

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

ABOVE GROUND, MULTI-OUTLET PIPELINE

(Ft.)

CODE 431

DEFINITION

A water distribution tubing consisting of aluminum, PVC, or lay-flat polyethylene pipeline with closely spaced orifices or gates.

PURPOSE

- To increase water use efficiency on irrigated land.
- To reduce irrigation induced soil erosion.
- To reduce excessive runoff, flooding, or ponding associated with inefficient irrigation water use.
- To improve the productivity, health and vigor of the crop.
- To increase the quantity and quality of feed and forage for domestic animals.

CONDITIONS WHERE PRACTICE APPLIES

The practice applies to irrigable land suited to surface application methods. This practice shall not be used in lieu of buried pipelines for conveyance systems. However, reaches of un-gated pipe may be used:

- to obtain necessary working pressure for the system,
- to convey water between fields (typically less than 300 feet),
- to convey water to various points within a field,
- for splitting irrigation runs as in surge irrigation, or
- where rock precludes the installation of buried pipelines.

Water supplies and rates of irrigation delivery for the area served by the multi-outlet pipeline shall be sufficient to make irrigation practical for the crop to be grown and for the method of application.

CRITERIA

General Criteria Applicable To All Purposes

Pipe Sizes. For durability and transportability, rigid pipes shall be a minimum of 6 inches in diameter and not greater than 12 inches in diameter.

Working pressure. The maximum working pressure for rigid pipe shall be 10 pounds per square inch or 23 feet of head. Excess working pressure shall be reduced to acceptable levels by installing an appropriate head control appurtenance.

For lay-flat polyethylene pipe, the manufacturer's recommendations for maximum allowable working pressure shall be followed. If the manufacturer's recommendations are not available, the hoop stress formula in National Engineering Handbook (NEH) Part 636 Chapter 52 shall be used to determine maximum working pressure, using a safety factor of 1.5.

Friction losses. For design purposes, friction head losses shall be no less than those computed by the Hazen-Williams equation, using roughness coefficients of C=130 for aluminum pipe and C=150 for plastic or lay-flat polyethylene pipe. The use of PHAUCET, other appropriate computer software, or a multiple outlet factor shall be used in computing losses when appropriate. Refer to National Engineering Handbook (NEH), Part 650, EFH Chapter 15: Irrigation for guidance.

Flow velocity. Velocity in the pipeline when operating at system capacity shall not exceed 7 feet per second unless appropriate surge protection is accounted for.

Capacity. The design capacity of the pipeline shall be sufficient to deliver an adequate irrigation stream to the design area for the planned irrigation method.

Outlet gates. Individual outlet gates shall have the capacity at design working pressure to deliver the required flow to a point at least 0.3 feet above the field surface.

Head requirement. The working head shall not be less than 0.5 feet above outlet gates, unless a detailed design or manufacturer's literature indicates that a lower head is adequate to deliver the required water to the field.

Where either the design working head exceeds 5 feet or where stream flows are erosive, an effective method of energy dissipation shall be installed on each gate, or permanent vegetation shall be planted along the pipeline to provide erosion control.

Flushing. A suitable outlet shall be installed at the end of the pipeline, if needed, for flushing the line free of sediment or other foreign material.

Materials. Rigid pipe shall be aluminum or plastic material certified for above ground use. All fittings and couplers shall equal or exceed the pressure rating of the pipe with which they will be used. They shall be made of material that is recommended by the manufacturer for use with the pipe

Rigid pipe and appurtenances shall be furnished with a coupling system that is interchangeable with the selected pipe material.

Rubber gaskets shall be according to the manufacturer's standard design dimensions and tolerances for the pipe material selected. They shall be of such size and shape as to provide an adequate compressive force against the spigot and socket after assembly to effect a positive seal. The gasket shall be the sole element depended upon to make the joint flexible and watertight. The gasket shall be a continuous elastomeric ring.

Minimum wall thickness for aluminum gated pipe shall be 0.050 inches for 6 through 10 inches in

diameter and 0.058 inches for 12 inch diameter pipe.

Corrosion protection shall be provided for aluminum pipe when:

- conveying water with a copper content exceeding 0.02 ppm,
- in contact with soil having a resistivity of less than 500 ohm-cm
- in contact with soil having a pH less than 4 or greater than 9

Minimum wall thickness of rigid PVC pipe shall be 0.120 inches. The pressure rating of the pipe shall be 22 p.s.i. or greater, prior to gate installation.

Minimum wall thickness of lay-flat polyethylene pipe shall be 6 mil (.006 inch).

Related structures. An open ditch supply shall include a permanent water control structure as the inlet to multi-outlet pipe.

When the water supply for lay-flat polyethylene pipe is greater than 0.5 feet above ground, a rigid pipe shall be used to convey water between the outlet and the coupling of lay-flat polyethylene pipe.

