agriculture

SUMMARY SHEET

category: WATER QUALITY

sub-category: AGRICULTURE

BMP: CONSERVATION TILLAGE

OBJECTIVE:

To protect the soil from erosion; to maintain the quality of the runoff water, thereby protecting water quality; to help maintain or develop good soil tilth and desirable water infiltration rate.

WHERE APPLICABLE:

On cropland and on certain other lands where vegetation is grown for harvest.

PROS

1) Non-inversion tillage retains protective amounts of residue mulch on the surface throughout the year. Examples are: No-tillage, Strip tillage, stubble mulching, and other types of non-inversion tillage.
2) Less labor and machine use is required when residue is left on the soil surface instead of being turned under.

CONS

1) May require additional care in cultivation and harvesting which may necessitate a departure from practices to which the operator has become accustomed.

IMPLEMENTATION CONSIDERATIONS

Planning

A. Heavy surface mulches should be avoided on poorly-drained soils. Avoid limited tillage systems for fields infested with difficult to control perennial weeds. Light tillage may be necessary where heavy residues prevent adequate weed control with herbicides. Wildlife needs are important considerations as well.

No-Tillage

A. Open Fields: No-Tillage is a method of planting in prior crop residue, in perennial sod, or in winter cover crops without plowing. Herbicides are used to kill existing vegetation prior to planting or at the time of planting. The only solid disturbance is in a seed row zone caused by planting equipment. Limit to clay loam, medium-textured, and coarse-textured soils. Do not use on flat, poorly-drained soils. Not recommended for fields which are infested with hard to control perennial species such as Bermuda-grass.

B. Orchards, Vineyards, and Small Fruit Areas:
   1. Weeds are controlled with recommended herbicides, reducing competition to an acceptable level. Obtain herbicide recommendations from a trained horticulturist or weed specialist.
   2. Weed competition may be controlled by mowing.
   3. The only cultural operation performed is to lightly incorporate lime and fertilizer without destroying sod.

a

Other Forms of No-Tillage

A. Strip tillage: A strip of several inches wide is tilled for the row zone, leaving an untilled strip between rows where the vegetation is controlled or suppressed with herbicides. This tillage method may be used on any soil suitable for cultivation. Not recommended for fields infested with hard to control weeds such as Bermuda grass. For orchards, vineyards, and small fruit areas, light tillage near tree rows may be used to reduce weed competition near the trees (vines), leaving a protective cover of vegetation between the rows for soil protection.

Other Forms Of Non-Inversion Tillage

A. Open fields: Deep off-set disk, disk plow, chisel plow, disk harrow, springtooth cultivation and other similar methods can be used to stir the soil without completely inverting it. Till-planting can be used to plant the new crop over the row of the previous crop following surface residue management. However, crop residues are more effective in protecting the soil from erosion when left on the surface.
B. Orchards, vineyards and small fruit areas: Cultural operations are limited to two cultivations or disking, one in early spring and the second after the cover crop seed has matured or for seedbed preparation for the next cover crop.

Amounts of Crop Residue Required On Surface

A. For protection from water erosion: Amount of crop residue to be left on soil surface was considered in computing crop and management factors for New Jersey.
B. Crop damage by windblown soil particles is the main concern from wind erosion in New Jersey. The use of surface residues is one way to keep crop damage to an acceptable level. Other benefits, such as road safety and health, accrue to control of windblown soil.

Methods for Use For Fall Tillage (in order of decreasing desirability)

No-tillage, grain crop residues overseeded with winter cover crop.
No-tillage, grain crop
No-tillage, other crops
Fall chisel or disk, high residue crops
Fall chisel or disk, low residue crops
Fall turnplow, high residues
Fall turnplow, low or no residues

Methods for Use For Spring Tillage (in order of decreasing desirability)

No-tillage planting (on adapted soils) in cover crop
No-tillage planting in heavy corn residue
Spring chisel or disk, high residue
Spring chisel or disk, low residue
Spring turnplow, high residues
Spring turnplow, low residues
Except for no-tillage into adequate amounts of crop residues, spring tillage will be used in preference to fall tillage where feasible.

