DRAIANGE ANALYSIS

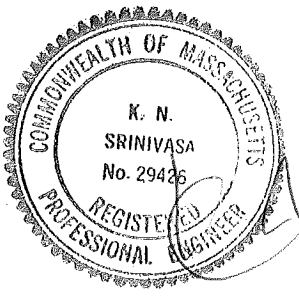
REPORT

FOR

COLLIN FARMS

FRAMINGHAM, MA

DECEMBER 18, 2013



SUBMITTED BY:

KALKUNTE ENGINEERING CORPORATION

1749 CENTRAL STREET

STOUGHTON, MA 02072

Tel: 781-344-8565

PROJECT DESCRIPTION
AND
OPERATION AND MAINTENANCE PLAN
FOR STORMWATER MANAGEMENT
COLLIN FARMS, FRAMINGHAM

December 18, 2013

A. PROJECT NARRATIVE:

Collin Farms Subdivision: Owner & Developer:

STARR CONSTRUCTION, INC.
550 Edgel Road
Framingham, MA 01701

Subdivision Engineer/Surveyor:

Applewood Survey LLC
21 Green Street
Holliston, MA 01746

Drainage Design Engineer:

Kalkunte Engineering Corporation
1749 Central Street
Stoughton, MA 02072

Collin Farms subdivision consists of two cul-de-sacs;

Feildstone Way with 3 buildable lots
Meadowview Lane with 4 buildable lots

Drainage design is done in accordance with the Framingham Subdivision Rules and Regulations which incorporates the DEP's Stormwater Management Standards of 2008, only for the two cul-de sacs. When individual lost are developed, at that time each lot should have an on-site drainage design be done in accordance with the Framingham Rules and Regulations.

Major Design Criteria:

1. The proposed subdivision will not increase the flow rates.
2. 100 year storm frequency rates are used in TR55 Calculations, and 100-year storm from post-construction flows are discharged in its entirety into ground through infiltration galleys, and drawdown is about four (4) hours.
3. TSS removal of not less than 44% prior to discharging into infiltration galleys
4. Storage is calculated by the Static Method
5. DEP's Checklist for Stormwater Report

Each cul-de-sac is considered separately for stormwater analysis.

B. HYDROLOGIC AND HYDRAULIC DESIGN:

B. 1: Description of the design storm frequency: In accordance the DPW regulations the following storm event frequencies are considered, and their maximum intensity of rainfall.

Runoff: Roof runoff from the street is directed is towards catch basins, and flows to water quality inlet tank, and then to the infiltration galleys. Estimated storm event intensity for 100-year storm event is 8.00 inches per hour

Test pits were made, and observed by Terry Ryan (SE) of Applewood Surveyor. Soil encountered was an excessively draining material, and a 1 MPI is assumed in the galley design and discharge to groundwater, Type A soil.

TR55 method is used to calculate the flows based of the storm event frequency. A summary sheet follows this page showing the storm event, pre and post construction flows, and storage required.

Following presents the Best management Practices adopted for the project to provide treatment to storm-water:

- Street sweeping: the Developer of the project will be responsible to keep the entire street clean, sweep all impervious surfaces periodically such that runoff carries minimal pollutants to the drainage system.
- Catch Basins: All catch basins shall have a minimum of 4' (four foot) sump to capture all solids brought by the runoff. Catch basins to be cleaned periodically to accommodate the incoming solids and to prevent it from overflow.
- Water Quality Inlet tank
- Infiltration galleys, discharge into ground.

Separate plan is added, to provide the needed details.
Soil evaluation sheet is enclosed.
Summary of pre and post development flows is in the report.
TSS removal sheet is enclosed.
Estimated operation and maintenance cost is about $500 to $1000 per year.
Long term pollution plan, shall be to keep the paved areas clean, and inspect the galleys to remove materials accumulated.
DEP Stormwater checklist is enclosed.

Construction Inspections by the Town; coordinate w/Town for advance time needed.

1. The initial site inspection of the erosion controls prior to any land disturbance;
2. Inspection of the bottom of the excavation of any stormwater facilities for soil conditions and groundwater before any stone or components are installed,
3. Inspection of the completed stormwater facilities with the components exposed prior to backfill; and
4. Final inspection of the as-built conditions of the completed stormwater facilities, and the stabilized site.

OPERATION AND MAINTENANCE PLAN
FOR STORMWATER MANAGEMENT
COLLIN FARMS, FRAMINGHAM

December 18, 2013

A. During Site Preparation and Construction: The site preparation work includes grading by bringing material from outside. No wetland on site. This area will be protected by siltation fence as directed in the field to the contractor. Any excavated material should be protected by covering with plastic sheets where wash out may reach the street area. Keep the construction site clean by removing excess material off-site.

B. Post-Construction – the owner of the facility will be made directly responsible to maintain all facilities properly and to the satisfaction of the DPW and Planning Board. The Developer shall have the power to seek additional help through consultants, when needed, for proper maintenance

1. Street Maintenance – Source Control: Street and site sweeping should be done periodically, at least ONCE 6 MONTHS, to keep the street clean and prevent erosion of dust and solids accumulation being transported to catch basins and leaching system. This will protect leaching system from plugging. Based on the usage of the roadway develop a sweeping program, that is, at the minimum how many times in a year or how often sweeping is needed to keep the source pollutants to be removed from the paved areas, and disposed properly. Regarding sweeping, the following suggested items be considered:

    - To insure good sweeping, entire paved areas shall be swept by power-full high efficiency vacuum sweeper. In addition, sweeping shall be undertaken soon after significant dirt collection on the paved areas. Sweeping is very essential in the storm water quality management.

