Tompkins County Water Resources Council

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December 1, 2011

Peter S. Briggs, Director
Bureau of Oil and Gas Regulations
Attn: dSGEIS Comments,
New York State Department of Environmental Conservation,
625 Broadway, Albany, NY 12233-6510

Subject: COMMENTS ON THE REVISED DRAFT SGEIS FOR GAS DRILLING

Dear Mr. Briggs:

Thank you for the opportunity to provide comments on the revised Draft Supplemental Generic Environmental Impact Statement (dSGEIS) for high volume hydraulic fracturing (HVHF) on the Oil, Gas, and Solution Mining Regulatory Program. The Tompkins County Water Resources Council (WRC) appreciates the tremendous effort required by the New York State Department of Environmental Conservation (NYSDEC) to prepare the revised dSGEIS. We were pleased to see that some of the key concerns detailed in our letter of December 21, 2009 concerning the September 2009 dSGEIS were addressed in the revised dSGEIS. Specifically, requirements for discharges to Publicly Owned Treatment Plants (POTWs), setbacks from water supplies, surface water withdrawal requirements, gas well construction, disposal of drill cuttings, prohibiting the use of surface impoundments for storage of flowback water without site specific review and prohibiting well pads in floodplains were substantially improved in the revised draft.

However, as detailed in our comments which follow, there are numerous areas where additional measures are warranted. Key concerns include the need to 1) address the combined and cumulative impact on groundwater and surface water statewide of water withdrawals and all interconnected drilling activities, 2) develop and implement a program to monitor and protect drinking water resources, 3) involve local governments in the process, and 4) hire sufficient regulatory staff to oversee the complex drilling process and assess sufficient fees associated with permitting to cover the costs associated with the extensive multi-agency regulatory and oversight program that will need to be developed to adequately protect the State's water resources from both drilling and construction of associated pipelines and compressor stations.

1.GENERAL COMMENTS

1. **Cumulative Impacts for Water Withdrawals.** We appreciate the effort to address cumulative impacts for water withdrawals; however, the SGEIS needs to address cumulative impacts on water resources in all areas. Although the Water Resources Bill passed in 2011 would address cumulative impacts of groundwater and surface water withdrawals, when and if regulations are developed, rules governing water withdrawal permits must be developed before permits are issued for drilling. Without the permitting framework for water withdrawals, it is not possible to determine if there are adequate safeguards for surface water and groundwater.

2. **Cumulative Impacts for all Interconnected Drilling Activities.** *A process needs to be established to address impacts from all interconnected activities, including drilling operations, that are regulated by NYSDEC and pipelines and compressor stations that are regulated by the PSC.* An Environmental Impact Statement for the gas lines and compressor stations must be performed by the PSC to assess the cumulative impacts on water resources, community infrastructure and quality of life issues such as noise, road damage and air quality from the additional pipelines and compressor stations that will be needed to transport the gas from the thousands of individual well pads to the regional pipelines. A compressor station will be needed for each hundred wells, with pipelines from each well to the compressor station, and additional pipelines from the compressor station to the main transmission line. However, the dSGEIS did not address the impacts of the pipelines or compressor stations necessitated by well drilling operations. The impact of the vast network of access roads, pipelines and compressor stations must be addressed by the SGEIS. The dSGEIS identifies the Public Service Commission (PSC) as the responsible agency to oversee construction and protection of the environment for pipeline construction. This segmentation of the environmental impact assessment makes it difficult for decision makers and the public to adequately assess the total environmental impacts anticipated from gas drilling activities.

3. **Program to Monitor and Protect Drinking Water Resources.** *Proper monitoring and assessment strategies must be in place to protect the State's water resources, and sufficient laboratory capabilities for analysis must be in place prior to drilling.* The state currently does not have a strategy in place for data collection and analysis. Such a strategy is key to developing a comprehensive regulatory process that must be in place prior to drilling. All stakeholders (regulatory personnel, drilling companies, and the public) need to be ensured that valid data is being collected and disseminated in a cost effective manner. Considering the volume of environmental and public health data that will be generated by HVHF gas drilling, it is essential that NYSDOH develop and manage comprehensive databases in order to facilitate effective, comprehensive oversight and public protection during gas drilling. A program must be developed for electronic sharing of monitoring data and must be shared with local health departments as they will be the agency first contacted if any contamination is detected.

4. **Funding for Environmental Oversight. Permit fees must be increased to cover the entire cost of a regulatory program for environmental oversight of the Marcellus gas drilling.** The State and local governments will incur increased costs for 1) DMR personnel to oversee field operations and process the associated paperwork, 2) health department personnel to develop and maintain a database, to evaluate drinking water quality data collected from groundwater wells near the drilling sites and respond to water quality complaints, 3) NYSDEC personnel to monitor surface water discharges from treatment plants, 4) personnel in the NYSDEC to develop and maintain a database on surface water flows and quality in the areas where drilling is occurring, 5) other regulatory personnel needed in the NYSDEC Division of Water and Bureau of Hazardous Waste and Radiation Management as well as the DMR to oversee the immense program that drilling in the Marcellus Shale will necessitate, and 6) local municipalities cover increased costs for expanded services caused by drilling activities. The Division of Budget must perform an economic analysis to ensure the fees are adequate to fund the necessary environmental oversight.

5. **Permit Re-evaluation.** The NYSDEC re-evaluation of specified permit condition in two or three years should involve public review and comment.

6. **Other low permeability shale formations.** The scope of the dSGEIS includes all low permeability shale formations where HVHF gas drilling will be employed. However, many sections of the document only reference the Marcellus Shale. Environmental impacts associated with other low permeability gas reservoirs where the hydrogeochemistry is different than the Marcellus shale are not addressed in the dSGEIS. The SGEIS must be expanded to include potential impacts from other formations.

2. LOCAL GOVERNMENT NOTIFICATION

1. **Local Government Notification. Local Governments need to be involved and informed in all aspects of the drilling process and a procedure for this needs to be in place before drilling begins.** Each municipality should receive copies of gas drilling permit applications, including parcel tax map numbers, before any permits are issued by NYSDEC. The NYSDEC should also be required to provide each local municipality and county government with 1) accurate Environmental Inspector contact information for permit coordination between agencies as well as emergency and spill response coordination, and 2) written notification to each municipality of location of each well plugging permit application, including tax map parcel number and mapping coordinates.

2. **Section 8.1.1.3.** "The Department will notify local governments of all applications for high-volume hydraulic fracturing in the locality, using a continuously updated database of local government officials and an electronic notification system that will both be developed for this purpose." The database developed and used to notify public officials of applications for drilling permits should be open to all public officials. Local government officials should also be notified when permits are issued. The local health department, County Administrator, and Town Supervisor or Village Mayor should be included in the local officials notified and this section should specify who in local government is to be notified.

3. REQUIREMENTS FOR MANDATORY DISCLOSURE OF HYDRAULIC FRACTURE ADDITIVES AND ALTERNATIVE ANALYSIS

This requirement is absolutely necessary to ensure adequate evaluation of disposal alternatives for fracking wastewater and we appreciate the addition of this requirement in the dSGEIS.

4. ENHANCED REQUIREMENTS FOR WELL CONSTRUCTION AND MANAGEMENT OF DRILL CUTTINGS

Appendix 8. The dGEIS indicates that surface casing should not extend into zones known to contain measurable quantities of shallow gas. Shallow saltwater and (or) gas has been penetrated in the upper Devonian bedrock in some areas. It is not clear from the dSGEIS how casing and cementing requirements will be modified to deal with these conditions, nor how drilling companies will know before they drill in an area if they should suspect gas in the upper Devonian in an area they are drilling. NYSDEC should have a program in place before issuing permits that will require drilling companies to *collect and share water quality data* concerning shallow gas and the depth of the fresh water. A database must also be established for this data.

5. Prohibition on well pads in New York City and Syracuse watersheds and 4,000 foot buffer

Section 6.1.5 Unfiltered Surface Drinking Water. ***NYSDEC should prohibit HVHF in all watersheds where surface water is the source of a public drinking water system, in addition to unfiltered surface water drinking sources.*** In section 6.1.5.1, p. 6-46, the dSGEIS states that Increases in phosphorus are expected to create algal blooms, possibly leading to production of neurotoxins, fish kills, taste and odor problems and increases in disinfection byproducts in unfiltered drinking waters or their source waters. Conventional drinking water filtration plants are not designed to remove neurotoxins. Taste and odor problems are not necessarily treatable at filtration plants. Finally, any increase in disinfection byproducts that is tied to increases in soluble organic matter will not be abated by going through a filtration plant.

Under the topic heading of toxic chemicals (section 6.1.5, p. 6-48) the dSGEIS states that unfiltered drinking water supplies have a heightened sensitivity to chemical discharges as there is no immediately available method to remove contaminants from the drinking water source waters. Filtration plants also do not treat chemical contaminants.

New York City's investment in its watershed (and drinking water system) is listed at $1.6 billion (section 6.1.5, p. 6-50). While water quality degradation (virtually guaranteed via storm water inputs per section 6.1.5) in source waters with existing filtration facilities will not require the kind of investment that building a new facility for New York City would, the costs are not insignificant. If water quality degradation included increases in soluble organic matter leading to violations of disinfection byproduct limits, new treatment technologies would have to be added - which could cost millions.

6. Prohibition on well pads in 2,000 foot buffer around public drinking water supplies

Protecting public drinking water supplies is essential to protect public health in the State, so increasing the buffer to 2,000 feet is a critical element in protecting these valuable resources. However, the location of zones with significant vertical permeability such as faults and fracture intensification domains (FIDs) (which have been identified by Jacoby, 2002, as often being associated with known faults and suspected faults) in the vicinity of public water supplies also has to be taken into account. Jacoby and Dellwig, 1968, found that fracturing induced brine flow 0.5 miles from the well being fractured. If there are faults or FIDs shown on published maps within 1000 feet of a public water supply well, well pads should also be prohibited within 2,500 feet of the fault or FIDs (Jacoby and Dellwig, 1968).

7. Prohibition on well pads in 500 foot buffer around private well supplies

Protecting private drinking water supplies is as essential as protecting public water supplies. We appreciate the increase in buffer to 500 feet; however, the buffer distance should be 1,000 feet to adequately protect these vital resources.

8. Prohibition on well pads in primary aquifers and 500 foot buffer

Protecting primary aquifers is essential to protect public health in the State. Although we appreciate the prohibition of well pads within primary aquifers and within a 500 foot buffer, the buffer should be increased to either the surface water divide for the aquifer or 2,000 feet from the aquifer **boundary** whichever is less to adequately protect these vital resources.

9. Prohibition on well pads in 100-year floodplain

Floodplains: We appreciate that well pads will not be permitted in floodplains and that NYSDEC is updating the floodplain maps. However, until the floodplain maps are updated, there should be a 500 foot setback from floodplains to provide a measure of safety from potential flooding.

10. Requirement for site specific SEQRA determination for well pads in principal aquifer and 500 foot buffer

Protecting New York State's public water supplies is essential to protect public health in the State. Requiring a site specific SEQRA determination for well pads in principal aquifers and within a 500 foot buffer is not adequate to protect these vital resources. Well pads should be prohibited in principal aquifers and within a buffer that includes either the surface water divide for the aquifer or 2,000 feet from the aquifer boundary, whichever is less, to adequately protect these vital resources.

11. Requirement for site specific SEQRA determination for certain water withdrawals

[no comment]

12. Passby flow calculation methodology and well permit conditions

The proposed passby flow calculation methodology is superior to the previous methodology contained in the 2009 dSGEIS and we support this change.

13. Comments on other revisions that are included in the 2011 dSGEIS (please identify/specify)

1. Section 7.1.4. The water quality monitoring program should **not** be complaint-based. ***NYSDEC should establish a groundwater monitoring and reporting procedure*** that requires the applicant to submit electronic versions of the analytical results to the repository agency and local health department within a specified time period and requires the applicant to determine if there have been any significant increases in chemical or physical concentrations. As in groundwater monitoring around landfills, the groundwater monitoring program around gas drilling sites should establish procedures for follow-up testing if results indicate there may be contamination in the monitoring wells. If the program is complaint-based, the burden of proving there is a problem will fall on the property owner, and he or she may not have the knowledge to understand the analytical results and know if there is a problem until the contaminant levels are very high. Moreover, with a complaint based program the property owner may have to pay for further tests to confirm the contamination. The burden for determining if there has been contamination of groundwater and any follow up actions required should be on the applicant, not the property owner.

2. Section 7.1.4.1, Pg. 7-44. *"…the results of each test must be provided to the property owner within 30 days of the operator's receipt of the laboratory results. The Department would further require that the data be available to the Department and local health department upon request for complaint investigation purposes."* Results should be required to be provided to the local health department and the NYSDOH. The NYSDOH should be the official data repository. *The data collected should be entered into a state-wide database that is available to the public.*

14. Additional comments you think should be reflected in the final SGEIS

1. Flowback Water Treatment Section 7.1.8. ***A thorough analysis of the cumulative impact on the receiving water should be conducted if multiple wastewater treatment plants will be used to dispose of wastewater into the same surface water body*.**

2. Waste Classification. Flowback and production waters should be classified as hazardous waste and subject to the corresponding regulations.

3. Cumulative Impacts Section 7.1. The dSGEIS should address the combined impacts and the cumulative impact on groundwater and surface water. *Safeguards should be included to ensure that the millions of gallons required for the drilling operations will not leave local residents without adequate drinking water*. Although the Water Resources Bill passed in 2011 would address cumulative impacts of groundwater withdrawals, when and if regulations are developed, rules governing water withdrawal permits must be developed before permits are issued for drilling. How can we make comments on water withdrawal when the permit and guidelines for water withdrawal are not yet available?

4. Groundwater Monitoring Section 7.1.4.1, Pg. 7-44. Before drilling the operator must be required to identify any abandoned gas or oil wells along the length of the horizontal bore hole as well as any mapped faults. The fault map in the dSGEIS (Fig. 4.13) is based on outdated information and does not contain many mapped faults (see comment 15 below). If any of these features have been identified along the horizontal length of the proposed bore hole the horizontal extent of monitoring should be increased to include these features. Drinking water wells within 1,000 feet of the well pad, or if there are none identified, drinking water wells within 2,000 feet of the horizontal well pad, should be included in the

monitoring program.

5. Groundwater Monitoring Section 7.1.4.1, Pg. 7-44. "*Testing before drilling is recommended as a mitigation measure related to the potential for groundwater contamination….*" This contradicts Appendix 10 which states that before site disturbance, the operator must sample and test residential wells. Section 7.4.1 should be changed to clarify that well testing is required before drilling in order to establish a baseline for comparison in the event groundwater contamination is suspected.

6. Groundwater Monitoring Section 7.1.4.1, Page 7-45. Sampling and analysis only continue until one year after the last well on the pad is hydraulically fractured. Part 360 requires at least five years of post closure monitoring. To detect longer-term cumulative impacts to the groundwater resources such as a gradual regional increase of chlorides and methane in the groundwater, *the permit should require that sampling continue at a minimum number of selected wells at least annually until the gas well is decommissioned.*

7. Groundwater Monitoring Section 7.1.4.1. *Water quality monitoring programs should focus on monitoring the groundwater resource, not just existing drinking water wells*. Water-supply wells should not be the sole means of determining if groundwater contamination has occurred near a Marcellus Shale gas well due to the unknown or varying construction, operation, and availability of these wells, and the possibility that there may be no private wells or springs within 2,000 feet of the proposed well pad. Natural groundwater quality in the aquifers overlying the Marcellus and Utica play areas is highly variable. Concentrations of parameters such as chlorides and radioisotopes vary by two orders of magnitude in water sampled from water wells. With such natural variability, documentation of water-quality impacts from gas drilling and hydraulic fracturing would be extremely difficult if baseline data do not exist. As in environmental regulations relating to landfills (360-2.11), the permit should require the applicant to install and monitor groundwater wells to detect groundwater contamination before it reaches individual or public supply wells. The results of the recent Duke study (Osborn, et. al., 2011) found evidence that methane concentrations increased in proximity to the nearest gas wells and detailed analysis of the methane indicated it came from deep earth deposits rather than shallow biogenic deposits. Thus, the risk of methane migration is a real potential threat to wells near gas drilling sites, and migration of methane should be detected using monitoring wells before it reaches a private water supply well. *At least three monitoring wells should be installed around each well pad (two downgradient and one upgradient) and these wells should be used to determine the direction of groundwater flow in the vicinity of the well pad and sampled and analyzed at the same frequency as the private water supply wells*.

8. Groundwater Monitoring Section 7.1.4.1, Pg. 7-48. Review of the water-well testing results by local health departments as proposed in the draft SGEIS following a complaint cannot be accomplished without additional resources. The Department proposes that county health departments have responsibility for initial response to most water well complaints, referring them to the Department when causes other than those related to drilling have been ruled out. *Funds for implementing this program should be provided to local health departments.* Fees cannot be raised directly by the local health departments since the NYSDEC has sole regulatory authority over gas wells.

9. Groundwater Monitoring Section 7.1.4. *Enforcement and mitigation procedures for non-compliance with well-testing requirements and parameters should be in place before drilling permits are issued by NYSDEC.* The well testing procedures outlined in the dSGEIS do not specify what enforcement actions will be taken if well testing requirements are not adhered to by the operator. Enforcement procedures for non compliance with well testing procedures must be in place before permits are issued for drilling.

10. Groundwater Monitoring Section 7.1.4.1. Table 7.2 Test parameters: There are several parameters that are important in evaluating potential contamination from HVHF. Arsenic, strontium and turbidity have important health concerns associated with them and should be included in table 7.2. Sodium, which is included in Table 7.2, is redundant and can be eliminated. It is generally not possible to take static water level in a private well and this parameter also should be eliminated. Also, the VOC

analysis is vague; VOCs should be analyzed using EPA Method 524.2

11. Groundwater Monitoring Section 7.1.4.1, Pg. 7-47. Sampling protocol: The sampling protocol described on page 7-49 is mostly reasonable. However, a blanket requirement that the well pump be run for five minutes before taking samples is misleading and should be changed. If the well is being used, the water in the pressure tank can be assumed to be representative of water in the formation. Therefore, if the water is run to evacuate half the volume of the pressure tank, or 5 minutes, whichever is less, before sample collection, the water sampled should be representative of water in the formation. It is not necessary to disinfect the faucet before sampling because biological samples are not being analyzed.

12. Surface Water Monitoring Sections 7.1.2 and 7.1.3. Because of the possibility of surface water contamination from storm water runoff and/or surface spills associated with gas drilling activities, a program to monitor surface water quality in areas affected by HVHF should be established by the NYSDEC. The NYSDEC should establish a fund to be used for surface water monitoring using a funding mechanism similar to FL-LOWPA whereby the NYSDEC allocates funds to Soil and Water Conservation Districts (SWDC) and SWCD staff request and review proposals from local agencies and organizations to monitor surface water quality.