For Additional Information

1. USDA, SCS. Engineering Field Manual for Conservation Practices. Washington GPO, continually updated.
2. The Sussex County Soil Conservation District, Route 206, Andover Township, R.D. 7, Box 13, Newton, N.J. 07860 (201) 383-7315.
3. Sussex County Cooperative Extension Service, Rt. 206, Andover Twp., R.D. 7, Box 13, Newton, N.J. 07860 (201) 383-3800.

b

SUMMARY SHEET

category: WATER QUALITY

sub-category: AGRICULTURE

BMP: CONSERVATION CROPPING

OBJECTIVE:

To improve or maintain good physical condition of the soil; protect the soil during periods of erosion; control weeds, insects and diseases; and above all, to help maintain or improve water quality.

WHERE APPLICABLE:

On all cropland and on certain recreation and wildlife areas.

PROS

1. Can be effective in attaining sound soil and water conservation by coordinating the physical, economic, and human resources of the operation.
2. Can also realize a positive economic return for the owner or operator.

CONS

1. May require a departure from operating practices to which the operator has become accustomed, even though they may be less effective.

IMPLEMENTATION CONSIDERATIONS

Establishment Procedure

A. Establish field diversions based on physical features, soil types, or other similar criteria.
B. Provide for the desired acreage of crops.
C. Select a sequence of crops and a combination of cultural and management practices or measures which is within the allowable soil loss (T value for the principal soil type).
D. Specify the number of years for each crop in the rotation and planned field arrangement.

Management

A. Fertility and pH are maintained at a level that will result in at least average yields based on soil tests. If a soil test is not used, follow recommendation of a current copy of the publication, "Fertilizer Recommendations for Delaware, Maryland, and New Jersey Farms" or past cropping history.
B. Current Extension Service recommendations are used to control insects, disease, and weeds at feasible levels.

a

Costs will vary depending on the nature of the conservation cropping plan, but should not exceed that of normal operations. In fact, with the greater degree of coordination of all farm resources, costs should be significantly reduced with the elimination of waste.

Standard crop maintenance procedures should be continued.

For Additional Information

1. USDA, SCS. Engineering Field Manual for Conservation Practices. Washington: GPO, continually updated.
2. The Sussex County Soil Conservation District, Route 206, Andover Township, R.D. 7, Box 13, Newton, N.J. 07860 (201) 383-7315.
3. The Sussex County Extension Service, Route 206, Andover Township, R.D. 7, Box 13, Newton, N.J. 07860 (201) 383-3800.

b

SUMMARY SHEET

category: WATER QUALITY

sub-category: AGRICULTURE

BMP: WASTE STORAGE

OBJECTIVE

Waste storage structures serve as components of a waste management system. Waste storage structures temporarily store liquid, slurry, or solid livestock manure or other agricultural wastes until treated, utilized, recycled, or otherwise disposed of in a manner reducing pollution

WHERE APPLICABLE

This practice applies where: 1) waste generated by agricultural production or processing needs temporary storage; 2) structures can be located near the source of the waste without polluting air or water resources; 3) soils and topography are suitable for construction.

PROS

1. Storage of agricultural wastes is a necessary component of waste management. Its advantage is that it allows for the proper dissemination of waste material back into the ground without overloading water or plant assimilative capacities.

CONS

1. The only disadvantage may be the initial capital cost outlay for construction of the structures. Attention should be given to the possibility of rehabilitating or converting existing structures to meet the specifications of this standard.

IMPLEMENTATION CONSIDERATIONS

Location

Waste storage structures should be located as near the source of waste as practicable. They should be located where prevailing winds, vegetative screening and building arrangement will minimize odor and other aesthetic problems to neighbors and the owner.

Roofing and Covers

Waste storage structures may be open or covered, within or outside of enclosed livestock housing, or beneath slatted floors. Manure stacking facilities may be open or roofed.

Size

1. The storage structure shall have a volume adequate to store at least the waste, bedding, wash water and needed dilution water for 2 months in Hunterdon, Somerset, Union and counties north.
2. Where a contributing drainage area exists, the storage structure should have storage volume for 4 inches of rainwater per month of storage time.
3. Where a contributing drainage area exists, the storage structure should have storage volume for an additional 5½ inches of rainwater.
4. Storage structures to be emptied by agitating and pumping should provide for a residual volume of 6 inches in the bottom. This will provide for original dilution to keep deposited waste from sticking to the bottom.

a

5. A minimum of 6 inches should be provided for freeboard.

The sum of these items will provide storage for accumulated waste, plus average monthly rainfall, plus the rainfall from 25 year 24 hour storm without overflow. The minimum volumes shall be increased when required by the waste management system.