    - When sand is used in winter, this should be removed promptly to insure the infiltration galleys do not get plugged.

    - Sweeping on regular basis is a powerful source control, and the record documents shall include the necessary procedures to implement sweeping regularly.

2. Routinely pick-up and remove litter from the paved areas, islands, and from the landscaped areas in addition to pavement sweeping.

3. The catch basins should be inspected and cleaned annually (at least) as they are equipped with hooded outlets to trap debris, sediments and floating contaminants. Each catch basin also includes an oil absorbent pillow and this should be removed and disposed properly, and be replaced.

4. The proposed catch basins are with four foot deep sump. The sump will trap settleable solids washed from the site and prevent it from further transportation. To retain a high efficient sump, pump out the sump periodically depending on a schedule that should be established based on the type of site usage.

5. **Catch Basins (CB)**: Catch basins are the first line of defense to capture storm water pollution. All catch basins are equipped with four-foot sump. The following minimum maintenance should be performed regularly:
   - Develop a detailed log sheet for best management.
   - Number all catch basins
   - Observe how the sump is filled-up with sand/debris
   - Measure the sump depth available below the CB outlet.
   - If the sump is half full start making arrangement to clean the sump.
   - Note all CBs may not be equally full at the same time. This depends on the location of a CB.
   - Establish a cleaning schedule.
   - Have a contract with a cleaning company.
   - CB cleaning must be done in early spring and as often as needed.

6. **Water Quality Inlet Tank**: This tank should be inspected every three months, clean the tank of any debris collected.

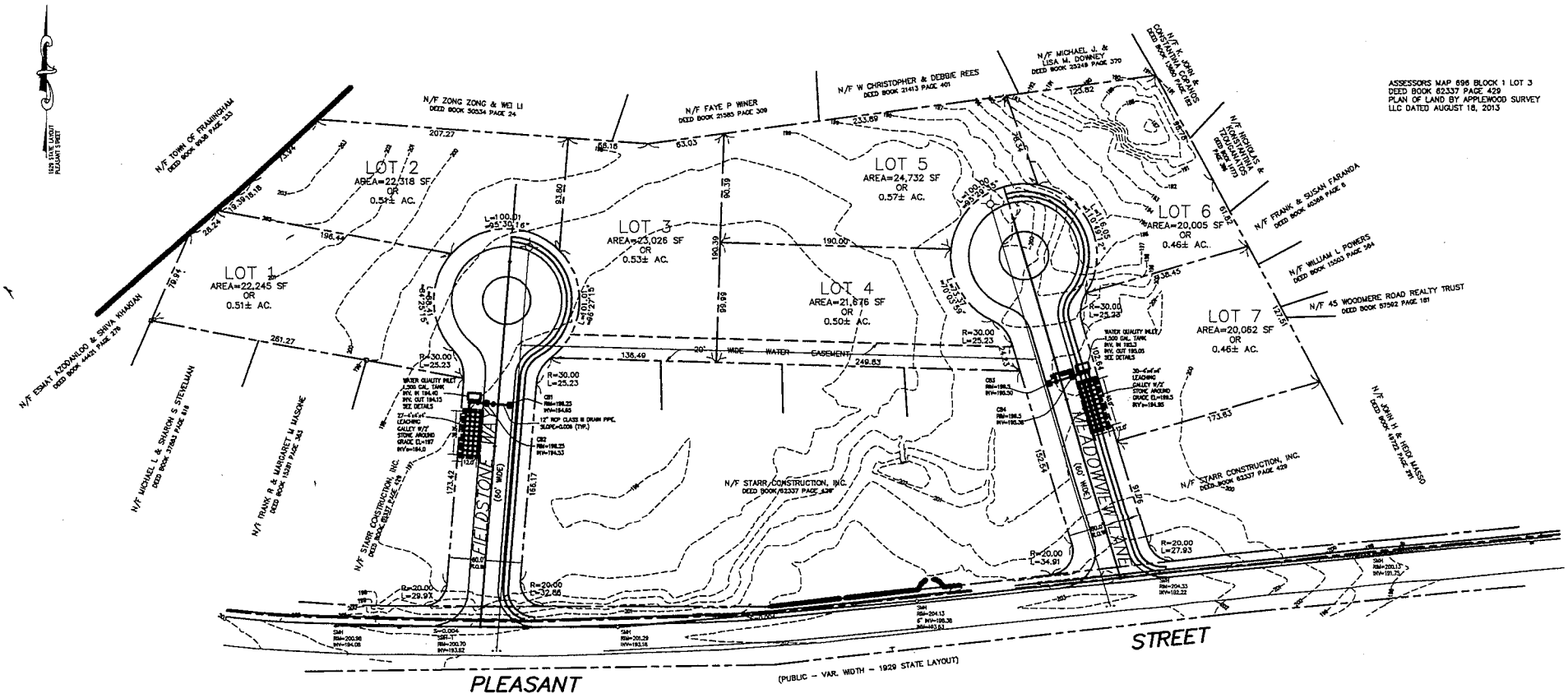
7. **Infiltration Galleys: Infitration galleys** are prone to failure due to clogging of porous soils. Therefore, it is very essential to maintain pretreatment facilities in high efficient status at all times. To achieve this, after a heavy storm event, the catch basins should inspected. Once the system is on-line, for first few storms it is very essential to check after each storm event to insure proper stabilization of the site and to make sure that the proposed system will function properly. If the water stands for more than three (3) days, the system may be plugged. Many factors responsible for clogging are upland sediment erosion, excessive compaction of soils and low spots. Take corrective action immediately.

