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Mr. Steve H. Shaw, Esq.
Hueston McNulty, PC
256 Columbia Turnpike, Suite 207
Florham Park, New Jersey 07932

Re: Technical Validity of the Highlands Water
Protection and Planning Act of New Jersey

Dear Mr. Shaw:

As per your request, the professional hydrogeologic and environmental consulting firm of Leggette, Brashears & Graham, Inc. (LBG) has completed an assessment on behalf of Hueston McNulty PC regarding the validity of the delineations defined by the Highlands Water Protection and Planning Act (the Act) passed by the New Jersey State Legislature in June 2004 (NJSA 13:20-1 et seq.), along with the reported environmental and water-resource related bases of the Act relative to the approximately 800,000-acre area comprising the portion of the Highlands occupying northern New Jersey (the Area).

Our assessment consisted primarily of a review of the technical bases and assumptions reportedly used to develop and support the delineations and respective goals of the Act, relative to the protection of and planning for the use of water resources occurring within the Highlands area. The information reviewed as part of our assessment included the publically available geographic information system (GIS) databases and maps used by the New Jersey Department of Environmental Protection (NJDEP), United States Department of Agriculture - Forest Service (USDA/USFS), the New Jersey Geological Survey (NJGS), and others, to establish and represent the respective Highlands delineations (Figures 1, 2, and 3).

According to the NJDEP, the main goal of the Act is to provide for the protection of water resources originating in the portion of the Highlands occurring in New Jersey. To this end, the NJDEP represents that the Act will "protect" these water resources, in part by "preserving" open space. As such, our assessment is focused on the technical (e.g., hydrologic, hydrogeologic, geologic, and environmental) bases of the Act relative to its stated goals, including but not limited to the protection of the Area's water resources. A comparison between the respective delineations (e.g., "Planning and Preservation Areas", "Central Core Area", etc.) , and the associated scientific and water-resource related bases for the Highlands Area as defined by the USDA/USFS, the NJGS, and the NJDEP, also constituted a major focus of our

assessment. The technical bases for the NJDEP delineations were also compared to those of the Pinelands area of southern New Jersey, and used to evaluate the applicability of land use regulations (e.g., stream designation and buffer size, minimum lot size, etc.) developed and proposed by the NJDEP and the Highlands Commission specifically for the Area. The Act separates the Highlands into a "Preservation Area" and "Planning Area", which comprise about 48 percent and 52 percent of the overall area, respectively (Figure 4).

Comparison Of Delineations

The Highlands of New Jersey is part of a physiographic region established between the late 1800's and early 1900's, and refined by the NJDEP/NJGS in 2002 (Figure 1). A physiographic region is a scientific characterization of a portion of the earth's surface based on geology and related geomorphology (topography and related landforms). The USDA/USFS defined this area initially in 1992 and subsequently in 2002 (Figure 2). The USDA/USFS definition is reportedly founded on the corresponding areal extent of the physiographic-related features of geology and topography. However, the USDA/USFS extended its delineation to include the entirety of those municipalities which partially occur within the physiographic-based region for the purpose of evaluating the overall dependence on water resources originating in the Highlands and not as a revision of the comprising physiography.

As defined, by the NJDEP in the Act: "the national. Highlands Region is an area that extends from northwestern Connecticut across the lower Hudson River Valley and northern New Jersey into east central Pennsylvania; that the national Highlands Region has been recognized as a landscape of special significance by the United States Forest Service; that the New Jersey portion of the national Highlands Region is nearly 800,000 acres, or about 1,250 square miles (mi²), covering portions of 88 municipalities in seven counties". Based on this description, the Highlands area in New Jersey as defined by the Act is founded on the definition established by the USDA/USFS and incorporates further non-physiographic based modifications (Figure 3).

