Otsego County Soil & Water Conservation District

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.

Comments Provided to:

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Note: the format of the following document is as follows: text taken directly from the dSGEIS in standard font, comments and recommendations are in *italics.*

Introduction to Comments:

The Otsego County Soil and Water Conservation District considers the new, high volume hydraulic fracturing process being reviewed here for low permeable formations to be a significant development in the land use of the area under consideration. The process differs in significant ways from what has been experienced in the past in NY and in ways that raise environmental concerns regarding health, water quality, best uses and protection of the ecosystems that provide those best uses.

Following this introduction are the Districts comments on the Draft Supplemental Generic Environmental Impact Statement (dSGEIS). The length is due in part to the inclusion of text taken directly from the dSGEIS that precedes each comment and recommendation (*in italics*). However, a reading of the dSGEIS is suggested for full context.

In order to be thorough, provide comments in regards to specific sections and follow the format of the document, some comments and recommendations are offered more than once. This is also true because some recommendations result in the elimination of a series of issues but were offered in the context of each and because some concerns spanned many sections of the dSGEIS.

One core recommendation that spans the dSGEIS is that the State regard the language in the Environmental Conservation Law (ECL) regarding its responsibilities to protect, conserve and improve the environment and the prevention of water pollution in regards to the handling and transport of solids, liquids and gases to take precedence over language in Article 23 of the ECL providing for greater ultimate recovery of the mineral resources.

One comment often repeated is the incompleteness of the dSGEIS in two regards. First, that it does not contain descriptions of the environmental impacts meant to be assessed and second, that it contains limited information on the chemical composition of additives used in the fracturing process and the chemical composition of flowback liquid.

Our perspective is one that promotes implementation of best management practices (BMP's). This perspective does not allow for wholesale rejection of a proposed activity, but rather emphasizes initial decision making, policy decisions and management practices that should be taken, or required as the case may be, in concert with the proposed activity. That is to say, that if the new, high-volume hydraulic fracturing process being reviewed here can be done in a way that safeguards our environment by the use of BMP's, SEQRA and permitting requirements for well pad siting, then those practices, regulations and siting requirements ought to be used.

Taking a root cause approach, emphasis is also placed on a few permitting decisions, management practices and concepts that are at the source of many potential environmental impacts and concerns. Some examples of this are the avoidance of environmentally sensitive areas, the use of closed-loop systems, site specific setbacks, and the knowledge of the chemical make-up of the additives anticipated to be used in the fracturing fluid and the chemical make-up of flowback liquid.

Given the nature of some of the recommendations made below, it is also recommended that the dSGEIS be revised, rewritten and resubmitted for public comment.

It is hoped that this document will be considered by the New York State Department of Environmental Conservation and others when formulating the final rules meant to protect the States soil and water resources and their best uses.

We believe that adoption of these recommendations would protect our environment from potential negative impacts and allow for the exploitation of natural gas in the area under consideration using the new, using the high volume hydraulic fracturing process being reviewed here.

Any correction, question, comment or concern regarding any of the comments and recommendations made here are welcome.

Respectfully submitted,

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1.2 Regulatory Jurisdiction

“The State of New York’s official policy, enacted into law, is "to conserve, improve and protect its natural resources and environment . . ,"

“As set forth in Environmental Conservation Law ("ECL") §3-0301(1), the Department’s broad authority includes, among many other things, the power to: manage natural resources to assure their protection and balanced utilization, prevent and abate water, land and air pollution, and regulate storage, handling and transport of solids, liquids and gases to prevent pollution.”

“In addition to protecting the environment and public health and safety, the Department is also required by Article 23 of the ECL to prevent waste of the State’s oil and gas resources, to provide for greater ultimate recovery of the resources, and to protect correlative rights.”

The implementation of the new, high-volume hydraulic horizontal fracturing process has inherent and potentially catastrophic implications for New York’s environment. Language within the ECL has the potential to conflict as environmental considerations are incompatible with exploitation of mineral resources.

It is recommended that, when weighing the cost and benefits of the new, high-volume hydraulic horizontal fracturing process, that greater weight be given to those costs and benefits associated with the preservation of the environment than those associated with mineral resource exploitation. By extension, it is further recommended that the language found within ECL (found throughout) that pertains to cumulative impact, conservation, improvement, protection, prevention of degradation, enhancement of the states soil and water resources and ecosystems, as well as the promotion and regulation of best management practices and all similar language that serves to protect our environment be seen as to supersede and take priority and precedence in every case over the phrase “to provide for greater ultimate recovery of the [oil and gas] resources” as written in Article 23 of the ECL.

1.3 Project Location

Drilling will not occur on State-owned lands which constitute the Adirondack and Catskill Forest Preserves because of the State Constitution’s requirement that Forest Preserve lands be kept forever wild and not be leased or sold.

Considering the benefit to water quality and soil retention/development, flood attenuation function of large, contiguous tracts of undeveloped land (in addition to other beneficial ecosystem services such as wildlife habitat, recreation and sustainable harvest of biological resources, i.e. timber), it is recommended that the

exemption of drilling from Forest Preserves be extended to State Forests, Wildlife Management Areas and land under state environmental conservation easement.

1.4.1 Generic Environmental Impact Statement (GEIS)

“Drilling and production of separate oil and gas wells, and other wells regulated under the Oil, Gas and Solution Mining Law (Article 23 of the Environmental Conservation Law) have common impacts. After a comprehensive review of all the potential environmental impacts of oil and gas drilling and production in New York, the Department found in the 1992 GEIS that issuance of a standard, individual oil or gas well drilling permit anywhere in the state, when no other permits are involved, does not have a significant environmental impact.”

“However, the Department also found in 1992 that issuance of a drilling permit for a location in a State Parkland, in an Agricultural District, or within 2,000 feet of a municipal water supply well, or for a location which requires other DEC permits, may be significant and requires a site- specific SEQRA determination.”

”Well stimulation, including hydraulic fracturing, was expressly identified and discussed in the GEIS as part of the action of drilling a well, and the GEIS does not recommend any additional regulatory controls or find a significant environmental impact associated with this technology, which has been in use in New York State for at least 50 years.”

”Major issues identified through the previous scoping process and addressed in the GEIS, as listed on page 3 of the Draft GEIS, were: impacts on water quality; impacts of drilling in sensitive areas, such as Agricultural Districts, areas of rugged topography, wetlands, drinking water watersheds, freshwater aquifers and other sensitive habitats; impacts caused by drilling and production wastes; impacts on land use; socioeconomic impacts; impacts on cultural resources and impacts on endangered species and species of concern.”

1.4.3 Well Permit Applications and the Environmental Review Process

“The 1992 Findings authorized use of a shortened, program-specific environmental assessment form ("EAF"), which is required with every well drilling permit application.10 The EAF and well drilling application form11 do not stand alone, but are supported by the four-volume GEIS….”

”When the application documents described above demonstrate conformance with the GEIS, SEQRA is satisfied and no Determination of Significance or Negative or Positive Determination under SEQRA is required.”

As described in the dSGEIS (section 5.4.3), the chemical constituents of the fracturing fluid are dependent on the geology of a specific site and that these conditions will

differ across sites. Therefore the make-up of the fracturing fluid will also differ across sites and formations as will the potential environmental impacts associated with concentrated chemicals and flowback liquids needed and produced in the new high-volume hydraulic horizontal fracturing process being reviewed here. Additionally, conditions at all sites, such as topography, hydrology and proximity to environmentally sensitive areas will also contribute to a wide variety of differing impacts. Furthermore, the rationale for the current SGEIS process is to take into account the new process, which is significant in terms of its potential to negatively impact the environment, with considerations not present in the more traditional methods used in the state in the past. Lastly, additional DEC permits will be required for operations; Multi-Sector General Permit for Stormwater Discharges (MSGP)associated with Industrial Activity and possible permits in conjunction with disturbances to wetlands and streams. Permits, issued by the Susquehanna River Basin Commission (SRBC), will also be required for drilling activities that require large amounts of water consumption in excess of their permitting triggers.

In light of the wide variety of potential impacts and due to the unique nature of the process being reviewed, the chemical constituents used and the varying physical conditions likely to be encountered, the invalidity of applying conclusions reached in the 1992 GEIS, as it did not consider the new, high volume nature of the work being proposed here or its influence on all aspects of the process, and the need for additional permits, both from within DEC and from SRBC, it is recommended that a site specific State Environmental Quality Review Act (SEQRA) process be initiated for each well proposed.

2.1 Purpose

“The SGEIS will address new activities or new potential impacts not addressed by the original GEIS and will set forth practices and mitigation designed to reduce environmental impacts to the maximum extent practicable. The SGEIS and its findings will be used to satisfy SEQR for the issuance of permits to drill, deepen, plug back or convert wells for horizontal drilling and high volume hydraulic fracturing.”

It is recommended that the SGEIS, in addition to requiring best management practices and mitigative steps, also include new, strict regulations that focus on potential impacts to sensitive areas not addressed in the 1992 GEIS in the context of this new process. Also, it is recommended that the SGEIS not be predetermined to satisfy SEQR for all proposed activities by default, but that, for reasons described above (comments on 1.4.1 & 1.4.3), all sites be considered significant and require specific SEQRA determination.

2.2 Public Need and Benefit

“Public Need and Benefit” section in its entirety.
While it is important to consider the reason for wanting to employ the new high-volume hydraulic horizontal fracturing process being reviewed (public need) and forecasted economic benefits, neither have a bearing on the environmental impacts of the process. It is recommended that this text be removed from the SGEIS and publicized in a more appropriate venue.

2.4.1 Water Use Classifications

“Water use classifications are assigned to surface waters and groundwaters throughout New York. Surface water and groundwater sources are classified by the best use that is or could be made of the source. The preservation of these uses is a regulatory requirement in New York.”

Table 2-2.1 – New York Water Use Classifications; last row, Other – Discharge Restriction Category applicable to all water types:

“Based on a number of relevant factors and local conditions, per 6 NYCRR 701.20, discharge restriction categories may be assigned to: (1) waters of particular public health concern; (2) significant recreational or ecological waters where the quality of the water is critical to maintaining the value for which the waters are distinguished; and (3) other sensitive waters where NYSDEC has determined that existing standards are not adequate to maintain water quality.”

” Per 6 NYCRR 701.24, specified substance shall not be permitted in new discharges, and no increase in the release of the specified substance shall be permitted for any

existing discharges. Storm water discharges are an exception to these restrictions. The substance will be specified at the time the waters are designated."

The importance of the public's enjoyment and use of clean water (surface and ground), as well as the dependency of various ecosystems and biological organisms throughout the food chain on this resource, is evident in the existence of regulatory requirements mandating its preservation. Considerable time and financial resources have always, and continue to be, dedicated for this purpose by New York State.

The area of New York State believed to contain both the Marcellus & Utica shale deposits is significant. For the Marcellus, the deposit includes most of the Upper Susquehanna River Watershed. The Utica shale also covers follows the same area, but also extends into the Hudson, New York City and Great Lakes watersheds. For different reasons, each of these areas can be said to have significant recreational or ecological waters where the quality of the water is critical to maintaining the value for which the waters are distinguished.

In order to guarantee the maintenance of water quality and protect ongoing investments in water quality, and therefore the best uses of surface and groundwaters, it is recommended, as it is in the comments regarding section 1.2, that existing regulations and statutes in ECL articulating DEC's role in protecting and preserving water quality take precedence and priority over language that describes the degree to which the state will facilitate oil and gas exploitation.

It is also recommended that the Upper Susquehanna River, Hudson River, New York City and Great Lakes watersheds be designated as having significant recreational benefit and are significant ecological waters where the quality of the water is critical to maintaining the value for which the waters are distinguished and that no discharges of either fracturing fluid or flowback (in whole or in part, as listed in sections 5.4.1 & 5.4.3 and as amended as new information on chemical composition on either is received by the Department) be allowed and that the chemical components of each be designated as a 'specified substance' as described in 6 NYCRR 701.24.

2.4.3 Drinking Water

"The protection of drinking water sources and supplies is extremely important for the maintenance of public health, and the protection of this water use type is paramount. Chemical or biological substances that are inadvertently released into surface water or groundwater sources that are designated for drinking water use can adversely impact or disqualify such usage if there are constituents that conflict with applicable standards for drinking water. These standards are discussed below."

Many of the chemicals described as being in the fracturing fluids and flowback are not listed in either the federal or state standards for water quality.

It is recommended that each of the chemicals identified in sections 5.4 and 5.11.3 (in whole or in part, and as amended as new information on chemical composition on either is received by the Department), particularly those known to cause health problems, be integrated into the standards for both surface and groundwaters. It is also recommended that contaminates that are naturally occurring, that also have the potential to be become mobile during the new, high-volume hydraulic horizontal fracturing process should also be included. Additionally, because of the mixed nature of the hydraulic fracturing fluid and flowback, and because the information provided in both state and federal lists of contaminants considers each as contaminant as discrete, it is further recommended that the effects to all biological life (throughout the terrestrial and aquatic food chain) be evaluated when these are mixed. This analysis should include those chemicals in both the fracturing fluid and flowback(at production and over time) that may be considered benign when isolated (at any concentration) but where the effects of mixing with other chemical constituents or materials found in the environment of the production zone are unknown.

2.4.3.1 Federal

"The primary standards are designed to protect drinking water quality by limiting the levels of specific contaminants that can adversely affect public health and are known or anticipated to occur in drinking water. The determinations of which contaminants to regulate are based on peer-reviewed science research and an evaluation of the following factors: Occurrence in the environment and in public water supply systems at levels of concern, Human exposure and risks of adverse health effects in the general population and sensitive subpopulations…"

Understanding that New York is a primacy state, has assumed responsibility for the protection of drinking water and that the gas industry currently is exempt from the federal Safe Drinking Water Act, it is recommended that, to the degree that it has not already been done, New York adopt the same strict regulations described in federal law with regulated contaminates including all of those found in sections 5.4, 5.2.4.2 and 5.11.3 (fracturing fluid and flowback, in whole or in part, and be amended as new information on chemical composition on either is received by the Department) as well as naturally occurring substances that may be made mobilized during the drilling process. Additionally, and as suggested above, it is recommended research and evaluation should also include the environmental impacts of combinations of these compounds.

2.4.5 Private Water Wells and Domestic-Supply Springs

"There are potentially tens to hundreds of thousands of private water supply wells in the State."…"The GEIS describes how improperly constructed private water wells are susceptible to pollution from many sources, and proposes a 150-foot setback to protect vulnerable private wells."

"NYSDOH includes springs – along with well points, dug wells and shore wells – as susceptible sources that are vulnerable to contamination from pathogens, spills and the effects of drought."

"Because of their vulnerability, and because in addition to their use as drinking water supplies they also supply water to wetlands, streams and ponds, the GEIS proposes a 150-foot setback."

As suggested above, the GEIS is not the proper reference for evaluating the potential negative impacts for the new high-volume hydraulic horizontal fracturing process being reviewed here. Therefore it is recommended that setbacks be regulated at a distances that are appropriate to the high volumes of potential contaminating liquids unique to the activities being reviewed here and will guaranteeing the protection and preservation of all private and public water wells, springs, aquatic and terrestrial ecosystems providing a best use by being determined in the field (section 7.1.12 below).

2.4.6 History of Drilling and Hydraulic Fracturing in Water Supply Areas

"No documented instances of groundwater contamination are recorded in the NYSDEC files from previous horizontal drilling or hydraulic fracturing projects in New York. No documented incidents of groundwater contamination in public water supply systems were reported by the NYSDOH central office and Rochester district office…. could not be substantiated because pre-drilling water quality testing was not conducted, improper tests were run which yielded inconclusive results and/or the incidents of alleged well contamination were not officially confirmed."

Past performance on the new, high-volume hydraulic horizontal fracturing process being reviewed is difficult to characterize given that it has yet to occur in New York. The implication of this text is to give the impression that the proposed activity is without incident. Improper testing, lack of pre-drilling water quality testing and official confirmation are not, in every case, evidence of the absence of environmental degradation.

It is recommended that statements meant characterize the relative safety or danger inherent in the new high-volume hydraulic horizontal fracturing process being described in the SGEIS be limited to those referencing the new process being reviewed here; include any surface water incidents (including related spills), improper management of stormwater and describe the process/standard for official confirmation.

2.4.7 Regulated Drainage Basins

"Mitigation measures presented in the GEIS are protective of water resources in all watersheds and river basins statewide, as are the enhanced mitigation measures identified in this document to address horizontal drilling and high-volume hydraulic fracturing."

2.4.7.1 through 2.4.10 in entirety

Natural landscape features at all scales such as watersheds, major rivers, 1st, 2nd and 3rd order streams, wetlands, forests, aquifers and the soils contained within them, provide many ecosystems services that are critical to the function a healthy environment and providing best uses. The area under consideration for the use of the new high-volume hydraulic horizontal fracturing process being reviewed here contains a significant amount of area containing each. While these portions of the 'Environmental Setting' section of the dSGEIS contain many important facts and relevant information, the sections do not list the importance of these ecosystem functions to the environment and best uses and therefore do not provide the platform from which an accurate and comprehensive assessment of the potential negative impacts of the new high-volume hydraulic horizontal fracturing process can be made.

It is therefore recommended that these sections be re-written to include the function of these ecosystem types, describe their relative fragility or resilience to external factors such as those anticipated from wide-spread drilling of this type, how these ecosystems function in the concert with one another and their aggregate effect at the watershed scale. Additionally, considerable experience and expertise in these areas exists within the Department within its various departments and bureaus and within the academic community. Therefore is also recommended that these human resources be utilized in authoring these sections.

3.1 Use of a Generic Environmental Impact Statement

"The Department's regulations to implement the State Environmental Quality Review Act ("SEQRA")…authorize the use of generic environmental impact statements to assess the environmental impacts of separate actions having generic or common impacts….When a final generic environmental impact statement has been filed, "no further SEQR compliance is required if a subsequent proposed action will be carried out in conformance with the conditions and thresholds established for such actions" in the generic environmental impact statement"

As described Chapter 5, the chemical constituents used in the fracturing fluid will differ based on site specific conditions. Different chemical constituents will have differing impacts on the environment (health, ecosystem function, etc..). Similarly, flowback composition will also differ between sites due to the heterogeneous nature of the underlying geology and target formations and its dynamic nature over time (increasing acidity and radioactivity, section 5.11.3.1). Compounding the difficulty in making any assessment regarding flowback liquids this is the relative lack of information describing what the flowback will contain (section 5.11.3) and the lack of information on compounds that may be formed. Additionally, environmental impacts will differ with respect to similar ecosystem types and health impacts depending on site-specific soils, hydrology, topography, degree of potential contamination, etc…

It is therefore unlikely that the environmental impacts of the new high-volume hydraulic horizontal fracturing process being reviewed here can be characterized as being common or generic. It is therefore recommended that the SGEIS not be predetermined to be able to serve the purpose of providing the rationale for not undertaking site-specific SEQRA determinations.

3.1.1 1992 GEIS and Findings

"Drilling and production of separate oil and gas wells, and other wells regulated under the Oil, Gas and Solution Mining Law (Article 23 of the Environmental Conservation Law) have common impacts. After a comprehensive review of all the potential environmental impacts of oil and gas drilling and production in New York, the Department found in 1992 that issuance of a standard, individual oil or gas well drilling permit anywhere in the state, when no other permits are involved, does not have a significant environmental impact. The review was conducted in accordance with SEQRA and is memorialized in the 1988 Draft and 1992 Final GEIS on the Oil, Gas and Solution Mining Program, which are incorporated by reference into this Supplement. A separate finding was made that issuance of an oil and gas drilling permit for a surface location above an aquifer is also a non-significant action based on special freshwater aquifer drilling conditions implemented by the Department."

"The Department further found in 1992 that issuance of a drilling permit for a location in a State Parkland, in an Agricultural District, or within 2,000 feet of a

municipal water supply well, or for a location which requires other DEC permits, may be significant and requires a site-specific SEQRA determination. The only instance where issuance of an individual permit to drill an oil or gas well is always significant and always requires a Supplemental Environmental Impact Statement ("SEIS") is when the proposed location is within 1,000 feet of a municipal water supply well."

"The Department also evaluated the action of leasing of state land for oil and gas development under SEQRA and found no significant environmental impact associated with that action. Lease clauses and the permitting process with its attendant environmental review mitigate any potential impacts that could result from a proposal to drill."

3.2 Future SEQRA Compliance

"When application documents demonstrate conformance with the GEIS, SEQRA is satisfied and no Determination of Significance or Negative or Positive Declaration under SEQRA is required. In that event Staff files a record of consistency with the GEIS."

"In cases where the SGEIS Supplemental Findings Statement indicates that the GEIS and the Supplement satisfy SEQRA, Department staff will not make Determinations of Significance or issue Negative or Positive Declarations. Such projects have common potential impacts, and the GEIS and this Supplement identify common mitigation measures that will be implemented through existing regulatory programs and permit conditions."

"An EAF Addendum for High-Volume Hydraulic Fracturing will be required in addition to the other well permit application materials. The EAF Addendum will provide the information necessary for Department staff to determine the next step based on the SGEIS Supplemental Findings Statement."

"If the proposed action is not addressed in the GEIS and the Supplement, then additional information will be required to determine whether the project may result in one or more significant adverse environmental impacts. The projects that the Department proposes fall into this category are listed in Section 3.2.3. Depending on the nature of the action, the additional information may include the Full EAF; topographic, geological or hydrogeological information; air impact analysis; chemical information or other information deemed necessary by the Department to determine the potential for a significant adverse environmental impact. A site-specific or project-specific supplemental environmental impact statement may be required."

While there are some similarities between the activities reviewed 20 years ago (which are the basis for the 1992 GEIS and its conclusions) and the new high-volume hydraulic horizontal fracturing process being reviewed here. However the new process differs significantly in practice from oil and gas exploitations that have taken

place in the state in the past. The large volumes of water and potentially harmful chemicals (in concentrated and dilute form), the large scale water withdrawals, proposed handling and storage, proposed on-site treatment and high-volume disposal, as well as the additional environmental impacts of significantly increased need for transport of water and chemicals and the long duration of the proposed activities, all represent significant departures from circumstances and potential impacts under consideration in the 1992 GEIS and supporting documents. The high volume nature of this new process transforms all aspects of the operation. Further, findings of significance in the 1992 GEIS under some circumstances indicate the potential for environmental impact even with the less intensive activities common at that time - impacts that are likely to increase in severity with the high-volume hydraulic horizontal fracturing process being reviewed here. Additionally, the requirement for on-site construction activities to gain coverage under the MSGP for Stormwater Discharges associated with Industrial Activity and possible permits in conjunction with disturbances to wetlands and streams as well as water withdrawal permits likely to be required by SRBC also indicates the need for site-specific SEQRA determinations.

It is therefore recommended that the State not impose findings of 'common impacts', 'non-significant action' and preclude the use of site specific SEQRA determinations for the majority of well applications, reached after review of one proposed activity (scope of gas and oil drilling techniques and environmental impacts common in the 1980's), onto the activities being proposed here. By extension, it is further recommended that the dSGEIS under consideration here be developed as a 'stand alone' document, without reference to the 1992 GEIS, that treats the new high-volume hydraulic horizontal fracturing process as wholly different than past practices and that re-examines all previous findings from this perspective. As a result, it is recommended that site-specific SEQRA determinations be used as a mechanism for protecting and preserving the soil and water resources of the state.

The development and requirement of an Addendum for High-Volume Hydraulic Fracturing the Full EAF address some aspects of the comments given above; additional information is critical to the accurate assessment of environmental impacts.

To have the most robust review process possible, it is recommended that a Stormwater Pollution protection Plan (SWPPP) and engineer/operator certification in sediment and erosion control practices be part of the Addendum and that the Department require review of each SWPPP for accuracy in conjunction with a site visit. It is also recommended that distances to perennial or intermittent streams, wetlands, storm drains, lakes, ponds, aquifers, etc…be determined on-site and calculated based on slope, hydrology and soil characteristics obtained in the field and that the distances be measured from the edge of pad or access road, which ever is closer, to the resource.

3.2.1.1 SGEIS Applicability - Definition of High-Volume Hydraulic Fracturing

"Potential impacts directly related to water volume are associated with water withdrawals, the volume of chemicals present on the well pad for fracturing, the handling and disposition of flowback water, and road use by trucks to haul both fresh water and flowback water. Judgment of when these impacts become substantial enough to require all of the additional controls described in this Supplement is subjective."

Judgments peculiar to a particular individual that are modified or affected by personal views, experience, or background lends itself to inconsistency and a lack of continuity both spatially and temporally. It is critical to the preservation and protection of soil and water quality, ecosystem function and best uses that variability be minimized when determining environmental impacts.

It is recommended that objective criteria be established within the SGEIS with respect to strict enforcement of environmental regulations, record keeping and the environmental impacts associated with the large volumes of water and harmful chemicals, withdrawals, proposed impoundments, proposed on-site treatment and high-volume disposal, as well as the additional environmental impacts of significantly increased need for transport of water and chemicals and the long duration of the proposed activities and that these criteria provide objective guidance that includes the array of site-specific conditions likely to be encountered in the field. It is also recommended that where individual judgments cannot be avoided, that precedence and priority be given to conservation, protection, prevention of degradation of the states soil and water resources and ecosystems, as well as the promotion and strict interpretation of regulations pertaining to best management practices.

3.2.1.2 Project Scope

"Chapter 3 of the GEIS and Section 1.5 of the Final Scope explain why gathering lines, compressor stations and pipelines are not within the scope of project review for well permit applications by the Department. Chapter 5 of this Supplement describes the facilities likely to be associated with a multi-well shale gas production site, and also provides details on the Public Service Commission's environmental review process for these facilities."

