MEMORANDUM

NEWMAN ENVIRONMENTAL ENGINEERING

Date: 9/16/11

To: File, Conservation Commission, Planning Board

From: GREG NEWMAN

Subject: Review of Stormwater Management Plan for Proposed Rivercrest Condominiums, Ferry Street, South Hadley, MA

Review based on following documents received from Heritage Surveys Inc. (HSI) on August 29, 2011:

- Plans entitled, "*Rivercrest Condominiums, Ferry Street, South Hadley, Massachusetts*", prepared by Heritage Surveys Inc., dated 8/24/2011 includes 10 plan sheets;
- Bound document entitled, "*Revised Roadway & Drainage Calculations – Rivercrest Condominiums, Ferry Street, South Hadley, MA*" prepared by Heritage Surveys Inc., dated August 16, 2011, includes single page summary of drainage calculations, plan depicting roadway and driveway post-construction drainage areas, and 132 pages of HydroCad model estimated runoff results for the 2-year, 10-year, 25-year and 100-year storm events.
- Bound document entitled, "*Revised Roof & Yard Drainage Calculations – Rivercrest Condominiums, Ferry Street, South Hadley, MA*" prepared by Heritage Surveys Inc., dated August 16, 2011, includes single page summary of drainage calculations, plan depicting roof & yard post-construction drainage areas, and 21 pages of HydroCad model estimated runoff results for the 2-year and10-year storm events. [several replacement pages for 10-year Storm event results received on 9/1/11].

The proposed plan for runoff control represents a significant departure from the previously submitted proposal that includes: one less housing unit, shorter roadway, change in technology used to control runoff from roadway, and modified runoff controls for roof and yard drainage. Previous memoranda submitted to the Conservation Commission and Planning Board discussed various issues that have not been addressed by the current submittals, including but not limited to:

- Off-site Flooding (SWM Standard 2)
- Erosion and Sediment Control Plan, (SWM Standard 8)
- Stormwater Pollution Prevention Plan (SWM Standard 8)
- Operation & Maintenance Plan (SWM Standard 9)

This memorandum incorporates many of the previous memoranda comments with modifications as appropriate to the current proposal. The intent is to provide the Conservation Commission with a single document to use as the basis for the current project review. While pertinent aspects of the Town Stormwater Bylaw are discussed herein, a separate Stormwater Bylaw Checklist has been prepared to allow the planning board to rapidly assess compliance with this bylaw.

1. Proposed Runoff Controls

Proposed runoff controls are separated into two categories:

- Connected runoff (Road & Driveway Drainage): Runoff that flows directly from impervious surfaces (roadway and driveways) into a storm drain system
- Unconnected runoff (Roof & Yard Drainage). Runoff from pervious and impervious areas (roofs) that does not flow directly into a storm drain system; i.e. this runoff has an opportunity infiltrate into pervious soils as it flows across lawn areas.

A. **Proposed road & driveways runoff control facilities**. The proposed runoff controls include facilities for conveyance, treatment, groundwater infiltration, and peak flow reductions as follows:

1) Deep sump catch basins: Eight (8) deep sump catch basins collect runoff from most of the roadway & driveways (approx. drainage area = 32,430 SF). Each catch basin includes a 12-inch diameter outlet to convey flow to the roadway storm drain system. If maintained properly (quarterly cleaning) these should provide a 25% reduction in TSS in the runoff.

2) Main roadway storm drain system: This includes seven (7) storm drain manholes, about 290 LF of 15-inch diameter drain pipe and about 700 LF of 18-inch diameter drain pipe. Flows are conveyed to a rock-lined infiltration trench located southeast of the cul-de-sac.

3) Rock-lined infiltration trench: The rock-lined infiltration trench is about 3-ft deep, 70.5-ft long and 18-ft wide (at top); bottom elev.=188.0; top elev.=191.0; overflow grate at elev.=190.0; and storage capacity (in open trench and rock voids) of about 1850-CF below the overflow grate. The trench has capacity to infiltrate up to 0.47 CFS when liquid level is at overflow grate. The overflow device conveys flow (through a 12-inch diameter pipe) to the proposed Stormtech infiltration system. If maintained properly (semi-annually and after major storms), infiltration trenches are anticipated to provide 80% TSS removal with pretreatment provided by deep sump catch basins. **ESHWT**: Based on Test pits TP-4 & TP-2, the ESHWT at the rock-lined infiltration trench is about 2.2-ft below the bottom of infiltration trench (elev.=186.5)

   The proposed infiltration trench design departs significantly from the example design in BMP section of the Stormwater Manual. **The following deficiencies are noted:**