By definition, the physiographic delineation presents the purely scientifically based Highlands area, independent of the influence of municipal boundaries. The physiographic-based delineation (about 625,000 acres) is expanded in area by the USDA/USFS and the NJDEP to about 789,000 acres and 859,000 acres, respectively. However, as previously mentioned, the delineations defined by the USDA/USFS and NJDEP are, extended to include all municipal boundaries (locally including over 90 percent of "downgradient" non-Highlands area), and in several instances municipalities which do not occur in the physiographic-defined Highlands (e.g., Bedminster Township, Belvidere Township, Hanover Township). Furthermore, several municipalities that do occur partially in the Highlands are excluded by the USDA/USFS and NJDEP delineations (e.g., Andover Boro, Andover Township). In reviewing the geologic and water-resource related GIS databases for the Highlands, we have found no scientific bases associated with ground-water recharge contribution and/or water-quality protection as justification for these inclusions and exclusions, respectively. This is a significant discrepancy that results in a non-scientific based (e.g., political based) expansion of the Highlands.

As previously discussed, the Act separates the delineated Highland area into a Preservation Area and Planning Area (Figure 4). The Act provides guidelines for the future use of land in the Highlands relative to the protection of its water resources that are commensurate with the importance of the comprising area designations relative to either preservation or

planning. Inherently, the most stringent of these land-use guidelines are applied to land in the Preservation Area. Based on the NJDEP GIS databases and related analyses, the Preservation Area as defined by the Act comprises approximately 48 percent (about 415,571 acres) of the respectively delineated Highlands.

Water-Resource Related Discrepancies

The Preservation and Planning Areas of the Highlands can be viewed relative to three fundamental water-resource related features as defined by respective NJDEP GIS databases: "Category 1 (C1) streams; ground-water recharge potential; and major aquifers. Given the stated primary goal and foundation of the NJDEP-based Highlands delineation relative to the preservation and protection of the comprising water resources, it should be valid to assume that the locations of C1 streams, areas of high-potential ground-water recharge, and areas underlain by major aquifers correspond to most, if not all, of the Preservation Areas delineated by the NJDEP.

Though C1 streams are considered by the Act relative to the linear extent of the respective water body, a more conservative approach would be to consider them relative to the respective watersheds. Figure 5 illustrates the extent of the respective C1 stream watersheds in the NJDEP defined Highlands. The overall extent of these watersheds in the Highlands is about 472,190 acres. Of this total area, only about 292,313 acres (or 62 percent) occur in the NJDEP defined Preservation Area (Figure 6). As such, the protection of C1 streams does not appear to be a primary basis for the delineation of the Preservation Area.

The Act references the importance of preserving ground-water recharge, recognizing its importance to local water supplies and streamflow. As such, relative ground-water recharge rates have been quantified by the NJGS for the municipalities comprising the Highlands, based on an annual average precipitation rate in the region of about 44 inches per year. Based on studies and planning assumptions made elsewhere in the northeast, including New Jersey, a ground-water recharge rate equivalent to at least 30 percent of the annual average precipitation amount can be conservatively assumed under optimal conditions. Figure 7 illustrates the extent of those areas where the NJGS-determined ground-water recharge rate is equal to or greater than 30 percent (at least 13-inches per year) of the annual average precipitation amount. The overall extent of the areas in the Highlands is about 515,608 acres. Of this total area, only about 284,169 acres (or 55 percent) occurs in the NJDEP defined Preservation Area (Figure 8). As such, the protection and preservation of current optimal ground-water recharge areas does not appear to be a primary basis for the delineation of the Preservation Area in the Highlands.

The geologic formations which comprise the Highlands vary in characteristics relative to the ability to store and transmit ground water. Those that are considered capable of meeting public community and industrial water supply demands are considered to be major aquifers, and typically consist locally of unconsolidated stratified glacial drift and fractured "carbonate" bedrock units (e.g., limestone). The extent of these major aquifers as determined by the NJGS in the Highlands is illustrated by Figure 9. The overall extent of these aquifers in the Highlands is about 183,721 acres. Of this total area, only about 47,632 acres (or 26 percent) occur in the NJDEP defined Preservation Area (Figure 10). As such, the protection of major aquifers does not appear to be a primary basis for the delineation of the Preservation Area.

