OMNI ENVIRONMENTAL LLC

An Evaluation of Wastewater Disposal via Discharge to Groundwater at Block 23, Lot 1, Borough of Hampton, Hunterdon County, New Jersey

Prepared by:
Raymond A. Ferrara, Ph.D.

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Table of Contents

List of Figures

List of Table

I. INTRODUCTION

This report involves an evaluation of the potential for wastewater treatment and disposal via discharge to groundwater at an approximately 77 acre parcel of land located within the Borough of Hampton, Hunterdon County, New Jersey. The subject property is identified as Block 23, Lot 1, and is located in the northwest corner of Hampton Borough with the Musconetcong River along its northern and western boundaries, and Valley Road along its southern boundary. The property is depicted in Figure 1.

The author has been asked to provide an expert opinion regarding whether it is reasonable to assume that a wastewater treatment plant with a discharge to groundwater could be permitted under applicable statutes and regulations and successfully operated on the subject property for three different service areas as follows:

Service Area I	The subject property developed with 300 single family two bedroom dwelling units.
Service Area II	Service Area I plus existing and potential development in the central portion of Hampton Borough.
Service Area III	Service Area II plus additional existing and potential development in Hampton Borough.

The locations of the properties for each of these three service areas are depicted in Figure 2, and the wastewater flows corresponding to each scenario are summarized in Table 1. Wastewater flows for the single family units on the subject property are specified as 225 gallons per day (gpd) per dwelling unit (gpd/du) consistent with N.J.A.C. 7:14A-23.3.[1] The wastewater flows and land use characterizations in Table 1 for the 'Central Borough' and 'Additional Borough' are as defined by the Highlands Council.[2]

[1] The Table 1 flow of 67,500 gpd for the subject property is consistent with an August 25, 2010 Applied Water Management, Inc. report. A June 2011 report by Applied Water Management, Inc. identifies a flow of 77,400 gpd but does not provide a basis for such.

[2] Letter dated December 9, 2011 from Eileen Swan, Executive Director, Highlands Water Protection and Planning Council to Raymond A. Ferrara, Principal, Omni Environmental LLC.

II. PREVIOUS STUDIES

In preparing this evaluation, the author was provided the following documents that were prepared by experts on behalf of the subject property owner.

A. Letter report from Stanley J. Sedwick, P.E. and Raymond J. Tully, P.E., President, Melick-Tully and Associates, P.C. to Lloyd H. Tubman, Esq., Archer & Greiner, P.C., August 18, 2010 (hereafter referred to as M&T August 2010)

B. Letter report from Raymond J. Tully, P.E., President, Melick-Tully and Associates, P.C. to Guliet D. Hirsch, Esq., Archer & Greiner, P.C., November 2, 2010 (hereafter referred to as M&T November 2010)

C. Letter report from Donald J. Geddes, P.G., Managing Geologist, Applied Water Management, Inc., American Water to Lloyd H. Tubman, Esq. and Guliet D. Hirsch, Esq., Archer & Greiner, P.C., August 25, 2010 (hereafter referred to as AWM August 2010)

D. Letter report from Donald J. Geddes, P.G., Managing Geologist, Applied Water Management, Inc., American Water to Guliet D. Hirsch, Esq., Archer & Greiner, P.C., January 14, 2011 (hereafter referred to as AWM January 2011)

E. Letter report from Donald J. Geddes, P.G., Managing Geologist, Applied Water Management, Inc., American Water to Lloyd H. Tubman, Esq., Archer & Greiner, P.C., July 11, 2011 (hereafter referred to as AWM July 2011)

F. Report on *Proposed Treatment Plant Design and Performance Evaluation for Hampton Farm Property*, prepared for Archer & Greiner, P.C., prepared by Applied Water Management, Inc., June 2011 (hereafter referred to as AWM June 2011)

G. Certification of David C. Krueger in *Jacob Haberman, Plaintiff vs. The Planning Board of the Borough of Hampton, et al., Defendants*, Superior Court of New Jersey, Law Division, Hunterdon County (Mt. Laurel II), Docket No.: L-6527-81 (hereafter referred to as the Krueger Certification)

H. Report on *Critical Wildlife Habitat Evaluation, Haberman Tract, Block 23 – Lot 1, Borough of Hampton, Hunterdon County, New Jersey*, prepared for Archer and

Greiner, P.C., prepared by Eastern States Environmental Associates Inc., October 29, 2010 (hereafter referred to as Eastern October 2010)

I. Letter report from Frank Getchell, P.G., Hydrologist/Sr. Vice President, Leggette, Brashears & Graham, Inc. to Guliet D. Hirsch, Esq., Archer & Greiner, P.C., July 29, 2011 (hereafter referred to as LBG July 2011)

J. Report on *Hampton Borough Water System Assessment in Terms of Capacity to Serve the Haberman Block 23 Lot 1 300 Unit Residential Development Project*, prepared by Theodore D. Cassera, Omland Engineering Associates, Inc. and Tracy G. Liberi, Camp Dresser & McKee Inc., January 2011 (hereafter referred to as Omland January 2011)

These documents were reviewed with respect to their findings pertinent to the matter of wastewater disposal via discharge to groundwater on the subject property.

A. M&T August 2010

M&T August 2010 presents the results of a "preliminary geologic and geotechnical evaluation of the site as it relates to the presence of carbonate geology". This report confirmed that the subject property is underlain by the Allentown Formation, a carbonate rock susceptible to solutioning and sinkhole formation. Prior geotechnical studies by M&T in the vicinity of the subject property identified the presence of sinkholes and other signs of karst activity. M&T's review of aerial photographs identified the possibility of sinkholes, but none in the farmed areas of the property. A representative from M&T walked around and through the wooded portions of the property. Access to the farmed areas was limited due to the height of corn throughout. Sinkholes were observed in the wooded areas.

M&T recommended completion of a Phase II geotechnical and geologic study. Nonetheless, they concluded that the presence of carbonate rock and sinkholes does not preclude development of the property. They further recommended that property improvements such as stormwater basins be located away from areas with significant karst activity. Development construction techniques recommended by M&T relative to

groundwater infiltration include lining swales with impermeable soils and connecting downspouts to impermeable surfaces. These techniques are meant to prevent concentrated infiltration of water from the land surface to the subsurface. M&T August 2010 further recommended additional reconnaissance at the site after crop harvesting.

B. M&T November 2010

M&T November 2010 presents the results of a supplementary geologic evaluation at the subject property. The primary purpose of this additional work by M&T was to allow detailed reconnaissance of the property after the corn crop was harvested. No sinkholes or other related surface manifestations of solutioning of the underlying carbonate rock were observed in the farmed portions of the site. Additional "properly planned and executed subsurface investigations" to identify those areas of the site most susceptible to the formation of sinkholes were contemplated. General design and construction techniques for areas of carbonate geology were discussed.

With regard to wastewater disposal, M&T November 2010 considers the original location of the discharge to groundwater system in the eastern portion of the subject property. M&T's visual inspection of that area of the site did not reveal the presence of sinkholes. M&T further indicated that the proposed wastewater discharge to groundwater with a controlled rate of infiltration poses a smaller risk of sinkhole formation than basins where large volumes of water would infiltrate in a short period of time. M&T also indicated that further investigation will be necessary in the area of the discharge to confirm its ability to support the disposal system.

C. AWM August 2010

AWM August 2010 presents the results of "nitrate dilution modeling and preliminary groundwater discharge feasibility assessments". In later reports[3], AWM refers to its August 2010 report as a "preliminary desktop study". AWM August 2010 indicates that published characteristics for the non-hydric soils and underlying geology

[3] AWM January 2011 and AWM July 2011

on the site suggest that septic systems and high rate groundwater disposal of treated wastewater may be feasible at this site. Furthermore, the report indicates that drinking water supply wells are sufficiently distant from the site to allow a discharge of treated wastewater to groundwater at this site. However, the report also indicates that the presence of the Category 1 Musconetcong River which borders the site, poses some restriction to the placement of any wastewater facilities.

AWM conducted groundwater mounding calculations and determined that it would be feasible to discharge 67,500 gpd of treated wastewater at this site without the subsequent groundwater mound rising within four feet of the ground surface. AWM calculated that a subsurface water mound of approximately 13 feet would occur as a result of this discharge to groundwater. The location of the originally proposed discharge facility and its associated groundwater mound is illustrated in Figure 3. AWM indicated that "this mounding analysis is a planning tool that cannot be substituted for the regional groundwater flow modeling required by NJDEP", and that "additional testing will be required to confirm on-site hydrogeologic conditions and subsurface disposal capacity." AWM further provided a "disclaimer" with regard to the risk in using preliminary analyses beyond a planning phase. AWM also provided a list of additional on-site data that NJDEP would require before considering a permit for such a project, and indicated that a 4 to 6 month or longer time frame would be required to collect such data (e.g., ground water levels).

D. AWM January 2011

AWM January 2011 presents the results of "a limited soil profile investigation in support of on-site wastewater disposal feasibility at the subject site." That investigation collected "preliminary data" on shallow subsurface conditions, and did not include any deeper geologic investigations. Analogous to statements in the August 2010 report, the January 2011 report indicated that its work "cannot be considered a substitute for the rigorous site testing required for wastewater permit development."

AWM January 2011 found that the location proposed for discharge to groundwater in AWM August 2010 was not suitable. Poor conditions for discharge to

groundwater "were present across most of the site". AWM indicated that an area in the west-central portion of the site should now be considered for the wastewater disposal field. That area is depicted in Figure 4. New mounding calculations were not performed at this location. Instead, the preliminary mounding calculations conducted at the prior location were assumed valid for the new location. AWM indicated that further site specific testing is needed. AWM also indicated that groundwater seepage was observed at 12 to 14 feet below grade in two test pits near the newly proposed disposal area (i.e., AWM test pit locations SL121610-2 and SL121610-3 as will be subsequently illustrated in Figure 10). AWM indicated that this seepage "is not necessarily coincident with seasonal high water level conditions". But the occurrence of that seepage apparently caused AWM to avoid locating the new disposal area near these test pits. AWM also indicated that "wet season static water level measurements are crucial". A footnote in Figure 1 of AWM January 2011 indicates that the choice of the new location did not take into account "measured seasonal high water, regional hydrogeology, nor contaminant transport."

E. AWM July 2011

AWM July 2011 presents the results of "a subsurface investigation to augment and refine our findings from prior studies to determine on-site wastewater disposal feasibility at the subject site." This effort allowed AWM "to identify general areas where test wells should be installed in later phases of the investigation." Test wells were not installed as part of this study, nor was any information provided indicating that they were subsequently installed. In the most favorable area, AWM's findings indicate the presence of 2 to 8 feet of surficial fine-grained soils underlain by 3 to 10 feet of coarser grained soils, subsequently underlain by competent bedrock which was primarily carbonate. The coarser grained soils were indicated to have "a relatively high permeability ….., and they appear to be directly connected to the bedrock and the adjacent Musconetcong River." AWM considered this favorable for on-site wastewater disposal. AWM soil borings 101, 102, 103, 104, 105, and 111 were considered to be suitable even though the soil logs indicate that groundwater was encountered at fairly shallow depths in borings 101, 103,

104, 105 and 111. Of these suitable borings, only boring 102 does not indicate that groundwater was encountered. These results regarding the presence of groundwater are consistent with the groundwater seepage noted in AWM January 2011.