"…location screening for well pad setbacks and other required permits, review of access road location and construction, and the required stormwater permit coverage will be for the well pad based on submission of the first well permit application for the pad."

Where drilling pads, access roads, gathering lines and pipelines are located on the landscape has definite implications for the natural environment. While setbacks are critical in this regard (as mentioned further below), the impact of infrastructure on hydrology, soils and habitat (both sheet flow, creating areas of concentrated flow and groundwater movement, soil compaction and loss of ecosystem services due to forest fragmentation, respectively) has the potential to limit best uses, reduce water infiltration and create new hydrological patterns that may negatively impact the environment. Access roads, right-of-ways and buried pipes (which will be a part of the landscape for the foreseeable future) in particular are well understood to include these dynamics.

It is recommended that criteria for determining the location of infrastructure (including feed pipes and pipelines that do not fall under the jurisdiction of the Public Service Commission) supportive of the drilling process be articulated in the SGEIS with an emphasis on hydrology.

3.2.1.3 Size of Project

"Centralized flowback water surface impoundments, when included in the project scope, may be as large as five acres for the impoundment itself, plus the acreage necessary for the access road, work areas, and to restrict access."

3.2.3 Projects Requiring Site-Specific SEQRA Determinations

"The Department proposes that site-specific environmental assessments and SEQRA determinations be required for the high-volume hydraulic fracturing projects listed below, regardless of the target formation, the number of wells drilled on the pad and whether the wells are vertical or horizontal. 1) Any proposed high-volume hydraulic fracturing where the top of the target fracture zone is shallower than 2,000 feet along the entire proposed length of the wellbore; 2) Any proposed high-volume hydraulic fracturing where the top of the target fracture zone at any point along the entire proposed length of the wellbore is less than 1,000 feet below the base of a known fresh water supply; 3) Any proposed centralized flowback water surface impoundment. Emphasis of the initial review will be on proposed additive chemistry relative to potential emissions of Hazardous Air Pollutants. Additional review of site topography, geology and hydrogeology will be required for any proposed centralized flowback water surface impoundment at the following locations: within 1,000 feet of a reservoir; within 500 feet of a perennial or intermittent stream, wetland, storm drain, lake or pond, or within 300 feet of a public or private water well or domestic supply spring; 4) Any proposed well pad within 300 feet of a reservoir, reservoir stem or controlled lake; 5) Any proposed well pad within 150 feet of a private water well, domestic-use spring, watercourse, perennial or intermittent stream, storm drain, lake or pond; 6) A proposed surface water withdrawal that is found not to be consistent with the Department's preferred passby flow methodology as described in Chapter 7;

and 7) Any proposed well location determined by NYCDEP to be within 1,000 feet of subsurface water supply infrastructure."

A number of environmental factors (topography, flooding, etc…) and conditions specific to the concept of centralized flowback surface impoundments at a scale required by the new high-volume hydraulic horizontal fracturing process being reviewed here (lack of information regarding flowback composition, NORM's, improper siting and setbacks, etc…), create the possibility for large scale negative environmental impacts. While the concept of surface impoundments to store flowback liquids does include beneficial aspects such as less water consumption and the resultant reduction in required transportation of materials, the potential for overtopping, leakage and catastrophic failure posses an unacceptable level of risk. These benefits can still be gained by employing the best management practice of closed-looped systems.

Well pad siting is a point in the new process from which many environmental concerns stem and therefore is the component of the permitting process where the most protection of the environment can be derived. In other words, the decision not to site well pads in environmental sensitive areas or under some circumstances, eliminates a host of potential impacts and best protects the environment.

It is recommended that the use of centralized flowback surface impoundments not be allowed for the new high-volume hydraulic horizontal fracturing process being reviewed by the State and that the closed-loop system be required.

Following the recommendation made above that language contained within the ECL describing the Departments obligation to protect, preserve, conserve and prevent the degradation of the States soil and water resources and ecosystems, it is also recommended that the SGEIS define environmental sensitive area's, that the potential impacts to these resources take precedence and priority over the exploitation of mineral resources and identify those as area's where a permit will not be issued.

It is recommended that these area's include, but be not limited to: any proposed high-volume hydraulic fracturing where the top of the target fracture zone is shallower than 2,000 feet along the entire proposed length of the wellbore; 2) Any proposed high-volume hydraulic fracturing where the top of the target fracture zone at any point along the entire proposed length of the wellbore is less than 1,000 feet below the base of a known fresh water supply; 3) Any proposed centralized flowback surface impoundment or proposal that does not use a closed-loop system;. 4) Any proposed well pad within 300 feet of a reservoir, reservoir stem or controlled lake; 5) Any proposed well pad within 150 feet of a private water well, domestic-use spring, watercourse, perennial or intermittent stream, storm drain, lake or pond; 6) A proposed surface water withdrawal that is found not to be consistent with the Department's preferred passby flow methodology or proposed for 1st and 2nd order streams; 7) any proposed groundwater withdrawal 8) Any proposed well pad within

2,000 feet of municipal water supply; 9) Any proposed well pad where topography exceeds a 15% slope; 10) any well pad that does not utilize horizontal, multiple well technique; 11) any proposed well pad located within a established floodplain 12) any proposed well pad located over a principal or primary aquifer 13) any proposed well within a State or Federally protected wetland and; 14) any proposed well pad where NORM levels are found to be higher than drinking water standards. Further elaboration of each of these recommendations is provided throughout this document.

4.6 Naturally Occurring Radioactive Materials (NORM) in Marcellus Shale

"Normal disturbance of NORM-bearing rock formations by activities such as mining or drilling do not generally pose a threat to workers, the general public or the environment."

A recent analysis of wastewater samples by the Department of Health found levels of radium-226, and related alpha and beta radiation that are up to 10,000 times higher than drinking water standards. Materials that are highly radioactive, whether in brine solutions, flowback liquid or in drill cuttings, pose a significant risk to the health of the environment and best uses of the State's water sources. While it is sometimes acceptable, and perhaps statistically accurate, to use descriptive language that phrases information in a general, non-threatening way, information on topics such as NORM levels that is provided in a document meant to serve as an assessment of environmental impact should be communicated more carefully and be reflective of the considerable attention due. While the following recommendation is made in light of the above referenced statement taken from the dSGEIS and the most recent available information, it can and should be applied to all assumptions made about the relative safety of the new high-volume hydraulic horizontal fracturing process being reviewed.

It is recommended that the assumptions made and conclusions drawn in the dSGEIS concerning NORM levels be re-evaluated and updated as new information is made available.

5.1.1 Access Roads

"…the proposed disturbed access road acreage for these sites ranges from 0.1 acres to 2.75 acres, with the access roads ranging from 130 feet to approximately 3,000 feet in length. Widths would range from 20 to 40 feet during the drilling and fracturing phase to 10 to 20 feet during the production phase."

"Sedimentation and erosion control features are also constructed as needed along the access roads and culverts may be placed across ditches at the entrance from the main highway or in low spots along the road."

"Routes for access roads may be selected to make use of existing roads on a property and to avoid disturbing environmentally sensitive areas such as protected streams, wetlands, or steep slopes."

5.1.2 Well Pads

"…using the set of currently pending applications as an example the 47 proposed wells would be drilled on eleven separate well pads, with between two and six wells initially proposed for each pad. Proposed well pad sizes range from 2.2 acres to 5.5 acres during the drilling and fracturing phase of operations…"

The number of newly constructed well pads, miles of new constructed access roads combined with the variability in the climate and topography of New York has the potential for accelerated loss of soil and the degradation of water quality through erosion typical of any construction site. In recognition of this fact, New York State has implemented GP-0-08-001 which requires site engineers of activities that disturb more than 1 acre to prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) and have all excavators and operators be certified in and sign off on such practices.

While the dSGEIS suggests that operators gain coverage Multi-Sector General Permit for Stormwater Discharges (MSGP), as noted above and discussed and commented on again below, it is recommended that any newly proposed activity associated with the new, high-volume hydraulic horizontal fracturing process be required to gain coverage under the GP-0-08-001 and require contractors and engineers to be certified in the NYS's 4-hour course on sediment and erosion control measures. To ensure compliance, it is also recommended that Department staff inspect SWPPP implementation when making routine visits to approved well drill sites.

Placement of this infrastructure also has the potential to disrupt and degrade critical ecosystem function and reduce ecosystem services provided and best uses. It is therefore recommended that selection routes for access roads be required to make use of existing roads on a property and access roads and pads avoid disturbing

environmentally sensitive areas such as protected streams, shallow aquifers, wetlands, or steep slopes.

5.1.3.2 Anticipated Well Pad Density

"The number of wells and well sites that may exist per square mile is dictated by reservoir geology and productivity, mineral rights distribution, and statutory well spacing requirements set forth in ECL Article 23, Title 5, as amended in 2008. The statute provides three statewide spacing options for shale wells…"

"Statewide spacing for vertical shale wells provides for one well per 40-acre spacing unit."

"Infill wells, resulting in more than one well per 40 acres, may be drilled upon justification to the Department that they are necessary to efficiently recover gas reserves"

"Statewide spacing for horizontal wells where only one well will be drilled at the surface site provides for one well per 40 acres"

"The third statewide spacing option for shale wells provides, initially, for spacing units of up to 640 acres with all the horizontal wells in the unit drilled from a common well pad. Vertical infill wells may be drilled, with justification, from separate surface locations in the unit."

"This method, which also provides the most flexibility to avoid environmentally sensitive locations within the acreage to be developed, is expected to be the most common approach to shale gas development in New York using horizontal drilling and high-volume hydraulic fracturing."

"A variance from statewide spacing or a non-conforming spacing unit requires the Department to issue a well-specific spacing order following public comment and, if necessary, an adjudicatory hearing."

Few aspects of Marcellus and Utica shale exploitation using the new, high-volume hydraulic horizontal fracturing process being reviewed here have the potential to safeguard the States natural resources, preserve ecosystem services and function and protect best uses. It is accurate to state that the number and degree of potential environmental impacts has a direct correlation to the number of anticipated wells, i.e. more wells, more opportunities for environmental degradation. By adopting the precept recommended above that protection of the environment take precedence over mineral resource exploitation, it follows that best management of activities intended to maximize mineral resources utilize technology that reduces the number of potential wells to the greatest extent. The new, high-volume hydraulic horizontal fracturing process being reviewed here has, as part that process, the ability to drill multiple

horizontal wells from a common well pad. Full utilization of this ability will have the greatest impact on limiting the number of wells anticipated, reducing the common denominator underlying all potential environmental impacts while achieving the goal of mineral resource exploitation.

It is therefore recommended that all permitted drilling activities for Marcellus and Utica shale be restricted to those proposing the multiple well from a single pad technique and that no variances from the 640 acres spacing unit dictated by this approach be offered.

5.2.2.1 Reserve Pits on Multi-Well Pads

"The GEIS describes the construction, use and reclamation of lined reserve pits, (also called "drilling pits" or "mud pits") to hold cuttings and fluids associated with the drilling process. Rather than using a separate pit for each well on a multi-well pad, operators may propose to maintain a single pit on the well pad until all wells are drilled and completed."

5.2.3 Drilling Mud

"As described in the GEIS, used drilling mud is typically reconditioned for use at a subsequent well. It is managed on-site by the use of steel tanks that are part of the rig's 'mud system'. Some drilling rigs are equipped with closed-loop tank systems, so that neither used mud nor cuttings are discharged to reserve pits."

5.2.4 Cuttings

"The very fine-grained rock fragments removed by the drilling process are returned to the surface in the drilling fluid and managed either within a closed-loop tank system or a lined on-site reserve pit.12 As described in Section 5.13.1, the proper disposal method for cuttings is determined by the composition of drilling fluids used to return them to the surface."

Similar to the rationale supporting recommendations above (section3.2.3) in regards to impoundments for flowback liquids, reserve pits for drilling muds and cuttings pose, although to a lesser extent based on composition and volume, similar potential for environmental impact.

It is therefore recommended that the closed-loop system recommended as a best management practice and be a requirement of the Department for the management of drilling muds and cuttings.

5.2.4.2 Naturally Occurring Radioactive Materials in Marcellus Cuttings

"The results, which indicate levels of radioactivity that are essentially background values, do not indicate an exposure concern for workers or the general public associated with Marcellus cuttings."

As noted above, a recent analysis of wastewater samples by the Department of Health found levels of radium-226, and related alpha and beta radiation that are up to 10,000 times higher than drinking water standards. Materials that are highly radioactive, whether in brine solutions, flowback liquid or in drill cuttings, pose a significant risk to the health of the environment its inhabitants and best uses of the State's soil and water resources. While it is sometimes acceptable, and perhaps statistically accurate, to use descriptive language that phrases information in a general, non-threatening way, information on topics such as NORM levels that is provided in a document meant to serve as an assessment of environmental impact should be communicated more carefully and be reflective of the considerable attention given.

While the following recommendation is made in light of the above referenced statement in the dSGEIS and the most recent available information, it can and should be applied to all assumptions made about the relative safety of the new high-volume hydraulic horizontal fracturing process being reviewed; It is recommended that the assumptions made and conclusions drawn in the dSGEIS concerning NORM levels, as described in be re-evaluated and updated as new information is made available.

5.3 Hydraulic Fracturing - Introduction

Both slickwater fracturing and foam fracturing have been proposed for Marcellus Shale
development. As foam fracturing is already addressed by the GEIS, this document focuses on slickwater fracturing. This type of hydraulic fracturing is referred to herein as "high-volume hydraulic fracturing" because of the large water volumes required.

As noted above, while there are similarities between technologies used 20+ years ago that were the basis for the GEIS and what is being suggested here, but there are significant departures that fundamentally change the nature of the operation. It is critical to protecting the environment from the potential hazards seen in the new high-volume hydraulic horizontal fracturing process being reviewed under the dSGEIS that all aspects of the anticipated operations be assessed from an environmental perspective.

It is therefore recommended that the SGEIS contain information (chemical composition, chemical concentration, etc...) on foam fracturing and green or non-chemical fracturing technologies and additives (section 9.2) and their potential environmental impacts.

5.4 Fracturing Fluid

“The fluid used for slickwater fracturing is typically comprised of more than 98% fresh water and sand, with chemical additives comprising 2% or less of the fluid”

“Altogether, some compositional information is on file with the Department for 197 products, with complete compositional information on file for 152 of those products. Within these products are approximately 260 unique chemicals whose CAS Numbers have been disclosed to the Department and an additional 40 compounds which require further disclosure since many are mixtures.”

“Table 5.4 is an alphabetical list of products for which only partial chemical composition information has been provided to the Department. Any product whose name does not appear within Table 5.3 or Table 5.4 was not evaluated in this SGEIS either because no chemical information was submitted to the Department or because the product was not proposed for use in fracturing operations at Marcellus shale wells or other wells targeting other low permeability gas reservoirs.”

5.4.3Composition of Fracturing Fluids

“The composition of the fracturing fluid used may vary from one geologic basin or formation to another in order to meet the specific needs of each operation; but the range of additive types available for potential use remains the same. There are a number of different chemical compositions for each additive type; however, only one product of each type is typically utilized in any given gas well. The selection may be driven by the formation and potential interactions between additives. Additionally not all additive types will be utilized in every fracturing job.”

“A sample composition by weight of fracture fluid is provided in Figure 5.3; this composition is based on data from the Fayetteville Shale.27 Based on this data, approximately 90 percent of the fracture fluid is water; another approximately 9 percent is proppant; the remainder, typically less than 0.5 percent consists of chemical additives listed above.”

“Even though no horizontal wells have been drilled in the Marcellus Shale in New York,
applications filed to date indicate that it is realistic to expect that the composition of fracture fluids used in the Marcellus Shale would be similar from one operation to the next. One potential exception is that additional data provided separately to the Department indicates that biocides have comprised up to 0.03% of fracturing fluid instead of 0.001% as noted…”

“Each product within the twelve classes of additives may be made up of one or more chemical constituents. Table 5.6 is a list of chemical constituents and their CAS

numbers, that have been extracted from complete product chemical compositional information and Material Safety Data Sheets submitted to the NYSDEC for nearly 200 products used or proposed for use in hydraulic fracturing operations in the Marcellus Shale area of New York. It is important to note that several manufacturers and suppliers provide similar chemicals (i.e. chemicals that would serve the same purpose) for any class of additive, and that not all types of additives are used in a single well. Table 5.6 represents constituents of all hydraulic-fracturing-related chemicals submitted to NYSDEC to date for potential use at shale wells in the State, only a handful of which would be utilized in a single well. Data provided to NYSDEC to date indicates similar fracturing fluid compositions for vertically and horizontally drilled wells."

The sections Fracturing Fluid (section 5.4) and Composition of Fracturing Fluid (section 5.4.3) appear to be contradictory. Chemical composition of fracturing fluid is estimated to be less than 2% and also 10% (with 0.5% in actual chemicals assuming activities in other formations will be the same in the Marcellus). Additionally, no reference is made to whether or not Utica shale or other low permeability formations will require similar or dissimilar chemicals. Using the percentages provided in section 5.4, if 5 million gallons of freshwater can be seen as the median value for the amount of water to be consumed during a single well fracturing and 1.75% can be seen as a typical amount of chemical additives (noted at 2% or less), it can be estimated that approximately 87,000 gallons of chemicals will be required for each well on a single pad. This number can then be multiplied by the number of anticipated wells from that pad (6-8).

From text taken from section 5.4, there are 45 products and 40 compounds for which chemical composition is incomplete or not disclosed in the dSGEIS. Additionally, the tabular information provided can also be viewed as incomplete given the qualifying statements describing Tables 5.3 and 5.4. Further, while percentages of chemical composition are provided by type or additive chemical composition of those additives (including concentrations, estimated or actual) are not provided. Considering the total volume of chemicals being estimated for use at a multi-well pad (approximately 600,000 gallons for a pad with 7 wells) and the deficiency in completeness in regards to what may or may not be used, and therefore the potential environmental impact of such large quantities of chemicals being dispersed and used on each multi-well pad throughout the southern tier of New York, conclusions on the safety of the State's soil and water resources, best uses, ecosystem function and services will also be deficient in their comprehensiveness.

Contradictions also exist in describing the rationale for assuming uniformity across the State in the chemical composition of fracturing fluid intended to be used. It is stated that the composition in fracturing fluid will differ based on formation (Marcellus, Utica, other), geologic basin, potential interactions because the chemical composition of each product (depending on manufacturer) will differ. Table 5.3 is stated to incomplete but nevertheless lists nearly 197 products (comprised of different

chemicals at currently unknown concentrations) used or proposed for use in hydraulic fracturing operations in the Marcellus Shale area of New York.

Further it stated that not all additive types will be used at all wells with only a 'handful' being used at any one well. If only a 'handful of products" will be used at a well and are taken from a list of 197 products that represents all products to be used, then it follows that different drilling operations will be using different products made up of different chemicals. This, in addition to considerations given to geologic basins, does not support the assumed expectation that the composition of fracture fluids used in the Marcellus Shale will be similar from one operation to the next; or consider the Utica or other target formations as a wholly different than the Marcellus and where further heterogeneity in fracturing fluid would be expected.

The differences in formation, geologic basin interaction between different chemicals and, logically and conservatively, the differences in fracturing liquid that can be anticipated, in addition to the variability in natural resources and ecosystems potentially impacted, is further reason not to assume 'common impacts'.

As mentioned above, assessing the conclusions of the dSGEIS relative to environmental impact is not possible without disclosure of details pertaining to all anticipated activities. Specifically, this relates to the inability to assess foam fracturing and other green technologies, from a perspective of chemical additives used and application.

Additionally, and similar to those comments expressed in relation to NORM's above, assumptions that are made in the dSGEIS regarding fracturing fluid composition that may be relied on for decades to come, that are critical to accurate assessment of potential environmental impacts and are made at a time before a single well is drilled in NY using the new high-volume hydraulic horizontal fracturing process being reviewed here, should be avoided or at least, be made in favor of greater environmental protection.

It is therefore recommended, in the interest in providing the best guidance possible, recommending best management practices and accurately assessing the potential environment impact, that no permitting of the new high-volume hydraulic horizontal fracturing process being reviewed go forward without complete, comprehensive and public knowledge of the chemical composition (including concentrations) of the fracturing fluid intended for use in both 'slickwater', foam fracturing applications and green technologies and that this include similar understanding of the flowback liquid as it is produced and over time. Appreciation has to be given to the complexity of the task requested; accounting for all chemicals to be used at all well sites when multiple products that serve similar purposes are available but have different chemical make-ups will not be easy. Therefore it is also recommended that the State consider determining what can and cannot be used in fracturing fluid so that clear and comprehensive knowledge can be had before the commencement of operations or

that a phased permitting approach be adopted where experience can be gained and data collected from sites inside and outside NY (PA).

5.4.3.1 Chemical Categories and Health Information

"Compound-specific toxicity data are very limited for many chemical additives to fracturing fluids, so chemicals potentially present in fracturing fluids were grouped together into categories according to their chemical structure."

"For most chemical categories, health information is available for only some of the chemicals in the category. More specific assessment of health risks associated with a contamination event would entail an analysis based on the specific additives being used and site-specific information about exposure pathways and environmental contaminant levels."

"Potential human health risks of a specific event would be assessed by comparison of case-specific exposure data with existing drinking standards or ambient air guidelines. If needed, other chemical-specific health comparison values would be developed, based on a case-specific review of toxicity literature for the chemicals involved. A case-specific assessment would include information on how potential health effects might differ (both qualitatively and quantitatively) depending on the route of exposure."

"As mentioned earlier, the 1992 GEIS addressed hydraulic fracturing in Chapter 9, and NYSDOH's review did not identify any potential exposure situations associated with horizontal drilling and high-volume hydraulic fracturing that are qualitatively different from those addressed in the GEIS."

In some cases, and all of those that involve the general public, impacts to human health are extensions of environmental degradation. Exposure mechanisms to the general public contain some aspect of the natural environment that acts as the pathway. For example, physical contact with chemicals at high concentrations as a result of spill involves the soil and water into, or onto, which the spill occurred; exposure through ingestion of contaminated drinking water would also necessarily involve soil and water; chemical fumes inhaled by definition involve the air. From some perspectives human health is at the apex of environmental concerns and may be the vantage point from which environmental degradation is detected. The information provided in the dSGEIS, as described in the text itself (above) is incomplete.

In order to accurately assess the potential for negative human health impacts it is reasonable to start with a comprehensive understanding of what it is that poses the risk. As noted above (sections 5.4 & 5.4.3) the list of known chemicals anticipated to be used in fracturing fluid is incomplete. Of the chemicals that have been identified, health and toxicity data are available for only a portion. Additionally, because of the mixed nature of fracturing fluid, attention should be given to chemical compounds

that might be formed and their effects on human health. While it is not possible to investigate case-specific impacts before-hand and there is an inherent difficulty in attempting to predict all site-specific conditions that may lead to a negative impact, it is reasonable to develop likely scenarios describing likely exposure pathways to the average individual and those where additional circumstances would warrant further investigation (children, pregnant women).

The statement that 'more specific assessment of health risks associated with a contamination event would entail an analysis based on the specific additives being used' further supports the recommendation made above regarding chemical composition (section 5.4.3); that complete knowledge of chemicals, concentrations of chemicals, impacts of mixtures of chemicals are needed. Additionally, the idea that potential human health risks could be assessed by comparison of case-specific exposure data with existing drinking standards or ambient air guidelines is flawed if the chemicals in question are not listed in the drinking water standard or ambient air guidelines. Addition of these chemicals to the states drinking water standards was made in section2.4.3.

Therefore, in the interest of accurate assessment of the potential negative impacts, public transparency and requiring the best management practices possible, it is recommended that the State develop health information and compound-specific toxicity data on all chemicals being proposed in fracturing fluid (and flowback liquid as commented on below, section5.11.3), including anticipated mixtures, perform analysis based on the specific additives being proposed and specific information common to a variety of site conditions that includes the full range of possible exposure pathways (to both industry workers and the general public) at the full range of levels.

5.5.2 New York State DOT Transportation Regulations

"Part 820.8 (Transportation of hazardous materials) states "Every person … engaged in the transportation of hazardous materials within this State shall be subject to the rules and regulations contained in this Part." The regulations require that the material be "properly classed, described, packaged, clearly marked, clearly labeled, and in the condition for shipment…" [820.8(b)]; that the material "is handled and transported in accordance with this Part" [(820.8(c)]; "require a shipper of hazardous materials to have someone available at all times, 24 hours a day, to answer questions with respect to the material being carried and the hazards involved" [(820.8.(f)]; and provides for immediately reporting to "the fire or police department of the local municipality or to the Division of State Police any incident that occurs during the course of transportation (including loading, unloading and temporary storage) as a direct result of hazardous materials" [820.8 (h)]."

Safe transportation of the chemical additives used in the high-volume hydraulic horizontal fracturing process being reviewed here is critical to the protection of the

environment. The negative impacts alluded to in the above section, although incomplete, warrant considerable attention to this issue. As described in the dSGEIS, State DOT regulations in this area are quite extensive and well developed. Prior knowledge of such activities is crucial to preparedness and the ability to respond to potential accidents. Additionally and further noted below, flowback liquid will contain some portion of the fracturing fluid used in addition to naturally occurring substances that also have the potential for negative environmental impacts in the event of an accident. Increasing the potential danger to the environment as the result of an accident and spill is the steep topography and variable climactic conditions through the area under consideration.

