

AN ORDINANCE  
REGULATING THE MANAGEMENT OF STORMWATER RUNOFF

LAND USE DEPARTMENT  
RECEIVED FOR RECORD  
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Christina A. P...  
LEDYARD TOWN CLERK

Be it ordained by the Town Council of the Town of Ledyard

PART 1. INTRODUCTION

Section 1. Purpose

Development in the Town of Ledyard contributes to a loss of natural vegetation and grassy and wooded areas, thereby changing the characteristics of stormwater runoff. Continued development without adequate drainage measures will have an adverse impact on the Town's environment and property values and on its ecological, recreational and scenic attributes. Drainage requirements are in the public interest and are essential to the health, welfare and safety of the citizens of the Town. The purpose of this Ordinance is to establish stormwater management policy and specifications which will protect citizens from the danger of improper drainage and flooding by controlling stormwater runoff while encouraging further development in the Town of Ledyard.

Section 2. Type of Development Being Regulated

- A. The requirements of this Ordinance shall apply to the following proposed developments:
  - 1. All subdivisions involving the creation of new Town roads.
  - 2. Reconstruction of existing roadways.
  - 3. All development for which the Town of Ledyard's zoning or subdivision regulations require conformance with the provisions of this Ordinance.
  - 4. Other forms of proposed development, providing the Public Works Director determines that a proposed development would be likely to have a significant impact on Town-owned drainage systems.
- B. The Mayor, with consent of the Town Council, may waive all or a portion of the requirements of this Ordinance when emergency or other conditions warrant such exceptions to be in the public benefit.

Section 3. Rate of Runoff

- A. For all development regulated by this Ordinance, a stormwater drainage system shall be designed to adequately mitigate downstream impacts resulting from any alteration of the stormwater discharge characteristics (i.e., rate of discharge, duration of discharge, time to peak discharge) resulting from the proposed development.
- B. Potential impacts shall be minimized by the management of the discharge characteristics through use of structural and/or natural control measures. The applicant may be required to determine the downstream impact of changes in the discharge characteristics of the watershed within which the proposed development is located. When required, this determination shall be made through hydrologic analysis conducted by a Professional Engineer. A zero percent increase in discharge characteristics, while not universally mandated, may be required in

certain cases where existing downstream land use or property is shown to be subject to flooding, based on results of hydrologic analysis. Natural runoff detention or retention capacity of adjoining downstream inland wetlands may be used as a mitigating factor in determining the scope of downstream impacts and the extent of on-site drainage control measures warranted. Increases to base flood elevations, as established by Flood Insurance Rate Maps, shall not be permitted.

- C. A zero percent increase in discharge characteristics is specifically not applicable in cases where the applicant can demonstrate that the runoff will discharge to the Thames River or the City of Groton Reservoir System without increasing the potential of downstream flooding.

#### Section 4. Types of Measures Permitted

- A. The applicant should pursue a stormwater drainage system design that accomplishes the necessary discharge control via the least intrusive measure(s) possible. Conservatism in the design is undesirable if it results in excessive control measures, especially those which are visually conspicuous, introduce safety hazards, or present greater operational or maintenance burdens.
- B. In designing a stormwater drainage system intended to reduce rates of post-development runoff, the applicant may use the following drainage control measures or combinations thereof:
  - 1. Grassy or vegetated strips, swales and ponding areas within or around parking lots.
  - 2. Grassed or riprap-lined waterways and swales, riprap check dams, and level spreaders.
  - 3. Groundwater recharge measures, such as roof downspouts connected to drywells, gravel driveways and parking areas, retention basins, and infiltration trenches.
  - 4. Detention Basins.
  - 5. Other measures which are intended to reduce runoff from impervious surfaces, consistent with Town's Zoning and Subdivision regulations and the Town's Road Ordinance
- C. In meeting the requirements of Section 3, structural drainage control measures permitted above must all be located on property subject to control of the applicant. In an effort to limit the size or capacity of structural drainage control measures, the applicant cannot rely upon voluntary or anticipated future cooperation of adjoining property owners. However, reliance upon natural runoff detention or retention capacity of wetlands not located on property under control of the applicant is permitted, provided that such capacity is demonstrated through hydrologic analysis conducted by a Professional Engineer.