Protection of the Pinelands of the New Jersey Coastal Plain, was deemed necessary in 1979, and is considered to be a foundation for the Highlands Act. As such, the Pinelands Protection Act is often compared to the Highlands Act with respect to similarity in goals and intent. Both Acts are associated with water and environmental resource protection, and as a result provide the basis for related land-use development restrictions. However, the hydrologic and hydrogeologic conditions between the respective physiographic regions of New Jersey are different. Significantly is the fact that the vast majority of the surface-water bodies and associated watersheds draining the Pinelands originate and stay in the Pinelands prior to their ultimate discharge location, the Atlantic Ocean. In the case of the Highlands, many of the surface-water bodies and associated watersheds originate and extend beyond the limits of the Highlands. Consequently, land use controls can be biased towards properties within the Highlands, allowing properties beyond the Highlands boundary to go without similar restrictions. From a ground-water resource basis the Pinelands area is underlain by a single upper aquifer, the Cohansy-Kirkwood (underlies over 92 percent of the area). This aquifer system receives the bulk of its recharge from within the Pinelands boundary, is developed as a supply primarily by and for the residents within its boundary only, and is the primary source of "baseflow" for the local surface-water bodies. The significance of this aquifer and its recharge area are taken into account by the corresponding Pinelands Preservation area which encompasses the majority of the watershed headwaters and aquifer recharge areas. Consequently, the Pinelands and Highlands differ relative to water resource types and protection needs.

As part of its study and delineation of the Highlands, the USDA/USFS considered not only the comprising water resources, but also related landscape, ecological, and environmental resources. The entirety of these considerations was used by the USDA/USFS to assign "Composite Resource Values" for the associated lands of the Highlands, with a "5" representing the highest value and "1" representing the lowest value. The USDA/USFS suggested that preservation and conservation should be prioritized towards higher value areas (Figure 11). In 2002, the USDA/USFS identified a Central Core area of the Highlands, which based on Page 79 of the respective report, corresponds to the "Green Pond Outlier" area within the Highlands. The Green Pond Outlier is defined by specific geologic and topographic conditions and occupies an area that is roughly centrally located in the Highlands. The Green Pond Outlier/Central Core is about 60,000 acres in area, of this about 37,000 acres are of Composite Resource Values of 4 and 5 (considered as exceptional by the USDA/USFS).

As we understand it, identification and delineation of a "Conceptual Core Area" for the Highlands were created by the NJDEP in 2004 for the Governor's Highlands Task Force. The map of the Conceptual Core Area was revised by the NJDEP at least 13 times before finalizing the statutory description of the Preservation Area (Figure 11). Based on a comparison between the respective USDA/USFS and Highlands Task Force high resource value areas, there does not appear to be a relationship between either designation. Nor does there appear to be a similarity between the assumptions used by the USDA/USFS to establish its high resource value, and what the NJDEP used to establish the Preservation Area. In fact, only about 234,404 acres, or roughly 56 percent, of the Preservation Area corresponds to areas associated with the highest USDA/USFS Composite Resource Values of 4 and 5.

NJDEP-Act Highlands Rules Issues

Our review of the proposed NJDEP Highlands Rules (NJAC 7:38) developed in support

of the stated goals of the Act by the NJDEP indicates that the fundamental water-resource related features requiring protection and/or preservation consist of "Category 1" ("C1") streams; ground-water recharge areas; and major aquifers. To this end, the proposed Rules define specific limitations and compliance goals relative to future development and associated water supplies, impervious surfaces, and water quality treatment systems in the Preservation Area of the Highlands.

