April 18, 2014

Tredyffrin Township
Attn: Stephen Burgo, PE
Township Engineer
1100 Duportail Road
Berwyn, PA 19312-1079

Re: Wayne Glen Independent Stormwater Management and Carbonate Geology Study Review
Tredyffrin Township, Chester County, Pennsylvania
pH No. 1380.001

Dear Steve,

Princeton Hydro is pleased to provide Tredyffrin Township with this letter report which summarizes our review of the March 5, 2014 and April 16, 2014 Geology “Certification Letter” submitted by Pennoni in support of the Wayne Glen development.

Documents Reviewed

The following documents were provided to us by the applicant’s engineer for the purpose of our review. These documents are supplemental to the plans and supporting documents which were originally received by our office on December 19th. Since that time we have received numerous correspondence and plan revisions from the applicant.


Comments on March 5, 2014 Response Letter

1. The applicant’s consultant has agreed to provide the final carbonate study report with the signature and seal of the project PA Professional Engineer and PA Professional Geologist.

2. The applicant’s consultant has provided a map that depicts the 100 foot buffer boundary around the known and identified karst features (i.e. sinkholes) on the site.

3. The applicant’s consultant has agreed to provide soil replacement materials for the recharge BMPs with a minimum cation exchange capacity (CEC) of at least 5%.

4. The applicant’s consultant has agreed to use only inverted filters for sinkhole repairs within stormwater BMPs onsite. While the letter includes a caveat of “where possible” through subsequent meetings, the consultant has agreed that inverted filters will be used within stormwater BMPs, including with the subsurface features in roadways without exception.

5. The applicant has agreed to include a “call out” on the plans and building plot plans to be submitted to the building department for permits a notification that the foundations will be designed to mitigate the detrimental impacts of the underlying carbonate formation (i.e. sinkholes and subsidence activity).

6. The applicant has agreed to address each and every identified karst feature/sinkhole, as well as potential sinkholes that may arise on a case by case basis, with specific approaches to reflect the need to protect the infiltrative capacity of stormwater BMP features on site (i.e. only use inverted filters in these areas) and respect distances from stormwater features outlined in our February 18, 2014 letter when using grouting or dynamic compaction techniques to stabilize sinkholes. The known specific sinkholes will be addressed as described in Pennoni’s letter of April 1, 2014 Carbonate Geology Letter.

Comments on April 16, 2014 Response Letter

The April 16, 2014 letter is intended to provide three primary objectives as follows:

- “Certify” that the development as designed would not cause undue harm to the health, safety, and welfare of the Township.
- Stipulate specific approaches to stabilize the existing known sinkholes on the property.
- Provide engineering justification to encroach within the 100 foot stormwater BMP buffers around karst features as prohibited via Chapter 174, Appendix B, and to
keep stormwater BMPs away from structures (as with the pervious pavement and subsurface stormwater storage features proposed within the roadways).

7. On page 2, second full paragraph, it states that the site has been designed to avoid overlap of infiltration facilities with "concentrations of solution activity". While this is generally true for the surface stormwater infiltration BMPs, it is not necessarily so for the subsurface BMPs. Regardless of their identifying name as "pervious pavers", these subsurface features are designed to manage the 2-year storm event from areas larger than the pervious paver coverage area and, therefore, are considered infiltration BMPs. The letter must be revised to acknowledge the fact that these are BMPs located below structures, and engineering justification must be provided to allow the placement of these features below the roadway.

8. As stated in comment 7 above, on page 6 within the middle paragraph that starts "It is our professional opinion the Carbonate Geology Study...", the stormwater infiltration BMPs within the roads are not mentioned as avoiding identified areas of solution feature activity. The stormwater features in the road must be acknowledged as stormwater BMPs and justification provided for their location below the road (i.e. structure) and how and if identified sinkholes have been avoided or are being remedied to allow for their placement atop and within 100 feet of a sinkhole.

9. Other than the comments discussed within comment 7 and 8 above, this letter provides reasonable assurance that the project as designed will reduce the risk associated with developing over carbonate geologic formation. Regarding the assurances, including financial coverage, presented at the bottom of page 7, we defer to the Planning Commission, Township Engineer, and Solicitor on whether or not the assurances provided are adequate to protect the future homeowners from undue financial hardship in the event of solution activity that may damage the site's infrastructure, including the stormwater management features.

**Stormwater**

It is our recommendation that the applicant prepare a revised plan set and submission which incorporates the various rounds of revisions which have been made since the December 18th submission. Due to the site's proposed density and stormwater system complexity, many of the revisions have impacts on other site features, therefore a review of the final plans and reports with all revisions incorporated is crucial.

Based on our review of the recent revisions to the plans and supporting calculations, the project will meet the volume control requirements and the peak flow rate requirements including the additional reductions per the TCO Ordinance. However,
as was outlined in our March 18th memo, the project's compliance with the Township requirements is contingent of the functionality of the proposed features. Specifically it is contingent on the anticipated rate of infiltration from the proposed features. This will be determined through additional infiltration testing as well as infiltration testing conducted both during construction and post construction monitoring. The proposed regional basin in its current size and outlet configuration will meet the 5% and 20% reductions for the 5 and 100 year respectively. Furthermore, the engineer has provided additional information that confirms that Walker Road will not flood due to backwater conditions at the 100 year flow rate.

We reiterate the concerns outlined in item four of our March 18, 2014 memo which related to the proposed site density, underlying geology and the reliance on subsurface roadway systems:

Pennoni has provided a revised version of Exhibit 14 (EX-14, latest revision March 11, 2014). This plan shows the locations of the karst features and the proposed stormwater management systems; including both the surface and subsurface roadway systems. The accompanying draft Carbonate Geology letter states that “At areas identified as active features the design has been revised several times to provide the recommended 100 ft setback, where possible.” We would argue that this is a requirement of the Ordinance and not a recommendation. As the letter suggests some revisions have been made, with the primary revision being the relocation of Surface Infiltration Basin #2. However, it is noted that essentially all of the 13 identified features on EX-14 are still within 100 feet of a proposed stormwater infiltration structure. Most notably, large portions of the proposed subsurface roadway systems are within the 100 foot buffer of many of the karst features. Due to the proposed density of the site, there is little to no flexibility built into the design of the stormwater system. In fact, two of the seven proposed subsurface roadway systems currently exceed the two-foot total effective depth guideline in Appendix B of the Stormwater Ordinance. During the review process we have stressed that the reliance on subsurface systems is not recommended, especially considering the site’s geology. Pennoni has also previously acknowledged the operational and maintenance advantages of surface versus subsurface features in karst geology. The replacement of a proposed subsurface system with surface Bioretention Basins #8 and #9 along Road D was previously completed in response to this comment. In summary, the project’s compliance with the Township’s Stormwater Ordinance relies heavily on the use of these subsurface roadway systems. Although not explicitly stated in the Ordinance, in general, the use of surface infiltration systems is preferred over subsurface systems. This is further compounded in areas with karst geology where proper access and inspection and maintenance are more critical.
Summary and Conclusions

This concludes our review of the revised Carbonate Geology Study and letter for the proposed Wayne Glen development. We would like to reserve the right to provide further comment. Please do not hesitate to contact me with any questions. We appreciate the opportunity to provide Tredyffrin Township with these services.

Sincerely,

[Signatures]

Geoffrey M. Goll, PE
Princeton Hydro, LLC

Clay H. Emerson, PhD PE
Princeton Hydro, LLC

Cc: Clay Emerson, PhD PE, Princeton Hydro
Geoff Goll, PE, Vice President, Princeton Hydro
Encl: (0)