F. AWM June 2011

AWM June 2011 provides information regarding the ability to treat for reduction of nitrate and fecal coliform before discharge to groundwater. The treatment technology and effluent data for four facilities are presented. The data indicate that these facilities regularly treat wastewater to achieve nitrate nitrogen concentrations below 10 mg/l, and that fecal coliform concentrations are regularly below the limit of detection which is 10 per 100 ml. Treatment technology to treat regularly to these levels is not uncommon. AWM June 2011 also indicated that the proposed treatment plant can be designed to "meet all applicable New Jersey groundwater quality standards".

G. The Krueger Certification

The Krueger Certification provides an independent opinion regarding the approximate limit of wetlands, State open waters and wetlands transition areas on the subject property. Figure 5 provides an illustration of the Krueger Certification wetlands in contrast to the wetlands identified by data obtained from the Highlands Council. The Krueger Certification and the Highlands Council delineations are very similar in the northwest portion of the property along the Musconetcong River. The Krueger Certification further identifies a small area of wetlands in the southwestern portion of the property that is not identified in the Highlands Council database. This is not unusual since the Highlands Council delineation is based on Statewide data. Given that the Krueger Certification wetlands delineation is based on a site specific survey, it likely represents a more accurate picture of wetlands on the property.

The wetlands transition area indicated in the Krueger Certification appears to be 50 feet in width. Given the fact that the Musconetcong Creek in the vicinity of the property is classified as a Category 1 stream, the wetlands transition area finally approved by NJDEP may be as wide as 150 feet. Regardless, the wetlands transition area falls

within a 300 foot riparian buffer required for Category 1 streams in connection with NJDEP's stormwater management regulations (N.J.A.C. 7:8 as discussed further below). The Krueger Certification also indicates the requisite 300 foot buffer which, in the area of these wetlands, coincides with data from the Highlands Council.

H. Eastern October 2010

Eastern 2010 provides an assessment of the subject property designation as having critical wildlife habitat particularly for the red-headed woodpecker. During a site inspection, Eastern did not observe the occurrence of red-headed woodpecker or other threatened or endangered species on or in the immediate vicinity of the subject property. Eastern further indicated that the lack of observance of any species during the inspection does not allow an assumption that they are absent, nor can the converse be assumed. Eastern October 2010 concluded that the characteristics of the habitat associated with the subject property do not serve to encourage utilization by the red-headed woodpecker, but the Musconetcong River corridor which forms the northern and western boundary of the property does provide a high level of wildlife utilization potential. Eastern further concluded that a 300 foot buffer along the River will preserve that habitat.

I. LBG July 2011

LBG July 2011 provides an "assessment of groundwater yield capacity and recharge source(s) associated with the local aquifer system." The focus of the LBG effort was potable water supply. As such, it does not address the wastewater disposal matter. However, it does contain some information germane to wastewater disposal via discharge to groundwater. In particular, the LBG report notes that the static water level in the Town's water supply well (which is approximately 400 feet from the Musconetcong River) is consistent with the water surface elevation in the River supporting the premise that there is a direct connection between groundwater and the River. This observation is the same as that of AWM July 2011. LBG July 2011 goes on further to note that wells in the area are supplied at least partially by the River further supporting the premise of a direct connection.

J. Omland January 2011

Omland January 2011 was prepared to evaluate aspects related to providing potable water to the proposed development on the subject property. The primary matter of investigation was the capacity of the existing Borough of Hampton water supply well and the potential for the placement of a backup well. In general, Omland January 2011 concluded that the capacity of the existing well was adequate and there was potential for placement of a backup well, although a hydrogeologic investigation would be needed to support a permit application. The matter of wastewater disposal via a discharge to groundwater was not addressed in Omland January 2011.

III. ENVIRONMENTAL FEATURES

The Highlands Council has provided the author with various information related to environmental features at and in the vicinity of the subject property. The following features are pertinent to the evaluation conducted in this effort.

A. Stream Buffers

The Musconetcong River in the vicinity of the subject property is classified FW2-TM(C1) (i.e., Fresh Water 2, Trout Maintenance, Category 1) in accordance with N.J.A.C. 7:9B Surface Water Quality Standards. The following definitions will help to explain this classification.

- FW2 waters are those fresh waters that are not designated as FW1 or PL (i.e., Pinelands) waters. FW1 waters include those surface waters that are to be maintained in their natural state of quality and are not to be subjected to any man-made wastewater discharges or increases in runoff from anthropogenic activities. PL waters are all surface waters within the boundaries of the Pinelands Area except those classified as FW1. FW2 is the least restrictive of the three classifications.
- Trout Maintenance (TM) waters include surface waters designated for the support of trout throughout the year. In contrast, Trout Production (TP) waters includes surface waters designated for use by trout for spawning or nursery purposes during their first summer, and NonTrout (NT) waters includes those surface waters that have not been designated TP or TM. Consequently, a TM classification is less stringent than a TP classification, but more stringent than an NT classification.
- Category 1 (C1) waters includes those surface waters designated for protection from measureable changes in water quality.

A C1 designation poses a particular constraint for activities in and around such a waterway. Activities must not cause any measurable change in water quality in the section of a waterway with a C1 classification. Implementation of the C1 provisions

normally precludes the approval of new or expanded point source wastewater discharges, treated or untreated, to such surface waters. While the C1 provisions do not directly preclude discharges of wastewater to groundwater in the vicinity of a C1 waterway, it is necessary to demonstrate that such a discharge to groundwater would not cause a measurable change to the quality of the adjacent C1 surface water. Specifically, New Jersey's Ground Water Quality Standards (GWQS) at N.J.A.C. 7:9C-1.2(b) state:

> *Discharges to ground water that subsequently discharge into surface waters shall not be permitted by the applicable regulatory program if such discharges would cause a contravention of surface water quality standards applicable to those surface waters. That is, those discharges must achieve compliance with both these standards and the surface water quality standards (N.J.A.C. 7:9B).*

The GWQS at NJAC 7:9C-1.7(g) go on further to state:

> *Where ground water that receives pollutants from a discharge(s) subsequently flows to surface waters, the Department shall regulate such discharges as necessary so as not to exceed the Surface Water Quality Standards applicable to that body of surface water. The discharger may request application of only the ground water quality standards by showing to the satisfaction of the Department, and in the context of the applicable regulatory procedure, that the flow of ground water pollutants into the surface water will not cause a violation of the Surface Water Quality Standards.*

The reports submitted by the subject property owner have demonstrated a direct connection between the proposed discharge to groundwater and the C1 Musconetcong River. No demonstration as to whether the proposed discharge to groundwater will cause a contravention of the surface water quality standards has been presented.

A C1 classification also places additional restrictions on activities on the land adjacent to the waterway. N.J.A.C. 7:8-5.5 requires the establishment of a Special Water Resource Protection Area (SWRPA) on each side of the C1 waterway. The SWRPA is

normally a 300 foot undisturbed buffer measured perpendicular from the top of the bank of the waterway. Encroachment into the SWRPA is permitted only into the outer 150 feet of the SWRPA, and only where (1) previous disturbance has occurred, and (2) an applicant can demonstrate that the functional value of the SWRPA will be maintained to the maximum extent practicable. In accordance with the Highlands Regional Master Plan, the same requirements apply, and agricultural use does not qualify as previous disturbance.[4]

Figure 6 illustrates the approximate boundaries of a 300 foot buffer for the Musconetcong River in the vicinity of the subject property. These boundaries are essentially the same as those presented in the Krueger Certification. Figure 6 also illustrates a 300 foot buffer around a tributary to the Musconetcong River that is identified in the Hunterdon County Soil Survey.[5] N.J.A.C. 7:8-5.5(h) specifies that SWRPAs "shall be established along all waters designated Category One at N.J.A.C. 7:9B and perennial or intermittent streams that drain into or upstream of the Category One waters as shown on the USGS Quadrangle Maps or in the County Soil Surveys, within the associated HUC 14 drainage."

The Highlands Council maintains its own definition of Riparian Areas and Open Water Protection Areas. The former includes streams and their associated wetlands, flood prone areas, and hydric soils.[6] The latter includes a 300 foot buffer from the edge of wetlands.[7] The Riparian Area and Open Water Protection Area boundaries defined by the Highlands Council for the subject site are illustrated in Figure 7. In the vicinity of the proposed wastewater disposal field, note the approximate coincidence of the riparian area and the 300 foot SWRPA defined above, but that the open water protection area extends nearly one hundred feet beyond the SWRPA boundary. Objective 1D4E and Policy 1D5 of the Highlands Regional Master Plan (2008) place restrictions on activities within the Riparian Area and Open Water Protection Area.

[4] Objective 1D4e of the Highlands Regional Master Plan
[5] See Sheet 4 of *Soil Survey Hunterdon County New Jersey*, U.S. Department of Agriculture Soil Conservation Service, November 1974
[6] Objective 1D2a of the Highlands Regional Master Plan
[7] Policy 1D4 of the Highlands Regional Master Plan

B. Wellhead Protection Areas

The Borough of Hampton operates a potable water supply well in the vicinity of the subject property. The location of the well is illustrated in Figure 8. NJDEP requires the specification of wellhead protection areas around such facilities. Three tiers of protection are defined as follows:

- Tier 1 includes the area within which it is calculated that a particle of water travels two years before it reaches the well.
- Tier 2 includes the area within which it is calculated that a particle of water travels five years before it reaches the well.
- Tier 3 includes the area within which it is calculated that a particle of water travels twelve years before it reaches the well.

In general, wastewater disposal via discharge to groundwater is not permitted within Tier 1. Given the tier boundaries illustrated in Figure 8, wellhead protection would not prevent the placement of a discharge to groundwater facility on the subject property.

C. Wetlands Buffers

As noted previously, wetlands exist on the subject property, and buffers will be required. The exact extent of the wetlands has not yet been confirmed via issuance of a Letter of Interpretation (LOI) by NJDEP. However, given the general agreement between the wetlands mapping provided by the Highlands Council and the site specific survey presented in the Krueger Certification, an approximate boundary for the wetlands is known. Whether the size of the buffer will be 50 feet or 150 feet has also yet to be determined. But, again as noted previously, even a maximum 150 foot wetlands buffer requirement poses no greater constraint than that imposed by the SWRPA.

D. Wildlife Habitat

Figure 9 shows the Highlands Council's mapping of Critical Wildlife Habitat on the subject property. Virtually all of the property is considered critical wildlife habitat. Also shown on Figure 9 are the NJDEP Landscape Project designations for wildlife

habitat. Nearly the entire site is designated Rank 3 for State Threatened Species, particularly the red headed woodpecker. A small sliver of the site is designated Rank 4 State Endangered Species, particularly for bobcat and Cooper's Hawk. The Landscape Project habitat boundaries coincide with the Highlands Council's habitat boundaries. These designations are significant with regard to sewer service.