It is recommended that local emergency response officials be given prior notice of when hazardous material will be being transported within their municipal boundaries, that they be given the proper training on how best to respond to accidental spills (that covers the array of chemicals currently known to be involved) and that development of protocol be undertaken that outlines who is involved in emergency response (from the driver to the clean up crew) along with phone numbers and the responsibility of each party. Further, until such time that full disclosure can be made regarding the chemical composition of flowback and brine liquid (including concentrations) it is recommended here that flowback liquid be considered in the same class as the concentrated chemical mentioned in the section above (hazardous) and that similar steps be taken for its handling.

5.6 On-Site Storage and Handling of Hydraulic Fracturing Additives

"Therefore, although the chemical lists in Tables 5.5 and 5.6 reflect nearly 200 products, no more than 12 products and far fewer chemicals than listed would be present at one time at any given site."
"This process is conducted and monitored by qualified personnel, and devices such as manual valves provide additional controls when liquids are transferred. Common observed practices during visits to drill sites in the northern tier of Pennsylvania included lined containments and protective barriers where chemicals were stored and blending took place."

The above statement regarding the number of chemicals expected to be present on any one well pad relative to the number of chemicals reported as being anticipated for use throughout the state further supports the statement that different chemicals will be used at different sites and supports the conclusion that the potential negative impacts to the environment will differ across the spectrum of potential well pads. Handling of the concentrated form of these chemicals during the fracturing process represents one of the moments in the process where accidental spills could have the greatest negative impact on the environment. Storage also represents, although perhaps to a lesser degree, another moment where accidents or equipment failures could have a potentially catastrophic impact to the local environment.

It is there fore recommended that Department staff are on-site during the fracturing process to insure that any accidental spill or discharge is dealt with in the quickest manner possible, guarantee Department knowledge of the incident (and by extension, public knowledge) and proper recording. It is also recommended that the practices observed (and additional similar practices) in PA be required by New York State for all proposed activities that require the storage and handling of chemicals used during the fracturing process. Lastly, and as recommended above, in consideration of the differing chemicals to be used at different well pads, it is recommended that a finding of 'common impact' not be used in the SGEIS and that site specific SEQRA determinations be made for every well proposed.

5.6.2 NYSDEC Programs for Bulk Storage

"The Department regulates bulk storage of petroleum and hazardous chemicals under 6 NYCRR Parts 612-614 for Petroleum Bulk Storage (PBS) and Parts 595-597 for Chemical Bulk Storage (CBS). The PBS regulations do not apply to non-stationary tanks; however, all petroleum spills, leaks, and discharges must be reported to the Department (613.8)."

"The CBS regulations that potentially may apply to fracturing fluids include non-stationary tanks, barrels, drums or other vessels that store 1000-Kg or greater for a period of 90 consecutive days. Liquid fracturing chemicals are stored in non-stationary containers but most likely will not be stored on-site for 90 consecutive days; therefore, those chemicals are exempt from Part 596, "Registration of Hazardous Substance Bulk Storage Tanks" unless the storage period criteria is exceeded. These liquids typically are trucked to the drill site in volumes required for consumptive use and only days before the fracturing process. Dry chemical additives, even if stored on site for 90 days, would be exempt from 6 NYCRR because the dry materials are stored in 55-lb bags secured on plastic-wrapped pallets."
"The facility must maintain inventory records for all applicable non-stationary tanks including those that do not exceed the 90-day storage threshold. The CBS spill regulations and reporting requirements also apply regardless of the storage thresholds or exemptions. Any spill of a "reportable quantity" listed in Part 597.2(b), must be reported within 2 hours unless the spill is contained by secondary containment within 24 hours and the volume is completely recovered. Spills of any volume must be reported within two (2) hours if the release could cause a fire, explosion, contravention of air or water quality standards, illness, or injury. Forty-two of the chemicals listed in Table 5.6 are listed in Part 597.2(b)."

As noted above, concentrated forms of the chemicals to be used during the fracturing process, to the degree that they are entirely known and information on human health and toxicity data has been provided in the dSGEIS, represent a serious impact to the environment in the event of an accidental spill or discharge. Assumptions of what is 'typical and likely' when assessing the new high-volume hydraulic horizontal fracturing process being reviewed here (for which the State has no prior experience),

particularly in regards to the presence concentrated forms of chemicals intended for use in the fracturing process, do not provide for the maximum protection of soil and water resources, ecosystem types, function and services and their best uses.

It is a conservative approach and not unreasonable to consider that there will be unforeseen circumstances that preclude 'typical' operation and execution of a drilling plan as initially written. Additionally, spills of concentrated chemicals represent a direct negative impact to the environment. In order to most accurately assess the potential impacts over the long term of the new high-volume hydraulic horizontal fracturing process being reviewed here, provide accurate recording of all accidental spills, guarantee public transparency and that proper and approved remediation steps have been taken, it is necessary that all spills (and mitigative steps taken) be fully reported to the State.

In the interest of providing the greatest protection possible from accidental discharge concentrated chemicals to the environment, it is recommended that PBS and CBS requirements be made applicable to all non-stationary tanks, all non-stationary tanks, barrels, drums or other vessels that store 1000-Kg of additive, all dry chemical additives regardless of packaging, that all such containers and packages be registered with the State, and that inventory records be maintained on all such containers and packages. It is further recommended that approved mitigative steps resulting in the recovery of spilled material be described and required in the SGEIS and that all spills, regardless of secondary containment and recovery, be reported to the state, that the mitigative steps taken be provided in that reporting and that Department staff perform site visits to verify such actions.

5.7 Source Water for High-Volume Hydraulic Fracturing

"Operators may withdraw water from surface or ground water sources themselves or may purchase it from suppliers. The suppliers may be municipalities with excess capacity in their public supply systems…"

"The costs of trucking large quantities of water increases and water supply efficiency decreases when longer distances and travel times are involved."

"Use of fewer, larger water sources avoids the need to utilize multiple smaller sources. A source that is less prone to supply fluctuations or periods of unavailability would be more highly valued than an intermittent and less steady source. Water from deep mines and saline aquifers may be more difficult to access than a surface water source unless adequate infrastructure is in place. Access to a municipal or industrial plant or reservoir may be inconvenient due to security or other concerns. Access to a stream may be difficult due to terrain, competing land uses, or other issues."

"The water may require pre-treatment or additional additives may be needed to overcome problematic characteristics."

"Figure 5-4- Protection of Waters – Dam Safety Permitting Criteria"

"If a proposed impoundment meets or exceeds the permitting thresholds discussed above, the well operator proposing use of the impoundment is required to apply for a Protection of Waters Permit though the Department's Division of Environmental Permits."

"In order to ensure that an impoundment is properly designed and constructed, the design, preparation of plans, estimates and specifications, and the supervision of the erection, reconstruction, or repair of an impoundment must be conducted by a licensed professional engineer."

"The Department's document "An Owners Guidance Manual for the Inspection and Maintenance of Dams in New York State" should be utilized by all impoundment owners, as it provides important, direct and indirect steps they can take to reduce the consequences of an impoundment failure."

As described in the dSGEIS, large quantities of freshwater will be required for each well drilled. Water consumption, in some cases falls under the jurisdiction of the appropriate River Basin Commission (RBC) depending on the nature and location of the withdrawal. However, there may be instances where RBC permitting may not be required and the stringent assessment of the potential environmental impact undertaken by the RBC's would not be applied. While comments and recommendations regarding water withdrawal are discussed below, some attention to groundwater withdrawal as described in this section is warranted. The attainment of groundwater from municipalities or any private entity poses significant risk to the water table and the ecosystems and private infrastructure on which it depends (wetlands, 1st and 2nd order streams, wet meadows, private well owners, etc…). While municipalities and other private sources may have excess water beyond what is consumed under normal circumstances, the high volume nature of the activities described here and the impact on the quantity and quality of water currently available to ecosystems and landowners would be difficult to characterize as positive or negligible. While costs may be a consideration of industry when considering the profitability of the proposed actions, increased or decreased costs have little bearing or relevance to the States role in environmental protection. Comments noting the importance of fewer, larger water sources and thus limiting risk to smaller more vulnerable sources are well noted.

Additionally, comments made in the dSGEIS regarding the potential need for pre-treatment of water for optimal functionality through the use of additional additives do not include a description of the pretreatment process (including storage and handling) or list what additives are likely to be present on the site inclusive of the potential impacts to the environment and human health as was provided, in part, for fracturing fluid additives. The use of freshwater impoundments for water storage has

the environmental benefit of reducing the need for transportation of water to the pad by truck and the review of DEC Dam Safety regulations is descriptive of the potential environmental impacts of large impoundments (although information meant to be provided in Figure 5-4 does not appear in the dSGEIS). Also described in great detail, some of which is provided above, are the considerable responsibilities of the impoundment owner and frequent mention of the need for a professional engineer to design such impoundments. However, no information is provided to identify who, either industry or private landowner, is the owner of the impoundment or in what state (and therefore familiarity with NYS regulations) the engineer holds a license.

It is therefore recommended that all permitted drilling activities require water withdrawal from surface waters, be limited to the mainstem of the regions major rivers regardless of consideration of cost to industry, that pre-treatment additives receive the same consideration in the SGEIS as chemicals used in fracturing fluids and flowback liquids, that describes pretreatment procedures, discloses chemical composition (and concentration), ownership of any constructed impoundment be define in the SGEIS and require that engineers used in the design of any impoundments be hold a license issued in the State of New York.

5.8.2 Methods for Limiting Fracture Growth

"ICF reports that, despite ongoing laboratory and field experimentation, the mechanisms that limit vertical fracture growth are not completely understood. Pre-treatment modeling, as discussed above, is one tool for designing fracture treatments based on projected fracture behavior. Other control techniques identified by ICF include…"

Groundwater contamination as a result of the new high-volume hydraulic horizontal fracturing process being reviewed here is a critical component of the range of potential negative environmental impacts of the process. The dGEIS describes a number of iterative steps that can be taken to mitigate vertical fracturing beyond the desired distance that would be appropriate in cases where the target formation is at great depth (>3,000 ft), the document does describe instances where fracturing is intended take place at shallower depths. The limited ability to accurately and consistently predict the length of vertical fractures towards the surface in shallow drilling operations, particularly where karst topography exists through the area under consideration, posses a significant risk to groundwater from the hydraulic fracturing process. Additionally, the dSGEIS does not state that these iterative steps are required by site operators.

Given the potential for negative impacts to groundwater quality from new high-volume hydraulic horizontal fracturing process being reviewed here and, following the precepts recommended above that environmental protection take precedence over mineral resource exploitation and siting be used as a means to protect water quality under certain circumstances, it is recommended that any proposed high-volume

hydraulic fracturing where the top of the target fracture zone is shallower than 2,000 feet along the entire proposed length of the wellbore and any proposed high-volume hydraulic fracturing where the top of the target fracture zone at any point along the entire proposed length of the wellbore is less than 1,000 feet below the base of a known fresh water supply not be permitted.

5.9 Hydraulic Fracturing Procedure

"There will be at least two strings of cemented casing in the well during fracturing operations. The outer string (i.e., surface casing) extends below fresh ground water and would have been cemented to the surface before the well was drilled deeper. The inner string (i.e., production casing) typically extends from the ground surface to the toe of the horizontal well."

Where the well comes into contact with the water table is of critical importance when assessing potential pathways of contaminates into groundwater. As all the chemical additives mentioned will be passing through the well hole, this area represents very close proximity between the resource being protected and the materials comprising any potential contamination. For this reason all materials meant to serve as a barrier between fresh groundwater and the potentially harmful chemicals must be guaranteed to be installed correctly and under the proper conditions. While industry staff have an interest in protecting the environment in which they work, responsibility for safeguarding that environment from any and all complications rests with the State.

Given the importance of the cement barriers to protecting groundwater, and the ecosystems, best uses and general public that depend on its quality, it is recommended that Department staff be required to be on-site when casings are being poured, inspect surface casings for imperfections before allowing installation of production casings and inspect and certify the proper installation of all casing before allowing frilling operations to continue.

5.10 Re-fracturing

"Developers may decide to re-fracture a well to extend its economic life whenever the production rate declines significantly below past production rates or below the estimated reservoir potential."

Given the limited information provided on re-fracturing processes, it is assumed that the will be identical to the processes described in the dSGEIS for the initial fracturing. If this is the case, it is recommended that identical standards relative to environmental safety apply. If there are departures from the fracturing process described in the dSGEIS, it is recommended that the SGEIS provide a full account of those differences (including chemicals used) as well as a description of any new potential environmental impacts.

5.11.1 Flowback Water Recovery

"Flowback water recoveries reported from horizontal Marcellus wells in the northern tier of Pennsylvania range between 9 and 35 percent of the fracturing fluid pumped."

"This volume is generally recovered within two to eight weeks, then the well's water production rate sharply declines and levels off at a few barrels per day for the remainder of its producing life."

5.11.1.1 Subsurface Mobility of Fracturing Fluids

"ICF's conclusion is that "hydraulic fracturing does not present a reasonably foreseeable risk of significant adverse environmental impacts to potential freshwater aquifers." 87 Specific conditions or analytical results supporting this conclusion include: • The developable shale formations are vertically separated from potential freshwater aquifers by at least 1,000 feet of sandstones and shales of moderate to low permeability. • The amount of time that fluids are pumped under pressure into the target formation is orders of magnitude less than the time that would be required for fluids to travel through 1,000 feet of low-permeability rock. • The volume of fluid used to fracture a well could only fill a small percentage of the void space between the shale and the aquifer. • Some of the chemicals in the additives used in hydraulic fracturing fluids would be adsorbed by and bound to the organic-rich shales. • Diffusion of the chemicals throughout the pore volume between the shale and an aquifer would dilute the concentrations of the chemicals by several orders of magnitude. • Any flow of fracturing fluid toward an aquifer through open fractures or an unplugged wellbore would be reversed during flowback, with any residual fluid further flushed by flow from the aquifer to the production zone as pressures decline in the reservoir during production."

The text from the dSGEIS provided above, comments describing the benefits of multiple wells at a single pad and those regarding utilization of large water sources, are among the few offered throughout the dSGEIS that provide solid rationale for the conclusions reached. However, the rationale offered above loses strength as the depth of the fracturing process is reduced.

For shallow wells (<2,000 feet), and perhaps wells drilled to greater depths, the reassurance of the unlikelihood of contamination of groundwater resources from the fracturing process may not be as iron-clad as is characterized above. Given the inability accurately predict the vertical distance towards the surface (i.e. bottom of water table) as described above and the inexact knowledge of all fractures, cracks, void spaces and fissures present in the material separating the shale formation and the bottom of the water table, it is impossible to say that the high pressure used during fracturing will not impact the water table in the area being drilled.

For shallow wells (<2,000 feet) groundwater contamination can occur from substances that are naturally occurring within the rock material between the target formation and the water table and are located considerably closer to the bottom of the water table than the production zone. It is conceivable, perhaps probable, that when pressure is applied from below, that these substances (saline water, methane, etc…) will be mobilized into the water table.

Understanding that naturally occurring substances that have the potential to negatively impact the water table, and by extension, the ecosystems and best uses they provide, will move in all directions, not just vertically upward, it is important to consider the topography in the area under consideration. That is, where fracturing is taking place at shallow depths, naturally occurring yet harmful contaminants can move laterally to where the distances between the formation and the water table are closed as the formation slopes up towards the surface and/or the ground surface and water table slopes down. While this latter concern may be less likely than the forcing of harmful, naturally occurring substances within the material separating the water table from the production zone into the water table as pressure is applied from below, both possibilities raise concern over the potential negative environmental impacts from drill at shallow depths. Fracturing at shallow depths removes the margin of error inherent in the process and lessens the validity of the rationale underpinning the conclusion of no adverse environmental impacts to fresh water aquifers.

Therefore it is recommended, as previously stated, that no permits be issued for activities intended to take place at a depth less than 2,000 feet.

5.11.3 Flowback Water Characteristics

"The following description of flowback water characteristics was provided by URS Corporation, under contract to NYSERDA. This discussion is based on a limited number of analyses from out-of-state operations, without corresponding complete compositional information on the fracturing additives that were used at the source wells.."

"Most fracturing fluid components are not included as analytes in standard chemical scans of flowback samples that were provided to DEC, so little information is available to document whether and at what concentrations most fracturing chemicals occur in flowback water."

"Flowback fluids include the fracturing fluids pumped into the well, which consists of water and additives discussed in Section 5.4; any new compounds that may have formed due to reactions between additives; and substances mobilized from within the shale formation due to the fracturing operation"

5.11.3.1 Temporal Trends in Flowback Water Composition

"The composition of flowback water changes with time, depending on a variety of factors."

"The concentrations of total dissolved solids (TDS), chloride, and barium increase;
• The levels of radioactivity increase,
• Calcium and magnesium hardness increases;
• Iron concentrations increase, unless iron-controlling additives are used;
• Sulfate levels decrease;
• Alkalinity levels decrease, likely due to use of acid; and
• Concentrations of metals increase"

5.11.3.2 NYSDOH Chemical Categories

"The GEIS identified high total dissolved solids (TDS), chlorides, surfactants, gelling agents and metals as the components of greatest concern in spent gel and foam fracturing fluids (i.e., flowback). Slickwater fracturing fluids proposed for Marcellus well stimulation may contain other additives such as corrosion inhibitors, friction reducers and microbiocides, in addition to the contaminants of concern identified in the GEIS. Most fracturing fluid additives used in a well can be expected in the flowback water, although some are expected to be consumed in the well (e.g., strong acids) or react during the fracturing process to form different products (e.g., polymer precursors)."

Knowing the chemicals contained within flowback liquids is fundamental to understanding the potential environmental impacts. Assessing the potential negative impacts of chemicals contained in flowback or assessing the degree of impact as it relates to potential means of introduction to the environment (large volume or high concentration acute incidents or low level, long term chronic exposure), is not possible without knowing what chemicals and compounds are under consideration. Flowback liquids will, as described throughout the dSGEIS, represent a very large volume of material that is anticipated to be handled, stored, treated and transported across the surface of the landscape and, unlike fracturing fluids, will not be separated from the surface by thousands of feet of earth and will be in very close proximity to the natural resources (soil, water tables and ecosystems of all types) meant to be protected by the regulations and best management practices provided for in the dSGEIS.

It can be conservatively estimated that many millions of gallons of this material will be in play at any given time should the new high-volume hydraulic horizontal fracturing process being reviewed here have wide-spread application across the State. From what limited information is available in the dSGEIS, which does not include the Utica shale or any other formation being considered, there is additional uncertainty as to what is to be assessed owing to dynamic nature of the liquid over

time and the anticipation of compounds forming as chemicals react with one another and the environment of the production zone. Of the changes in composition that are known to take place over time for the Marcellus shale, at least two components that increase over time have been identified as 'components of greatest concern' in the 1992 GEIS. Others include increases in acidity and radioactivity; parameters known to have negative environmental impacts.

Additionally, many of the chemical constituents listed, and recognized as incomplete, are not found in water quality standards of New York State. Lastly, given the range of chemicals anticipated to be used from one well to another and across the state and that flowback composition is dependent, at least in part, on the fracturing chemicals used and the target formation being fractured and understanding that environmental impacts will be dependent on the composition of the contaminant, common impacts cannot be expected.

For these reasons, and continuing the precept noted throughout the comments provided that environmental consideration be given precedence and priority over mineral resource exploitation, it is recommended that no permit be issued for any well using the new high-volume hydraulic horizontal fracturing process being reviewed here until full disclosure of the chemical composition of flowback liquids (including concentrations) can be provided, assessed for potential environmental impact and, based on that information, recommendations for the proper best management practices and safe handling, storage, treatment and transportation can be made. It is recommended that a phased approach to permitting be adopted by the State, so that this information can be gained from experience and data collect inside and outside NY. Further, if these goals can be achieved and given the wide variety of chemicals and compounds likely to be documented and used and the differing potential environmental impacts that can be expected from their use, it is further recommended that no finding of common impact be made by the State and that site-specific SEQRA determinations be made for all well permits.

5.12 Flowback Water Treatment, Recycling and Reuse

"Operators have expressed the objective of maximizing their reuse of flowback water for
subsequent fracturing operations at the same well pad or other well pads. This involves dilution of the flowback water with fresh water or more sophisticated treatment options. Regardless of the treatment objective, whether for reuse or direct discharge, the three basic issues that need consideration when developing water treatment technologies are:
1. Influent (i.e., flowback water) parameters and their concentrations 2. Parameters and their concentrations allowable in the effluent (i.e., in the reuse water) 3. Disposal of residuals"

5.12.1 through 5.12.3 in entirety

The reuse of flowback water does have environmental benefits by virtue of reducing the potential negative impacts of high-volume water consumption and the need to transport large volumes of water associated with new process being reviewed here. However, given the limited information currently available on the chemical composition of flowback liquid, how that composition changes over time, the number of unknown compounds created by chemicals reacting with one another and the influence of different formations under consideration in the dSGEIS on chemical composition, it is unclear how the three 'basic issues that need consideration' for the on-site treatment, recycling and reuse of flowback liquid can be addressed.

If the chemical composition and concentration of the influent(flowback liquid) is currently unknown (or at least limited), then it will not be possible to place allowable limits on composition and concentration or provide guidance, based on potential negative environmental impact, on best management practices or the proper and safe disposal of residuals. Further, the potential for negative environmental impacts of storing this liquid in open pits (based on the information provided) as large as 5 acres and holding 16 million gallons is considerable. This is in addition to the inability to accurately assess the true potential impact due to the incompleteness of information as described above. Additionally, given the information provided in the dSGEIS regarding on-site treatment of flowback liquid, all options, with the exception of electrodialysis, require either additional chemical additives (for which no chemical information or environmental assessment is provided) or operations requiring large footprints, or are unproven (Ozone/Ultrasonic/Ultraviolet).

If the above recommendation regarding the need to know the chemical composition (and concentrations) can be achieved and described in the SGEIS, then it is further recommended that only those applications describing closed loop systems be permitted. It is also recommended that the SGEIS contain the chemical composition of all additives, compounds and solutions used in treatment of flowback liquid and environmental assessments be developed for those chemicals.

5.13.3 Flowback Water

"Flowback water requiring disposal is considered industrial wastewater, like many other water use byproducts."

"Potential flowback water disposal options discussed in the GEIS include: injection wells, which are regulated under both the Department's SPDES program and the federal Underground Injection Control ("UIC") program, municipal sewage treatment facilities, and out-of-state industrial treatment plants."

"Use of existing or new private in-state waste water treatment plants, and injection for enhanced resource recovery in oil fields have also been suggested."

5.13.3.3 Municipal Sewage Treatment Facilities

"POTWs typically discharge treated wastewater to surface water bodies, and operate under SPDES permits which include specific discharge limitations and monitoring requirements. The effluent limitations are the maximum allowable concentrations or ranges for various physical, chemical, and/or biological parameters to ensure that there are no impacts to the receiving water body."

5.13.3.4 Out-of-State Treatment Plants

"The only regulatory role DEC has over disposal of flowback water at out-of-state municipal or industrial treatment plants is that transport of these fluids, which are considered industrial waste, must be by a licensed Part 364 Transporter."

5.13.3.7 Enhanced Oil Recovery

"Waterflooding is an enhanced oil recovery technique whereby water is injected into partially depleted oil reservoirs to displace additional oil and increase recovery."

5.13.4 Solid Residuals from Flowback Water Treatment

"URS Corporation reports that residuals disposal from the limited on-site treatment currently occurring generally consists of injection into disposal wells."

Many of the chemicals currently being proposed for use in new high-volume hydraulic horizontal fracturing process being reviewed here are classified as hazardous under federal laws, but are not treated as hazardous during drilling and disposal because of gas industry exemptions to the Clean Water Act, the Environmental Response, Compensation, and Liability Act (CERCLA, also known as the Superfund law), the Resource Conservation and Recovery act, and the Safe Drinking Water Act. Considering the human health and toxicity information provided (although limited) and the volume of these chemicals anticipated, the consideration of flowback liquid as industrial wastewater instead of hazardous materials may be more the result of political considerations and successful lobbying efforts aimed at providing exemptions rather than an assessment of the chemicals in the flowback liquid and potential environmental impacts.

Compounding the potential for negative environmental impacts, and as noted in previous sections, the makeup of the flowback liquid (both in composition and concentration) is not completely known for the Marcellus formation and not provided for any other low permeability formations being considered here. As noted above, chemical constituents (and concentrations) of additives to be used in some on-site treatment procedures is also not described. Additionally, the high-volume nature of the process being reviewed here differs significantly with that reviewed under the

1992 GEIS, making conclusions drawn regarding injection wells as a means of disposal less applicable to this process. As with on-site treatment, the applicability of the disposal options outlined in the dSGEIS cannot be fully assessed without knowledge of the material (chemical composition and concentration) to be disposed of and suggestions of options is premature.

Until such time that full disclosure can be made regarding the chemical composition of flowback and brine liquid (including concentrations), it is recommended that flowback material be considered hazardous material by the State and that disposal and transportation methods be suggested based on the regulations that govern the handling of material under this classification.

5.16.1 Partial Site Reclamation

"Any pits used for those operations must be reclaimed and the site must be re-graded and seeded to the extent feasible to match it to the adjacent terrain."

The dSGEIS discusses the possibility that wells will be re-fractured as production decreases and that the interval for this process may be several years. However, in regards to pits (freshwater pits if the recommendation for closed-loop systems is adopted) and well pad reclamation, the dSGEIS does not address whether or not reclamation will take place after the initial fracturing process or after re-fracturing activities have ended. It is recommended that this be addressed in the SGEIS.