CONSIDERATIONS

Consider provisions for thrust control at locations subject to pipe movement.

Consider applicability of future surge or automation alternatives in preparing the design.

Consider the water source and potential trash types and amounts when evaluating screen types and sizes and in the design of an inlet screen.

Consider effects on the water budget, including water quality, volume of runoff, and rates of runoff, in any downstream drainage.

Consider effects on wetlands and water related wildlife.

Consider effects on water flows and aquifers and the effects on other water uses and users.

Consider disposal of lay-flat polyethylene pipe and potential of recycling.

Consider anchoring lay-flat polyethylene tubing when winds may cause it to move.

Consider including a water measuring device to assist in irrigation water management.

Cultural Resources

NRCS policy is to avoid any effect to cultural resources and protect them in their original location. Determine if installation of this practice or associated practices in the plan could have an effect on cultural resources. The National Historic Preservation Act may require consultation with the California State Historic Preservation Officer.

<http://www.nrcs.usda.gov/technical/cultural.html>

is the primary website for cultural resources information. The California Environmental Handbook and the California Environmental Assessment Worksheet also provide guidance on how the NRCS must account for cultural resources. The e-Field Office Technical Guide, Section II contains general information, with Web sites for additional information.

Document any specific considerations for cultural resources in the design docket and the Practice Requirements worksheet.

Endangered Species

If during the Environmental Assessment NRCS determines that installation of this practice, along with any others proposed, will have an effect on any federal or state listed Rare, Threatened or Endangered species or their habitat, NRCS will advise the client of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the client selects one of the alternative conservation treatments for installation; or with concurrence of the client, NRCS initiates consultations concerning the listed species with the U.S. Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared to show site specific details. The drawings and specifications shall show pipe location(s), pipe

size(s), construction details for the inlet structure and screen as applicable, sizes and construction details for head control facilities, and gate spacing and erosion details as appropriate.

If lay-flat polyethylene pipe is included in the plan, and the manufacturer's recommendations for working pressure are not available, an appropriate formula or table for determining maximum working pressure shall be included in the practice specification.

Plans should also included gate openings or orifice sizes necessary to deliver the design flows as determined by appropriate surface irrigation design procedures.

OPERATION AND MAINTENANCE

The operation and maintenance plan for the system shall include:

- requirements for flushing pipe,
- requirements for cleaning and repairing of screens and structures,
- requirements for replacing individual gates and gaskets,
- requirements for off-season storage and handling of pipe,
- requirements for anchoring pipe where wind conditions require, and
- recommendation for recycling lay-flat polyethylene pipe, where recycling is available.

If the source of water supply is from a water well, the operation and maintenance plan shall note that the presence of sand in the pipeline may indicate problems with the water well.

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE SPECIFICATION

431 – ABOVE-GROUND, MULTI-OUTLET PIPELINE

I. SCOPE

The work shall consist of furnishing and of installing multiple-outlet pipe to the lines and grades as shown on the drawings. The pipe shall be installed according to the recommendations of the manufacturer.

II. JOINTS AND CONNECTIONS

All joints and connections shall be capable of withstanding the design maximum working head for the pipeline without leakage and shall leave the inside of the line free of any obstruction that can reduce the capacity below design requirements.

All fittings shall be installed according to the recommendations of the manufacturer.

If dissimilar metals are used, the fittings or orifice plates shall be protected against galvanic corrosion. For example, separate dissimilar metals with a rubber or plastic insulator.

A flexible connection shall be installed between the pump discharge pipe and the pipeline. Aluminum lines shall be coupled with a suitable insulating material.

III. INSTALLATION

The pipe shall be obtained and placed in position in the field for which it is planned. The installation of the pipe shall conform to the manufacturer's recommendations. Any bends or changes in alignment shall be within the allowable deflection angle to prevent leakage. The field installation shall be such to provide for the required uniformity distribution rate of water being applied.

IV. MATERIALS

Pipeline shall be composed of aluminum, PVC or polyethylene.

Aluminum Pipe

Aluminum tubing shall be manufactured according to ASTM Standard B-313 as appropriate. Material shall be alloy 3004 with an H 26 temper.

The pipe shall meet the minimum wall thickness listed in Table 1 for the given pipe diameter and specified materials.

Table 1. Minimum Wall Thickness for Aluminum Gated Pipe

<u>Tube Diameter</u>	<u>Minimum Wall Thickness</u>
in.	in.
6	0.050
8	0.050
10	0.050
12	0.058

PVC Pipe

PVC pipe shall meet requirements found in ASTM D2241 except as noted in Table 2. PVC compound used to extrude pipe must meet 12454-cell classification per ASTM D1784. Compound must contain sufficient UV stabilizer as to allow the finished tubing to pass the original factory specifications for quick burst (ASTM D1599-99) and impact performance (ASTM D2444-9) after 10-years usage in the field under normal UV exposure. Manufacturer will provide independent 3rd-party lab data demonstrating conformance to these requirements.