Each local program should select monitoring locations in anticipated high activity areas in such a way as to better understand the general characteristics of the watershed as well as to characterize, to the extent they are known pre-drilling, the smaller catchment areas where gas wells will be drilled. The following minimum monitoring frequencies and water quality indicators are recommended:

1. Chemical monitoring
Frequency: Pre-drilling and at least quarterly during drilling and fracking;
General method: Water samples collected and analyzed by a certified lab;
Indicators of pollution: Soluble reactive phosphorus, total phosphorus, count of either E. coli or fecal coliform, total suspended solids, turbidity, and a set of "signature chemicals" to screen for contamination by toxic compounds in gas well waste: pH, alkalinity, total dissolved solids, conductivity, potassium, chloride, bromide, sulfate, total hardness, barium, strontium, dissolved oxygen, chemical oxygen demand, gross alpha radioactivity, gross beta radioactivity.

2. Biological monitoring
Frequency: Pre-drilling and at least once a year
General method: Benthic macroinvertebrate (BMI) sampling and analysis. Two replicate samples are collected at each of a subset of chemical monitoring locations. Adhere to Tier 2 or Tier 3 protocol in Hudson Basin River Watch Guidance Document, which are based on NYSDEC monitoring protocols.

3. Follow-up
Monitoring should continue for at least five years after the last gas well on a multi-well pad has been plugged. If monitoring results indicate degradation of the designated use of a stream, lake or reservoir in the vicinity of the well pad, the NYSDEC should investigate, as mandated under the Clean Water Act.

All water sampling results should be made available to the public.

In order to minimize impacts from spills and other incidents, NYSDEC representatives should be monitoring drilling activities on-site at least three times per week.

13. Wetlands Section 7.3. While Section 7.3 refers to the State's Freshwater Wetland Regulatory program, HVHF should be prohibited within 500 feet of wetlands. Wetland prohibition should include those delineated by NYSDEC, the federal government, and local government.

14. Geology - Extent of Marcellus Shale, Section 4. *Lateral drilling should be prohibited below the Finger Lakes and "Dry" Finger Lake valleys because of the thinness or absence of Marcellus shale in these areas.*

Figures 4.8 through 4.12 These figures which show the extent and thickness of the Marcellus Shale are inaccurate in the Finger Lakes troughs (for ex. Cayuga, Seneca, Skaneateles, Canandaigua Lake troughs) and in some "Dry Finger Lakes valleys" (for ex. Tully Valley and Genesee Valley). Seismic work done by Mullins and others (1996) and well data collected by USGS (Yager and others, 2001, and Yager and others, 2007) have shown that, in these deep trough valleys, the glaciers had eroded down to the Onondaga Limestone (completely removing the Marcellus Shale) and then rode from 5 to 10 miles southward on top of the Onondaga Limestone until it began to rise up back onto the Hamilton Group (including the Marcellus Shale). Since the Marcellus Shale is absent in much of the deep Finger Lakes (ex. Cayuga and Seneca Lakes) and is missing in the northern 2/3 thirds of the medium-deep Finger Lakes (ex. Canandaigua Lake) and in some "Dry" Finger Lake valleys (ex. Tully valley), the extent of the Marcellus Shale is not correct in the figures 4.8.- 4.12. Also, in the southern 1/3 of the medium deep Finger lakes, where the Hamilton Group begins to reappear in the bottom of the trough and where the overlying rock is much thinner than depicted in fig. 4.8, the depths to tops and thickness of the Marcellus Shale are inaccurate. David Barclay (Geology Professor, SUNY Cortland) adds "*The basic issue is that the outcrop maps of the Marcellus Shale being used in the SGEIS ignore the deeply scoured troughs of the Finger Lakes. The maps suggest that Marcellus is present and is over 1000' below the land surface throughout the central and southern Finger Lakes region. However, subsurface data along the lakes collected by Mullins and others in the 1980s and 1990s show that bedrock in the troughs is scoured down to the Onondaga Limestone and so the overlying Marcellus is either locally absent or only thinly buried by Pleistocene lake clays. This means that the Marcellus is much closer to contact with the waters of the Finger Lakes than has been generally assumed. The concern here is that lateral drilling of the Marcellus from well pads near lakeshores may breach into the unconsolidated lake floor sediments, from where drilling fluids may then escape into overlying lake waters. Even if drilling does not cross the bedrock-sediment contact, drilling close to this boundary may still enable fluids to escape horizontally when wells are pressurized during hydrofracking. Nowhere in the SGEIS do I see consideration of the natural topography of the Finger Lakes troughs and how it might affect drilling operations."* Therefore, since the Marcellus is absent, thinner (by ice erosion), or overlain by much less rock than depicted in figs. 4.8 – 4.12, lateral drilling should be prohibited below the Finger Lakes and "Dry" Finger Lake valleys. In addition, a significant buffer should be included along the trough walls for both well bores and laterals to prevent fracking solution from entering the lake trough.

15. Geology - Extent of Marcellus Shale, Section 4. *NYSDEC must establish a set back distance for well bores and laterals from salt mines***.** Past solution mining practices for salt mines has typically caused collapses and disruptions of bedrock structure. These zones of disrupted bedrock structures could act as conduits through which fluids could flow, including methane-rich formation fluids and fracking fluids. During hydrofracking, it is possible that highly-pressurized drilling fluids will force methane-rich fluids in the disrupted zones to flow into the salt mines.

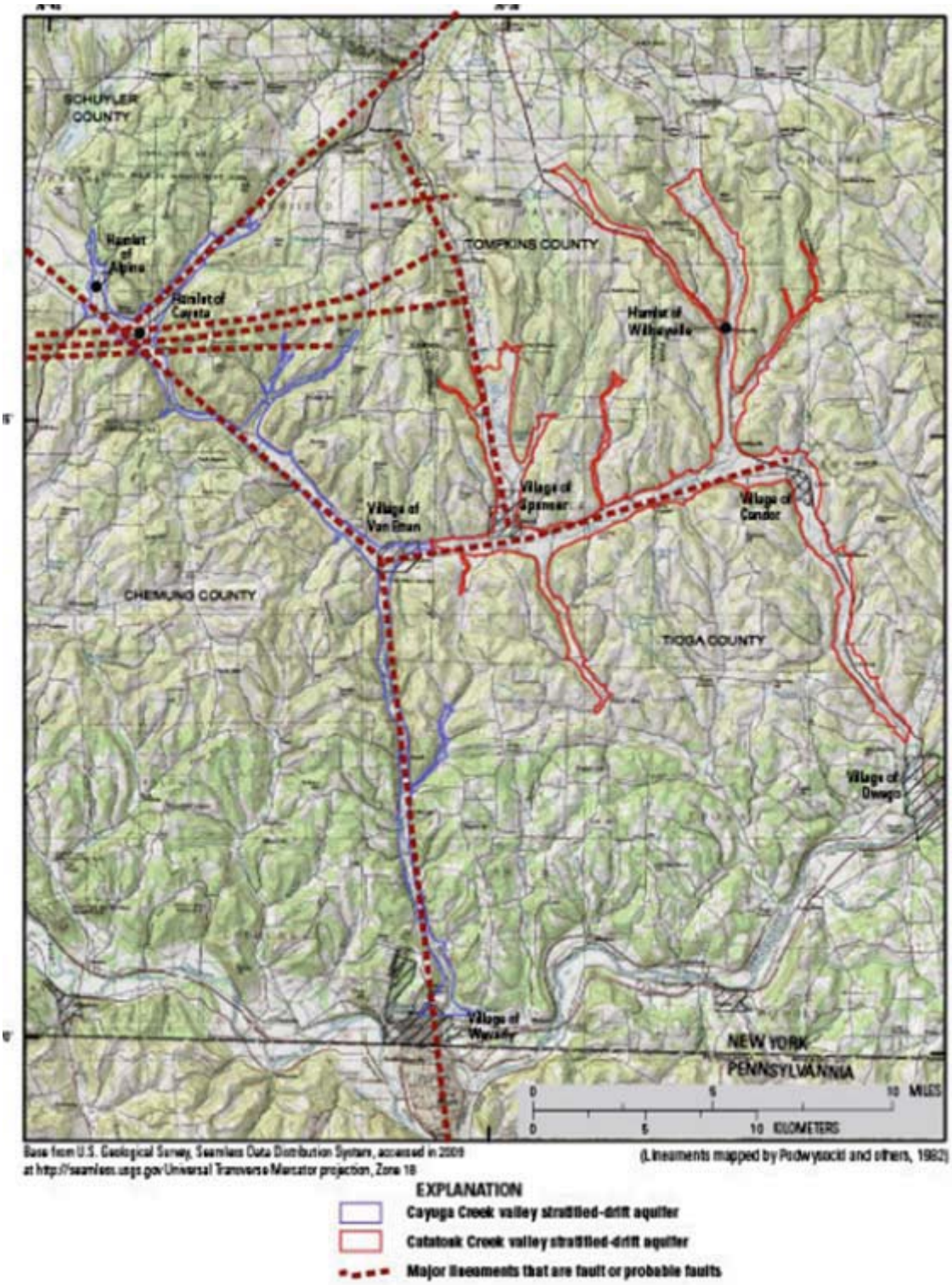
16. Geology – Faults. *The mapping of faults in the dSGEIS is inadequate and the potential impact of hydrofracking near faults is not given adequate attention in the dSGEI**S.*** The NYSDEC should require 3-D seismic testing before drilling to ensure neither the well bore or laterals intersect faults.

Section 4.5.1, Page 4-24. There is no discussion of the nature, type, history of tectonic stresses, and timing of the formation of faults in central NY. There is only discussion of the occurrence of faults in eastern and northern NY. This is a major oversight since the main subject of this document is gas drilling that is most likely to occur in the southern central NY.

Section 4.5. There is no discussion that some faults could result in disturbed zones of crushed (brecciated) rock, and if these zones are not healed by precipitation of minerals, igneous intrusions, or movement of salt, then the secondary permeability formed along these fault planes could act as conduits through which fluids could flow, including methane-rich formation fluids and fracking fluids. During hydrofracking, it is possible that highly-pressurized drilling fluids will force methane-rich fluids in the faults to flow upward, possibly discharging to shallow aquifers (if present) or to land surface. **Case history- at the Watkins Glen salt brine field, Jacobi and Dellwig (1974) reported that while hydraulic fracturing was being conducted in one of the wells at a depth of 970 meters (3,180 ft), a flow of brine developed at land surface about .7 kilometer (0.4 mi) to the north probably as a result of the movement of the brine along a strike-slip fault. The strike-slip fault was mapped by Stone &**

Webber (1978a, 1978b, and 1979) and by Murphy (1981). Incidentally, this fault is not shown in dSGEIS fault map, Fig. 4.13 The fault (strike of N5^{0} W) can be projected southward along the west shore of Seneca Lake and extending from the Himrod mine in the north to Watkins Glen brine field (and continuing southward, the fault trace coincides with a landsat lineament mapped by Isachsen and McKendree (1977).

Section 4.5. There is no discussion concerning the potential for faults underlying valleys with sand and gravel aquifers (see figure below).



The map above shows that faults often underlie valleys that contain sand and gravel aquifers. It is possible that methane, methane-rich fluids, and fracking fluids could migrate through faults during the hydrofracking process of gas wells and to the bottom of these aquifers. Therefore, it is prudent that hydrofracking should <u>not</u> be conducted where there are major faults in order to avoid the risk of gases

and fluids migrating upward and contaminating shallow aquifers that are sources of potable water to many residents and communities.

dSGEIS fault map, Fig. 4.13. The fault (strike of N5^{0} W) can be projected southward along the west shore of Seneca Lake and extending from the Himrod mine in the north to Watkins Glen brine field (and continuing southward, the fault trace coincides with a landsat lineament mapped by Isachsen and McKendree (1977).

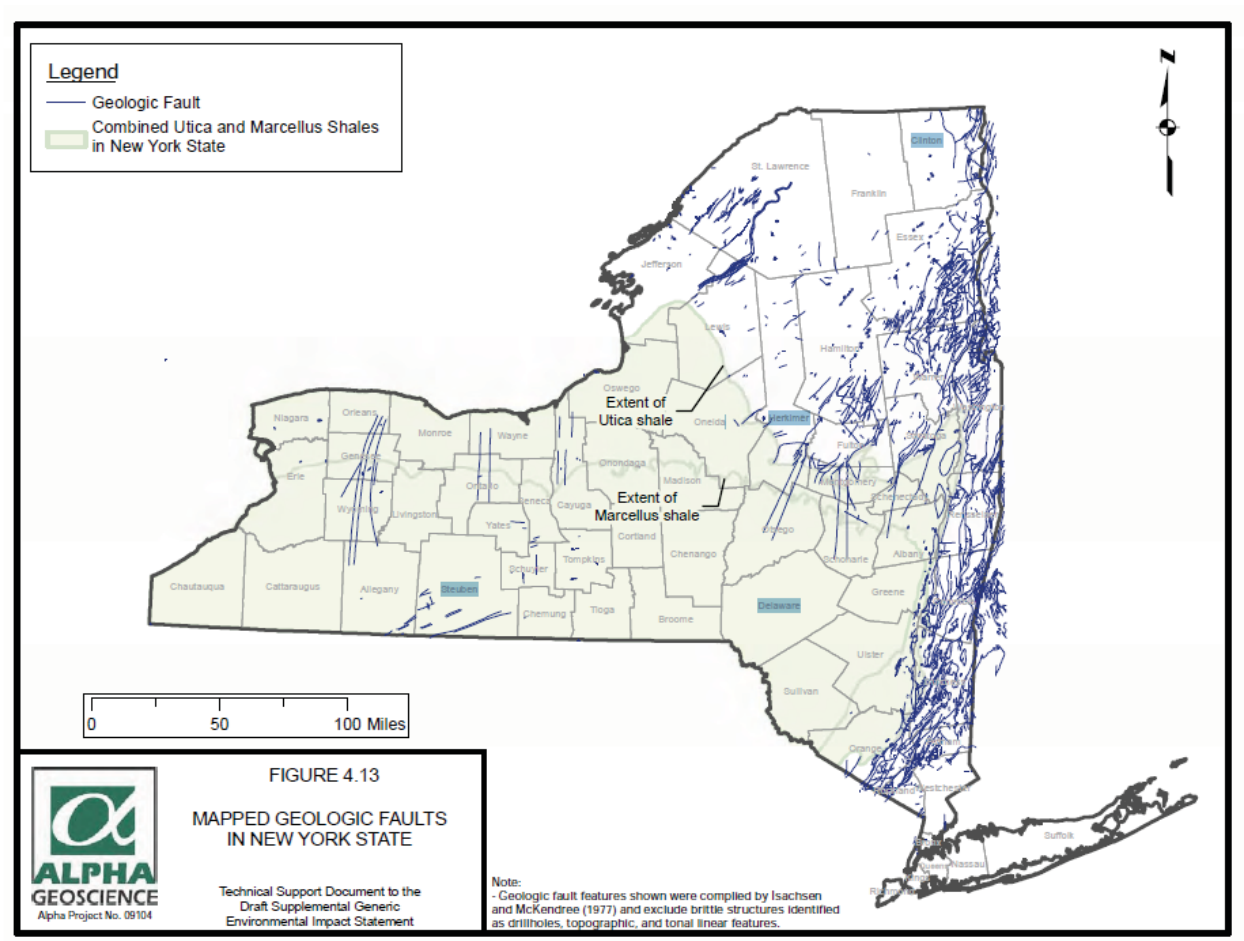


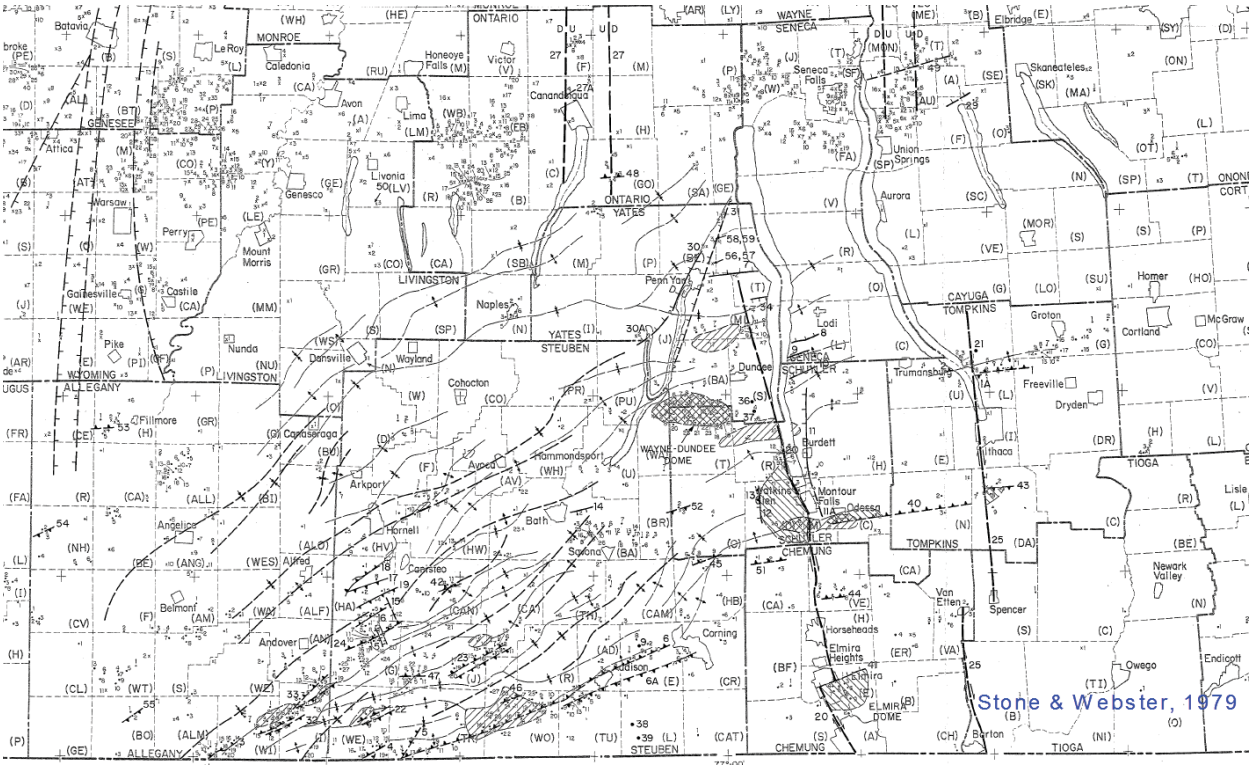
Figure 4.13. This map showing faults in NY grossly under represents the number and extent of faults in central NY. A few notable missing faults include the Retsof, the Leroy, the Cayuga Lake, the Seneca Lake, the Cortland-Ithaca, the Cayuta Creek, Catatonk Creek, the W. Danby faults, and the West Valley faults. The fault map, "Mapped Geologic Faults in New York State", presented as figure 4.13 in the dSGEIS, is outdated (based on mostly pre-1977 gas well and some seismic data, in which the distribution of data was unevenly spread across the southern tier) and does not include many publications that have mapped additional faults. The pre-1977 data that were used in the sGEIS is concentrated in clumps in relatively small areas (such as in Genesee and Wyoming Counties) and there were little data in large parts in central NY (such as in most parts of Tompkins, Cortland, Tioga, and Broome Counties). Data

points should be shown in the map to show where there is ample data and where there is scant data. Even using the incomplete data that were used, it would be only speculation to assume that areas with no or little data contain no faults.