   - **Design does not include observation port(s) and does not include a top filter layer (typically pea-stone over filter fabric).** These deficiencies would make inspection and maintenance difficult as sediments would build up below the rip-rap rock (out of sight) and would not be easily removed.
   - **Design does not provide a setback >100-ft from slopes >20%** (Required by MA-DEP Stormwater Handbook); actual setback distance provided is about 45-ft.
   - **The Town Stormwater Bylaw, Section 16-6 (3) (A) (6), requires a minimum of 3-ft vertical separation from bottom of infiltration "basins" to the ESHWT; it is not clear whether this design criteria applies to the proposed rock-lined infiltration trench.**

4) Double catch basin: One double catch basin is proposed in the cul-de-sac to collect runoff from the southern portion of roadway (including cul-de-sac) and several driveways (approx. drainage area = 9,915 SF). This catch basin includes a deep sump and with quarterly maintenance is anticipated to provide 25% TSS removal (as a pretreatment unit). The catch basin has a 12-inch diameter outlet (inv.= 188.0) that conveys flows (~180-LF, s~0.005) to a Stormceptor-450i treatment unit.

5) Stormceptor-450i: This unit is located about 180-ft southwest of the cul-de-sac near the southwest corner of the proposed rock-lined trench. This treatment unit can provide about 70% TSS removal when designed for impervious runoff area of less than 0.24-acre[1].

6) Stormtech infiltration system: This system receives runoff flow from the entire roadway and all driveways; i.e. flow from the infiltration trench is combined with flow from the stormceptor unit (serving the cul-de-sac). The Stormtech infiltration system includes a buried bed of 55-chambers (5 rows of 11 SC-310 chambers) in stone with overall infiltration dimensions of 20.15-ft by 80.32-ft. This system provides a maximum storage capacity of about 2100 CF and maximum infiltration capacity of about 0.37 CFS. The proposed system includes ten (10) inspection ports; one inspection port at each end of each row of chambers. Flows from the Stormtech infiltration system are conveyed through a 6-inch diameter outlet manifold and single 6-inch outlet pipe to proposed manhole No. 8 (PDMH#8) that discharges to the detention basin through an 8-inch diameter drain. **ESHWT**: Based on test pits TP-2,TP-3 & TP-7, the bottom of the infiltration system stone is about 3.0-ft above the ESHWT.

   The following deficiencies are noted:

   - **Maintenance access is not provided.**
   - **The design does not include a bypass** (as required per MA-DEP Stormwater Handbook Vol.2 and Town Stormwater Bylaw) to avoid surcharging and excessive flow through system during high flow events. These high flow events can damage the infiltration system.

7) Dry Detention Basin: The proposed dry detention basin is 3-ft deep and approximately 45-ft long by 25-ft wide; bottom elev. =182.0; top of berm elev. =185.0; and overflow grate elev. = 184.25. The basin has a storage capacity of about 3000-CF at the level of the overflow grate. The basin has no infiltration capacity. The overflow outlet includes a rip-rapped pad, plunge pool, and 10-ft wide level spreader. At overflow rates of 1.0 to 2.6 CFS the flow from the level spreader is anticipated to have velocity of 2 – 3 FPS and depth of about 1-inch. The basin has a low-flow under-drain, a small diameter perforated pipe placed in a stone bed. The maximum flow capacity of the low-flow drain is not provided. It is anticipated that low flow drain would have a flow capacity of 0.05 to 0.10 CFS, such that the full basin will drain in about 8 to 17 hours. **ESHWT**: Based on test pit TP-1 & TP-8, the bottom of the detention basin is about 0.3-ft (or more) above the ESHWT. See comments below.

   The following deficiencies are noted:

   - **Emergency spillway required** (by MA-DEP Stormwater Management Handbook Volume 2, Sturctural BMPs) but not provided.
   - **Access way for maintenance required,** but not provided
   - **Recommend proponent consider raising berm height.** The proposed design provides only 0.75-ft freeboard at the level of the overflow grate; in high flow situations the freeboard may be less than 6-inches and washout of berm top soils could occur resulting in basin failure.
   - **The low-flow drain will not maintain a dry basin**. Detail of low-flow drain indicates drain is about 0.5-ft above basin bottom. Combined with close proximity to ESHWT, the basin bottom is likely to remain wet for extended periods of time.

[1] Stormceptor-450i TSS removal based on Stormceptor-900 with design area modified by factor of 0.435 in Tables A2 of "Technology Assessment - Storm*ceptor* ® CSR™ New England Pipe", prepared by Dr. Eric Winkler for The Massachusetts Strategic Enviro-technology Partnership (STEP), December, 1997.

