

PA 451, as amended (NREPA) on watercourses with contributing area of 2 square miles or greater. If a floodplain has not been mapped, the applicant's consultant shall provide the floodplain delineation including the floodway to the Kent County Drain Commission for approval.

To provide for streambank stability a buffer zone is to be established and called out on a recorded plat, an approved block grading plan, a site plan, or an improvement plan. This zone shall consist of existing natural tree and vegetation slope protection within a minimum of 25 feet from the ordinary high water mark. This buffer zone shall be maintained as is, that is, no earth change or disturbance is to take place.

Replacement of lost floodplain shall meet the following criteria.

1. Replacement of the loss of floodplain storage volume at a 1 to 1 ratio unless watershed conditions warrant a higher ratio. This applies to floodplain associated with rainfall events up to a 100-year frequency. The grading plan shall provide for an equivalent volume of storage for floodplains associated with more frequent events such as 10 and 25 year frequencies.
2. Storm water detention does not apply toward the replacement volume.
3. Floodplain storage volume shall be computed above the seasonal high ground water level only.
4. The inflow and outflow rates to the area shall be consistent with predevelopment rates.
5. Up to 50 percent of the floodplain mitigation storage volume may be used for snow storage.
6. The proximity of the floodplain mitigation area shall provide for an equivalent hydrologic impact to the receiving stream and adjacent parcels.

3 DESIGN CRITERIA

The basis of design for the stormwater management facilities are governed by the following criteria:

3.1 DESIGN STORM DURATION AND DISTRIBUTION

The design storm serves as the basis for design. The selection of the storm duration and distribution affects the resulting runoff volume and peak discharge rate. Total storm volume and distribution has been selected to produce total runoff volume and peak runoff rates that are independent of the tributary area. The following characteristics of the design storm have been selected:

- The duration of the rainfall event shall be dependent on the time of concentration for the individual site. Section 5.3.7 provides information for calculating the time of concentration.
- Rainfall distribution for the design storm used for any stormwater management facilities must be in accordance with the U.S. Department of Agriculture, Soil Conservation Service (SCS) Type II Rainfall Distribution. Total rainfall volume and the distribution of that rainfall per SCS Type II are provided in Table 1. The distribution is provided at one-half hour intervals for a variety of return intervals.

3.2 DESIGN STORM VOLUME

The design of all facilities must be based on the design storm return interval that is the probability that the storm will occur in any one year. For example, the 100-year storm has a 1 percent probability of being met or exceeded in any one year. The 25-year storm has a 4 percent probability of being met or exceeded in any one year. The following are the return interval design criteria for stormwater related facilities:

- Bridges for major roads
 - 100-year with no backwater for new crossings
 - 100-year with no greater than a 0.1 foot increase or reduction in backwater for existing crossings.
- Ditches and bridges/culverts for drainage external to a development
 - 100-year storm if no floodway channel is available
 - 10-year storm may be used otherwise
- Storm Sewers
 - 10-year storm flow capacity, using gravity flow, if floodway available
 - 100-year flow capacity required if no floodway channel available
- Floodways
 - 100-year flow capacity
- Roadside swales for drainage internal to the development
 - 10-year flow capacity
- Detention/retention basin primary discharge control volume
 - 25-year flow capacity
- Detention/retention basin emergency floodway capacity
 - Provisions shall be made to convey the 10-year storm flow over the emergency spillway without damaging the containment berm

3.3 BASIN DISCHARGE CONTROLS

- The peak release rate shall be 0.13 cfs/acre
- The first 0.5" of runoff shall be held for not less than 12 hours or more than 24 hours.

3.4 REQUIRED CALCULATION METHODS

A variety of methods can be used to calculate the peak runoff rate and to estimate runoff volume for a development. Three alternative methods are provided each with certain limits on their usage. Any of these three methods may be used subject to the development size limitations set forth.

Alternative generally accepted engineering calculation methods are allowed, but will require additional review prior to acceptance. The permissible calculation methods are described as follows:

- Developments with tributary areas that are less than 40 acres:
 - The Rational Method – (Section 5)
- Developments with tributary areas that are between 40 and 200 acres:
 - The SCS TR55 method – (Section 6)
- Developments with tributary areas that are over 200 acres:
 - HEC-HMS AND HEC-RAS
- Other acceptable Hydrologic and Hydraulic Computer Models include: PondPack, SWMM, HSPF, and FEQ.