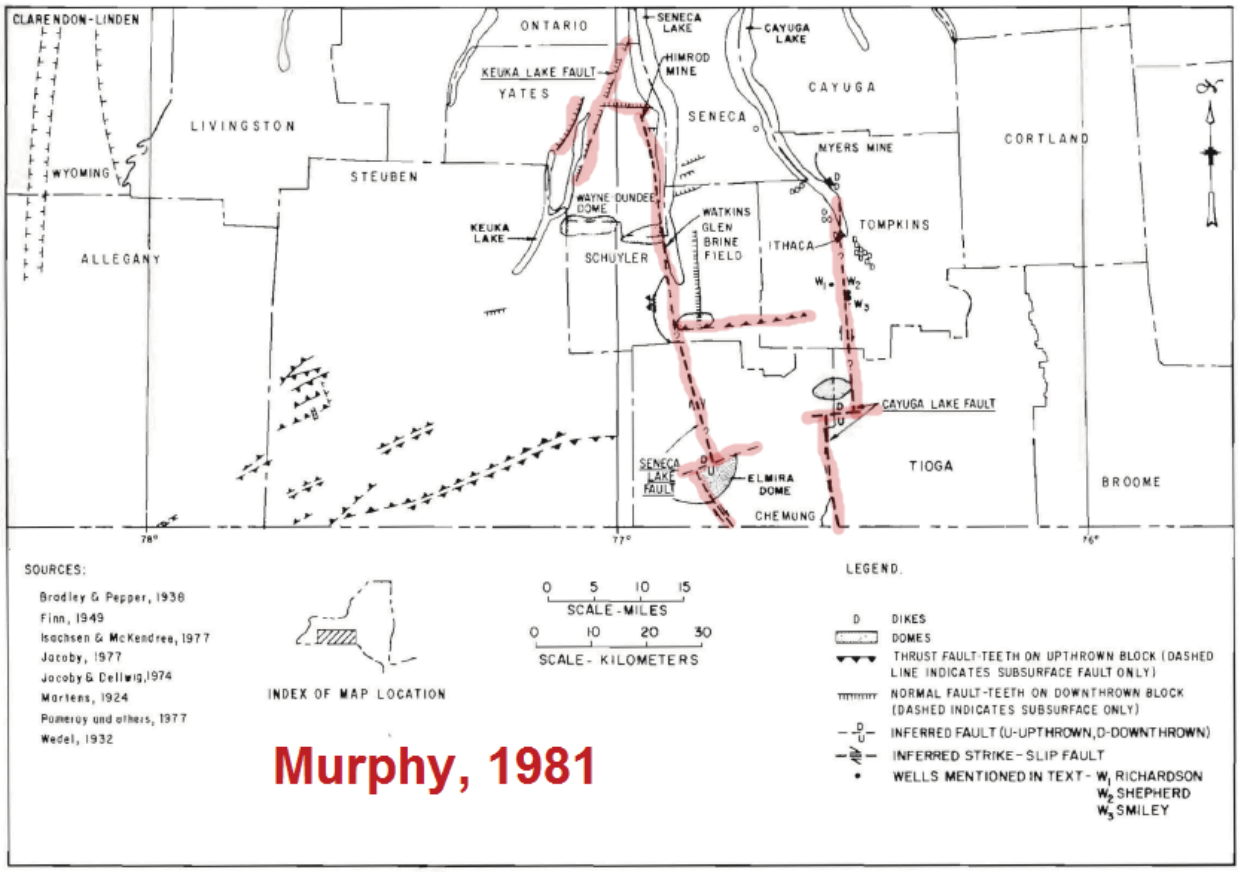
What is disturbing about the fault map in the dSDGEIS is that there already exist many reports (see references) that have mapped or noted many additional faults that are not shown in the fault map that Alpha Geoscience uses in the dSGEIS. Most structural geologists agree that the more likely scenario is that, if more data were available, it would show many more faults. This should be stated in the report. Robert D. Jacobi, professor of geology at University of Buffalo, contends that he and many other structural geologists have uncovered increasingly convincing evidence that upstate New York is severely chopped by hundreds of faults of a kind characterized by very sporadic seismic activity (Jacobi, 2002; and Smith and Jacobi, 2009).

To demonstrate that many more faults have been mapped that are not shown in the fault map (fig. 4.13, dSGEIS), the following list of selected studies is presented below in chronological order. Selected additional papers that report additional faults are:

- The Retsof fault mapped by Jacobi (1969)
- Seneca Lake fault discovered by Jacobi and Dellwig (1974). The fault (strike of N5^{0} W) can be projected southward along the west shore of Seneca Lake and extending from the Himrod mine in the north to Watkins Glen brine field (and continuing southward, the fault trace coincides with a landsat lineament mapped by Isachsen and McKendree (1977**).** (
- Stone & Webster geologic and hydrologic reports (1978a, 1978b, and 1979) which evaluated the suitability of burying high-level radioactive waste in the Salina Formation in central NY. One of the conclusions of the Stone and Webster reports was that "Faulting in the New York study area (south central NY) is more widespread than previously thought" (Oct. 1979). The Stone and Webster report show more faults (see figure below) in central NY than that depicted in figure 4.13 of the dSGEIS.. The Stone & Webster reports also stated in the conclusions that *"We believe that the evidence is sufficient at this time (1978) to conclude that the salt basin in New York is cut by strike-slip tear faults (shown in the Stone and Webster reports but not shown in fig. 4.13 dSGEIS) and other nearly vertical faults which represent potential conduits of groundwater circulation."*



- It has been established that the Clarendon-Linden fault extends beneath Lake Ontario (Hutchinson and others, 1979).
- Murphy (1981), used geophysical well logs supplemented by descriptions of sample cuttings of all wells drilled as of May 1979 to prepare the figure below. Murphy describes the West Seneca Lake fault, the Cayuga Lake fault (which is a right-lateral fault extending south into Cayuta Creek valley and has an en echelon offset along the Catatonk Creek valley), Keuka Lake faults.

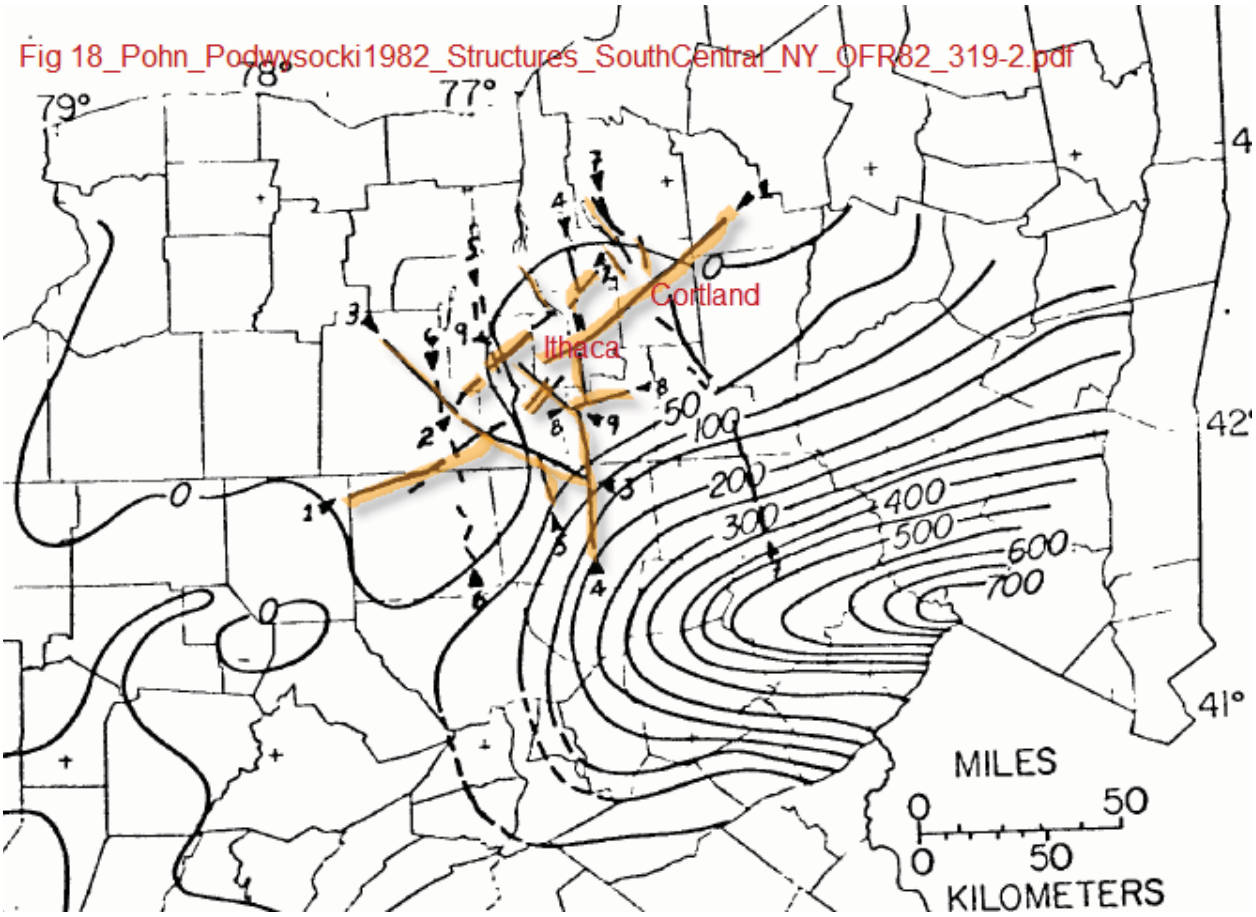


- Figure 3: Structure map of south-central New York showing relationships of the proposed faults with known structures.

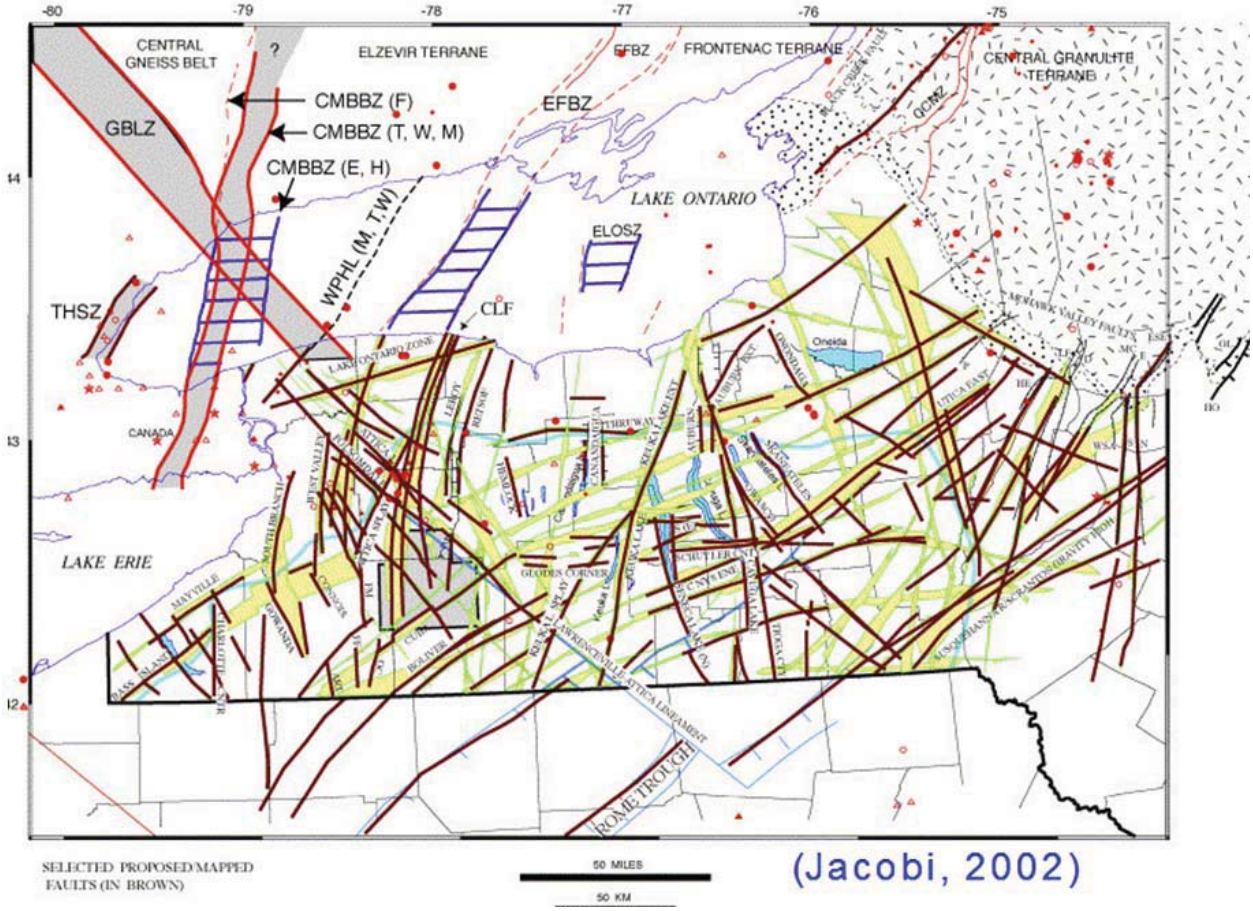
- An independent USGS study (Podwysocki, Pohn, and others, 1982) investigated the feasibility of storing high-level radioactive waste in the Salina Salt Formation in south-central NY. In addition to mapping the faults also mapped in the Murphy paper (1981), this USGS report mapped additional faults and probable faults such as W. Danby thrust faults, the Cortland-Ithaca fault, Watkins Glen-Taughannock fault, Corning-Bath fault, Van Etten-Towanda fault, Corning-Bath fault, Endicott-Syracuse fault, and others. Although, the presence of faults in these valleys were not confirmed everywhere because of a scarcity of deep well logs, the presence of faults was based on several other sources of data including:
  1. digital contrast enhancement of several Landsat multispectral scanner images,
  2. analysis of lineament patterns from a Landsat MSS-7 mosaic,
  3. field mapping of bedrock joint patterns,
  4. compilation and analysis of surface and subsurface structure and isopach maps,
  5. collection and digital analysis of aeromagnetic data for southern New York,
  6. compilation and analysis of aeromagnetic and gravity data for much of New York and Pennsylvania, and
  7. analysis of seismic reflection survey lines for selected portions of New York and Pennsylvania.

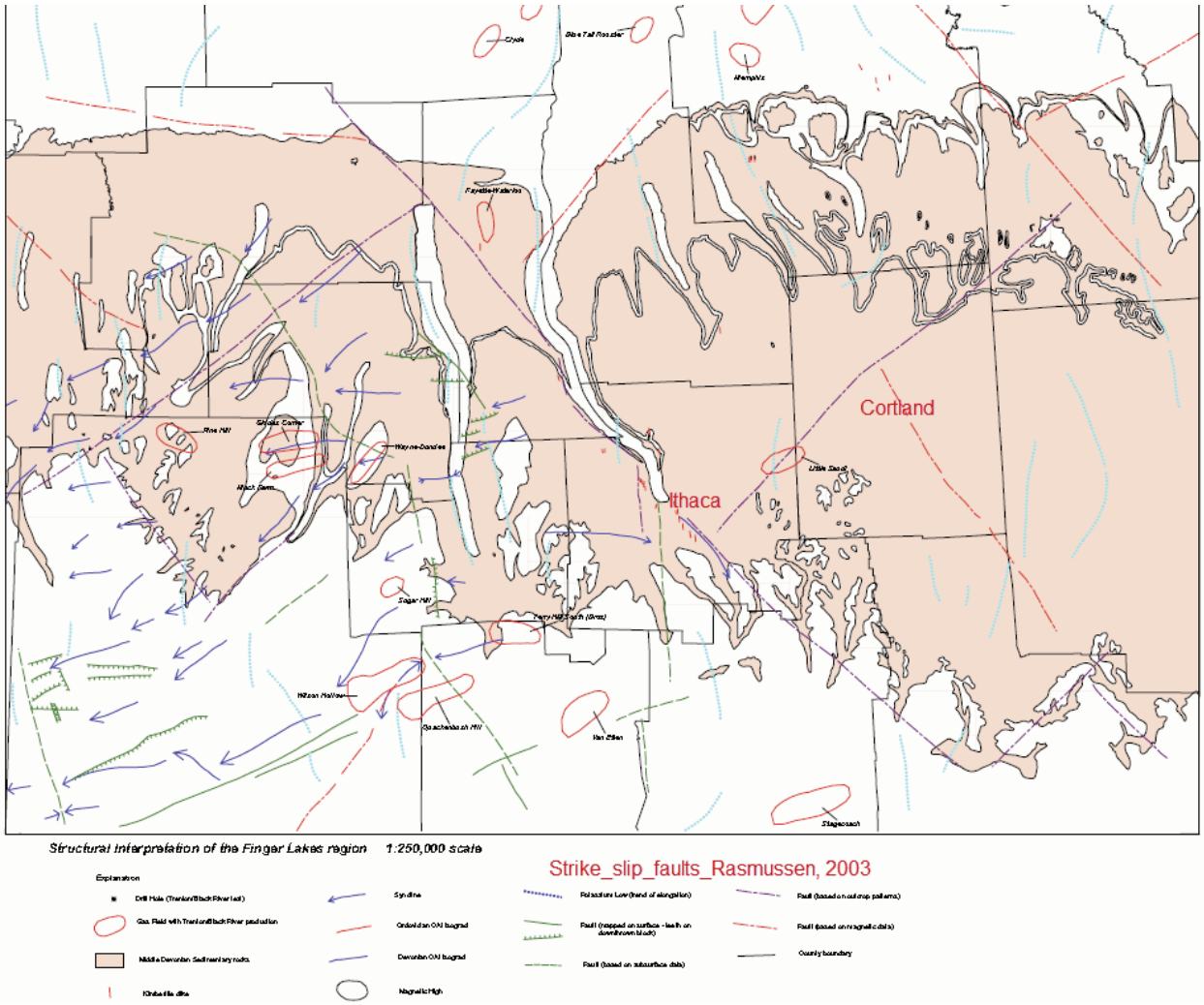
  Podwysocki, Pohn, and others summarized the geology of south-central NY as follows: "*We believe the data examined show the study area to be structurally complex, having undergone several periods of deformation. The stratigraphic units proposed as potential storage beds for disposal of nuclear wastes appear to be affected by both Pre-Alleghanian extensional (?) deformation as well as Alleghanian compressional and shear tectonism. The general shape of the block and its relation to the Alleghanian folds begs for a thrust sheet interpretation for the block,*

with the east and west bounding lineament zones acting as tear faults and the northward displacement being taken up along splay faults of the West Danby fault system. We have cited evidence which corroborates this thesis. Two lineaments within the rectilinear block also display thrust or tear fault attributes. Thus, where on a megascopic scale only one large thrust sheet is recognized, more detailed inspection reveals that the block probably consists of many smaller blocks bounded by their own thrusts and tears."



