banks results in additional TSS and turbidity in the watershed. The NYCDEP identifies turbidity as the first of three "significant issues and challenges that have arisen over the course of the past five years and that are important to the continuation of filtration avoidance."[31] The other two are compliance with new standards for disinfection byproducts and increased development.[32] The development of the well pads, roads, and other construction required for the gas drilling and production operations, as discussed previously, can significantly increase erosion and turbidity in nearby water bodies. The cumulative effect of increased TSS and turbidity could potentially result in the need for New York City to construct a filtration system for the drinking water supply at an estimated cost of $10 billion to construct and $100 million a year to operate.[33]

It is not possible to analyze the impact of extending peak flow discharge time from the development of well pads and associated roads without performing a cumulative analysis of multiple discharges to a river or stream. The analysis must include all potential drilling sites

---

28 Memorandum to Phil DeGaetano, NYSDEC Division of Water, from Rene' VanSchaack, Greene County Soil & Water Conservation District, Re: Proposal for EPA Funding of Turbidity Programs in Schoharie Watershed, May 4, 1999.

29 New York City Department of Environmental Protection, *Turbidity in the Catskill Watershed, Preliminary Report,* April 2002.

30 United States Environmental Protection Agency, New York Filtration Avoidance Determination, July 2007.

31 United States Environmental Protection Agency, New York Filtration Avoidance Determination, July 2007.

32 United States Environmental Protection Agency, New York Filtration Avoidance Determination, July 2007.

33 Letter from Steven W. Lawitts, Acting Commissioner, New York City Department of Environmental Protection, to Alexander B. Grannis, Commissioner, New York State Department of Environmental Conservation, September 25, 2009.

on a river or stream. Furthermore, a cumulative analysis must be conducted in order to determine the potential impacts of increased turbidity on aquatic fauna, including trout and bass species.

6. ***Comment*: In DSGEIS Section 7.1.2, NYSDEC acknowledges that Section AD of the MSGP is not currently adequate to prevent adverse impacts to stormwater but fails to provide any specific mitigation measures that may ultimately be included in a revised MSGP. NYSDEC is only proposing the option of revising the MSGP not guaranteeing that it will be revised. Absent a revised MSGP, it is not possible to determine if revised permit requirements will result in avoiding or sufficiently mitigating adverse environmental impacts. Because the DSGEIS fails to provide any changes to Section AD of the MSGP, analysis of industrial stormwater environmental impacts and mitigation measures must be done for each individual permit. If and when NYSDEC modifies the MSGP, another SGEIS must be prepared that analyzes industrial stormwater environmental impacts and defines mitigation methods.**

Discussion: Section 7.1.2.2 of the DSGEIS contains a recitation of typical BMPs generally used to improve the quality of industrial stormwater runoff under the General Permit. Aside from a simple assertion that NYSDEC is proposing the option of revising the MSGP as necessary, the DSGEIS contains no assessment of adverse environmental impacts and merely promises that future unidentified and hypothetical mitigation measures will be adequate.

7. ***Comment:*** **In the DSGEIS, NYSDEC fails to identify and evaluate the impact of stormwater runoff containing highly erodible soils in Marcellus Shale drilling areas. The soil characteristics of these soils require stormwater BMPs above and beyond those commonly used to remove turbidity from stormwater runoff. The DSGEIS fails to identify adverse environmental impacts in areas where difficult to settle soils are likely to occur and fails to require specific mitigation measures for such areas. The DSGEIS must identify such areas and impose specific mitigation measures to avoid or reduce adverse environmental impacts from soil erosion.**

Discussion: Soil characteristics such as particle size and settleablity affect the efficacy of typical stormwater management systems. Typical BMPs, such as settlement and detention basins, do not effectively remove difficult-to-settle fine clay soils found in areas where the Marcellus Shale may be developed, including the New York City Watershed and in Sullivan County. As discussed earlier, absent the use of extraordinary erosion control measures,

construction of gas drilling operations and support facilities in fine clay soils can result in turbid stormwater discharges to receiving waters.