5.16.6 Brine Disposal

"Production brine disposal options include injection wells, treatment plants and road spreading for dust control and deicing"

5.16.7 Naturally Occurring Radioactive Materials in Marcellus Production Brine

"The data indicate the need to collect additional samples of production brine to assess the need for mitigation and to require appropriate handling and treatment options, including possible radioactive materials licensing."

Brine production, as described in the dSGEIS, can result in large volumes of liquids over the lifetime of the well. Disposal via road spreading would disperse this material over very large areas and put it in proximity and provide connectivity with many of the States streams, creeks and rivers as roadways frequently follow these waterbodies and have features meant to collect, concentrate and discharge runoff to these waterbodies (i.e. road ditches, culverts, etc…). Given the need for additional samples to assess mitigation, handling, treatment options and, presumably environmental impacts, in addition to the recently reported high NORM levels being encountered, as described above (section4.6), the practice disposal through road spreading

represents a potential negative impact to freshwater ecosystems systems, their function, services and best uses.

It is therefore recommended that road spreading of brine solutions not be considered in the SGEIS and that processing at treatment plant be required as a best management practice for the disposal of brine.

5.16.8 Gas Gathering and Compression

"Siting of gas gathering and pipeline systems, including the centralized compressor stations described above, is not subject to SEQRA review. See 6 NYCRR 617.5(c)(35)."

"This SGEIS will not result in SEQRA findings or new SEQRA procedures regarding the siting and approval of gas gathering and pipeline systems or centralized compression facilities."

5.16.8.1 Regulation of Gas Gathering and Pipeline Systems

"Article VII, "Siting of Major Utility Transmission Facilities," is the section of the New York Public Service Law (PSL) that requires a full environmental impact review of the siting, design, construction, and operation of major intrastate electric and natural gas transmission facilities in New York State. The Public Service Commission (Commission or PSC) has approval authority over actions involving intrastate electric power transmission lines and high pressure natural fuel gas pipelines, and actions related to such projects.

"The PSL defines major natural gas transmission facilities, which statutorily includes many gathering lines, as pipelines extending a distance of at least 1,000 feet and operated at a pressure of 125 psig or more…"
"DEC's permitting authority over gathering lines operating at pressures less than 125 psig primarily focuses on the permitting of disturbances in environmentally sensitive areas, such as streams and wetlands, and the DEC is responsible for administering federally delegated permitting programs involving air and water resources."

"To combat formation damage during hydraulic fracturing with conventional fluids, a new and alternative hydraulic fracturing technology recently entered the Canadian market and was also used in Pennsylvania in September 2009. It uses liquefied petroleum gas (LPG), consisting mostly of propane in place of water-based hydraulic fracturing fluids. Using propane not only minimizes formation damage, but also eliminates the need to source water for hydraulic fracturing, recover flowback fluids to the surface and dispose of the flowback fluids.120 While it's unknown if and when LPG hydraulic fracturing will be proposed in New York, having gathering infrastructure in place, would allow the propane to be recovered during flowback directly to a pipeline along with the produced natural gas."

While not unique to the new high-volume hydraulic horizontal fracturing process being reviewed here, the siting, construction and maintenance of pipeline infrastructure (gathering lines and major transmission lines) represents a considerable portion of the activities that can be expected with development of low permeability formations and should not be separated from it when considering environmental impacts. Additionally, while well pads, pits and other infrastructure associated with this mineral resource exploitation is transient in some sense, pipelines will be permanent. Siting and construction, in particular, have the potential to create long-term, adverse environmental impacts through erosion, soil compaction, habitat fragmentation (and associated impacts on ecosystem health and services) and the alteration of surface and subsurface hydrology. In this respect, experiences and knowledge of the impacts road construction and clear-cut right of ways on the natural environment can be applied to some degree.

It is recognized that PSC (not DEC), through language contained in PSL, has jurisdiction over most types of pipelines and that a full environmental impact review is required of the activities mentioned here. However, the dSGEIS is meant to define and describe potential environmental impact of the new high-volume hydraulic horizontal fracturing process being reviewed so that the public has knowledge of potential impacts and guidance can be promulgated relative to preparation for such activities and best management practices. Further, the mention of LPG hydraulic fracturing, while not currently being described in applications submitted to the State, in this section is inappropriate. If the dSGEIS is meant to evaluate the environmental impact of activities that may be used in exploiting low permeability formations, then equal consideration should be given to all activities that may arise (i.e. LPG and foam fracturing).

It is therefore recommended that the SGEIS not be considered applicable to those practices that may be suggested in the future that have not been described within the dSGEIS. Relative to pipelines, it is also recommended that the SGEIS contain within it a full description of the potential environmental impacts (focusing, but not limited to, those mentioned above) relative to the long term placement of pipelines throughout the landscape. It is further recommended that, where pipeline infrastructure fall below the requirements established in the PSL for regulation by the PSC, that DEC develop and describe regulations regarding the siting, construction and maintenance of such pipeline infrastructure in the SGEIS.

5.17 Well Plugging

"any unsuccessful well or well whose productive life is over must be properly plugged and abandoned, in accordance with Department-issued plugging permits and under the oversight of Department field inspectors. Proper plugging is critical for the continued protection of groundwater, surface water bodies and soil."

Protection of groundwater and surface water bodies is among the prime concerns when considering potential environmental impacts. Contamination of these water resources can have potentially devastating impacts on physical (non-biological) component ecosystems of all types; degrading function, services provided and best uses. Impacts can also be extended to those organisms that live, support and contribute to function, services and best uses – soil microbial communities, aquatic and terrestrial vegetation (including algae), benthic fauna, macro-invertebrates, amphibian, avian and mammalian species, insects, etc..; essentially all life within the area under consideration has the potential to be adversely impacted by ground and surface water contamination by the chemicals, compounds inherent in the new high-volume hydraulic horizontal fracturing process being reviewed (a portion of which that are never fully recovered during the life of the well) as well as naturally occurring, yet harmful materials that may be mobilized by the process. From the statement provided above, taken from the dSGEIS, the critical nature of proper plugging and the consequences of plug failure are appreciated.

Given the importance of this as aspect of the proposed activities, and in addition to staff inspection at the time of plugging and to the degree that it is not included in the 1992 GEIS, it is recommended that Department staff inspect plugged wells on an annual basis to ensure proper function.

6.1 Water Resources

"SEQRA regulations state that 'EISs should address only those potential significant adverse environmental impacts that can be reasonably anticipated and/or have been identified in the scoping process.'"

"Two additional water resources concerns were frequently raised during the public scoping process. These were: 1) Potential degradation of New York City's surface drinking water supply; and 2) Potential groundwater contamination from the hydraulic fracturing procedure itself. Because of the high level of public concern about both potential impacts, NYSERDA commissioned studies of their likelihood. As presented and summarized in Section 6.1 of this chapter, and in Chapters 7 and 8 and in Appendix 11, neither potential impact is reasonably anticipated."

From the statements in the dSGEIS, section 5.4, there are 45 products and 40 compounds for which chemical composition is incomplete or not disclosed in the dSGEIS. Additionally, the tabular information provided can also be viewed as incomplete given the qualifying statements describing Tables 5.3 and 5.4. Further, while percentages of additives are provided by type, amounts and concentrations (estimated or actual) of the chemicals of which they are comprised are not provided. Chemical compounds formed by interaction between individual chemicals and individuals chemicals (and the unknown compounds) and naturally occurring materials (which may differ between target formations) is also not known. Additionally, and as described above, wells drilled at shallow depth (<2,000 feet) may have the potential to push environmentally harmful, naturally occurring substances entrained in the underlying earth into the water table as pressure applied from below mobilizes these substances (methane, brine, NORM's) vertically through existing pore spaces, voids, fractures or fissures. Horizontal mobilization may also be a concern where shallow wells are fractured and surface topography closes the distance between the target formation and the water table. Also to be considered, although not described in any detail here, are the recent public accounts of ground water contamination where the new high-volume hydraulic horizontal fracturing process being reviewed here are being implemented.

Given the incomplete knowledge of the chemicals under consideration, the possibility of contamination of the water table from fracturing at shallow depths, and the experiences in other areas, it is recommended that the SGEIS consider potential groundwater contamination from the hydraulic fracturing procedure implemented at shallow depths to have potential significant adverse environmental impacts and that these impacts could differ from well pad to well pad depending on chemicals used, their interaction with the target formation (which will also be different between formations) and the heterogeneity of the underlying geology across the landscape preclude the 1992 GEIS conclusion of common impacts. It is also recommended here again that no wells using the new high-volume hydraulic horizontal fracturing process being reviewed proposed for depths less than 2,000 feet be permitted.

6.1.1 Water Withdrawals

"Without proper controls on the rate, timing and location of withdrawals, stream flow modifications could result in negative impacts to a stream's best uses, including but not limited to the aquatic ecosystem, downstream riverine and riparian resources, wetlands, and aquifer supplies."

6.1.1.6 Aquifer Depletion

"The primary concern regarding groundwater withdrawal is aquifer depletion that could affect other uses, including nearby public and private water supply wells. This includes cumulative impacts from numerous groundwater withdrawals and potential aquifer depletion from the incremental increase in withdrawals if groundwater supplies are used for hydraulic fracturing. Aquifer depletion may also result in aquifer compaction which can result in localized ground subsidence. Aquifer depletion can occur in both confined and unconfined aquifers."

"Aquifer depletion can lead to reduced discharge of groundwater to streams and lakes, reduced water availability in wetland areas, and corresponding impacts to aquatic organisms that depend on these habitats."

6.1.1.7 Cumulative Water Withdrawal Impacts

"There are several potential cumulative impacts from existing water use and new withdrawals associated with natural gas development, including, but not necessarily limited to: Stream flow and groundwater depletion, Loss of aquifer storage capacity, Water quality degradation, Fish and aquatic organism impacts, Significant habitats, endangered, rare or threatened species impacts, Existing water users and reliability of their supplies, Underground infrastructure."

Existing Water Usage and Withdrawals
Withdrawals for High-Volume Hydraulic Fracturing
pages 6-9 to 6-14

Section 6.1 and the subsections regarding water withdrawal, generally support the comments provided above on above importance of ground water to the health of ecosystems, ecosystem function and services. Although relatively brief, considering water resources are 'a primary emphasis of the Department and the oil and gas regulatory program', the dSGEIS does generally outline conditions for potential negative impacts from the water consumption portion of the new high-volume hydraulic horizontal fracturing process being reviewed here. However, the text contained on pages 6-9 through 6-14, although relevant to the issue in general, are not descriptive of the resulting environmental impacts meant to be contained in Chapter 6.

It is recommended that the SGEIS describe in detail the potential negative impacts of the water withdrawal at the scale being proposed here; utilizing the considerable expertise within the various departments in DEC and the extensive literature available on the topic. Additionally, it is recommended that the information provided on pages 6-9 through 6-14 be placed in a Chapter more appropriate.

6.1.2 Stormwater Runoff

"All phases of natural gas well development, from initial land clearing for access roads, equipment staging areas and well pads, to drilling and fracturing operations, production and final reclamation, have the potential to cause water resource impacts during rain and snow melt events if stormwater is not properly managed."

6.1.3.1 Surface Spills and Releases at the Well Pad

"Spills or releases can occur as a result of tank ruptures, equipment or surface impoundment failures, overfills, vandalism, accidents (including vehicle collisions), ground fires, or improper operations. Spilled, leaked or released fluids could flow to a surface water body or infiltrate the ground, reaching subsurface soils and aquifers."

"Contamination of surface water bodies and groundwater resources during well drilling could occur as a result of failure to maintain stormwater controls, ineffective site management and surface and subsurface fluid containment practices, poor casing construction, or accidental spills and releases. Surface spills would involve materials and fluids present at the site during the drilling phase. Pit leakage or failure could also involve well fluids."

6.1.3.2 Hydraulic Fracturing Additives

"…contamination of surface water bodies and groundwater resources during well stimulation could occur as a result of failure to maintain stormwater controls, ineffective site management and surface and subsurface fluid containment practices, poor well construction and grouting, or accidental spills and releases."

6.1.3.3 Flowback Water

"Opportunities for spills, leaks, operational errors, and pit or surface impoundment failures during the flowback water recovery stage are the same as they are during the prior stages with the additional potential of releases from: hoses or pipes used to convey flowback water to tanks, an on-site pit, a centralized surface impoundment, or a tanker truck for transportation to a treatment or disposal site; and tank leakage or failure of a pit or surface impoundment to effectively contain fluid."

"With respect to surface spills, leaks and container failures, the durability concerns discussed above apply and are magnified by the potential use of large centralized

surface impoundments that could be in use for several years, with fluids transferred by pipes laid along the ground. In addition, the large volume of flowback water that may be present at either a well pad or a centralized site increases the importance of appropriate practices, control measures and contingency plans."

The sections pertaining to stormwater and surface spills and releases at the well pad, from which the above text was pulled, lists possible mechanisms for contamination from various sources. Although some possible pathways are common to stormwater, the drilling process itself, chemicals contained within the fracturing fluid and flowback liquid, they total approximately 20+ ways in which contamination of the environment could take place. This is compounded by the anticipated duration of the activities proposed given that any or all could happen as long as the stage of the process in which the pathway is described is happening (i.e. multiple and or simultaneous occurrences).

Sections of the dSGEIS describe, to the extent that information is available, the chemicals anticipated to be used in the fracturing process and to a lesser extent, the chemicals anticipated in flowback liquid. Sections dSGEIS also discuss the potential to create chemical compounds as individual chemicals interact with each other and the natural environment of the production zone that are not further described in the dSGEIS. Depending on the nature of an accidental spill or discharge, all chemicals, and in addition to suspended sediment and associated nutrients common to erosion, may be present in stormwater runoff.

The difficulty in accurately assessing the potential environmental impact of the new high-volume hydraulic horizontal fracturing process being reviewed here without complete knowledge of what it is that may be posing the threat has already been stated. The dSGEIS, while providing possible pathways of contaminants, does not address the impact of those contaminants on the environment. For example, from the information provided in the dSGEIS, it is not possible to assesses impact of stormwater or surface spills and releases at the well pad of concentrated forms of the chemicals to be used in the fracturing fluid, the fracturing fluid itself, petroleum fuel or flowback liquid on lakes, rivers, streams, creeks, wetlands, agricultural fields, forested ecosystems or any ecosystem or any organism within the landscape (including humans) because those impacts are not described in the dSGEIS.

The main purpose of the draft Generic Environmental Impact Statement is to describe environmental impacts so that they may be assessed and made known to the public. Without this information, the ability to provide guidance and prescribe best management practices is, at best, extremely limited.

It is therefore recommended that SGEIS contain impacts that can be expected by the potential introduction of stormwater, surface spills and releases to the environment of concentrated forms of the chemicals to be used in the fracturing fluid, the fracturing fluid itself, petroleum fuel and flowback liquid on lakes, rivers, streams, creeks,

wetlands, agricultural fields, forested ecosystems and organisms that are necessary for, and dependent on, the best uses of those waterbodies.

6.1.4 Groundwater Impacts Associated With Well Drilling and Construction

"The wellbore being drilled, completed or produced, or a nearby wellbore that is ineffectively sealed, could provide subsurface pathways for groundwater pollution from well drilling, flowback or production operations. Pollutants could include turbidity; fluids pumped into or flowing from rock formations penetrated by the well; and natural gas present in the rock formations penetrated by the well. These potential impacts are not unique to horizontal wells and are described by the GEIS"

Similar to comments provided in the above section dealing with environmental impacts to surface waterbodies, section 6.1.4 describes possible pathways of groundwater contamination (in some cases) but information describing its impacts (with the exception of natural gas which has the potential environmental impact of explosion and suffocation of living organisms) to the groundwater, and by extension, the ecosystems that are dependent on it, is not provided.

In regards to fluids pumped into or flowing from rock formations penetrated by the well, the dSGEIS not only does not describe the potential for and impacts of the introduction of harmful, yet naturally occurring substances that may be mobilized during the fracturing process (particularly at wells drilled to less that 2,000 feet), the dSGEIS relies on a study that was funded by an entity with a financial interest in mineral resource exploitation and took place three decades ago.

Similar to comments made above, accurate assessment of the potential environmental impact of groundwater contamination as a result of the drilling process is not possible from the information provided in the dSGEIS.

Therefore it is recommended that the SGEIS contain information on the impacts to groundwater from turbidity, the potential introduction of harmful, yet naturally occurring substances. Additionally, to the degree that research is performed by private entities to support conclusions drawn in the dSGEIS, it is recommended that such entities be objective and free of possible conflict of interest.

6.1.5 Hydraulic Fracturing Procedure

"Concern has been expressed that potential impacts to groundwater from the high-volume hydraulic fracturing procedure itself could result from: wellbore failure; or movement of unrecovered fracturing fluid out of the target fracture formation through subsurface pathways such as: a nearby poorly constructed or improperly plugged wellbore; fractures created by the hydraulic fracturing process; natural faults and fractures; and movement of fracturing fluids through the interconnected pore spaces in the rocks from the fracture zone to a water well or aquifer. As summarized in

Section 5.18, regulatory officials from 15 states have recently testified that groundwater contamination from the hydraulic fracturing procedure is not known to have occurred despite the procedure's widespread use in many wells over several decades."

6.1.5.1 Subsurface Pathways

As described in Section 6.1.4.2, the probability of fracture fluids reaching an underground source of drinking water (USDW) from properly constructed wells due to subsequent failures in the casing or casing cement due to corrosion is estimated at less than 2 x 10-8 (fewer than 1 in 50 million wells).

Concerns over the movement of unrecovered fracturing fluid out of the target fracture formation through subsurface pathways such as: a nearby poorly constructed or improperly plugged wellbore; fractures created by the hydraulic fracturing process; natural faults and fractures; and movement of fracturing fluids through the interconnected pore spaces in the rocks from the fracture zone to a water well or aquifer are not raised here.

However, this list does not include the possibility of harmful, yet naturally occurring materials present closer to the bottom of the water table than the production zone and that may be pushed into the water table by the pressure involved in the fracturing process when wells are fractured at shallow depths (<2.000 feet) and surface topography slopes away to close the distance between the water table and the production zone as opposed to contamination by the fracturing fluid itself.

In addition, and as noted above (section 6.1.4) statistics used to support conclusions in the dSGEIS that are the result of studies funded by private entities that have a financial interest in the activity under review puts the dSGEIS at risk of being seen as an instrument of those entities and interests. Lastly, and in a more general sense, none of the information provided in the section 6.1.5 discusses or provides information on potential environmental impacts.

Therefore it is recommended, as it is above, that no permits be issued for activities intended to take place at a depth less than 2,000 feet. It also recommended that all studies used to support conclusions in the SGEIS are conducted by public entities or those with no financial interest in the outcome of the process. It is further recommended that the chapters pertaining to potential environmental impacts related to the new high-volume hydraulic horizontal fracturing process being reviewed here be composed of information describing those potential impacts and that rationale precluding the existence of impacts be located elsewhere in the SGEIS.

6.1.6 Waste Transport

"Drilling and fracturing fluids, mud-drilled cuttings, pit liners, flowback water and produced brine are classified as non-hazardous industrial waste which must be hauled under a New York State Part 364 waste transporter permit issued by the Department."

"…manifesting is generally not required for non-hazardous industrial waste, which prevents tracking and verification of disposal destination on an individual load basis."

Information available in the dSGEIS on the chemical composition and concentrations of those chemicals in flowback liquid is indicated in the dSGEIS as being limited as is that for brine solutions. The combined volume of these liquids produced from the new high-volume hydraulic horizontal fracturing process being reviewed here is an anticipated to be in the many millions of gallons. Chemical compounds that may be formed through interactions of individual chemicals and the materials present in the environment of the production zone and (as noted above) predictable levels of NORM's are also not known at this time. Similarly, the potential impacts of introduction of the chemicals of these liquids on soil and water quality that are the basis for ecosystem health, function, services and requisite for best uses are not available in the dSGEIS.

Nevertheless, from the information provided (health information and toxicity data) and, as noted above, the lack of information provided in regards to potential environmental impacts from these liquids contained within this section, our conclusion that there will be negative environmental consequences should these liquids be introduced to the environment follows the precept, described above, that when assumptions have to be made, that they be made in favor of protecting and conserving the health and best uses of the environment.

Therefore, transportation of these materials, which will require many thousands of miles traveled over hilly terrain, over an almost continually shallow water table, and amongst many ecologically sensitive areas, should be treated with the upmost attention and concern. Section 6.11 describes the anticipated volume of road use activity numbering in approximately 1,000 trips per well; for a better estimate of road use, this number should be multiplied by the number of wells per pad (estimated at 3-8) and by the number of anticipated pads.

The probability of traffic accidents involving tanker trucks containing these liquids, particularly in light of the anticipated number of trips, the nature of the local roads to be traveled in rural New York (dirt, steep, narrow with blind turns), poor driving conditions during the late fall, winter and early spring and the possibility that out-of –state drivers will be unfamiliar with these conditions (mainly those who are accustom to, and have gained their experience from, driving in the southern portion of the country) is high relative to what is being experienced without the proposed activity. Topography also increases the probability that accidentally discharged

liquids will reach a waterbody. The area under consider is characterized by hills and slopes of all gradients (i.e. not many flat areas) where spilled liquids will be mobilized down hill and into the waterbodies that typically are located at the bottom.

Should an accident involving a truck carrying flowback liquids occur, the ability to mitigate the potential environmental will depend in large part on knowing the contents of the truck (appropriateness of berming, use of absorbents, precautionary measures for down stream waters should the spilled liquid enter a waterbody, etc…). Given what is known regarding the composition of flowback liquids and what is not currently known at the time of production and over time, the lack of information in the dSGEIS relative to the environmental impacts of accidental discharge of flowback liquids, and that the characterization of flowback liquid as an industrial by-product, as opposed to a hazardous material, may have been a result of political considerations rather than environmental ones at the federal level we assume the accidental discharge of flowback liquids into the environment will have a negative consequence.

For these reasons, and in-line with our precept that protection of the environmental be given precedence over other consideration and until such time that full disclosure can be made regarding the chemical composition of flowback (including concentrations), it is therefore recommended that flowback liquids be considered a hazardous material and the all the applicable standards for its handling, storage and transport be applied. Also as mentioned above, it is further recommended that local emergency response officials be given prior notice of when flowback liquids will be being transported within their municipal boundaries, that they be given the proper training on how best to respond to accidental spills (that covers the array of chemicals currently known to be involved), that development of protocol be undertaken that outlines who is involved in emergency response (from the driver to the clean up crew) along with phone numbers and the responsibility of each party.

6.1.7 Centralized Flowback Water Surface Impoundments

"The Dam Safety Regulations described in Section 5.7.2.1, including the requirement for a Protection of Waters Permit, only apply to fresh water surface impoundments and, therefore, would not apply to flowback water surface impoundments. However, the same concerns exist regarding the potential for personal injury, property damage and natural resource damage if a breach should occur. Adverse impacts to groundwater quality are also a concern relative to large geomembrane-lined surface impoundments. Controlling leakage is a difficult task. An appreciable hydraulic headgreatly increases the impact of any liner defect…Under such conditions, even the smallest defect can release significant volumes of contaminated liquid over short periods of time. In addition, in cases where a single-liner system is not ballasted with a protective soil layer and leakage is trapped in the interstitial area between the liner and liner sub-base, the increased hydraulic pressures and buoyant forces of the geomembrane materials may cause the geomembrane to float. This would typically

result in more liner system damage. For deep surface impoundments, the amount of ballast material needed to reduce this problem is appreciable and the placement of this large amount of ballast material also increases the amount of liner system defects. Rapid drawdown of the contained liquid can result in instability of the ballast materials on the surface impoundment's side wall, resulting in catastrophic damage of the liner system. Conveyances to and from centralized impoundments are also potential pathways for contaminants to reach the environment."

Similar to other sections throughout the dSGEIS relative to components of the new high-volume hydraulic horizontal fracturing process being reviewed here, this section does describe potential pathways for flowback liquid to be introduced to the environment as a result of the use of surface impoundments, but does not provide a description of what the resulting environmental impacts of that introduction would be.

As mentioned throughout these comments, this makes an accurate assessment of the practice in regards to environmental impact, from information provided in the dSGEIS, impossible. In regards to surface impoundments of flowback liquids, this is compounded by the incomplete information provided in the dSGEIS on the chemical composition of flowback liquid (and concentration) is it is produced and over time.

The area under consideration undergoes flooding conditions (either locally or regionally) on a regular basis. Unlike other similar man-made structures (ponds, wetlands, etc…) flowback liquid impoundments will not have structural features meant to protect its stability from overflow – outlets or spillways. Although these other structures typically have in-lets, which flowback impoundments will not, the dSGEIS does not take into consideration the potential for flooding, either in the form of precipitation entering the impoundment directly or increases in groundwater movement/pressure as it may impact the geomembrane, to impact the stability of the impoundment.

Additionally, the storage of millions of gallons of flowback liquid (the chemical composition of which is not entirely known) in open pits throughout the area under consideration represents a part of the process being reviewed here where there is no reliable barrier between the potential contaminant and the environment. The potential for leakage described above and the potential for overtopping (and perhaps failure) due to flood events, the composition of the liquid (at production and over time to the degree that it is known) and the lack of information provided on the resulting environmental impacts of introduction, warrants the implementation of the most appropriate best management practices.