#### Section 5 - Alternative Designs

Because stormwater management system design is a process which depends largely upon hydrologic modeling and engineering judgment, these standards are not intended to limit the use of new and innovative design methods and products. Engineering criteria given in this Ordinance are based on standard models and methods which are adequate for design purposes in most cases. In all cases drainage analyses and stormwater management system design shall be certified by a Professional Engineer, and the design approach shall be clearly delineated and documented.

## PART 2. DEFINITIONS

The following definitions shall be used in interpreting this Ordinance:

- A. Applicant: Any person, firm, corporation or partnership whose action is subject to regulation under Part I of this Ordinance.
- B. Detention Basin: An area excavated or constructed for the purpose of temporary storage of stormwater runoff.
- C. Discharge or Rate of Flow: The volume of water passing a particular point in a unit of time, Units of discharge to be used include cubic feet per second (cfs) or gallons per minute (gpm).
- D. Drainage Easement: The right, at any time, to direct the flow of surface water across any property owned or proposed to be owned by another. Said right is defined to include the flow of water by any method or means, including but not limited to, unrestricted sheet flows, ditches, swales, or by enclosed structures. Said right also includes the right to enter upon the property and to maintain said flow of water in perpetuity.
- E. Embankment Toe: The point at which a change in slope occurs between the existing grade and a cut or fill area.
- F. Reconstruction of Roadways: Significant revisions in the horizontal and vertical alignments of the roadway coupled with total replacement of the pavement structure. It shall not include normal maintenance required for the upkeep of the highway system.
- G. Retention Basin: An area excavated or constructed for the purpose of storage of Stormwater runoff. Discharge from the retention basin is achieved through the infiltration of the stored runoff into the ground.
- H. Stormwater Detention: The process by which stormwater is temporarily stored at or near the site of its origin and subsequently discharged at a predetermined release rate.
- I. Stormwater Retention: The process by which stormwater is stored at or near the site of its origin and subsequently discharged into the ground through infiltration.
- J. Watercourses: Watercourses are the areas identified and defined in Section 22a-38 of the General Statutes of Connecticut, as amended. "Watercourses" means rivers, streams, brooks, waterways, lakes, ponds, marshes, swamps, bogs and all other bodies of water that are contained within, flow through, or border upon any portion of this State; whether natural, artificial, public or private; but does not include any tidal waters.

## PART 3. STANDARD ENGINEERING CRITERIA

### Section 1. Standards for Hydrologic Models

#### A. Methods

As a general rule, when used, the following methods shall be applied as follows:

##### 1. Rational/ Modified Rational Method:

The Rational Method shall be used for small drainage areas (0-200 acres), The Modified Rational Method may be used alternatively for areas not to exceed 20 acres.

- a. Far rainfall intensity, the chart for New Haven, CT shall be used ~~(Figure 1)~~.
- b. For calculating the time of concentration, the Seelye Chart (Figure 2) is provided for use.
- c. A table of runoff coefficients (Table 1) is provided as a guide in calculating the runoff.

2. SCS TR-55:

The SCS TR-55 method shall be used for medium drainage areas (200-2,000 acres).

- a. The analysis shall be conducted in accordance with the methodology and data provided in SCS TR 55, *Urban Hydrology for Small watersheds*, and any subsequent revisions thereto.
- b. For rainfall intensity, the following data for New London County shall be used.

Inches of Rainfall

FREQUENCY	1-YR.	2-YR.	5-YR.	10-YR.	25-YR.	50-YR.	100-YR.
New London	2.7	3.4	4.3	5.0	5.7	6.3	7.1

*Reference: U.S. Dept of Commerce and Weather Bureau; T.P. 40, May 1961*

3. SCS TR-20:

The SCS TR-20 method shall be used for large drainage areas (over 2,000 acres).

There may be circumstances where a method should be applied outside of the acreage limitations given above. This is acceptable as long as its application is consistent with guidance given in the supporting documentation for the selected method.

B. Design Storm Criteria

The following drainage criteria shall be followed in the design of stormwater management systems. In all cases the design of a drainage system shall contain the seal and signature of a registered Professional Engineer.

For design year storm, the following return frequencies shall be used:

Pipe Design -	25 Year Storm
Major Ditches and Channels -	50 Year Storm
Positive Flood Relief -	100 Year Storm and tributary areas over 100 acres
Existing Streams	Encroachment Lines based on 100 Year Flood "A" Zone

Under certain circumstances for public safety, the storm frequency may be increased.