New Jersey's Water Quality Management Planning Regulations at N.J.A.C. 7:15-5.24 specify that sewer service may only be provided to areas that are not identified as environmentally sensitive. As defined in that regulation, environmentally sensitive areas include areas mapped as endangered or threatened wildlife habitat in NJDEP's Landscape Project maps, SWRPAs along a C1 waterway, and wetlands. While the SWRPA and wetlands for the subject site eliminate some of the property from sewer service, there is still a majority of the site that would otherwise be suitable for sewer service and placement of the discharge to groundwater facility. However, if nearly the entire property continues to be classified as threatened and/or endangered species habitat, not only is there no suitable area for placement of a discharge to groundwater facility, but the homes to be constructed on the property could not be included in the sewer service area for that discharge to groundwater facility. There are opportunities within the regulations at N.J.A.C. 7:15 for the property owner to request inclusion of these environmentally sensitive areas in the sewer service area. They essentially require the preparation of a Habitat Suitability Determination which rebuts the present designation as threatened and endangered species habitat. Eastern October 2010 suggests that the site should not be classified as critical wildlife habitat other than the area along the Musconetcong River. That material has not yet been presented to NJDEP for its review and evaluation as a basis for a Habitat Suitability Determination, and an assumption that such would be acceptable would be presumptuous.

E. Topography

Figure 10 shows land surface contours for the subject property. Note the good agreement between the contours and the tributary that flows from east to west just south of the disposal field (as previously shown in Figure 6). The tributary may actually extend

further to the southeast as evidenced by the contour lines and aerial photo. Also note that the approximate elevation of the water surface elevation of the Musconetcong River (i.e., approximately elevation 328 feet in the vicinity of the proposed discharge to groundwater) is consistent with groundwater elevations in the borings presented in AWM July 2011 supporting the conclusion that there is a direct link between groundwater and the River.

F. Wild and Scenic Designation

On December 22, 2006, President George W. Bush signed into law the Musconetcong Wild and Scenic Rivers Act designating the Musconetcong River as a National Wild and Scenic River. The National Wild and Scenic Rivers Program is designed to provide protection from federally licensed or assisted dams, diversions, channelizations, and other water resource projects that would have direct and adverse effects on a river designated under the program. New Jersey's Water Quality Management Planning Regulations at N.J.A.C. 7:15-5.17(a)5 require that wild and scenic rivers be mapped as part of any wastewater management plan. This requirement recognizes that designation as a wild and scenic river provides an opportunity and may require federal review of actions such as those related to preparation or amendment of a wastewater management plan. Preparation of a wastewater management plan would be required to designate the subject property for sewer service with a centralized wastewater treatment plant and a discharge to groundwater.

With many of its tributaries being trout production streams, the Musconetcong River is one of the finest trout fishing streams in New Jersey. One of the goals of the Musconetcong River Management Framework prepared in connection with the wild and scenic rivers designation is to maintain existing water quality in the River and its tributaries, and to improve it where possible. The designation of the Musconetcong River as a C1 waterway is consistent with its designation as a wild and scenic river further emphasizing the strict review and evaluation that would be afforded to any project that may potentially impact water quality in the River.

IV. OBSERVATIONS

Consideration of the subject property's environmental features and the information presented in the previous studies leads to the following observations.

1. The property clearly lies over carbonate rock formations. Sinkholes have been observed by the property owner's experts. To the author's knowledge, neither the Phase II investigation of the site recommended in M&T August 2010 nor the specific investigation of the area for the proposed wastewater discharge to groundwater system recommended in M&T November 2010 were conducted.

2. While M&T August 2010 and November 2010 concluded that the site is suitable for development, their recommendations for construction mitigation techniques effectively are designed to eliminate concentrated sources of infiltration. An approximately 2 acre discharge to groundwater continuously infiltrating the subsurface would appear to be in direct conflict with these recommendations. In its November 2010 report, M&T expresses an opinion that the controlled rate of discharge characteristic of a wastewater discharge to groundwater poses "a significantly smaller risk of sinkhole formation". M&T did not opine about how small the risk is, and clearly indicated that additional investigation would be needed at the specific location of the discharge to groundwater. Neither of the two M&T reports indicated any knowledge or opinion about the most recently proposed location for the discharge to groundwater in the western portion of the site along the Musconetcong River.

3. The AWM reports, presumably having had the benefit of the M&T reports, do not address any of the recommendations in the M&T reports, nor do they directly discuss whether the carbonate rock poses any limitations for placement of a wastewater disposal system relying on discharge to groundwater on the subject

property. In fact the proposed wastewater disposal area is located adjacent to an area where M&T August 2010 reports the presence of "numerous sinkholes".[8]

4. AWM August 2010 provides a desktop study of nitrate dilution and groundwater mounding for a proposed discharge to groundwater in the eastern portion of the subject property. That report clearly indicated that the work performed was preliminary, and that additional investigation was necessary. Subsequent work presented in AWM January 2011 found that the location proposed for the discharge to groundwater in AWM August 2010 was not acceptable. A new location in the western portion of the site was proposed. New nitrate dilution and groundwater mounding calculations for this new location were not presented. The new field work presented in AWM January 2011 was also characterized as preliminary. AWM July 2011 presented the results of additional field work, but again no new nitrate dilution and groundwater mounding calculations were presented. Consequently, groundwater mounding and nitrate dilution calculations that can be relied upon to conclude that the new location (or any other location on the site for that matter) will be acceptable have not been presented.

5. As noted above, AWM January 2011 proposes a location for the discharge to groundwater in the western portion of the site near the Musconetcong River. Poor conditions for discharge to groundwater were found to exist across most of the site including the eastern location initially proposed for the disposal area in AWM August 2010. In AWM July 2011 soil boring logs noted as suitable indicate groundwater is present at fairly shallow depths. Those findings are consistent with the groundwater seepage noted in this area in AWM January 2011. This information suggests that the favorable area for discharge to groundwater is limited to only that area around soil boring SB-102 and test pits SL121510-9 and SL121610-1, i.e., this limited area appears to have sufficiently deep groundwater

[8] Plate 8 of M&T August 2010

and sufficiently high soil permeability. However, as demonstrated in the AWM August 2010 groundwater mounding calculations, the zone of impact would extend far beyond the limited favorable area. Consequently, it must be demonstrated via additional field investigations and refined groundwater mounding calculations that such a disposal location can work.

6. Even in the latest report prepared by AWM (i.e., July 2011), it is indicated that additional testing is needed "in later phases of the investigation." Consequently, sufficient information and calculations have not been prepared to conclude that a discharge to groundwater at the subject property will be acceptable, or to support an application for a permit to allow such a facility.

7. Figure 11 illustrates all of the test pits and soil borings presented in the AWM reports along with the second area proposed for wastewater disposal via discharge to groundwater. Clearly one soil boring (SB-107) deemed not suitable by AWM is within the disposal area.

8. AWM July 2010 noted that the soils in the area of the second proposed disposal area have a relatively high permeability and are directly connected to the Musconetcong River. LBG July 2011 confirms that the River and the groundwater in the area of the subject property are connected. As such, any wastewater discharged to the soils at the proposed location will directly enter the Musconetcong River. Due to its classification as a C1 waterway, the Musconetcong River in this location is protected against any measureable change in water quality. No demonstration has been provided that the wastewater that will directly enter the River will not cause a measureable change in River water quality. Wastewater treated to the levels indicated in AWM June 2011 will be lower in quality (i.e., have higher pollutant concentrations) than that of water in

the Musconetcong River.[9] Contrary to the claim in AWM June 2011 that the proposed treatment plant will meet all applicable New Jersey groundwater quality standards, until and unless a demonstration can be made that there will not be a measureable change in water quality in the Musconetcong River, it can not be assumed that the proposed discharge will satisfy the groundwater quality standards. Rather, given that constituents such as nitrate and dissolved solids in the discharge will be higher in concentration than that which exists in the River, it is more appropriate to assume (a) that there would be a measureable change in water quality in the River, and (b) that the applicable standards will not be satisfied.

9. A number of environmental constraints limit the area potentially suitable for a discharge to groundwater facility. These are illustrated in Figure 12. The soil borings and test pits completed by AWM characterize most of the site as not suitable for such a facility. Other constraints such as the SWRPA 300 foot buffer further limit the suitable area. The Highlands Council riparian area and open water protection area (which are not depicted in Figure 11) place additional restrictions on the potentially available area. For the limited area that AWM characterized as having "suitable" soil data outside of the Musconetcong River SWRPA, the lower wooded area must be excluded since based on aerial photographs, topography and the Soil Survey maps, a surface water drainageway travels through it. In the northern area, soil boring SB-105 was indicated to have groundwater at less than 10 feet below ground level and test pit SL121610-2 was

[9] For example, nitrate nitrogen concentrations at four wastewater treatment plants offered by AWM June 2011 as representative of the treated wastewater quality that will be discharged at the subject property averaged between 3.54 and 5.35 mg/l. Data for a Musconetcong River monitoring station just upstream of the subject property in *Watershed Restoration and Protection Plan for the Musconetcong River Watershed from Hampton to Bloomsbury, Water Quality Monitoring Data Report*, prepared by Rutgers Cooperative Extension Water Resources Program (August 26, 2011) indicate an average nitrate nitrogen concentration of 2.18 mg/l. Data at an NJDEP monitoring station AN0072 about a mile upstream of the subject property indicate an average nitrate nitrogen concentration of 1.99 mg/l. Consequently, concentrations for nitrate nitrogen in the discharge are more than twice that in the River. Even higher ratios are very possible for other parameters like total dissolved solids, phosphorus and ammonia nitrogen.

noted to have groundwater seepage at 12 to 14 feet below ground level making that area questionable due to shallow groundwater. (Long term groundwater level monitoring was not conducted at either location, and neither test was particularly conducted during the time when the seasonal high water table might occur, so groundwater levels may be even shallower.) Based on the limited data available, a groundwater mound of approximately 13 feet would be prohibitive in this area. Therefore, even if one excludes the SWRPA for the tributary, the only potentially suitable area for a discharge to groundwater is a portion of the second disposal field proposed by AWM. And of course as shown in Figures 6 and 12 that area is located within the SWRPA for the tributary to the Musconetcong River. Furthermore as noted above, the direct connection of this area to the Musconetcong River places a severe restriction on its suitability for wastewater disposal via discharge to groundwater.

10. Given the above, there is not likely to be sufficient suitable area for wastewater disposal via discharge to groundwater to serve development of the subject site with 300 single family homes. Obviously, if there is not sufficient suitable area to serve the site itself, then there is not sufficient suitable area to serve other areas in Hampton Borough as identified earlier in Table 1.

V. CONCLUSION

Based on the information available to date and the findings of this report, it is the opinion of the author that it is not reasonable to assume that a wastewater treatment plant with a discharge to groundwater will be permitted under applicable statues and regulations. Clearly additional data must be obtained and additional calculations must be completed before such an assumption can even be considered. The available data, including that collected by the property owner's experts, indicate that there is only a small portion of the subject property that has soil potentially suitable to accept the concentrated and continuous discharge that would occur with such a facility. The various reports presented by the property owner repeatedly emphasize the need for additional data collection to support a conclusion regarding the acceptability of a discharge to groundwater.