Clean work material generated from the manufacturer's own pipe production may be used by the same manufacturer if the pipe produced meets all requirements of this standard.

The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign matter, or other defects. The pipe shall be as uniform in color, opacity, density, and other physical properties as is commercially practicable.

The rigid plastic gated pipe shall meet the dimensional requirements listed in Table 3. The minimum working pressure class for this pipe without gates shall be 22 lbs/in² or 50 feet of head.

Table 2

Nominal Pipe Size	Max SDR	Min. impact Test resistance (ft-lb)
3"	32.5	120
4"	21	255
6"	32.5	250
8"	32.5	300
10"	32.5	350
12"	32.5	400

Markings on the pipe shall include the following, spaced at intervals of not more than 5 feet.

- Nominal pipe size (for example, 10 inches).
- Applicable material specification.
- Type of material according to the designation code (for example, PVC 1120).
- Manufacturer's name trademark.

Polyethylene Lay-flat Pipe

The minimum wall thickness of polyethylene pipe shall be 6 mil (0.006 inch). Pipe shall be selected so that the design operating pressure does not exceed manufacturer's recommendations.

Fittings and couplers

All fittings and couplers shall equal or exceed the pressure rating of the pipe with which is used. They shall be made of material that is recommended by the manufacturer for use with the pipe.

The pipe and appurtenance shall be furnished with a coupling system that is interchangeable with aluminum gated pipe.

V. TESTING

The pipeline shall be thoroughly and completely tested at the design pressure for pressure strength and leakage.

The pipe shall be slowly filled with water. The pressure shall be slowly built up to the maximum design working pressure of the system. While this pressure is maintained, all exposed pipe, fittings, valves, hydrants, joints, appurtenances will function properly at design capacity. At or below design

capacity there shall be no objectionable flow conditions shall include water hammer, continuing unsteady delivery of water, damage to the pipeline, or detrimental discharge from control valves, vents, or stands.

VI. BASIS OF ACCEPTANCE

The acceptability of the pipe shall be determined by inspection to check compliance with all the provisions of these specifications.

VII. SPECIAL MEASURES

Measures and construction methods shall be incorporated as needed and practical that enhance fish and wildlife values. Special attention shall be given to protecting visual resources and maintaining key shade, food and den trees.

OPERATION AND MAINTENANCE ITEMS

A properly operated and maintained irrigation pipeline is an asset to your farm. This irrigation pipeline was designed and installed to transmit water to where it may be utilized. The estimated life span of this installation is at least 10 years. The life of this pipeline can be assured and usually increased by developing and carrying out a good operation and maintenance program.

This practice will require you to perform periodic maintenance and may also require operational items to maintain satisfactory performance. Here are some recommendations to help you develop a good operation and maintenance program.

Check to make sure all valves and air vents are set at the proper operating condition so they may provide protection to the pipeline.

Maintain the design depth of cover over the pipeline.

Limit traffic over the pipeline to designated section that was designed for traffic loads.

Avoid travel over pipelines by tillage equipment when the soil is saturated.

Avoid any subsoiling operation that may disturb the pipeline.

Maintain vigorous growth of vegetative coverings. This includes reseeding, fertilization and application of

herbicides when necessary. Periodic mowing may also be needed to control height.

Remove all foreign debris that hinders system operation.

Drain the system and components in areas that are subject to freezing. If parts of the system cannot be drained, an anti-freeze solution may be added.

Eradicate or otherwise remove all rodents or burrowing animals. Immediately repair any damage caused by their activity.

Other items specific to your project are listed on the "Practice Requirements" sheet.

Table 3. Dimension of Rigid Gated Plastic Pipe

Nominal Size in.	Outside Diameter		Wall Thickness		
	Average in.	Tolerance in.	Minimum in.	Tolerance in.	
6	6.0 ±	0.011	0.120	+0.020	
8	8.0 ±	0.015	0.120	+0.020	
10	10.0 ±	0.015	0.120	+0.020	
12	12.0 ±	0.015	0.120	+0.020	

U.S DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
CALIFORNIA

**PRACTICE REQUIREMENTS
FOR
431 – ABOVE GROUND MULTI-OUTLET PIPELINE**

For: Business Name _____
Job Location _____
County _____ RCD _____ Farm/Tract No. _____
Referral No. _____ Prepared By _____ Date _____

IT SHALL BE THE RESPONSIBILITY OF THE OWNER TO OBTAIN ALL NECESSARY PERMITS AND/OR RIGHTS, AND TO COMPLY WITH ALL ORDINANCES AND LAWS PERTAINING TO THIS INSTALLATION.