Materials

Waste storage structures should be constructed of reinforced concrete, reinforced concrete blocks, precast concrete panels, concrete staves, coated steel, treated tongue and grove lumber or other durable material. Lumber should not be used for walls which support moving stacking elevators or similar equipment. Structural steel and other corrodible materials should be adequately protected with concrete, paint or other protective coatings to preserve required strength and safety.

Structural Design

Storage structures should be constructed on soils which will provide adequate bearing. A minimum bedding of 6 inches of gravel or crushed rock should be placed under the floor when located on poorly drained foundation. The bedding should have a free outlet to prevent hydrostatic loads on the structure and to prevent frost heave damage. No bedding should be required when the foundation is naturally well drained.

Operation

With open space storage structures, central loading from an elevation at or above the top of the sidewall allows more complete and uniform filling, particularly with manure containing bedding. Ramps or pushoffs should be level, or slope moderately away (0.2 to 0.3 percent) to prevent runoff from entering the structure. For floor level push-in type stacking areas the floor should slope moderately (0.2 to 0.3 percent) away from the entrance. Equipment operates best with a straight line push.

Ramps for equipment entrance should be relatively flat with slopes of 7 horizontal to 1 vertical or flatter for safe operation.

Seepage from solid organic wastes will concentrate in low areas of storage structures and methods should be provided for its removal and safe disposal.

Costs of the structure will depend on the availability of materials, arrangements for labor and equipment, and the season of construction.

Maintenence is the responsibility of the owner or operator. Assistance in determining the maintenence requirements for a particular type of structure can be obtained from the Extension Service or the SCD.

Depending on the nature of the structure being constructed and the town or towns where the farm is located, local building codes may govern location or construction specifications.

For Additional Information

1. USDA, SCS. Engineering Field Manual for Conservation Practices. Washington: GPO, continually updated.
2. The Sussex County Soil Conservation District, Route 206, Andover Township, R.D. 7, Box 13, Newton, N.J. 07860 (201) 383-7315
3. The Sussex County Cooperative Extension Service, Route 206, Andover Twp. R.D. 7, Box 13, Newton, N.J. 07860 (201) 383-3800
4. USDA, SCS. The Agricultural Waste Management Field Manual. Washington: GPO, continually updated.

b

SUMMARY SHEET

category: WATER QUALITY

BMP: WASTE UTILIZATION

sub-category: AGRICULTURE

OBJECTIVE

To safely use wastes to provide fertility for crops, forage or fiber production, improve or maintain soil structure, prevent erosion and safeguard water resources.

WHERE APPLICABLE

On soils and vegetation suitable for the use of wastes as a fertilizer. This includes wastes such as those from farm, feedlot and dairy operations, municipal treatment plants, and agricultural processing plants.

PROS

1. After collection and treatment, a comprehensive waste management plan will provide for the creative utilization of agricultural waste. These collective efforts will add to the degree to which groundwater resources are protected and aid in their management.
2. The efficient use of treated agricultural by-products should cut fertilizer costs significantly for crops that are applicable.

CONS

1. Quantities of treated waste material should be carefully calculated and measured to avoid over-application. Applying more than the soil and plant matter can utilize will create the same threat to groundwater as applying excess quantities of fertilizer.

IMPLEMENTATION CONSIDERATIONS

Sludge Application Quantities

A. Privately owned and controlled land

1. Maximum lifetime site application - No greater amount of sludgeborne metals may be applied than those that follow:

Metal	Soil Cation Exchange Capacity (meg/200g)*					
	0-5		5-15		15	
	(maximum addition, 1 lb/acre (kg/ha))					
Zn	225**	(250)	450	(500)	900	(1000)
Cu	110	(125)	225	(250)	450	(500)
Ni	45	(50)	90	(100)	180	(200)
Cd	4.5	(5)	9	(10)	18	(20)
Pb	450	(500)	900	(1000)	1800	(2000)

* Determined on unsludged soil using pH 7 ammonium acetate method for a weighted average to a depth of 20 in (50 cm).

** kg/ha = lb/acre x 1.12

2. Maximum applications annually - Should be the lower of the two following values:
   a) Nitrogen requirement of the crop
      1) When incorporated- Sludge should be applied at no more than 100% of the crop requirement for available (inorganic) N. Estimate 20%

a

of organic N becomes inorganic N in the year of application.