Section 2. Storm Sewer System Design Flows

- A. Except where indicated by special design studies, stormwater drain pipes and culverts shall be designed to flow "just full" or less than full for the "design storm," Total allowable headwater for inlet control conditions shall not exceed 1.5 times the pipe diameter. Pipes or culverts designed to flow under greater heads will require special studies to be submitted for approval by the Public Works Director.
- B. Where storm sewer pipes run on a tangent line through a drainage structure, the energy line for the inlet and outlet pipes shall match approximately. Where a change in size of pipe is made at a structure, the crowns of these pipes will normally be aligned on grade.

Section 3. Gutter Flow Analysis

- A. The top width (spread) of the gutter flow shall not exceed one-third of the traveled lane width for the design storm. For complying with this requirement, a gutter storm flow depth chart is provided (Figure 3).

- B. Proper spacing of storm sewer inlets to limit the gutter flow spread is encouraged rather than the use of Type II double-catch basins.
- C. The effective width of depressed single grate inlets for gutter flow interception shall be 2.5 feet. Gutter flow occurring outside the 2.5-foot effective width shall be assumed to bypass the inlet.
- D. For catch basins located in sag locations, a clogging percentage of 30% shall be used to account for restricted capacity due to litter, leaves, etc.

**PART 4. PHYSICAL DESIGN OF STORMWATER MANAGEMENT SYSTEMS**

**Section 1. Placement and Design of Drainage Structures**

**A. Catch Basins:**

- 1. The first set of catch basins in a storm drain system shall be located no greater than 400 feet from a street high point. Maximum spacing between sets of catch basins should be 300 feet. Closer spacing of inlet structures may be required to satisfy gutter flow requirements. Inlet structures shall also be located and connected to the system to pick up low spots in shoulder areas of the right-of-way and in adjacent lots.
- 2. Inlets shall be installed to properly drain all intersections of new streets and intersections of new streets with existing streets. Gutter flow shall not be allowed to run across intersections. Improvements to storm drainage removal at existing intersections may be required if a new development's traffic significantly increases the intersection's use.
- 3. Structures (catch basins or manholes) shall be placed at each grade change along a storm drain, at each change in horizontal direction, and at each junction point of two or more storm drains.
- 4. At sags in vertical curves, catch basins shall be depressed so that minimum gutter slope shall not be less than 0.8%.

**B. Drainage Pipe:**

- 1. All drainage pipe, including driveway crossings, shall be a minimum of fifteen (15) inches in diameter. Unreinforced concrete pipe shall not be permitted.
- 2. Long skew crossings of stormwater drainage pipe under pavement shall be avoided, wherever possible. Pipes will normally be laid on straight alignments and vertically with catch basins or manholes providing access at all deflection points or at a junction of two or more lines.
- 3. All stormwater drainage pipe shall be designed to provide a self-cleansing velocity of at least 2.5 fps when flowing full. Stormwater drainage pipe shall have a minimum slope of 0.5%
- 4. A minimum cover of 2.0 feet shall be provided for all drain pipe unless special designs, as approved by the Public Works Director, are utilized. Minimum cover for culverts under driveways shall be reviewed on a case-by-case basis by the Public Works Director.

- C. **Outlet Structures:** All storm drain systems shall be terminated with a flared end section, endwall, or other approved outlet structure to prevent erosion and resultant displacement of discharge piping. Special energy dissipators may be required to prevent erosion. On steep slopes, storm drains shall be extended out to the toe with full outlet end treatment to prevent erosion.

- D. Private Drains: The size and location of all private storm drains that connect to the Town storm drain system shall be approved by the Town prior to installation; however, the Town shall not be responsible for the private storm drainage system in the event of any failure. All rear yard drains, cellar or foundation drains that are connected to the Town's storm drainage system must be shown on final as-built site plans.
- E. Special Structures Bridges and box culverts shall be designed to carry at least the full width of the required Street pavement and at least a four (4) foot sidewalk on one side of the structure.
- F. Street Underdrains: Street underdrains shall be installed in all areas with a seasonally high-water table or where directed by the Public Works Director. Underdrain outlets shall be connected to drainage structures wherever practical. When impractical, underdrains shall be terminated with an approved outfall structure, and riprap energy dissipator.
- G. Standard Structures: The design should incorporate standard structures and details to the maximum extent possible as these standard structures and details are the basis for concrete product suppliers making precast catch basins, sumps, tops, and blocks. Contractors using this standard and the State standards will be able to obtain the necessary material at a lower cost than constructing similar units in the field. It is recommended that precast concrete structures be used in lieu of masonry wherever possible.