Flocculants can be used to improve settleability of fine clay soils. Flocculants, however, can have adverse environmental impacts. For example, Chitosan, a flocculent derived from shells, was recommended by a developer for use at the Belleayre ski resort in New York State to improve discharge TSS quality.[34] Chitosan has been reported to be toxic to Rainbow Trout at very low concentrations.[35] The DSGEIS does not contain any evaluation of the potential adverse environmental impacts resulting from the use of flocculants or other additives to enhance settling of poorly settleable soils nor does it contain limitations on their use.

8. *Comment:* In the DSGEIS, NYSDEC fails to evaluate the cumulative adverse environmental impacts on stormwater resulting from transport of flowback water to treatment facilities and to require mitigation measures to eliminate or minimize adverse impacts.

Discussion: As discussed in Comments 2 and 3, large quantities of flowback water will be generated by high volume hydraulic fracturing. A significant portion of the generated flowback water is likely to be transported by truck to central impoundments and/or transported to POTWs or other treatment facilities. Two to three times as much fresh water must be transported by truck or pipeline to the well sites for well construction and hydraulic fracturing. Additional truck traffic will be required to transport equipment and chemicals to the well sites. The amount of pollutants, including sediment, metals, oils and greases, etc, discharged in stormwater from roads increases as traffic increases. No evaluation of the cumulative impact of the pollutants generated by additional truck traffic on water bodies and other environmentally sensitive areas is included in the DSGEIS. Mitigation methods to minimize or eliminate adverse environmental impacts from this activity are not included in the DSGEIS.

---

[34] The LA Group, Landscape Architecture and Engineering, *Draft Environmental Impact Statement, for Belleayre Resort at Catskill Park, Town of Shandaken and Middletown, Ulster and Delaware Counties, New York,* September 2003.

[35] Bullick, Graham, et. al., "Toxicity of acidified chitosan for cultured rainbow trout (Oncorhynchus mykiss)," Aquaculture, Elsevier Science, November 7, 1999

NYSDEC indicated in the DSGEIS that cumulative environmental impact analysis cannot be performed because of the uncertainty of the rate of drilling due to economic factors. NYSDEC, however, recognized in the 1992 GEIS that "the potential for negative impacts on water quality, land use, endangered species and sensitive habitats increases significantly" with increased density.[36,37] Nevertheless, the DSGEIS includes an estimate of 2,000 wells per year from one private company.[38] NYSDEC should include an analysis of the cumulative impacts of truck traffic on receiving waters from stormwater discharge for a reasonable, worst case scenario.

Spills

9. ***Comment***: **The DSGEIS fails to include an analysis of the inevitable adverse environmental impacts resulting from unavoidable spills from fluids associated with gas well operations including, but not limited to, fracturing chemicals, flowback water, and brine.**

Discussion: In September 2009, a spill in Pennsylvania of 8,000 gallons of drilling fluids into a nearby creek resulted in fish kills.[39] The drilling fluids discharged to the creek contained a liquid gel concentrate consisting of chemicals listed as possible human carcinogens. The September 2009 discharge of chemicals to receiving waters was one of several spills from facilities operated by the same company, including an 800-gallon diesel spill from an overturned truck.[40] Additionally, ToxicsTargeting.com has listed over 270 spills from 1986 to date from the gas/oil well operations in NYS ranging from less than one gallon to over 100,000 gallons.[41] The majority of the spills listed were a result of human error and equipment failure, inevitable events for any major construction project. The DSGEIS fails to determine the potential impact chemical and fuels spills can have on the environment.

---

36 DSGEIS Section 6.13.2, 2009.
37 DSGEIS Section 6.13, 2009.
38 DSGEIS Section 6.13.2.1, 2009.
39 Lustgarten, A., "Frack Fluid Spill in Dimock Contaminates Stream, Killing Fish," ProPublica, September 22, 2009.
40 Lustgarten, A., "Frack Fluid Spill in Dimock Contaminates Stream, Killing Fish," ProPublica, September 22, 2009.
41 ToxicsTargeting, Drilling Spills Profiles, http://www.toxicstargeting.com/MarcellusShale/drilling_spills_profiles.

