Project No. READ-0029

Applicant:
Mass Equity Investors or Nominees
11 Middlesex Ave – Unit 8
Wilmington, MA 01887

Mitigative Drainage Analysis
5 Lot Residential Subdivision
(1260-1264 Main Street)
Reading, Massachusetts

December 7, 2016

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Purpose:

The purpose of this report is to provide a stormwater analysis for a proposed five (5) lot residential subdivision in compliance with the requirements of Section 7.4.4 of the Town of Reading Massachusetts Rules and Regulations Governing the Subdivision of Land in Reading adopted October 6, 1997 amended August 28, 2006, (R&R).

Introduction:

The project is located on the west-side of Main Street between Rocky Road and Franklin Street and is approximately 3.07 acres in size. In the pre-development condition the area is occupied by two (2) residential dwellings (#1260 & #1264) and is covered predominantly by woods, lawn, gravel roadways, paved driveways, patios, walkways, sheds, an in-ground pool and cleared areas. There are also areas of ledge outcroppings, boulders and stone walls located on and adjacent to the premises.

The proposal is to construct a three-hundred and thirty-four (334') foot long paved roadway to provide access for five (5) residential dwellings. The construction of the dwellings and roadway will include paved driveways, lawn, landscaping, sewer, drainage, a subsurface infiltration area, water services and other various utilities. The existing house located at #1260 will be razed, however, the existing house at #1264 will remain in place with a garage addition and driveway relocation to the rear of the dwelling.

It should be noted that there are no wetland resource area disturbances associated with this project, however, proposed activities within the one-hundred (100') buffer zone to the edge of bordering vegetated wetlands will require a filing with the Conservation Commission.

Existing Condition Soils Analysis:

In order to model the runoff parameters for both the existing and proposed watershed parameters, the parent soils on site were mapped using the Web Soil Survey (WSS) made available on the United States Department of Agriculture (USDA) National Resources Conservation Service (NRCS) website. The WSS provides vital soil data and information such as Hydrologic Soil Group (HSG) which is then input into a mathematical model to generate runoff curve numbers. The user inputs the soil cover type as well as the hydrologic soil group to generate a weighted curve number (CN) and also uses the topography of the land to generate a time of concentration (Tc) from which the stormwater runoff rate as well as volume may be calculated for a certain watershed for comparison. A minimum Tc of 6 minutes has been utilized in this analysis.

The NRCS lists the majority of this property as being Charlton-Hollis-Rock Outcrop Complex, 3 to 8 percent slopes with Hydrologic Soil Group of "A" and the remainder of the site being Scarboro, Mucky fine sandy loam with Hydrologic Soil Group of "A/D".

Because the composition of Charlton-Hollis-Rock Outcrop complex is comprised of many different soil types according to the NRCS, Williams & Sparages performed soil testing on October 31, 2016 to determine the underlying soils.

During the soil testing procedure, we observed that the site is predominantly comprised of sandy loam (sl) for the top soil, subsoil and substratum over refusal which varies in depth across the site. We also observed that the soils on the northerly edge of the property, behind the pool and westerly along the edge of clearing are sandy loam for the top and subsoil over deposits of sand and loamy sand which varies in depth.

Based on our field observations, that is, ledge outcrops on and around the site, boulders and runoff entering the stream located just northerly of the premises, it is our opinion that the soil group of the site behaves as a "B" soil. Our position is further supported by Table 2-1 Infiltration Rates for Various Soil Textures found in the Hydrology Handbook for Conservation Commissioners dated March 2002 by the Department of Environmental Protection (DEP) which lists Sandy Loam as a "B" soil.

Stormwater Modeling Methodology:

The mathematical model used in this analysis was provided using the HydroCAD 10.0 Version developed by HydroCAD Software Solutions LLC. HydroCAD is a program that is used to model the hydrology and hydraulics of stormwater runoff and is based largely on programs and techniques developed by the NRCS, specifically TR-20 and TR-55 as well as other hydraulic calculation methods.

HydroCAD allows the user, for a given rainfall event, to generate runoff hydrographs for single or multiple watersheds and is used to determine if a given drainage system is adequate under the desired conditions as well as to predict flooding or other impacts at specified locations such as erosion. As required by the Reading Rules & Regulations, four (4) design storm events were analyzed and the results presented in the tables that follow for the two (2) year, ten (10) year, twenty-five (25) year and one-hundred (100) year storm events for comparison.

As mentioned above, we have held a minimum time of concentration of six (6) minutes which was the accepted

Existing Condition Watershed:

The limit of the watershed analysis has been delineated along the existing property line and the up gradient areas tributary thereto for comparison with the proposed condition as can be seen on the accompanying watershed maps. A majority of the site is tributary to an un-named stream located just north of the premises which then conveys runoff under Main Street via an existing 2′ high x 2′ wide culvert with stone headwall on the west-side of Main Street. The balance of the site flows onto Main Street which is then captured by an existing catch basin located in the low point approximately one-hundred and thirty feet (130′) north of the property.

Using the methods described in the stormwater modeling explanation above, runoff curve numbers and times of concentration were generated for each watershed for the existing condition to be used for comparison with the proposed condition described below. A schematic of the mathematical model as well as the results of the calculations for the 2 year, 10 year, 25 year and 100 year, Type III, 24-hour storm events are included in this report.

