

STATE OF
ARIZONA
WATERSHEDS

OPERATION AND MAINTENANCE HANDBOOK

FOR PROJECTS INSTALLED WITH ASSISTANCE

from the

SOIL CONSERVATION SERVICE



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STATE OF ARIZONA

WATERSHEDS

OPERATION AND MAINTENANCE HANDBOOK

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I. General

This handbook is intended to acquaint sponsors with the essentials of operating and maintaining their watershed projects. The information and suggestions will help each sponsor understand and appreciate the job more fully so that it can be carried out in a timely and efficient manner.

The life of a watershed project can be divided into three broad phases, i.e., planning, installation, and operation and maintenance. Real effort and quality workmanship are essential in all three phases if the project is to provide the watershed community with the desired benefits. Sponsors may request and get considerable professional assistance for planning and installing their projects. In fact, trained Soil Conservation Service (SCS) technicians actually perform many of the various and complicated tasks in the first two phases. The operation and maintenance phase is equally critical and requires effort and expenditures throughout the useful life of the project. Sponsors are required to operate and maintain projects without financial assistance from SCS.

II. Definitions

A. Operation

The administration, management, and performance of non-maintenance actions needed to keep completed works of improvement functioning as planned.

B. Maintenance

Work required to keep works of improvement in, or restore them to, their original physical and functional condition.

Maintenance includes performance of work and application of measures to prevent deterioration as well as restoring, rebuilding, replacing, and putting together parts that have been torn, broken, or deteriorated.

C. Operation and Maintenance Agreement

A binding agreement between watershed sponsors and SCS that records the action each is to take in the operation and maintenance of the works of improvement described in the agreement.

The operation and maintenance agreement is a record of mutually satisfactory arrangements for:

1. Periodic and special inspections to determine how works of improvement are functioning and what operation and maintenance are needed.

2. Report of findings and record of how, when, and by whom the needed work is to be done.
3. Record and report of the cost and the date work was done.

A plan of operation and maintenance detailing the major routine needs is included in the operation and maintenance agreement. A separate plan is included for each measure or group of measures for which the routine operation and maintenance needs are expected to be different.

III. Reasons for Operation and Maintenance

Watershed projects move into the construction stage only after it is determined that the resulting benefits will equal or exceed the cost. The categories of cost include administration, land rights, installation, operation, and maintenance. Thus, watershed structures are designed and installed with the knowledge that operation and maintenance will be required.

The cost of operation and maintenance can be expected to increase if action is delayed. For example, delaying action to control woody plant growth in some channels for a single year can more than double the cost of spraying or cutting the plants. In addition, woody plants restrict waterflow and prevent the channel from effectively performing its planned project function. It is usually a small job to repair erosion rills when they first develop on earthen fills or in spillways. If erosion is allowed to continue, the corrective measures become more costly; in extreme cases, inattention to these maintenance needs can cause the structure to fail.

IV. Beginning of the Operation and Maintenance Phase

Each portion of watershed works of improvement enters the operation and maintenance phase when it is completed.

Structures installed by contract are considered completed when they are accepted from the contractors. Structures installed by local organization force accounts are considered completed when SCS agrees and notifies the local organization that the installation has been completed in accordance with the approved plans.

Vegetative measures are considered completed as soon as either of the following conditions are met:

- A. SCS determines that an adequate cover has been obtained.
- B. Two growing seasons have elapsed after the initial vegetative installation.

The earthen embankment, spillway, and other structural portions of a dam may enter the operation and maintenance phase before planned vegetative cover is obtained on the earthen portions. Sponsors are responsible for maintaining the structural portions as soon as the work is accepted from the construction contractors. However, sponsors are not expected to bear the entire cost of repairing damages caused by lack of planned vegetative cover if damages occur before vegetative measures are completed.

Provisions to this effect are to be included in operation and maintenance agreements covering structures on which vegetative cover is an integral feature.

SCS will notify sponsors when, in accordance with these criteria, the vegetative measures are complete.