In addition to the insufficiency of the technical information available to support an assumption that discharge to groundwater is feasible on this site, there are additional regulatory constraints for even the small portion of the site that potentially has suitable soil for placement of a wastewater disposal facility discharging to groundwater. Proximity and a direct connection between the proposed disposal area and the Musconetcong River, a C1 waterway, requires a demonstration that the discharge to groundwater will not cause a measureable change to water quality in the River. New Jersey's groundwater quality standards specify that a discharge such as proposed in this instance must satisfy the surface water quality standards. Given that there exists a direct connection between the discharge to groundwater and the River, that discharge effectively acts like a direct discharge to the surface water. New or expanded discharges to C1 surface waters are customarily denied due to the no measurable change requirement. Therefore, not only is it inappropriate to assume that the no measurable change requirement can be satisfied, it is likely that it can not be satisfied. The C1 designation also requires a Special Water Resource Protection Area buffer, and it would not be appropriate to assume that encroachment into that buffer would be permitted.

Furthermore, New Jersey's Water Quality Management Planning regulations prohibit sewer service in areas that are environmentally sensitive. Based on NJDEP's current wildlife habitat characterization, nearly the entire subject property would be considered environmentally sensitive as defined by those regulations. The property owner has provided a critical wildlife

habitat evaluation which concluded that most of the property is not environmentally sensitive in terms of wildlife habitat. However, until such time as that information has been reviewed and evaluated by NJDEP, it can not be assumed that the current environmentally sensitive characterization of the property will be revised, and therefore it would not be appropriate to assume that sewer service would be permitted on the subject property.

Even if (a) the no measurable change requirement can be satisfied, (b) the designation of the site as environmentally sensitive can be changed, and (c) encroachment into the SWRPA would be permitted, the data provided in reports prepared for the property owner indicate that the area suitable for wastewater disposal via discharge to groundwater is limited and can not be assumed to be sufficient to support even the 300 homes proposed for development on Block 23, Lot 1. At a minimum, nitrate dilution and groundwater mounding calculations must be completed based on the site specific subsurface characteristics at the proposed disposal location.

One might argue that the no measurable change requirement could be satisfied by constructing and operating a wastewater treatment plant that would produce an effluent equal in quality to the existing background water quality in the Musconetcong River. While that may be possible with regard to some pollutants like nitrate, the construction and operation costs for such a facility would be extremely high. However, of greater significance is that treatment for other pollutants like dissolved solids is only practiced in situations where extremely high purity water is needed (e.g., industrial uses requiring high purity water). The costs of such are prohibitive for customary domestic wastewater treatment facilities. Furthermore, the operation of such a facility would require diligent and careful care which again would be cost prohibitive for a facility of the size proposed for this project. There are no such wastewater treatment plants in operation in the State of New Jersey that treat domestic wastewater to levels equal in quality to the background water quality that exists in a C1 waterway like the Musconetcong River.

Accordingly, it is my conclusion that it is not reasonable to assume that NJDEP would permit the proposed discharge to groundwater at the subject property.

FIGURES

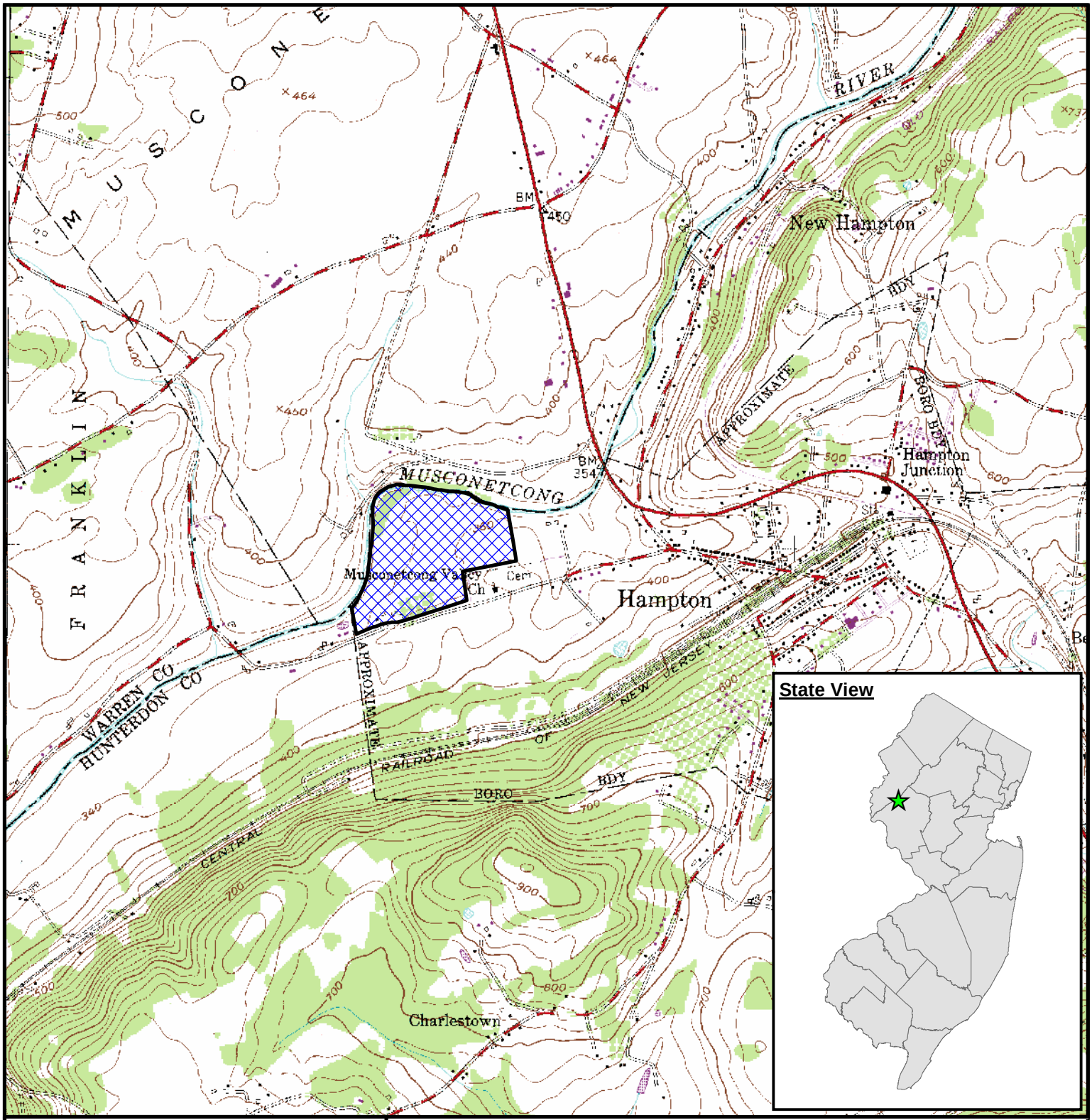

FIGURE 1
LOCATION MAP

An Evaluation of Wastewater Disposal via Discharge to Groundwater
Block 23 Lot 1, Borough of Hampton
Hunterdon County, NJ

January 2012

OMNI ENVIRONMENTAL LLC
321 Wall Street
Princeton, NJ 08540
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www.Omni-Env.com

Site Boundary

High Bridge, NJ USGS Quadrangle

0 2,000 4,000
Feet

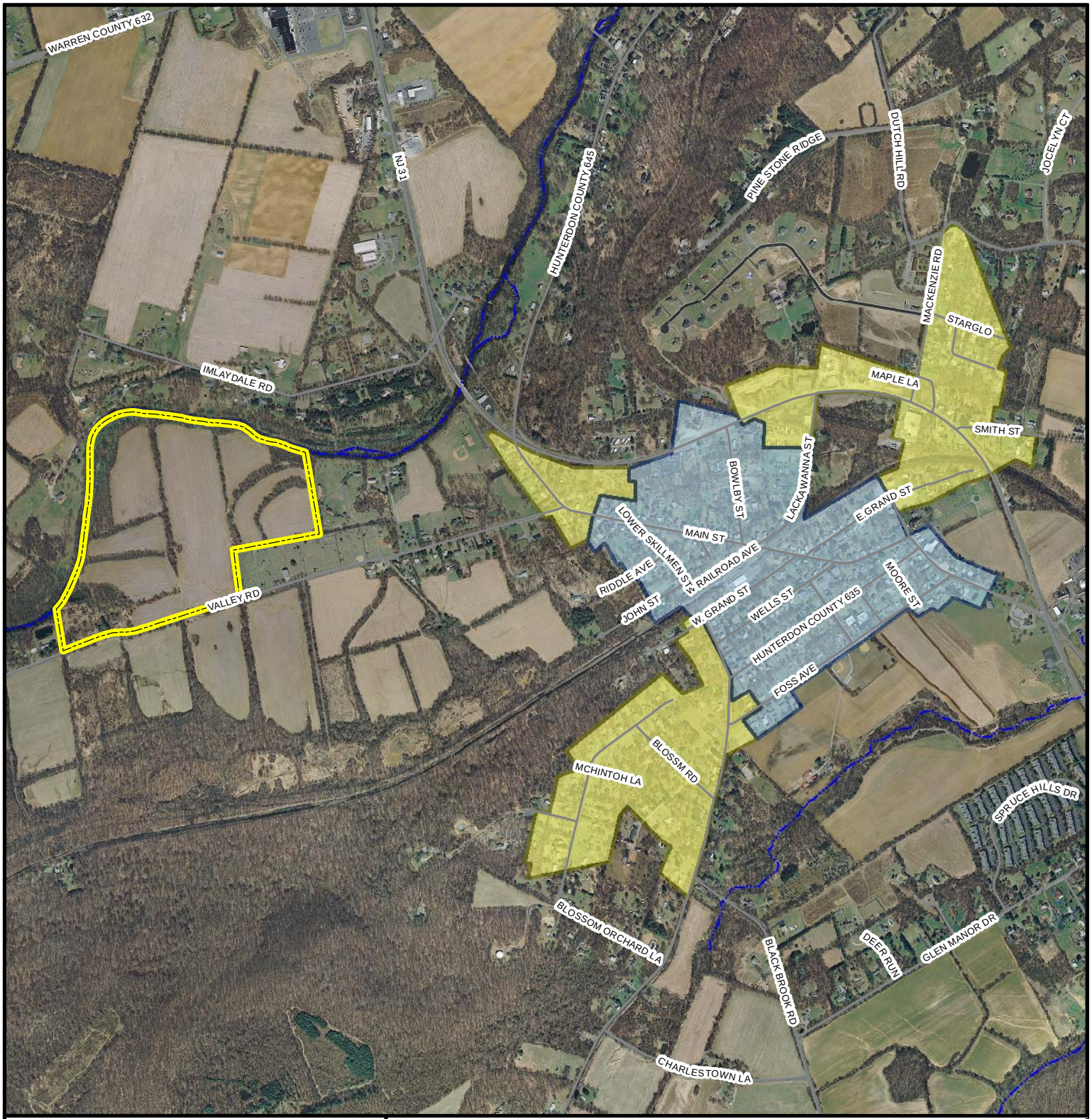

Figure 2
Sewer Service Areas

An Evaluation of Wastewater Disposal via Discharge to Groundwater
Block 23 Lot 1, Borough of Hampton
Hunterdon County, NJ