Other computer models may be used in lieu of those mentioned above if the complete input data and output data sets are furnished. Also provided that the data fields, column headings, etc. are described in text format.

TABLE 1 -Design Storm Hyetographs – SCS Method

Type II 24-Hour Distribution

Frequency:	2year	5year	10year	25year	50year	100year
Duration :	24 Hour	24 Hour	24 Hour	24 Hour	24 Hour	24 Hour
Depth	2.37	3.00	3.52	4.45	5.27	6.15
0.0	0.000	0.000	0.000	0.000	0.000	0.000
0.5	0.013	0.016	0.019	0.024	0.028	0.033
1.0	0.013	0.017	0.019	0.024	0.029	0.034
1.5	0.013	0.017	0.020	0.025	0.030	0.034
2.0	0.014	0.018	0.021	0.026	0.031	0.036
2.5	0.014	0.018	0.021	0.027	0.032	0.038
3.0	0.015	0.019	0.022	0.028	0.033	0.039
3.5	0.016	0.020	0.024	0.030	0.035	0.041
4.0	0.016	0.021	0.024	0.031	0.036	0.042
4.5	0.017	0.022	0.025	0.032	0.038	0.044
5.0	0.018	0.023	0.027	0.034	0.041	0.047
5.5	0.019	0.024	0.028	0.036	0.042	0.049
6.0	0.020	0.026	0.030	0.038	0.045	0.052
6.5	0.021	0.027	0.032	0.040	0.047	0.055
7.0	0.023	0.029	0.034	0.043	0.051	0.060
7.5	0.025	0.032	0.037	0.047	0.055	0.065
8.0	0.027	0.034	0.040	0.051	0.060	0.070
8.5	0.030	0.038	0.044	0.056	0.066	0.077
9.0	0.033	0.042	0.049	0.062	0.073	0.085
9.5	0.037	0.047	0.056	0.070	0.083	0.097
10.0	0.043	0.055	0.064	0.081	0.096	0.113
10.5	0.055	0.070	0.082	0.104	0.123	0.144
11.0	0.071	0.090	0.105	0.133	0.158	0.184
11.5	0.117	0.148	0.173	0.219	0.259	0.303
12.0	0.900	1.140	1.337	1.691	2.002	2.336
12.5	0.170	0.216	0.253	0.320	0.379	0.442
13.0	0.088	0.112	0.131	0.166	0.197	0.229
13.5	0.063	0.080	0.093	0.118	0.140	0.163
14.0	0.045	0.057	0.067	0.085	0.100	0.117
14.5	0.048	0.060	0.071	0.089	0.106	0.124
15.0	0.037	0.047	0.056	0.070	0.083	0.097
15.5	0.033	0.041	0.049	0.061	0.073	0.085
16.0	0.030	0.037	0.044	0.056	0.066	0.077
16.5	0.027	0.034	0.040	0.050	0.060	0.069
17.0	0.025	0.032	0.037	0.047	0.055	0.065
17.5	0.023	0.029	0.034	0.043	0.051	0.059
18.0	0.022	0.027	0.032	0.040	0.048	0.056
18.5	0.020	0.026	0.030	0.038	0.045	0.052
19.0	0.019	0.024	0.028	0.036	0.042	0.049
19.5	0.018	0.022	0.026	0.033	0.040	0.046
20.0	0.017	0.022	0.026	0.032	0.038	0.045
20.5	0.016	0.021	0.024	0.031	0.036	0.042
21.0	0.015	0.020	0.023	0.029	0.034	0.040
21.5	0.016	0.020	0.023	0.029	0.035	0.041
22.0	0.014	0.017	0.020	0.026	0.031	0.036
22.5	0.014	0.018	0.021	0.026	0.031	0.036
23.0	0.013	0.017	0.020	0.025	0.030	0.034
23.5	0.013	0.017	0.019	0.024	0.029	0.034
24.0	0.013	0.016	0.019	0.024	0.028	0.033