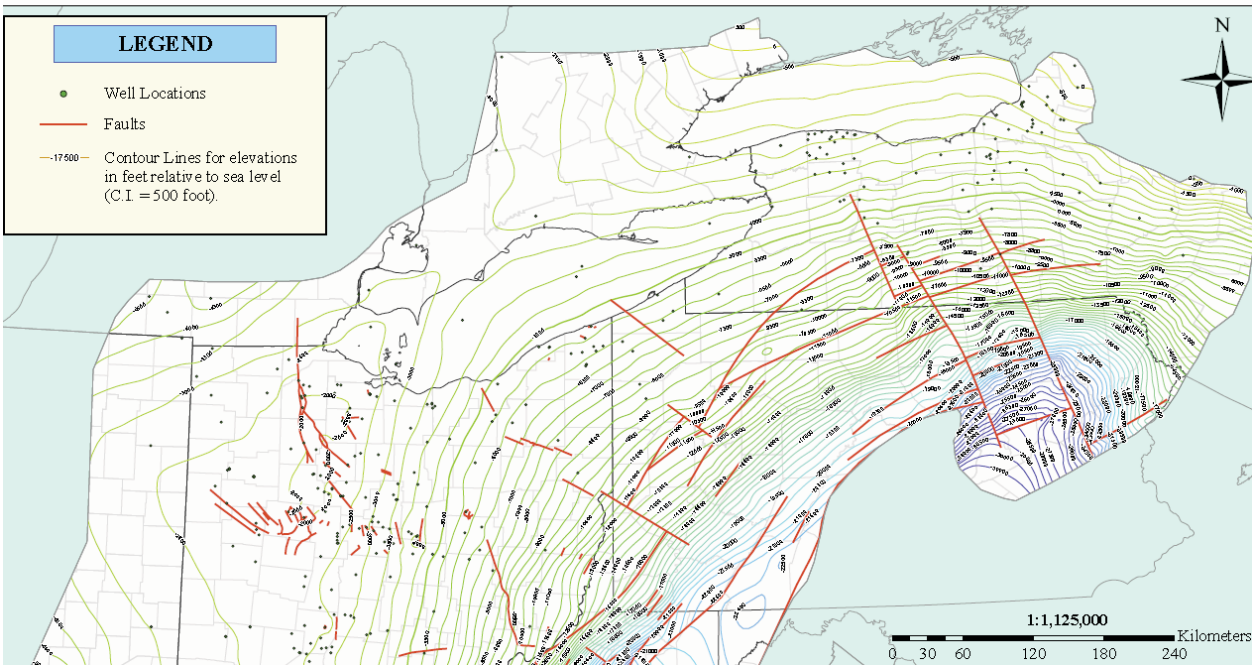
Numerous papers by Jacobi and his colleagues such as Jacobi and others (2002) mapped additional faults and an extensive array of Fracture Intensification Domains (FIDs) which were particularly useful in that they generally mark the location of nearby faults that can be identified on the basis of stratigraphic displacements inferred from outcrops, well logs, or seismic reflection data (e.g., Jacobi and Fountain, 2002). Moreover, faults with small offset commonly occur in outcrops within an FID. Thus, by identifying lineaments, and ground truthing the lineaments, it is possible to predict the location and extent of subtly expressed faults that were previously overlooked. Evidence utilized for recognition of faults in NYS included the integration of FIDs, E97 lineaments, topographic lineaments, gradients in gravity and magnetic data, seismic reflection profiles, and well logs.


-80
-79
-78
-77
-76
-75
CENTRAL GNEISS BELT
?
ELZEVIR TERRANE
EFBZ
FRONTENAC TERRANE
CENTRAL GRANULITE TERRANE
GBLZ
CMBBZ (F)
CMBBZ (T, W, M)
CMBBZ (E, H)
EFBZ
QCBZ
LAKE ONTARIO
ELOSZ
WPHL (M, T,W)
CLF
THSZ
CANADA
LAKE ERIE
Oneida
ROME TROUGH
SELECTED PROPOSED MAPPED FAULTS (IN BROWN)
50 MILES
50 KM
(Jacobi, 2002)

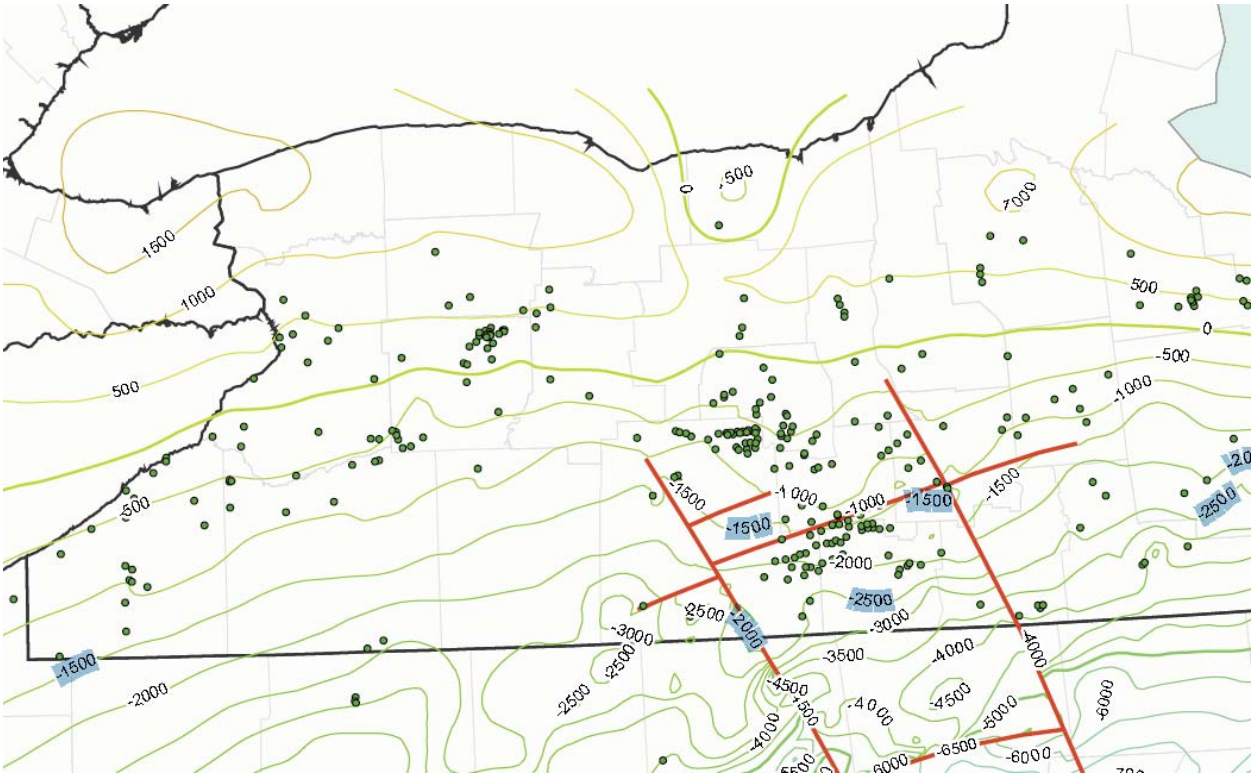


More faults (above map) mapped by Ramussen and others, 2003.

Plate 2-2 : Structure of the Top of the Precambrian Unconformity



Faults (top of Precambrian) mapped by the **Trenton-Black River Research Consortium, 2006**



Faults (base of Devonian) mapped by **Trenton-Black River Research Consortium, 2006**

In addition to fault studies that have been conducted in NY, consideration should also be given to fault studies conducted in Pennsylvania because several studies in that state show that some faults (not mapped in the NY fault map, fig. 4.13, dSGEIS) extend to the NY/PA border (it is almost certain that faults don't stop at the border) and some faults extend into New York (example below. Pohn, 2000, fig. 36, p.53).

THE PRESENCE OF LATERAL RAMPS WORLDWIDE 53

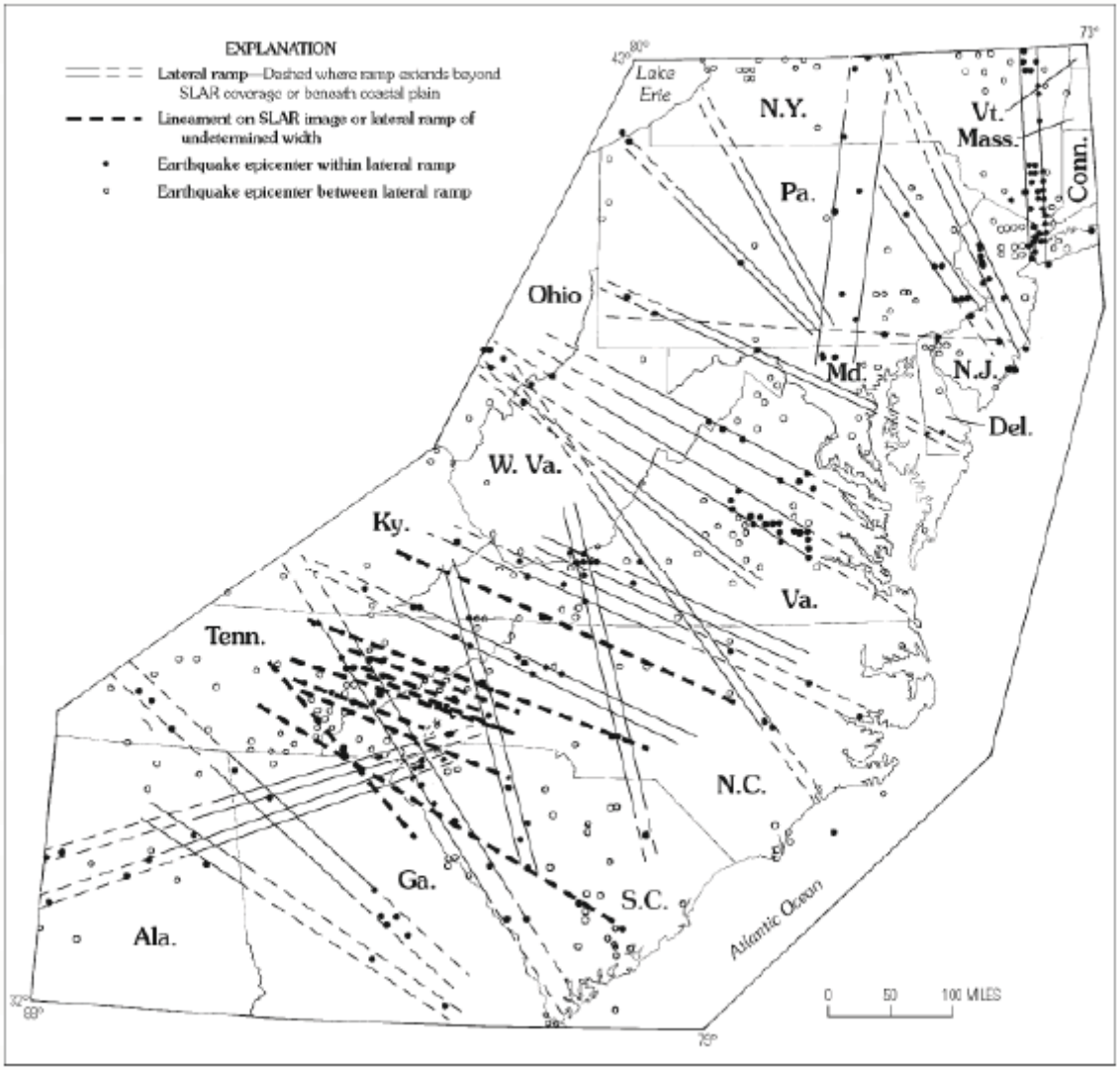


Figure 36. Map showing relationship between lateral ramps and earthquakes in the eastern United States. See figure 30 for ramp names. Earthquake data are from Earth Technology Corporation (written commun., 1984). Modified from Pohn and Coleman (1991).

On Page 4-18, it is stated "Figure 4.13 shows the locations of faults and other structures that may indicate the presence of buried faults in New York State.[35]" This map does not show "other structures that may indicate the presence of buried faults in New York State", it shows only faults. In fact, the note in the bottom of the map states that the other structures that may indicate the other buried faults were removed from the map, such as brittle structures (ex. lineaments). If Alpha believes there are other structures shown on the map that may indicate other buried faults then they should be labeled as such on the map.

If Alpha really meant to show other structures that may be faults, then the fault maps such as by Jacobi (2002, shown below) and others should have been used. Also, the footnote at the end of the sentence cites an Alpha report (Alpha, 2009) which is not the original source of data, which is Isachsen and McKendree (1977). Alpha should not be taking credit for the fault map which they did not construct. This citation comment goes for many other references that are cited by Alpha throughout the report.

Because many more faults exist than that depicted in the fault map by Alpha (fig. 4.13), the risk for migration of gas and fluids during gas drilling operations is greater than that claimed in the dSGEIS, especially, since it has been demonstrated that hydraulic fracking can result in forcing fluids up a vertical or nearly vertical fault to land surface (Jacobi and Dellwig, 1974). Also, it follows that since earthquakes are associated with faults and that the fault map by Alpha grossly under represents the number and extent of faults in central NY, that the discussion and conclusions of seismicity risks (dSGEIS section 6.12) are, at best, inconclusive, and probably not even valid. Without a thorough understanding of the extent, distribution, and cause of faulting, one cannot make creditable statements about the risks of seismicity during gas drilling operations.

Although Alpha states that "It is important to avoid injecting fluids into known, significant, mapped faults when hydraulic fracturing.", the dSGEIS does not state a requirement that gas drillers need to stay clear of faults, rather it is at the discretion of the gas drilling companies to do so. Due to the importance to avoid hydrofracking in fault zones due to potential for contaminates (fluids and gas) to migrate through these preferred avenues with greater permeability, the NYSDEC should require that gas drillers stay clear of faults. In order to accomplish this, a thorough background literature search should be conducted on faults in central NY. The known faults, probable faults, hypothetical faults, zones of concentrated vertical fractures (Jacobi), and areas where there is insufficient data to determine whether faults are present or not, should be identified. Just because a map doesn't show faults doesn't mean that none are present, it may, or is likely, that there just is insufficient data to determine that case. The literature search of previous studies indicates that where there is abundant deep subsurface data, there tends to be more mapped faults than in areas where data is scant.

17. Section 4.7, Naturally Occurring Methane in New York, Section 4.7. *The discussion on naturally occurring methane in New York minimizes the potential contamination of water wells from methane and conclusions drawn in this section do not follow the data presented.*

Page 4-38. Alpha cites the 2011 Duke University report on the occurrence of methane contamination of drinking water associated with Marcellus and Utica Shale gas development as evidence that methane gas concentrations are higher away from active gas extraction wells (in a small group of samples collected New York). However, the conclusions of the Duke report are opposite of that indicated by Alpha. Curiously, Alpha does not mention the most important conclusions of the study, that samples taken from wells located within 1 kilometer (0.62 miles) of shale drilling sites tended to have higher concentrations of dissolved methane (the primary component of natural gas) than samples taken from wells located more than 1 kilometer from drilling sites. Detailed analyses of the methane indicated that it originated from deep earth deposits (thermogenic), rather than from near-surface sources (biogenic). The authors listed three possible ways that deep methane can rise to shallow drinking water supplies, and suggested that leaky gas well casings were most likely. Such methane may pose an explosion risk within enclosed spaces. In contrast, concentrations of chemicals associated with hydraulic fracturing flowback water (salt, boron, radioactive radium) did not differ according to distance from drilling sites. Thus, the findings do not show evidence that flowback from hydrofracking contaminates drinking water, at least in the timeframe of the study. Conversely, the fact that the authors did not find other contaminants associated with drilling near Marcellus operations suggests that flowback does not cause widespread contamination of drinking water – as is widely feared. However, because methane is more mobile than other dissolved substances, those other substances may appear in the future. As excerpted from the abstract-*"-In active gas-extraction areas (one or more gas wells within 1 km), average and maximum methane concentrations in drinking-water wells increased with proximity to the nearest gas well and were 19.2 and 64 mg CH4 L−1 (n ¼ 26), a potential explosion hazard; in contrast, dissolved methane samples in neighboring nonextraction sites (no gas wells within 1 km) within similar geologic formations and hydrogeologic regimes averaged only 1.1 mgL−1 (P < 0.05; n ¼ 34). Average δ13C-CH4 values of dissolved methane in shallow groundwater*

were significantly less negative for active than for nonactive sites (−37 _ 7‰ and −54 _ 11‰, respectively; P < 0.0001). These δ13C-CH4 data, coupled with the ratios of methane-to-higher-chain hydrocarbons, and δ2H-CH4 values, are consistent with deeper thermogenic methane sources such as the Marcellus and Utica shales at the active sites and matched gas geochemistry from gas wells nearby. In contrast, lower-concentration samples from shallow groundwater at nonactive sites had isotopic signatures reflecting a more biogenic or mixed biogenic/thermogenic methane source. We found no evidence for contamination of drinking-water samples with deep saline brines or fracturing fluids." (Osborn et. Al, 2011).

Page 4-39. The conclusions drawn by Alpha-cannot be interpreted from the data presented. The presented argument made in the last paragraph on this page was that of the 46 wells that were sampled-- *"The highest methane concentration from all samples analyzed was 22.4 mg/L (from a well in Schoharie County); and the average detected value was 0.79 mg/L."* One cannot conclude that *" These groundwater results confirm that methane migration to shallow aquifers is a natural phenomenon and can be expected to occur in active and non-active natural gas drilling areas"* because (1) it has to established first ~~that~~ where the wells sampled were ~~from~~ in relation to active and non-active gas drilling areas (which is not mentioned in the dSGEIS) and (2) it's the number of wells within the dataset with a significant conc. of methane that determines whether methane occurrence is common or not (not the average conc or highest conc). A histogram of the distribution of conc. of methane should be used. The well with the highest concentration and the average concentration of methane of all wells sampled has nothing to do with how common the occurrence is. What also needs to be taken into account is the distance of the sampled wells from faults or zones of concentrated vertical fractures which may be avenues for movement of methane from deep zones to shallow zones. It should be noted that the well with the highest methane concentration was near Belfast in the Genesee Basin (422018078071901, methane 45.4mg/L), is near gas wells. This information should be included in the dSGEIS. In addition, the original USGS data should be cited.

18. Section 4, Geology References. All references should cite the original report that the data, concept, or cited statement originates from, not a subsequent report that uses and cites that information. Credit should be given to the original authors that did the work.

Sincerely,

Frank P. Proto
Chairman
Tompkins County Water Resources Council

Cc:
Governor Cuomo
NYS Senators Skelos, Kolb, O'Mara, Seward, and Nozzolio
Speaker Silver
Assemblywoman Lifton
Chair of Senate Committee on Environmental Conservation (via Mark Grisanti)
Chair of Senate Committee on Local Governments (via Jack M. Martins)
Chair of Senate Committee on Health (via Kemp Hannon)
Chair of Assembly Committee on Environmental Conservation (via Robert Sweeney)
Chair of Assembly Committee on Health (via Richard Gottfried)
Chair of Assembly Committee on Local Government (via William Magnarelli)
Chair of Assembly Committee on Science and Technololgy (via Donna Lupardo)
Chair of Assembly Committee on Toxic Substances and Hazardous Waste (via Mike Spano)
Chair of Assembly Committee on Water Resources Needs of NYS and Long Island (Robert Sweeney)
Members of Assembly Committee on NYSDEC Oversight (Daniel Burling, Crystal Peoples-Stokes, Matthew Titone)
Attorney General Schneiderman

U.S. Senators Schumer and Gillibrand
Representatives Salazar and Hanna
FRAC Act Sponsors in the House and Senate – Diane DeGette, Maurice Hinchey, Jarid Polis, Bob Casey, Chuck Schumer
NYSDEC Commissioner Martens
New York State Association of Counties
New York State Association of State County Health Officials (NYASCHO)
Tompkins County Board of Health
Town Supervisors and Clerks
Tompkins County Legislature
Town of Ithaca Conservation Board
City of Ithaca Mayor Peterson
City of Ithaca Conservation Advisory Council
City of Ithaca Natural Areas Commission
City of Ithaca Water Department
Cayuga Heights Department of Public Works
Cornell University Water Treatment Plant

Electronic copies to:
Tompkins County Planning Department
Tompkins County Health Department
Tompkins County Environmental Management Council (EMC)
Tompkins County Information Officer
Tompkins County Council of Governments (TCCOG)
Tompkins County Soil and Water Conservation District (TCSWCD)
Southern Cayuga Lake Intermunicipal Water Commission (SCLIWC - Bolton Point)
Ithaca Journal
Ithaca Times

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Smith, G.J. and Jacobi, R.D., 1999, Summary-- Structural controls of north-south trending faults strongly influence deposition of the Lower Rushford Member in the northern area of Cattaraugus and Allegany counties. [These faults are not shown in fig. 4.13].