## Section 2. Design of Drainage Control Measures

- A. General: Criteria provided in the "*Connecticut Guidelines for Soil Erosion and Sediment Control*", as amended, available from the Department of Environmental Protection, shall be utilized in the design and construction of drainage control measures, Additional specific design requirements are provided below.
- B. Detention Basin Structural Design:
  - 1. Basins which are designed to drain completely within 12 hours of the end of a rainfall are preferred. Detention basin designs that result in the presence of permanent standing water, where none existed prior to development, shall not be permitted.
  - 2. To facilitate complete drainage and mitigate siltation, the bottom of any detention basin shall have a slope of not less than 1 percent.
  - 3. Setbacks
    - a. A minimum setback distance of fifteen (15) feet shall be maintained between the detention basin embankment toe and any existing or proposed property line.
    - b. All emergency spillways or other measures for the release of excess flow beyond the design capacity of the structure shall be located no closer than thirty (30) feet upstream from an existing or proposed property line.
  - 4. Aesthetics: Detention basins shall be designed to utilize the natural contours of the land to the extent possible. Natural low areas should be chosen for the location of proposed detention basins. Steep slopes should be avoided. Site selection for detention basins should be included in early schematic designs, using the basin as a visual amenity. The use of soft varying slopes and curves is recommended. The outlet structure should be configured so that it is not the focal point of the pond. The planting of evergreen and/or deciduous trees may be required to screen the detention basin.
- C. Grassy or vegetated strips and swales in parking areas shall have a pervious subgrade in order to be considered in the runoff calculations. Ponding areas around parking lots shall not have a ponded depth exceeding one (1) foot and the ponding limits shall not extend to within ten (10) feet of a pedestrian access way or parking area.
- D. Safety Measures: All drainage control measures which are designed to hold standing water for a period of time greater than 12 hours following the conclusion of a rain storm shall include reasonable safety measures such as fencing at least 6 feet high with a lockable access.

PART 5. EASEMENTS, OWNERSHIP AND MAINTENANCE

Section 1. Easements

- A. Easements at least twenty (20) feet in width, centered on the drainage structure, shall be provided for all ditches, channels, swales, or natural streams not located within a street right-of-way. Easements shall extend to a suitable existing storm drain or an adequate natural watercourse.
- B. Drainage easements shall be provided for all upstream areas, outside the street right-of-way, inundated by ponding due to inlet structure backwater effects for the design storm.
- C. Within all proposed subdivisions, the applicant will deed to the Town, at no cost, all drainage control measures and sufficient access for maintenance purposes. The applicant shall provide a maintenance access driveway for permanent drainage control structures. This maintenance driveway shall be at least 10 feet in width, have a rolled gravel surface, and shall not have a grade in excess of 15 percent.

Section 2. Ownership and Maintenance

- A. The Town will assume responsibility for future maintenance of drainage measures in subdivisions upon official acceptance of the deeds for such structures. The procedure for official acceptance is found in the Town's Road Ordinance.
- B. Within developments which are intended to remain under single ownership, the property owner shall be responsible for future maintenance of all drainage control measures. An operation and management plan shall be prepared for use by the owner, or other party responsible for the system, to ensure that each component functions properly. This plan shall provide requirements or inspection, operation, and maintenance of individual components, including outlets.

PART 6. APPLICATION PROCEDURES AND REQUIREMENTS

Section 1. Information to be Submitted by Applicant

This section outlines information that shall be submitted by the applicant for review of a proposed stormwater management system. One (1) copy shall be submitted to the Public Works Director and two (2) copies shall be submitted to the land use commission overseeing the activity proposed. All stormwater drainage calculations and design drawings shall be certified by a registered Professional Engineer.