It is therefore recommended that closed- loop systems be required for the handling, treatment and storage of flowback liquid, cuttings and mud for all permits be issued for the new high-volume hydraulic horizontal fracturing process being reviewed here. It is further recommended that the SGEIS contain descriptions of the environmental impacts on the environment (aquatic and terrestrial ecosystems) and their impact on

best uses that are likely to be encountered should flowback liquids be discharged or leaked from surface impoundments.

6.1.8 Fluid Discharges

"Direct discharge of fluids onto the ground or into surface water bodies from the well pad is prohibited. Discharges will be managed at treatment facilities or in disposal wells."

6.1.8.1 Treatment Facilities

"Surface water discharges from water treatment facilities are regulated under the Department's SPDES program. Acceptance by a treatment plant of a waste stream that upsets its system or exceeds its capacity may result in a SPDES permit effluent violation or a violation of water quality standards within the receiving water. Water pollution degrades surface waters, potentially making them unsafe for drinking, fishing, swimming, and other activities or unsuitable for their classified best uses. Treatability of flowback water is a further concern. Residual fracturing chemicals and naturally-occurring constituents from the rock formation could be present in flowback water and have treatment, sludge disposal, and receiving-water impacts."

6.1.8.1 Disposal Wells

"As stated in the GEIS, the primary environmental consideration with respect to disposal wells is the potential for movement of injected fluids into or between potential underground sources of drinking water."

6.1.9 Solids Disposal

"Most waste generated at a well site is in liquid form. Rock cuttings and the reserve pit liner are the significant exception."

6.1.9.3 Cuttings and Liner Associated With Mud-Drilling

"Operators have not proposed on-site burial of mud-drilled cuttings, which would be equivalent to burial or direct ground discharge of the drilling mud itself. Contaminants in the mud or in contact with the liner if buried on-site could adversely impact soil or leach into shallow groundwater."

The description of fluid discharges as 'prohibited' does reflect the potential environmental impact of those discharges. Discharges could be in the form of the chemicals anticipated to be used in the fracturing process in concentrated form, in dilute form as part of the fracturing fluid mixture, flowback liquids, brine liquids or any other chemical anticipated to be on site during normal operations (diesel fuel, chemical involved in the pre-treatment or treatment process, etc..). Owing to the

variation in composition of each of these liquids, different impacts would be expected. Additionally, where these fluids potentially could be discharged (soil, aquifers, wetlands, streams, rivers, terrestrial ecosystems, agricultural fields, etc...) would also influence the type of impact that would be expected to that system and the biological components of that system.

The ability for municipal or private facilities to adequately treat liquids produced by the new high-volume hydraulic horizontal fracturing process being reviewed here and avoid effluent violations and violate water quality standards within the receiving water, resulting in water pollution that degrades surface waters, potentially making them unsafe for drinking, fishing, swimming, and other activities or unsuitable for their classified best uses, is dependent on prior knowledge of the composition of what is to be treated.

As noted above, the high volume nature of the process being reviewed here differs significantly of those processes reviewed in the 1992 GEIS. Therefore conclusions drawn relative to the environmental impact of the use of injection wells as a disposal method for flowback liquids may not be applicable. Additionally, considering that the composition of the flowback will be, at least in part, dependent on the target formation, the composition of the flowback may also be different in low permeability formations than what was considered in 1992, which may indicate a re-evaluation of injections wells as a appropriate disposal method.

While rock cuttings and pit liner are noted as solids to be considered, the dSGEIS does not address solids that will be present in suspension of the flowback liquid (section 5.12.1). These materials can be expected to be anything that becomes mobilized from the zone of production during the fracturing process and returned to the surface during flowback. Considering the possibility of chemical compounds being formed during the fracturing process and as the fracturing fluids and compounds come into contact with material surrounding production zone, there exists the possibility that some of these compounds my precipitate from solution and also be present as solids in the flowback liquid.

It is therefore recommended that potential fluid discharges and the resulting environmental impact of each to soil, aquifers, wetlands, streams, rivers, terrestrial ecosystems, agricultural fields, be described in the SGEIS. As noted above, until such time that full disclosure can be made regarding the chemical composition of flowback and brine liquid (including concentrations) it is recommended that flowback material be considered hazardous material by the State so that proper manifesting can take place and facilities intended to treat and discharge the resulting effluent have prior knowledge of the chemical composition of the material they are accepting. It is further recommended that solids anticipated to be suspended in the flowback be addressed to evaluate proper handling, storage and disposal techniques as well as best management practices meant to reduce any environmental impact and that the

possibility of chemical precipitates to be present in flowback be addressed in the SGEIS .

6.2 Floodplains

The GEIS summarizes the potential impacts of flood damage relative to mud or reserve pits, brine and oil tanks, other fluid tanks, brush debris, erosion and topsoil, bulk supplies (including additives) and accidents. Severe flooding is described as "one of the few ways" that bulk supplies such as additives "might accidentally enter the environment in large quantities."

As described in some detail in Chapter 2, the area of under consideration undergoes frequent and severe flooding. Not including severe local flash floods, Otsego County alone has had 3 federally declared emergencies or disasters related to severe storms and flooding in the last 4 years. While the dSGEIS references information provided in the 1992 GEIS on various contaminates that may enter the environment during a flood event, it does not account for the flowback pits proposed in the new high-volume hydraulic horizontal fracturing process being reviewed here or describe what the environmental impact to aquatic ecosystems that would result should those potential contaminants be introduced during a flood.

Additionally, by definition, floodplain areas are within very close proximity to waterways, closing the distance between the proposed activities and the aquatic environmental resources that are the primary emphasis of the protection efforts intended here.

Given the amount of concentrated chemicals likely to be present on site during the fracturing process (estimated at 87,000 gallons per well above using the 2% or less estimate provided in the dSGEIS, section 5.4.3 of these comments) and the amount of flowback liquid anticipated to be on-site afterwards (>1 million gallons) and the proximity to the states water resources and the vulnerability of the area under consideration to severe storms, localized flash floods and regional flooding events, locating well pads in the floodplain is inherently dangerous.

As mentioned in section 3.2.1.3, well pad siting is a point in the new process from which many environmental concerns stem and therefore is the component of the permitting process where the most protection of the environment can be derived. In other words, the decision not to site well pads in environmental sensitive areas or under some circumstances, eliminates a host of potential impacts and best protects the environment.

It is therefore recommended that no permits be issued for the new high-volume hydraulic horizontal fracturing process being reviewed here that are proposed to take place within established floodplains. It is further recommended that the SGEIS

describe what the environmental impact to aquatic ecosystems would be should the chemicals anticipated to be present on site be introduced during a flood.

6.X Primary and Principal Aquifers

"About one quarter of New Yorkers rely on groundwater as a source of potable water."

"Because they are largely contained in unconsolidated materials, the high permeability of Primary and Principal Aquifers and shallow depth to the water table, makes these aquifers particularly susceptible to contamination."

As noted throughout these comments on various aspects of the new high-volume hydraulic horizontal fracturing process being reviewed here, section 6.X also does not describe the potential environmental impacts from spills or discharges of either the chemicals used in the fracturing process (either in concentrated or dilute form) or flowback liquids or brine, stormwater or any of the other chemicals that can be anticipated to be on site (including diesel fuel or chemicals related to the on-site treatment process) to primary and principal aquifers. Aquifers commonly follow major rivers and tributaries to which they are hydrologically connected. This connectivity, in addition to the high permeability and shallow depth noted above, make aquifers and their associated waterways 'particularly susceptible to contamination'.

Given the number of ways contamination can occur during this process as described in the dSGEIS, the large quantities of chemicals and flowback liquids involved and the dependency of some municipalities and private residences on these aquifers as sources of potable water and their connectivity to major aquatic systems, placement of well pads above primary and principal aquifers represents, similar to well pads in floodplains, an avoidable risk.

It is recommended that descriptions of the environmental impacts of potential spills or discharges of the chemicals intended for use in the fracturing process (either in concentrated or dilute form, to the degree they are known), flowback liquids and brine (to the degree that it is known), stormwater and associated nutrients or any of the other chemicals that are anticipated to be on-site (including diesel fuel or chemicals related to the on-site treatment process) to primary and principal aquifers be described in the SGEIS. Further, and following the precept that when potential impacts to the environment can be avoided by the regulatory process that they be, it is further recommended that no permits be issued for the new high-volume hydraulic horizontal fracturing process being reviewed here be issued for activities that are proposed to take place over primary and principal aquifers.

6.3 Freshwater Wetlands

"State regulation of wetlands is described in Chapter 2. The GEIS summarizes the potential impacts to wetlands associated with interruption of natural drainage, flooding, erosion and sedimentation, brush disposal, increased access and pit location. Potential impacts to downstream wetlands as a result of surface water withdrawal are discussed in Section 6.1.1.4 of this Supplement. Other concerns described herein relative to stormwater runoff and surface spills and releases, including from centralized flowback water surface impoundments, also extend to wetlands."

The text provided above (6.3 Freshwater Wetlands), is the extent to which the dSGEIS describes potential environmental impacts of the new high-volume hydraulic horizontal fracturing process being reviewed here on wetlands. While the 1992 GEIS is referenced on some aspects of the anticipated activities, other concerns regarding potential impacts of spills, discharges (of either the chemicals involved in the fracturing process in either concentrated or dilute form, chemicals contained in the flowback and brine liquids, stormwater, or other chemicals that may be on-site) are not provided in the dSGEIS as they would apply to wetlands or most ecosystems (or their biological components).

As noted above and throughout, having information pertaining to the potential environmental impact on wetlands from the proposed activities is fundamental to accurately assessing those impacts. Wetlands provide many valuable services to the landscape (nutrient and pathogen retention, flood attenuation, etc…), provide critical habitat for species specialized for that habitat (wetland flora, amphibians, etc…) and habitat for migrating avian species. Wetlands are dependent on the presence of water; although the GIES and the dGEIS describe how changes in hydrology may occur, they do not address the potential environmental impact of changes in hydrology resulting from the large scale water consumption anticipated here.

Given the lack of information provided on potential environmental impact and the importance of wetlands in providing a filtering effect on the waterbodies (and by extension their best uses) within the area under consideration, it is recommended that the SGEIS describe potential impacts from spills, discharges (of either the chemicals involved in the fracturing process in either concentrated or dilute form, chemicals contained in the flowback and brine liquids, stormwater, or other chemicals that may be on-site) on wetland ecosystems and provide guidance on best management practices.

6.4 Ecosystems and Wildlife

"Three areas of concern unique to high-volume hydraulic fracturing are: 1) water withdrawals for hydraulic fracturing; 2) potential transfer of invasive species as a result of activities associated with high-volume hydraulic fracturing; and 3) use of centralized flowback water surface impoundments."

Section 6.4 is uncommon in comparison the other sections provided in the dSGEIS in that it does briefly describe environmental impacts to wildlife relative to invasive species and centralized flowback impoundments. However, no account is given to ecosystems (of any type) in regards to potential environmental impacts from contamination resulting from spills or discharges containing flowback liquids, any information on potential environment impact on ecosystems of any type or wildlife from spills or discharges from fracturing fluids or the chemicals from which it is made, or, despite its identification as a area of concern, water withdrawals for hydraulic fracturing. As noted throughout the comments provided here, understanding the potential impacts of the various components of the new high-volume hydraulic horizontal fracturing process being reviewed on ecosystem types found throughout the area under consideration and their biological components is critical to the ability to accurately assess those impacts and provide guidance on best management practices meant to protect their function, services and ability to provide best uses.

It is therefore recommended that the SGEIS include the potential environmental impacts to the ecosystems types found within the area under consideration from contamination resulting from spills or discharges containing flowback liquids, from spills or discharges from fracturing fluids or the chemicals from which it is made and water withdrawals for hydraulic fracturing.

6.5.1.1 Air Quality; Well Drilling and Hydraulic Fracturing Operations

"Oil and gas drilling rigs require substantial power to drill and case wellbores to the depths of hydrocarbon deposits. In the Marcellus Shale, this power will typically be provided by transportable diesel engines, which generate exhaust from the burning of diesel fuel."

As a Soil and Water Conservation District, the comments offered here are limited to soil and water resources and the ecosystems of which they are critical components. However, air quality does have an impact as NOx (hundreds of tons per year per well for multi-pad wells with 10 wells) and particulates settle in and on these resources through atmospheric deposition. This represents a considerable amount of additional material that can be expected to be introduced into the environment as a result of the new high-volume hydraulic horizontal fracturing process being reviewed here. Potential environmental impacts to aquatic and terrestrial ecosystems from atmospheric deposition as a result of diesel fuel consumption are not addressed in the dSGEIS.

In the interest of being able to accurately assess the environmental impact of the activities being proposed here, it is recommended that the impact of atmospheric deposition, as a result of on-site diesel fuel consumption, on aquatic and terrestrial ecosystems be described in the SGEIS.

6.7 Centralized Flowback Water Surface Impoundments

"The potential impacts associated with use of such impoundments that are identified in several sections above and are summarized here."

"Potential soil, wetland, surface water and groundwater contamination from spills, leaks or other failure of the impoundment to effectively contain fluid. This includes problems associated with liner or construction defects, unstable ballast or operations-related liner damage. Potential soil, wetland, surface water and groundwater contamination from spills or leaks of hoses or pipes used to convey flowback water to or from the centralized surface impoundment…"

The text above, taken from the dSGEIS, states that potential impacts from flowback impoundments are identified in several sections of the document. As noted throughout these comments, the description of potential pathways of contamination, which are summarized in section 6.7, do not constitute a description of the impacts as a result of contamination via the pathways described. For example, the statement that 'Potential soil, wetland, surface water and groundwater contamination from spills or leaks of hoses or pipes used to convey flowback water to or from the centralized surface impoundment' is not descriptive of the impact of such contamination.

As mentioned throughout these comments, this makes an accurate assessment of the practice in regards to environmental impact, from information provided in the dSGEIS, impossible. In regards to surface impoundments of flowback liquids, this is compounded by the incomplete information provided in the dSGEIS on the chemical composition of flowback liquid (and concentration) is it is produced and over time. The area under consideration undergoes flooding conditions (either locally or regionally) on a regular basis. Unlike other similar man-made structures (ponds, wetlands, etc…) flowback liquid impoundments will not have structural features meant to protect its stability from overflow – outlets or spillways. Although these other structures typically have in-lets, which flowback impoundments will not, the dSGEIS does not take into consideration the potential for flooding, either in the form of precipitation entering the impoundment directly or increases in groundwater movement/pressure as it may impact the geomembrane, to impact the stability of the impoundment.

Additionally, the storage of millions of gallons of flowback liquid (the chemical composition of which is not entirely known) in open pits throughout the area under consideration represents a part of the process being reviewed here where there is the potential negative environmental impacts as there is no reliable barrier between the potential contaminant and the environment. The potential for leakage described in the dSGEIS and the potential for overtopping (and perhaps failure) due to flood events, the composition of the liquid (at production and over time to the degree that it is known) and the lack of information provided on the resulting environmental impacts

of introduction, warrants the implementation of the most protective best management practices.

Lastly, and adding to the concern regarding potential leakage and failure, the flowback impoundments, as described above, are not subject to dam safety regulations regardless of size (either berm height or gallons held) or potential threat to down hill features such as homes, infrastructure, etc... Considering the size of some the impoundments currently being proposed (up to 5 acres holding 16 million gallons of potential contaminate) and their contents (and associated potential environmental impacts), not holding the construction of the impoundments meant to contain flowback liquids to the same rigorous dam safety regulations in place for freshwater impoundments (which pose considerable less potential environmental impact in that they hold water devoid of any chemical additive, chemical compound formed during the fracturing process, naturally occurring, yet environmentally harmful substances or potential treatment chemicals that would be present in flowback liquid) does not provide the most environmental protection possible.

It is therefore recommended that closed- loop systems be required for the handling, treatment and storage of flowback liquid, drillings and muds for all permits be issued for the new high-volume hydraulic horizontal fracturing process being reviewed here. It is further recommended that the SGEIS contain descriptions of the environmental impacts on the environment (aquatic and terrestrial ecosystems) and their impact on best uses that are likely to be encountered should flowback liquids be discharged or leaked from surface impoundments.

6.8 Naturally Occurring Radioactive Materials in the Marcellus Shale

"Chapter 4 explains that the Marcellus shale is known to contain NORM concentrations at higher levels than surrounding rock formations, and Chapter 5 provides some sample data from Marcellus Shale cuttings. Activities that have the potential to make the radioactive material more accessible to human contact or to concentrate these constituents through surface handling and disposal may need regulatory oversight to ensure adequate protection of workers, the general public, and the environment. Gas wells can bring NORM to the surface in the cuttings, flowback fluid and production brine, and NORM can accumulate in pipes and tanks (pipe scale.)"

"Oil and gas NORM occurs in both liquid (produced waters), solid (pipe scale, cuttings, tank and pit sludges), and gaseous states (produced gas). Although the largest volume of NORM is in produced waters, it does not present a risk to workers because the external radiation levels are very low. However, the build-up of NORM in pipes and equipment (scale) has the potential to expose workers handling (cleaning or maintenance) the pipe to increased radiation levels. Also filter media from the treatment of production waters may concentrate NORM and require controls to limit radiation exposure to workers handling this material."

As with other potential contaminates, the dSGEIS does describe potential sources of NORM contamination. This section also speaks to the potential risks to drill pad workers. However, and as seen throughout the document, the section does not provide information on the impacts of NORM contamination to any of the ecosystems (stream, river, wetland, forest, etc...), or their biological components, located within the area under consideration. Additionally, the new high-volume hydraulic horizontal fracturing process being reviewed here applies to all low-permeability formations. Data supplied in the dSGEIS only pertains to the Marcellus and no information is provided regarding the applicability of this information to other formations (the Utica, for example).

Additionally, and as noted above, recent information provided by DOH on NORM levels has been found to be much higher than those anticipated – 10,000 times the drinking water standard. Lastly, NORM levels have been found to increase in flowback as time goes on. Information relative to this dynamic and its potential for increasing environmental impact are also not provided in the dSGEIS. As with other potential contaminants, information on the potential impacts on the ecosystems and biological components that inhabit them is critical to assessing the activities being proposed here and to the ability to regulate activities and prescribe best management practices meant to protect those ecosystems, their function, services and best uses.

It is therefore recommended that the SGEIS re-evaluate assumptions on NORM's present in the dSGEIS, contain descriptions of the potential environmental impact from introduction of NORMS from cuttings, flowback liquid and production brine to aquatic and terrestrial ecosystems, prescribe best management practices and provide the appropriate regulations for protection of the environment.

6.13.1 Site-Specific Cumulative Impacts

"The potential for site specific cumulative impacts as a result of multi-well pads, while real, is easily quantified and can be adequately addressed during the application review process. General areas of concern with regard to noise, visual, and community character issues are the same as those of individual well pads. While the pads may be slightly larger than those used for single wells, the significant impacts are due to the cumulative time and trucking necessary to drill and stimulate each individual well."

6.13.2 Regional Cumulative Impacts

The level of impact on a regional basis will be determined by the amount of development and the rate at which it occurs. Accurately estimating this is inherently difficult due to the wide and variable range of the resource, rig, equipment and crew availability, permitting and oversight capacity, leasing, and most importantly, economic factors.

As discussed earlier, the density for multi-well pads, one per 640-acre spacing unit, is significantly less than for single well pads, reducing the total number of disturbances to the landscape. While multi-well pads will be slightly larger than single well pads the reduction in number will lead to a substantial decrease in the total amount of disturbed acreage, providing additional mitigation for long term visual and land use impacts on a regional basis.

While section 6.13.1 does describe and take into account the site-specific cumulative impacts of noise, visual, and community character, it does not describe the potential cumulative impacts to the environment. Such site-specific cumulative impacts could include the potential for repeated or chronic small volume spills or leaks of any of the chemicals or chemical containing fluids (including brine) and NORM's as discussed, the impacts of atmospheric deposition of NOx and particulates generated from on-site engine emissions, the potential for more large scale spills or leaks of the above mentioned fluids or, more appropriately, the potential cumulative impacts of all.

For regional cumulative impacts, the 640-acre spacing unit does provide the benefits described above and reduce, by virtue of fewer well pads, the number of places where the types of spills, leaks and discharges and potential environmental impacts, discussed throughout these comments but largely not described in the dSGEIS, could take place.

However, this 640-acre spacing unit is an option and the utilization of the 40-acre spacing unit (where one well is drilled per pad) would largely negate these benefits; increasing the potential impact on a regional scale. Similar to the section on site-specific cumulative impacts, the section on regional cumulative impacts does not describe the potential impacts to the environment for the area under consideration as a whole. The 100% success rate described in the dSGEIS for wells drilled in PA and the annual increase in permits issued there (10-fold increase in a 3-year period) does indicate the use of the new high-volume hydraulic horizontal fracturing process being reviewed here has the potential to become widespread in NY. The impacts to wetlands, streams, rivers, aquifers, forested landscapes, agricultural land uses etc…and their biological components (all of which play a critical role in the best uses of the States water resources) from water consumption, the potential discharges of the type described above and atmospheric deposition does have the potential to have a cumulative impact on the environment at the regional scale.

Additionally, NYS ECL (Article 3 Title 3) states that it is the responsibility of the department to carry out the environmental policy of the State, described in section 1-0101, includes the following: "Promote and coordinate management of water, land, fish, wildlife, and air resources to assure their protection, enhancement, provision, allocation, and balanced utilization consistent with the environmental policy of the state and take into account the cumulative impact upon all of such resources in making any determination in connection with any license, order, permit, certification

or other similar action or promulgating any rule or regulation, standard or criterion;"

Considering the potential for cumulative environment impacts, both on the site-specific and regional scale, the importance of an evaluation of such impacts to the ability to accurately assess the new high-volume hydraulic horizontal fracturing process being reviewed in regards to the environment and the language within ECL describing the need for such assessments in issuing permits for the protection of water, land, fish, wildlife, and air resources, it is recommended that the SGEIS contain descriptions of the cumulative environment impacts, both on the site-specific and regional scale, of the activities being reviewed here.

Chapter 7 – Mitigation Measures

"Many of the potential impacts identified in Chapter 6 are mitigated by existing regulatory programs, both within and outside of DEC. These are identified and described in this chapter, along with recommendations for enhanced procedures and permit conditions necessitated by the unique aspects of horizontal drilling and high-volume hydraulic fracturing. In addition, the proposed EAF Addendum contains a series of informational requirements, such as the disclosure of additives, the proposed volume of fluids used for fracturing, the percentage weight of water, proppants and each additive, and mandatory pre-drilling plans, that also serve as mitigation measures. As with Chapter 6, this Supplement text is not exhaustive with respect to mitigation measures because it incorporates by reference the entire 1992 GEIS and Findings Statement. This document focuses on:

1) mitigation of impacts not addressed by the GEIS (e.g., water withdrawal) and

2) enhancements to GEIS mitigation measures to target potential impacts associated with horizontal drilling, multi-well pad development and high-volume hydraulic fracturing.

Although every single mitigation measure provided by the GEIS is not reiterated herein, such measures remain available and applicable as warranted."

The new high-volume horizontal hydraulic fracturing process being reviewed here has several components that are unique to it and are wholly different from the types of activities typically regulated by existing programs. For example, the presence of large surface impoundments containing flowback liquids that have chemicals, and to some degree, are radioactive (conditions that change over time; increases in acidity and radioactivity) is significantly different in their potential impacts to the environment than other activities typically undertaken to date: typical commercial and residential development, agricultural operations, etc… Additionally, although the new process being reviewed here has similar aspects to the permitted activities under consideration in the 1992 GEIS and its supporting documents , the components that have been deemed different in the dSGEIS (volume of water consumption and drilling duration) have enough of an altering effect on the nature of the components deemed to be similar, that conclusions and proposed mitigation methods described in 1992 may no longer be applicable.

Although there is little doubt that the proposed EAF addendum will result in the reporting of more information than otherwise would have been in the case, the dSGEIS does not describe how this additional reporting, in and of itself, is a process that will lessen the potential impact on the environment. Also, in respect to information requested about additives, it has been noted above that the chemical composition of additives will differ by purpose and, in cases where the purpose of different additives is the same, by manufacturer and that the concentrations of

chemicals within the additives is not known. This does not change with the informational requirements of the EAF addendum. Considering the amount of additives to be on site during the fracturing of one well, the number of wells per pad and the number of pads throughout the area under consideration (again wholly different than most activities permitted by the State to date), this information is critical to assessing the potential environmental impact of the new high-volume horizontal hydraulic fracturing process being reviewed here.

Mitigation measures have a cost associated with them. Mineral resources exploitation is largely a commercial endeavor meant to be profitable. To the degree that mitigation methods increase costs, they will also reduce net profits. Although industry has an interest in being good environmental stewards during their activities, it is not known if this will take priority over their commercial motivation. That is to say that when mitigation methods are 'recommended' and are 'available', there remains the possibility that they will not be implemented if seen to be in conflict with the profitability of the operation.

It is recommended, that the SGEIS be written as a stand-alone document, not relying on the conclusions of the 1992 GEIS and its supporting documents, and where similarities exist between the 1992 documents and the new process being reviewed here, that the SGEIS describe mitigation methods in the context of the new process. It is also recommended that the new high-volume horizontal hydraulic fracturing process being reviewed here be considered as significantly different than most activities covered under existing regulatory programs and that the SGEIS describe a regulatory framework specific to this process. It is recommended that the EAF addendum contain requests for information that include the chemical composition of the additives being proposed (including concentrations) and that all mitigation methods described in the SGEIS, or in the 1992 GEIS, to the degree that they are applicable, be required by the State.

