

**TURTLE RUN  
SUBDIVISION OFF  
ROUTE 39  
HARWICH, MA**

**STORM WATER REPORT**

**FOR COMPLIANCE WITH THE MASSACHUSETTS STORMWATER POLICY**

**April 6, 2022**

**PREPARED FOR**

**EASTWARD HOMES BUSINESS TRUST**

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## **Background**

Turtle Run is a proposed residential subdivision comprised of 5 lots situated on 8.6 acres of land in East Harwich, MA.

Untreated stormwater generated within the Turtle Run subdivision has the potential to impact a source of municipal drinking water and nearby wetland resource areas. Since the project seeks to create more than 4 building lots stormwater controls that meet the standards of the Massachusetts Stormwater Policy shall be required.

The property is within the zone of contribution to a municipal well and is underlaid with soil that has a rapid infiltration rate. Stormwater generated on the site would be discharged to an area considered a "Sensitive Area" pursuant to the Massachusetts Stormwater Policy.

The following report documents compliance with the Massachusetts Stormwater Policy and follows the procedures outlined in the Massachusetts Stormwater Handbook, Volume 3, Chapter 1; Documenting Compliance.

## **LID Measures**

No LID credits are being requested. Credits are not possible because the project site, the Subdivision Rules and Regulations and the Zoning By-Law do not permit design credits to be used.

Credit 1.       Environmentally Sensitive Development

In order to be eligible for this Credit, a residential project is required to have less than 1 dwelling per acre. All of the lots are about 1/2 acre and therefore do not qualify for this credit.

Credit 2.       Rooftop Runoff Directed to Qualifying Pervious Area

There may be opportunities to direct roof runoff to Qualifying Pervious Areas for at least 4 of the 5 lots. No development plans for individual lots have been prepared at this time.

Credit 3.       Roadway, Driveway or Parking Lot Runoff Directed to Qualifying Pervious Area.

The roadway cannot be directed towards a Qualifying Pervious Area. A majority of the length of the road parallels a fresh water pond where the slope is greater than 5% which does not meet the Qualifying Pervious Area requirements. The Subdivision Rules and Regulations require a 3-inch (in.) asphalt berm to keep runoff within the paved roadway. This shoulder prevents the use of grass swales to direct runoff to infiltration areas.

## **Standard 1       No New Untreated Discharges**

No new untreated discharges are proposed.

All storm water generated from new impervious surfaces shall be directed towards new stormwater BMPs.

## Standard 2 Peak Rate Attenuation

Existing stormwater runoff leaving the site generally sheet flows down into Hidden Pond.

The area is predominantly second and third growth forest land with a healthy canopy and understory. For the HydroCad™ analysis of predevelopment, a runoff coefficient of 30 has been used.

The predevelopment site consists of one discharge point, being Hidden Pond. No distinct channels were observed to break the site into smaller watersheds.

The attached predevelopment HydroCad™ output depicts that negligible runoff occurs from the 2 yr. and 10 yr. storm events and a very small runoff from the 25 yr. storm event. Runoff can be expected from the 100 year storm event. Since no runoff is directed to a coastal embayment, post construction on-site controls shall be required to attenuate the 100 year storm event.

### PREDEVELOPMENT HydroCad™ RESULTS

Drainage Area	2 Yr. Storm (cfs)	10 Yr. Storm (cfs)	25 Yr. Storm (cfs)	100 Yr. Storm (cfs)
	0.00	0.00	0.05	0.57

Pursuant to the Town of Harwich Subdivision Rules and Regulations, it is required that the 25 yr. storm event be captured and infiltrated on site.

The number of analysis points where runoff could enter Hidden Pond have been assumed to coincide with each roadway drainage area.

The proposed roadway has been divided up into four (4) post development drainage areas and a typical residential lot drainage area. Runoff from each drainage area within the roadway shall be directed to standard deep sump catch basins and then to subsurface infiltration basins (leaching catch basins). The following is summation of the HydroCad™ outputs for each drainage area prior to routing to infiltration BMPs.

### POSTDEVELOPMENT TR55 RESULTS

Drainage Area	2 Yr. Storm (cfs)	10 Yr. Storm (cfs)	25 Yr. Storm (cfs)	100 Yr. Storm (cfs)
1	0.10	0.49	0.87	1.75
2	0.17	0.72	1.24	2.46
3	0.09	0.56	1.04	2.18
4	0.00	0.00	0.03	0.41

## Design Assumptions

Deep observation test pits were excavated in the locations of the infiltration areas. Soils were found to be coarse sand identified in the Barnstable County Soil Survey as Carver Series.

Standard Title 5 percolation tests were performed at all locations of proposed infiltration structures. The tests were performed in the parent material C substratum. A Title 5 infiltration rate of less than 2 minutes per inch was observed in all tests. This is equivalent to an infiltration

rate of 30 inches per hour. For design purposes, the maximum rate of 8.27 inches per hour as required by the Stormwater Handbook shall be used.