B. Roof & Yard Drainage

1) Roof & Yard Drainage for Units 8 thru 19 (sub-catchment 1S -4S and ponds 1P -4P)

Leach trench along northern property line. Includes 560-ft stone leach trench; trench is 3-ft wide by 3.5-ft deep and includes embedded pipeline to assist in removing flows greater than 10-year storm event. As reviewed, the system has adequate storage and infiltration capacity to handle 10-year storm event. **No impact on neighboring properties to north of this trench is anticipated for the 10-year storm event.** Modeling of 25-year and 100-year storm has not been provided.

Infiltration elevation relative to ESHWT: Based on TP-6 at north side of Unit 11 (existing grade elev. = 203.1) indicates ESHWT at 6-ft below grade (ESHWT elev. =197.1). The leach trench is designed to slope with existing grades; bottom of trench is about 3.5-ft below existing grades (consistent with plan details and elevations presented in "*Revised Roof & Yard Drainage Calculations*"). Using TP-6 as basis for ESHWT along the leach trench (i.e. 6-ft below existing grades), it is estimated that the leach trench bottom is about 2.5-ft above the ESHWT. Detailed analysis of trench section nearest to TP-6 (~20-ft north of TP-6) indicates bottom of trench estimated at 199.2, slightly more than 2-ft above the ESHWT determined at TP-6. Providing a 2-ft separation from the ESHWT is appropriate for roof drainage without additional treatment in accordance with MA-DEP Stormwater Guidance documents. See comment below about additional soil testing.

This infiltration device receives yard drainage and roof drainage that sheet flows across a grassed yard. **It is important to ensure that no contaminants (silt, fertilizer, and pesticides) enter the infiltration device; i.e. grass shall be well maintained (no bare soil) and use of fertilizers and pesticides minimized.**

The following deficiencies are noted

- **Requires modification to design detail to be consistent with modeled operation**; i.e. inlet perforations to embedded pipeline should be at least 2-ft above trench bottom.
- **Trench barriers needed** to avoid rapid migration of stored runoff to lower sections of the trench; proper placement of flow barriers across the trench would allow use of trench storage within each section. Location of barriers should be consistent with runoff discharges from roof drains and yard areas to provide equitable distribution of flow to each section.
- **Additional soil testing is required** to ensure that the proper separation from the ESHWT is provided and that the soils are consistent with the design infiltration rates; MA-DEP Stormwater Handbook Vol. 2 requires "borings" every 50-ft of trench.

2) Roof & Yard Drainage for Units 20-26 (sub-catchment 5S and pond 5P)

Drainage swale, leach trench & yard drain south of Unit 22. Includes a 30-ft leach trench in drainage swale (trench 5-ft wide by 3.5-ft deep), a yard drain, and bermed area to allow for temporary ponding of water within drainage swale over leach trench and yard drain. A total system infiltration capacity of 0.22 CFS and storage of 813 CF is estimated herein. A storage volume of more than 1095 CF is required to convert the ten year peak flow (0.84 CFS) to a peak outflow of 0.22 CFS; required volume estimated herein using TR-55 formula. While HydroCad modeling does not indicate this requirement, the more conservative TR-55 approach is recommended to ensure that system operates as planned adjacent to steep slopes. **As a minimum, it is recommended that the berm around the swale be raised by more than 0.5-ft to provide additional storage.**

Infiltration elevation relative to ESHWT: There is no test pit data presented in vicinity of this proposed infiltration device. The nearest test pit data includes:

a) TP-4: more than 220-ft down-gradient (>10-ft lower elevation) with ESHWT at 3.3-ft

b) TP-6: more than 270-ft up gradient (2-6-ft higher elevation, located across a drainage divide) with ESHWT at 6.0-ft.

The leaching yard drain has proposed rim elev. = 195.75; and bottom elevation (of leaching stone) = 191.0; i.e. the bottom of this leaching facility is about 6-ft (or more) below the existing grades at the proposed site. **This facility does not appear to provide adequate separation to groundwater. .**

This infiltration device receives yard drainage and roof drainage that sheet flows across a grassed yard. **It is important to ensure that no contaminants (silt, fertilizer, and pesticides) enter the infiltration device; i.e. grass shall be well maintained (no bare soil) and use of fertilizers and pesticides minimized.**

The following deficiencies are noted:

- **Additional soil testing is required** in the region of this leaching facility; and may require re-design of this facility to achieve the required 2-ft separation to the ESHWT.
- **Design does not provide a setback >100-ft from slopes >20%** (Required by MA-DEP Stormwater Handbook); actual setback distance provided is about 5-ft. **As designed, this system has a high erosion potential.**

