August 12, 2014

Scientists, Engineers & Environmental Planners Designing Innovative Solutions for Water, Wetland and Soil Resource Management

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

Re: Wayne Glen 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 recently revised Wayne Glen development application package. Similar to our previous letters we have focused on general compliance issues relevant to the Conditional Use application.

Documents Reviewed

The following documents were provided to us by the applicant's engineer for the purpose of our review. It is our understanding that submitted material represents a complete revision of the application materials and that the review of this submission is essentially independent from the previously submitted material. A compact disc containing the revised plans and reports was received by our office on July 18th. Specifically the compact disc contained the following items that were the focus of this report:

- Post-Construction Stormwater Management Report, Wayne Glen Tredyffrin Township, Chester County, PA, prepared by Pennoni, dated April 22, 2013, last revised July 16, 2014.
- Carbonate Geology Study, Wayne Glen Tredyffrin Township, Chester County, PA, prepared by Pennoni, dated August 2, 2013, last revised July 16, 2014.
- Wayne Glen Conditional Use Submission, Tredyffrin Township, Chester County, Pennsylvania, 50 Sheets, prepared for Arcadia Tredyffrin, LLC, prepared by Pennoni, dated April 22, 2013, last revised July 16, 2014.
- Digital input files for HEC-HMS model.

Introduction

The current plans have several notable revisions from the previously submission. The proposed roadway configuration on the eastern (Carriage Home) side of the residential area has been modified. These changes resulted in an overall increase in the number of total units with a decrease in the number of Carriage Homes and an increase in the number of Townhomes.

From a stormwater and geotechnical perspective, the most notable of these revisions is that the proposed stormwater management features have been relocated to avoid the previously identified karst features and respect the 100 foot buffer area around those features as illustrated in EX-14 of the Carbonate Geology Study report. This involved the relocation of the proposed bioretention basins near the proposed stream crossing on Road D; the area of the site has the highest density of existing karst features. The extent of the subsurface porous paving has been significantly reduced as a result of maintaining the 100 foot buffer to known karst features. Generally, this stormwater management has largely been relocated to a series of tiered basins located on the eastern side of the Regional Basin.

In general, the plans meet the Township's stormwater requirements. However, it is noted that the current configuration of the stormwater system including the Regional Basin, has little to no flexibility or opportunity for excess capacity as is further discussed.

Stormwater

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. The following sections summarize the project's compliance with individual sections of the ordinance.

Groundwater Recharge and Volume Control

Similar to previous versions of the plans, the site plan includes a series of interconnected stormwater management structures including features that are designed to provide groundwater recharge and volume control in compliance with §174-20 and the TCO Ordinance. It is our opinion that the calculation methodology used to represent these features is consistent with the intent of the Township ordinance. The methods used by the engineer accurately reflect our previous comments including those related to the determination of the loading ratio for basins designed in series.

The current system provides the appropriate volume control storage, however, it is noted that there is likely little additional flexibility in the design which may be

needed to address currently unforeseen issues during land development and construction. Specifically, the estimated depth to bedrock in five of the proposed basins is less than three feet, with three basins having an estimated depth to bedrock equal only to the minimum two foot separation. There is little flexibility considering the spatial constraints posed by the necessary regional basin storage and the currently proposed residential unit density of 108 units.

As we have previously mentioned, the project's compliance with the volume control requirements is contingent on the functionality of the proposed stormwater infiltration systems. Specifically it is contingent on the anticipated rate of infiltration from the proposed features. Limited infiltration tests have been completed, the results of which suggest that the rate of infiltration and drain time will not be problematic. Further confirmation and infiltration testing should be conducted at the land development stage, in addition to infiltration testing during construction and post construction monitoring.

Peak Flow Rate Control

The applicant has demonstrated that the project will meet the requirements of §174-23 with the additional reductions per the TCO Ordinance. The applicant has made a clear effort to eliminate the total amount of areas which bypass the proposed stormwater management features and capture all of the impervious coverage. The bypass areas primarily consist of narrow perimeter areas and other areas that drain directly to the Regional Basin. The applicant states that these areas will contain limited amounts of lawn and be primarily maintained in a meadow condition.

Operation & Maintenance

The applicant has previously submitted an operation and maintenance document in support of the December 16, 2013 submission. We would recommend that the Township require that an updated operation and maintenance manual be submitted for the revised plan.

The revised basin configuration, especially on the eastern side of the residential area, appears to make access to the basins and critical outlet control structures difficult. We recommend that the revised operation and maintenance manual include a plan showing the locations of each basin along with a dedicated access route which demonstrates full access to each of the basins. Full access to the basins is especially critical considering the karst bedrock which is prevalent on the property. Access routes for each basin should not be encumbered by adjacent residential units or landscaping and should have a minimum width of ten (10) feet with slopes less than or equal to 5:1. The currently proposed berm width between basins 2B and 2A appears to be less than ten feet wide and is not consistent with the cross section detail shown on Sheet CS9504.

Regional Basin

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 previously provided additional information that confirms that Walker Road will not flood due to backwater conditions at the 100 year flow rate.

The digital HEC-HMS files (Hydrologic/Hydraulic model) were provided with the revised submission and the input data appears to be consistent with the outlet structure configuration detailed on Sheet 9501 of the plan set. The revisions to the residential portion of the development resulted in minor changes to the size of the proposed Regional Basin with a maximum reduction of up to 0.15 acres at some elevations.

The revised plans appear to maintain access to the eastern side of the Regional Basin via an access road originating near the eastern side of the stream crossing off Road D. However, the engineer should demonstrate that adequate access to the sanitary sewer on the western side of the stream can still be accommodated.

No additional hydraulic analyses of the Walker Road and Glenhardie Road crossings were submitted with this revision. A revised dam breach analysis and report was not submitted with this application and therefore no additional comments related to the breach analysis are provided. No further discussion or clarification on the proposed monitoring effort at the Regional Basin has been provided.

Geotechnical

The revised application includes a revision of the Carbonate Geology Study which has been slightly revised to reflect the modified layout of the project plans. No additional exploratory work was required or completed. As was previously discussed the plans have been revised to respect the 100 foot buffers around all of the existing karst features. Most notably this has entailed the relocation of basins which were proposed adjacent to the stream crossing. This has also included the near elimination of the permeable pavement subsurface systems, with only an approximately 200 linear foot section of Road E being proposed with permeable pavers and subsurface storage along with less than 30 parking spaces.

The revised report is signed and sealed by both a Professional Geologist and a licensed Professional Engineer. The applicant has provided a map that depicts the 100 foot buffer boundary around the known and identified karst features on the site (EX-14) as requested.

The applicant has previously agreed to include a notification that the foundations will be designed to mitigate the detrimental impacts of the underlying carbonate formation (i.e.

sinkholes and subsidence activity) on the final plans and building plot plans submitted to the building department for permits.

Summary and Conclusions

In summary, the revised plans appear to meet the stormwater ordinance and additional requirements as part of the TCO Ordinance. However, we note that there is little flexibility in the design. Stormwater features appear to have been maximized in terms of total storage with little room to expand without either reducing the size of the regional basin which currently achieves the required 5% (two-year) and 20% (100-year) peak flow reductions or impacting the currently proposed site density. This appears to have already resulted in the creation of multiple retaining walls between the basins and residential units, some of which are as high as 13 feet. As has been discussed, the engineer should demonstrate that unimpeded access can be provided to all the proposed stormwater features and the Regional Basin.

This concludes our review of the revised application materials 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,

Geoffrey M. Goll, PE
Princeton Hydro, LLC

Clay H. Emerson, PhD PE CFM
Princeton Hydro, LLC

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