Instead, the DSGEIS states: "Specific secondary containment requirements will be included in supplementary well permit conditions for high-volume hydraulic fracturing on a site-specific basis if the proposed location or operation raises a concern about potential liquid chemical release that is not, in the Department's judgment, sufficiently addressed by the GEIS, the SGEIS, inherent mitigation factors and well pad setbacks."[42] In other words, NYSDEC may exercise its discretion to impose secondary containment requirements for fracturing chemicals, but such containment currently is not required. NYSDEC did provide criteria for determining what types of locations or operations "raise a concern."

The DSGEIS must identify the adverse environmental impacts that will occur from unavoidable spills based upon the total number of well permits contemplated. NYSDEC must make a determination if those adverse environmental impacts are of sufficient magnitude to limit the number of permits issued or if any permits should be issued in sensitive areas such as the NYC watershed.

Floodplains

10. ***Comment*: In the 1992 Final Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program (GEIS), NYSDEC states that flooding is likely to occur sometime during the typical 30-year producing life of a well that is located within a floodplain.[43,44] In the DSGEIS, NYSDEC states that centralized flowback water surface impoundments will not be approved in 100-year floodplains.[45] NYSDEC has failed to evaluate the environmental impacts to waterways associated with flood-related releases of contaminants from the well pads placed in a floodplain. Based on the risks acknowledged in the 1992 GEIS, NYSDEC should be wholly prohibiting the placement of well pads within floodplains.**

***Discussion*:** In the DSGEIS**,** NYSDEC proposes to prohibit the placement of centralized flowback water surface impoundments and aboveground flowback water piping and conveyances within the 100-year floodplain.[46] However**,** NYSDEC still proposes to mitigate the risk of surface water contamination from well pad operations by allowing closed-loop

42 DSGEIS, Section 7.1.3.3.
43 Final Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program (hereafter "GEIS") Section 16.B.2.c., 1992.
44 GEIS Section 8.D.2.d., 1992.
45 DSGEIS, Section 7.2.
46 DSGEIS, Section 7.2.

tank and piping systems for drilling and completion operations in floodplains.[47] The NYSDEC has recognized numerous environmental impacts associated with the imminent event of a flood during the life of an operating gas well pad site within a floodplain. [48] A closed loop system will not mitigate the potential environmental impacts from contaminants such as brine, oil, spent fracturing fluids, chemical additives, and petroleum releases during a flooding event. Flooding is considered "one of the few ways that bulk supplies such as additives might accidentally enter the environment in large quantities."[49] Allowing closed-loop systems in a flood plain still leaves open the potential for environmental harm in the event of a flooding event from damage due to large pieces of debris impacting the well pad site. Because NYSDEC has recognized the danger of contaminants to watercourses in the event of a flood, no part of any well pad or ancillary well pad structures should be allowed in a floodplain. Without such a limitation, New York's gas development practices will lag behind those in Texas and Pennsylvania, where many communities have prohibited gas drilling and development within floodplains.[50,51,52,53] NYSDEC must eliminate the potential for flood related spills of contaminants by prohibiting gas drilling and hydraulic fracturing activities, including the placement of ancillary structures, within a floodplain.

Watercourses, Waterbodies & Wetlands

11. ***Comment*: A site-specific SEQRA review must be required for any proposed well within 150 feet of NYSDEC regulated wetlands and associated 100-ft wetland adjacent areas as well as federally and locally mapped wetlands as required for proposed well pads within 150 feet of a watercourse, perennial or intermittent stream, storm drain, lake or pond.[54] Additionally, NYSDEC must assess the potential impacts to water resources as a result of large volume spills and require larger setbacks from water resources accordingly.**

***Discussion*:** NYSDEC proposes that site-specific SEQRA review be required for any

47 DSGEIS, Section 7.1.12.2.
48 DSGEIS, Section 7.1.3
49 DSGEIS, Section 6.2.
50 Lancaster Township Zoning Ordinance, Article XIII Regulations in the Applicable Flood Plain District. http://www.twp.lancaster.pa.us/planningZoning/articles/art13.htm. December 2001.
51 Town of Bartonville, Texas, Gas Well Development Plat Regulations, Ordinance No. 462-08, Section 2.8 J.3, October 2008.
52 Town of Flower Mound, Texas, Oil and Gas Drilling Ordinance, Section 34-420 (k), March 2007.
53 City of Grapevine, Texas, Code of Ordinances, Section 12-145(b)(10), August 2009.
54 DSGEIS, Section 7.1.12.2.