3) Roof & Yard Drainage for Units 27-30 (sub-catchment 6S and pond 6P)

Leach trench on slope east of Units 27-30. Includes a 70-ft leach trench in shallow drainage swale; trench 5-ft wide by 3.5-ft deep. Total system infiltration capacity of 0.16 CFS and storage of 490 CF. A storage volume of more than 596 CF is required to convert the ten year peak flow (0.51 CFS) to a peak outflow of 0.16 CFS; required volume estimated herein using TR-55 formula. While HydroCad modeling does not indicate this requirement, the more conservative TR-55 approach is recommended to ensure that system operates as planned adjacent to steep slopes. [*NOTE*: *Extending this leach trench to 80-ft length would provide additional infiltration capacity and storage such that the trench would provide peak flow attenuation for the 10-year storm in accordance with TR-55 formula.*]

Infiltration elevation relative to ESHWT: Based on TP-6 at north side of Unit 11 (existing grade elev. = 203.1) indicates ESHWT at 6-ft below grade (ESHWT elev. =197.1). The leach trench is located about 130-ft to 200-ft from this test pit. Existing grades at the proposed site of this leach trench vary from 198 to 202; i.e. ESHWT elevation at the proposed trench site could be 192 to 196. The trench is designed to run roughly parallel to finished grades east of building units 27-30. The trench design bottom elevation of 197.0 is about 3.5-ft below proposed grades (consistent with plan details and elevations presented in "*Revised Roof & Yard Drainage Calculations*"). Using TP-6 as the basis for ESHWT along the leach trench (i.e. 6-ft below existing grades), it is estimated that the proposed leach trench bottom is about 1.0-ft to 6.0-ft above the ESHWT. See comments below.

Providing a 2-ft separation from the ESHWT is appropriate for roof drainage without additional treatment in accordance with MA-DEP Stormwater Guidance documents.

This infiltration device receives yard drainage and roof drainage that sheet flows across a grassed yard. **It is important to ensure that no contaminants (silt, fertilizer, and pesticides) enter the infiltration device; i.e. grass shall be well maintained (no bare soil) and use of fertilizers and pesticides minimized.**

The following deficiencies are noted:

- **Additional soil testing is required** in the region of this leaching facility; and may require re-design of this facility to achieve the required 2-ft separation to the ESHWT.

- **Design does not provide a setback >100-ft from slopes >20%** (Required by MA-DEP Stormwater Handbook); actual setback distance provided is about 5-ft. **As designed, this system has a high erosion potential.**

4) Roof and Yard Drainage for Units 4-7 (sub-catchment 7S and pond 7P)

Drainage swale, leach trench & yard drain east of Unit 6. Includes a 30-ft leach trench in drainage swale (trench 5-ft wide by 3.5-ft deep), a yard drain, and bermed area to allow for temporary ponding of water within drainage swale over leach trench and yard drain. Total system infiltration capacity of 0.17 CFS and storage of 757 CF. A storage volume of more than 437 CF is required to convert the ten year peak flow (0.41 CFS) to a peak outflow of 0.17 CFS; required volume estimated using TR-55 formula. The proposed system has adequate infiltration capacity and storage to manage the 10-year storm runoff from these units.

Infiltration elevation relative to ESHWT: Based on TP-5 data (existing grade elev. = 209.6) indicates ESHWT at 7-ft below grade (ESHWT elev. = 202.6). TP-5 located about 70-ft west of proposed yard drain. The existing grades at proposed infiltration device vary from 211.2 to 212.7. The leaching yard drain has proposed rim elev. = 208.75; and bottom elevation (of leaching stone) = 204.0; i.e. the bottom of this leaching facility is more than 7-ft below the existing grades at the proposed site. **This facility does not appear to provide 2-ft separation to groundwater.**

This infiltration device receives yard drainage and roof drainage that sheet flows across a grassed yard. **It is important to ensure that no contaminants (silt, fertilizer, and pesticides) enter the infiltration device; i.e. grass shall be well maintained (no bare soil) and use of fertilizers and pesticides minimized.**

The following deficiencies are noted:

- **Additional soil testing is required** in the region of this leaching facility; and may require re-design of this facility to achieve the required 2-ft separation to the ESHWT.
- **Design does not provide a setback >100-ft from slopes >20%** (Required by MA-DEP Stormwater Handbook); actual setback distance provided is about 40-ft.