Smith, G.J. and Jacobi, R.D., 2000, Geologic investigation of the gas potential in the Otsego County Region, Eastern New York State (Shows faults in Schoharie and Montgomery Counties that are not depicted in Fig. 4.13)

Stone & Webster, 1978a, Regional geology of the Salina Basin: The Office of Nuclear Waste Isolation, Battelle Memorial Institute, Project Management Div., U.S. Dept. of Energy, Report no. ONWI/SUB-E512-00600/1, v. I.

Stone & Webster, 1978a, Regional geology of the Salina Basin: The Office of Nuclear Waste Isolation, Battelle Memorial Institute, Project Management Div., U.S. Dept. of Energy, Report no. ONWI/SUB-E512-00600/1, v. II.

Stone & Webster, 1979, New York and Ohio Technical Update and Summary: The Office of Nuclear Waste Isolation, Battelle Memorial Institute, Project Management Div., U.S. Dept. of Energy, Report no. ONWI/SUB-E512-00600/1, v. III.

2. **Cumulative Impacts for all Interconnected Drilling Activities.** *A process needs to be established to address impacts from all interconnected activities, including drilling operations, that are regulated by NYSDEC and pipelines and compressor stations that are regulated by the PSC.* An Environmental Impact Statement for the gas lines and compressor stations must be performed by the PSC to assess the cumulative impacts on water resources, community infrastructure and quality of life issues such as noise, road damage and air quality from the additional pipelines and compressor stations that will be needed to transport the gas from the thousands of individual well pads to the regional pipelines. A compressor station will be needed for each hundred wells, with pipelines from each well to the compressor station, and additional pipelines from the compressor station to the main transmission line. However, the dSGEIS did not address the impacts of the pipelines or compressor stations necessitated by well drilling operations. The impact of the vast network of access roads, pipelines and compressor stations must be addressed by the SGEIS. The dSGEIS identifies the Public Service Commission (PSC) as the responsible agency to oversee construction and protection of the environment for pipeline construction. This segmentation of the environmental impact assessment makes it difficult for decision makers and the public to adequately assess the total environmental impacts anticipated from gas drilling activities.

3. **Program to Monitor and Protect Drinking Water Resources.** *Proper monitoring and assessment strategies must be in place to protect the State's water resources, and sufficient laboratory capabilities for analysis must be in place prior to drilling.* The state currently does not have a strategy in place for data collection and analysis. Such a strategy is key to developing a comprehensive regulatory process that must be in place prior to drilling. All stakeholders (regulatory personnel, drilling companies, and the public) need to be ensured that valid data is being collected and disseminated in a cost effective manner. Considering the volume of environmental and public health data that will be generated by HVHF gas drilling, it is essential that NYSDOH develop and manage comprehensive databases in order to facilitate effective, comprehensive oversight and public protection during gas drilling. A program must be developed for electronic sharing of monitoring data and must be shared with local health departments as they will be the agency first contacted if any contamination is detected.

4. **Funding for Environmental Oversight. Permit fees must be increased to cover the entire cost of a regulatory program for environmental oversight of the Marcellus gas drilling.** The State and local governments will incur increased costs for 1) DMR personnel to oversee field operations and process the associated paperwork, 2) health department personnel to develop and maintain a database, to evaluate drinking water quality data collected from groundwater wells near the drilling sites and respond to water quality complaints, 3) NYSDEC personnel to monitor surface water discharges from treatment plants, 4) personnel in the NYSDEC to develop and maintain a database on surface water flows and quality in the areas where drilling is occurring, 5) other regulatory personnel needed in the NYSDEC Division of Water and Bureau of Hazardous Waste and Radiation Management as well as the DMR to oversee the immense program that drilling in the Marcellus Shale will necessitate, and 6) local municipalities cover increased costs for expanded services caused by drilling activities. The Division of Budget must perform an economic analysis to ensure the fees are adequate to fund the necessary environmental oversight.

5. **Permit Re-evaluation.** The NYSDEC re-evaluation of specified permit condition in two or three years should involve public review and comment.

6. **Other low permeability shale formations.** The scope of the dSGEIS includes all low permeability shale formations where HVHF gas drilling will be employed. However, many sections of the document only reference the Marcellus Shale. Environmental impacts associated with other low permeability gas reservoirs where the hydrogeochemistry is different than the Marcellus shale are not addressed in the dSGEIS. The SGEIS must be expanded to include potential impacts from other formations.

2. LOCAL GOVERNMENT NOTIFICATION

1. **Local Government Notification. Local Governments need to be involved and informed in all aspects of the drilling process and a procedure for this needs to be in place before drilling begins.** Each municipality should receive copies of gas drilling permit applications, including parcel tax map numbers, before any permits are issued by NYSDEC. The NYSDEC should also be required to provide each local municipality and county government with 1) accurate Environmental Inspector contact information for permit coordination between agencies as well as emergency and spill response coordination, and 2) written notification to each municipality of location of each well plugging permit application, including tax map parcel number and mapping coordinates.

2. **Section 8.1.1.3.** "The Department will notify local governments of all applications for high-volume hydraulic fracturing in the locality, using a continuously updated database of local government officials and an electronic notification system that will both be developed for this purpose." The database developed and used to notify public officials of applications for drilling permits should be open to all public officials. Local government officials should also be notified when permits are issued. The local health department, County Administrator, and Town Supervisor or Village Mayor should be included in the local officials notified and this section should specify who in local government is to be notified.

3. REQUIREMENTS FOR MANDATORY DISCLOSURE OF HYDRAULIC FRACTURE ADDITIVES AND ALTERNATIVE ANALYSIS

This requirement is absolutely necessary to ensure adequate evaluation of disposal alternatives for fracking wastewater and we appreciate the addition of this requirement in the dSGEIS.

4. ENHANCED REQUIREMENTS FOR WELL CONSTRUCTION AND MANAGEMENT OF DRILL CUTTINGS

Appendix 8. The dGEIS indicates that surface casing should not extend into zones known to contain measurable quantities of shallow gas. Shallow saltwater and (or) gas has been penetrated in the upper Devonian bedrock in some areas. It is not clear from the dSGEIS how casing and cementing requirements will be modified to deal with these conditions, nor how drilling companies will know before they drill in an area if they should suspect gas in the upper Devonian in an area they are drilling. NYSDEC should have a program in place before issuing permits that will require drilling companies to *collect and share water quality data* concerning shallow gas and the depth of the fresh water. A database must also be established for this data.

5. Prohibition on well pads in New York City and Syracuse watersheds and 4,000 foot buffer

Section 6.1.5 Unfiltered Surface Drinking Water. ***NYSDEC should prohibit HVHF in all watersheds where surface water is the source of a public drinking water system, in addition to unfiltered surface water drinking sources.*** In section 6.1.5.1, p. 6-46, the dSGEIS states that Increases in phosphorus are expected to create algal blooms, possibly leading to production of neurotoxins, fish kills, taste and odor problems and increases in disinfection byproducts in unfiltered drinking waters or their source waters. Conventional drinking water filtration plants are not designed to remove neurotoxins. Taste and odor problems are not necessarily treatable at filtration plants. Finally, any increase in disinfection byproducts that is tied to increases in soluble organic matter will not be abated by going through a filtration plant.

Under the topic heading of toxic chemicals (section 6.1.5, p. 6-48) the dSGEIS states that unfiltered drinking water supplies have a heightened sensitivity to chemical discharges as there is no immediately available method to remove contaminants from the drinking water source waters. Filtration plants also do not treat chemical contaminants.

New York City's investment in its watershed (and drinking water system) is listed at $1.6 billion (section 6.1.5, p. 6-50). While water quality degradation (virtually guaranteed via storm water inputs per section 6.1.5) in source waters with existing filtration facilities will not require the kind of investment that building a new facility for New York City would, the costs are not insignificant. If water quality degradation included increases in soluble organic matter leading to violations of disinfection byproduct limits, new treatment technologies would have to be added - which could cost millions.

6. Prohibition on well pads in 2,000 foot buffer around public drinking water supplies

Protecting public drinking water supplies is essential to protect public health in the State, so increasing the buffer to 2,000 feet is a critical element in protecting these valuable resources. However, the location of zones with significant vertical permeability such as faults and fracture intensification domains (FIDs) (which have been identified by Jacoby, 2002, as often being associated with known faults and suspected faults) in the vicinity of public water supplies also has to be taken into account. Jacoby and Dellwig, 1968, found that fracturing induced brine flow 0.5 miles from the well being fractured. If there are faults or FIDs shown on published maps within 1000 feet of a public water supply well, well pads should also be prohibited within 2,500 feet of the fault or FIDs (Jacoby and Dellwig, 1968).

7. Prohibition on well pads in 500 foot buffer around private well supplies

Protecting private drinking water supplies is as essential as protecting public water supplies. We appreciate the increase in buffer to 500 feet; however, the buffer distance should be 1,000 feet to adequately protect these vital resources.

8. Prohibition on well pads in primary aquifers and 500 foot buffer

Protecting primary aquifers is essential to protect public health in the State. Although we appreciate the prohibition of well pads within primary aquifers and within a 500 foot buffer, the buffer should be increased to either the surface water divide for the aquifer or 2,000 feet from the aquifer **boundary** whichever is less to adequately protect these vital resources.

9. Prohibition on well pads in 100-year floodplain

Floodplains: We appreciate that well pads will not be permitted in floodplains and that NYSDEC is updating the floodplain maps. However, until the floodplain maps are updated, there should be a 500 foot setback from floodplains to provide a measure of safety from potential flooding.

10. Requirement for site specific SEQRA determination for well pads in principal aquifer and 500 foot buffer

Protecting New York State's public water supplies is essential to protect public health in the State. Requiring a site specific SEQRA determination for well pads in principal aquifers and within a 500 foot buffer is not adequate to protect these vital resources. Well pads should be prohibited in principal aquifers and within a buffer that includes either the surface water divide for the aquifer or 2,000 feet from the aquifer boundary, whichever is less, to adequately protect these vital resources.

11. Requirement for site specific SEQRA determination for certain water withdrawals

[no comment]

12. Passby flow calculation methodology and well permit conditions

The proposed passby flow calculation methodology is superior to the previous methodology contained in the 2009 dSGEIS and we support this change.

13. Comments on other revisions that are included in the 2011 dSGEIS (please identify/specify)

1. Section 7.1.4. The water quality monitoring program should **not** be complaint-based. ***NYSDEC should establish a groundwater monitoring and reporting procedure*** that requires the applicant to submit electronic versions of the analytical results to the repository agency and local health department within a specified time period and requires the applicant to determine if there have been any significant increases in chemical or physical concentrations. As in groundwater monitoring around landfills, the groundwater monitoring program around gas drilling sites should establish procedures for follow-up testing if results indicate there may be contamination in the monitoring wells. If the program is complaint-based, the burden of proving there is a problem will fall on the property owner, and he or she may not have the knowledge to understand the analytical results and know if there is a problem until the contaminant levels are very high. Moreover, with a complaint based program the property owner may have to pay for further tests to confirm the contamination. The burden for determining if there has been contamination of groundwater and any follow up actions required should be on the applicant, not the property owner.

2. Section 7.1.4.1, Pg. 7-44. *"…the results of each test must be provided to the property owner within 30 days of the operator's receipt of the laboratory results. The Department would further require that the data be available to the Department and local health department upon request for complaint investigation purposes."* Results should be required to be provided to the local health department and the NYSDOH. The NYSDOH should be the official data repository. *The data collected should be entered into a state-wide database that is available to the public.*

14. Additional comments you think should be reflected in the final SGEIS

1. Flowback Water Treatment Section 7.1.8. ***A thorough analysis of the cumulative impact on the receiving water should be conducted if multiple wastewater treatment plants will be used to dispose of wastewater into the same surface water body*.**

2. Waste Classification. Flowback and production waters should be classified as hazardous waste and subject to the corresponding regulations.

3. Cumulative Impacts Section 7.1. The dSGEIS should address the combined impacts and the cumulative impact on groundwater and surface water. *Safeguards should be included to ensure that the millions of gallons required for the drilling operations will not leave local residents without adequate drinking water*. Although the Water Resources Bill passed in 2011 would address cumulative impacts of groundwater withdrawals, when and if regulations are developed, rules governing water withdrawal permits must be developed before permits are issued for drilling. How can we make comments on water withdrawal when the permit and guidelines for water withdrawal are not yet available?

4. Groundwater Monitoring Section 7.1.4.1, Pg. 7-44. Before drilling the operator must be required to identify any abandoned gas or oil wells along the length of the horizontal bore hole as well as any mapped faults. The fault map in the dSGEIS (Fig. 4.13) is based on outdated information and does not contain many mapped faults (see comment 15 below). If any of these features have been identified along the horizontal length of the proposed bore hole the horizontal extent of monitoring should be increased to include these features. Drinking water wells within 1,000 feet of the well pad, or if there are none identified, drinking water wells within 2,000 feet of the horizontal well pad, should be included in the

monitoring program.

5. Groundwater Monitoring Section 7.1.4.1, Pg. 7-44. "*Testing before drilling is recommended as a mitigation measure related to the potential for groundwater contamination….*" This contradicts Appendix 10 which states that before site disturbance, the operator must sample and test residential wells. Section 7.4.1 should be changed to clarify that well testing is required before drilling in order to establish a baseline for comparison in the event groundwater contamination is suspected.

6. Groundwater Monitoring Section 7.1.4.1, Page 7-45. Sampling and analysis only continue until one year after the last well on the pad is hydraulically fractured. Part 360 requires at least five years of post closure monitoring. To detect longer-term cumulative impacts to the groundwater resources such as a gradual regional increase of chlorides and methane in the groundwater, *the permit should require that sampling continue at a minimum number of selected wells at least annually until the gas well is decommissioned.*

7. Groundwater Monitoring Section 7.1.4.1. *Water quality monitoring programs should focus on monitoring the groundwater resource, not just existing drinking water wells*. Water-supply wells should not be the sole means of determining if groundwater contamination has occurred near a Marcellus Shale gas well due to the unknown or varying construction, operation, and availability of these wells, and the possibility that there may be no private wells or springs within 2,000 feet of the proposed well pad. Natural groundwater quality in the aquifers overlying the Marcellus and Utica play areas is highly variable. Concentrations of parameters such as chlorides and radioisotopes vary by two orders of magnitude in water sampled from water wells. With such natural variability, documentation of water-quality impacts from gas drilling and hydraulic fracturing would be extremely difficult if baseline data do not exist. As in environmental regulations relating to landfills (360-2.11), the permit should require the applicant to install and monitor groundwater wells to detect groundwater contamination before it reaches individual or public supply wells. The results of the recent Duke study (Osborn, et. al., 2011) found evidence that methane concentrations increased in proximity to the nearest gas wells and detailed analysis of the methane indicated it came from deep earth deposits rather than shallow biogenic deposits. Thus, the risk of methane migration is a real potential threat to wells near gas drilling sites, and migration of methane should be detected using monitoring wells before it reaches a private water supply well. *At least three monitoring wells should be installed around each well pad (two downgradient and one upgradient) and these wells should be used to determine the direction of groundwater flow in the vicinity of the well pad and sampled and analyzed at the same frequency as the private water supply wells*.

8. Groundwater Monitoring Section 7.1.4.1, Pg. 7-48. Review of the water-well testing results by local health departments as proposed in the draft SGEIS following a complaint cannot be accomplished without additional resources. The Department proposes that county health departments have responsibility for initial response to most water well complaints, referring them to the Department when causes other than those related to drilling have been ruled out. *Funds for implementing this program should be provided to local health departments.* Fees cannot be raised directly by the local health departments since the NYSDEC has sole regulatory authority over gas wells.

9. Groundwater Monitoring Section 7.1.4. *Enforcement and mitigation procedures for non-compliance with well-testing requirements and parameters should be in place before drilling permits are issued by NYSDEC.* The well testing procedures outlined in the dSGEIS do not specify what enforcement actions will be taken if well testing requirements are not adhered to by the operator. Enforcement procedures for non compliance with well testing procedures must be in place before permits are issued for drilling.

10. Groundwater Monitoring Section 7.1.4.1. Table 7.2 Test parameters: There are several parameters that are important in evaluating potential contamination from HVHF. Arsenic, strontium and turbidity have important health concerns associated with them and should be included in table 7.2. Sodium, which is included in Table 7.2, is redundant and can be eliminated. It is generally not possible to take static water level in a private well and this parameter also should be eliminated. Also, the VOC

analysis is vague; VOCs should be analyzed using EPA Method 524.2

11. Groundwater Monitoring Section 7.1.4.1, Pg. 7-47. Sampling protocol: The sampling protocol described on page 7-49 is mostly reasonable. However, a blanket requirement that the well pump be run for five minutes before taking samples is misleading and should be changed. If the well is being used, the water in the pressure tank can be assumed to be representative of water in the formation. Therefore, if the water is run to evacuate half the volume of the pressure tank, or 5 minutes, whichever is less, before sample collection, the water sampled should be representative of water in the formation. It is not necessary to disinfect the faucet before sampling because biological samples are not being analyzed.

12. Surface Water Monitoring Sections 7.1.2 and 7.1.3. Because of the possibility of surface water contamination from storm water runoff and/or surface spills associated with gas drilling activities, a program to monitor surface water quality in areas affected by HVHF should be established by the NYSDEC. The NYSDEC should establish a fund to be used for surface water monitoring using a funding mechanism similar to FL-LOWPA whereby the NYSDEC allocates funds to Soil and Water Conservation Districts (SWDC) and SWCD staff request and review proposals from local agencies and organizations to monitor surface water quality.

Each local program should select monitoring locations in anticipated high activity areas in such a way as to better understand the general characteristics of the watershed as well as to characterize, to the extent they are known pre-drilling, the smaller catchment areas where gas wells will be drilled. The following minimum monitoring frequencies and water quality indicators are recommended:

1. Chemical monitoring
Frequency: Pre-drilling and at least quarterly during drilling and fracking;
General method: Water samples collected and analyzed by a certified lab;
Indicators of pollution: Soluble reactive phosphorus, total phosphorus, count of either E. coli or fecal coliform, total suspended solids, turbidity, and a set of "signature chemicals" to screen for contamination by toxic compounds in gas well waste: pH, alkalinity, total dissolved solids, conductivity, potassium, chloride, bromide, sulfate, total hardness, barium, strontium, dissolved oxygen, chemical oxygen demand, gross alpha radioactivity, gross beta radioactivity.