2) When surface applied - Sludge should be applied at no more than 150% of the crop requirement for available N.

3. Sludges having cadmium contents greater than 25 mg/kg (dry weight) should not be applied to privately owned land unless the cadmium content is less than 1.5% of the zinc content on an elemental weight basis.
4. Apply sludge only to soils that are adjusted to pH 6.5 or greater, and are to be managed at pH 6.2 or greater thereafter.
5. Sludge should not be applied to soils with less than 20 inches (50cm) of depth to bedrock or to other root restricting layers.

B. Publically controlled land
On publically controlled land, up to 5 times the amount of sludgeborne metals listed above may be applied if the sludge is mixed into the 0-6 (0-15cm) surface soil. Where deeper incorporation is practiced, proportionately higher total metal applications may be made. These applications apply only to soils that are adjusted to pH 6.5 or greater when sludge is applied. (Suitability for consumption of products is questionable.)

Wastes should not be applied to land immediately adjacent to ponds, lakes, streams, wells, sinkholes, or other areas where there is a probability of water pollution from runoff unless special provisions are made to control runoff and pollution.

Two periods are critical when using wastes on land. First, the winter when weather and land conditions create operational and environmental restrictions and second, the summer when crops occupy the application area. The water added to the soil with the waste may limit the amount of waste needed to satisfy plant nutrient requirements, especially with an irrigation system. To avoid soil drainage and erosion problems, base application of liquid waste on the soil infiltration rate and on the amount of water needed to bring the soil moisture content up to field capacity at the time of application.

All federal, state and local laws, rules and regulations governing waste management, pollution abatement, health and safety should be strictly adhered to. The owner or operator is responsible for securing all required permits and approvals and for performance in accordance with appropriate laws, rules, and regulations.

For Additional Information

1. USDA, SCS. Engineering Field Manual for Conservation Practices. Washington: GPO, continually updated.
2. The Sussex County Cooperative Extension Service, Route 206, Andover Township, R.D. 7, Box 12, Newton, N.J. 07860 (201) 383-3800.
3. The Sussex County Soil Conservation District, Route 206, Andover Township, R.D. 7, Box 13, Newton, N.J. 07860 (201) 383-7315.
4. USDA, SCS. The Agricultural Waste Management Field Manual. Washington: GPO, continually updated.
5. The Agricultural Experiment Station, Cook College, Rutgers University, New Brunswick, N.J. 08903. (201) 932-3596
6. The Soils and Crops Department, Cook College, Rutgers University, New Brunswick, N.J. 08903. (201) 932-9748 (Robert Hanna, Extension Specialist).

b

SUMMARY SHEET

category: WATER QUALITY

sub-category: AGRICULTURE

BMP: LAGOONS

OBJECTIVE

Waste treatment lagoons serve as components of waste management systems and are constructed to biologically treat organic waste, reduce pollution and protect the environment.

WHERE APPLICABLE:

This practice applies where: 1) waste generated by agricultural production or processing needs treatment; 2) lagoons can be located near the source of the waste and a minimum of 300 feet from a neighboring residence or public area; 3) soils are suitable to retain the waste or can be sealed; and 4) a water supply is adequate to fill and maintain the lagoon at the necessary operating depth.

PROS

1. Lagoons perform a part of the treatment function in the overall waste management system. They facilitate biological degradation of organic compounds in agricultural waste.
2. They are relatively easy to construct with normal farm machinery (e.g. backhoe).

CONS

1. Like any other construction endeavor, there will be a cost involved. Cost will depend on the availability and price of labor and equipment, and as always, time.

IMPLEMENTATION CONSIDERATIONS

Location

The following are factors in locating lagoons: 1) minimize distance to waste source; 2) consider prevailing winds; 3) maximize exposure to sun and wind; 4) 100 foot minimum from groundwater supply systems; 5) do not locate in flood prone areas; 6) prevent drainage from outside areas.

Naturally Aerobic Lagoon Size

Design for maximum loading rate of 35 pounds of BOD_5 per acre of lagoon surface.

Naturally Aerobic Lagoon Surface Area

Waste Source	BOD_5 lb/day/1,000 lb. of Animal	Surface Area Sq. Ft./1,000 lb. of Animal
Calf, veal	0.7	900
Cattle, dairy or beef	1.7	2,100
Hog	2.2	2,700
Horse	1.4	1,700
Poultry	3.8	4,800
Sheep	0.8	1,000
Milk House & Milking Parlor	0.06	80

a

Mechanically Aerated Lagoon Size

Mechanically aerated lagoons can be used for odor control or for treatment of wastes.