Installation shall be in accordance with the following drawings, specifications and special requirements. NO CHANGES ARE TO BE MADE IN THE DRAWINGS OR SPECIFICATIONS WITHOUT PRIOR APPROVAL OF THE NRCS TECHNICIAN.

1. Drawings, No. _____
2. Practice Specifications _____
3. Type of Pipe: (Plastic) (Polyethylene) (Aluminum) _____
4. Nominal Pipe Size: _____
5. Special Requirements: _____

6. Special Maintenance Requirements: _____

PRACTICE APPROVAL:

Job Classification: (Ref: Section 501 NEM)

Show the limiting elements for this job. This job is classified as, Class _____

Limiting elements:	Units
<u>Design Capacity</u> _____	_____ gpm
_____	_____
_____	_____
_____	_____

Design Approved by: _____ Date: _____

LANDOWNER'S/OPERATOR'S ACKNOWLEDGEMENT:

The landowner/operator acknowledges that:

- a. He/she has received a copy of the construction drawings and specification, and that he/she has an understanding of the contents, and the requirements.
- b. He/she has obtained all the necessary permits.
- c. No changes will be made in the installation of the job without prior concurrence of the NRCS technician.
- d. Maintenance of the installed work is necessary for proper performance during the project life.

Accepted by: _____ Date: _____

PRACTICE COMPLETION:

I have made an on site inspection of the site (or I am accepting owner/contractor documentation), and have determined that the job as installed does conform to the drawings and practice specifications.

Construction Certification by:

/s/ _____ Date _____

UNITED STATES DEPARTMENT OF AGRICULTURE
 NATURAL RESOURCES CONSERVATION SERVICE
431 – ABOVE-GROUND, MULTI-OUTLET PIPELINE

OPERATION AND MAINTENANCE

Sponsor/Land user: _____ Date: _____

Address: _____

Location GPS Coordinates Map Datum: _____ E _____ N _____

Quad Sheet Name _____ SEC _____ T _____ R _____

A properly operated and maintained irrigation pipeline is an asset to your farm. This irrigation pipeline was designed and installed to deliver water to where it may be utilized. The estimated life span of this installation is at least 10 years. The life of this installation can be assured and usually increased by developing and carrying out a good operation and maintenance program.

This practice will require you to perform periodic operation to maintain satisfactory performance. Here are some recommendations to help you develop a good operation and maintenance program:

GENERAL RECOMMENDATIONS

- Check to make sure all valves and air vents are set at the proper operating condition providing protection to the pipeline.
- Allow the time to fill gradually when being put into use after shut down or draining.
- Periodically check and repair all valves, gates and regulators to the system requirements following the manufacturer's recommendations.
- Limit traffic over the pipeline to designated sections that were designed for traffic loads.
- Remove all foreign debris that hinders system operation.
- Immediately repair any vandalism, vehicular, or livestock damage to any outlets and appurtenances.
- Inspect for damage from rodents or burrowing animals. Repair any damage. Take appropriate corrective actions to alleviate further damage.

SPECIFIC RECOMMENDATIONS FOR YOUR IRRIGATION PIPELINE

CONTACT YOUR LOCAL NATURAL RESOURCES CONSERVATION SERVICE OFFICE FOR ANY ADDITIONAL TECHNICAL ASSISTANCE YOU MIGHT NEED FOR IMPLEMENTATION OF THIS OPERATION AND MAINTENANCE PLAN FOR YOUR IRRIGATION PIPELINE.

STATEMENT OF WORK
Above Ground Multi-Outlet Pipeline (431)

These deliverables apply to this individual practice. For other planned practice deliverables refer to those specific Statements of Work.

DESIGN

Deliverables:

1. Design documentation that will demonstrate that the criteria in NRCS practice standard have been met and are compatible with other planned and applied practices.
 - a. Practice purpose(s) as identified in the conservation plan
 - b. List of required permits to be obtained by the client
 - c. Compliance with NRCS national and state utility safety policy (NEM Part 503-Safety, Subpart A - Engineering Activities Affecting Utilities 503.00 through 503.06)
 - d. Practice standard criteria related computations and analyses to develop plans and specifications including but not limited to:
 - i. Capacity
 - ii. Hydraulics and Appurtenance Design
 - iii. Trench and Backfill Requirements
 - iv. Materials
 - v. Vegetation
2. Written plans and specifications including sketches and drawings shall be provided to the client that adequately describes the requirements to install the practice and obtain necessary permits.
3. Design Report and Inspection Plan as appropriate (NEM Part 511, Subpart B Documentation, 511.11 and Part 512, Subpart D Quality Assurance Activities, 512.30 through 512.32).
4. Operation and Maintenance Plan
5. Certification that the design meets practice standard criteria and comply with applicable laws and regulations (NEM Subpart A, 505.03 (a) (3)).
6. Design modifications during installation as required.