V. Responsibilities for Operation and Maintenance

A. Contractor

The contractor is responsible for providing an installation that fully conforms to the contract drawings and specifications. Usually the contractor's responsibility for the work terminates when work has been completed and accepted by the contracting officer. But under certain circumstances the contractor's liability may be extended. For example, the factory warranty on items, such as electric motors, may extend for a specified number of months or years. If this is so or if a failure results from the use of material or workmanship of less quality than specified in the contract, the contractor's responsibility may extend beyond the date on which work has been accepted by the contracting officer.

B. Sponsoring Local Organization

The sponsors are fully responsible for financing and performing operation and maintenance needs on works of improvement without SCS cost-sharing assistance. If there is a malfunction or failure of any works of improvement, the sponsors should notify SCS immediately. The sponsors should avoid any action that would relieve the contractors or contractor suppliers of liability.

C. Soil Conservation Service

SCS is to determine the cause and measures needed to correct any malfunction or failure of watershed works of improvement. If design or construction for which SCS was responsible is at fault, SCS will provide funds if available for the federal

share of reconstruction costs. A separate agreement detailing work to be done and cost-sharing arrangements must be signed by SCS and the sponsors before the work is started.

SCS will:

1. Plan and design structural measures to function satisfactorily with reasonable maintenance for their estimated life.
2. Provide sponsors with complete, frank, and timely information on the expected cost of operation and maintenance in time, effort, and money.
3. Include in the work plan a complete description and discussion of anticipated major, as well as uncommon, items of operation and maintenance needs for each type of structure.
4. Counsel with sponsors on entrance and user fees where applicable.
5. Help sponsors make maintenance inspections for the first 3 years.
6. Furnish information from as-built plans when needed.

Within the limits of available resources, SCS will also:

7. Help sponsors schedule and program their operations and maintenance resources.
8. Advise sponsors on operation and maintenance controls and techniques.
9. Make engineering surveys and designs for maintenance when needed.

VI. Performing Operation and Maintenance

One of the first and major problems that sponsors need to resolve is arranging for funds to pay for operation and maintenance work. Experience has shown that fees collected for concessions and use of public recreation developments seldom cover the total cost of operating the development and leave no funds for maintenance. Plans for individual landowners to maintain structures on their own land are usually unsatisfactory because of changing interests, ownerships, and costs. Expected freewill donations to cover maintenance costs usually fail to materialize when needed.

Tax assessments provide an equitable and continuing means of funding operation and maintenance activities.

Although the watershed work plan includes an estimate of funds for the designed life of the project, actual costs can be expected to vary from year to year. For example, weather conditions could require higher-than-normal expenditure for operation and maintenance the very year a structure is completed.

Thus, sponsors will need enough funds to begin maintenance as soon as work is completed, and arrangements should be made to accumulate a reserve of funds to pay for greater-than-normal annual maintenance costs as they occur.

The manner of getting maintenance performed should be carefully considered and a method selected that will best fit the resources, desires, and capabilities of the sponsors. If sponsors have the equipment and work forces and are normally engaged in similar work, they may wish to use their own forces. Some sponsors have been very successful in arranging for local or state public works or highway departments to do the work. In all cases, it is strongly recommended that sponsors appoint maintenance managers and delegate authority to arrange for force-account work or to contract for the work. The important thing is to get timely performance of quality maintenance work.

VII. Plan of Operation and Maintenance

Operation and maintenance needs for dams, channels, or other works of improvement depend on variable factors such as topography, geology, size, purpose served, and use. Some items of maintenance may be critically important for one or more structures but may be less important for other similar structures in the project. Identifying operation and maintenance needs, structure by structure, will be useful to sponsors in planning and scheduling an effective operation and maintenance program.

SCS will help sponsors of each project prepare a plan of operation and maintenance tailored to fit each of the planned works of improvement having different operation and maintenance needs. The plan of operation and maintenance should be as detailed as necessary to identify all items of maintenance that are likely to be needed and specify the means to be used to accomplish them. It should be prepared before installation of the works of improvement is started.

Some examples of operation and maintenance actions that may be required on watershed works of improvement are listed in the appendix. Sponsors may find this list helpful in developing individual plans of operations.