January 2012

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- Block 32 Lot 1
- Central Borough
- Additional Borough
- Road
- Stream

Aerial Photography - NJDEP 2007

0 1,250 2,500
Feet

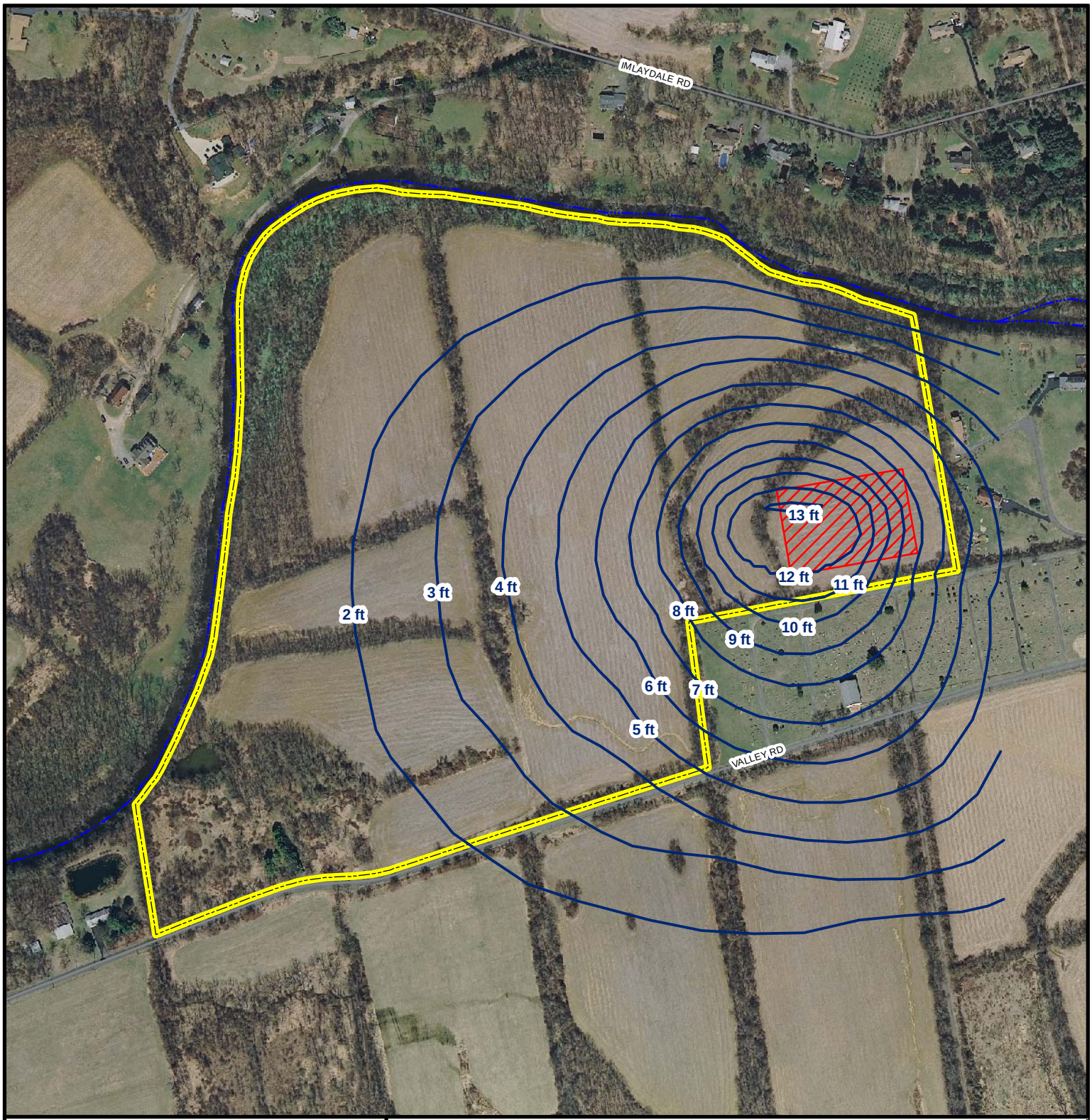

FIGURE 3
Mounding Analysis

An Evaluation of Wastewater Disposal via Discharge to Groundwater
Block 23 Lot 1, Borough of Hampton
Hunterdon County, NJ

January 2012

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- Site Boundary
- Relative Groundwater Mound (feet)
- Proposed Disposal Area (2.12 Ac)
- Road
- Stream

Aerial Photography - NJDEP 2007
Adapted from Figure 6 of AWM August 2010

0 400 800
Feet

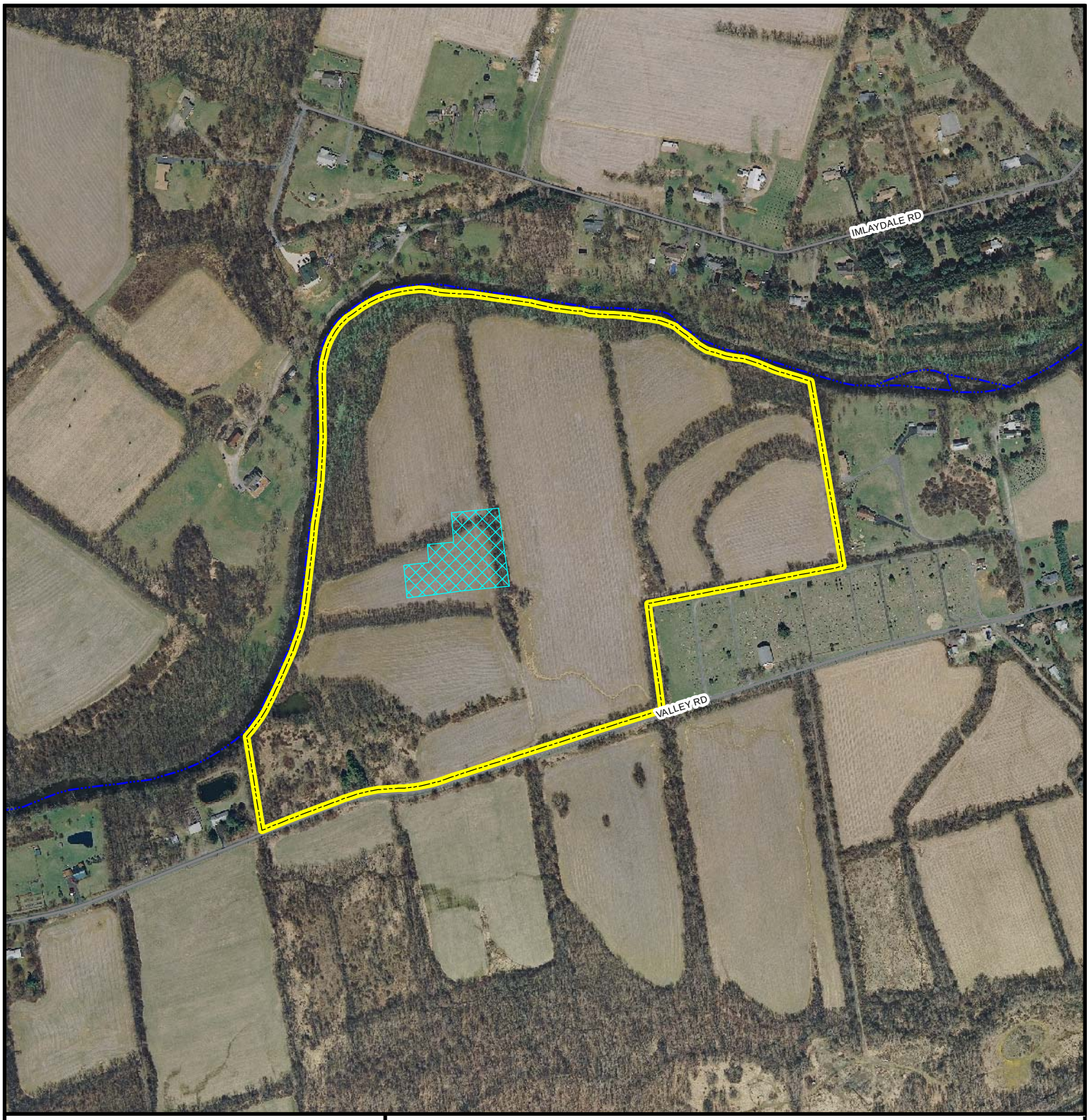

FIGURE 4
Proposed Disposal Area

An Evaluation of Wastewater Disposal via Discharge to Groundwater
Block 23 Lot 1, Borough of Hampton
Hunterdon County, NJ

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Site Boundary
Proposed Disposal Area (Adapted from Figure 1 of AWM January 2011)
Road
Stream