INSTALLATION

Deliverables

1. Pre Installation conference with client and contractor.
2. Verification that client has obtained required permits.
3. Staking and layout according to plans and specifications including applicable layout notes.
4. Installation inspection (according to inspection plan as appropriate).
 - a. Actual materials used (Part 512, Subpart D Quality Assurance Activities, 512.33)
 - b. Inspection records
5. Facilitate and implement required design modifications with client and original designer
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation.
7. Certification that the installation process and materials meets design and permit requirements.

CHECK OUT

Deliverables

1. As-Built documentation.
 - a. Extent of practice units applied
 - b. Drawings
 - c. Final quantities
2. Certification that the installation meets NRCS standards and specifications and is in compliance with permits (NEM Subpart A, 505.03 (c) (1)).
3. Progress reporting.

STATEMENT OF WORK
Irrigation Water Conveyance - Rigid Gated Pipeline (430HH)

REFERENCES

- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard - Irrigation Water Conveyance Rigid Gated Pipeline, 430hh
- NRCS National Engineering Manual (NEM).
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

CONSERVATION COVER

(Ac.)

CODE 327

DEFINITION

Establishing and maintaining permanent vegetative cover.

PURPOSE

This practice may be applied to accomplish one or more of the following:

- Reduce soil erosion and sedimentation
- Improve water quality
- Improve air quality
- Enhance wildlife habitat
- Improve soil quality
- Manage plant pests

CONDITION WHERE PRACTICE APPLIES

This practice applies on all lands needing permanent vegetative cover. This practice does not apply to plantings for forage production or to critical area plantings.

CRITERIA

General Criteria Applicable to All Purposes

Species must be adapted to local soil, ecological sites and climatic conditions, be easily established, long-lived, and manageable. Care will be taken when selecting plants to avoid invasive species. Species shall be in conformance with the respective Major Land Resource Area (MLRA) Vegetative Guide in Section II of the Field Office Technical Guide.

Species planted shall be suitable for the planned purpose and site conditions. Use of

invasive species shall be avoided. Species listed on the California Invasive Plant Inventory shall not be planted.

Seeding rates and methods shall be adequate to accomplish the planned purpose. Certified seed shall be used when available.

Planting dates, planting methods and care in handling and planting of the seed or planting stock shall ensure that planted materials have an acceptable rate of survival. Vegetative planting material (e.g. sprigs, rhizomes, bulbs) shall be from a reliable supplier.

Site preparation shall be sufficiently adequate to eliminate weeds for establishment and growth of selected species.

Timing and use of equipment shall be appropriate for the site and soil conditions.

All nutrients shall be applied following the nutrient management requirements in the Field Office Technical Guide (FOTG).

For tree and shrub plantings as a component of this practice refer to Tree/Shrub Establishment Standard 660 for planting criteria.

Runoff shall not contain levels of sediment, nutrients, organics, salts or other pollutants that are in excess of identified federal, state and local standards.

Vegetative manipulation will be accomplished by mechanical, biological or chemical methods, by prescribed burning, or a combination of the four. If burning is used alone or in combination with the other methods, Prescribed Burning practice 338 must be included as a planned practice.

Additional Criteria to Improve Water Quality

In perennial crop systems such as orchards, vineyards, berries and nursery stock, vegetation established shall provide full ground coverage in the alleyway. Permanent herbaceous vegetation consisting of a single species or a mixture of grasses, legumes and/or other forbs adapted to the soil, climate, nutrients, chemicals, and practices used in the current management system shall be established.

Additional Criteria to Reduce Soil Erosion and Sedimentation

The amount of plant biomass and cover needed to reduce wind and water erosion to the planned soil loss objective shall be determined using the current approved wind and/or water erosion prediction technology.

Additional Criteria for Improving Air Quality

In perennial crop systems such as orchards, vineyards, berries and nursery stock, vegetation established shall provide full ground coverage in the alleyway during mowing and harvest operations.

To sequester carbon, plant cover established will result in a positive CO₂ equivalent value when determined by the current approved carbon prediction technology.

Additional Criteria for Enhancing Wildlife Habitat

Grasses, forbs, shrubs and/or legumes shall be planted in a diverse mix to promote biodiversity and meet the needs of the targeted species of wildlife.

Additional Criteria to Improve Soil Quality

Plants will be selected on the basis of producing high volumes of organic material to maintain or improve soil organic matter. The amount of biomass needed will be determined using the current soil condition index procedure.

Additional Criteria to Manage Plant Pests

In perennial crop systems such as orchards, vineyards, berries and nursery stock, permanent vegetative cover shall be established and managed according to

University of California, Davis, Integrated Pest Management (IPM) recommendations for the target pest species.

CONSIDERATIONS

This practice may be used to promote the conservation of wildlife species in general, including threatened and endangered species.

Certified seed and planting stock that is adapted to the site should be used when it is available.