8. Inspect for oil sheen on the surface of the catch basin sump and on the liquid surface of the Water Quality Inlet tank. Call an appropriate company to pump out the oil.

9. Spill Prevention: For any oil spill on the site, develop an emergency notification to the Board of Health and DEP.

10. Inspect for structural integrity of the storm water system. Notice for any crack in the catch basin gratings, access covers, crack in the tank. And any other noticeable deficiencies. For defect found, initiate remedial measures including contacting professional help.

Develop a logbook and keep a book of maintenance work done, prepare an annual report summarizing work done and actions taken.



DEFINITIVE SUBDIVISION PLAN
GRADING AND UTILITY PLAN
COLLIN FARMS
FRAMINGHAM, MASS.

PREPARED FOR:
STARR CONSTRUCTION, INC.
550 EDGELL ROAD
FRAMINGHAM, MASS. 01701

PROPERTY OF:
STARR CONSTRUCTION, INC.
550 EDGELL ROAD
FRAMINGHAM, MASS. 01701

ENGINEERS & SURVEYORS:
APPLEWOOD SURVEY LLC
21 GREEN STREET
HOLLISTON, MASS. 01746
TERRENCE M. RYAN R.L.S. 37057

DATE: NOVEMBER 10, 2013

SCALE: 1" = 40'

0 40 80 FEET 120 160 200
0 10 20 METERS 40 50 60

FRAMINGHAM PLANNING BOARD
APPROVAL UNDER THE SUBDIVISION CONTROL LAW REQUIRED

DATE:

I CERTIFY THAT THIS SURVEY AND PLAN WERE PREPARED IN ACCORDANCE WITH THE PROCEDURAL AND TECHNICAL STANDARDS FOR THE PRACTICE OF LAND SURVEYING IN THE COMMONWEALTH OF MASSACHUSETTS.

I CERTIFY THAT THIS PLAN CONFORMS TO THE RULES AND REGULATIONS OF THE REGISTRY OF DEEDS.

TERRENCE M. RYAN R.L.S. 37057

C:\dwg\framingham\dwg\subdivision.dwg, 12/18/2013 12:19:01 PM

SOIL TESTING COLIN FARMS FRAMINGHAM
Performed on May 7, 2013 by TMR

DTH-1
Location: approx. sta 1+00 Meadowview Lane

0-10" Ap 10YR3/3 Sandy Loam Granular
10"-50" Bw 2.5Y6/6 Sandy Loam Structureless
50"-115" C 5Y4/3 Coarse Sand & Gravel Structureless Many Cobbles
No water, No mottles, No refusal
Perc rate: LT 2 mpi

DTH-2
Location: approx. sta 2+25 Meadowview Lane

0-6" A 10YR3/3 Sandy Loam Structureless
6"-48" C1 Unconsolidated fill, many cobbles and stones
48"-78" C2 2.5Y5/3 Coarse Sand & Gravel Structureless Many cobbles
78"- 108" C3 2.5Y5/3 Coarse Sand & Gravel Structureless
No water, No mottles, No refusal
Perc rate: LT 2 mpi

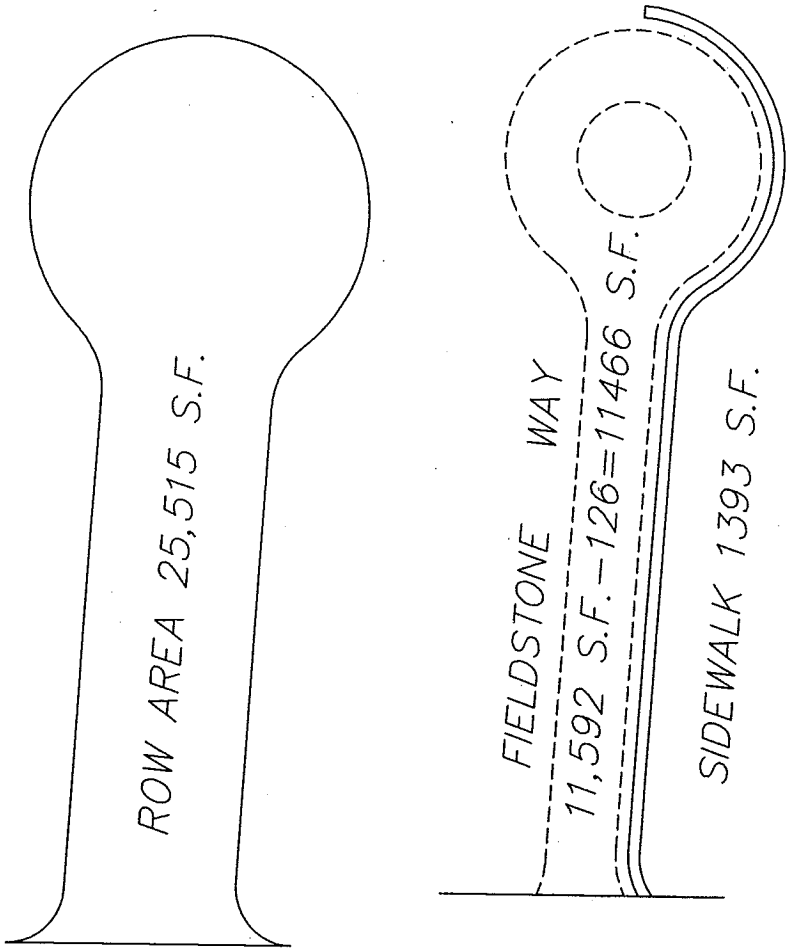
DTH-3
Location: approx. sta 3+00 Fieldstone Way