- A. Topographic Contour Map(s) showing drainage areas(s). Wherever possible, Town of Ledyard Photogrammetry at a scale of 1" = 100' shall be used.
- B. Plan and profile of all existing and proposed drainage structures for the development property. Scales shall be no smaller than 1" = 40' horizontal and 1" = 4' vertical, with 2-foot contour intervals.
- C. Written description and computations including at least the following, as applicable:
  - 1. Method used to calculate storm runoff. Where computerized hydrologic models are utilized for analysis and design, the applicant's engineer shall provide documentation of the computer algorithm and the method(s) it is based on.
  - 2. Runoff characteristics of the property both before and after development, including ground cover, soil types, slopes, existing streams, abutting property, proposed land uses.
  - 3. Drainage calculations and design criteria:
    - a. Pre- and post-development runoff from the property to be developed and its effect on downstream watersheds.

- b. Gutter flow analysis.
- c. Storm sewer system design and summary sheet:
  - (1) Maximum velocity and quantity at point or points of discharge.
  - (2) Design of energy dissipators.
  - (3) Headwater depths at all inlets.
- d. For detention structures (as applicable to the method of construction):
  - (1) Detail of the outlet structures.
  - (2) Cross sections of proposed detention structure, freeboard, cross sections with slopes, vegetative cover.
  - (3) Inflow and outflow hydrographs for detention area.
  - (4) Maximum storage volume and volume as a percentage of the design storm runoff.
  - (5) Design of spillway or other measures for the release of excess flows beyond that of the design capacity of the structure.
  - (6) Flood routing of all runoff greater than the design capacity of the detention facility.
  - (7) Time which is required for the facility to drain completely (98% of storage volume).
  - (8) Materials used in construction of the facility.
  - (9) Methods employed to avoid clogging the discharge mechanism.
  - (10) Safety measures, including fencing, trash racks, location, etc.
  - (11) Proposed landscaping and vegetative measures used to stabilize slopes and bottom surfaces, and for aesthetic purposes.

## Section 2. Public Works Director Review and Approval

The Public Works Director shall respond in writing to the proposal within 30 days from the date of application submission. The report of the Public Works Director shall be forwarded to the appropriate land use commission with a recommendation for approval, approval with conditions, or disapproval. Proposals should be submitted to the Public Works Director prior to or simultaneously with required submissions to the appropriate commission(s).

## Section 3. Performance Security

- A. The appropriate land use commission may require the posting of a bond or other acceptable security to assure the proper construction and functioning of all proposed drainage control measures. Such security shall be posted by the applicant with the Town Treasurer prior to initiation of any construction. The amount of security shall cover the completion of all work proposed by the applicant, including sufficient sediment and erosion control measures.
- B. The appropriate commission may, upon written notification to the Town Treasurer, order the release in whole or in part of the security required by this Ordinance.

## Section 4. Inland Wetlands Permit

When drainage structures and/or discharges are proposed within or adjacent to wetlands or watercourses, the applicant shall refer the proposed activity to the Inland Wetlands and Watercourses Commission for classification and determination as to need for a permit, pursuant to Connecticut General Statutes, Sections 22a-36 to 22a-45, as amended. If a permit is required, it shall be obtained prior to final approval of an application by the Planning and/or Zoning Commissions, and before any work or activity can be initiated.



PART 7. SEVERABILITY / EFFECTIVE DATE

Section 1. Severability

If any provision of this Ordinance shall be held invalid by a court having competent jurisdiction, such invalidity shall not affect any of the other provisions of this Ordinance that can be given effect without the invalid provision and for this purpose the provisions of this Ordinance are hereby declared severable.

Section 2. Effective Date

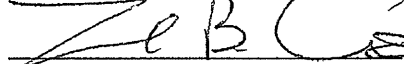
Adopted: February 22, 1995

Effective Date: March 1, 1995

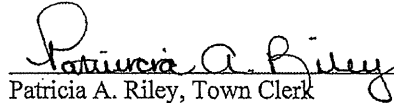
Renumbered by the Ledyard Town Council on: September 25, 2019