5) Roof and Yard Drainage for Units 1-3 (not modeled)

The current report does not provide any modeling of roof and yard drainage for these units. **If there is no flow from this sub-catchment, it should be documented by modeling and described in the drainage reports**. The current plans show a 3-ft wide leach trench along property line at northwest side of entrance road. This facility is not described in the drainage reports. The presentation of this facility on the plans suggests that the proponents may have considered using this facility in some way to mitigate potential yard flooding around Units 1 through 3, see comments below.

The development of Unit 1 has a high potential to aggravate an existing flooding problem in yard of house to east of the proposed project entrance. As documented at a previous Conservation Commission meeting, the yard of the existing house tends to flood during spring while the ground is frozen. This existing flooding situation may extend into proposed project area and may include runoff from Ferry Street. Filling of this area of project site for construction of building and yard of proposed Unit 1 could have following impacts

a. Obstruct the natural flow of runoff across the project site to areas west of the entrance

b. Reduce the storage volume available to contain existing flood events, potentially resulting in higher flooding of neighbor's yard and/or more rapid runoff from flooded site to other areas.

Since frozen ground purportedly plays a role in these flooding events it may be appropriate to install a yard drain in this area to allow the flood waters to infiltrate into ground (below the frost surface).

Proposed grading may lead to flooding at Units 2, 3 or 4. The proposed grading around Units 1, 2 & 3, indicates a potential for runoff from property east of the project entrance (purportedly subject to flooding) to flow towards Units 2, 3 & 4. This flow may move westerly between Units 1 & 2 or between Units 3 & 4. These conditions suggest that the project proponents should consider use of catch basins to convey runoff from the east side of these Units to the leach trench northwest of entrance way. This might include the following:

a. A catch basin southeast of unit 1 with piped discharge running between Units 1 & 2 to proposed leach trench; and
b. A catch basin southeast of unit 3 with piped discharge running between Units 3 & 4 to proposed leach

This approach may better imitate of existing drainage patterns; increase infiltration rates at the developed site; reduce potential for flooding at units 2 & 3; and reduce existing yard flooding at property east of the project entrance.

2. Simulation of runoff volume and peak flows

As part of this review, a simplified model was prepared (using HydroCad) to estimate runoff volume and peak flow though the proposed stormwater management system. This modeling effort essentially found reasonable agreement with the modeling conducted by Heritage Surveys as noted in Table 1.

Table 1: Results of Runoff Simulations for Road & Driveways

	HSI Pre-Devel.		HIS Proposal		NEE Same		NEE Modified	
Storm Event	Volume (CF)	Peak CFS)	Volume (CF)	Peak CFS)	Volume (CF)	Peak CFS)	Volume (CF)	Peak CFS)
2-year	0	0	0	0	0	0	0	0
10-year	218	<0.1	0	0	1350	<0.1	1742	<0.1
25-year	---	---	2526	0	2700	0.1	3311	0.5
100-year	3964	0.2	4269	1.5	4443	1.9	5314	2.6

"NEE Same" modeled same catchment area as HSI Proposal but included minor corrections and modifications to: (1) reduce surcharging of various "free draining" outlets in system; and (2) outlet controls at detention basin to allow for draining of basin within 24-hours. "NEE Modified" model includes an additional sub-catchment to simulate rain falling on the site of stormwater controls (i.e. infiltration trench, Stormtech infiltration bed, and detention basin). NEE simulations mimic the proposed design to evaluate accuracy of reported peak flows (provided by proponent) and are not intended to indicate that design is sufficient for purposes intended. In some cases NEE simulations may have indicated partial flooding of various components; evaluation of the acceptability of such flooding is the responsibility of proponent's design engineer (not NEE).

Please note that above simulations do not include increases in runoff that may result from roof & yard drainage; 100-year storm event not simulated for roof & yard drainage.

Areas used for estimating Runoff and compliance with Standard 2. As modeled, for runoff calculations, the Driveways & Road Drainage catchments have a total area of 43,345-SF (0.995-acre). The Roof & Yard Drain catchment areas have a combined area of 91,852-SF (2.11-acre). The total area modeled for developed site runoff calculations is 135,197-SF (3.10-acre). The current modeling effort does not include the runoff generated from the area of the infiltration trench, Stormtech infiltration system, and the detention basin. The original submittal included modeling of

two existing catchments with a total area of 191,138-SF (4.39-acre). **Comparing the runoff estimate from a proposed development of 3.10-acre to the estimated runoff from a 4.39-acre undeveloped site is not valid**. For the purpose of demonstrating no net increase in flow (i.e. compliance with Stormwater Management Standard 2), the runoff estimates from the pre-development site and developed site must be based on the same total area contributing flow.