Aerial Photography - NJDEP 2007

0 600 1,200
Feet

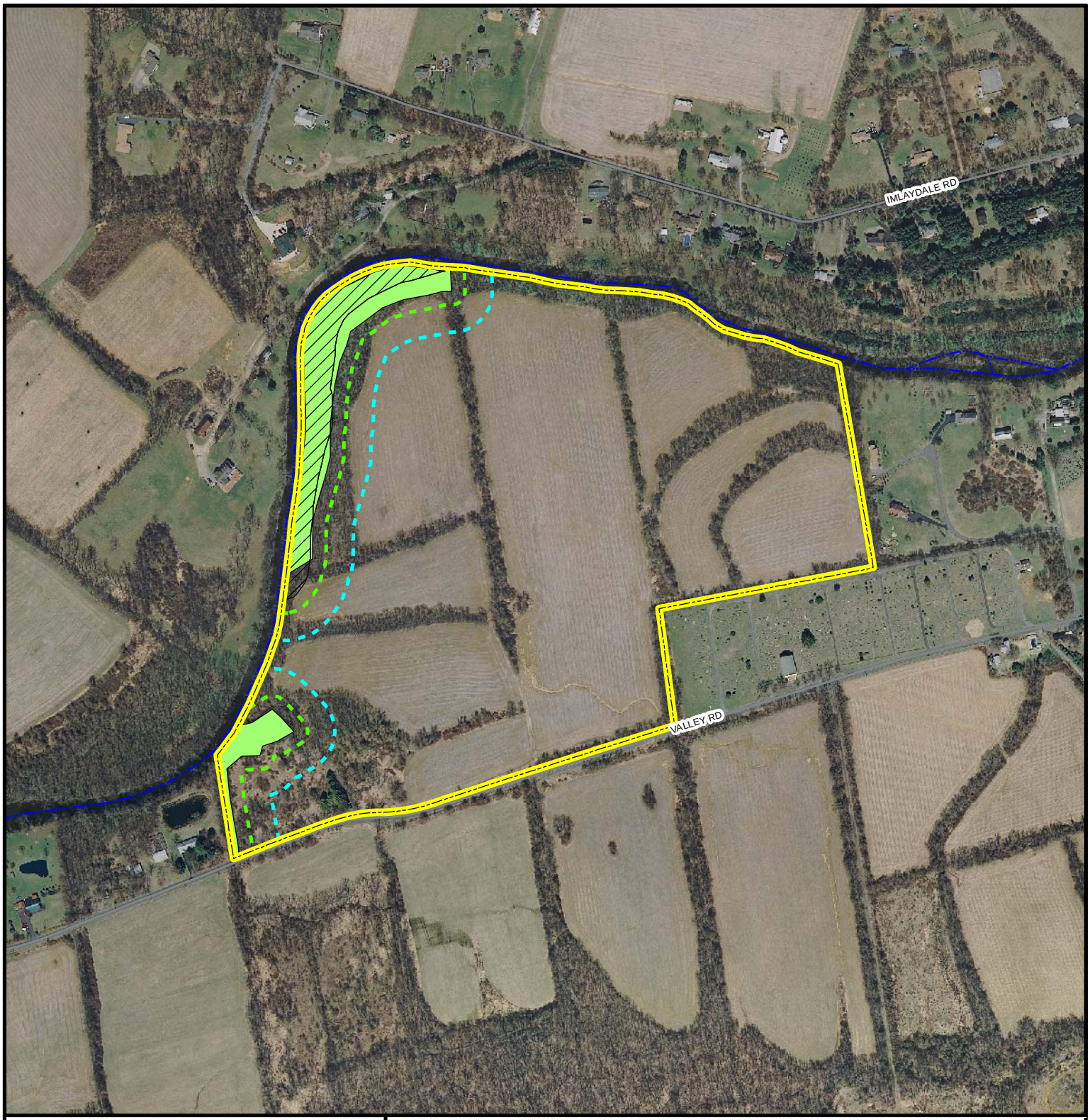

FIGURE 5
Wetlands

An Evaluation of Wastewater Disposal via Discharge to Groundwater
Block 23 Lot 1, Borough of Hampton
Hunterdon County, NJ

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Site Boundary

Wetland

- Krueger Certification (12/20/2010)
- NJ Highlands Council
- 50 Foot Wetland Transition Area
- 150 Foot Wetland Transition Area
- Road
- Stream

Aerial Photography - NJDEP 2007

0 500 1,000
Feet

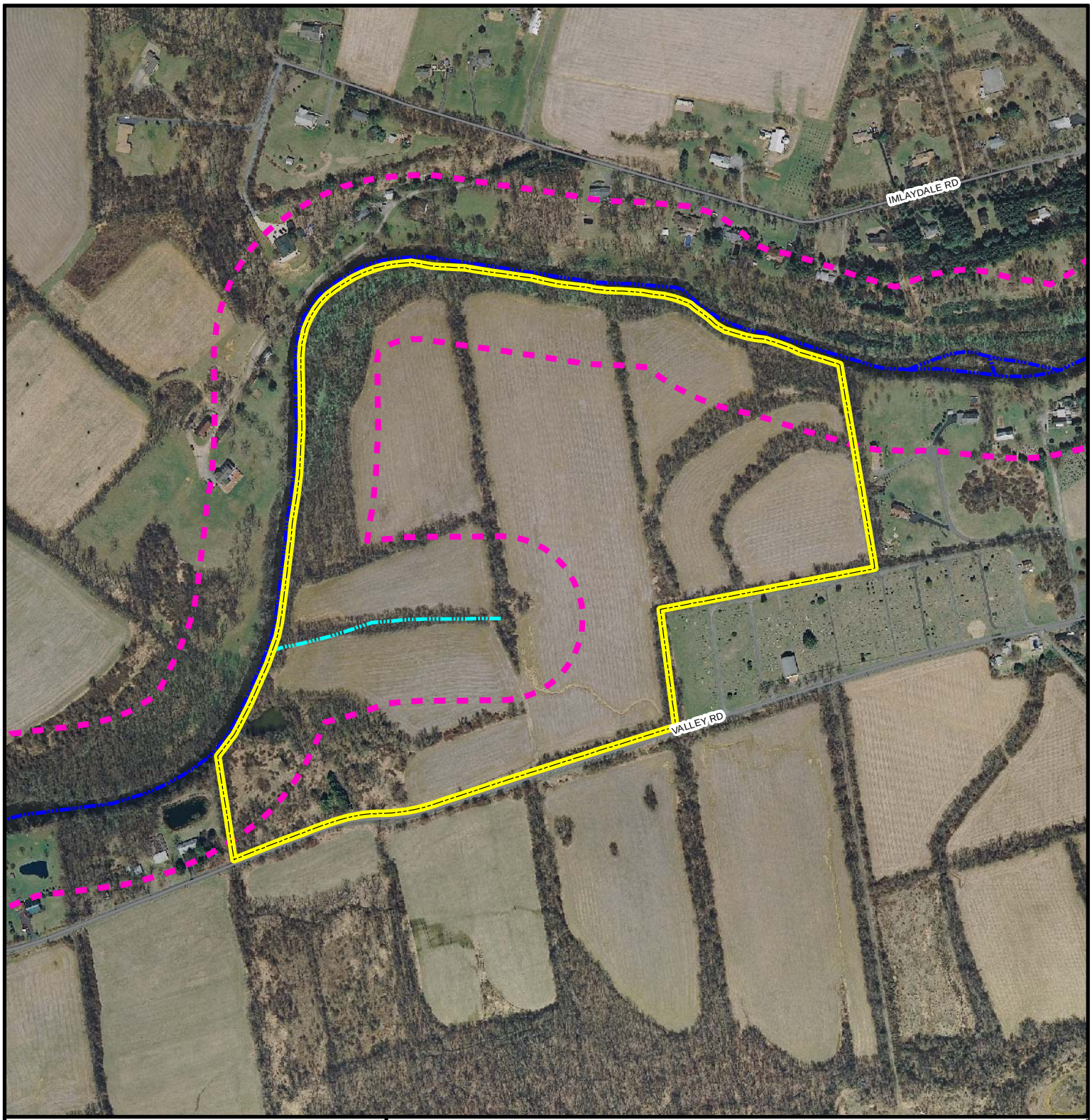

FIGURE 6
Special Water Resource Protection (SWRPA) Boundaries

An Evaluation of Wastewater Disposal via Discharge to Groundwater
Block 23 Lot 1, Borough of Hampton
Hunterdon County, NJ

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- Site Boundary
- Musconetcong River
- Tributary to Musconetcong River (Hunterdon County Soil Survey 1974)
- 300 Foot SWRPA
- Road

Aerial Photography - NJDEP 2007

0 500 1,000
Feet

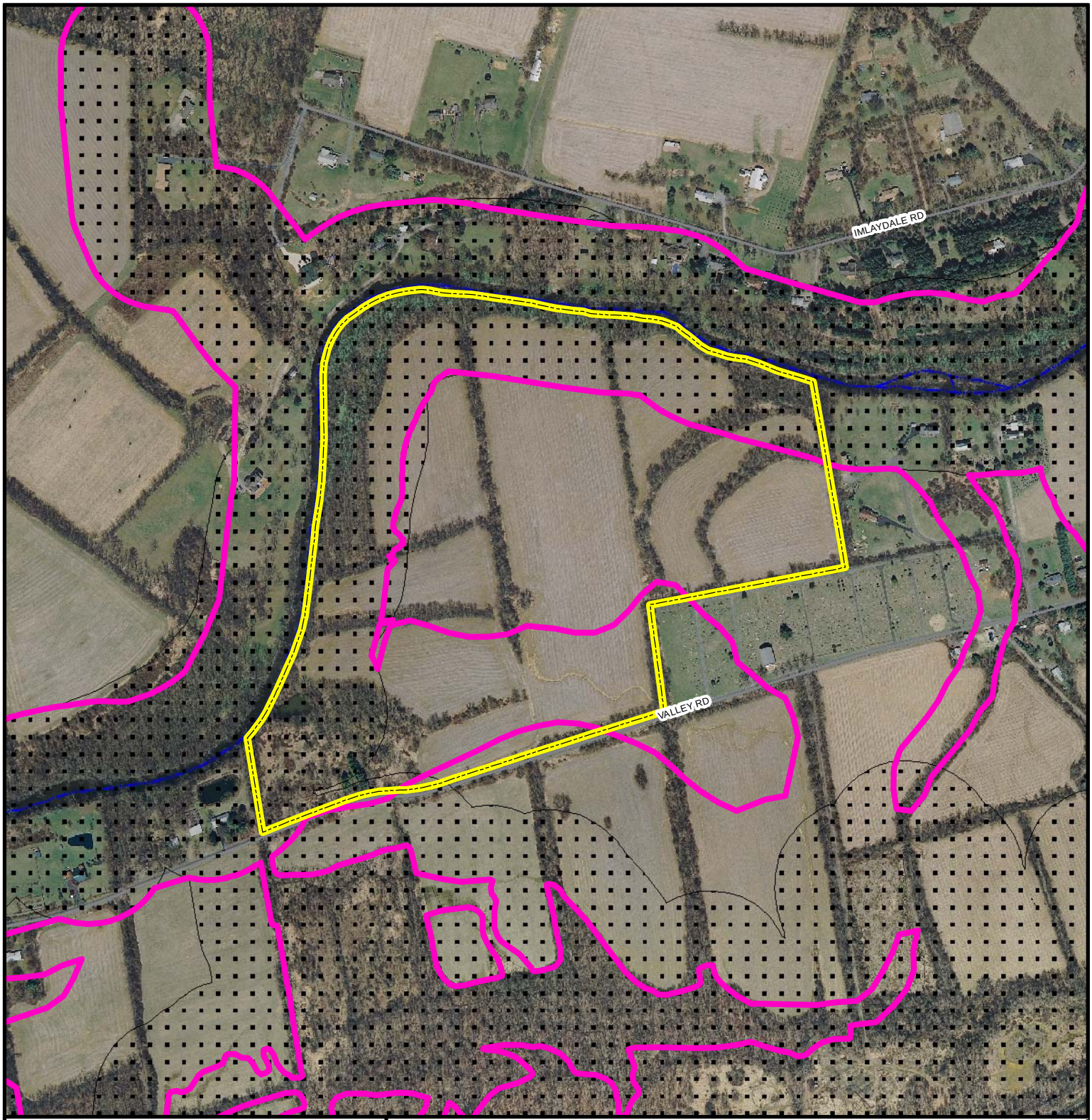

FIGURE 7
Open Water Protection Area/Riparian Area

An Evaluation of Wastewater Disposal via Discharge to Groundwater
Block 23 Lot 1, Borough of Hampton
Hunterdon County, NJ

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- Site Boundary
- Open Water Protection Area (NJ Highlands)
- Riparian Area (NJ Highlands)
- Road
- Stream