2. Biological monitoring
Frequency: Pre-drilling and at least once a year
General method: Benthic macroinvertebrate (BMI) sampling and analysis. Two replicate samples are collected at each of a subset of chemical monitoring locations. Adhere to Tier 2 or Tier 3 protocol in Hudson Basin River Watch Guidance Document, which are based on NYSDEC monitoring protocols.

3. Follow-up
Monitoring should continue for at least five years after the last gas well on a multi-well pad has been plugged. If monitoring results indicate degradation of the designated use of a stream, lake or reservoir in the vicinity of the well pad, the NYSDEC should investigate, as mandated under the Clean Water Act.

All water sampling results should be made available to the public.

In order to minimize impacts from spills and other incidents, NYSDEC representatives should be monitoring drilling activities on-site at least three times per week.

13. Wetlands Section 7.3. While Section 7.3 refers to the State's Freshwater Wetland Regulatory program, HVHF should be prohibited within 500 feet of wetlands. Wetland prohibition should include those delineated by NYSDEC, the federal government, and local government.

14. Geology - Extent of Marcellus Shale, Section 4. *Lateral drilling should be prohibited below the Finger Lakes and "Dry" Finger Lake valleys because of the thinness or absence of Marcellus shale in these areas.*

Figures 4.8 through 4.12 These figures which show the extent and thickness of the Marcellus Shale are inaccurate in the Finger Lakes troughs (for ex. Cayuga, Seneca, Skaneateles, Canandaigua Lake troughs) and in some "Dry Finger Lakes valleys" (for ex. Tully Valley and Genesee Valley). Seismic work done by Mullins and others (1996) and well data collected by USGS (Yager and others, 2001, and Yager and others, 2007) have shown that, in these deep trough valleys, the glaciers had eroded down to the Onondaga Limestone (completely removing the Marcellus Shale) and then rode from 5 to 10 miles southward on top of the Onondaga Limestone until it began to rise up back onto the Hamilton Group (including the Marcellus Shale). Since the Marcellus Shale is absent in much of the deep Finger Lakes (ex. Cayuga and Seneca Lakes) and is missing in the northern 2/3 thirds of the medium-deep Finger Lakes (ex. Canandaigua Lake) and in some "Dry" Finger Lake valleys (ex. Tully valley), the extent of the Marcellus Shale is not correct in the figures 4.8.- 4.12. Also, in the southern 1/3 of the medium deep Finger lakes, where the Hamilton Group begins to reappear in the bottom of the trough and where the overlying rock is much thinner than depicted in fig. 4.8, the depths to tops and thickness of the Marcellus Shale are inaccurate. David Barclay (Geology Professor, SUNY Cortland) adds "*The basic issue is that the outcrop maps of the Marcellus Shale being used in the SGEIS ignore the deeply scoured troughs of the Finger Lakes. The maps suggest that Marcellus is present and is over 1000' below the land surface throughout the central and southern Finger Lakes region. However, subsurface data along the lakes collected by Mullins and others in the 1980s and 1990s show that bedrock in the troughs is scoured down to the Onondaga Limestone and so the overlying Marcellus is either locally absent or only thinly buried by Pleistocene lake clays. This means that the Marcellus is much closer to contact with the waters of the Finger Lakes than has been generally assumed. The concern here is that lateral drilling of the Marcellus from well pads near lakeshores may breach into the unconsolidated lake floor sediments, from where drilling fluids may then escape into overlying lake waters. Even if drilling does not cross the bedrock-sediment contact, drilling close to this boundary may still enable fluids to escape horizontally when wells are pressurized during hydrofracking. Nowhere in the SGEIS do I see consideration of the natural topography of the Finger Lakes troughs and how it might affect drilling operations."* Therefore, since the Marcellus is absent, thinner (by ice erosion), or overlain by much less rock than depicted in figs. 4.8 – 4.12, lateral drilling should be prohibited below the Finger Lakes and "Dry" Finger Lake valleys. In addition, a significant buffer should be included along the trough walls for both well bores and laterals to prevent fracking solution from entering the lake trough.

15. Geology - Extent of Marcellus Shale, Section 4. *NYSDEC must establish a set back distance for well bores and laterals from salt mines***.** Past solution mining practices for salt mines has typically caused collapses and disruptions of bedrock structure. These zones of disrupted bedrock structures could act as conduits through which fluids could flow, including methane-rich formation fluids and fracking fluids. During hydrofracking, it is possible that highly-pressurized drilling fluids will force methane-rich fluids in the disrupted zones to flow into the salt mines.

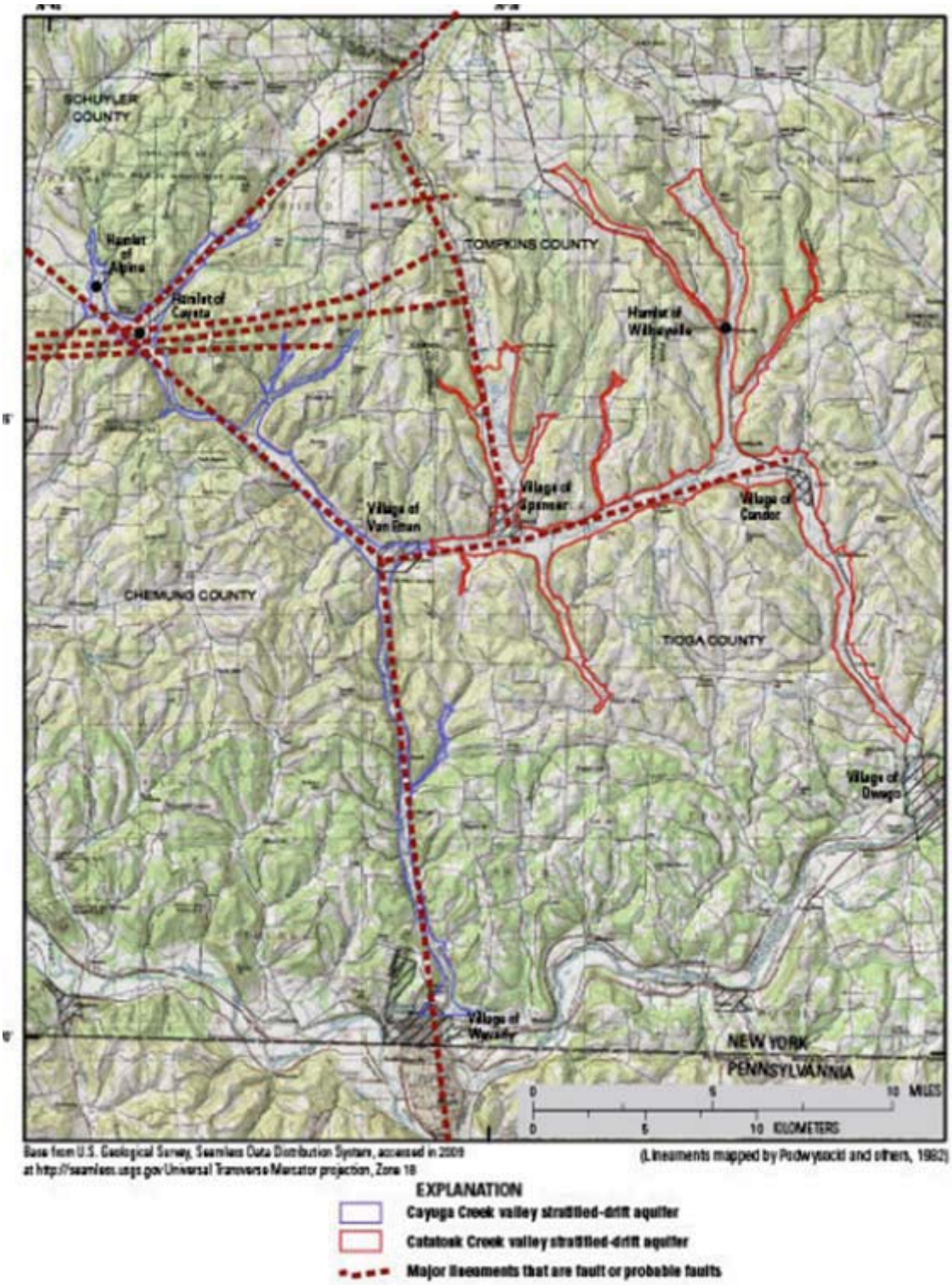
16. Geology – Faults. *The mapping of faults in the dSGEIS is inadequate and the potential impact of hydrofracking near faults is not given adequate attention in the dSGEI**S.*** The NYSDEC should require 3-D seismic testing before drilling to ensure neither the well bore or laterals intersect faults.

Section 4.5.1, Page 4-24. There is no discussion of the nature, type, history of tectonic stresses, and timing of the formation of faults in central NY. There is only discussion of the occurrence of faults in eastern and northern NY. This is a major oversight since the main subject of this document is gas drilling that is most likely to occur in the southern central NY.

Section 4.5. There is no discussion that some faults could result in disturbed zones of crushed (brecciated) rock, and if these zones are not healed by precipitation of minerals, igneous intrusions, or movement of salt, then the secondary permeability formed along these fault planes could act as conduits through which fluids could flow, including methane-rich formation fluids and fracking fluids. During hydrofracking, it is possible that highly-pressurized drilling fluids will force methane-rich fluids in the faults to flow upward, possibly discharging to shallow aquifers (if present) or to land surface. **Case history- at the Watkins Glen salt brine field, Jacobi and Dellwig (1974) reported that while hydraulic fracturing was being conducted in one of the wells at a depth of 970 meters (3,180 ft), a flow of brine developed at land surface about .7 kilometer (0.4 mi) to the north probably as a result of the movement of the brine along a strike-slip fault. The strike-slip fault was mapped by Stone &**

Webber (1978a, 1978b, and 1979) and by Murphy (1981). Incidentally, this fault is not shown in dSGEIS fault map, Fig. 4.13 The fault (strike of N5^{0} W) can be projected southward along the west shore of Seneca Lake and extending from the Himrod mine in the north to Watkins Glen brine field (and continuing southward, the fault trace coincides with a landsat lineament mapped by Isachsen and McKendree (1977).

Section 4.5. There is no discussion concerning the potential for faults underlying valleys with sand and gravel aquifers (see figure below).



The map above shows that faults often underlie valleys that contain sand and gravel aquifers. It is possible that methane, methane-rich fluids, and fracking fluids could migrate through faults during the hydrofracking process of gas wells and to the bottom of these aquifers. Therefore, it is prudent that hydrofracking should <u>not</u> be conducted where there are major faults in order to avoid the risk of gases

and fluids migrating upward and contaminating shallow aquifers that are sources of potable water to many residents and communities.

dSGEIS fault map, Fig. 4.13. The fault (strike of N5^{0} W) can be projected southward along the west shore of Seneca Lake and extending from the Himrod mine in the north to Watkins Glen brine field (and continuing southward, the fault trace coincides with a landsat lineament mapped by Isachsen and McKendree (1977).

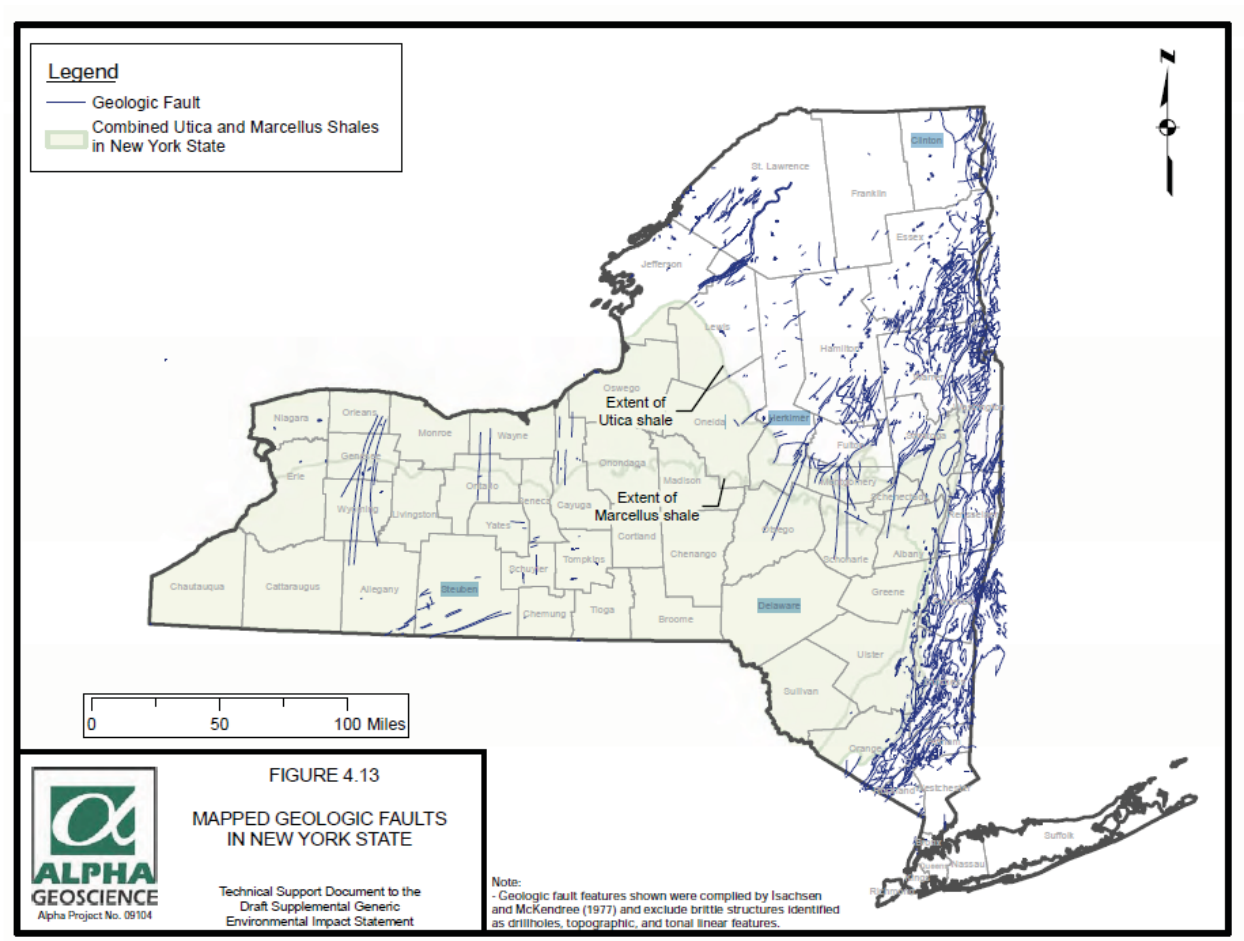


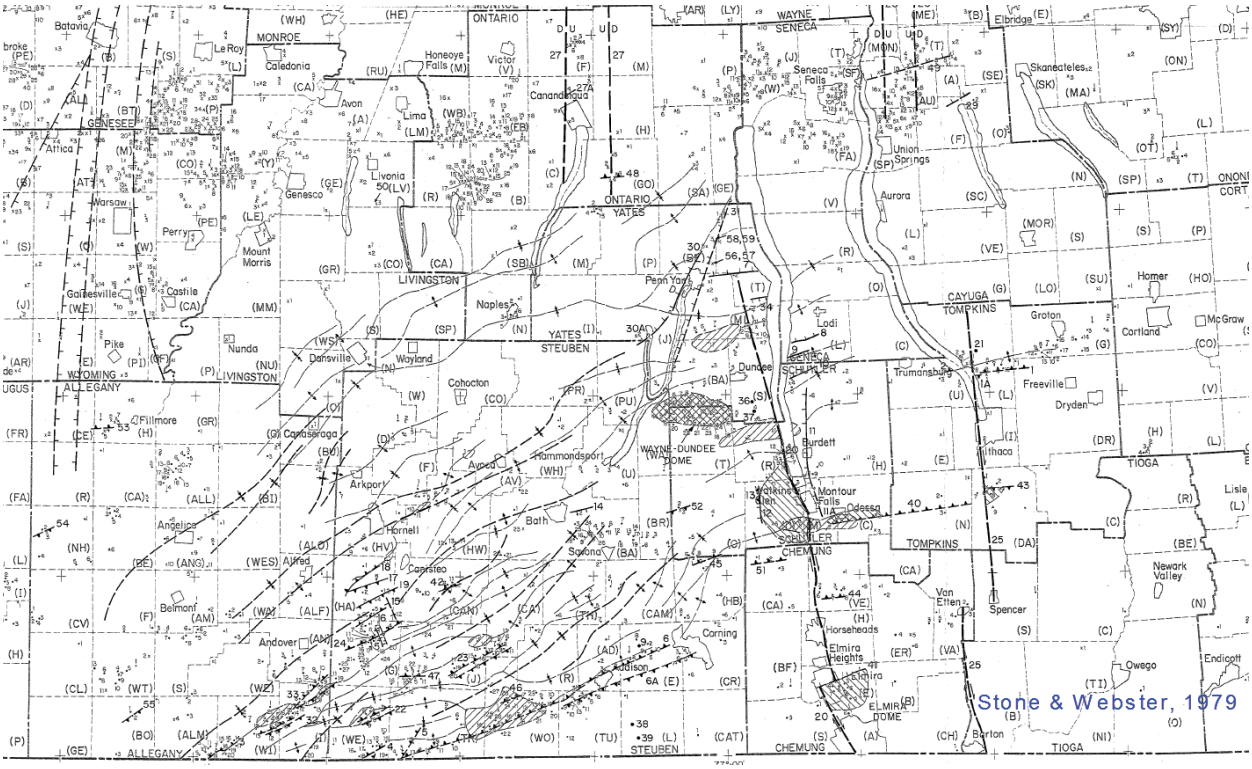
Figure 4.13. This map showing faults in NY grossly under represents the number and extent of faults in central NY. A few notable missing faults include the Retsof, the Leroy, the Cayuga Lake, the Seneca Lake, the Cortland-Ithaca, the Cayuta Creek, Catatonk Creek, the W. Danby faults, and the West Valley faults. The fault map, "Mapped Geologic Faults in New York State", presented as figure 4.13 in the dSGEIS, is outdated (based on mostly pre-1977 gas well and some seismic data, in which the distribution of data was unevenly spread across the southern tier) and does not include many publications that have mapped additional faults. The pre-1977 data that were used in the sGEIS is concentrated in clumps in relatively small areas (such as in Genesee and Wyoming Counties) and there were little data in large parts in central NY (such as in most parts of Tompkins, Cortland, Tioga, and Broome Counties). Data

points should be shown in the map to show where there is ample data and where there is scant data. Even using the incomplete data that were used, it would be only speculation to assume that areas with no or little data contain no faults.