3. Evaluation of Stormwater Management Standards

A. SWM Standard 1- No untreated discharge or erosion. The proposed roadway drainage system generally appears to comply with SWM Standard 1. As mentioned in previous review, drainage on north side of cul-de-sac may jump curb and cause erosion or untreated discharge to wetland. The proposed site plans as well as the Roof & Yard Drainage Report indicate that there will be no untreated discharges to wetlands from roof & yard drainage (storms larger than 10-year storm not evaluated). The proposed plans include roof drainage infiltration devices adjacent to steep slopes and do not provide means of slope stabilization. As such, erosion from these sources is possible; therefore **proposed plans are not in compliance with Standard 1**. Plan modifications are required to ensure that runoff does not cause erosion or other problems at following locations:
    1) East of unit 7
    2) East (& south) of units 27 though 30
    3) South of Units 20 - 23.
    4) Road drainage on north side of cul-de-sac.
    5) Foundation drains. These are not shown on plans.

B. SWM Standard 2 – Peak rate attenuation. The proposed roadway drainage system appears to comply with this standard with following caveats:
    1) HydroCAD modeling errors: Proposed system modeling may underestimate peak flows relative to existing flows; area modeled for proposed development does not match area used to model pre-development site. The current modeling effort does not include rain falling on stormwater control devices (rock-lined infiltration trench, Stormtech infiltration system, and detention basin). The current model appears to have some backwater effects in storm drainage system that may affect system performance.
    2) **Evaluation of potential increase in off-site flooding from 100-year storm event should be provided.**
    3) Roof and yard drainage associated with Units 1 -3 has not been provided. Other proposed roof & yard drainage systems (with minor modifications) appear to attenuate peak flows but may have other issues (e.g. potential for increased erosion in violation of Standard 1).
    4) Off-site flooding of private property to east of proposed entrance to Rivercrest Condominiums may be increased by proposed development

C. SWM Standard 3 – Stormwater Recharge. The proposed facilities have adequate recharge capacity to meet Standard 3 with following caveat: proposed infiltration facilities may cause erosion on adjacent steep slopes (see Standard 1, above)

D. SWM Standard 4 – Water Quality. **The proponent has not submitted calculations to demonstrate that the proposed facilities comply with the water quality standard.**

E. SWM Standard 5 – LUHPPLs. This standard is met by proposed project since no LUHPPLs are proposed.

F. SWM Standard 6 – Critical Areas. This standard is met since proposed project is not within any identified critical areas.

G. SWM Standard 7 – Redevelopment. The proposed project does not qualify as redevelopment and therefore must fully comply with SWM Standards 1 – 6.

H. SWM Standard 8 – Erosion & Sediment Control Plan and Stormwater Pollution Prevention Plan. No new information is provided on this subject. As stated previously, the following modifications to the E&SCP and the SWPPP are recommended:
   a. Weekly inspection of sediment barriers (and after storm events)
   b. Additional sediment controls required around storm drain inlets roof drain drywells and yard drains
   c. Daily inspection of construction entrance and sweeping or upgrade controls as needed.
   d. Contractor and Conservation Commission to jointly review on site the staked out proposed limit of work (siltation barrier) prior to any tree removal.
   e. Include specification for temporary stabilization measures for disturbed areas with no activity for more than 14 days and specific stabilization measures required for slopes less than 4:1 and slopes greater than 4:1.
   f. Spill prevention should include secondary containment for fuels, lubricants, cleaners, paints, adhesives, etc. that may be stored on site.
   g. Constructing detention basin (or other temporary sedimentation basin) as soon as roadway is roughed in. Allow this basin to act as temporary sedimentation basin during construction. The temporary sedimentation basin and sediment flow shall not be allowed at location of proposed infiltration structures.
   h. Plan must include sections on: Diversion channels and temporary detention basins; vegetated slope stabilization; stabilization of outfalls; dust control; and use of temporary or permanent check dams to control flows and sediment movement.