We believe that certain measures currently required by the NJDEP Rules have not been scientifically justified relative to the water resources of the Highlands. These include:

1) *Limitation of Impervious Surface* The Act requires compliance with, numerous NJDEP regulations, and provides definitions related to these regulations and applicable land usage. Of significance are the recently enacted State of New Jersey storm water management regulations. These regulations require that proposed "major" developments "maintain" 100 percent of the ground-water recharge. This requirement is adequately restrictive to protect the ground-water recharge for an area, and can potentially enhance the quantity of ground water recharge, which is scientifically consistent with the goals of the Act, and recognized as a necessity by the scientific community. Consequently, the flat out rejection by the proposed Land Use Rules of any development in the Highlands where greater than 3 percent is proposed as impervious surface based on an assumed loss of ground-water recharge can not be scientifically justified without the completion of a site-specific analysis and the potential use of recharge enhancement techniques.

No scientific bases are provided by the NJDEP for the use of a 3 percent threshold. Furthermore, the scientific literature, relative to areas in the United States with physiographic and ecologic conditions similar to the Highlands, indicates that maximum impervious areas of 10 percent can be adequately protective. In fact, the USDA/USFS recommended 10 percent in its assessment of the Highlands. It should be noted that recommendations regarding maximum allowable impervious surface areas are often based on the assumption that local ground-water recharge will be impacted due to inadequate storm water management measures.

2) *Highland Open Waters* The Rules require an open-water buffer of 300-feet per side (total width of 600 feet). However, no scientific bases are provided by the NJDEP to justify the required buffer amount. Furthermore, the scientific literature, relative to areas in the United States with physiographic and ecologic conditions similar to the Highlands, typically recommends open-water buffers of about 100 feet. The USDA/USFS recommended 150 feet in its assessment of the Highlands. It should be noted that research previously conducted in New Jersey recommended varying buffer widths, dependent on the proximity to a water supply reservoir, with recommendations for adequate tributary stream protection being afforded by a 50-foot buffer. In addition, the Rules place equal value from a water-resource perspective on intermittent (i.e., ephemeral and seasonally dry) streams and perennial streams (i.e., always flowing). In many instances, intermittent streams can be nothing more than drainage ditches and swales. Scientific justification for the carryover equivalent buffers for true bodies of flowing water, and those that can be absent of flow and reliant ecosystems is absent in the Rules and the Act. Furthermore, it contradicts the inherent basis of adopting C1 classifications

and buffering requirements, since without water, no trout could survive, never mind "produce".

3) *Septic System Minimum Lots Size Requirements* The NJDEP Highlands Regulations requires minimum lot sizes of 88 acres and 25 acres, for properties with greater than 50 percent forest and less than 50 percent forest, respectively, where individual subsurface disposal (septic) systems are intended for use. Given that septic system effectiveness relies on subsurface characteristics (e.g., permeability), and adequate ground-water recharge, we agree that a minimum lot size requirement is consistent with the Act's goal of preserving and protecting the water resources of the Highlands. However, the reliance on ground-water resources to remediate and appropriately assimilate subsurface septic discharges (also known as "carrying capacity"), is typically assessed based on site and locale specific hydrologic and hydrogeologic characteristics. The NJGS has provided such characterization for the Highlands region using techniques described in "GSR-32" and illustrated by publically available GIS mapping for the area. The NJGS byway of these tools enables determination of appropriate Carrying capacity based minimum lot sizes relative to septic system discharges. Based on our review of the NJGS specified ground-water recharge rates for the Highlands, we do not believe there is a scientific basis for the Regulations regarding the minimum lot sizes of 88 acres and 25 acres, respectively.

Summary

In summary, based on our review of the overall NJDEP Highlands delineation, and the associated Preservation Area, and the available supporting databases, we do not see a water-resource protection and preservation basis as the primary goal of the Act. Furthermore, the NJDEP Highlands Rules do not appear to be based on a scientific justification for: a required maximum 3-percent impervious area protective measure; 300-foot wide buffers for streams; and minimum lot sizes of 88 acres and 25 acres, respectively, for residences served by septic systems.

If you have any questions, or need additional information, please call.

Very truly yours,

LEGGETTE, BRASHEARS & GRAHAM, INC.



Frank Getchell, PG
Hydrogeologist/Principal

FG:pw
Enclosures

FIGURES