The Stormwater Handbook also requires that only bottom area be considered. This along with the 8.27 inches per hour infiltration rate produces an extremely conservative infiltration design for the 25 yr. storm event.

The infiltration basins consist of standard 6 ft. diameter, 750 gallon or 1,000 gallon precast concrete leach pits. Various configurations have been selected depending on the size of the areas of contribution and available areas for disposal. The configurations are all based upon a 6 ft. diameter structure with ¾" to 1 ½" double washed stone placed evenly around the structure. 2 to 4 precast structures have been selected for each configuration.

The corresponding effective capacities are as follows:

<u>No. of Pits (Depth)</u>	<u>Bottom Area (sf.)</u>	<u>Sidewall Area (sf.)</u>	<u>Volume (cf)*</u>
2 (4 ft.)	294	256	494
3 (4 ft.)	434	336	724
4 (4 ft.)	574	416	1089

\*A void ratio of 0.35 is presumed for the placed stone aggregate.

Town of Harwich Zoning Regulations limit the amount of site coverage to 40% of the lot. Since the lots are approximately 19,000 sf. in size, each has the potential to have up to 7,600 sf. of impervious surfaces.

For design purposes, only the residential driveways and the roadway shall be included in the calculations of impervious area within each roadway drainage area. Up to 1,500 sf. of driveway per building lot is included in the design. In addition, it is presumed that each lot will create 10,000 sf. of lawn and all remaining areas that do not include building and hardscape will remain natural woods or more substantial landscape cover.

It is a condition of this design that when each lot is subsequently developed, the homeowner/developer shall be required to provide additional stormwater controls for the dwelling and exterior hardscape features such as patios, swimming pools and decks. It is recommended that the Planning Board adopt such conditions as necessary to ensure future compliance. A separate drainage calculation for a reasonable development of a single building lot is included in Appendix 2.

### **Drainage Calculations**

HydroCad™ stormwater modeling software was used for determining depth of runoff, peak rates of runoff, infiltration sizing and detention area design for each drainage area.

The Planning Board Rules and Regulations require that the 25-year, 24-hour storm event be infiltrated.

Appendix 1 details the drainage calculations for each drainage area. The results show that stormwater controls for each drainage area have the capacity to infiltrate the 25 yr – 24 hr. storm event.

Rainfall events greater than the 25 yr. storm event will fill the infiltration systems beyond capacity and the excess flow will travel downstream within the roadway gutter to stormwater controls designed to capture and contain up to a 100 yr. storm event.

Overflow from each system will pond within detention areas created at each infiltration point. The areas have been sized to contain the entire excess flow from the 100 yr. storm event. The total volume of runoff is expected to flood the depression to depths not to exceed 1.0 ft. The bottom of the detention areas is assumed to be impervious.

### **Conclusion**

Each of the post development drainage areas that receive runoff from disturbed areas have been designed to infiltrate up to a 25 yr. storm event. No increase in runoff shall occur from the 2 yr., 10 yr. or 25 yr. storm event.

Excess runoff from the 100 yr. storm event shall be contained within man-made detention areas along the shoulders of Turtle Run and within the cul de sac.

### **Standard 3      Recharge**

Runoff from all new impervious surfaces is directed to stormwater BMPs that have been designed to capture and infiltrate a 25 year storm event which is far greater than the amount required by Standard 3.

Drainage Area	Storage Capacity (cf)	Total Impervious Area (sf)	Water Quality/Recharge Volume (cf)
1	1,482	9,131	760
2	2,178	11,234	936
3	1,448	10,751	896

### **Conclusion**

Each of the infiltration structures have been designed to capture and infiltrate 1 in. of runoff from impervious areas.

All runoff is contained within the site.

### **Standard 4      Water Quality**

#### **Long Term Pollution Prevention Plan**

A Long Term Pollution Prevention Plan has been prepared for this development. A homeowner's association shall be created. The association shall be responsible for implementation of the Long Term Pollution Prevention Plan.

#### **Required Water Quality Volume**

As stated above, the stormwater BMPs have been designed to capture and infiltrate a 25 year storm event which is greater than the Water Quality Volume required by Standard 4

## **TSS Removal**

Deep sump catch basins shall be used as a pretreatment BMP prior to routing of stormwater to leaching catch basins and then ultimately to groundwater.

The removal efficiency of a deep sump catch basin is 25%  
The removal efficiency of a leaching catch basin is 80%

The combined efficiency is  $25\% + (100\% - 25\%) \times 80\% = 85\%$

## **Standard 5**

### **Land Uses with Higher Potential Pollutant Loads**

The project is not considered a Land Use with a Higher Potential Pollutant Load

## **Standard 6**

### **Critical Areas**

The project is located within rapid infiltration rate soils and DEP approved zones of contribution to municipal wells. Therefore, the area is considered a Critical Area.

## **Standard 7**

### **Redevelopment**

This is not considered a Redevelopment Project.

