# Erosion and Sediment Control


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**Grassed Waterways**
A grassed waterway is a shaped or constructed channel that is vegetated and graded with suitable grass and legumes. These waterways help to control the disposal of runoff and also prevent gullies from forming. Grassed waterways can be implemented where there is additional runoff capacity and to filter runoff by absorbing some of the chemicals and nutrients contained in surface water runoff. Grassed waterways can also provide cover for small birds and animals as well as greatly improve surface water quality. Unfortunately, grassed waterways have little effect on groundwater quality.

Before implementing a conservation buffer system, the capacity must first be considered so that the waterway is capable of confining the highest amount of rainfall and runoff expected for the particular area. The minimum capacity needed should ensure the removal of water before damage to crops occurs. The velocity of water flow should be determined by soil type and texture and the density of the types of grass and legumes which will be used in constructing the system.

**To establish a grassed waterway, consider the following:**

- The amount of expected runoff that will be traveling downstream through the slope of the land where the channel is located, the velocity of the traveling water and the type of grass and legume mix.
- The maintenance and amount of labor required to keep the system functioning properly.
- Preventing compaction and pollution from machinery implements and sprayers by careful use of farm equipment when crossing a grassed waterway.
- Fertilizing and mowing of grass if/when needed.
- Avoid planting crop end rows near the edge of the waterway to prevent formation of gullies.
- When tilling, maintain a suitable width between tilled area and edges of waterway to enable the use of soil applied pesticides on crops without getting close to the waterway.
- Landscape conditions, such as depth of water table and location of bedrock layer in the soil.
- Outlets must be able to carry the maximum amount of water expected for that are and have an erosion control mechanism. Mechanisms include; stone center lined or concrete lined outlets.
- For a permanent vegetation cover, the area must be seeded densely before winter to ensure proper establishment. It's best to use herbicide resistant grasses to prevent pollution from soil persistent herbicides such as triazines, commonly used to control grass weeds.

Contact NRCS for engineering components, such as depth and width of waterway.

**Filter Strips**
Filter strips are strips of vegetation that are planted and used as a permanent cover. Filter strips may be trees, grasses or shrubs that filter run-off and remove sediment, fertilizer chemicals and pesticides before they come in to contact with nearby water resources. The run-off is collected and buffered in the vegetation which allows less contaminated water to enter the water resource. Filter strips can also provide habitat for birds and small animals.

**To ensure successful filter strips, consider the following**:

- Soil conservation methods such as conservation tillage or cover crops, must be installed over the filter strip vegetation.
- The type of vegetation used must be suitable for the soil type in order to be successful at buffering the run-off.
- Topography is directly related to the successful use of filter strips. Filter strips are most successful on land with slopes of five percent or less. For other slope components contact NRCS.
- Livestock should not graze near filter strips.
- Close mowing will reduce the effectiveness of filter strips.

General maintenance is low, but may need adjustment depending on local conditions. Contact NRCS for specifications.

**Diversions**
Diversions are earthen embankments that direct and divert run-off water containing harmful chemicals. A diversion should be located down slope of the farm where wetlands and water tables are located however, it can also be located in the middle of sloping land to divert and catch run-off before it reaches farmed lowlands. The run-off water can be collected in a collection facility where it can be treated and recycled. A diversion contains vegetation that acts as a buffering agent to reduce the amount of run-off subject to water contamination as well as reducing soil erosion by catching this run-off.

**To ensure successful diversions, consider the following**:

- Diversions should not be substituted for terraces in order to control erosion.
- Diversions should be constructed based on the average rainfall in the particular area. However, it should be able to carry rain that is produced from a 10 year, 24 hour storm.
- Diversions must have an outlet where water can be collected and stored for treatment. A grassed waterway, a grade stabilization structure or underground outlet can be used.
- Grassed waterways or other vegetative outlets should be constructed before the diversion is built. Outlets should be kept clear of debris.
- Diversions should not be constructed in areas of high sediment production without other erosion control measures.
- Vegetative strips can accompany the diversion to aid in protection, but are not necessary.
- Keep burrowing animals out of diversion area. This can lead to the preferential flow of run-off water through channels allowing it to escape to lowland areas.

**Farm Terrace**
A terrace is an earthen embankment around a sloping hillside that stores, stops and guides run-off water safely off a field and away from lowlands. Following the contour of the slope, farm terraces break up the land into shorter slopes. There are two kinds of terraces, a storage terrace which, collects water and stores it until it can infiltrate into the ground or until it is suitable for release from an outlet, and gradient terraces which, channel run-off water and carry it to another outlet such as a grassed waterway.

**To ensure successful farm terraces, consider the following**:

- Implementation of other conservation practices must be used with farm terraces to prevent sedimentation.

- Chisel parts of the terrace that will be farmed to reduce soil compaction. This will decrease permeability and prevent run-off from infiltrating the soil.
- Avoid farming too close to the intakes of the terrace.
- Repair sections of the terrace as needed to prevent continued erosion or excessive settlement/sediment.