7.1.1.1 NYSDEC Jurisdictions

Section on degradation of water use. "This water quality standard generally prohibits any alteration in flow that would impair a fresh surface waterbody's designated best use.1 Determination of an appropriate passby flow needs to be done on a case by case basis. However, the TOGS that is necessary to provide effective guidance on the application of the narrative water quality for flow has not been promulgated. For the purpose of this SGEIS only, the Department intends to employ the Natural Flow Regime Method as an interim protection measure in lieu of the flow standard pending completion of the flow standard TOGS."

Section on reduced streamflow. "The requirements of 6 NYCRR 601 pertain to public water supply withdrawals and include an application that describes the project (map, engineer's report and project justification) and the proposed water withdrawal. The

applicant is required to identify the source of water, projected withdrawal amounts and detailed information on rainfall and streamflow."

Section on impacts to aquatic ecosystems. "6 NYCRR Part 608 regulates the use and protection of waters in the state, and has subparts that address the protection of fish and wildlife species. Under Part 608.2, "No person or local public corporation may change, modify or disturb any protected stream, its bed or banks, nor remove from its bed or banks sand, gravel or other material, without a permit issued pursuant to this Part". The Department reviews permits for changes, modifications, or disturbances to streams with respect to potential environmental impacts on aquatic, wetland and terrestrial habitats; unique and significant habitats; rare, threatened and endangered species habitats; water quality; hydrology; and water course and waterbody integrity. Part 608 does not regulate disturbances of the many streams classified as "C" or below."

Section on impacts to wetlands. "Actions located within 100 feet of wetlands regulated by Article 24 of the ECL generally require a permit from DEC. Thus, the placement of a structure to withdraw surface water or to withdraw groundwater within 100 feet of the wetland requires a permit. Permits for these structures can only be granted if there is no alternative to placement within 100 feet. If there is no alternative location, a permit can only be granted if the structure has no impact on the wetlands or if that impact is outweighed by an economic and social need."

Section on aquifer depletion. "The concern for aquifer depletion due to increased ground water use in New York currently is being reviewed and addressed by the DEC. The Department's Division of Water's Pump Test Procedures for Water Supply Applications in conjunction with the SRBC's aquifer testing protocol will be used to evaluate proposed groundwater withdrawals for high-volume hydraulic fracturing."

Understanding the regulations meant to protect the environment is critical to an accurate assessment of, and therefore comment on, those regulations. If technical & operational guidance documents will dictate how water consumption will be regulated as the activity being reviewed here is undertaken, then established TOGS are necessary before the permitting of that activity.
Water withdrawals from smaller water bodies where the margin for error is smaller, can have negative environmental impacts should those projected withdrawal amounts exceed the appropriate passby on any given day. The requirement of site specific flow data is critical to avoiding over consumption. In regards to aquatic ecosystems, as described in the dSGEIS, 6 NYCRR Part 608 has no previsions regarding water consumption.

Similarly, the section on impacts to wetlands does not describe the potential impacts to wetlands as a result of the high-volume water withdrawal. Withdrawals, particularly the high volume withdrawal of ground water over time, taken over 100 ft away could impact the hydrological cycle of an ecosystem, impacting the nature of

the wetland. Wetlands have a very large cumulative impact on how a watershed (at any scale) functions through flood attenuation, its ability to retain sediment, nutrients and pathogens and its biodiversity. These ecosystem services have an economic value in the area under consideration as increased regulation to reduce sediment and nutrients is anticipated from the EPA for the Upper Susquehanna River watershed in NY.

Similar to the TOGS on passby requirements, the protocol to evaluate proposed groundwater withdrawals for high-volume hydraulic fracturing is still under development and cannot be accurately described in the dSGEIS. Aquifer depletion, the alteration of groundwater movement and water table elevations has the potential to also impact streams and their best uses during dry-weather, base flow.

It is recommended that the SGEIS contain the TOGS on passby and the requirements and guidance regarding groundwater withdrawals. It is also recommended that the SGEIS describe mitigative requirements on water withdrawal in regards to streams and wetlands and that potential impact to hydrology and function be taken into account when considering economic and social need.

7.1.1.3 Other Jurisdictions – Susquehanna River Basin Commission Jurisdictions

Section on reduced streamflow. "The SRBC primarily uses the following regulations, procedures and programs to address potential impacts of reduced stream flow associated with a water taking: Consumptive use regulations; Mitigation measures; Conservation measures and water use alternatives; Conservation releases; Evaluation of safe yield (7-day, 10-year low flow); Passby requirements; Monitoring and reporting requirements; Aquifer testing protocol."

7.1.1.5 Cumulative Water Withdrawal Impacts

"New York State regulations do not address water quantity issues in a manner consistent with those applicable within the Susquehanna and Delaware River Basins with respect to controlling, evaluating, and monitoring surface water and ground water withdrawals for shale gas development. The application of the Natural Flow Regime Method to all surface water withdrawals to support the subject hydraulic fracturing operations is an option to comprehensively address cumulative impacts on stream flows. Adverse cumulative impacts could be addressed by the Natural Flow Regime Method described above if each operator of a permitted surface water withdrawal estimated or reported the maximum withdrawal rate and measured the actual passby flow for any period of withdrawal. This is because the stream gauge measurements which govern the pass by flow calculation reflect the natural hydrograph of an unregulated stream and do not take into account pre-existing or upstream withdrawals."

The SRBC regulations in the dSGEIS are well described. Particular attention was paid to maximum water withdrawals (ground and surface) under a variety of settings and describes modifications of the Natural Flow Regime Method so that it better reflects natural variation in flow. However, much of the data required for areas where little or no flow (cfs) information is readily available relies on extrapolation from data taken in from elsewhere. This practice, particularly when applying data recorded at a larger scale to a smaller area, is an estimate and may not reflect conditions on the ground at any given time. This is compounded by the nature of much of the precipitation in the area under consideration which is known to have heavy localized events (i.e. significantly effecting one watershed or basin, but not another).

The existence of such complex and wide ranging rules indicates the difficulty in guaranteeing protection of the States water resources form excess withdrawal, particularly for smaller streams and areas where groundwater information is also hard/impossible to obtain. Additionally, the complexity of the flow regimes and groundwater conditions sometimes results in over simplification of remote assessment tools and a reluctance to collect the mid to long- term data in the field that would yield the best results. The potential impact of excess withdrawal is reduced as the size of the waterbody the water is being taken from increases.

Given the smaller margin of error when dealing with groundwater and small sources of surface water and following the precepts made above, that environmental considerations should take precedence over other interests and when an alternative is available that reduces the potential environmental impact that it be made a requirement of the process, it is recommended that the SGEIS require all water withdrawals for the new high-volume hydraulic horizontal fracturing process being reviewed here be made from the main stem of the areas major rivers or suitably large lakes. It is also recommended that the State adopt similar assessment tools and methods as the SRBC to ensure continuity across jurisdictions.

7.1.2 Stormwater

“The principal control mechanism to mitigate negative impacts from stormwater runoff is to develop, implement and maintain comprehensive Stormwater Pollution Prevention Plans (SWPPP).”

“The Department has determined that natural gas well development using high-volume hydraulic fracturing is eligible for inclusion in Sector AD of the Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity (GP-0-06-002) (MGSP).27 The Department is proposing the option of amending this Multi-Sector General Permit to address a number of potential pollutant discharges associated with the subject operations. As discussed below, the Department is proposing a method to terminate the application of the MSGP after completion of major operations.”

"SWPPPs shall be prepared in accordance with good engineering practices and DEC's General Permit for Construction Activity. Inspections and documentation of inspections must be initiated upon commencement of construction activities and continue until coverage under the MSGP has been appropriately terminated."

7.1.2.2 Industrial Activities

"The MSGP will be revised as necessary to incorporate a required SWPPP for industrial activities to address potential sources of pollution which may reasonably be expected to affect the quality of stormwater discharges associated with industrial activity from Marcellus Shale and other low-permeability gas reservoir hydraulic fracturing operations."

Creation and implementation of a SWPPP is critical to reducing the potential impact to the environment as a result of stormwater runoff; sediment and nutrient loading and conveyance of other chemicals are at risk to mobilization during a rain or snow melt event. The new high-volume hydraulic horizontal fracturing process being reviewed here has components that fit within this second category. The MGSP, as noted above, covers the extensive protocol for development of a SWPPP, what should be included and how it is to be maintained, inspected, documented and terminated. However, the dSGEIS does not describe mitigation activities that are specific to the activity propose here. Similar to attempting to weigh the impact to the environment from the proposed activity when the impact is not described (as noted throughout these comments), commenting on the mitigation actions that may be required for development of low-permeability formations is not possible without a description of those actions.

Given the size of the operations being reviewed (individually and cumulatively), topography and the ubiquitous nature of surface water in the area under consideration, the impact known to occur to the environment from mismanaged construction sites and the probability of significant rain events during the course of the anticipated operations, proper SWPPP design, implementation and maintenance is critical. Familiarity with the site, beyond what can be gained from remote techniques, and with NYS regulations will result in better SWPPP's.

From experience with the level of adherence to the stormwater regulations for construction sites, the effectiveness of regulations is compromised by light enforcement. This is a result of the number of field staff relative to the number of sites requiring coverage. However, requirements by the State to have all engineers and contractors involved in such operations that disturb greater than one acre gain certification in the practices commonly used in SWPPP's is expected to improve compliance.

It is recommended that revisions to the MGSP for the activity being reviewed here be made prior to and be included in the writing of the SGEIS. It is also recommended

that engineers be licensed in NY, be required to visit the site when developing SWPPP's and that contractors and excavators be required to attend the States 4-hour training course in SWPPP implementation.

7.1.3.1 Drilling Rig Fuel Tank and Tank Refilling Activities

The diesel tank associated with the larger rigs described in Chapter 5 may be larger than 10,000 gallons in capacity and may be in one location on a multi-well pad for the length of time required to drill all of the wells on the pad. However, the tank is removed along with the rig during any drilling hiatus between wells or after all the wells have been drilled. There are no long-term or permanent operations at a drill pad which require an on-site fuel tank. Therefore, the tank is considered non-stationary and is exempt from the Department's petroleum bulk storage regulations and tank registration requirements.

"To the extent practical, the Department will encourage operators to position the tank more than 500 feet from these water resources."

"The comprehensive Stormwater Pollution Prevent Plan (SWPPP) that is required by the Department's Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity (GP-0-06-002) (MSGP) will include Best Management Practices to minimize or eliminate pollutants in stormwater. Such BMPs include, but are not limited to, a combination of some or all of the following, or other equally protective practices:
Identification of a spill response team and employee training on proper spill prevention and response techniques, Inspection and preventative maintenance protocols for the tank(s) and fueling area, Procedures for notifying appropriate authorities in the event of a spill, Procedures for immediately stopping the source of the spill and containing the liquid until cleanup is complete, Ready availability of appropriate spill containment and clean-up materials and equipment, including oil-containment booms and absorbent material, Disposal of cleanup materials in the same manner as the spilled material, Use of dry cleanup methods and non-use of emulsifiers or dispersants,…."

The portion of section 7.1.3.2 dealing with the components SWPPP's relative to spill containment could also be very helpful to local first emergency personnel who may be responding to an incident involving the spill or discharge of flowback liquid and chemicals in their concentrated form.

Given their necessity to drilling operations, their size and the duration of stay, it is recommended that diesel tanks greater than 10,000 gallons and on site greater than 1 month be considered stationary and be required to gain coverage under the Departments petroleum bulk storage regulations and tank registration requirements and that exemptions, if the tank is removed for any reason, be made on a case by case determination during the permitting process and field verified. It is also

recommended that local officials be provided similar information and training regarding the response procedures to spills of the nature anticipated to potentially occur with the activity proposed.

7.1.3.2 Drilling Fluids

"Regulations require that pit fluids must be removed within 45 days of cessation of drilling operations (includes stimulation), 'unless the department approves an extension based on circumstances beyond the operator's control. The Department may also approve an extension if the fluid is to be used in subsequent operations according to the submitted plan, and the department has inspected and approved the storage facilities.'"

"Pits used for more than one well will be used for a longer period of time. 'The containment of fluids within a pit is the most critical element in the prevention of shallow ground water contamination.'"

7.1.3.3 Hydraulic Fracturing Additives

7.1.3.4 Flowback Water

The GEIS addresses use of the on-site reserve pit for flowback water associated with a single well. However, even in the single-well case, potential flowback water volumes associated with high-volume hydraulic fracturing exceed GEIS descriptions. Estimates provided in Section 5.11.1 are for 216,000 gallons to 2.7 million gallons of flowback water recovered within two to eight weeks of hydraulic fracturing a single well. The volume of flowback water that would require handling and containment on the site is variable and difficult to predict, and data regarding its likely composition are incomplete. Therefore, the Department proposes a requirement that flowback water handled at the well pad be directed to and contained in steel tanks.

Although the impact of contamination on the environment is not covered within the dSGEIS, as noted above, it does alluded to storage of flowback liquid within an open pit as representing a component of the new high-volume hydraulic horizontal fracturing process here that has the potential for significant negative environmental impact. This is in part due to the volume associated with the new practice, the limited availability on the chemical composition of the flowback and chemical reactions over time and the potential for liners and other means of separation to fail. As noted with regard to water withdrawals above, when an alternative is available that reduces the potential environmental impact, it should be made a requirement of the process

Closed-loop systems, where flowback liquids are continually and reliably separated from the environment by metal tanks represents the best management practice most effective at reducing potential contamination of groundwater (through leakage) and

surface waters (through potential over topping, spilling and failure). Potential leakage from a closed loop system would be easier to detect as it would be visible to the eye and therefore dealt with in a timely manner. Closed loop systems also eliminate many of the issues related to site reclamation and disposal inherent in the impoundment concept. Closed-loop systems would also provide separation of the flowback liquid from any chemicals used during the treatment period.

Additionally, this section describes many mitigation activities, particularly as they relate to the proper implementation of the site's SWPPP, that should result in the reduction of potential contamination of the States soil and water resources. However, the dSGEIS does not describe who will performing these activities, what certification/training (if any) is needed to accomplish these tasks and whether or not (or to what degree) Department staff will be inspecting each site at the appropriate time to ensure compliance. This level of oversight is considerable and would require a significant resources and field presence. Oversight and inspection are crucial to compliance and accountability.

It is therefore recommended that the mitigation activities required in the SGEIS be inspected by Department staff at the appropriate intervals, depending on BMP, and that the resources needed to properly staff this effort be incorporated into the drilling fee. In line with the states intentions, it is also recommended that closed-loop systems be made a requirement of any planned activity using the new high-volume hydraulic horizontal fracturing process being reviewed here.

In the interest of providing the greatest protection possible from accidental discharge concentrated chemicals to the environment, it is recommended that PBS and CBS requirements be made applicable to all non-stationary tanks, all non-stationary tanks, barrels, drums or other vessels that store 1000-Kg of additive, all dry chemical additives regardless of packaging, that all such containers and packages be registered with the State, and that inventory records be maintained on all such containers and packages. It is further recommended that approved mitigative steps resulting in the recovery of spilled material be described and required in the SGEIS and that all spills, regardless of secondary containment and recovery, be reported to the state, that the mitigative steps taken be provided in that reporting and that Department staff perform site visits to verify such actions.

7.1.4 Ground Water Impacts Associated With Well Drilling and Construction

"…issues associated with well drilling and construction relate to ground water and include the following: Baseline water quality testing of private wells within a specified distance of the proposed well; Sufficiency of as-built wellbore construction prior to high-volume hydraulic fracturing, including: Adequacy of surface casing to protect fresh water and to isolate potable fresh water supplies from deeper gas-bearing zones, Adequacy of cement in the annular space around the surface casing, Adequacy of cement on production (and intermediate) casing to prevent upward migration of

fluids during all reservoir conditions, Use of centralizers to ensure that the cement sheath surrounds the casing strings, and the opportunity for state regulators to witness casing and cementing operations and Prevention of pressure build-up in the annular space between the surface casing and intermediate or production casing."

7.1.4.1 Private Water Well Testing

"Supplementary permit conditions for high-volume hydraulic fracturing will require the sampling and testing of residential water wells within 1,000 feet of the well pad, subject to the property owner's permission, or within 2,000 feet of the well pad if no wells are available for sampling within 1,000 feet either because there are none of record or because the property owner denies permission. All testing and analysis must be by an ELAP-certified laboratory,40 and the results of each test must be provided to the property owner and the county health department prior to commencing drilling operations."

"Testing before drilling provides a baseline for comparison in the event that water contamination is suspected. Testing prior to drilling each well at a multi-well pad provides ongoing monitoring between drilling operations, so the requirement will be attached to every well permit that authorizes high-volume hydraulic fracturing. Testing at established intervals after drilling or hydraulic fracturing operations provides opportunities to detect contamination or confirm its absence. If no contamination is detected a year after the last hydraulic fracturing event on the pad, then further routine monitoring should not be necessary."

"Under the proposed protocols, county health departments will receive the results of baseline testing and ongoing monitoring that occurs until a year after the last hydraulic fracturing operations on a well pad. Therefore, they remain in the best position to investigate initial water well complaints from residential well users."

The establishment of water quality base-line data sets it critical to contamination detection. Pre-drilling baselines must be initiated as far in advance and be performed at a frequency necessary to account for natural fluctuations in the parameter being measured (seasonality) over time. Many of the chemicals that are anticipated for use in the new high-volume hydraulic horizontal fracturing process being reviewed here are not listed in the NYS Drinking Water Standard. Sampling for specific chemicals becomes difficult when not all the chemicals, as with flowback liquids, are known and the degree to which indicator parameters can be selected is similarly limited.

Water contamination (surface and ground) concerns extend beyond the 2,000 foot radius described in the dSGEIS. Local streams and creeks, the highly permeable nature of primary and principal aquifers are examples where a potential incident could have impacts beyond this zone. Additionally, where migration of a contaminant, whether chemical or naturally occurring substance, is slower due to the hydraulics of groundwater movement, the time-frame within which such contamination could be

detectable is likely to be long term. Compilation, organization and analysis of the resulting data sets, as well as investigating complaints regarding potential contaminants will be a difficult task and will require resources.

It is therefore recommended that the Department prescribe a water quality sampling protocol that is adequate in terms the frequency of samples collected prior to drilling and is recommended at 1 per month for 12 months, that the Department make this information to the general public and municipalities regardless of their proximity to the anticipated well, provide for sampling of public waters such as groundwater, streams and lakes down hill of the proposed activity and that State derived funds be established and allocated County Health departments so that they can compile, organize, manage and analyze the resulting data and investigate complaints made by the public.

7.1.4.2 Sufficiency of As-Built Wellbore Construction through

"Section on Inspections to Witness Casing and Cementing Operations. "Current casing and cementing practices attached as conditions to all oil and gas well drilling permits require notification to the Department prior to any surface casing pressure test. In primary and principal aquifer areas, the Department must be notified prior to surface casing cementing operations and cementing cannot commence until a state inspector is present. These requirements will continue to apply to wells drilled for high-volume hydraulic fracturing. Supplementary Permit Conditions for High-Volume Hydraulic Fracturing will require notification prior to surface casing cementing for all wells, so that Department staff has the opportunity to witness the operations."

7.1.5 Hydraulic Fracturing Procedure

"As detailed in Section 6.15, potential impacts to ground water from the high-volume hydraulic fracturing procedure itself are, in most cases, not reasonably anticipated. To the extent that any could occur, mitigation is provided by all of the enhanced requirements proposed as Supplementary Permit Conditions for High-Volume Hydraulic Fracturing and discussed above."

"As explained in Section 6.1.5.2, the conclusion that harm to freshwater aquifers from fracturing fluid migration is not reasonably anticipated is contingent upon the presence of certain natural conditions, including 1,000 feet of vertical separation between the bottom of a potential aquifer and the top of the target fracture zone."

As noted above, where the well comes into contact with the water table is of critical importance when assessing potential pathways of contaminates into groundwater. As all the chemical additives mentioned will be passing through the well hole, this area represents very close proximity between the resource being protected and the materials comprising any potential contamination. For this reason all materials

meant to serve as a barrier between fresh groundwater and the potentially harmful chemicals must be guaranteed to be installed correctly and under the proper conditions. Section 7.1.4 describes in detail the many requirements during the casement process and related activities. While industry staff have an interest in protecting the environment in which they work, responsibility for safeguarding that environment from any and all complications rests with the State.

Given the number of ways contamination can occur during this process as described in the dSGEIS, the large quantities of chemicals and flowback liquids involved and the dependency of some municipalities and private residences on aquifers as sources of potable water and their connectivity to major aquatic systems, placement of well pads above primary and principal aquifers represents, similar to well pads in floodplains, an avoidable risk.

Groundwater contamination as a result of the new high-volume hydraulic horizontal fracturing process being reviewed here is a critical component of the range of potential negative environmental impacts of the process. The dGEIS describes a number of iterative steps that can be taken to mitigate vertical fracturing beyond the desired distance that would be appropriate in cases where the target formation is at great depth (>3,000 ft). However, the limited ability to accurately and consistently predict the length of vertical fractures towards the surface in shallow drilling operations, particularly where karst topography exists throughout the area under consideration, posses a significant risk to groundwater as harmful, yet naturally occurring substances could be mobilized into the water table Additionally, the dSGEIS does not state that these iterative steps are required by site operators.

As noted above given the potential for negative impacts to groundwater quality from the chemicals comprising the fracturing fluid (as accidently spilled or discharged),the negative impacts from naturally occurring, yet harmful materials, to the degree that they are known, and the limited information provided regarding the composition of flowback liquids and, following the precept recommended above that environmental protection take precedence over mineral resource exploitation, it is recommended that any proposed high-volume hydraulic fracturing where the top of the target fracture zone is shallower than 2,000 feet along the entire proposed length of the wellbore and any proposed high-volume hydraulic fracturing where the top of the target fracture zone at any point along the entire proposed length of the wellbore is less than 1,000 feet below the base of a known fresh water supply not be permitted.

Further, and following the precept that when potential impacts to the environment can be avoided by the regulatory process that they be, it is further recommended that no permits be issued for the new high-volume hydraulic horizontal fracturing process being reviewed here be issued for activities that are proposed to take place over primary and principal aquifers.

It is also recommended that the mitigation activities required in the SGEIS in regards to surface casings, surface casing cement, intermediate and production casing cement and centralizers including be inspected, documented and certified prior to the commencement of drilling by Department staff at the appropriate intervals, and that the resources needed to properly staff this effort be incorporated into the drilling fee.

7.1.6.1 Drilling and Production Waste Tracking Form

Because of the anticipated high volume of flowback water compared to traditional operations, the paucity of reliable data regarding flowback water and production brine composition, NORM concerns, the number of wells that may be drilled and the current limited disposal options, the Department will require that a *Drilling and Production* Waste Tracking Form be completed and maintained by generators, haulers and receivers of all flowback water associated with activities addressed by this Supplement.

Safe transportation of the flowback liquid resulting from the high-volume hydraulic horizontal fracturing process being reviewed here is critical to the protection of the environment. The potential negative impacts and the limited information available describing the composition of the liquid warrant considerable attention to this issue. As described in the dSGEIS, State DOT regulations regarding the transportation of hazardous materials are quite extensive and developed well beyond what is required by the medical waste form (which does not include chemical composition of contents), including the manifesting of the contents of any transport. Prior knowledge of such activities and of the contents being shipped is crucial to preparedness and the ability to respond to potential accidents and the ability of treatment facilities to handle the liquid satisfactorily.

Until such time that full disclosure can be made regarding the chemical composition of flowback and brine liquid (including concentrations), it is recommended that flowback liquid be considered hazardous materials and that the adherence to the appropriate regulations be required for its handling, storage and transport. It is also recommended that local emergency response officials be given prior notice of when hazardous material will be being transported within their municipal boundaries, that they be given the proper training on how best to respond to accidental spills (that covers the array of chemicals currently known to be involved), that development of protocol be undertaken that outlines who is involved in emergency response (from the driver to the clean up crew) along with phone numbers and the responsibility of each party.

7.1.6.2 Road Spreading

Section on Flowback. “As explained in Chapter 5 and presented in Appendix 12, consistent with past practice, the Department began in January 2009 notifying Part 364 haulers applying for, modifying, or renewing their Part 364 permit that flowback water may not be spread on roads and must be disposed of at facilities authorized by the Department or transported for use or re-use at other gas or oil wells where acceptable to the Division of Mineral Resources.”

Section on Brine. “The notification described above puts Part 364 haulers on notice that any entity applying for a Part 364 permit or permit modification to use production fluid for road spreading must submit a petition for a beneficial use determination (“BUD”) to the Department.”

Brine production, as described in the dSGEIS, can result in large volumes of liquids over the lifetime of the well. Disposal via road spreading would disperse this material over very large areas and put it in proximity and provide connectivity with many of the States streams, creeks and rivers as roadways frequently follow these waterbodies and have features meant to collect, concentrate and discharge runoff to these waterbodies (i.e. road ditches, culverts, etc…). Given the need for additional samples to assess mitigation, handling, treatment options and, presumably environmental impacts, in addition to the recent DOH report where high NORM levels are being encountered, the practice disposal through road spreading represents a potential negative impact to freshwater ecosystems systems, their function, services and best uses.

It is therefore recommended that road spreading of brine solutions not be considered in the SGEIS and that processing at treatment plant be required as a best management practice.