proposed well pad within 150 feet of a watercourse, perennial or intermittent stream, storm drain, lake or pond.[55] All watercourses and wetlands, inclusive of NYSDEC regulated wetlands and associated 100-ft wetland adjacent areas as well as federal and locally mapped watercourses and wetlands, must receive the same level of protection as the other surface water resources regardless of whether they are located within the NYC watershed.[56] The rationale behind the 150-foot buffer as referenced in the DSGEIS is "…the GEIS found that a 150-foot distance between the well site and a surface water supply would provide adequate protection in the event of an accidental spill." All state, federal, and locally mapped wetlands must be afforded the same protections from an accidental spill.[57]

Furthermore, as the potential exists for large scale spills, such as the recent 8,000 gallon drilling fluid spill in Pennsylvania, larger setbacks from water resources must be required by NYSDEC. [58] The analysis conducted by Dr. Tom Myers on the DSGEIS for the Natural Resources Defense Council, Inc. indicates that a setback of 2,000 feet should be maintained unless a site specific analysis is conducted.[59] A setback of 2,000 feet would afford protection for water resources, including wetlands, in the event of a large volume spill, and a site specific analysis would address the potential impacts associated with a facility being placed within the 2,000 foot setback.[60] NYSDEC must assess the reasonable worst case scenario impacts associated with potential large volume spills and require setbacks accordingly, with possible setbacks as great as 2,000 feet from water resources as suggested by the analysis performed by Dr. Myers.

Water Withdrawals

12. *Comment*: In DSGEIS Section 6.1.1.7, Cumulative Water Withdrawal Impacts, NYSDEC concluded that it was unable to calculate the total volume of water withdrawals from gas drilling and hydraulic fracturing. NYSDEC acknowledged that the withdrawal of large quantities of water would have significant cumulative environmental impacts, including stream flow and groundwater depletion; loss of aquifer storage capacity; water quality degradation; fish and aquatic organism

55 DSGEIS, Section 7.1.12.2.
56 DSGEIS, Section 7.1.12.2.
57 DSGEIS, Section 7.1.12.2.
58 Lustgarten, A., "Frack Fluid Spill in Dimock Contaminates Stream, Killing Fish," ProPublica, September 22, 2009.
59 Myers, T., *Technical Memorandum* (Attachment D), 2009.
60 Myers, T., *Technical Memorandum* (Attachment D), 2009.

impacts; significant habitats, endangered, rare or threatened species impacts; impacts to existing water users and reliability of their supplies; and impacts to underground infrastructure.[61] Based on the development potential of the Marcellus shale, NYSDEC must evaluate the impacts of the total potential withdrawals on a cumulative regional basis.

Discussion*:* NYSDEC states that "The total volume of water to be withdrawn for horizontal well drilling and associated hydraulic fracturing will not be known until applications are received and reviewed, and approved or rejected by the appropriate regulatory agency or agencies."[62] Although NYSDEC signed compacts with other regulatory agencies governing water withdrawals, such as the Delaware River Basin Commission (DRBC) and Susquehanna River Basin Commission (SRBC), these compacts do not preclude NYSDEC from assessing potential cumulative environmental impacts associated with water withdrawals. One estimate from the drilling industry contained in the Section 6.13.2.1 of the DSGEIS is that from 1,500 to 2,500 wells per year could be developed in Marcellus Shale in New York. Using the SRBC's approximate average of approved volume water withdrawal of 1.5 MGD for an individual application currently identified, and an average of 2,000 wells per year (the midpoint of the industry estimate), results in the potential to withdraw approximately 3 billion gallons of water per day.[63,64] A cumulative assessment based on the projected number of wells established in the context of NYSDEC regulations and protections must be provided to ensure that critical water resources and wildlife habitat are not degraded, threatened or otherwise subjected to unmitigated impacts.[65]

Wildlife

13. *Comment*: Within the DSGEIS, NYSDEC has failed to address the potential significant adverse cumulative impacts of surface impoundments for gas wastewater on wildlife, specifically, waterfowl and migratory bird species. NYSDEC must fully assess the potential cumulative impacts and provide appropriate mitigation measures to address the impacts of impoundments on wildlife.