Aerial Photography - NJDEP 2007

0 600 1,200
Feet

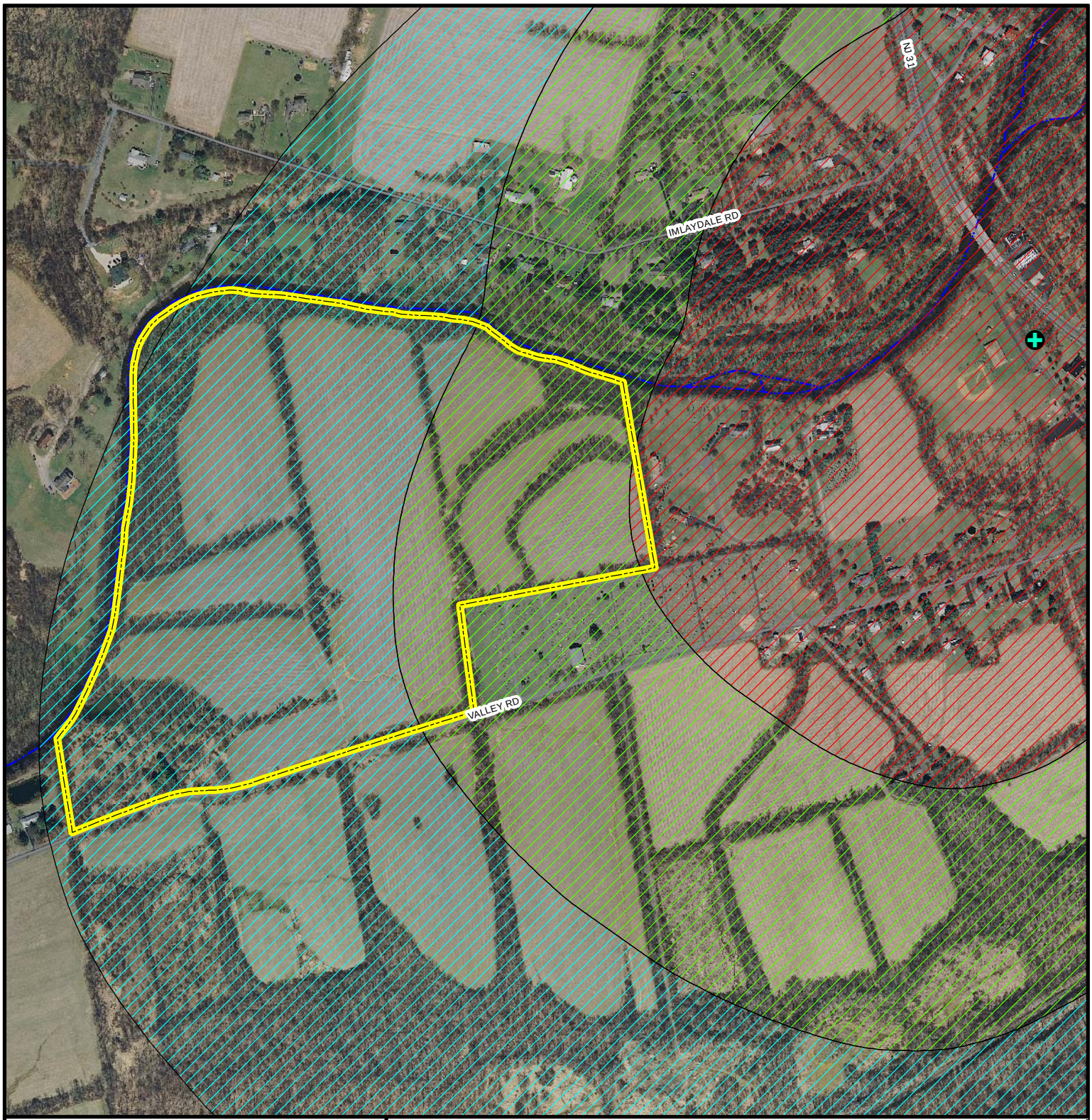

FIGURE 8
Wellhead Protection Area

An Evaluation of Wastewater Disposal via Discharge to Groundwater
Block 23 Lot 1, Borough of Hampton
Hunterdon County, NJ

January 2012

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Fax: 609-924-8831
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Site Boundary
Public Community Water Supply Well
Wellhead Protection Area
Tier 1
Tier 2
Tier 3
Road
Stream

Aerial Photography - NJDEP 2007

0 600 1,200
Feet

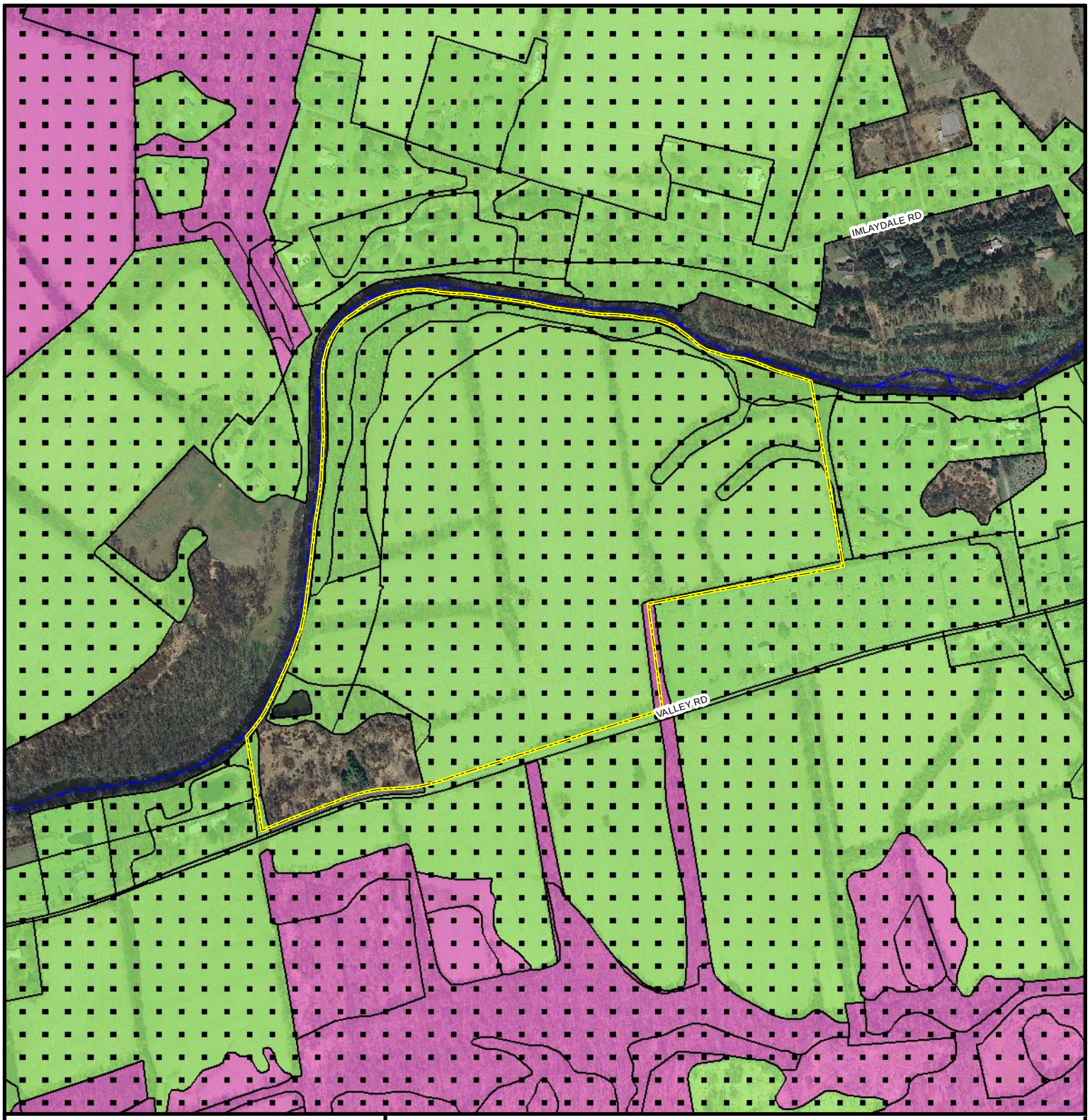

FIGURE 9
Environmentally Sensitive Areas

An Evaluation of Wastewater Disposal via Discharge to Groundwater
Block 23 Lot 1, Borough of Hampton
Hunterdon County, NJ

January 2012

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Site Boundary
Critical Wildlife Habitat (NJ Highlands)
Landscape Project v3.0
Rank 3 - State Threatened (Red-headed Woodpecker)
Rank 4 - State Endangered (Bobcat, Cooper's Hawk)
Road
Stream

Aerial Photography - NJDEP 2007

0 600 1,200
Feet

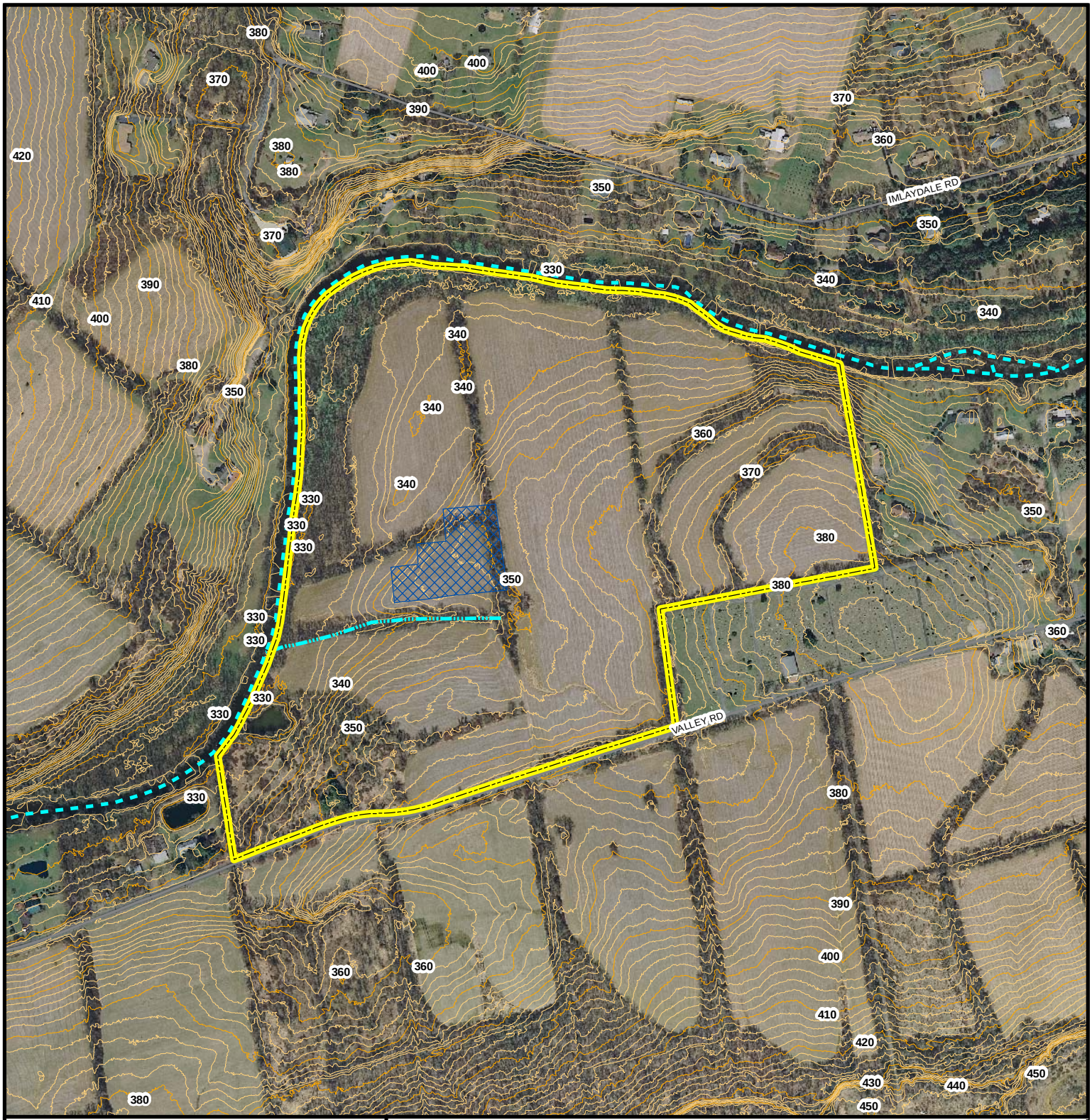

FIGURE 10
Topography

An Evaluation of Wastewater Disposal via Discharge to Groundwater
Block 23 Lot 1, Borough of Hampton
Hunterdon County, NJ