Linda C. Davis, Chairman



Fred B. Allyn, III, Mayor



Patricia A. Riley, Town Clerk

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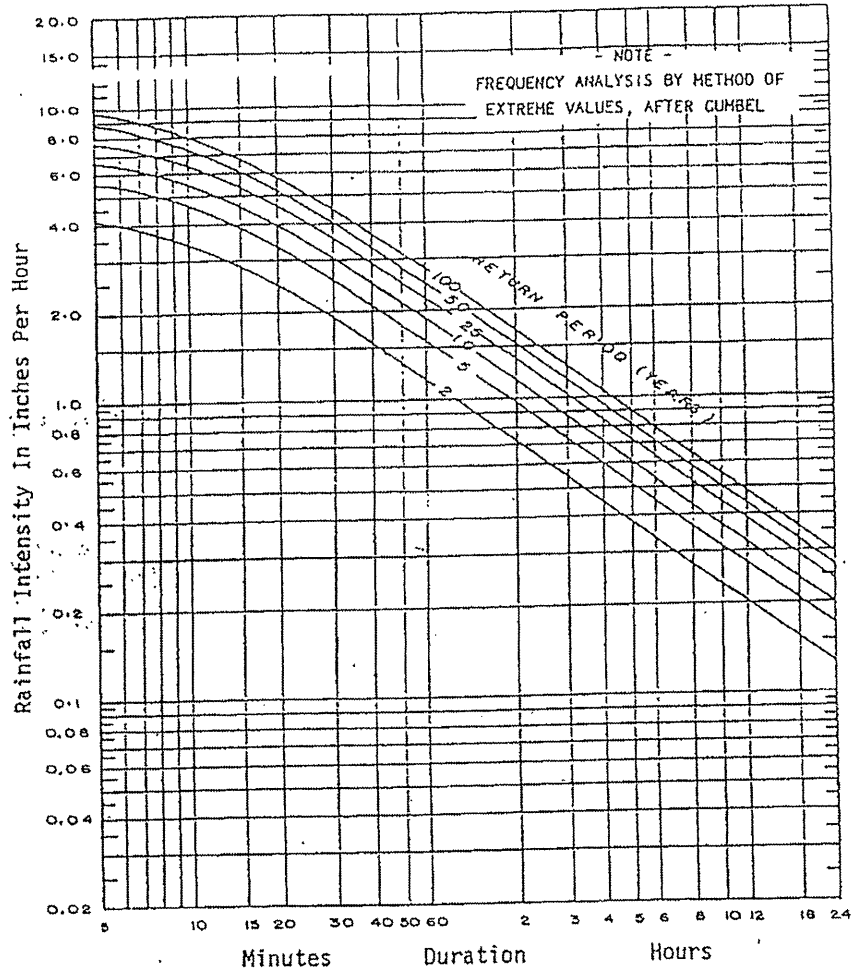
Revisions: Ordinance #44 "*Ordinance Regulating the Management of Stormwater Runoff*"  
Adopted: October 26, 1988; Ordinance #44 "*An Ordinance Regulating the Management of Stormwater Runoff*" Adopted: February 22, 1995.

History: The Twenty-fourth Town Council (2017- 2019) Ordinance Update Initiative:  
Renumbered Ordinance #44 "*An Ordinance Regulating the Management of Stormwater Runoff*"  
to Ordinance #300-016.

2019: Reformatted document. No substantive changes were made to the ordinance.