***Discussion*:** NYSDEC identifies the potential for waterfowl and migratory birds to utilize

---

61 DSGEIS, Section 6.1.1.7.
62 DSGEIS, Section 6.1.1.7.
63 DSGEIS, Section 6.1.1.7.
64 DSGEIS, Section 6.13.2.1.
65 NYSDEC, SEQR Handbook, 3rd Edition, 2010.

impoundments as rest stops during seasonal migrations.[66] The potential toxicity of the flowback water stored in these impoundments is also briefly discussed; however, NYSDEC fails to address the potential significant adverse cumulative impacts that these impoundments would have on waterfowl and migratory birds and fails to require appropriate mitigation measures to address these impacts.

According to the federal Migratory Bird Treaty Act (MBTA), it is "unlawful at any time, by any means or any manner to...take...any migratory bird," and additionally, according to the Endangered Species Act (ESA), it is unlawful for any person to "take any [endangered] species within the United States."[67,68] The act of "taking" a species is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct."[69]

The MBTA and the ESA were enacted as a means to protect both migratory birds, and threatened and endangered species, as each species possesses an esthetic, ecological, educational, historical, recreational, and scientific value that should be conserved. The MBTA is an international treaty that is implemented by the United States to protect birds that migrate across borders between Canada and Mexico. The ESA is administered by both the United States Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA), but it is the responsibility of all federal departments and agencies to conserve endangered and threatened species by encouraging the States and other interested parties, such as the NYSDEC, to develop and maintain conservation programs which meet both national and international standards for conservation.

Per both the MBTA and the ESA regulations harm caused by the exposure to toxic flowback water stored in impoundments would be considered an illegal taking of any species, inclusive of waterfowl and migratory birds.[70] As a result, NYSDEC has the responsibility to either determine the full, cumulative extent of the potential impacts of these impoundments on waterfowl and migratory bird species, or to provide adequate mitigation measures to prevent

66 DSGEIS, Section 6.4.2.
67 Migratory Bird Treaty Act, 16 U.S.C.A. Subsections 703 (a).
68 Endangered Species Act of 1973, 16 U.S.C. Subsections 1538 (a)(1)(B).
69 Endangered Species Act of 1973, 16 U.S.C. Subsections 1532 (19).
70 USA v Exxon Mobil Corporation, US District Court – District of Colorado – MBTA Violation.

the taking of such species including bird protection measures such as netting, bird balls, or other approved measures of equal effectiveness (barrier-type device). Furthermore, NYSDEC should require facilities to enact routine surveillance activities to ensure that bird deterrent measures are being maintained, specifically through observing the area within 50 yards of any impoundments for the presence of deceased, injured, or sick migratory birds.[71]

14. *Comment*: In the DSGEIS, NYSDEC has failed to address the potential significant adverse cumulative impacts of noise associated with multi-well pad development on all wildlife species.

***Discussion*:** NYSDEC addresses noise impacts associated with individual well pad development to some species of wildlife within the context of the GEIS.[72] In the Section 6.10 of the DSGEIS, NYSDEC states that the duration of drilling associated with horizontal well development will take 4 to 5 weeks of 24-hour drilling to complete.[73] Additionally, it states that a significant increase in trucking and noise associated with fracturing will be generated as a result of increased truck trips to bring in water for drilling and to remove flowback.[74] NYSDEC provides a brief analysis on the impacts to people living in close proximity to multi-well pad sites and the measures taken to mitigate these impacts, citing proper well pad location and design.[75] However, this analysis is not sufficient, and the NYSDEC does not address the impacts of 4 to 5 weeks of 24-hour drilling on resident wildlife. Some species of wildlife are more sensitive to a greater sound frequencies and volume than humans, and therefore, these impacts should be addressed.[76]

Animals use auditory signals for a variety of reasons including evasion of predators, location of mates, offspring, and prey, and definition of their territories.[77] Undesired noise sources can cause masking of or the interference with auditory communication or signals.[78] If communication patterns among wildlife species are interrupted, there is the potential for