## **Standard 8**

### **Construction Period Pollution Prevention and Erosion and Sedimentation Control**

A Construction Stormwater Pollution Prevention Plan (SWPPP) shall be prepared for this project by the project owner and construction general contractor. An Erosion Control Plan has been prepared for this project and are part of the construction documents.

## **Standard 9**

### **Post Construction Stormwater Controls Operation & Maintenance Plan**

A Post Construction Stormwater Controls Operation & Maintenance Plan has been prepared for this project.

## **Standard 10**

### **Illicit Discharges**

Statement: No materials other than stormwater shall be discharged to the stormwater controls. Homeowners shall be made aware of the existence of the stormwater BMPs through a Homeowner's Association and restrictive Covenant that prohibits any activity that could damage the treatment BMPs or the environment including but not limited to disposal of pesticides, paints and solvents, motor oil and yard waste.

## **APPENDIX 1**

### **DRAINAGE CALCULATIONS**



# PREDEVELOPMENT DRAINAGE CALCULATIONS

## **POSTDEVELOPMENT DRAINAGE CALCULATIONS**

## DRAINAGE AREA 1

HydroCad™ input variables:

Total area of contribution:	23,200 sf.	0.532 Ac.
Area of pavement <u>no</u> driveways	9,200 sf.	0.211 Ac.
Areas of roadway shoulders, side slopes And undisturbed forest	14,000 sf.	0.321 Ac.

Composite Curve Number 58

### Infiltration System:

3 sets of 3 - 6ft. x 4 ft. precast pits w/ 4 ft. of stone in trench configuration

### Results: HydroCad™

25 Yr. – 24 Hr. Storm	No overflow; Maximum Depth within Infiltration Basin 2.1'; Time to Exfiltrate after end of storm 0.5 hrs.
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100 Yr. – 24 Hr. Storm	Excess discharge of 830 cf occurs. Excess directed to low point on the west side of Turtle Run. Time to Exfiltrate after end of storm 0.5 hrs.
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## **DRAINAGE AREA 2**

HydroCad™ input variables:

Total area of contribution:	31,400 sf.	0.721 Ac.
Area of roadway pavement	7,800 sf.	0.179 Ac.
Area of driveways lots 1 and 5	3,000 sf.	0.069 Ac.
Areas of roadway shoulders, side slopes And undisturbed forest	20,600 sf.	0.473 Ac.

Composite Curve Number 59

### **Infiltration System:**

2 sets of 4 - 6ft. x 4 ft. precast pits w/ 4 ft. of stone in trench configuration

### **Results:**

25 Yr. – 24 Hr. Storm	No overflow; Maximum Depth within Infiltration Basin 1.9'; Time to Exfiltrate after end of storm 0.5 hrs.
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100 Yr. – 24 Hr. Storm	Excess discharge of 915 cf occurs. Excess directed to low point on the west side of Turtle Run. Time to Exfiltrate after end of storm 0.5 hrs.
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### **DRAINAGE AREA 3**

HydroCad™ input variables:

Total area of contribution:	34,300 sf.	0.788 Ac.
Area of pavement including driveways from lot 4	8,322 sf.	0.191 Ac.
Areas of lawn from lot 4 And roadway shoulders & side slopes	16,540 sf.	0.380 Ac.
Remaining forest or significant landscape Groundcover	9,438 sf.	0.217 Ac.

Composite Curve Number 51

#### **Infiltration System:**

3- 6ft. x 6 ft. precast pits w/ 4 ft. of stone in trench configuration

#### **Results:**

25 Yr. – 24 Hr. Storm	No overflow; Maximum Depth within Infiltration Basin 2.9'; Time to Exfiltrate 2.2 hrs.
100 Yr. – 24 Hr. Storm	Excess discharge of 2,744 cf occurs. Excess directed to Detention Area in center of cul de sac.

## **DRAINAGE AREA 4 Undisturbed remaining watershed to Hidden Pond**

HydroCad™ input variables:

Remaining forest or significant landscape Groundcover	223,250 sf.	5.125 Ac.
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Curve Number 30

### **Results:**

100 Yr. – 24 Hr. Storm      0.41 cfs < 0.57 cfs predevelopment conditions

## Typical Lot Development

HydroCad™ input variables:

Total area of contribution of just impervious surfaces less driveway  
8,000 sf.                      0.1836 Ac.

Composite Curve Number 98

### Infiltration System:

4- 6ft. x 6 ft. precast pits w/ 4 ft. of stone in trench configuration

### Results:

25 Yr. – 24 Hr. Storm                      No overflow; Maximum Depth within  
Infiltration Basin 2.5'; Time to Exfiltrate  
1.7 hrs.

100 Yr. – 24 Hr. Storm                      No excess discharge occurs.

It is recommended that the project be conditioned to include a requirement that a minimum of 4- 6x6 leaching catch basins with 4 ft. of stone each be installed to control runoff from each dwelling or additional stormwater calculations be submitted with individual building permit applications to document compliance that no increase in runoff occurs.