VIII. Operation and Maintenance Inspection and Followup

The timing for some recurring operation and maintenance needs can usually be predicted with reasonable accuracy. For example, the operation and maintenance of public recreation facilities may require continuous attention during certain seasons. The vegetation on some earthen embankments may be expected to need an annual application of fertilizer and perhaps mowing periodically during certain seasons. The plan of operation and maintenance includes provisions to take care of these types of recurring needs. However, other operation and maintenance needs can be determined only by careful onsite observation. Thus, it will be necessary for sponsors to arrange for periodic inspection of project structures.

SCS will help sponsors inspect each structural measure to determine operation and maintenance needs for a period of 3 years after the structure is completed. Inasmuch as untreated minor maintenance needs can grow rapidly into major and costly maintenance problems, it is highly recommended that inspections be made 1 month after the structure is completed, every 3 months thereafter for 1 year, and annually thereafter. In addition, each structure should be inspected after unusually heavy runoff-producing storms. The findings, showing the needs and the date maintenance is to be performed, are to be recorded and made available to SCS. SCS also requests that sponsors send a copy of their accomplishment records that show the date of completed work and the cost to sponsors. This information will help SCS keep maintenance cost estimates current, thereby enabling SCS to provide better help to other sponsors. Many sponsors have found that simple forms help in recording and reporting inspection and follow-up activities. SCS will help sponsors develop a format or form for filing inspection reports that meet the needs of the sponsors and SCS.

IX. Environment

Watershed projects are designed to improve the total environment of the community. Actions are taken during project installations to minimize adverse effects on the environment. Completed projects should be living evidence of the consideration and concern sponsors have for the future well-being of the entire watershed community.

How successful this effort will be depends directly on the manner in which the project is operated and maintained. Methods and procedures of operation and maintenance activities can be developed that maintain and add to the beauty of the area, eliminate health hazards, control erosion and other pollutants, avoid contamination from use of unproven pesticides and herbicides, improve the economy, and insure the safe use and enjoyment of all facilities for their planned life.

EXAMPLES OF OPERATION AND MAINTENANCE

A - INSPECTION

1 - Objective -

To insure continuous and efficient operation of the project by periodic inspection of the physical condition of all elements of the project, recording of results of the inspection, and the development of plans to correct deficiencies observed.

2 - Participants -

a - Responsibility for conducting the inspection rests with the sponsoring local organization and should include those individuals charged with performing the maintenance work.

b - A representative from the USDA Soil Conservation Service is required for 3 years following installation of the works of improvement. After the 3-year period representation by the Soil Conservation Service is optional.

c - Co-sponsoring organizations or agencies interested in or affected by the project should be invited to participate in inspections. Among those invited to participate in the inspections should be representatives of Soil Conservation Districts, counties, cities, utility companies, irrigation districts, Federal, state, and local agencies etc.

d - The inspection party should include at least one individual technically qualified, through experience or training, to judge the condition of the works and to make appropriate recommendations.

3 - Scheduling -

a - The timing and frequency of inspections will be in accordance with par. 2, sec. VIII, of this handbook or as specifically provided for in the OPERATION AND MAINTENANCE AGREEMENT.

b - Notification of the time and place of inspections should be made to all interested groups far enough in advance of the scheduled date to permit adequate advance planning for the attendance by representatives of the groups.

c - The inspection schedule in the OPERATION AND MAINTENANCE AGREEMENT should provide for inspections to be made far enough in advance of normal flood seasons to permit the completion of any needed repairs prior to the beginning of the flood season.

A - Inspection

3 - Scheduling (cont.)

- d - Although in many instances the OPERATION AND MAINTENANCE AGREEMENT may actually require only an annual inspection, the sponsors are encouraged to make others, even if only partial inspections after heavy runoff-producing storms or during and after normal growing seasons.

4 - Recording and Reporting

- a - During inspections the sponsoring local organization representative is requested to record the results of inspections. Such information should contain the consensus of the inspecting group on the state of operation and the work needed for any repairs. Such information should be made available to the Soil Conservation Service.
- b - Although this handbook does not require a report of inspections, such a requirement may be agreed to in the OPERATION AND MAINTENANCE AGREEMENT. Unless a specific format or form is agreed to in the O&M AGREEMENT the sponsors may record and report their findings by narrative or on previously prepared forms. SCS personnel, if desired, will help sponsors develop formats, forms, or narrative outlines for uniform recording or reporting.
- c - The SCS requests being informed of the kind and cost of all maintenance work performed by the sponsors. This kind of information will enable SCS to provide better service to sponsors of other watershed projects.