Mechanically aerated lagoons are usually designed on the basis of BOD_5 or ultimate BOD loading, and equipment manufacturer's performance data for oxygen transfer and mixing. When used for odor control, aeration equipment should provide a minimum of one pound of oxygen for each pound of BOD_5 contributed daily. For treatment use design, procedures are provided in the Agricultural Waste Management Field Manual. A mechanically aerated lagoon requires about 5 percent of the surface area of an aerobic lagoon.

The minimun operating depth should be 6 feet. The maximum operating depth should be that which is dictated by the site and equipment. A mechanically aerated lagoon should meet the volume requirements of a naturally aerobic lagoon.

Embankment Lagoons

For embankment lagoons, the earth embankment and foundation cutoff should meet the earth embankment and foundation cutoff requirements in practice #378 in the Engineering Field Manual for Conservation Practices.

Excavated Lagoons

For excavated lagoons, the excavation should meet the side slopes and placement of excavated material requirements in standard #378 in the Engineering Field Manual for Conservation Practices.

Bottoms and Edges

The bottom of aerobic lagoons should be approximately level. The edges of all lagoons below the planned water line should be constructed as steep as soil conditions will permit to reduce areas of shallow water and inhibit weed growth.

Solids Removal

To reduce lagoon size, solids should be removed from waste of animals which are fed high roughage rations. A solids trap or separator may be provided between the waste source and the lagoon. An excavated or concrete tank would serve the purpose.

Loading

The lagoon should be fillled with water to the minimum operating depth. The first loading should be gradual. Daily loading results in the best operations. If intermittent loading is necessary, the minimum depth should be maintained by addition of water when needed.

Floating Material

Provisions should be made to keep material, straw, oil and other floating material out of the lagoon. Grass clippings from mowing operations should be removed from the lagoon.

Depending on the nature of the lagoon being constructed and the town or towns where the farm is located, local construction codes may govern location or construction specifications.

For Additional Information

1. USDA, SCS. Engineering Field Manual for Conservation Practices. Washington: GPO, continually updated.
2. The Sussex County Soil Conservation District, Route 206, Andover Township.
3. Sussex County Cooperative Extension Service, Rt. 206, Andover Twp.
4. USDA, SCS. The Agricultural Waste Management Field Manual. Washington: GPO, continually updated.

b

SUMMARY SHEET

category: WATER QUALITY

sub-category: AGRICULTURE

BMP: WASTE MANAGEMENT SYSTEMS

OBJECTIVE

Waste Management systems are used in rural areas to minimize the degradation of air, soil, and water by precluding the discharge of pollutants to surface or groundwater and by recycling wastes through soil and plants.

WHERE APPLICABLE

This practice applies where: 1) waste is generated from agricultural production or processing; 2) waste from municipal and industrial treatment plants is utilized in agricultural production; 3) all practice components necessary to make a complete system are specified; and 4) soil, water, and plant resources are adequate to properly manage the waste.

PROS

1. An effective combination of waste management practices executed as part of a comprehensive waste management plan can provide immediate results in improving surface and groundwater quality.
2. Wastes that are recycled and reused cut the costs of fertilizer and bedding.

CONS

1. To fully implement a comprehensive waste management plan, the construction of some devices such as waste storage ponds, or structures such as dikes or waste storage structures may be necessary.
2. The adoption of the BMPs required for a successful waste management plan may necessitate a departure from traditional farming practices.

IMPLEMENTATION CONSIDERATIONS

A waste management system for a given enterprise should include those components necessary to properly manage waste and prevent degradation of air, water, soil and plant resources. A system may consist of a number of components. Components should not be installed until an overall waste management system has been planned.

