General

The design of grass lined waterways is based on the erodibility of the soil and the type of vegetal cover expected within the channel cross section.

Soil erodibility is a descriptive feature based on the soil's allowable effective stress which is defined as the maximum hydraulic stress that may be applied directly to the soil without the occurrence of unacceptable erosion.

For non-cohesive soils including those classified as GW, GP, SW, and SP in the Unified Soil Classification System, allowable effective stress is determined by the grain size d_{75} in inches. For cohesive soils including those classified as GM, SC, GC, SM, CH, CL, MH, ML, OH, and OL, plasticity index and void ratio are needed.

From information contained in the Web Soil Survey, soil series found in New Jersey have been categorized for soil erodibility, see Table NJ7-1. The allowable effective stress used in design of a waterway should be based on this erodibility classification unless an on-site investigation is performed. The allowable effective stress for an easily eroded soil is 0.02 pounds per square foot and for an erodible soil the value is 0.03 pounds per square foot.

Vegetal cover decreases the effective stress exerted by the flow of water in the waterway channel. The vegetal cover factor describes the ability of the vegetal cover to reduce the maximum hydraulic stress on the soil and is determined by the type and quality of the vegetation. Dense sod forming grasses provide better protection and therefore have a higher cover factor than sparser bunch type grasses. Most agricultural waterways in New Jersey are designed for a grass mixture providing good, uniform coverage and assuming C and D retardance for capacity and stability design, respectively.

The establishment period for the vegetal cover is critical to the successful installation of a grassed waterway. While the waterway is designed assuming a well established vegetation, that is not the case immediately following seeding and through perhaps the first growing season. During this period, flow in the waterway will exert a greater effective stress on the soil so measures are necessary to prevent erosion and damage.

Ideally, flow should be diverted from the waterway until grass can become established. However, because the waterway is likely to take some flow even with runoff from future diversions or terraces excluded, a mulch cover is generally required. The establishment method including the mulch material or product, and degree of anchoring should be selected based on the assumed cover factor, see Table NJ7-2. In general, the higher the vegetal cover factor, the greater the role vegetation will play in ensuring the stability of the waterway, and, therefore, more important is the need for a high quality well anchored mulch during the establishment period.

Table NJ7-1:
Soil Erodibility Classification for Design of Grassed Waterways

Soil Series	Erodibility Classification
Abbottstown	Easily Eroded
Adelphia	Easily Eroded
Adrian	1
Alden	Easily Eroded
Alloway	Erodible
Amwell	Easily Eroded
Annandale	Easily Eroded
Appoquinimink	1
Arendtsville	Erodible
Arnot	Erodible
Askecksy	Easily Eroded
Atherton	Easily Eroded
Athol	Easily Eroded
Atsion	Easily Eroded
Aura	Easily Eroded
Bartley[2]	Easily Eroded
Beaches	Easily Eroded
Bedington	Easily Eroded
Berks[2]	Easily Eroded
Berryland	Easily Eroded
Bertie	Easily Eroded
Biddeford	1
Bigapple	Easily Eroded
Birdsboro[2]	Easily Eroded
Boonton	Easily Eroded
Bowmansville	Easily Eroded
Braceville	Easily Eroded
Broadkill	1
Bucks	Easily Eroded
Buddtown	Easily Eroded
Califon	Easily Eroded
Carlisle	1
Catden	1
Chalfont	Easily Eroded
Charlton	Easily Eroded
Chatfield	Easily Eroded
Chenango	Easily Eroded
Chicone	Easily Eroded Erodible
Chippewa	Easily Eroded
Cokesbury	Easily Eroded
Colemantown	Easily Eroded
Collington	Easily Eroded
Colonie	Easily Eroded
Colts Neck	Easily Eroded
Croton	Erodible
Delaware	Easily Eroded
Dennisville	Easily Eroded
Deptford	Easily Eroded
Donlonton	Easily Eroded
Downer	Easily Eroded
Doylestown	Easily Eroded
Duffield	Erodible
Dunellen	Easily Eroded
Elkton	Erodible
Ellington variant	Easily Eroded
Evesboro	Easily Eroded
Fallsington	Easily Eroded
Farmington	Easily Eroded
Fort Mott	Easily Eroded
Fredon	Easily Eroded
Freehold[2]	Easily Eroded
Galestown	Easily Eroded
Galloway	Easily Eroded
Galway	Easily Eroded
Gladstone	Easily Eroded
Glassboro	Easily Eroded
Great Piece	Easily Eroded
Haledon	Easily Eroded
Halsey	Easily Eroded
Hammonton	Easily Eroded
Hasbrouck	Easily Eroded
Hazen	Easily Eroded
Hazleton	Easily Eroded
Hibernia	Easily Eroded
Hinckley	Easily Eroded
Hollis	Easily Eroded
Holmdel	Easily Eroded
Holyoke	Easily Eroded
Hooksan	Easily Eroded
Hoosic	Easily Eroded
Horseneck	Easily Eroded