0-15" Ap 10YR3/3 Sandy Loam Granular
15"-55" Bw 10YR5/6 Sandy Loam Structureless
55"-108" C Coarse Sand & Gravel Structureless Few cobbles
No water, No, mottles, No refusal
Perc rate: LT 2 mpi

DTH-4
Location: approx sta 0+75 Fieldstone Way

0-13" Ap 10YR3/3 Sandy Loam Granular
13"-24" Bw 10YR5/6 Sandy Loam Structureless
24"-36" C1 5YR5/3 Coarse Sand & Gravel Strutureless
36"-108" C2 10YR4/4 Coarse Sand & Gravel Strutureless Some small cobbles
No water, No mottles, No refusal
Perc rate: LT 2 mpi

COLLIN FARMS
FRAMINGHAM, MASS.



Total Drainage Area: 25,515 SF

= 0.58574 Acres

Kalkunte Engineering Corporation
Consulting Engineers
1749 Central Street, Stoughton, MA 02072
Tel: 781-344-8565; Fax: 781-341-6017

December 17, 2013

RE: Collin Farms -Fieldstone Way, Framingham, MA
ON-SITE DRAINAGE ANALYSIS – STORMWATER STORAGE
Drainage C

Proposed Stormwater Storage is shown on the site plan.
Observed percolation rate: Less than 0.5 MPI
Based on the Percolation rate of 1 MPI, storage volume is calculated.

Drainage system is designed for a 100 year storm event, by using TR55 method for small areas. Volume needed is 1740.37 **cubic feet** of storage based on net increase in the roof impervious area.

Leaching system: 27 pre-cast concrete leaching galleys (4'x4'x4 deep, Benson's) are proposed, with 2' stone around, plus 3.25' of water depth is taken for calculations and 12 inches of stone in the bottom.

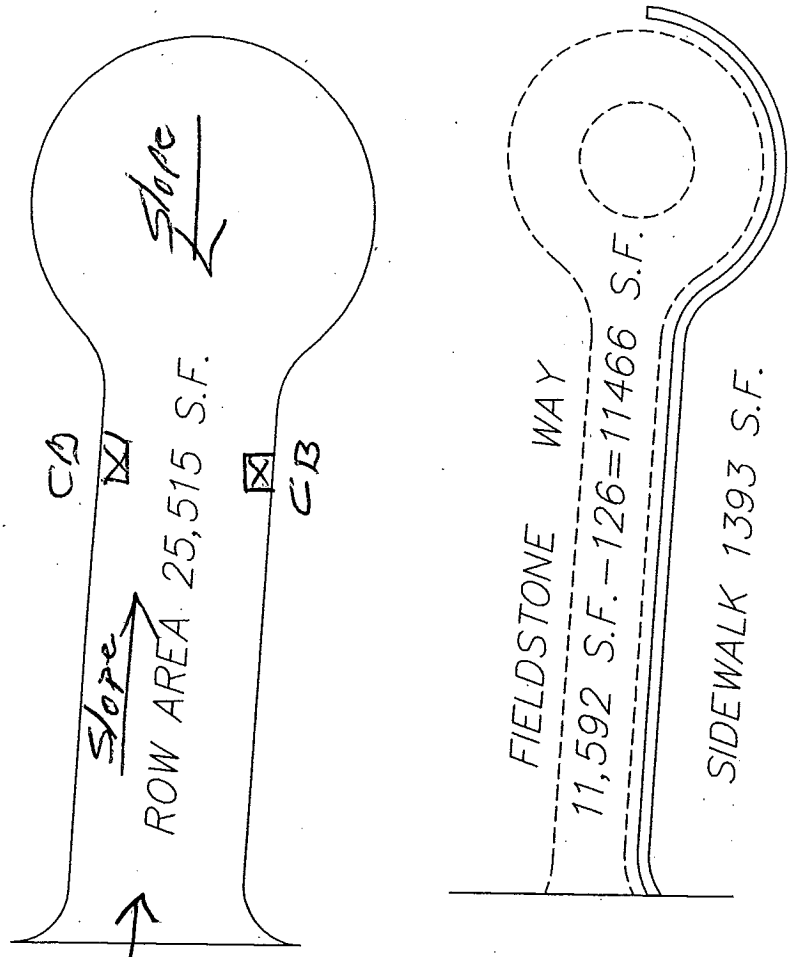
Concrete galleys: 3.25' depth x 4'x4'x 27 Units = 1404 Cu.Ft.
Bottom Stone:
16'x40'x12" inches depth = 640 Cu. Ft.
Vertical Stone:
((16'x40') – (12'x36')) x3.25' = 676 Cu. Ft

Total Stone Volume: 1316 Cu.Ft

Volume available for water: 1316 Cu Ft x 30% voids = 394.8 Cu.Ft

Total volume proposed for the leaching system: 1798.8 Cu. Ft.
Volume provided: 1799 Cu. Ft.
Volume provided is satisfactory.

COLLIN FARMS
FRAMINGHAM, MASS.