---

71 USA v Exxon Mobil Corporation, US District Court – District of Colorado – MBTA Violation.
72 GEIS, Section 8.J.1.
73 DSGEIS, Section 6.10.
74 DSGEIS, Section 6.10.
75 DSGEIS, Section 6.10.
76 U.S. EPA, *Effects of Noise on Wildlife and Other Animals: Review of Research since 1971*, July 1980.
77 U.S. EPA, *Effects of Noise on Wildlife and Other Animals: Review of Research since 1971*, July 1980.
78 U.S. EPA, *Effects of Noise on Wildlife and Other Animals: Review of Research since 1971*, July 1980.

adverse behavioral or physiological impacts.[79] As a result, NYSDEC should fully assess the potential significant adverse environmental impacts from noise and propose necessary mitigation measures on a site-specific and cumulative basis in each individual application for a drilling permit.[80]

15. *Comment*: In both the GEIS and DSGEIS, NYSDEC failed to account for the individual and cumulative impacts of multiple disturbances to vernal pools that may result in wide-scale destruction or fragmentation of essential habitat. These cumulative impacts must be addressed in the DSGEIS.

***Discussion*:** Vernal pools provide breeding habitat for the group of woodland salamanders called the "mole salamanders," which include marbled, Jefferson, blue-spotted, and spotted salamanders, as well as wood frogs. As vernal pools are typically isolated, low in oxygen, and dry during the summer they do not support fish populations and therefore provide high-quality "nursery" habitat for the developing eggs and larvae of salamanders and frogs.[81] Seasonal field surveys must be conducted as part of the permit application process to determine whether any areas of vernal habitat exist on-site and to verify the presence or absence of breeding vernal habitat species. Field surveys must be conducted during the spring and fall to verify and evaluate if any vernal habitat-dependent species utilize the wetlands for part of their lifecycle. The DSGEIS must indicate the timing of surveys and survey methodology used to determine the presence of vernal pools.[82] In addition the DSGEIS fails to address the potential significant adverse impacts, site-specific or cumulative, to amphibians or vernal pool inhabitants with regards to exposure to toxic water in centralized flowback water impoundments during breeding cycles or in the event of an impoundment leak.[83] NYSDEC must evaluate the cumulative impacts to vernal pool habitat and provide details regarding avoidance or mitigation measures designed to offset, reduce, or eliminate losses to vernal habitat dependent species.[84]

16. *Comment*: In both the GEIS and DSGEIS, NYSDEC failed to account for the potential significant adverse individual and cumulative impacts of multiple

---

79 U.S. EPA, *Effects of Noise on Wildlife and Other Animals: Review of Research since 1971*, July 1980.
80 NYSDEC, SEQR Handbook, 3rd Edition, 2010.
81 NYSDEC Region 3, Comments on Draft Environmental Impact Statement, July 3, 2009.
82 NYSDEC Region 3, Comments on Draft Environmental Impact Statement, July 3, 2009.
83 DSGEIS, Section 6.4.2.
84 NYSDEC, SEQR Handbook, 3rd Edition, 2010.

disturbances to bat species, including the state and federally endangered Indiana Bat (*Myotis sodalis*), that may result from impairment of essential habitat. These cumulative impacts must be addressed in the DSGEIS.

***Discussion*:** NYSDEC must identify known and potential bat hibernacula associated with Karst formations and abandoned mines.[85] Disturbances to bat hibernacula due to natural gas drilling have the potential to disturb air flow, temperature, and humidity which are critical components for bat survival.[86] In addition, surface water impoundments with potential toxic compounds would pose a danger to foraging bats.[87] As bat populations have plummeted more than 90 percent in Northeast caves due to "White Nose Syndrome," protecting critical habitat is essential to maintaining the health of the remaining bat communities.[88] NYSDEC must evaluate the potentially significant adverse individual and cumulative impacts to bat habitat and provide details regarding avoidance or mitigation measures designed to offset, reduce, or eliminate losses to bat species.[89]

17. *Comment*: NYSDEC must require the same analysis for the presence of Rare, Threatened, and Endangered Species (RTE) as it proposes for documenting the presence of Invasive Species in Sections 3.2.2.7 and 7.4.1.1 of the DSGEIS. NYSDEC does not address the cumulative impacts associated with the destruction and fragmentation of RTE habitat.