Contact NRCS for design components.

**Water and Sediment Control Basin**
A water and sediment control basin is a deep earthen embankment used in place of a terrace. Basins are used where terraces can't be constructed. The basin is built across an area with that has a depression in the land and a concentrated run-off flow. The basin prevents the run-off from polluting the land below by tapping water and sediment. In addition to improving water quality, basins reduce gully erosion by controlling water flow in a drainage area. The grass cover of the basin can also provide vegetative cover for small animals.
**To ensure successful basins, consider the following**:

- The basin must be large enough to control run-off from a 10 year storm without overflowing.
- Will the basin be part of an existing terrace system?
- The slope of the site.
- Outlets must be installed.
- Use fill free of sod, roots, frozen material and stones larger than 6 inches in diameter. The basin should have a correct soil moisture content to ensure proper compaction.
- Re-seed and maintain vegetative cover as needed.
- Check the basin after large storms to make any necessary repairs.

Contact NRCS for construction dimensions and specifications. Spacing for water and sediment control basins depends on the land slope, tillage and management system.

**Contour Farming**
Contour farming involves performing tillage operations across a slope to prevent run-off to lower land. Crop row ridges built by tilling and/or planting on the contour create hundreds of small dams which slow water flow. Contour farming improves surface water quality by reducing run-off and reduces soil erosion by as much as 50 percent. Contour farming can increase soil water infiltration rates which promotes better water quality. Contour farming should be used along with sustainable pest management practices. These combined practices can help to reduce the loss of pesticide chemicals in runoff water.

**To ensure successful contour farming, consider the following**:

- Frequent maintenance of ridges and furrows during times of high erosion and runoff is necessary.
- Is more than one key contour line needed because of steep or irregular slopes?
- Are terraces or strip cropping necessary for steeper slopes?
- Are borders needed to replace end rows in the contour system to control sheet and till erosion?
- Contour key line grades should not exceed two percent except within 100 feet of an outlet, where the grade can be three percent.
- Maintenance of contour markers will ensure successful farming on the contours.
- Grassed waterways in addition to contour farming, can prevent gully erosion. Contoured rows should enter the grassed area of waterways on the level, but should direct water into the grass. A narrow, permanent strip of grass along each key contour line should be established to avoid laying out new key contour lines each year.
- Contour farming is less effective in preventing soil erosion on steeper or longer slopes.

Contact local NRCS for technical assistance and any other questions.

**Contour Buffer Strip**
Contour buffer strips are strips of grass or legumes grown in a contoured field, which help trap sediment and nutrients. A series of grass strips are placed across the slope on a contour. The alternating strips of grass or other permanent vegetation slow runoff flow, trap sediment from the crop strips above and increase water infiltration. Because the buffer strip is established on the contour, runoff flows evenly across the entire surface of the grass strip, reducing sheet and till erosion. Vegetation provides cover and habitat for small birds and animals.

**To ensure successful contour buffer strips, consider the following**:

- Do you want parallel crop strips or parallel buffer strips?
- Will additional conservation measures such as crop residue management be installed or to help reduce siltation of grass strips?
- Do the planned acres in row crops meet your production objectives?
- Buffer strips must be at least 15 feet wide and make up 20 to 30 percent of the slope. You should delay mowing until July 15$^{th}$ to help ground-nesting birds.
- Either crop strips or grass strips may be parallel. Parallel crop strips are easier to farm with no point rows, but results in less of the slope in row crops.
- Methods to control weeds and brush in grass filter strips.
- Vegetation should be kept tall in spring and early summer to help slow runoff flow.
- Fertilize as needed.
- The buffer strip may be moved up or down the slope to help re-establish vegetation.

Contact NRCS as needed and be sure to check local conditions.

**Soil Conservation Practices**
Conservation tillage systems manage crop residue on the soil surface with little to no tillage. The crop residues may be placed or formed in any way pertaining to the system being used. These conservation tillage systems used include at least 30 percent residue as a groundcover to reduce soil erosion. The main objectives of conservation tillage include: 1) controlling soil erosion by wind and water with plant residue left on the surface, 2) conserving soil moisture, 3) conserving energy by reducing the use of farm machinery and 4) the increase of organic matter. The six systems of conservation tillage are no-till, ridge plant, strip till, disk and chisel till, and eco fallow (chem fallow).

**No till** agriculture is the ultimate conservation tillage system. No till includes planting and preparing a single strip, leaving the preceding crops residue on the surface and minimum use of herbicides for weed control. Coulters are used to slice through the residue in order to reduce disturbance.

**Advantages of no till agriculture include:**

- Reduces erosion and increases soil moisture levels.
- Uses less farm equipment and reduces labor and fuel costs.
- The reduced plowing helps areas where tilled soil becomes muddy after rainfall.

**Ridge plant**, sometimes called till plant, allows planting of a crop with little or no pre-tillage on ridges formed from preceding crop seasons. Ridges are 30 to 40 inches apart and this system uses a disk cultivator to control weeds between rows.