B - OPERATIONS

Good management is essential for the continued operation, use and enjoyment of the watershed works of improvement.

Watershed drainage areas must be under good management with conservation measures applied and maintained to prevent damage or excessive maintenance costs to the works of improvement.

Fences, gates, levees, dikes, channels, dams, and related water control structures must operate properly and be maintained in good working condition if watershed works of improvement are to function efficiently.

Examples of Operation -

B - Operations (Cont.)

1 - Gates, Structural

Operate gates and other features to regulate the retention or release of water for irrigation, drainage, flood control, stock water, or other use in accordance with the OPERATION & MAINTENANCE AGREEMENT. Operation must comply with permits granted under State or local laws as they apply to the storage, release, depletion, and use of water.

2 - Water Regulation

Regulate storage in multiple purpose reservoirs, if so designated, to provide for maximum flood storage as watershed conditions dictate.

3 - Fish and Wildlife

a - Establish and regulate fishing and hunting in accordance with Federal, state, and local laws.

b - Prohibit unregulated use of power-operated boats.

c - In areas where water sports and fishing occur, establish water-use zoning to minimize conflict between the two recreational uses.

d - In areas designated for wildlife minimize human interference by prohibiting public motorized vehicles etc.

4 - Recreation

Recreational usage must conform to state and local laws regarding hunting, fishing, camping, swimming, etc., on public or private lands.

5 - Motor Vehicle Control

Prohibit travel of vehicles in designated areas to prevent erosion, damage to vegetation, impairment of recreational values, and adverse effect on fish and wildlife resources.

Keep motor vehicles confined to designated roads and trails and at speeds within acceptable and safe limits.

6 - Sanitation

Keep recreational facilities clean and sanitary. Service toilets and restrooms as often and intensively as necessary to maintain

B - Operations (Cont.)

6 - Sanitation (Cont.)

acceptable standards of cleanliness. Service septic tanks as needed to keep them functioning properly, to reduce objectionable odors and to exclude insects and rodents.

7 - Public Health, Welfare, and Safety

Develop, promulgate, and enforce reasonable and necessary regulations for occupancy and use of each public recreation and fish and wildlife development in order to protect the public's health, welfare, safety, and enjoyment. These include regulations for use of recreation areas and facilities within design limits and for purposes intended. (Misuse, including overuse, of an area leads to rapid deterioration, diminished aesthetic value, and general depreciation of the environment usually accompanied by unsafe and unsanitary conditions.)

Prevent contamination or pollution of all water for human consumption and/or recreation use. Test water regularly and treat all water as necessary to protect public health. If the water is unsafe, immediately post against its use. Take all reasonable steps to prevent use of unsafe water until corrective measures are taken. Consider applicable state and local laws, ordinances, and codes as minimum requirements for safeguarding public health and safety.

Dispose of garbage and other refuse as often as necessary to avoid threat to public health and safety and detraction from public use and enjoyment. Keep containers tightly covered. Do not allow containers to overflow and treat them to minimize obnoxious odors. Empty containers often enough to prevent breeding of flies and other disease-bearing insects and rodents. Eliminate from recreation areas all safety hazards such as dangerous trees, toxic plants, broken steps, protruding nails or bolts, glass, and cans. Provide lifeguards and safety devices in swimming or boating areas as required by state and local laws and regulations.

Public liability protection should be considered a part of the operation and maintenance plan.

8 - Dust Abatement

Install vegetative cover or provide other effective means of wind control measures. Protect and maintain vegetative cover and control grazing.

Prohibit or control vehicular travel in problem areas.

C- Maintenance (Cont.)

1 - Channels, Lined and Unlined (Cont.)

- h - Properly prepare and fill cracks or voids in concrete lined channels with an adequately designed patching mix.
- i - Fill contraction cracks in lined channels with appropriate materials.
- j - Control growth of undesirable weeds and brush. Comply with ordinances pertaining to spraying or burning.