***Discussion*:** The State Environmental Quality Review Act (SEQRA) requires that the potential impacts to RTE species be considered, which requires consultation with the Natural Heritage Program (NHP) prior to any development projects that have the potential to impact Rare, Threatened, and Endangered (RTE) species.[90] Surveys for RTE species that are present or documented must be provided with the same analytical level of detail required for invasive species referenced in the DSGEIS because all flora and fauna within the area of potential

---

85 U.S. Fish and Wildlife Service (USFWS), Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision, 2007.

86 U.S. Fish and Wildlife Service (USFWS), Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision, 2007.

87 U.S. Fish and Wildlife Service (USFWS), Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision, 2007.

88 NYSDEC, *DEC Survey Shows Bat Populations down 90 Percent in Caves Impacted by "White Nose Syndrome": Wide-ranging, Coordinated Research Effort Continuing; NY Gearing Up for Next Round of Winter Surveys*, http://www.dec.ny.gov/press/61104.html, December 16, 2009.

89 NYSDEC, SEQR Handbook, 3rd Edition, 2010.

90 6 NYCRR Part 617.7(C)(1)(ii).

impact must be equally considered prior to site development.[91] NYSDEC must evaluate the potential cumulative loss of RTE habitat on a reasonable worst case scenario estimating the number, duration, and location of proposed wells, and propose necessary mitigation measures to address such impacts.

18. *Comment:* NYSDEC must require a four season Natural Resource Inventory for individual and multi-pad well sites that provides a comprehensive analysis inclusive of all site flora and resident and migratory fauna.

Discussion: A four season natural resource inventory (NRI) should be conducted to fully characterize the floral and faunal species that inhabit all proposed gas development well sites.[92] NYSDEC should provide applicants with a list of resources available for consultation in order to conduct a comprehensive NRI including the following: Ecological Communities of New York State, the New York State Breeding Bird Atlas, Audubon Society, USFWS Environmental Conservation Online System, NatureServe Explorer and the Natural Heritage Program (NHP).

Mapping

19. *Comment*: NYSDEC has not provided detailed up-to-date maps for public review in the DSGEIS that provide for a comprehensive evaluation and understanding of regional cumulative impacts to watercourses, waterbodies, wetlands, and RTE species in areas overlying the Marcellus Shale and other low-permeability shales.

***Discussion*:** The NYSDEC has the ability to provide for public review**,** detailed maps utilizing department maintained GIS databases that include and integrate the following information:

- Total area of potential well pad development within Marcellus shale and other shale regions.
- Critical Environmental Areas (CEAs) as noted in the GEIS and defined in 6 NYCRR

[91] DSGEIS, Section. 3.2.2.7 and 7.4.1.1; "A map (1:24000) showing all occurrences of invasive species within the project site must be produced and included with the survey as part of the EAF Addendum"; "…it is necessary to identify the types of invasive species within the project site as well as map the locations and extent of any established population."

[92] CEQR Technical Manual – Chapter 3I.

617.2 (i)).[93]

- DEC regulated wetlands and associated 100-ft adjacent areas as defined in 6 NYCRR 664, inclusive of "eligible" wetlands that are not currently mapped but likely meet the requirements to be mapped.
- DEC regulated lakes, rivers, streams and other bodies of water defined as *Navigable waters of the state* per 6 NYCRR 608.
- Watercourses, reservoirs, reservoir stems, intermittent streams, perennial streams as defined by New York City Watershed Rules and Regulations (NYCWR).[94]
- Primary and principal aquifers.[95]
- 8 digit United States Geological Survey (USGS) Hydrologic Unit Code (HUC) watershed outline and associated watercourse flowlines based on USGS National Hydrography Dataset (NHD) data.
- National Wetland Inventory (NWI) mapped wetlands and watercourses regulated under Section 404 of the Clean Water Act.
- Rare, Threatened, and Endangered species which are present or documented.

In addition, as part of the EAF submission, NYSDEC must require applicants to provide color maps that clearly depict and delineate the above information so that the public can better assess the potential significant adverse site-specific impacts of a proposed permit and so that appropriate mitigation for any such impacts can be identified and imposed.

93 GEIS, Chapter 8, Section O, 1992.
94 Title 15, Rules of the City of New York, Section 18-16, Definitions.
95 DSGEIS, Section 2.4.4.1, Figure 2.1.