SYSTEM COMPONENTS

Components of complete waste management systems may include, but are not limited to, the following:

- Critical Area Planting
- Settling Facilities
- Dikes
- Diversions
- Fencing
- Grassed Waterways
- Irrigation Management
- Subsurface Drainage
- Waste Storage Structure
- Waste Storage Lagoon
- Waste Utilization

Waste should be utilized to the fullest extent possible by recycling through soil and plants. Where there is very little land available initial treatment may be necessary, using practices such as lagoons and oxidation ditches. The diversion of uncontaminated runoff away from animal wastes should be maximized. Wastes should be collected and safely spread on land, treated, or stored until it can be safely spread. Polluted runoff should also be collected, treated, or stored for later land application.

a

Manure

In the absence of site data, the following table can be used to calculate the volume of manure produced:

Animal	Cubic feet/day Per 1,000 Lbs of Animal Weight
Dairy Cattle	1.4
Beef Cattle	1.4
Horses	0.9
Swine	1.0
Poultry	1.0
Sheep	0.7

Land Application Methods

1. Manure spreader and Tank Wagons - common method, high labor requirement, calculate the number of trips and time required to spread, may need chopper/agitator pumps to load spreader or tank wagon.
2. Filter strips or grass filter beds - can be used to apply small volumes of wastes with few solids such as feedlot runoff or milking center waste. Dosing will be necessary.
3. Sprinkler irrigation - can handle large or small quantities of liquids, waste may have to be diluted to get solids content low enough to be handled by the sprinkler equipment. Low labor requirement.

The overall system should include sufficient land for proper utilization or disposal of waste at locations, times, rates and volumes which maintain desirable water, soil, plant, and other environmental conditions.

Costs of the system will be site specific and will depend on the adaptibility of existing facilities, as well as additional components that are required.

Maintenance is the responsibility of the owner or operator. Assistance in determining the maintenance requirements for each of the practices can be obtained from the Extension Service or the SCD.

The following is from the "State Program Elements Necessary For Participation in the National Pollution Discharge Elimination System, Concentrate Animal Feeding Operations:"

A. Permits are required under the National Pollutant Discharge Elimination Systems for animal feeding operations of more than 1000 animal units.
B. Permits are required under the NPDES for animal feeding operations of more than 300 animal units but less than 1000 animal units, if it discharges pollutants through a manmade conveyance or into waters passing through animals in a confined area.
C. Permits are not required under NPDES for animal feeding operations of less than 300 animal units, unless the operation discharges pollutants through a manmade conveyance or into waters passing through animals in the confined areas, and after an onsite inspection, written notice is given to the owner or operator. This procedure is carried out on a case by case designation.

The milk inspection regulations and local building codes are two areas of regulations that should be investigated.

For Additional Information

1. USDA, SCS. Engineering Field Manual for Conservation Practices. Washington: GPO, continually updated.
2. Sussex County Soil Conservation District, Route 206, Andover Township
3. Sussex County Cooperative Extension Service, Rt. 206, Andover Twp.
4. USDA, SCS. The Agricultural Waste Management Field Manual. Washington: GPO, continually updated.

b

SUMMARY SHEET

category: WATER QUALITY

sub-category: AGRICULTURAL

BMP: STRIP, CONTOUR CROPPING

OBJECTIVE

To reduce erosion, control water, and to improve water quality.

WHERE APPLICABLE

On sloping cropland and on certain recreation and wildlife land where the topography is uniform enough to permit tilling and harvesting on the contour, and where it is an essential part of a cropping system to effectively reduce soil and water losses.

PROS

1. Arranging crops in strips or bands which are perpendicular to the direction of water flow serves to slow runoff, promote percolation, and retain soil.
2. The retention of top soil preserves the useful life of the land and maintains its productivity.

CONS

1. Topography must be uniform enough to permit tilling and harvesting on the contour.
2. A small investment in time will probably be necessary to plan the most effective crop layout. Desired acreages of closegrowing, clean-tilled, and fallow land will have to be calculated.

IMPLEMENTATION CONSIDERATIONS

1. Strip boundaries will follow guide lines, or will parallel guide lines, which are laid out on or near the contour. Deviations from the contour should be sufficient to provide for adequate row drainage and for the practical operation of equipment, but should not exceed 1% on well drained soils, or 2% on moderately well to poorly drained soils. Deviations greater than those above are permitted for a maximum of 150 feet in one direction.
2. Strip widths will be close to the limits shown in the following table with the technician taking into consideration the soil, topography, allowable soil loss, crops to be grown, cropping systems, farm machinery to be used, and other conservation practices, applied or to be applied. The following table should be used as a guide in determining maximum strip widths.