I. SWM Standard 9 – Operation & Maintenance Plan. No new information received from proponents regarding O & M Plan. Modifications to the O & M plan are anticipated to correspond with the currently proposed stormwater management system. As stated previously, the following modifications are recommended (as a minimum):
   1) The ownership and membership of the Ferry Street Nominee Trust should be more clearly defined, particularly when the transfer of the financial responsibility will fall to the membership (owners) of the future condominium association
   2) Deeds may require a statement assigning financial responsibility for the stormwater system O&M to new property owners and an estimated annual cost (adjustable) for this maintenance.
   3) A mailing address or other means for delivery of legal notifications to Owner(s) and/or other responsible parties is required.
   4) Routine O& M should include quarterly inspection of catch basins, stormceptor, leach trenches, and yard drains; and no reduction in quarterly inspection requirements without Conservation Commission approval.
   5) Rock-lined trench, Stormtech infiltration system, and detention basin inspection every 6-months (as well as after large storm events); and mowing grassed portions of these components every 2-weeks during growing season.
   6) Requires scale plans that show specific stormwater BMPS that require regular maintenance (as part of the O & M Plan)
   7) Requires Description of Public Safety Features.
   8) Requires estimated annual O & M budget
   9) Easements to Town to allow Town operation or maintenance of stormwater controls, if needed for public safety or to protect environment.

10) The MA-DEP Stormwater Handbook has very specific operation & maintenance guidance for operation of leach trenches and yard drains that include details of maintenance and inspections. Since these systems may be operated by untrained personnel, the detailed guidance provided in the MA-DEP Stormwater Handbook should be provided in the project O&M manual; summarizing the O&M requirements is not sufficient.

4. LID Alternatives Analyses.

The Stormwater Report does not include a written alternatives analysis that discusses Low Impact Development (LID) techniques as required per Stormwater Handbook and 310 CMR 10.05 (6) (n).

5. Wetlands Bylaw

The proposed project appears to comply with Town of South Hadley Bylaws, Article XVI “Non-Zoning Wetlands Bylaw”, that requires a 50-ft undisturbed “Conservation Zone” around wetlands.

6. South Hadley Stormwater Bylaw

A separate checklist is provided to facilitate review of compliance with the Town Stormwater Bylaw. The following outstanding concerns with regard to complying with this bylaw have been noted previously and remain issues of concern:

A. Inspections required (per 16-4.6). General construction notes should inform & direct the Contractor with regard to required inspections and personnel to be contacted for inspections. As a minimum, the following inspections shall be identified in "General Construction Notes" on plans
   1) Prior to site clearing meeting with DPW Engineer and Conservation Commission representatives to field check limits of work and clearing as staked out on site. This would provide opportunity to protect vegetation (trees & shrubs) located in close proximity to wetlands, near steep slopes or other fragile areas of site.
   2) Erosion and sediment control inspections. These should include inspections immediately following site clearing, following rough grading and following final grading to ensure that erosion & sediment control measures are implemented. In practice, it may be more practical to establish a frequency for inspection (e.g. bi-weekly).
   3) Bury inspection. Contractor must coordinate with DPW for inspection prior to backfilling of any underground drainage or stormwater conveyance pipelines and structures. The Contractor must also coordinate and provide access for inspections of all buried utilities by the Design engineer for purposes of as-built preparation. Inspections by Town representatives do not relieve Contractor of responsibility for providing inspections by Design Engineer.
   4) Final Inspection. After completion of all work including stormwater management facilities and final landscaping, the Contractor shall coordinate with DPW for final inspection. Contractor shall provide a full (dated) TV inspection of all stormwater pipelines to DPW.

B. Stockpiles. Plans should indicate locations where stockpiles of materials (e.g. soils, stumps, building supplies, etc.) may occur and any means to divert runoff around these stockpiles.

C. Easements. Easements may be required for any runoff directed off-site onto adjacent properties. The Town may also want easements to allow site entry for inspections, maintenance, and/or repairs to the stormwater system. These rights may be granted by current owner applying for a stormwater permit; however, an easement may be required to allow continued access by Town personnel after property transfer. See Operation, Maintenance, and Inspection Agreement, below.

D. Operation, Maintenance and Inspection Agreement. An O&M/Inspection agreement is required per Bylaw 16-8. This maintenance agreement includes: listing of all responsible parties for O&M and Inspections; a maintenance schedule for all stormwater facilities; list of all easements; and a process for modifying the O&M plan. This agreement will also grant rights of access for inspection (and maintenance, if required) by Town personnel and assessing Town costs and penalties to property owners for such work. See also Section 3I, above. The O& M agreement shall also specify record keeping requirements and submittal of maintenance records to the Town DPW. This agreement must be added to property deed(s) at Hampshire County Registry of Deeds.

E. Performance Guarantee. A performance guarantee is required (per 16-9) equal to or greater than the total construction cost of the stormwater management facilities. This performance guarantee may be in addition to any other Town required performance guarantees for the project. The intent is to allow the Town use of this Performance Guarantee to ensure that the stormwater management system performs as designed. **As such the proponent must provide an estimated construction cost of all stormwater management facilities,** including yard drains, leach trenches, catch basins, manholes pipelines, treatment units, rock-lined infiltration trench, stormtech infiltration system, detention basin, outlet structures, slope stabilization, etc.