Total Drainage Area: 25,515 SFt
= 0.58574 Acres

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Tel: 781-344-8565; Fax: 781-341-6017

12/16/2013

Project: Collin Farms - Fieldstone Way, Framingham, MA
TR55 STORMWATER ANALYSIS BY: K.N. SRINIVASA,P.E.
AND BY RATIONAL METHOD
POST CONSTRUCTION FLOWS

Sheet Flow Time of Travel		
Segment ID		#VALUE!
Surface Description		Roof/Paved
Manning's roughness coefficient for overland flow, n		0.011
Flow Length, L (total L < 300 ft)	ft	100
100 year 24 hour rainfall, I	in/hr	8
Land slope S	ft/ft	0.0175
TC = (.933 ((nL)/S^0.5)^0.6) / (I^0.4*60)	hr	0.024122293
Volume of Runoff for 100 year Design Storm		
Segment ID		Roof/Paved
100 year design storm frequency, P; at 5 minutes	in	8
drainage area, A; includes Bldg. & paved areas	acres	0.58574
Conversion factor, Kc		3630
Volume of runoff, Vr=Kc I A	cf	17009.89
Runoff coefficient for rational method C		0.6062
Average rainfall intensity, I for 100 year frequency	in/hr	8
drainage area, A	acres	0.58574
Q = C I A	cfs	2.841
Volume of Storage required		
Vr, Volume of runoff	cf	17009.89
Qo, Peak flow of infiltration (a)	cfs	0.8888
Qi, Peak flow from runoff	cfs	2.841
Tp, Time to peak inflow of design storm	hr	0.1
Ti, Time base of inflow of design storm	hr	24
Vs/Vr = (1.291 * (1-Qo/Qi)^0.753) / ((Ti/Tp)^0.411)		0.102315085
Vs, Volume of storage required (multiply Vs/Vr ratio by the Vr from above	cf	1740.368292
(a) Perc Test:1 MPI;		ok
over an area of 16'x40' = 640 sft		
Note: Excessive draining soil, type A; <0.5 MPI		
Assumed 1 MPI		

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12/16/2013

Project: Collin Farms - Fieldstone Way, Framingham, MA
TR55 STORMWATER ANALYSIS BY: K.N. SRINIVASA,P.E.
AND BY RATIONAL METHOD
PRE- CONSTRUCTION FLOWS

Sheet Flow Time of Travel		
Segment ID		#VALUE!
Surface Description		Roof/Paved
Manning's roughness coefficient for overland flow, n		0.011
Flow Length, L (total L < 300 ft)	ft	100
100 year 24 hour rainfall, I	in/hr	8
Land slope S	ft/ft	0.0175
TC = (.933 ((nL)/S^0.5)^0.6) / (I^0.4*60)	hr	0.024122293
Volume of Runoff for 100 year Design Storm		
Segment ID		Roof/Paved
100 year design storm frequency, P; at 5 minutes	in	8
drainage area, A; includes Bldg. & paved areas	acres	0.58574
Conversion factor, Kc		3630
Volume of runoff, Vr=Kc I A	cf	17009.89
Runoff coefficient for rational method C		0.25
Average rainfall intensity, I for 100 year frequency	in/hr	8
drainage area, A	acres	0.58574
Q = C I A	cfs	1.171
Volume of Storage required NOT APPLICABLE		
Vr, Volume of runoff	cf	17009.89
Qo, Peak flow of infiltration (a)	cfs	0.8888
Qi, Peak flow from runoff	cfs	1.171
Tp, Time to peak inflow of design storm	hr	0.1
Ti, Time base of inflow of design storm	hr	24
Vs/Vr = (1.291 * (1-Qo/Qi)^0.753) / ((Ti/Tp)^0.411)		0.046529379
Vs, Volume of storage required (multiply Vs/Vr ratio by the Vr from above	cf	791.4595987
(a) Perc Test:1 MPI;		ok
over an area of 16'x40' = 640 sft		
Note: Excessive draining soil, type A; <0.5 MPI		
Assumed 1 MPI		
(a) Perc Test:1 MPI;		ok
over an area of 16'x40' = 640 sft		
Note: Excessive draining soil, type A; <0.5 MPI		
Assumed 1 MPI		

KALKUNTE ENGINEERING CORPORATION
Consulting Engineers
1749 Central Street
STOUGHTON, MASSACHUSETTS 02072
(781) 344-8565

JOB Collins Farm, Framingham
SHEET NO. _____ OF _____
CALCULATED BY KNS DATE 12/17/2015
CHECKED BY _____ DATE _____
SCALE Drainage