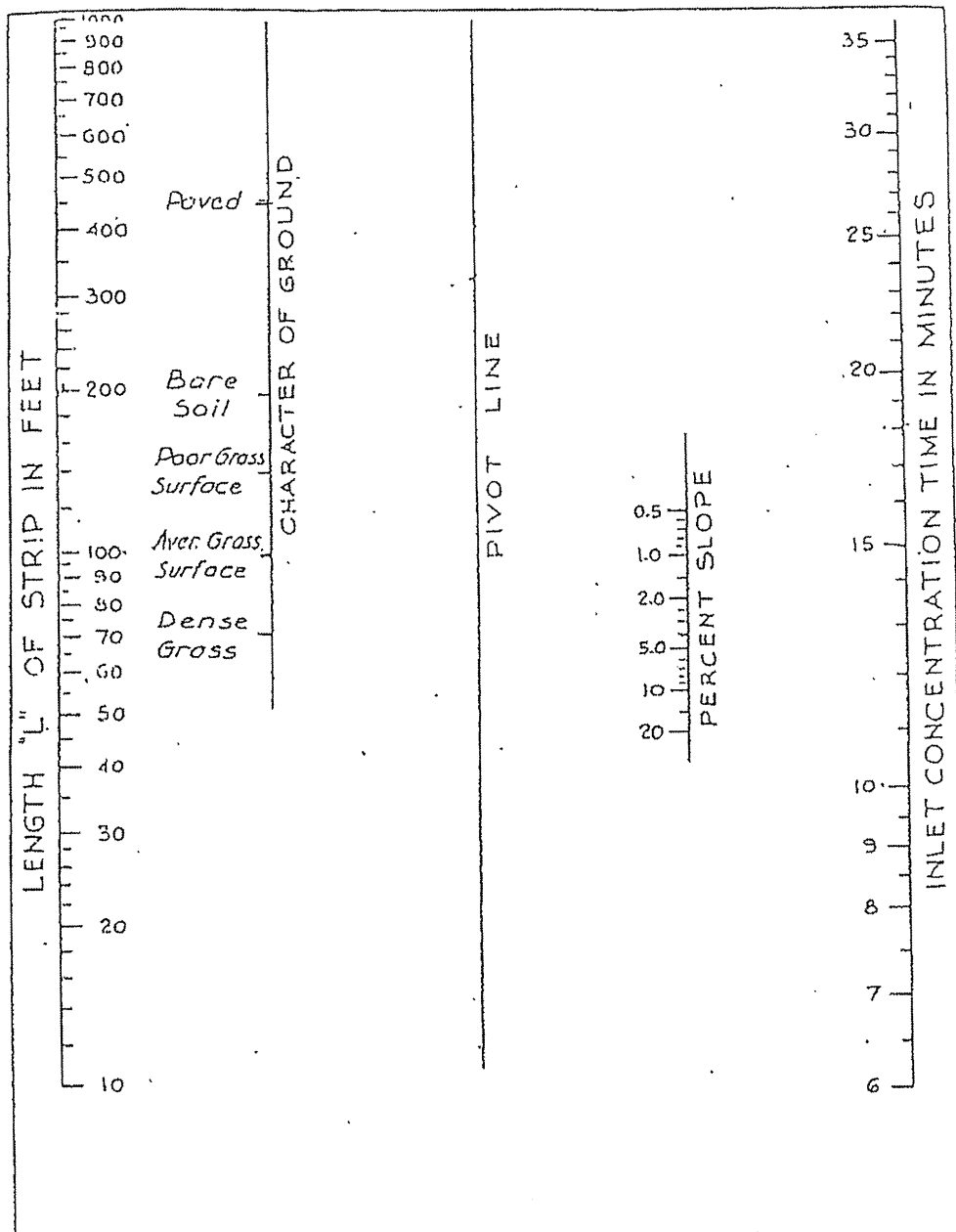
Appendix

NEW HAVEN, CONNECTICUT  
1905-1951



Source: Connecticut Department of Transportation, Wethersfield, Connecticut

Figure 1: Rainfall Frequency-Duration-Intensity Chart



Source: Design-Data Book for Civil Engineers,  
Elwyn E. Seelye, 3<sup>rd</sup> Edition