7.1.7.4 Use of Tanks Instead of Impoundments for Centralized Flowback Water Storage

Above ground storage tanks have some advantages over surface impoundments. The Department’s experience is that landfill owners prefer above ground storage tanks over surface impoundments for storage of landfill leachate. Tanks, while initially are more expensive, experience fewer operational issues associated with liner system leakage. In addition, tanks can be easily covered to control odors and air emissions from the liquids being stored. Precipitation loading in a surface impoundment with a large surface area can, over time, increase the volumes of liquid needing treatment. Lastly, above ground tanks also can be dismantled and reused. The provisions of Section 360-6.3 address the minimum regulatory requirements applicable to above ground storage tanks which would be equally applicable for adequate flowback water containment as well.

The text from the dSGEIS regarding the use of tanks (above) and the precept that where best management practices are available that would reduce the potential impact to the environment also supports the recommendation made above that closed-loop systems be required for any permitted activity involving the new high-volume hydraulic horizontal fracturing process being reviewed here.

7.1.8 SPDES-Regulated Discharges

Flowback water and production brine are considered industrial wastewater. Wastewater is generated by many water users and industries.

7.1.8.1 Treatment Facilities

"The large volumes of return water from high-volume hydraulic fracturing combined with the diverse mixture of chemicals and high total dissolved solids (TDS) that exist in both flowback water and produced brine, requires that the permittee submit a headworks analysis to the Department for review in accordance with DOW's Technical and Operational Guidance Series(TOGS)1.3.8."

"Flowback water and produced brine must be fully characterized prior to acceptance by a POTW for treatment."

"Flowback water or produced brine may contain inhibitory amounts of dissolved solids, as well as an elevated pH, residual hydraulic fracturing additives, heavy metals, and potentially barium or other radioactive substances."

"Specific information regarding these fluids, such as chemical makeup and aquatic toxicity, will be required for this analysis."

"However, in no circumstance shall a fracturing additive be approved or evaluated in a headworks analysis without aquatic toxicity data."

As noted throughout the dSGEIS and these comments, information on the chemical composition, and related health and toxicity data, of flowback and brine liquid is limited. Also noted above, the ability for a treatment plant to handle this form of waste safely is dependent on this information. Further complicating the issue is that, to some degree, flowback and brine liquids may also be different from one well pad to another and from one target formation to another and change over time. Information on what chemical compounds may be formed during the fracturing process is also limited. Headworks analysis flowback and brine goes some way to addressing these issues. However, given that treatment of flowback represents the last stage the process before the liquid is discharged back into the environment, every precaution should be taken to ensure it's proper treatment and discharge. Additionally, and as noted above, the classification of flowback liquid as an industrial waste is an

extension of federal exemptions given the industry where environmental considerations may have been given second priority to other considerations.

Until such time that full disclosure can be made regarding the chemical composition of flowback and brine liquid (including concentrations), it is recommended that these liquids be considered hazardous materials and be required to be handled, stored, transported and disposed of accordingly. If this recommendation is not taken, it is recommended that the headworks analysis be made part of a manifesting procedure that ensures knowledge of any particular tanker trucks contents and that local emergency officials be give prior notice as to when transportations are to place as well as provided with the appropriate training and materials needed in the event of a spill.

7.1.8.2 Disposal Wells

Because of the 1992 Finding that brine disposal wells require site-specific SEQRA review, mitigation measures are discussed here for informational purposes only and are not being proposed on a generic basis.

Flowback and disposal strata water quality must be fully characterized prior to permitting and injecting into a disposal well. Additional geotechnical information regarding the disposal strata's ability to accept and retain the injected fluid is also necessary.

Compounding the potential for negative environmental impacts, and as noted in previous sections, the makeup of the flowback liquid at production and over time (both in composition and concentration) is not completely known for the Marcellus formation and not provided for in the dSGEIS on any other low permeability formations being considered here. As noted above, the chemical constituents (and concentrations) of additives to be used in some on-site treatment procedures are also not described. Additionally, the high-volume nature of the process being reviewed here differs significantly with that reviewed under the 1992 GEIS, making conclusions drawn regarding injection wells as a means of disposal less applicable to this process.

Given the incompleteness of what is currently know regarding flowback liquids derived from low permeability formations in NY, the potential for environmental impact from what is known to be included and the volumes involved and the significant differences these circumstances represent when compared to considerations taken into account in the 1992 GEIS, it is recommended that injection wells not be considered until such time as information regarding flowback liquids derived from low permeability formations in NY can be produced and assessed.

7.1.9 Solids Disposal

Cuttings may be managed within a closed loop system or discharged to the lined reserve pit. If cuttings are discharged to the reserve pit and a common reserve pit is used for multiple wells on the pad, cuttings may have to be removed several times to maintain the required two feet of freeboard set forth in Section 7.1.3.2. Care must be taken during this operation not to damage the liner.

While rock cuttings and pit liner are noted as issues to be considered, the dSGEIS does not address solids that will be present in suspension of the flowback liquid (section 5.12.1). These materials can be expected to be anything that becomes mobilized from the zone of production during the fracturing process and returned to the surface during flowback. Considering the possibility of chemical compounds being formed during the fracturing process and as the fracturing fluids and compounds come into contact with material surrounding production zone, there exists the possibility that some of these compounds my precipitate from solution and also be present as solids in the flowback liquid.

It is therefore recommended that solids anticipated to be suspended in the flowback be addressed in the SGEIS to evaluate proper handling, storage and disposal techniques as well as best management practices meant to reduce any environmental impact and that the possibility of chemical precipitates to be present in flowback be addressed .

7.1.12 Setbacks

"The New York State Department of Health (NYSDOH) recognizes separation distances, or setbacks, as a crucial element of protecting water resources against contamination. While the cited reference pertains specifically to drinking water wells, setbacks also mitigate potential impacts to other water resources. As established in the 1992 GEIS with respect to municipal water supply wells, setback distances can be used to define the level of environmental review and mitigation required for a specific proposed activity."

7.1.12.1 Setbacks from Ground Water Resources

"The proposed well and well pad setbacks apply to well permit applications where the target fracturing zone is either at least 2,000 feet deep or 1,000 feet below the underground water supply. These wells would be drilled vertically through the aquifer, so that the aquifer penetration at each well is beneath the well's surface location."

The dSGEIS describes setbacks as a fundamental part of protecting water resources. The distance separating a potential contamination source from a receiving water body can serve to slow migration and absorb and hold chemicals within the soil. This

would include potential contamination from chemicals used in the fracturing process (either in dilute form or concentrated form), flowback and brine liquids (the chemical composition and concentrations and radioactivity levels are not described in the dSGEIS), other chemicals that are anticipated to be on site and stormwater. Setbacks can also been seen as benefiting wildlife that are sometimes specific to the area being avoided (e.g. wetlands).

However, by judging only the lateral distance between a proposed activity and a waterbody leaves out several other principle considerations when judging the width of a buffer. Topography is also a fundamental part of the calculation. In order to slow the migration of a liquid discharge slope must be considered along with volume. Similarly, the degree to which a soil can retain contamination is necessarily dependent on the amount of time the two materials are in contact. In both cases, the steeper the slope, the less these benefit are gained. Other considerations include local hydrology and soil type – which are also heavily influenced by topography – as they relate to effective buffers (areas of concentrated flow and soil permeability). It should be noted that there is considerable area under consideration here dominated by hills and ridges.

Accurate measurements and calculations of these factors results in the proper determination of width. Adoption of the NYSDOH's separation distances in Appendix 5-B of the State Sanitary Code with a determination of a single width to be representative of all sites (grouped only by type of waterbody receiving) will not result in the most appropriate setback width. Without site specific information on topography, hydrology (surface hydrology, areas of concentrated flows, etc..) and soil type (permeability, drainage class, hydrologic soil group, etc..) the benefit of the separation distances will be lost.

The recommendation not to issue permits for the new high-volume hydraulic horizontal fracturing process being reviewed here where the target fracturing zone is either at least 2,000 feet deep or 1,000 feet below the underground water supply was made above in regards to the potential contamination of the water table by naturally occurring materials in the ground that may become mobilized during the fracturing process. However, in regards to setbacks, the potential for accidental surface discharges to reach surface waters is the same no matter the depth.

It is recommended that setbacks from any waterbody (surface or ground) to any operation using the new high-volume hydraulic horizontal fracturing process being reviewed here, at any depth, be determined on-site by slope, surface hydrology and soil type (where buffer width increases with potential volume of contaminate, slope and permeable soil characteristics) and that the setbacks designated for specific water sources described throughout the SGEIS remain as a minimum for those water sources. It is further recommended that this process be used to define the level of environmental review and it be made a part of a suite of mitigation actions that are required for a specific proposed activity.

Section on Public Water Supply Wells. “The Department’s 1992 SEQRA review found that issuance of a permit to drill less than 1,000 feet from a municipal water supply well is considered "always significant" and requires a site-specific Supplemental Environmental Impact Statement (SEIS) dealing with groundwater hydrology, potential impacts and mitigation measures.

These comments note the incompleteness of the information provided within the dSGEIS in regards to the chemical composition (and concentration) for additives proposed to be used in the fracturing fluid, what compounds may be formed when those chemicals interact with each other and the environment around the production zone, the chemical composition of flowback and brine liquids (which are anticipated to be very large in volume) at the time of production or over time and similar information regarding the chemicals that may be used in some on-site treatment activities. These comments also describe the dSGEIS as not providing information on the environmental impacts of potential contamination. This makes assessing mitigative measures not possible. The 1992 SEQRA process and a site-specific Supplemental Environmental Impact Statement (SEIS) do not remedy this issue. The use of surface impoundments to store and treat flowback liquid only adds to the potential environmental risk.

Aquifers and water tables are single unit hydrologically and encompass areas under the surface. Potential contamination to an aquifer or water table from which a well draws its water takes place at the point of entry which is not always represented by the well head.

It is therefore it is recommended that the point of measurement for a groundwater source be the closest edge of the aquifer to the proposed activity and that no operation using the new high-volume hydraulic horizontal fracturing process being reviewed here be permitted to drill unless using the closed-loop system; is less than 1,000 feet from a municipal water supply; is less than 150 feet from a private water well or domestic-supply spring.

7.1.12.2 Setbacks from Surface Water Resources

“Application of setbacks from surface water resources prevents direct flow of the full, undiluted volume of a spilled contaminant into a surface water body. Some amount of soil adsorption or evaporation would occur in the event of a spill. Existing regulations prohibit the surface location of an oil or gas well within 50 feet of any “public stream, river or other body of water.”69 The 1992 GEIS proposed that this distance be increased to 150 feet and apply to the entire well site instead of just the well itself. Based on the above information and mitigating factors, the Department proposes that site-specific SEQRA review be required for the following projects: any proposed well pad within 300 feet of a reservoir, reservoir stem or controlled lake; any proposed well pad within 150 feet of a watercourse, perennial or intermittent stream, storm

drain, lake or pond; any proposed centralized flowback water impoundment within 1,000 feet of a reservoir; and any proposed centralized flowback water surface impoundment within 500 feet of a perennial or intermittent stream, wetland, storm drain, lake or pond."

For the same reasons given above (inadequacy of setback recommendations in the dSGEIS, incomplete information regarding chemical composition of potential contaminates and their potential impacts to aquatic ecosystems) and following the precept that when an single management practice (i.e. siting) can reduce numerous potentially negative impacts that it be taken, it is recommended that no operation using the new high-volume hydraulic horizontal fracturing process being reviewed here be permitted to drill within 150 feet of a watercourse, perennial or intermittent stream, storm drain, lake, pond or wetland.

7.2 Protecting Floodplains

Because of the length of time that activity may continue at a multi-well pad, a closed-loop tank system will be required instead of a reserve pit for managing fluids and cuttings. Additional comprehensive guidelines relative to site construction in flood-prone areas are presented in Chapter 8 of the GEIS.

With respect to fluid disposal plans required under 6 NYCRR 554.1(c)(1), centralized flowback water surface impoundments will not be approved in 100-year floodplains, nor will above-ground flowback water piping and conveyances.

While flowback liquids certainly are a major cause for concern during a flood event, it represents only a portion of the potential contaminates that could enter the environment. The dSGEIS notes that this circumstance is one where large quantities of concentrated chemicals, as they are stored on site, are also at risk as is anything in the floodplain. Additionally, by definition, are within very close proximity to the waterbodies being protected making the distance needed to cause a contamination relatively small (i.e. setback). Given the volumes involved, the uncertainty as to what specific chemicals are in the additives that going to be on site, and uncertainty of the composition of flowback, given the concern of what is known about their composition and what is known about other chemicals that will be on site (diesel fuel), introduction into a waterbody of these materials during a flood event can be expected to have a significant negative impact on the environment.

It is recommended, as above, that no operation using the new high-volume hydraulic horizontal fracturing process being reviewed here be permitted to drill within an established floodplain.

7.3 Protecting Freshwater Wetlands

"Section 2.4.10 summarizes the State's Freshwater Wetlands regulatory program, which addresses activities within 100 feet of regulated wetlands."

"Additional measures proposed in this Supplement include the following:
• Requirement that, to the extent practical, fuel tanks for drilling rigs not be placed within 500 feet of a wetland (Section 7.1.3.1) ; Requirement for secondary containment consistent with the Department's SPOTS 10 for any drilling rig's fuel tank, regardless of size, that is placed within 500 feet of a wetland (Section 7.1.3.1); and Requirement for a site-specific SEQRA determination for any fluid disposal plan submitted pursuant to 6 NYCRR 554.1(c)(1) that includes a centralized flowback water surface impoundment within 500 feet of a regulated wetland (Section 7.1.12.2)."

As noted in the comments above on section xxx, setback widths are best determined on a site-specific basis in the field considering topography, surface hydrology and soil type. These comments also describes the difficulty in making assessments of mitigation activities without complete information on the potential contaminate and the resulting impact. Wetland ecosystems are fragile in that they are dependent on a narrow range of hydrologic conditions and foster unique habitat, biodiversity. Wetlands also benefit the environment by providing such services as reducing flood peaks and retaining sediment, nutrients and pathogens. Because of the nature of the hydrologic connectivity of the groundwater that surrounds whatever surface water may present in a wetland ecosystem and the dependency of the ecosystem on that water, measurements of setbacks should be to the edge of a wetland delineation (soils, hydrology, flora), not to the edge of surface waters.

For these reasons, and by utilizing siting as a best management practice to reduce potential negative impacts, it is recommended again that no operation using the new high-volume hydraulic horizontal fracturing process being reviewed here be permitted to drill within an State or Federally protected wetland, that the setbacks provided in section 7.3 be used as a minimum, that the width of the setback be determined by slope, surface and subsurface hydrology, soils and volume of potential spill based on site conditions and be measured from the closest boundary of a wetland delineation.

7.4 Protecting Ecosystems and Wildlife

"Water withdrawal, invasive species concerns, and use of centralized flowback water surface impoundments are indentified in Chapter 6 as the ecosystem and wildlife concerns specifically related to high-volume hydraulic fracturing that are not addressed by the GEIS. Mitigation of the potential adverse impacts of water withdrawal is discussed in Section 7.1.1."

"Therefore, the Department will require that well operators submit, with the EAF Addendum, a comprehensive survey of the entire project site, documenting the presence and identity of any invasive plant species. This survey will establish a baseline measure of percent aerial coverage and, at a minimum, must include the plant species identified on the Interim List of Invasive Plant Species in New York State78. A map (1:24,000) showing all occurrences of invasive species within the project site must be produced and included with the survey as part of the EAF Addendum."

The section on invasive species is comprehensive and is indicative to the level of attention that the dSGEIS should provide for all natural resource concerns including potential impacts to aquatic and terrestrial ecosystems, their function, service and best uses from all major components of the new high-volume hydraulic horizontal fracturing process being reviewed here. As noted above, Chapter 6 is deficient in its description of all potential impacts on ecosystems related to new process.

It is recommended that all potential environmental impacts of the new, high-volume hydraulic fracturing process being reviewed here be provided rigorous mitigation requirements as is given in section 7.4

7.5.1.1 NOx

Section on Control Technologies for Natural Gas Engines. "Three generic control techniques have been developed for reciprocating engines: parametric controls (timing and operating at a leaner air-to-fuel ratio); combustion modifications such as advanced engine design for new sources or major modification to existing sources (clean-burn cylinder head designs and pre-stratified charge combustion for rich-burn engines); and post-combustion catalytic controls installed on the engine exhaust system. Post-combustion catalytic technologies include selective catalytic reduction (SCR) for lean-burn engines, nonselective catalytic reduction (NSCR) for rich-burn engines, and CO oxidation catalysts for lean-burn engines."

NOx and metals associated with combustion engines represent a potential impact on terrestrial and aquatic ecosystems at all scales. The tonnage of these pollutants is given and comments are provided in section xxx. Technologies exist, as described within the dSGEIS to reduce emissions of NOx and other pollutants harmful to the environment through atmospheric deposition.

It is recommended that all internal combustion engines anticipated to be used during the new high-volume hydraulic horizontal fracturing process being reviewed here be required have, or be fitted to have, technologies that reduce NOx and other potential pollutants to the greatest degree.

7.6.2 Site Selection

“Site selection directly impacts the number of rig and equipment mobilizations needed to develop a well pad or area. Well operators can limit the generation of CO2 by limiting vehicle miles traveled (VMT) and fuel consumption. Examples of measures that could be included in a greenhouse gas emissions impacts mitigation plan include: Drilling as many wells as possible on a pad with one rig move, Spacing wells for efficient recovery of natural gas, Hydraulic fracturing as many wells as possible on a pad with one equipment move, and Planning for efficient rig and fracturing equipment moves from one pad to another.”

7.6.4 Well Design and Drilling

“Well operators can limit GHG emissions during well drilling operations by effectively designing drilling programs. Examples of measures that could be included in a greenhouse gas emissions impacts mitigation plan include: Extending each lateral wellbore as far as technically and legally possible to reduce the total number of wells required within a spacing unit, Spacing the lateral wellbores for efficient recovery of natural gas, Re-using drilling fluids, Drilling overbalanced to limit/prevent venting and/or flaring of CH4, Using materials with recycled content (e.g., well casing, drilling fluids), Using efficient rig engines, Using efficient air compressor engines for drilling, Using efficient exterior lighting, Ensuring all flow connections are tight and sealed, Whenever possible, flaring methane instead of venting, and Performing leak detection surveys and taking corrective actions.

7.6.5 Well Completion

“Well completion activities primarily contribute to GHG emissions from the internal combustion engines required for hydraulic fracturing and flaring operations during the flowback period. Examples of measures that could be included in a greenhouse gas emissions impacts mitigation plan include: Re-using flowback water, Using materials with recycled content (e.g., frac fluids), Using efficient hydraulic fracturing pump engines, Using efficient exterior lighting, Limiting flaring during the flowback phase by using reduced emissions completions (REC) equipment (see Appendix 25), If allowed by the Public Service Commission (PSC), constructing gathering lines so that the first well on a pad can initially be flowed into a sales line, Ensuring all flow connections are tight and sealed, Whenever possible, flaring methane instead of venting, and Performing leak detection surveys and taking corrective actions.”

7.6.6 Well Production

“As mentioned above, compared to any of the aforementioned operational phases, the ongoing production phase of any given well is the most significant period and contributor of GHGs, especially CH4. Natural gas compressors which run virtually around-the-clock, produce both CO2 and CH4 emissions. Equipment required to

process produced natural gas, specifically the glycol dehydrators (i.e., vents & pumps) and pneumatic devices, generate CH4 emissions during normal production operations. Examples of measures that could be included in a greenhouse gas emissions impacts mitigation plan include: Implementing USEPA's Natural Gas STAR Best Management Practices (BMP) including below: Reducing Methane Emissions From Pneumatic Devices in the Natural Gas Industry, Reducing Methane Emissions from compressor rod packing systems, Reducing emissions when taking compressors off-line, Replacing Glycol Dehydrators with Desiccant Dehydrators, Replacing gas-assisted glycol pumps with electric pumps, Optimizing glycol circulation and installing flash tank separators in glycol dehydrators, Using efficient compressor engines, Using efficient line heaters, Using efficient glycol dehydrators, Re-using produced waters, Ensuring all flow connections are tight and sealed, Performing leak detection surveys and taking corrective actions, Using efficient exterior lighting, and Using solar-powered telemetry devices.

Considering the potential impact of air borne pollutants on terrestrial and aquatic ecosystems (not described in the dSGEIS) and there function, services and best uses, the investment being made in reducing NOx throughout the area under consideration, an impending TMDL for the Upper Susquehanna River in NY (particularly its cap on nitrogen) and the precept that when best management practices can be employed that they should, it is recommended that the mitigation measures described in sections 7.6.2, 7.6.4, 7.6.5, 7.6.6 (Site Selection, Well Design & Drilling, Well Completion and Well Production respectively) be required for any proposed activity involving the new high-volume hydraulic horizontal fracturing process being reviewed here.

7.7 Mitigating Impacts from Centralized Flowback Water Impoundments

"The potential use of large centralized surface impoundments to hold flowback water as part of a dilution and reuse system is described in Section 5.12.2.1. Potential impacts are discussed throughout Chapter 6 and summarized in Section 6.7."

"The Department anticipates that, by the time the final SGEIS is published, additional data and analyses will be made public by the Marcellus Shale Committee and the Appalachian Shale Water Conservation and Management Committee. If so, this information and any further information provided to the Department regarding flowback characteristics associated with Marcellus operations in the northern tier of Pennsylvania will be considered during the comment period before the SGEIS is finalized. If sufficient information is not provided before the SGEIS is finalized to support different protocols than are described herein, then any required site-specific environmental reviews in New York must be based on the operator's analysis, reviewed by the Department, of actual flowback data collected within reasonable proximity to the well pads that will be serviced by the proposed surface impoundment."

Potential environmental impacts from the use of centralized flowback water impoundments are not described in the dSGEIS. While potential pathways of introduction are discussed in Chapter 6, these are not descriptive of the impact (or effect) on water soil and quality, aquatic and terrestrial ecosystems, their function, services and best uses from such an introduction. Compounding the difficulty is assessing mitigation methods is the incomplete nature of the information provided in the dSGEIS regarding the chemical composition of the flowback liquid. As described above, implementing the practice of closed-loop systems provides the best protection of the environment from contamination of the source.

It is recommended that no permit be issued for the new high-volume hydraulic horizontal fracturing process being reviewed here that does not include a closed-loop system. It is further recommended, as it is above, that no permit be issued for the new high-volume hydraulic horizontal fracturing process being reviewed here until full disclosure of the contents of flowback liquid (at production and over time) can be provided in the SGEIS.

7.8.1 State and Federal Responses to Oil and Gas Norm

"Discovery of elevated concentrations of NORM levels in other areas outside of New York in the 1980s led to a series of state and private investigations of the issue. State responses to the potential of elevated oil and gas NORM range from no action (barring self-reported problems) to decisions for further study, to implementation of new formal regulations and guidance documents. To date, no state has assessed the occurrence of NORM from longer duration drilling operations at multi-well sites and larger accumulations of shale cuttings from horizontal drilling. NORM is not subject to direct federal regulation (except its transport) under either the AEA or LLRWPA, and exploration and production (E&P) wastes are specifically exempt from regulation under Subtitles D and C of RCRA (LA Office of Conservation, 2009); however, NORM is regulated indirectly at the federal level through potential environmental impacts to drinking water (SDWA) and cleanup of abandoned hazardous waste sites (CERCLA and NCP)."

"In order to determine which gas production facilities may be subject to the licensing and environmental discharge requirements, radiological surveys and measurements are necessary including radiation exposure rate measurements of areas of potential NORM contamination, accessible piping, tanks or other equipment that could contain NORM scale buildup. Facilities that possess NORM wastes or piping, tanks or other equipment with elevated radiation levels may need a radioactive materials license. Further, any discharge of effluents into the environment will need to be tested for NORM concentrations prior to discharge."

A recent analysis of wastewater samples by the Department of Health found levels of radium-226, and related alpha and beta radiation that are up to 10,000 times higher than drinking water standards. Materials that are highly radioactive, whether in

brine solutions, flowback liquid or in drill cuttings, pose a significant risk to the health of the environment and best uses of the State's water sources. Radioactivity can be expected to be present in flowback & brine liquids and levels can be expected to increase over time (section 5.11.3.1).

Considering the potential for environmental contamination from these liquids and the lack of complete information regarding their composition, that exemptions at the federal level may not have been a result of environmental considerations, and until such time that full disclosure can be made regarding the chemical composition of flowback (including concentrations) it is recommended that flowback and brine be considered hazardous materials and treated, handled, stored and shipped in a manner consistent with the regulations that govern such materials. It is also recommended that the assumptions made and conclusions drawn in the dSGEIS concerning NORM levels be re-evaluated in the SGEIS and updated as new information is made available.

7.11 Mitigating Road Use Impacts

"Under New York State Highway Vehicle Traffic Laws, local municipalities retain control over their roads. This makes it important for municipalities to monitor the NYSDEC web site for information regarding gas development in their areas. Local governments (County, Town and Village) should be proactive in exercising their authority under New York State Highway Vehicle Traffic Laws. This would include the completion of a road system integrity study to potentially assess fees for maintenance and improvements. The applicant should attempt to obtain a road use agreement with the municipality or document the reasons for not obtaining one. When there is no agreement, operators should develop a trucking plan that includes estimated amount of trucking, hours of operations, appropriate off road parking/staging areas, and routes for informational purposes."

"Examples of measures that could be included in a road use agreement or trucking plan include: route selection to maximize efficient driving and public safety, avoidance of peak traffic hours, school bus hours, community events, and overnight quiet periods, coordination with local emergency management agencies and highway departments, upgrades and improvements to roads that will be traveled frequently for water transport to and from many different well sites, advance public notice of any necessary detours or road/lane closures, adequate off-road parking and delivery areas at the site to avoid lane/road blockage"

The ability of an operator or municipality to obtain a road use agreement is dependent on many factors outside environmental considerations. However, many of the components described in the dSGEIS of an agreement also have application to preventing potential negative impacts to the environment as a result of an accident.