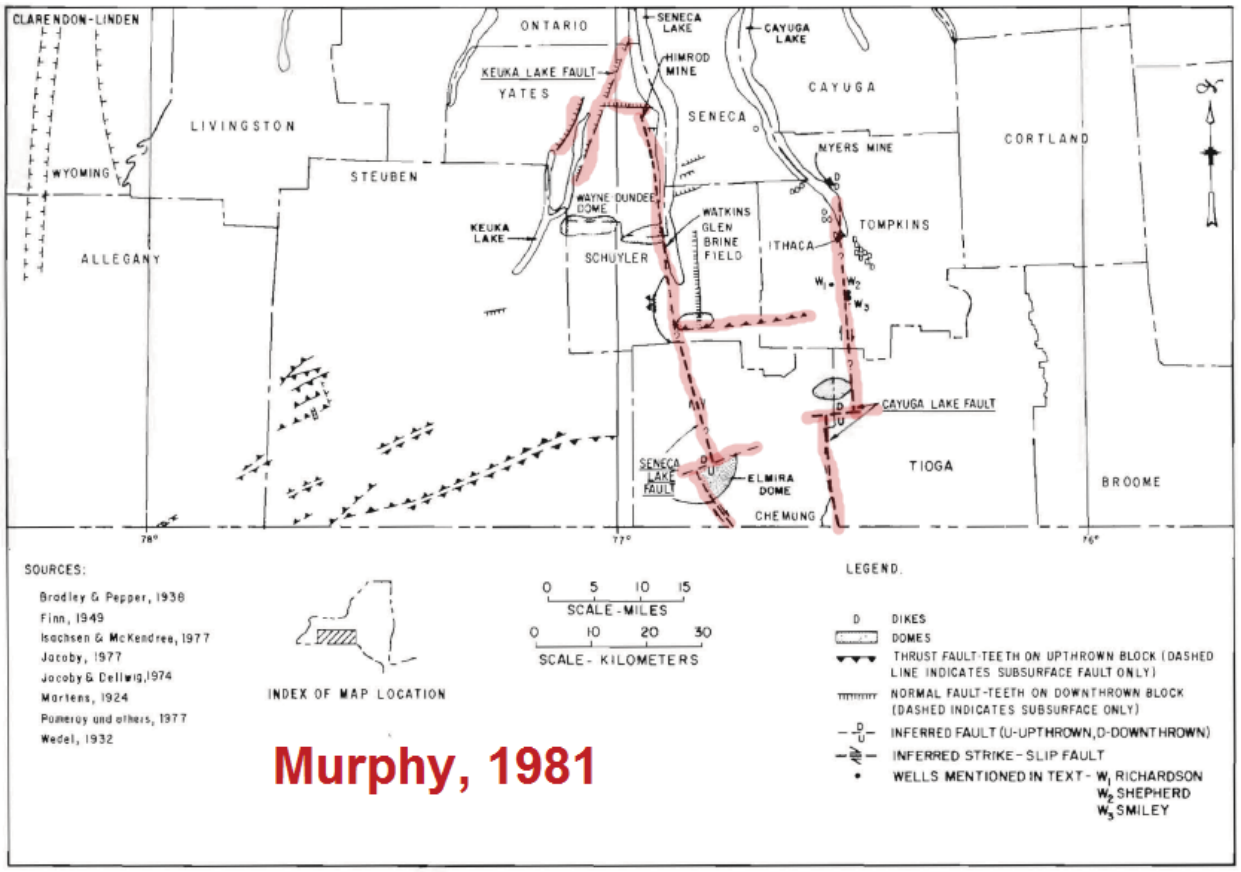
What is disturbing about the fault map in the dSDGEIS is that there already exist many reports (see references) that have mapped or noted many additional faults that are not shown in the fault map that Alpha Geoscience uses in the dSGEIS. Most structural geologists agree that the more likely scenario is that, if more data were available, it would show many more faults. This should be stated in the report. Robert D. Jacobi, professor of geology at University of Buffalo, contends that he and many other structural geologists have uncovered increasingly convincing evidence that upstate New York is severely chopped by hundreds of faults of a kind characterized by very sporadic seismic activity (Jacobi, 2002; and Smith and Jacobi, 2009).

To demonstrate that many more faults have been mapped that are not shown in the fault map (fig. 4.13, dSGEIS), the following list of selected studies is presented below in chronological order. Selected additional papers that report additional faults are:

- The Retsof fault mapped by Jacobi (1969)
- Seneca Lake fault discovered by Jacobi and Dellwig (1974). The fault (strike of N5^{0} W) can be projected southward along the west shore of Seneca Lake and extending from the Himrod mine in the north to Watkins Glen brine field (and continuing southward, the fault trace coincides with a landsat lineament mapped by Isachsen and McKendree (1977**).** (
- Stone & Webster geologic and hydrologic reports (1978a, 1978b, and 1979) which evaluated the suitability of burying high-level radioactive waste in the Salina Formation in central NY. One of the conclusions of the Stone and Webster reports was that "Faulting in the New York study area (south central NY) is more widespread than previously thought" (Oct. 1979). The Stone and Webster report show more faults (see figure below) in central NY than that depicted in figure 4.13 of the dSGEIS.. The Stone & Webster reports also stated in the conclusions that *"We believe that the evidence is sufficient at this time (1978) to conclude that the salt basin in New York is cut by strike-slip tear faults (shown in the Stone and Webster reports but not shown in fig. 4.13 dSGEIS) and other nearly vertical faults which represent potential conduits of groundwater circulation."*



- It has been established that the Clarendon-Linden fault extends beneath Lake Ontario (Hutchinson and others, 1979).
- Murphy (1981), used geophysical well logs supplemented by descriptions of sample cuttings of all wells drilled as of May 1979 to prepare the figure below. Murphy describes the West Seneca Lake fault, the Cayuga Lake fault (which is a right-lateral fault extending south into Cayuta Creek valley and has an en echelon offset along the Catatonk Creek valley), Keuka Lake faults.

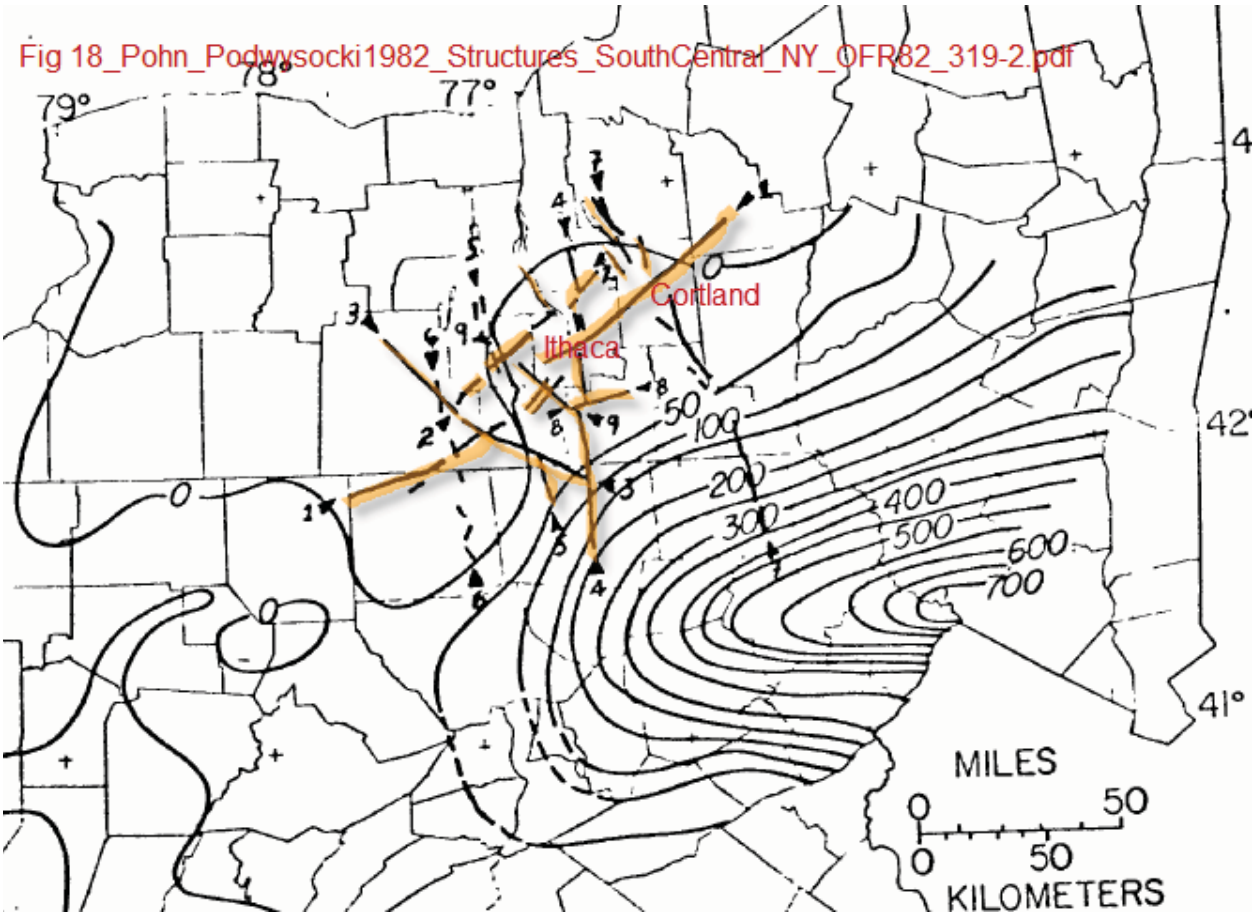


- Figure 3: Structure map of south-central New York showing relationships of the proposed faults with known structures.

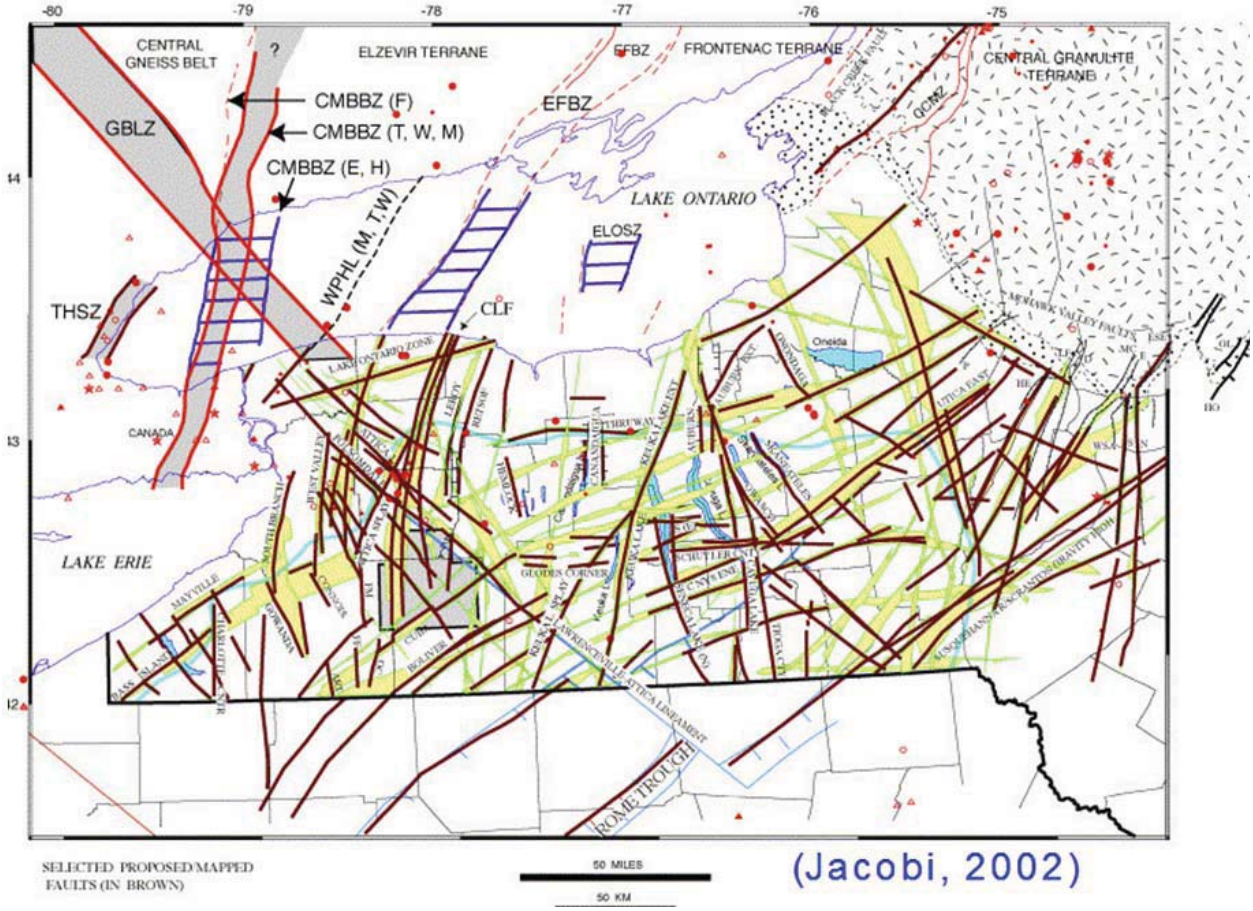
- An independent USGS study (Podwysocki, Pohn, and others, 1982) investigated the feasibility of storing high-level radioactive waste in the Salina Salt Formation in south-central NY. In addition to mapping the faults also mapped in the Murphy paper (1981), this USGS report mapped additional faults and probable faults such as W. Danby thrust faults, the Cortland-Ithaca fault, Watkins Glen-Taughannock fault, Corning-Bath fault, Van Etten-Towanda fault, Corning-Bath fault, Endicott-Syracuse fault, and others. Although, the presence of faults in these valleys were not confirmed everywhere because of a scarcity of deep well logs, the presence of faults was based on several other sources of data including:
  1. digital contrast enhancement of several Landsat multispectral scanner images,
  2. analysis of lineament patterns from a Landsat MSS-7 mosaic,
  3. field mapping of bedrock joint patterns,
  4. compilation and analysis of surface and subsurface structure and isopach maps,
  5. collection and digital analysis of aeromagnetic data for southern New York,
  6. compilation and analysis of aeromagnetic and gravity data for much of New York and Pennsylvania, and
  7. analysis of seismic reflection survey lines for selected portions of New York and Pennsylvania.

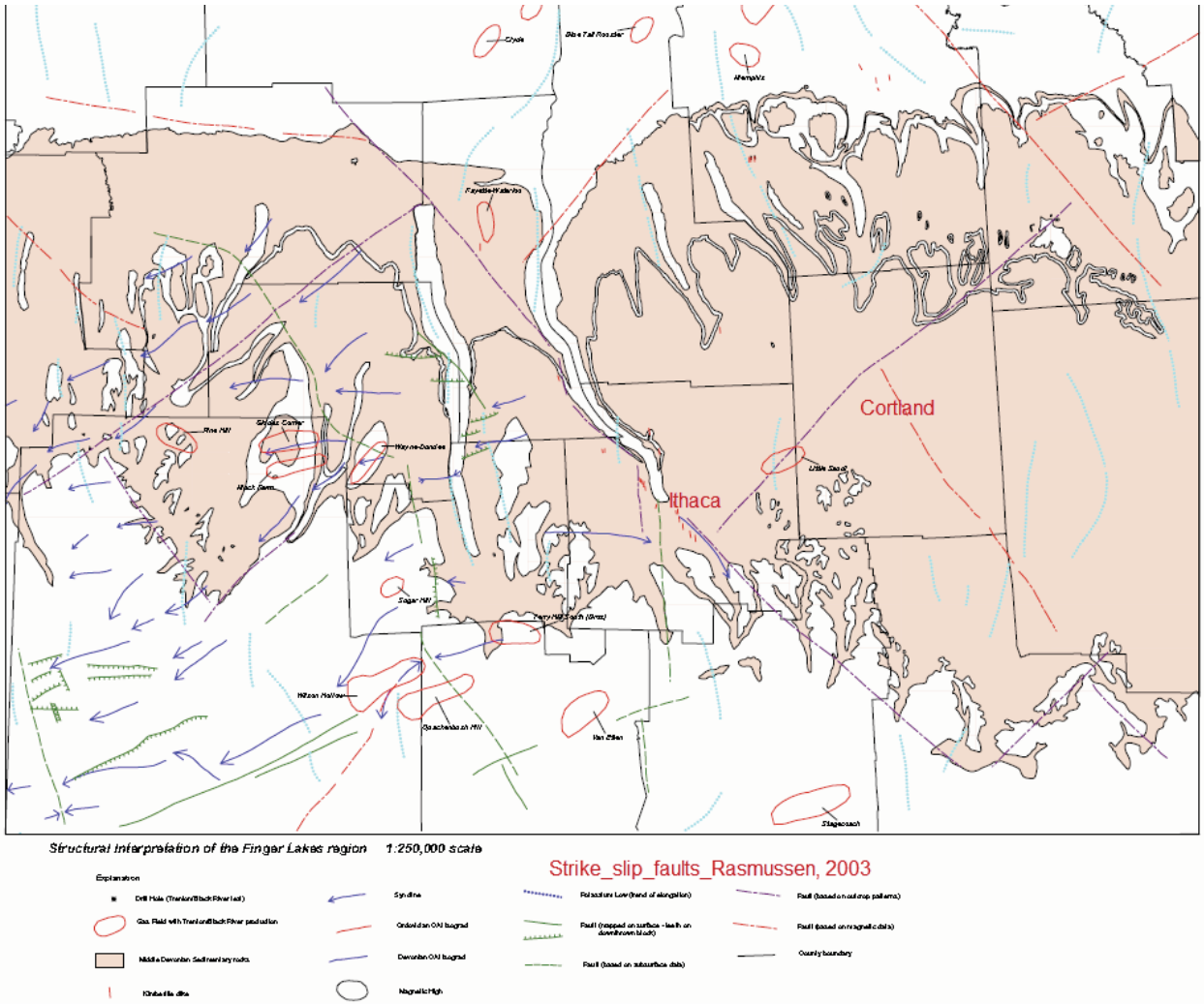
  Podwysocki, Pohn, and others summarized the geology of south-central NY as follows: "*We believe the data examined show the study area to be structurally complex, having undergone several periods of deformation. The stratigraphic units proposed as potential storage beds for disposal of nuclear wastes appear to be affected by both Pre-Alleghanian extensional (?) deformation as well as Alleghanian compressional and shear tectonism. The general shape of the block and its relation to the Alleghanian folds begs for a thrust sheet interpretation for the block,*

with the east and west bounding lineament zones acting as tear faults and the northward displacement being taken up along splay faults of the West Danby fault system. We have cited evidence which corroborates this thesis. Two lineaments within the rectilinear block also display thrust or tear fault attributes. Thus, where on a megascopic scale only one large thrust sheet is recognized, more detailed inspection reveals that the block probably consists of many smaller blocks bounded by their own thrusts and tears."