Collins Farm — Fieldstone Way

Weighted Average Runoff Coefficient C

Total area of R.O.W = 25,515 SFT

Paved Roadway = 11,592 SFT

Grass circle @ end = 126 SFT

Sidewalk = 1393 SFT

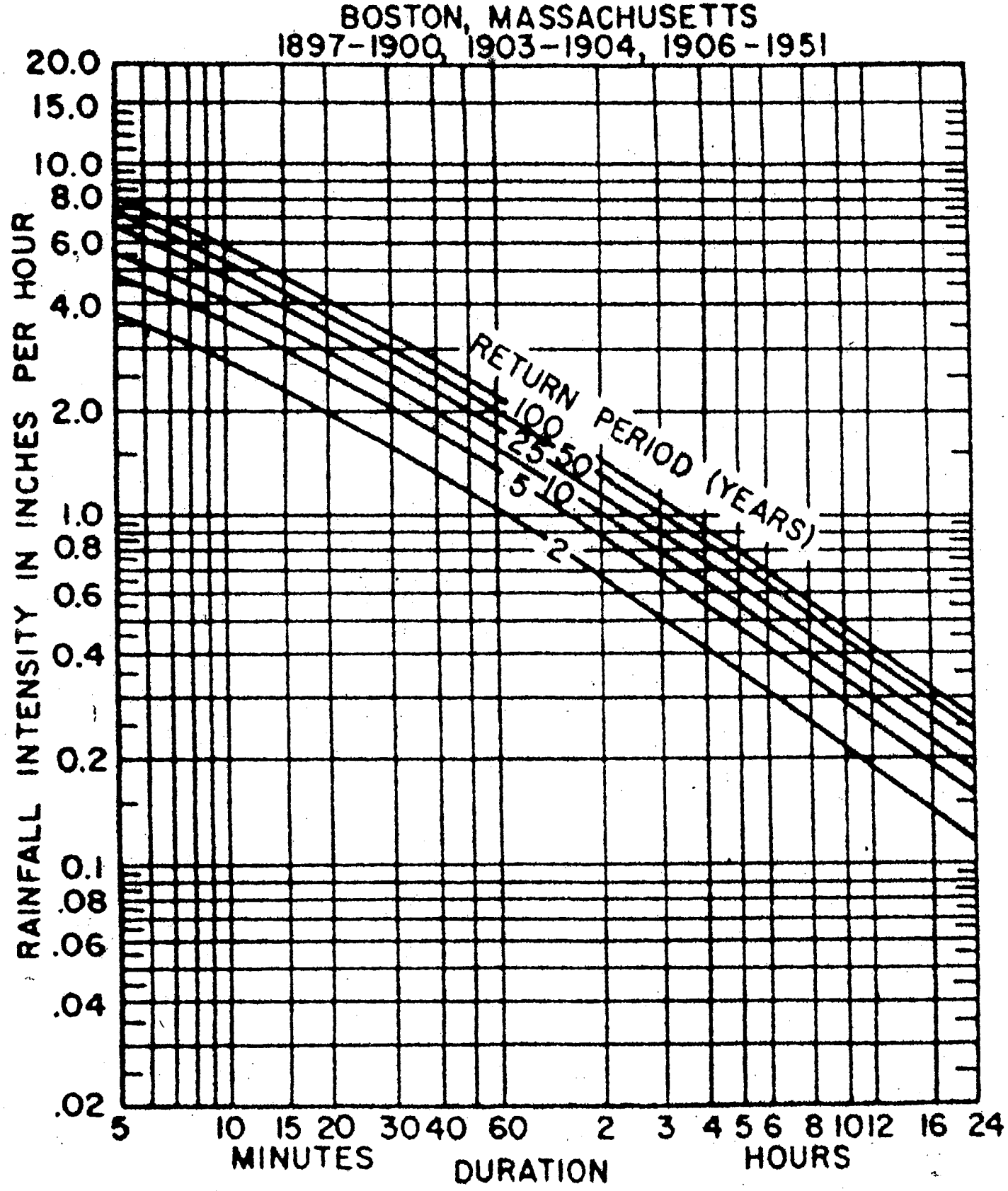
Grass area (within ROW) = 12404 SFT

$$C_{avg} = \frac{11,592 \times 0.95 + 126 \times 0.25 + 1393 \times 0.95 + 12404 \times 0.25}{25,515}$$

$$= \frac{11,012 + 31.5 + 1323.35 + 3101}{25,515}$$

$$= \frac{15467.85}{25,515}$$

$$C_{avg} = 0.6062$$


BOSTON, MASSACHUSETTS
1897-1900, 1903-1904, 1906-1951
RAINFALL INTENSITY IN INCHES PER HOUR
20.0
15.0
10.0
8.0
6.0
4.0
2.0
1.0
0.8
0.6
0.4
0.2
0.1
.08
.06
.04
.02
RETURN PERIOD (YEARS)
100
25
50
5
10
2
5
10
15
20
30
40
60
2
3
4
5
6
8
10
12
16
24
MINUTES
DURATION
HOURS

Project: Collin Farms, Framingham, MA

Flow Computation by Manning's formula
Q=AV; Q= Flow in cubic feet per second, V= Velocity in ft/second
A= Area in square feet
Mannig's formula for Pipe: 1.486/n x R^0.667 x S^0.5
R=Hyd. Radius; n=Mannig's Rohgness Coeffcient, S=Hydraulic slope

		SDR 35	
Inches	Avg. OD	Thickness	ID
4	4.215	0.12	3.975
6	6.275	0.18	5.915
8	8.4	0.24	7.92
10	10.5	0.3	9.9
12	12.5	0.36	11.78
15	15.3	0.437	14.426

Used 12" RCP Class III; Minimum Slope 0.006
Velocity > 3 ft/s

	Pipe			
	Pipe	12	RCP	
Slope		0.006		
A=		0.785	Sq.ft.	
Wetted Peri.	P=	3.14		
R=Hyd. Rad.	A/P	0.25		
n	0.01			
V=		4.565837	Ft/s	
Q=AV		3.584182	Cfs	
		2.31686	mgd	
		1608.92	gpm	

12" ϕ RCP

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STOUGHTON, MASSACHUSETTS 02072
(781) 344-8565

JOB Collins Farms, Framingham
SHEET NO. _____ OF _____
CALCULATED BY PAS DATE 12/18/2013
CHECKED BY _____ DATE _____
SCALE Drainage Design

Drawdown Within 72 hours

Fieldstone Way

$$\text{Time}_{\text{drawdown}} = \frac{Rv}{(K)(\text{Bottom Area})}$$

Rv = Storage Volume
K = Standard hydraulic conductivity = 8.27 "/hour
(Copy of Table attached).