It is therefore recommended that, regardless of a road use agreement being reached, operators be required to make route selection known to emergency coordinators when moving concentrated chemicals, flowback liquids and brine liquids, that the local officials be trained and equipped to handle spills involving the specific chemicals anticipated to be on site, flowback and brine liquids and that they be provided with a clear description of the line of communication (who is involved and their responsibilities) between a spill and ultimate clean-up.

7.13 Mitigating Cumulative Impacts

"Mitigation of cumulative impacts associated with water withdrawal for hydraulic fracturing is discussed in Section 7.1.1.8."

"Regarding other types of cumulative impacts, as determined by NTC in its study for NYSERDA and paraphrased in Section 6.13.2.1, "The rate of development cannot be predicted with any certainty ... Nor is it possible to define the threshold at which development results in unacceptable adverse noise, visual and community character impacts… There is no way to objectify these inherently subjective perspectives [and] …there is no sound basis for an administrative determination limiting the shale development at this time."

"The appropriate approach for minimizing cumulative impacts associated with noise, aesthetics, traffic and community character, therefore, is to encourage and adhere to the following practices: careful siting of well pads, use by the operators of site-specific visual and noise impact mitigation plans, negotiation of road use agreements with the appropriate local governing authorities, and recognition of and, to the extent practical, attention to local planning documents and policies.

Taken from comments on section 7.1.1.8; the SRBC regulations in the dSGEIS are well described. Particular attention was paid to maximum water withdrawals (ground and surface) under a variety of settings and describes modifications of the Natural Flow Regime Method so that it better reflects natural variation in flow. However, much of the data required for areas where little or no flow (cfs) information is readily available relies on extrapolation from data taken in from elsewhere. This practice, particularly when applying data recorded at a larger scale to a smaller area, is an estimate and may not reflect conditions on the ground. This is compounded by the nature of much of the precipitation in the area under consideration which is known to have heavy localized events (i.e. significantly effecting one watershed or basin, but not another). The existence of such complex and wide ranging rules indicates the difficulty in guaranteeing protection of the States water resources form excess withdrawal, particularly for smaller streams and areas where groundwater information is also hard/impossible to obtain. Additionally, the complexity of the flow regimes and groundwater conditions sometimes results in over simplification of remote assessment tools and a reluctance to collect the mid to long- term data in the

field that would yield the best results. The potential impact of excess withdrawal is reduced as the size of the waterbody the water is being taken from increases.

The rate of success of the new high-volume hydraulic horizontal fracturing process being reviewed here in Pennsylvania is estimated at 100%. The number of permits issued has increase tenfold since drilling began in 2007. It is reasonable to think that similar success may be encountered in NY and that this could be considered as a basis for assessing cumulative impacts. While adverse impacts to noise, visual and community character may be difficult to assess cumulatively, potential adverse impacts to soil and water resources at a large scale is less so. The practices mentioned above do begin to address noise, visual and community character, but similar guidance on how to assess and mitigate the cumulative impact to soil and water resources and aquatic and terrestrial environments is not described in the dSGEIS.

Given the smaller margin of error when dealing with groundwater and small sources of surface water and following the precept made above, that environmental considerations should take precedence over other interests when an alternative is available that reduces the potential environmental impact that it be made a requirement of the process, it is recommended that the SGEIS require all water withdrawals for the new high-volume hydraulic horizontal fracturing process being reviewed here be made from the main stem of the areas major rivers or suitably large lakes. It is also recommended that the State adopt similar assessment tools and methods as the SRBC to ensure continuity across jurisdictions. It is also recommended that the SGEIS provide a full account of the potential cumulative impacts as they relate to: wetland function, best uses for the waters within the area under concern, critical habitats, nitrogen and sediment flux from NY to PA via the Susquehanna River and agriculture.

8.1.1.1 SEQRA Participation

"For the following actions which were found in 1992 to be significant or potentially significant under SEQRA, the process will continue to include all opportunities for public input normally provided under SEQRA: issuance of a permit to drill in State Parklands, Issuance of a permit to drill within 2000 feet of a municipal water supply well…"

"Based on the recommendations in this Supplement, the following additional actions will also include all opportunities for public input normally provided under SEQRA: issuance of a permit to drill when high-volume hydraulic fracturing is proposed shallower than 2,000 feet anywhere along the entire proposed length of the wellbore. Issuance of a permit to drill when high-volume hydraulic fracturing is proposed where the top of the target fracture zone at any point along the entire proposed length of the wellbore is less than 1,000 feet below the base of a known fresh water supply. Issuance of a permit to drill when high-volume hydraulic fracturing is proposed and the fluid disposal plan required by 6 NYCRR 554.1(c)(1) includes use of a centralized flowback water surface impoundment that has not been previously approved by the Department. Issuance of a permit to drill the first well when high-volume hydraulic fracturing is proposed on a well pad within 300 feet of a reservoir, reservoir stem or controlled lake. Issuance of a permit to drill the first well when high-volume hydraulic fracturing is proposed on well pad within 150 feet of a private water well, domestic-use spring, watercourse, perennial or intermittent stream, storm drain, lake or pond. Issuance of a permit to drill when high-volume hydraulic fracturing is proposed and the source water involves a surface water withdrawal not previously approved by the Department that is not based on the Modified Tennant Method as described in Chapter 7. Issuance of a permit to drill any well subject to Article 23 whose location is determined by NYCDEP to be within 1,000 feet of subsurface water supply infrastructure."

As described in the SGEIS, the chemical constituents of the fracturing fluid are dependent on the geology of the specific site and that these conditions will differ across sites. Therefore the make-up of the fracturing fluid will also differ as will the composition of flowback liquids across sites as will the potential environmental impacts associated with those aspects of the new high-volume hydraulic horizontal fracturing process being reviewed here. Additionally, conditions at all sites, such as topography, hydrology and proximity to environmentally sensitive areas will also contribute to a wide variety of differing impacts. Furthermore, the rationale for the current SGEIS process is to take into account the new, high-volume nature of the process which are significant in terms of their potential to negatively impact the environment in ways not present in the more traditional methods used in the state in the past. Lastly, additional DEC permits will be required for operations; Multi-Sector General Permit for Stormwater Discharges (MSGP) (coverage under GP-0-08-001 recommended below) associated with Industrial Activity and possible permits in conjunction with disturbances to wetlands and streams. Permits, issued by the

Susquehanna River Basin Commission (SRBC), will also be required for drilling activities that require large amounts of water consumption in excess of their permitting triggers.

Following the recommendation made above that language contained within the ECL describing the Departments obligation to protect, preserve, conserve and prevent the degradation of the States soil and water resources and ecosystems (section xxx), it is also recommended that the SGEIS define areas of environmental sensitivity and circumstances where potential impacts to these resources take precedence and priority over the exploitation of mineral resources and for which a permit will not be issued.

It is recommended that these conditions include, but be not limited to: any proposed high-volume hydraulic fracturing where the top of the target fracture zone is shallower than 2,000 feet along the entire proposed length of the wellbore; 2) Any proposed high-volume hydraulic fracturing where the top of the target fracture zone at any point along the entire proposed length of the wellbore is less than 1,000 feet below the base of a known fresh water supply; 3) Any proposed centralized flowback surface impoundment or proposal that does not use a closed-loop system;. 4) Any proposed well pad within 300 feet of a reservoir, reservoir stem or controlled lake; 5) Any proposed well pad within 150 feet of a private water well, domestic-use spring, watercourse, perennial or intermittent stream, storm drain, lake or pond; 6) A proposed surface water withdrawal that is found not to be consistent with the Department's preferred passby flow methodology as described in Chapter 7 or proposed for 1st and 2nd order streams; 7) any proposed groundwater withdrawal 8) Any proposed well pad within 2,000 feet of municipal water supply; 9) Any proposed well pad where topography exceeds a 15% slope; 10) any well pad that does not utilize horizontal, multiple well technique; 11) any proposed well pad located within a established floodplain 12) any proposed well pad located over a principal or primary aquifer 13) any proposed well within a State or Federally protected wetland and; 14) any proposed well pad where NORM levels are found to be higher than drinking water standards.

In light of the wide variety of potential impacts due to chemical constituents used and physical conditions likely to be encountered, the invalidity of applying conclusions reached in the 1992 GEIS, as it did not consider the new, high volume nature of the work being proposed here, and the need for additional permits, both from within DEC and from SRBC, it is further recommended that a site specific State Environmental Quality Review Act (SEQRA) process be initiated for each well proposed.

8.1.1.4 Local Floodplain Development Permits

Local jurisdiction over development activities in 100-year floodplains is explained in Chapter 2. As set forth in Chapter 7 and the proposed Supplementary Permit

Conditions for High-Volume Hydraulic Fracturing, the operator will be required to obtain any required local floodplain development permit prior to site disturbance.

As described in some detail in Chapter 2, the area of under consideration undergoes often frequent and severe flooding. Not including severe local flash floods, Otsego County alone has had 3 federally declared emergencies or disasters related to severe storms and flooding in the last 4 years. While the dSGEIS references information provided in the 1992 GEIS on various contaminates that may enter the environment during a flood event, it does not account for the flowback impoundments proposed in the new high-volume hydraulic horizontal fracturing process being reviewed here or describe what the environmental impact to aquatic ecosystems would be should those potential contaminants be introduced during a flood. Additionally, by definition, floodplain areas are within very close proximity to waterways, closing the distance between the proposed activities and the aquatic environmental resources that are the primary emphasis of the protection efforts intended here. Given the amount of concentrated chemicals likely to be present on site during the fracturing process (estimated at 87,000 gallons per well above using the 2% or less estimate provided in the dSGEIS, section 5.4.3 of these comments) and the amount of flowback liquid anticipated to be on-site afterwards (>1 million gallons), the proximity to the states water resources and vulnerability of the area under consideration to severe storms, localized flash floods and regional flooding events, locating well pads in the floodplain is inherently dangerous.

It is therefore recommended that no permits be issued for the new high-volume hydraulic horizontal fracturing process being reviewed here that are proposed to take place within established floodplains.

8.2.1.2 Required Hydraulic Fracturing Additive Information

As set forth in Chapter 5, NYSDOH reviewed information on 260 unique chemicals present in 197 products proposed for hydraulic fracturing of shale formations in New York, categorized them into chemical classes, and did not identify any potential exposure situations that are qualitatively different from those addressed in the 1992 GEIS. The regulatory discussion in Chapter 5 concludes that adequate well design prevents contact between fracturing fluids and fresh ground water sources, and text in Chapter 6 along with Appendix 11 on subsurface fluid mobility explains why ground water contamination by migration of fracturing fluid is not a reasonably foreseeable impact. Chapters 6 and 7 include discussion of how setbacks, inherent mitigating factors, and a myriad of regulatory controls protect surface waters. Chapter 7 also proposes a water well testing protocol using indicators that are independent of specific additive chemistry.

The only potential exposure pathway to fracturing additives identified by this Supplement is via air emissions from uncovered surface impoundments used to contain flowback water.

The Department recognizes that flowback water chemistry may be preferable for determining impoundment emissions, but to date Department staff has not seen any flowback water analyses that tested for all of the chemicals and compounds that could be present.

The sections Fracturing Fluid (section 5.4) and Composition of Fracturing Fluid (section 5.4.3) appear to be contradictory. Chemical composition of fracturing fluid is estimated to be less than 2% and also 10% (with 0.5% in actual chemicals assuming activities in other formations will be the same in the Marcellus). Additionally, no reference is made to whether or not Utica shale or other low permeability formations will require similar or dissimilar chemicals. Given the uncertainty of assumptions and expectations and therefore using the percentages provided in section 5.4, if 5 million gallons of freshwater can be seen as the median value for the amount of water to be consumed during a single well fracturing and 1.75% can be seen as a typical amount of chemical additives (noted at 2% or less), it can be estimated that approximately 87,000 gallons of chemicals will be required for each well on a single pad. This number can then be multiplied by the number of anticipated wells from that pad (6-8). From the statements above, section 5.4, there are 45 products and 40 compounds for which chemical composition is incomplete or not disclosed in the dSGEIS. Additionally, the tabular information provided can also be viewed as incomplete given the qualifying statements describing Tables 5.3 and 5.4. Further, while percentages of composition are provided by type, concentrations (estimated or actual) of each chemical, within the 2% or less estimate, are not provided. Considering the total volume of chemicals being estimated for use at a multi-well pad (approximately 600,000 gallons for a pad with 7 wells) and the deficiency in completeness in regards to what may or may not be used, and therefore the potential environmental impact of such large quantities of chemicals being dispersed and used on each multi-well pad throughout the southern tier of New York, conclusions on the safety of the State's soil and water resources, best uses, ecosystem function and services will also be deficient in their comprehensiveness.

Contradictions also exist in describing the rationale for assuming uniformity across the State in the chemical composition of fracturing fluid intended to be used. It is stated that the composition in fracturing fluid will differ based on formation (Marcellus, Utica, other), geologic basin, potential interactions because, while the range of additive types will remain the same and serve similar functions, the chemical composition of each product (depending on manufacturer) will differ. Table 5.3 is stated to incomplete but nevertheless lists nearly 197 products (comprised of different chemicals at currently unknown concentrations) used or proposed for use in hydraulic fracturing operations in the Marcellus Shale area of New York. Further it stated that not all additive types will be used at all wells with only a 'handful' being used at any one well. If only a 'handful of products will be used at a well' taken from a list of 197 products that represents all products to be used, then it follows that different drilling operations will be using different products made up of different

chemicals. This, in addition to considerations given to geologic basins, does not support the assumed expectation that the composition of fracture fluids used in the Marcellus Shale would be similar from one operation to the next or consider the Utica or other target formations as a wholly different and where further heterogeneity in fracturing fluid would be expected. The differences in formation, geologic basin interaction between different chemicals and, logically and conservatively, the differences in fracturing liquid that can be anticipated, in addition to the variability in natural resources and ecosystems potentially impacted, is further reason not to assume 'common impacts'.

Concerns over movement of unrecovered fracturing fluid out of the target fracture formation through subsurface pathways such as: a nearby poorly constructed or improperly plugged wellbore; fractures created by the hydraulic fracturing process; natural faults and fractures; and movement of fracturing fluids through the interconnected pore spaces in the rocks from the fracture zone to a water well or aquifer that are described in Chapter 6 are not raised here.
However, this list does not include the possibility of harmful, yet naturally occurring materials present closer to the bottom of the water table than the production zone and that may be pushed into the water table by the pressure involved in the fracturing process when wells are fractured at shallow depths (<2.000 feet) and surface topography slopes away to close the distance between the water table and the production zone as opposed to contamination by the fracturing fluid itself.

Additionally are the numerous instances noted throughout the dSGEIS and commented on throughout this document that describe potential pathways of environmental contamination from the chemicals anticipated to be in fracturing fluid (in concentrated form or dilute form), flow back and brine liquids and stormwater runoff, beyond air emissions.

In addition, statistics used to support conclusions in the dSGEIS that are the result of studies funded by private entities that have a financial interest in the activity under review puts the dSGEIS at risk of being seen as an instrument of those entities and interests. Lastly, and in a more general sense, none of the information provided in the section 6.1.5 discusses or provides information on potential environmental impacts.

Therefore it is recommended that all studies used to support conclusions in the SGEIS are conducted by public entities or those with no financial interest in the outcome of the process. It is further recommended, in the interest in providing the best guidance possible, prescribing best management practices and accurately assessing the potential environment impact, that no permitting of the new high-volume hydraulic horizontal fracturing process being reviewed go forward without complete, comprehensive and public knowledge of the chemical composition (including concentrations) of the fracturing fluid intended for use in both fracturing applications including the produced flowback liquid. Appreciation has to be given to the complexity of the task requested; accounting for all chemicals to be used at all well

sites when multiple products that serve similar purposes are available but have different chemical make-ups will not be easy. Therefore it is also recommended that the State consider determining what can and cannot be used in fracturing fluid so that clear and comprehensive knowledge can be had before the commencement of operations or that a phased permitting approach be adopted where experience can be gained and data collected from sites inside and outside NY (PA).

8.3.1 Use and Summary of Supplementary Permit Conditions for High-Volume Hydraulic Fracturing

"A generic environmental impact statement addresses common impacts and identified common mitigation measures. The proposed Supplementary Permit Conditions for High-Volume Hydraulic Fracturing capture the mitigation measures identified as necessary by this review (see Appendix 10)."

As described in the dSGEIS, the chemical constituents of the fracturing fluid are dependent on the geology of the specific site and that these conditions will differ across sites. Therefore the make-up of the fracturing fluid will also differ as will the composition of flowback liquids and the potential environmental impacts associated with those aspects of the new high-volume hydraulic horizontal fracturing process being reviewed here. Additionally, conditions at all sites, such as topography, hydrology and proximity to environmentally sensitive areas will also contribute to a wide variety of differing impacts. Furthermore, the rationale for the current SGEIS process is to take into account the new, high-volume nature of the process which are significant in terms of their potential to negatively impact the environment in ways not present in the more traditional methods used in the state in the past. Lastly, additional DEC permits will be required for operations; Multi-Sector General Permit for Stormwater Discharges (MSGP) (coverage under GP-0-08-001 recommended below) associated with Industrial Activity and possible permits in conjunction with disturbances to wetlands and streams. Permits, issued by the Susquehanna River Basin Commission (SRBC), will also be required for drilling activities that require large amounts of water consumption in excess of their permitting triggers.

In light of the wide variety of potential impacts due to chemical constituents used and physical conditions likely to be encountered, the invalidity of applying conclusions reached in the 1992 GEIS, as it did not consider the new, high volume nature of the work being proposed here, and the need for additional permits, both from within DEC and from SRBC, it is recommended that a site specific State Environmental Quality Review Act (SEQRA) process be initiated for each well proposed. It is also recommended that the Supplementary Permit Conditions for High-Volume Hydraulic Fracturing be required for all permits.

9.1 Prohibition of Development

"The prohibition of development of Marcellus Shale and other low permeability gas reservoirs by horizontal drilling and high-volume hydraulic fracturing would be contrary to New York State and national interests. It would also contravene Article 23-0301 of the Environmental Conservation Law where it is stated: It is hereby declared to be in the public interest to regulate the development, production and utilization of natural resources of oil and gas in this state in such a manner as will prevent waste; to authorize and to provide for the operation and development of oil and gas properties in such a manner that a greater ultimate recovery of oil and gas may be had, and that the correlative rights of all owners and the rights of all persons including landowners and the general public may be fully protected, and to provide in similar fashion for the underground storage of gas, the solution mining of salt and geothermal, stratigraphic and brine disposal wells."

From section 1.2 of the dSGEIS: "The State of New York's official policy, enacted into law, is 'to conserve, improve and protect its natural resources and environment and it is the Department's responsibility to carry out this policy. As set forth in Environmental Conservation Law ("ECL") §3-0301(1), the Department's broad authority includes, among many other things, the power to: manage natural resources to assure their protection and balanced utilization, prevent and abate water, land and air pollution, and regulate storage, handling and transport of solids, liquids and gases to prevent pollution."

"In addition to protecting the environment and public health and safety, the Department is also required by Article 23 of the ECL to prevent waste of the State's oil and gas resources, to provide for greater ultimate recovery of the resources, and to protect correlative rights."

The implementation of the new, high-volume hydraulic horizontal fracturing process being reviewed here has inherent and potentially catastrophic implications for New York's environment. Language within the ECL has the potential to conflict as environmental considerations are incompatible with exploitation of mineral resources.

It is recommended that, when weighing the cost and benefits of the new, high-volume hydraulic horizontal fracturing process, that greater weight be given to those costs and benefits associated with the preservation of the environment than those associated with mineral resource exploitation. By extension, it is further recommended that the language found within ECL (found throughout) that pertains to cumulative impact, conservation, improvement, protection, prevention of degradation, enhancement of the states soil and water resources and ecosystems, as well as the promotion and regulation of best management practices, and all similar language that serves to protect our environment, be seen as to supersede and take priority and

precedence in every case over the phrase "to provide for greater ultimate recovery of the [oil and gas] resources" as written in Article 23 of the ECL. It is also recommended that prohibition of development be used as a management practice in areas of environmental concern and under certain circumstances as described in section 8.1.1.1.

9.2 Phased Permitting Approach

"The use of a phased-permitting approach to developing the Marcellus Shale and other low permeability gas reservoirs, including consideration of limiting and restricting resource development in designated areas, was evaluated. Phased permitting as a means to mitigate regional cumulative impacts is not practical or necessary given the inherent difficulties in predicting gas well development for a particular region or part of the State."

"The 1992 GEIS found that the negative impacts associated with gas development were short term and could be mitigated with siting restrictions and setback requirements. This is also true for multi-well pads; therefore the mitigation techniques discussed in the 1992 GEIS and set forth in this SGEIS should be utilized."

"The final scoping document summarizes the challenge of forecasting rates of development as follows: 'The number of wells which will ultimately be drilled cannot be known in advance, in large part because the productivity of any particular formation at any given location and depth is not known until drilling occurs. Changes in the market and other economic conditions also have an impact on whether and how quickly individual wells are drilled.'"

"Additional research has identified that "Experience developing shale gas plays in the past 20 years has demonstrated that every shale play is unique." Each individual play has been defined, tested and expanded based on understanding the resource distribution, natural fracture patterns, and limitations of the reservoir, and each play has required solutions to problems and issues required for commercial production. Many of these problems and solutions are unique to the play."

The dSGEIS covers the problems encountered when trying to assess the rate of expansion of the new, high-volume hydraulic horizontal fracturing process into being reviewed here into the area under consideration. Its reliance on conclusions drawn in 1992 is unwarranted given the differences in the process that is being proposed here and practices that have taken place in New York in the past.

Given the 100% success rate report for PA and the ten fold increase in permits issued in a year – from 99 in 2007 to over 1,000 through Aug 2009 it is possible that gas exploration of the type described here will also be successful in NY at a similar rate. In this way an estimate of cumulative impacts on hydrology, water quality (i.e.

introduction of potential pollutants) and the best uses that aquatic and terrestrial ecosystems provide can be established.

For example, the data on combustible engine emissions could be used to model NOx input by atmospheric deposition and its impacts on water quality in conjunction with data already on hand(in the form of a permit applications) to determine potential influx and impact. Another example may be to estimate the amount effluent that will be permitted to be discharged using application data and model the increase and its impact on water quality. Additionally, scenarios incorporating these questions (and others) could be run on the impact of full expansion by assuming full implementation at the 640 acre spacing unit. The estimate would have some limitations, but it serve as an important reference point.

The phased approach also has another potential benefit that was not discussed in the dSGEIS. By using a phased approach, critical information that is currently not available (fracturing fluid or flowback liquid chemical composition, for example) could be gained by experience and through efforts to reach out to other states for any available relevant information. This approach, more than any site-specific measure, has the potential to address significant concerns.

It's recommended that a phased permitting approach be established for an interval of time, dependent on the ability of the state to collect and analyze the appropriate number of samples over the appropriate time, to accurately describe the contents of fracturing and flowback liquids at production and over time. It is further recommended that this time also be used assessing any chemical treatment options that may be used in the state. It is also recommended that this time be used to begin investigations into the cumulative impacts regarding water quality and the ecosystems that provide their best uses.

9.2.2 Regional Cumulative Impacts Conclusion/Recommendation

The approach for addressing regional cumulative impacts is to focus on the proactive siting of well pads as discussed in previous sections of this SGEIS. If the location and construction of each well pad is based on 'Best Practices' (See Appendix A, NTC) then the potential impacts will be lessened and/or eliminated.

As mentioned above, the siting of well pads using the best practice of 640 acres is part of one of the many potential cumulative impact assessments that could be performed. By focusing on site specific impacts when trying to assess cumulative impacts over a very wide area, the actual question, regarding regional impacts, is never asked. Appendix A is not contained in the dSGEIS as distributed. However, a list of industry specific best practices would be very helpful to being able to comment on the full range of options available for the mitigation of environmental impact.

It is recommended that a phased approach be taken in permitting and that the time gained be used to begin investigations into the cumulative impacts regarding water quality and the ecosystems that provide their best uses. It is also recommended again that the only permits issued for the new, high-volume hydraulic horizontal fracturing process being reviewed here are for multi-well pads using the 640-acre spacing unit. It is also recommended that the SGEIS provide a list of industry specific BMP's for review and comment.

9.3 Green or non-chemical fracturing technologies and additives

"Hydraulic fracturing operations involve the use of significant quantities of additives/products, albeit in low concentrations, which potentially could have an adverse impact on the environment if not properly controlled. The recognition of potential hazards has motivated investigation into environmentally-friendly alternatives for hydraulic fracturing technologies and chemical additives"

"URS reports that the following environmentally-friendly technology alternatives have been identified as being in use in the Marcellus Shale, with other fracturing/stimulation applications or under investigation for possible use in Marcellus Shale operations:
liquid carbon dioxide alternative, nitrogen-based foam alternative, liquefied petroleum gas, horizontal and directional wells.."

The use of carbon dioxide, nitrogen, petro chemicals or a process that requires more water than is currently described in the dSGEIS for the fracturing process represents a significant departure from what is being reviewed here and can not be properly evaluated, at least in terms of its environmental impacts, without additional information.

It is recommended that if any of the alternatives mentioned in section 9.3 only be permitted after a scoping and dSGEIS process, similar to the process that is being used here relative to the new, high-volume hydraulic horizontal fracturing process being reviewed.