Figure 2: Overland Flow Time of Concentration

Chart 1

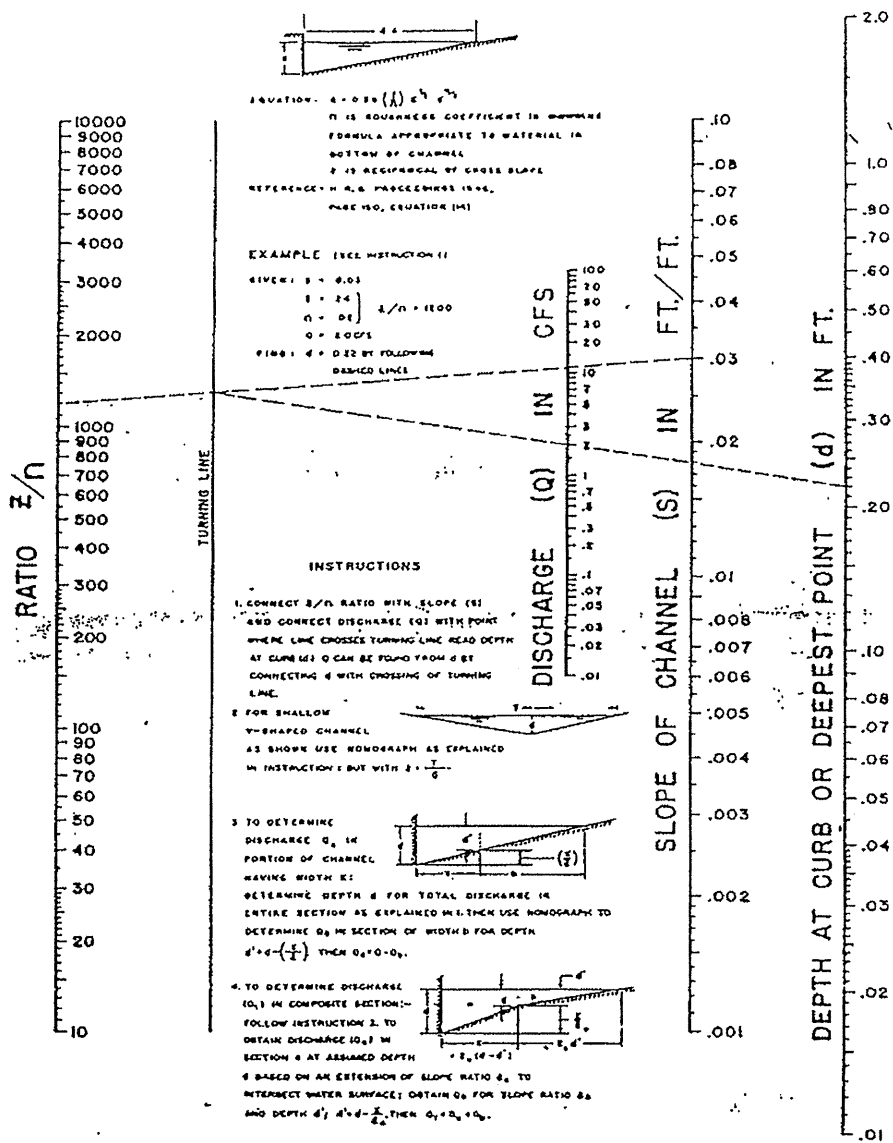


Figure 3: Storm Flow Depth at Gutter

It often is desirable to develop a composite runoff coefficient based on the percentages of different types of surfaces in the drainage area. This procedure often is applied to typical "sample" blocks as a guide to selection of reasonable values of the coefficient for an entire area. Coefficients with respect to surface type currently in use are:

<u>Character of Surface</u>	<u>Runoff Coefficient</u>
<u>Pavement</u>	
Asphaltic and Concrete .....	0.70 to 0.95
Brick.....	0.70 to 0.85
Roofs.....	0.75 to 0.95
<u>Lawns, sandy soil</u>	
Flat, 2 percent.....	0.05 to 0.10
Average, 2 to 7 percent.....	0.15 to 0.20
Steep, 7 percent.....	0.15 to 0.20
<u>Lawns, heavy soil</u>	
Flat, 2 percent.....	0.13 to 0.17
Average, 2 to 7 percent.....	0.18 to 0.22
Steep, 7 percent.....	0.25 to 0.35

The range of coefficients, classified with respect to the general character of the tributary area reported in use, is:

<u>Description of Area</u>	<u>Runoff Coefficients</u>
<u>Business</u>	
Downtown.....	0.70 to 0.95
Neighborhood.....	0.50 to 0.70
<u>Residential</u>	
Single-family.....	0.30 to 0.50
Multi-units, detached.....	0.40 to 0.60
Multi-units, attached.....	0.60 to 0.75
Residential (suburban).....	0.25 to 0.40
Apartment.....	0.50 to 0/70
<u>Industrial</u>	
Light.....	0.50 to 0.80
Heavy.....	0.60 to 0.90
Parks, Cemeteries.....	0.10 to 0.25
Playgrounds.....	0.20 to 0.35
Railroad yard.....	0.20 to 0.35
Unimproved.....	0.10 to 0.30

NOTE: The coefficients in these two tabulations are applicable for storms of 5 – 10 year frequencies. Less frequent, higher intensity storms will require the use of higher coefficients because infiltration and other losses have a proportionally smaller effect on runoff. The coefficients occur when the ground surface is frozen.

SOURCE: Design and Construction of Sanitary and Storm Sewers, WPCF Manual of Practice No. 9 and ASCE Manual of Engineering Practice No. 37.

Table 1: Runoff Coefficients