P Values, Maximum widths, and slope-length limits for contour stripcropping

Land Slope Percent	P Values (1)			Strip Widths (2)	Max. Slope Lgth.
	A	B	C	(ft)	(ft)
1 to 2	.30	.45	.60	130	800
3 to 5	.25	.38	.50	100	600
6 to 8	.25	.38	.50	100	400
9 to 12	.30	.45	.60	80	240
13 to 16	.35	.52	.70	80	160

(1)
P Values

A. For 4-year rotation of row crops, small grain with meadow seeding, and 2 years of meadow. A second row crop can replace the small grain if meadow is established in it.

B. For 4-year rotation of 2-year row crop, winter grain with meadow seeding and 1-year meadow.

C. For alternate strips of row crop and small grain

a

2. Adjust strip width limit, generally downward, to accomodate widths of farm equipment.

   For examples of current applications of strip-cropping and for technical assistance in layout design, contact the County Agricultural Agent or the Sussex County Soil Conservation District.

When graded strips are laid out to remove excess water, dispose of in a grassed waterway, constructed outlet, or protected area. Generally, water should not be conducted along graded rows for a distance in excess of 500 feet. Planting and cultivation of crops should be parallel to guide lines. Short or point rows should be placed in the center of the strip on well drained soils. Crops should be arranged so that there are alternate strips of row and drilled crops, or row and close sown crops, or drilled and close sown crops. The close sown crops in the latter may be an established seeding or a new seeding of a drilled crop.

An added benefit will be realized if the crops selected to be grown in the protective strip should be those that will produce a seed crop which is utilized by dove, quail, geese, pheasant, and other species of wildlife.

Although Soil Erosion Control Plans are required for any other land use construction where the soil is removed or disturbed, there is no such requirement for farmers as they decide which areas of their land to cultivate. Therefore the adoption of this method, although highly encouraged, is completely voluntary.

For Additional Information

1. USDA, SCS. Engineering Field Manual for Conservation Practices. Washington: GPO, continually updated.
2. The Sussex County Soil Conservation District, Route 206, Andover Township, R.D. 7, Box 13, Newton, N.J. 07860 (201) 383-7315
3. The Sussex County Cooperative Extension Service, Route 206, Andover Township, R.D. 7, Box 13, Newton, N.J. 07860 (201) 383-3800.

b

SUMMARY SHEET

category: WATER QUALITY

sub-category: AGRICULTURE

BMP: IRRIGATION MANAGEMENT

OBJECTIVE

To effectively utilize the available irrigation supply in managing and controlling the moisture environment to minimize soil erosion and to control undesirable water loss.

WHERE APPLICABLE

This practice is adapted to all lands that are suitable for irrigation and that have a water supply of suitable quality and quantity..An adapted conservation irrigation system should be available, either as a portable system or a system that has been established on the land to be irrigated.

PROS

1. The threat of transport of organic chemicals in irrigation water can be minimized if the water is applied so that most of it is absorbed into the soil.
2. The benefit of effectively managing irrigation water is magnified when combined with the effective application of fertilizers and herbicides in quantities that crops can absorb.
3. The water quality of both surface and ground water is improved.

CONS

1. The irrigator must have the knowledge and capability to manage and apply irrigation water in such a manner that the objectives mentioned above are ensured.
2. The irrigator may have to install a portable conservation irrigation system if his existing system is not adaptable.

IMPLEMENTATION CONSIDERATIONS

1. Determinations should be made by the irrigator relating to the following:
   A. How to determine when irrigation water needs to be applied based on crop water use rates and stages of plant growth.
   B. How to measure or estimate the amount of water required for each irrigation including the leaching needs.
   C. How to compute the amount of water delivered to an area.
   D. The normal time needed for the soil to absorb the required amount of water and how to detect changes in intake rate.
   E. How to adjust stream size, application rate or irrigation time as necessary to compensate for changes in such factors as intake rate or amount of water to be applied.
   F. How to recognize erosion caused by irrigation.
   G. How to evaluate the uniformity of water application.
2. Unfortunately, land most suitable for water application is also the most difficult to drain. It is usually flat and surface flow is slow. Ground water often exists at relatively shallow depths and excess water applied to the land for irrigation may cause the groundwater to rise dangerously near the surface, where it can easily be contaminated. Two ways to minimize this problem follow:*

a

A. Make provisions for drainage of excess water. A drainage tile system is most commonly used for this purpose.
B. Convert to a sprinkler irrigation system which applies the water uniformly at a rate and in a total quantity that prevents unwanted runoff and deep percolation.