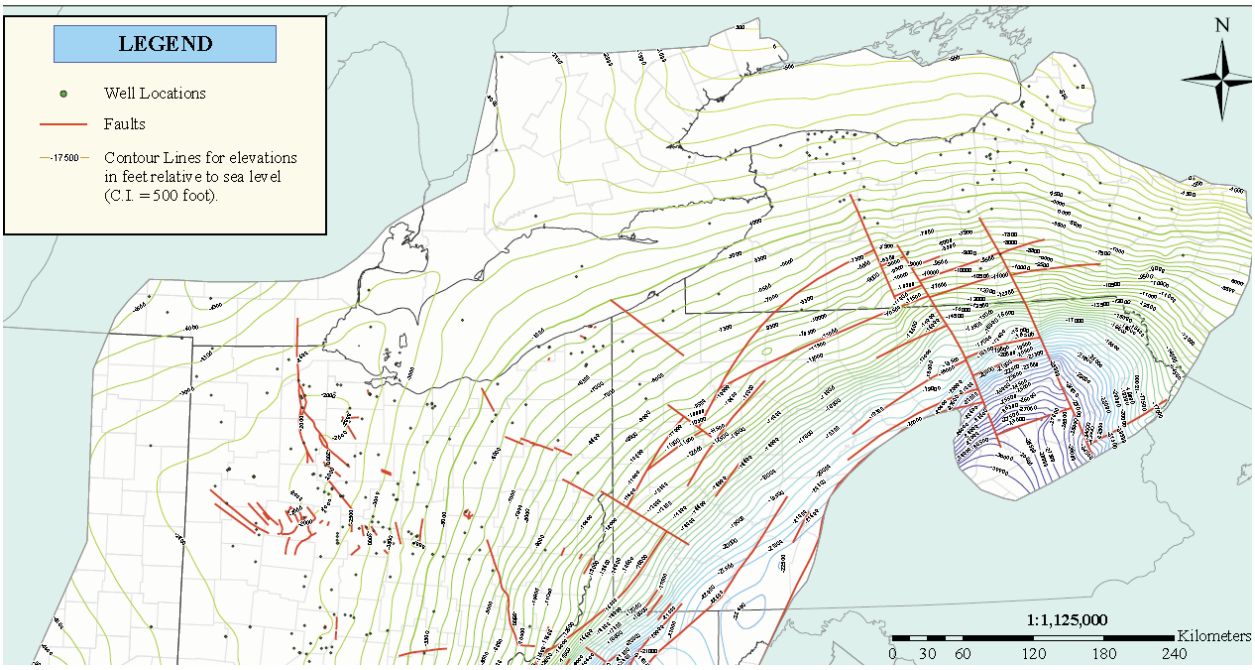
Numerous papers by Jacobi and his colleagues such as Jacobi and others (2002) mapped additional faults and an extensive array of Fracture Intensification Domains (FIDs) which were particularly useful in that they generally mark the location of nearby faults that can be identified on the basis of stratigraphic displacements inferred from outcrops, well logs, or seismic reflection data (e.g., Jacobi and Fountain, 2002). Moreover, faults with small offset commonly occur in outcrops within an FID. Thus, by identifying lineaments, and ground truthing the lineaments, it is possible to predict the location and extent of subtly expressed faults that were previously overlooked. Evidence utilized for recognition of faults in NYS included the integration of FIDs, E97 lineaments, topographic lineaments, gradients in gravity and magnetic data, seismic reflection profiles, and well logs.


-80
-79
-78
-77
-76
-75
CENTRAL GNEISS BELT
?
ELZEVIR TERRANE
EFBZ
FRONTENAC TERRANE
CENTRAL GRANULITE TERRANE
GBLZ
CMBBZ (F)
CMBBZ (T, W, M)
CMBBZ (E, H)
EFBZ
QCBZ
LAKE ONTARIO
ELOSZ
WPHL (M, T,W)
CLF
THSZ
CANADA
LAKE ERIE
Oneida
ROME TROUGH
SELECTED PROPOSED MAPPED FAULTS (IN BROWN)
50 MILES
50 KM
(Jacobi, 2002)

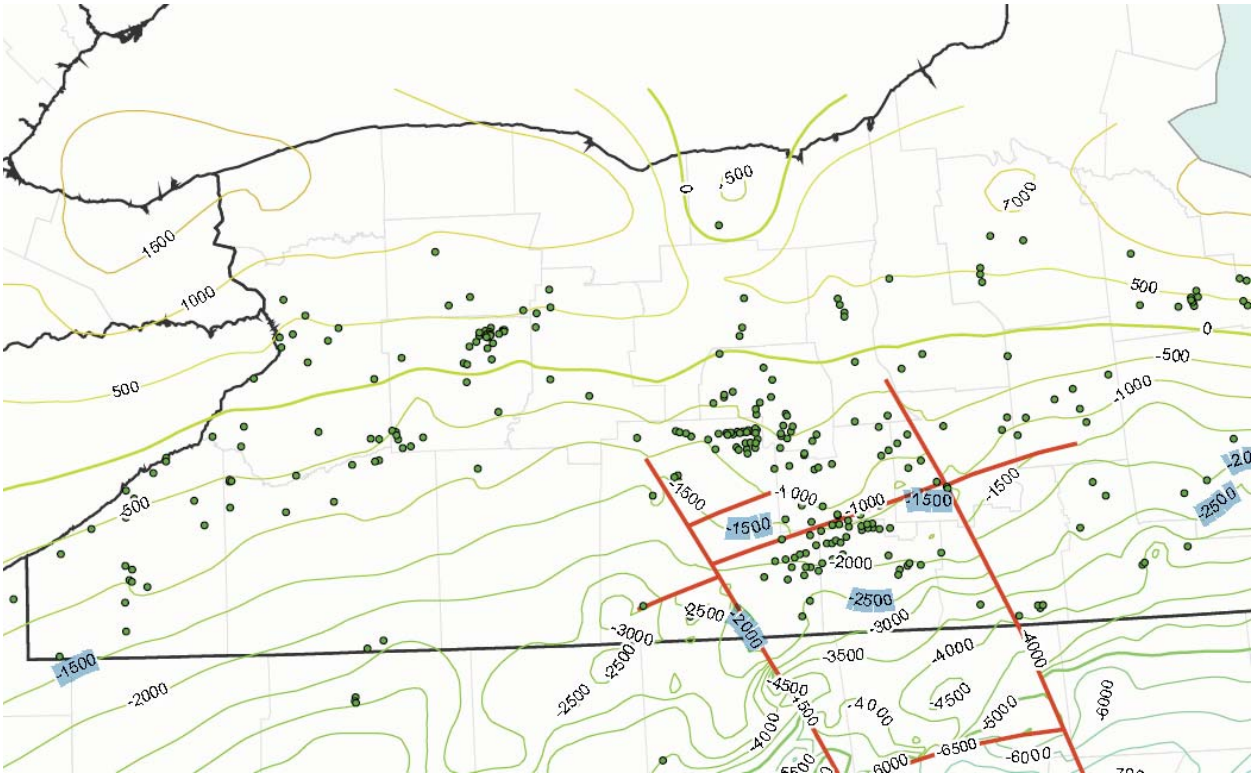


More faults (above map) mapped by Ramussen and others, 2003.

Plate 2-2 : Structure of the Top of the Precambrian Unconformity



Faults (top of Precambrian) mapped by the **Trenton-Black River Research Consortium, 2006**



Faults (base of Devonian) mapped by **Trenton-Black River Research Consortium, 2006**

In addition to fault studies that have been conducted in NY, consideration should also be given to fault studies conducted in Pennsylvania because several studies in that state show that some faults (not mapped in the NY fault map, fig. 4.13, dSGEIS) extend to the NY/PA border (it is almost certain that faults don't stop at the border) and some faults extend into New York (example below. Pohn, 2000, fig. 36, p.53).

THE PRESENCE OF LATERAL RAMPS WORLDWIDE 53

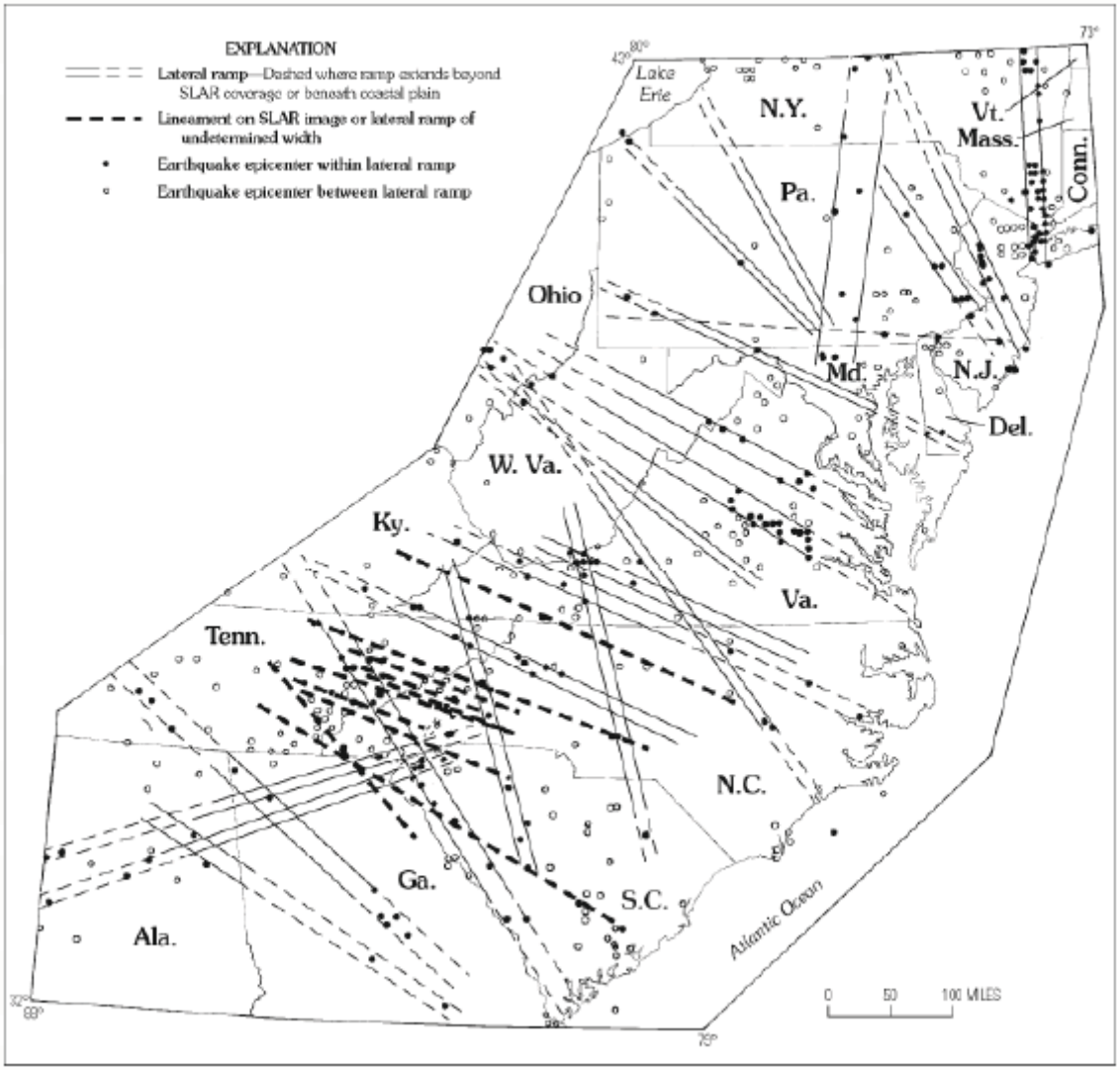


Figure 36. Map showing relationship between lateral ramps and earthquakes in the eastern United States. See figure 30 for ramp names. Earthquake data are from Earth Technology Corporation (written commun., 1984). Modified from Pohn and Coleman (1991).

On Page 4-18, it is stated "Figure 4.13 shows the locations of faults and other structures that may indicate the presence of buried faults in New York State.[35]" This map does not show "other structures that may indicate the presence of buried faults in New York State", it shows only faults. In fact, the note in the bottom of the map states that the other structures that may indicate the other buried faults were removed from the map, such as brittle structures (ex. lineaments). If Alpha believes there are other structures shown on the map that may indicate other buried faults then they should be labeled as such on the map.

If Alpha really meant to show other structures that may be faults, then the fault maps such as by Jacobi (2002, shown below) and others should have been used. Also, the footnote at the end of the sentence cites an Alpha report (Alpha, 2009) which is not the original source of data, which is Isachsen and McKendree (1977). Alpha should not be taking credit for the fault map which they did not construct. This citation comment goes for many other references that are cited by Alpha throughout the report.

Because many more faults exist than that depicted in the fault map by Alpha (fig. 4.13), the risk for migration of gas and fluids during gas drilling operations is greater than that claimed in the dSGEIS, especially, since it has been demonstrated that hydraulic fracking can result in forcing fluids up a vertical or nearly vertical fault to land surface (Jacobi and Dellwig, 1974). Also, it follows that since earthquakes are associated with faults and that the fault map by Alpha grossly under represents the number and extent of faults in central NY, that the discussion and conclusions of seismicity risks (dSGEIS section 6.12) are, at best, inconclusive, and probably not even valid. Without a thorough understanding of the extent, distribution, and cause of faulting, one cannot make creditable statements about the risks of seismicity during gas drilling operations.

Although Alpha states that "It is important to avoid injecting fluids into known, significant, mapped faults when hydraulic fracturing.", the dSGEIS does not state a requirement that gas drillers need to stay clear of faults, rather it is at the discretion of the gas drilling companies to do so. Due to the importance to avoid hydrofracking in fault zones due to potential for contaminates (fluids and gas) to migrate through these preferred avenues with greater permeability, the NYSDEC should require that gas drillers stay clear of faults. In order to accomplish this, a thorough background literature search should be conducted on faults in central NY. The known faults, probable faults, hypothetical faults, zones of concentrated vertical fractures (Jacobi), and areas where there is insufficient data to determine whether faults are present or not, should be identified. Just because a map doesn't show faults doesn't mean that none are present, it may, or is likely, that there just is insufficient data to determine that case. The literature search of previous studies indicates that where there is abundant deep subsurface data, there tends to be more mapped faults than in areas where data is scant.

17. Section 4.7, Naturally Occurring Methane in New York, Section 4.7. *The discussion on naturally occurring methane in New York minimizes the potential contamination of water wells from methane and conclusions drawn in this section do not follow the data presented.*

Page 4-38. Alpha cites the 2011 Duke University report on the occurrence of methane contamination of drinking water associated with Marcellus and Utica Shale gas development as evidence that methane gas concentrations are higher away from active gas extraction wells (in a small group of samples collected New York). However, the conclusions of the Duke report are opposite of that indicated by Alpha. Curiously, Alpha does not mention the most important conclusions of the study, that samples taken from wells located within 1 kilometer (0.62 miles) of shale drilling sites tended to have higher concentrations of dissolved methane (the primary component of natural gas) than samples taken from wells located more than 1 kilometer from drilling sites. Detailed analyses of the methane indicated that it originated from deep earth deposits (thermogenic), rather than from near-surface sources (biogenic). The authors listed three possible ways that deep methane can rise to shallow drinking water supplies, and suggested that leaky gas well casings were most likely. Such methane may pose an explosion risk within enclosed spaces. In contrast, concentrations of chemicals associated with hydraulic fracturing flowback water (salt, boron, radioactive radium) did not differ according to distance from drilling sites. Thus, the findings do not show evidence that flowback from hydrofracking contaminates drinking water, at least in the timeframe of the study. Conversely, the fact that the authors did not find other contaminants associated with drilling near Marcellus operations suggests that flowback does not cause widespread contamination of drinking water – as is widely feared. However, because methane is more mobile than other dissolved substances, those other substances may appear in the future. As excerpted from the abstract-*"-In active gas-extraction areas (one or more gas wells within 1 km), average and maximum methane concentrations in drinking-water wells increased with proximity to the nearest gas well and were 19.2 and 64 mg CH4 L−1 (n ¼ 26), a potential explosion hazard; in contrast, dissolved methane samples in neighboring nonextraction sites (no gas wells within 1 km) within similar geologic formations and hydrogeologic regimes averaged only 1.1 mgL−1 (P < 0.05; n ¼ 34). Average δ13C-CH4 values of dissolved methane in shallow groundwater*

were significantly less negative for active than for nonactive sites (−37 _ 7‰ and −54 _ 11‰, respectively; P < 0.0001). These δ13C-CH4 data, coupled with the ratios of methane-to-higher-chain hydrocarbons, and δ2H-CH4 values, are consistent with deeper thermogenic methane sources such as the Marcellus and Utica shales at the active sites and matched gas geochemistry from gas wells nearby. In contrast, lower-concentration samples from shallow groundwater at nonactive sites had isotopic signatures reflecting a more biogenic or mixed biogenic/thermogenic methane source. We found no evidence for contamination of drinking-water samples with deep saline brines or fracturing fluids." (Osborn et. Al, 2011).

Page 4-39. The conclusions drawn by Alpha cannot be interpreted from the data presented. The presented argument made in the last paragraph on this page was that of the 46 wells that were sampled-- *"The highest methane concentration from all samples analyzed was 22.4 mg/L (from a well in Schoharie County); and the average detected value was 0.79 mg/L."* One cannot conclude that *" These groundwater results confirm that methane migration to shallow aquifers is a natural phenomenon and can be expected to occur in active and non-active natural gas drilling areas"* because (1) it has to established first ~~that~~ where the wells sampled were ~~from~~ in relation to active and non-active gas drilling areas (which is not mentioned in the dSGEIS) and (2) it's the number of wells within the dataset with a significant conc. of methane that determines whether methane occurrence is common or not (not the average conc or highest conc). A histogram of the distribution of conc. of methane should be used. The well with the highest concentration and the average concentration of methane of all wells sampled has nothing to do with how common the occurrence is. What also needs to be taken into account is the distance of the sampled wells from faults or zones of concentrated vertical fractures which may be avenues for movement of methane from deep zones to shallow zones. It should be noted that the well with the highest methane concentration was near Belfast in the Genesee Basin (422018078071901, methane 45.4mg/L), is near gas wells. This information should be included in the dSGEIS. In addition, the original USGS data should be cited.

18. Section 4, Geology References. All references should cite the original report that the data, concept, or cited statement originates from, not a subsequent report that uses and cites that information. Credit should be given to the original authors that did the work.

Sincerely,

Frank P. Proto
Chairman
Tompkins County Water Resources Council

Cc:
Governor Cuomo
NYS Senators Skelos, Kolb, O'Mara, Seward, and Nozzolio
Speaker Silver
Assemblywoman Lifton
Chair of Senate Committee on Environmental Conservation (via Mark Grisanti)
Chair of Senate Committee on Local Governments (via Jack M. Martins)
Chair of Senate Committee on Health (via Kemp Hannon)
Chair of Assembly Committee on Environmental Conservation (via Robert Sweeney)
Chair of Assembly Committee on Health (via Richard Gottfried)
Chair of Assembly Committee on Local Government (via William Magnarelli)
Chair of Assembly Committee on Science and Technololgy (via Donna Lupardo)
Chair of Assembly Committee on Toxic Substances and Hazardous Waste (via Mike Spano)
Chair of Assembly Committee on Water Resources Needs of NYS and Long Island (Robert Sweeney)
Members of Assembly Committee on NYSDEC Oversight (Daniel Burling, Crystal Peoples-Stokes, Matthew Titone)
Attorney General Schneiderman

U.S. Senators Schumer and Gillibrand
Representatives Salazar and Hanna
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City of Ithaca Conservation Advisory Council
City of Ithaca Natural Areas Commission
City of Ithaca Water Department
Cayuga Heights Department of Public Works
Cornell University Water Treatment Plant

Electronic copies to:
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Tompkins County Health Department
Tompkins County Environmental Management Council (EMC)
Tompkins County Information Officer
Tompkins County Council of Governments (TCCOG)
Tompkins County Soil and Water Conservation District (TCSWCD)
Southern Cayuga Lake Intermunicipal Water Commission (SCLIWC - Bolton Point)
Ithaca Journal
Ithaca Times

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