Inoculating legume seed with the proper Rhizobium bacteria should be considered on sites where the legumes to be planted have not been previously grown.

Mowing may be needed during the establishment period to reduce competition from broadleaf annual weeds.

On sites where annual grasses are an expected weed problem it may be necessary to postpone nitrogen fertilizer application until the planted species are well established.

Where applicable this practice may be used to conserve and stabilize archeological and historic sites.

Consider rotating management and maintenance activities (e.g. mow only one-fourth or one-third of the area each year) throughout the managed area to maximize spatial and temporal diversity.

Where wildlife management is an objective, the food and cover value of the planting can be enhanced by using a habitat evaluation procedure to aid in selecting plant species and providing or managing for other habitat requirements necessary to achieve the objective.

Use native species that are appropriate for the identified resource concern and management objective. Consider trying to re-establish the native plant community for the site.

If a native cover (other than what was planted) establishes, and this cover meets the intended purpose and the landowner's objectives, the cover should be considered adequate.

CULTURAL RESOURCES CONSIDERATIONS

NRCS policy is to avoid any effect to cultural resources and protect them in their original location. Determine if installation of this practice or associated practices in the plan could have an effect on cultural resources. The National Historic Preservation Act may require consultation with the California State Historic Preservation Officer.

<http://www.nrcs.usda.gov/technical/cultural.html> is the primary website for cultural resources information. The California Environmental Handbook and the California Environmental Assessment Worksheet also provide guidance on how the NRCS must account for cultural resources. The e-Field Office Technical Guide, Section II contains general information, with Web sites for additional information.

Document any specific considerations for cultural resources in the design docket and the Practice Requirements worksheet.

ENDANGERED SPECIES CONSIDERATIONS

If during the Environmental Assessment NRCS determines that installation of this practice, along with any others proposed, will have an effect on any federal or state listed Rare, Threatened or Endangered species or their habitat, NRCS will advise the client of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the client selects one of the alternative conservation treatments for installation; or with concurrence of the client, NRCS initiates consultations concerning the listed species with the U.S. Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game.

PLANS AND SPECIFICATIONS

Specifications for this practice shall be prepared for each site. They shall include, but are not limited to:

- Recommended species
- Seeding rates and dates
- Establishment procedures
- Other management actions needed to insure an adequate stand

Specifications shall be recorded using approved specifications sheets, job sheets, narrative statements in the conservation plan, or other acceptable documentation.

OPERATION AND MAINTENANCE

Mowing and harvest operations in perennial crop systems such as orchards, vineyards, berries and nursery stock shall be done in a manner which minimizes the generation of particulate matter.

If wildlife habitat enhancement is a purpose, maintenance practices and activities shall not disturb cover during the reproductive period for the desired species. Exceptions should be considered for periodic burning or mowing when necessary to maintain the health of the plant community.

Maintenance measures must be adequate to control noxious weeds and other invasive species.

To benefit insect food sources for grassland nesting birds, spraying or other control of noxious weeds shall be done on a "spot" basis to protect forbs and legumes that benefit native pollinators and other wildlife.

REFERENCES

K. G. Renard, G. R. Foster, G. A. Weesies, K. D. K. McCool and D. C. Yoder. 1997. Predicting Soil Erosion by Water: A Guide to Conservation Planning with the Revised Universal Soil Loss Equation (RUSLE), Agricultural Handbook Number 703.

Revised Universal Soil Loss Equation Version 2 (RUSLE2) website (checked May 2007): http://fargo.nserl.purdue.edu/rusle2_dataweb/RUSLE2_Index.htm

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

CONTOUR BUFFER STRIPS

(Ac.)

CODE 332

DEFINITION

Narrow strips of permanent, herbaceous vegetative cover established around the hill slope, and alternated down the slope with wider cropped strips that are farmed on the contour.

PURPOSE

This practice is applied to achieve one or more of the following:

- Reduce sheet and rill erosion
- Reduce transport of sediment and other water-borne contaminants downslope
- Increase water infiltration

CONDITIONS WHERE PRACTICE APPLIES

This practice applies on all sloping cropland, including orchards, vineyards and nut crops.

Where the width of the buffer strips will be equal to or exceed the width of the adjoining crop strips, the practice Stripcropping (code 585) applies.

CRITERIA

General Criteria Applicable to All Purposes

Surface flow from contoured crop rows must be delivered to a stable outlet.

The width of the cropped strip shall be designed to accommodate some multiple of full equipment width.

No plants listed on the noxious weed list of the state will be established in a buffer strip cropping system.

Buffer strips shall not be used as travel lanes for livestock or equipment.

Buffer strips are not a part of the normal crop rotation, and shall remain in the location they were originally established until they need to be renovated or re-established.

Row Grade. When the row grade of any crop strip reaches the maximum allowable design grade, a new baseline shall be established up or down slope from the last buffer strip and used for the layout of the next crop strip.