*SOURCE: R.L. Hausenbuiller, Soil Science: Principles and Practices, Dubuque, Iowa: WM. C. Brown Company Publishers, 1972, page 435.

Costs will be encountered if an entirely new system, such as a sprinkler system, is desired, or if a drainage system, such as a tile system, is required. Technical advise in these matters is available at the Extension Service and Soil Conservation District.

In lieu of an actual evaluation at each irrigation site, evidence that the physical layout of the irrigated area meets the requirements of a conservation irrigation system plus the technician's evaluation as to the knowledge and use of the principles of water management by the irrigator is acceptable in determining that good water management is being practiced.

For Additional Information

1. USDA, SCS. Engineering Field Manual for Conservation Practices. Washington GPO, continually updated.
2. The Sussex County Soil Conservation District, Route 206, Andover Township, R.D. 7, Box 13, Newton, N.J. 07860 (201) 383-7315.
3. The Sussex County Cooperative Extension Service, Route 206, Andover Township, R.D. 7, Box 13, Newton, N.J. 07860 (201) 383-3800.

For technical assistance in the design or conversion of a conservation irrigation system on a specific site, contact the County Agricultural Agent and/or the Sussex County Soil Conservation District (See references).

b

SUMMARY SHEET

category: WATER QUALITY

sub-category: AGRICULTURE

BMP: CROP RESIDUE USE

OBJECTIVE

To conserve moisture, increase infiltration, reduce soil loss, and improve soil tilth.

WHERE APPLICABLE

Method is most applicable on land where adequate crop residues are produced.

PROS

1. Erosion is reduced by plant residues, which are spread over cultivated fields during critical erosion periods.
2. By slowing or stopping erosion, the residue promotes the infiltration of rain water into the ground, and thus increases groundwater recharge.
3. The reduction of erosion relieves the stormwater load on streams and collection facilities.

CONS

1. Only certain crops are suitable for residue use.
2. Significant quantities of residue producing crops must be grown in order to make their use cost effective for a farmer.
3. Crop residues should be left standing or lying on the soil surface to provide supplemental food and cover for birds and mammals during the fall and winter. This may require a change in post-harvest operations.

IMPLEMENTATION CONSIDERATIONS

Residue Amounts:

CROP TYPE	REQ'D RESIDUE LBS/Acre	Equiv. Yield BU./Acre	Crops Not Desirable For Residue Use
Corn, field or sweet	5,000	70	Bush Fruits
Barley	3,000	48	Potatoes
Oats	2,300	43	Tomatoes
Wheat	2,600	31	Vegetables (most)
Rye	2,600	29	Vineyards
Soybeans	1,800	23	

SOURCE: "New Jersey Agricultural Statistics 1978."

1. Disk or shred corn or sorghum stalks as soon after harvest as practical. Residue should remain on or near the surface until seedbed is prepared for the succeeding crop.
2. Leave stubble and straw or residue of small grains and soybeans on soil surface until seedbed is prepared for succeeding crop.
3. Residues should not be chopped, incorporated in or detached from the soil surface, especially on land where overland flow of water occurs.
4. Carry out cultural practices as nearly on the contour as practical.
5. Crop reside use should be planned as a component of the conservation cropping system.
6. Maximize the amount of residue that remains on the field at all times of the year.

a

Guidelines for estimating amounts of residue per acre on land surfaces, using the grain-residue ration method:

SORGHUM	80 pounds of residue	per bushel of grain
WHEAT	85 pounds of residue	per bushel of grain
OATS	55 pounds of residue	per bushel of grain
BARLEY	65 pounds of residue	per bushel of grain
RYE	90 pounds of residue	per bushel of grain
SOYBEANS	80 pounds of residue	per bushel of grain
CORN	70 pounds of residue	per bushel of grain

There are no additional materials required to implement this BMP, but the time needed to spread the residue should be measured against the time needed to clear the residue if that was normal procedure.

For Additional Information

For more information or for specific examples of the application of this method in Sussex County, contact the County Agricultural Agent or the Soil Conservation District.

1. The Sussex County Soil Conservation District, Route 206, Andover Township, R.D. 7, Box 13, Newton, N.J. 07860 (201) 383-7315.
2. The Sussex County Cooperative Extension Service, Route 206, Andover Township, R.D. 7, Box 13, Newton, N.J. 07860 (201) 383-3800.

b