Soil Series	Erodibility Classification
Howell	Easily Eroded
Ingleside	Easily Eroded
Jade Run	Easily Eroded
Keansburg	Easily Eroded
Keyport[2]	Easily Eroded
Klej	Easily Eroded
Klinesville	Easily Eroded
Knickerbocker	Easily Eroded
Kresson[2]	Easily Eroded
Lackawanna	Easily Eroded
Lakehurst	Easily Eroded
Lakewood	Easily Eroded
Lamington	Easily Eroded
Lansdale	Easily Eroded
Lansdowne[2]	Easily Eroded
Lawrenceville	Easily Eroded
Legore[2]	Easily Eroded
Lehigh	Easily Eroded
Lenni	Easily Eroded
Lenoir	Easliy Eroded
Lordstown	Erodible
Manahawkin	1
Manlius	Easily Eroded
Mannington	1
Marlton[2]	Easily Eroded
Matapeake	Easily Eroded
Matawan	Easily Eroded
Mattapex	Easily Eroded
Meckesville	Easily Eroded
Minoa	Easily Eroded
Mispillion	1
Mount Lucas[2]	Easily Eroded
Mullica	Easily Eroded
Muttontown	Easily Eroded
Nanticoke	1
Nassau	Easily Eroded
Natchaug	1
Neshaminy[2]	Easily Eroded
Netcong	Easily Eroded
Nixon	Easily Eroded
Norton	Easily Eroded
Norwich	Easily Eroded
Oquaga	Easily Eroded
Othello	Easily Eroded
Otisville	Easily Eroded
Palms	1
Parker	Easily Eroded
Parsippany	Erodible
Pascack	Easily Eroded
Passaic	Erodible
Pattenburg	Easily Eroded
Pawcatuck	1
Paxton	Easily Eroded
Peckmantown	Easily Eroded
Pedricktown	Easily Eroded
Pemberton	Easily Eroded
Penn	Easily Eroded
Phalanx	Easily Eroded
Plummer	Easily Eroded
Pompton	Easily Eroded
Pope	Easily Eroded
Portsmouth variant	Erodible
Preakness	Easily Eroded
Quakerbridge	Easily Eroded
Quakertown	Easily Eroded
Raritan	Easily Eroded
Readington	Easily Eroded
Reaville	Easily Eroded
Ridgebury	Easily Eroded
Rikers	Easily Eroded
Riverhead	Easily Eroded
Rockaway	Easily Eroded
Rowland	Easily Eroded
Royce	Easily Eroded
Sassafras	Easily Eroded
Scio	Easily Eroded
Sharptown	Easily Eroded
Shrewsbury	Easily Eroded
Swainton	Easily Eroded
Swartswood	Easily Eroded
Swedesboro	Easily Eroded
Tinton	Easily Eroded
Tioga	Easily Eroded
Transquaking	1
Trussum	Easily Eroded
Tunkhannock	Easily Eroded
Turbotville	Erodible
Unadilla	Easily Eroded
Venango	Easily Eroded
Wallkill	1
Wallpack	Easily Eroded

Soil Series	Erodibility Classification	Soil Series	Erodibility Classification
Washington	Erodible	Whippany	Erodible
Wassaic	Easily Eroded	Whitman	Easily Eroded
Watchung	Erodible	Willette	1
Weeksville	Easily Eroded	Woodmansie	Easily Eroded
Wellsboro	Easily Eroded	Woodstown	Easily Eroded
Westphalia	Easily Eroded	Wurtsboro	Easily Eroded
Wethersfield	Easily Eroded	Yalesville[2]	Easily Eroded

1. Drainage measures are more commonly applied to this series.

2. Some mapping units within this soil series may be classified as "Erodible". Refer to the Web Soil Survey for specific mapping unit descriptions at the design location or conduct an on-site investigation to verify soil properties.

Table NJ 7-2 Establishment method for grass lined channels

C (cover factor)	Grass type and Cover Condition	Establishment Method
C > 0.75 0.87	Sod-type grass, good cover	Establish waterway with sod or apply anchored mulch blanket to seeded channel
0.5 ≤ C ≤ 0.75 0.75 0.50 0.50	Grass mixture, good cover Grass mixture, fair cover Bunch-type grass, good cover	Anchor mulch to seeded channel by disking or by anchored netting
C < 0.5 0.37 0.40	Grass mixture, poor cover Bunch-type grass, fair cover	Apply mulch or hydromulch to seeded channel

Refer to EFH Chapter 7, Table 7-3 for cover factors for various grasses in good uniform cover condition