Arrangement of Strips. A crop strip shall occupy the area at the top of the hill, unless unusually complex topography requires vegetating this area in order to establish a farmable system.

When used in combination with terraces, diversions or water and sediment control basins, the layout of the buffer strips shall be coordinated with the grade and spacing of the terraces so that the buffer strip boundaries will parallel the terraces as closely as possible. The buffer strip shall be located immediately upslope from the terrace channel or the storage area of the water and sediment control basin.

Additional Criteria to Reduce Sheet and Rill Erosion

Minimum Row Grade. The cropped strips shall have sufficient row grade to ensure that runoff water does not pond and cause unacceptable crop damage.

Maximum Row Grade. The maximum row grade shall not exceed:

- one-half of the up-and-down hill slope percent used for conservation planning,

or 2%, whichever is less.

Up to 3% row grade is allowed for a maximum of 150 feet as crop rows approach a stable outlet.

When the row grade reaches the maximum allowable design grade, a new baseline shall be established up or down slope from the last contour line and used for layout of the next contour pattern.

Width of Strips. The minimum width shall be:

- At least 15 feet wide for strips planted to grasses or grass-legume mixtures with at least 50% grass and
- At least 30 feet wide when legumes are used alone or legumes make up more than 50% of the stand

Buffer strip widths shall be increased as needed to keep the width of the cropped strips uniform.

Cropped strips shall be of uniform width between buffer strips and shall not exceed 50% of the slope length (L), used for the erosion calculation.

Vegetation. Buffer strips designed to reduce sheet and rill erosion shall be established to permanent vegetation consisting of grasses, legumes or grass-legume mixtures.

Species established shall be adapted to the site, and tolerant of the anticipated depth of sediment deposition.

Species must be adapted to local soil, ecological sites and climatic conditions, be easily established, long-lived, and manageable. Care will be taken when selecting plants to avoid invasive species. Species shall be in conformance with the respective Major Land Resource Area (MLRA) Vegetative Guide in Section II of the Field Office Technical Guide.

The buffer strips shall have at least 95% ground cover during periods when erosion is expected to occur on the cropped strips.

The stem density for grasses and grass-legume mixtures shall be at least 50 stems per square foot, and for pure legume stands at least 30 stems per square foot.

Additional Criteria to Reduce the Transport of Sediment and Other Water-Borne Contaminants Downslope

Minimum Row Grade. The cropped strips shall have sufficient row grade to ensure that runoff water does not pond and cause unacceptable crop damage.

Maximum Row Grade. The maximum row grade within the crop strips shall not exceed one-half of the up-and-down-hill field slope used for conservation planning, or 2%, whichever is less.

Up to 3% row grade is allowed for a maximum of 150 feet as crop rows approach a stable outlet.

Vegetation. Buffer strips designed for this purpose shall be established to permanent sod-forming vegetation with stiff, upright stems.

Width of Strips. Buffer strips for this purpose shall be at least 15 feet wide. The buffer strip widths shall be increased as needed to keep the width of the cropped strips uniform.

The maximum width of cropped strips shall be one-half of the field slope length or 150 feet, whichever is less.

Arrangement of Strips. In addition to the buffer strips established on the hillside, a buffer strip will be established at the bottom of the slope. This strip shall be two times the width of the narrowest buffer strip in the system.

Additional Criteria to Increase Water Infiltration

Row Grade. The grade along the upper edge of the buffer strip shall not exceed 0.2%.

CONSIDERATIONS

General. Several factors influence the effectiveness of contour farming to reduce soil erosion. These factors include: 10-year, 24-hour rainfall in inches; ridge height; row grade; slope steepness; soil hydrologic group; cover and roughness; and slope length. Cover and roughness, row grade, and ridge height can be influenced by management and provide more or less benefit depending on design.

Contour farming is most effective on slopes between 2 and 10 percent. This practice will be less effective in achieving the stated purpose(s) on slopes exceeding 10 percent and in areas with 10-year, 24-hour rainfall of about 6.5 inches. The practice is not well suited to rolling topography having a high degree of slope irregularity because of the difficulty meeting row grade criteria.

This practice is most effective when the slope length on the cropped strips is between 100 and 400 feet long. On slopes longer than 400 feet, the volume and velocity of overland flow exceeds the capacity of the contour ridges to contain them. Increasing residue cover and roughness will change the vegetative cover-management conditions and decrease overland flow velocities, thus increasing the slope length at which this practice is effective. Increasing roughness alone is not sufficient to produce this effect.

Contour buffer strips are more difficult to establish on undulating to rolling topography because of the difficulty of maintaining parallel strip boundaries across the hill slope or staying within row grade limits.

Areas of existing or potential concentrated flow erosion should be protected by conservation practices such as grassed waterways, water and sediment control basins, or diversion terraces.