January 2012

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Site Boundary
Proposed Disposal Area (Adapted from Figure 1 of AWM January 2011)
Road
Musconetcong River
Tributary to Musconetcong River (Hunterdon County Soil Survey 1974)

Topography (NJ Highlands Council)
10 Foot Contour
2 Foot Contour

Aerial Photography - NJDEP 2007

0 500 1,000
Feet

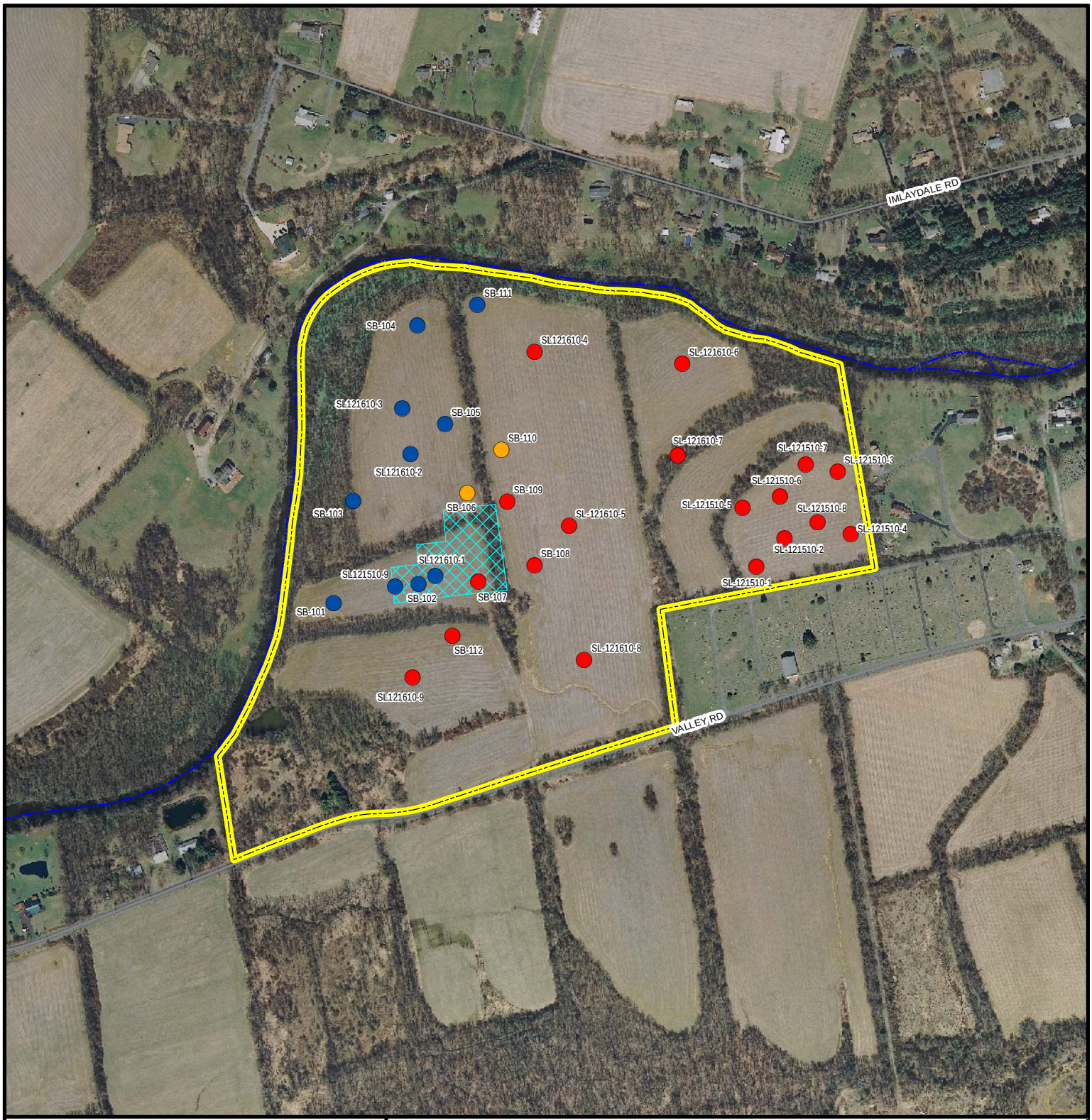

FIGURE 11
AWM Soil Borings & Test Pits

An Evaluation of Wastewater Disposal via Discharge to Groundwater
Block 23 Lot 1, Borough of Hampton
Hunterdon County, NJ

January 2012

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Site Boundary
Proposed Disposal Area (Adapted from Figure 1 of AWM January 2011)
Soil Boring/Profile (Adapted from Figure 1 of AWM January 2011)
- Suitable
- Possibly Suitable
- Not Suitable

Road
Stream

Aerial Photography - NJDEP 2007

0 500 1,000
Feet

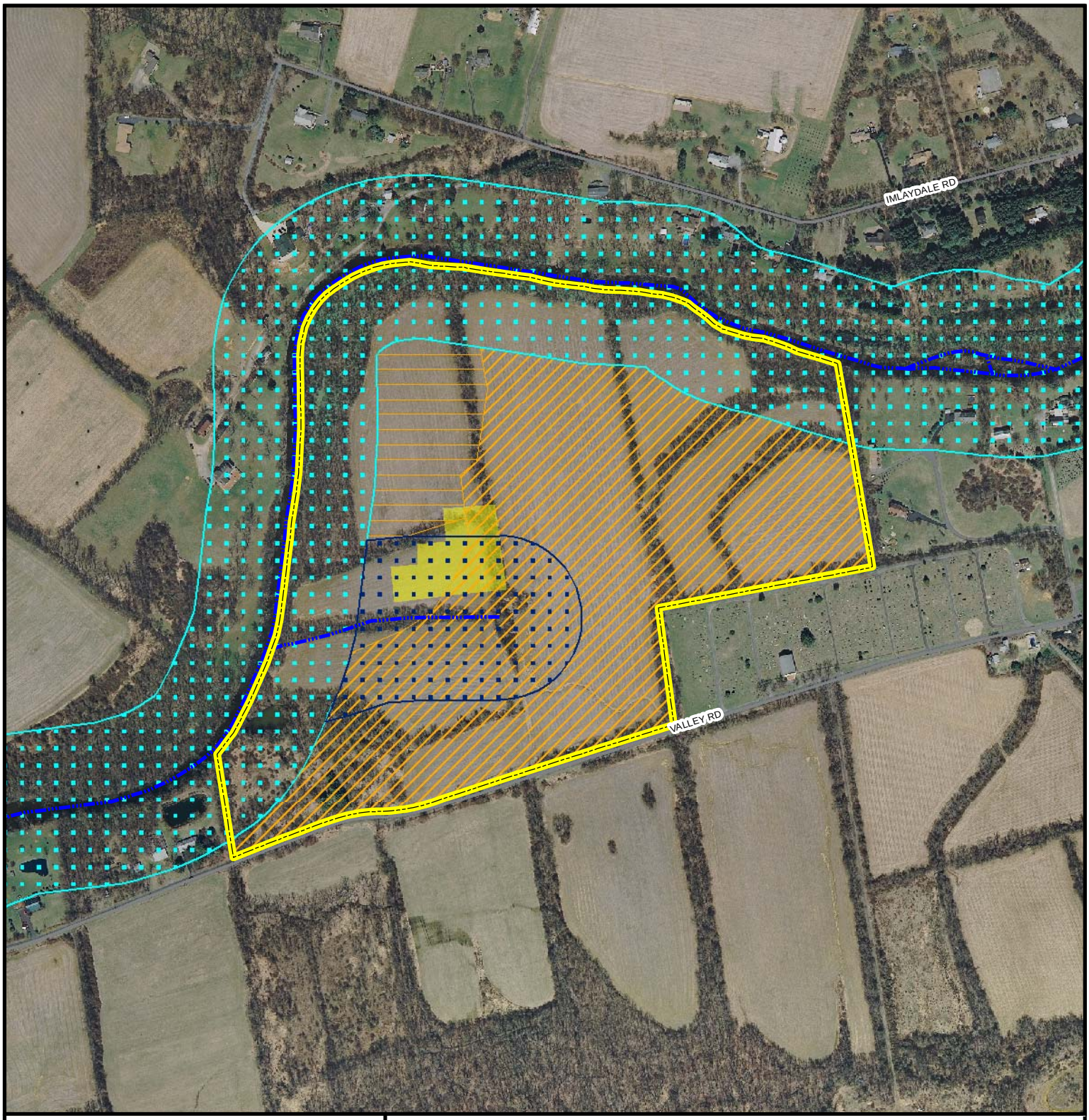

FIGURE 12
Constraints to Discharge to Groundwater

An Evaluation of Wastewater Disposal via Discharge to Groundwater
Block 23 Lot 1, Borough of Hampton
Hunterdon County, NJ

January 2012

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- Site Boundary
- Musconetcong River SWRPA
- Unnamed Trib To Musconetcong River SWRPA
- Proposed Disposal Area (Adapted from Figure 1 of AWM January 2011)
- Not Suitable Soil
- Questionable Soil - High Groundwater
- Road

Aerial Photography - NJDEP 2007

0 500 1,000
Feet

TABLE

Table 1 Wastewater Flows for Three Sewer Service Scenarios					
		parcels	gpd		gpd
Block 23, Lot 1	residential	300	67,500		
				Service Area I = Block 23, Lot 1	67,500
Central Borough	residential	249	56,025		
	office/commercial	4	2,818		
	industrial	1	189		
	subtotal		59,032		
				Service Area II = Service Area I + Central Borough	126,532
Additional Borough	residential	398	89,550		
	office/commercial	12	16,985		
	industrial	2	899		
	subtotal		107,434		
				Service Area III = Service Area II + Additional Borough	233,966