7. Missing information on Plans.

A. **Roof drains not specified on plans**; i.e. use of gutters, number of roof drain outlets, locations, or general principles of installation relative to runoff control devices. Without these indicated on the site plans there is no assurance that they will be built and no method to ensure that proposed stormwater management facilities will operate as intended. For example, roof drains could be directed onto driveways or roadways causing the roadway runoff control system to fail.

B. **Foundation drains not shown on site plans**; plans should indicate locations and any methods of slope stabilization if these discharge near steep slopes. Plans must also indicate that there shall be no connections between foundations drains and the stormwater systems.

C. **Test pit locations missing on some site plans**; e.g. Test pits TP-7 & TP-8 missing from detailed site plan (sheet 6) showing location of roadway runoff control structures; these test pits are critical to evaluating component compliance relative to infiltration rates and separation from groundwater.

D. **Directions to Contractor relative to compliance with various regulations**: a general statement and specific statements to contractor which reference to requirements of MA-DEP Stormwater Guidance documents and the South Hadley Stormwater Bylaw. Specific requirements pertinent to construction of this project should be found on plans or plans should reference other pertinent documents (which contractor will have access to); e.g. plans should inform Contractor of obligation to comply with a Wetlands Order of Conditions (and where such document may be found).

E. **Contractor responsibility to coordinate inspections**: see Section 6A, above regarding inspections required by Town Stormwater Bylaw, additional inspections may be required by Conservation Commission, DPW etc.; e.g. "*Contractor review with Conservation Commission the proposed limit of work (siltation barrier) as staked out on site, prior to any tree removal*." Plans must inform contractor of responsibility for coordinating and where to obtain information relative to inspections and who to contact.

F. **Infiltration areas should not be used for sediment control basins during construction .** Plans should include note: "**Contractor shall rope off all infiltration areas and shall protect infiltration areas from vehicle traffic and sediments during construction."** The MA-DEP Stormwater handbook requires the following for infiltration trenches:
   - Infiltration trenches should never serve as temporary sediment traps for construction.
   - Before the development site is graded, the area of the infiltration trench should be roped off and flagged to prevent heavy equipment from compacting the underlying soils.
   - Infiltration trenches should not be constructed until the entire contributing drainage area has been stabilized. Diversion berms should be placed around the perimeter or the infiltration trench during all phases of construction. Sediment and erosion controls should be used to keep runoff and sediment away from the trench area.
   - During and after excavation, all excavated materials should be placed downstream, away from the infiltration trench, to prevent re-deposition of these materials during runoff events. These materials should be properly handled and disposed of during and after construction.
   - Light earth-moving equipment should be used to excavate the infiltration trench. Use of heavy equipment causes compaction of the soils in the trench floor, resulting in reduced infiltration capacity.

G. **Control of construction methods**. Various measures that control construction methods are mentioned in MA-DEP stormwater handbook, Town Stormwater Bylaw, reports, project memos, and other documents; all of these should be added to general construction notes on plans.

H. **Cross-reference construction notes**. Construction notes are presented on various sheets and each section of notes should provide referral to notes provided on other sheets.

8. Additional Plan Modifications Required

Site plans require modifications that include (but are not limited to) the following:

A. Detention basin requires an emergency spillway, increased berm height, and modification to low flow drain detail

B. **Stormtech infiltration system requires emergency by-pass**; this system should also be modified to allow access for maintenance.

C. **Rock-lined infiltration trench requires modifications** to grading of surrounding side slopes; inspection ports and other measures may be required to facilitate maintenance of this facility; proponent should present evidence that this system does not present erosion threat to nearby steep slopes.

D. **Modifications to prevent erosion of steep slopes adjacent to leach trenches and yard drains** (designed to control roof runoff) are required at some locations

E. **Other Design Review comments**

1) Check all structure labels & invert elevations in “Structure Table” (Sheet 5); e.g. pipeline flows uphill from PDMH#6 to PDMH#7

2) Check proposed grading; at least one additional contour line (elev. 191) required around rock-lined infiltration trench on sheet 6, this is likely to change extent of side slope grading.

3) Provide additional references to details (and sheet locations); e.g. detention basin overflow structure detail (Sheet 7) should be associated with stone sediment filter detail (sheet 6).

4) Check details for proper specification of materials; in some cases details do not specify materials of construction; e.g. type of fill materials, or kind of filter fabric, etc.

5) Recommend project proponents review fertilizer requirements to reduce potential impacts on infiltration devices and groundwater