Where contour row curvature becomes too sharp to keep equipment aligned with rows during field operations, increasing the buffer strip width can help avoid sharp ridge points. In drainage ways, establishing grassed waterways at least up to the point of sharp curvature can allow the equipment to be lifted and/or turned to meet the same rows across the turn strip.

Prior to design and layout, remove any obstructions or making changes in field boundaries or shape, where feasible, to improve the effectiveness of the practice and the ease of performing farming operations.

Prior to layout, inspect the field's position on the landscape to find key points for starting layout or getting the width of one set of strips (one cultivated and one buffer) to pass by an obstruction or ridge saddle.

Whenever possible, run strip boundaries parallel with fence lines or other barriers.

Wildlife Food and Cover. The following management activities may be carried out to enhance wildlife benefits as long as they do not compromise the effectiveness of the buffer strips:

- Plant herbaceous species that provide habitat enhancement for the wildlife species of concern.
- Add native forbs to the seeding mixture to increase habitat diversity.
- Mow the buffer strips every other year or every third year depending upon geographical location. The standing cover provides early and late season nesting and escape cover for many species of wildlife displaced from adjacent disturbed areas.
- Delay mowing until after the nesting period of ground-nesting species, but mow early enough to allow for regrowth before the growing season ends.

ENDANGERED SPECIES CONSIDERATIONS

If during the Environmental Assessment NRCS determines that installation of this practice, along with any others proposed, will have an effect on any federal or state listed Rare, Threatened or Endangered species or their habitat, NRCS will advise the client of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the client selects one of the alternative conservation treatments for installation; or with concurrence of the client, NRCS initiates consultations concerning the listed species with the U.S. Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game.

CULTURAL RESOURCES CONSIDERATIONS

NRCS policy is to avoid any effect to cultural resources and protect them in their original location. Determine if installation of this practice or associated practices in the plan could have an effect on cultural resources. The

National Historic Preservation Act may require consultation with the California State Historic Preservation Officer.

<http://www.nrcs.usda.gov/technical/cultural.htm>

is the primary website for cultural resources information. The California Environmental Handbook and the California Environmental Assessment Worksheet also provide guidance on how the NRCS must account for cultural resources. The e-Field Office Technical Guide, Section II contains general information, with Web sites for additional information.

Document any specific considerations for cultural resources in the design docket and the Practice Requirements worksheet.

PLANS AND SPECIFICATIONS

Specifications for installation, operation and maintenance of Contour Buffer Strips shall be prepared for each field according to the Criteria, Considerations and Operations and Maintenance described in this standard. The plans shall include, as a minimum:

- Percent land slope used for conservation planning
- The minimum and maximum allowable row grades for the contour system
- The designed width of the buffer strips
- The species to be established in the buffers strips
- A sketch map or photograph of the field showing:
 - ◊ the approximate location of the baselines used to establish the system;
 - ◊ the location of stable outlets for the system

This and other pertinent information shall be recorded on specification sheets, job sheets, in practice narratives in conservation plans, or other acceptable documentation.

OPERATION AND MAINTENANCE

Conduct all farming operations parallel to the strip boundaries except on headlands or end

rows with gradients less than the criteria set forth in this standard.

Time mowing of buffer strips to maintain appropriate vegetative density and height for optimum trapping of sediment from the upslope cropped strip during the critical erosion period(s).

Fertilize buffer strips as needed to maintain stand density.

Mow sod turn strips and waterways at least once a year.

Spot seed or totally renovate buffer strip systems damaged by herbicide application after residual action of the herbicide is complete.

Redistribute sediment that accumulates along the upslope edge of the buffer strip/crop strip interface as needed. This sediment shall be spread evenly upslope over the cultivated strip when needed to maintain uniform sheet flow along the buffer/cropped strip boundary.

If sediment accumulates just below the upslope edge of the buffer strip to a depth of 6 inches or more, or stem density falls below specified amounts in the buffer strip, relocate the buffer/cropped strip interface location.

Cultivated strips and buffer strips shall be rotated so that a mature stand of protective cover is achieved in a newly established buffer strip immediately below or above the old buffer strip before removing the old buffer to plant an erosion-prone crop. Alternate repositioning of buffer strips to maintain their relative position on the hill slope.

Renovate vegetated headlands or end row area as needed to keep ground cover above 65 percent.

References

Foster, G.R. Revised Universal Soil Loss Equation, Version 2 (RUSLE2) Science Documentation (In Draft). USDA-ARS, Washington, DC. 2005. Renard, K.G., G.R. Foster, G.A. Weesies, D.K. McCool, and D.C. Yoder, coordinators. 1997. Predicting soil erosion by water: A guide to conservation planning with the Revised Universal Soil Loss Equation (RUSLE). U.S. Department of Agriculture, Agriculture Handbook 703.