The results of which are presented in the HydroCAD results printout and the summary table found below which lists both peak rates of runoff and volumes of runoff as required in the R&R.

Proposed Condition Watershed:

The proposed development requires the construction of two (2) stormwater management areas, a subsurface infiltration pond and surface infiltration pond which will provide peak rate of runoff mitigation as well as groundwater recharge opportunities in the volume provided below the pond outlets. We have also proposed roof-recharge areas in locations where the best opportunity for infiltration will occur in order to reduce the amount of runoff volume discharging from the site based on our test hole data.

Runoff from roadway, driveways and some of the roof areas will be collected using deep-sump catch basins with hoods from the paved surfaces and piped directly into oil/water separator units for pre-treatment before reaching the infiltration areas. As mentioned above, certain roof areas will be discharged directly into separate sub-surface chambers where topographically feasible and based on the soils, groundwater elevation, prescience of refusal, etc.

The subsurface infiltration structure will be comprised of (49) Cultec 330XL XD Heavy Duty Recharger units connected together with internal manifolds. The structure will sit on a 6″ crushed stone bed, have a 12″ crushed stone border and will have a 6″ crushed stone cover layer for additional storage volume. The system will also have two (2) 6″ PVC outlet pipes discharging onto rip-rap aprons to control the rate of stormwater discharge over and above the volume of groundwater recharge.

The surface infiltration pond will be graded at a 3:1 slope with a berm, 8′ long stone spillway and six (6″) diameter outlet pipe for discharge onto a rip-rap apron for velocity reduction before flowing towards the existing stream to the north.

Using the methods described above, runoff curve numbers and times of concentration were generated for each watershed for the existing condition to be used for comparison with the existing condition described above. A schematic of the mathematical model as well as the results of the calculations for the 2 year, 10 year, 25 year and 100 year, Type III, 24-hour storm events are included in this report.

Conclusion:

As can be seen by examining the following summary & performance tables, the proposed stormwater management system is effective for mitigating the peak flow rates and volume of runoff from the limit of the watershed analysis for the 2, 10, 25 & 100 year storm events for the proposed 5 lot residential development. More detail will be provided in the Stormwater Report to be submitted with the Notice of Intent filing at a later date.

Total Peak Rate of Runoff Comparison Table

Description	24 hour Type III Storm Event (year)	Existing Condition Peak Rate of Runoff (Q) cfs.	Proposed Condition Peak Rate of Runoff (Q) cfs.
Runoff Discharging into Municipal Drainage System (Link 4L)	2 (3.1 inch) 10 (4.5 inch) 25 (5.3 inch) 100 (6.5 inch)	*2.0* *5.4* *7.8* *11.6*	**1.1** **4.3** **6.1** **8.9**

Total Volume of Runoff Comparison Table

Description	24 hour Type III Storm Event (year)	Existing Condition Volume of Runoff (Q) acre-ft	Proposed Condition Volume of Runoff (Q) acre-ft
Runoff Discharging into Municipal Drainage System (Link 4L)	2 (3.1 inch) 10 (4.5 inch) 25 (5.3 inch) 100 (6.5 inch)	*0.195* *0.456* *0.630* *0.915*	**0.156** **0.386** **0.554** **0.842**

Proposed Subsurface Infiltration Area - HydroCAD Pond 78P

(49) Cultec Recharger 330XL HD Units – 7 rows of 7 units
Top of Stone=207.0
Top of Chambers=206.5
12″ Invert In=205.29
Bottom of Chambers=203.96
Bottom of 6″ Stone bed=203.46
(2) 6″ HDPE Inverts out=206.0
Install (7) Inspection Ports at the end of each row to finish grade

24 hour Type III Storm Event (YR)	Peak Rate of Runoff In (Qin) cfs.	Peak Rate of Runoff Out (Qout) cfs.			Peak Water Level (W.L.) ft.
		*Infiltration (Discarded)	6″ HDPE outlets	Total Outflow	
2	0.8	0.04	0.0	0.04	204.51
10	1.5	0.04	0.0	0.04	205.65
25	1.9	0.04	0.07	0.12	206.13
100	2.6	0.04	0.45	0.50	206.46

* Calculated infiltration rate and peak water levels are based upon a rate 1.02 inches per hour for sandy loams as found in the Hydrology Handbook for Conservation Commissioners, March 2002 Table 2-1.

Surface Infiltration Pond - HydroCAD Pond 9P

Top of Berm=208.2
Bottom of Berm=205.0
12″ FES Inv. In=208.0
8′L Emergency Stone Spillway=207.2
12″ PVC Inv. Out=206.0

24 hour Type III Storm Event (YR)	Peak Rate of Runoff In (Qin) cfs.	Peak Rate of Runoff Out (Qout) cfs.				Peak Water Level (W.L.) ft.
		*Infiltration (Discarded)	12″ HDPE	8′L Stone Spillway	Total Outflow	
2	0.8	0.04	0.0	0.0	0.04	204.51
10	1.5	0.04	0.0	0.0	0.04	205.65
25	1.9	0.04	0.07	0.0	0.12	206.13
100	2.6	0.04	0.45	0.0	0.50	206.46