**Advantages of ridge plant agriculture include:**

- Reduces erosion.
- Reduces dependency on herbicides for weed control.
- Fields with ridges warm up faster in the spring.
- Ridges conserve moisture.

**Strip tillage**, otherwise known as till plant flat, means pushing away narrow strips of residue to plant seed.

**Advantages of strip tillage include**:

- Provides good seed to soil contact.
- Increased soil moisture.

**Disk and chisel systems** are used in the fall and spring, or both. The equipment is made to leave most of the residue on the topsoil.

**Advantages of the disk and chisel system include**:

- Better incorporation of herbicides and fungicides in the soil.
- Soil warms faster with this system.

**Eco fallow or chem fallow** requires the use of a chisel plow and an air seeder drill. Weeds are controlled by chemicals and tillage. This system is commonly used in wheat production.

**Advantages of Eco or chem fallow include:**

- Stubble deflects wind drifts in the winter and can prevent damage from snow drifting.
- Increased soil moisture.

**Contour Strip Cropping and Cover Crops**

Contour strip cropping can be described as crop rotation and contouring combined. Equal width strips of corn and soybeans are planted on the contour and alternated with strips of oats, grasses or legumes. The crops should be formed and arranged so that strips of meadows or small grains alternate with strips of row crops. The meadow planting slows runoff, reduces erosion and increases infiltration.

**Advantages include:**

- Reduced soil erosion thereby protecting water quality.
- Reduced fertilizer costs as a result of legumes adding nitrogen to the soil.

Cover crops are close growing crops that temporarily protect soil from erosion when residues are not adequate. Cover crops include cereal rye, oats, clover, hairy vetch and winter wheat. They are planted to protect the ground from wind and water erosion. Before planting cover crops, be sure you have a seeding method that will not harm standing crops and adequate soil conservation methods are in place. Cover crops are commonly used when crops such as soybeans and corn silage do not produce enough residue to protect the soil from erosion.

**Advantages include:**

- Cover crops keep ground cover and warm soil.
- Increased organic matter and nutrients.
- Improves soil and reduces weed competition.

**Crop Residue Management**

Crop residue management involves leaving last year's crop residue on the surface before and during planting operations to provide cover for the soil at a critical time of the year. The residue is left on the surface by reducing tillage operations and turning the soil less. Pieces of crop residue shield soil particles from rain and wind until plants can produce a protective canopy. This is beneficial because ground cover prevents soil erosion and protects water quality. Residue improves soil and adds organic matter to the soil as it decomposes. Less tillage reduces soil compaction as well as time, energy and labor.

**To ensure successful crop residue management, consider the following**:

- Does your crop produce enough residue?

- Planning for residue cover begins at harvest. Ensure ample residues are spread evenly over the field.
- Reduce the number of unnecessary tillage passes. Every tillage pass buries more crop residue.
- Use straight points and sweeps on chisel plows instead of twisted points. Twisted points can bury 20 percent more residue.
- Set tillage tools to work at shallower levels and reduce speed of operation.

To measure crop residues, estimate residue levels by using a line that has 50 or 100 equally divided marks. Stretch the line diagonally across crop rows. Count the number of marks that have residue under the leading edge when looking from directly above the mark. Walk the entire length of the rope. The total number of marks with residue under them is the percent residue cover. If the line has only 50 marks, multiply your count by two. Repeat this three to five times in a representative area of the field. Contact NRCS for technical advice.

**Pasture Planting**
Pasture planting is planting grass and legumes to reduce soil erosion and improve production. This is accomplished by drilling or broadcasting adapted grass or legumes into a low-producing pasture or a steep, eroding cropland field. This is beneficial because heavy grass cover slows water flow thereby reducing soil erosion. Good pastures protect water quality by filtering runoff water and increasing infiltration. Lush pastures will also give cover and habitat for wildlife. In addition, as plants recycle and roots die, organic matter in the soil is improved.

**To ensure successful pasture planting, consider the following**:
- Choose species that are appropriate for the soil composition, that will help reduce the use of pesticides and herbicides and will meet the needs of your livestock.
- Do not mix warm and cool season grasses in the same pasture.
- Selected grass and legumes should be compatible with the planned management.
- When only two grass species are selected, they should make up equal proportions of the seeding mixture.
- Add legumes to improve forage quality and extend the grazing season.
- Drill seed uniformly to a depth of ¼ to ½ inch.
- Leave residues and till on the contour.
- If erosion is a problem, leave at least 30 percent residue cover after planting.
- Plant a nurse crop on steeper slopes or where weeds are a problem to get a good stand. NRCS recommends seeding oats at 1 to 1 ½ bu./acre as a nurse crop.
- Graze or closely chop pastures before reseeding and apply a burn down herbicide.
- For Maintenance, wait until pasture is well established to graze and mow weeds when they reach a height of 6-8 inches. Control persistent weeds with herbicides and fertilize as needed.

Contact NRCS for more information.