$$T_{\text{drawdown}} = \frac{1740.37 \text{ cft}}{(8.27 \text{"/hr}) \times (15\text{'}/12\text{"}) \times 640}$$

$$= 3.94 \text{ hours} < 72 \text{ hours}$$

OK

Type III 24-hr Rainfall=1.29"

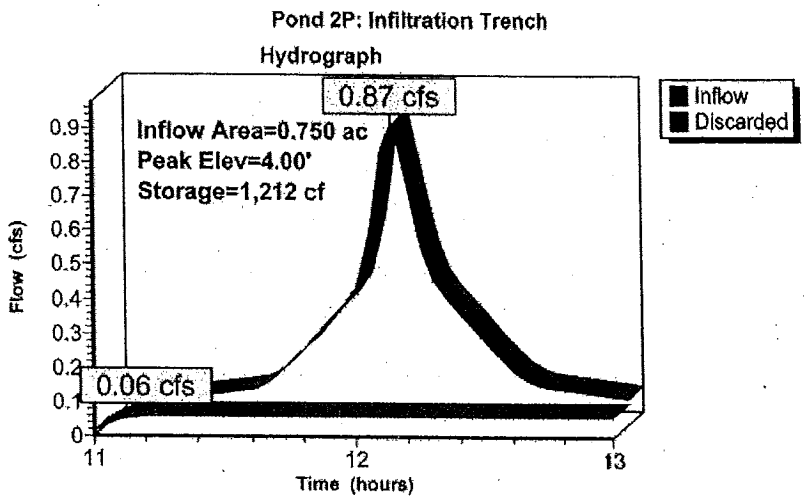
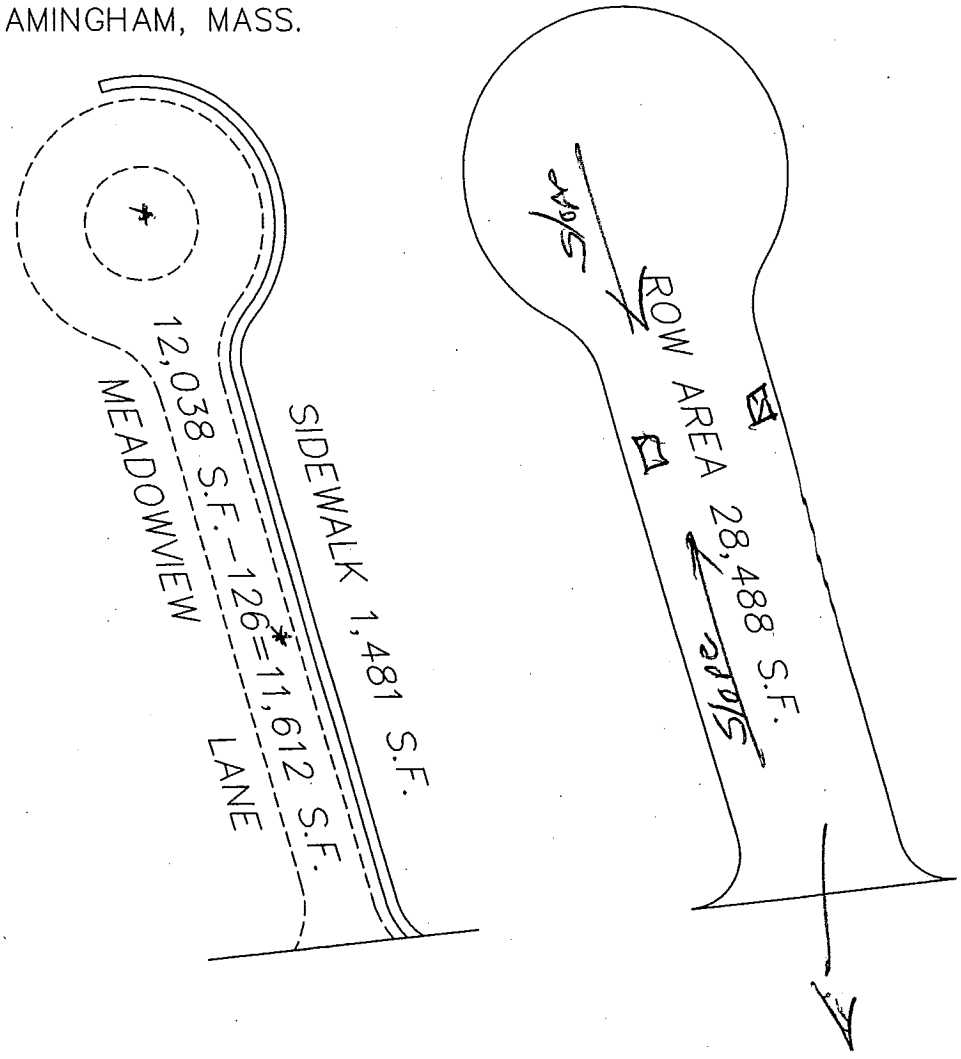


Table 2.3.3. 1982 Rawls Rates[18]

Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate Inches/Hour
Sand	A	8.27
Loamy Sand	A	2.41
Sandy Loam	B	1.02
Loam	B	0.52
Silt Loam	C	0.27
Sandy Clay Loam	C	0.17
Clay Loam	D	0.09
Silty Clay Loam	D	0.06
Sandy Clay	D	0.05
Silty Clay	D	0.04
Clay	D	0.02

[18] Rawls, Brakensiek and Saxton, 1982

COLLIN FARMS
FRAMINGHAM, MASS.



Total Area, Row: 28,488 ~~SF~~
= 0.65399 Acres

Kalkunte Engineering Corporation
Consulting Engineers
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December 17, 2013

RE: Collin Farms -Meadowview Lane, Framingham, MA
ON-SITE DRAINAGE ANALYSIS – STORMWATER STORAGE
Drainage C

Proposed Stormwater Storage is shown on the site plan.
Observed percolation rate: Less than 0.5 MPI
Based on the Percolation rate of 1 MPI, storage volume is calculated.

Drainage system is designed for a 100 year storm event, by using TR55 method for small areas. Volume needed is 1926 **cubic feet** of storage based on net increase in the roof impervious area.

Leaching system: 30 pre-cast concrete leaching galleys (4'x4'x4 deep, Benson's) are proposed, with 2' stone around, plus 3.25' of water depth is taken for calculations and 12 inches of stone in the bottom.

Concrete galleys: 3.25' depth x 4'x4'x 30 Units = 1560 Cu.Ft.

Bottom Stone:
16'x44'x12" inches depth = 704 Cu. Ft.

Vertical Stone:
((16'x44') – (12'x40')) x3.25' = 728 Cu. Ft

Total Stone Volume: 1432 Cu.Ft

Volume available for water: 1432 Cu Ft x 30% voids = 429.6 Cu.Ft

Total volume proposed for the leaching system: 1989.6 Cu. Ft.
Volume provided: 1989 Cu. Ft.
Volume provided is satisfactory.

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12/16/2013

Project: Collin Farms - Meadowview lane, Framingham, MA
TR55 STORMWATER ANALYSIS BY: K.N. SRINIVASA,P.E.
AND BY RATIONAL METHOD
POST CONSTRUCTION FLOWS

Sheet Flow Time of Travel		
Segment ID		#VALUE!
Surface Description		Roof/Paved
Manning's roughness coefficient for overland flow, n		0.011
Flow Length, L (total L < 300 ft)	ft	100
100 year 24 hour rainfall, I	in/hr	8
Land slope S	ft/ft	0.0175
TC = (.933 ((nL)/S^0.5)^0.6) / (I^0.4*60)	hr	0.024122293
Volume of Runoff for 100 year Design Storm		
Segment ID		Roof/Paved
100 year design storm frequency, P; at 5 minutes	in	8
drainage area, A; includes Bldg. & paved areas	acres	0.65399
Conversion factor, Kc		3630
Volume of runoff, Vr=Kc I A	cf	18991.87
Runoff coefficient for rational method C		0.5822
Average rainfall intensity, I for 100 year frequency	in/hr	8
drainage area, A	acres	0.65399
Q = C I A	cfs	3.046
Volume of Storage required		
Vr, Volume of runoff	cf	18991.87
Qo, Peak flow of infiltration (a)	cfs	0.9777
Qi, Peak flow from runoff	cfs	3.046
Tp, Time to peak inflow of design storm	hr	0.1
Ti, Time base of inflow of design storm	hr	24
Vs/Vr = (1.291 * (1-Qo/Qi)^0.753) / ((Ti/Tp)^0.411)		0.10140725
Vs, Volume of storage required (multiply Vs/Vr ratio by the Vr from above	cf	1925.913273
(a) Perc Test:1 MPI;		ok
over an area of 16'x40' = 640 sft		
Note: Excessive draining soil, type A; <0.5 MPI		
Assumed 1 MPI		

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Project: Collin Farms -Meadowview Lane, Framingham, MA
TR55 STORMWATER ANALYSIS BY: K.N. SRINIVASA,P.E.
AND BY RATIONAL METHOD
PRE- CONSTRUCTION FLOWS

Sheet Flow Time of Travel		
Segment ID		#VALUE!
Surface Description		Roof/Paved
Manning's roughness coefficient for overland flow, n		0.011
Flow Length, L (total L < 300 ft)	ft	100
100 year 24 hour rainfall, I	in/hr	8
Land slope S	ft/ft	0.0175
TC = (.933 ((nL)/S^0.5)^0.6) / (I^0.4*60)	hr	0.024122293
Volume of Runoff for 100 year Design Storm		
Segment ID		Roof/Paved
100 year design storm frequency, P; at 5 minutes	in	8
drainage area, A; includes Bldg. & paved areas	acres	0.65399
Conversion factor, Kc		3630
Volume of runoff, Vr=Kc I A	cf	18991.87
Runoff coefficient for rational method C		0.5822
Average rainfall intensity, I for 100 year frequency	in/hr	8
drainage area, A	acres	0.65399
Q = C I A	cfs	3.046
Volume of Storage required NOT APPLICABLE		
Vr, Volume of runoff	cf	18991.87
Qo, Peak flow of infiltration (a)	cfs	0.9777
Qi, Peak flow from runoff	cfs	3.046
Tp, Time to peak inflow of design storm	hr	0.1
Ti, Time base of inflow of design storm	hr	24
Vs/Vr = (1.291 * (1-Qo/Qi)^0.753) / ((Ti/Tp)^0.411)		0.10140725
Vs, Volume of storage required (multiply Vs/Vr ratio by the Vr from above	cf	1925.913273
(a) Perc Test:1 MPI;		ok
over an area of 16'x40' = 640 sft		
Note: Excessive draining soil, type A; <0.5 MPI		
Assumed 1 MPI		