2 - Dams

- a - Replace eroded soil on banks and around structures as required.
- b - Maintain riprap or other bank protection measures and replace as needed.
- c - Remove and/or stabilize slide materials as soon as practical. Construct berms on flattened slopes if necessary.
- d - Restore to their proper elevation dikes that have settled excessively to eliminate possible overtopping.
- e - Replace eroded materials in emergency spillways.
- f - Revegetate denuded areas to maintain the natural vegetative cover of the area.
- g - Blade or drag top of dam or otherwise fill consolidation or shrinkage cracks and irregularities to prevent erosion from rainfall accumulation.
- h - Inspect drainage systems and relief wells periodically for proper functioning and clean out or replace as necessary.
- i - Remove debris and trash from principal and emergency spillways to insure proper functioning.

3 - Structures

- a - Replace eroded backfill adjacent to structures. Use sands, gravels or other non-shrink soils as backfill material.
- b - Divert water away from structures and into protective inlets.
- c - Stabilize plunge pools with non-erosive materials as needed.

B - Operations (Cont.)

9 - Safety Hazards

Provide or require adequate protective devices for men and equipment used in the operation and maintenance of structural works of improvement. Provide fences, guard rails, cat walks, etc. Post warning signs as needed to draw attention to hazardous conditions.

10 - Utilities including irrigation facilities

Operation and maintenance of utilities within the project should be coordinated between all parties concerned.

Interested parties should be notified of any work being performed within their right-of-way boundaries. Schedule maintenance of utilities when possible during periods of the year least affecting operations of the works of improvement.

Locations of underground utilities are to be well posted.

C - MAINTENANCE

Maintenance work must be planned, scheduled, and performed on a timely basis if the works of improvement are to function according to plan.

Examples of Maintenance -

1 - Channels, Lined and Unlined

- a - Remove silt deposits and dispose of them outside the channel perimeter within right-of-way limitations. Maintain aesthetic values.
- b - Remove and properly dispose of debris.
- c - Repair or replace damaged structures. Replace eroded backfill as needed.
- d - Replace, reinforce or extend riprap where needed.
- e - Renovate damaged channel banks.
- f - Maintain dikes and spoil banks. Divert water to protect inlets or to prevent erosion.
- g - Keep access roadways used for maintenance in a usable condition. Control travel by maintaining fences and access gates.

C - Maintenance (Cont.)

7 - Access Roads

- a - Maintain access roads in a useable condition.
- b - Control unauthorized vehicular traffic by use of gates and signs.
- c - Provide fences to limit access or use of roads as appropriate.

8 - Recreational Facilities

- a - Maintain in good condition and proper working order facilities such as bathhouses, toilets, docks, beaches etc. Facilities shall conform to State Health Department Rules and Regulations
- b - Remove weak diving boards, hidden rocks, or other obstructions in swimming waters.
- c - At swimming areas -
 - (1) Conspicuously post general safety rules.
 - (2) Establish depth markers.
 - (3) Provide lifesaving and first-aid equipment.

9 - Diversion Dikes

- a - Replace eroded soil on banks and around structures.
- b - Maintain riprap or other bank or slope protective measures and replace as needed.
- c - Revegetate denuded areas.

10 - Utilities

- a - Maintain utility crossings in good condition.
- b - Keep locations of underground utilities well posted.
- c - Mutually inspect and supervise maintenance work on or around utility lines.
- d - Maintain a current file on utility companies involved and their personnel.

11 - Right-of-Way Crossings

- a - Maintain right-of-way crossings in good condition.
- b - Maintain fencing and access gates.

C - Maintenance (Cont.)

3 - Structures (Cont.)

- d - Keep stilling basins free of debris.
- e - Restore eroded earth or damaged rock riprap around energy dissipating structures.
- f - Replace concrete that has been damaged or deteriorated.
- g - Maintain in proper working order gates and valves, trash racks etc. Keep works free of debris that might hamper their function. Restore protective coatings when necessary.
- h - Maintain in proper working order any electrical or mechanical controls, equipment, and power units.
- i - Repaint all material surfaces requiring paint protection against corrosion or weathering.

4 - Water Control Gates

- a - Maintain all gates and valves in proper working order.
- b - Keep works free of debris.
- c - Lubricate and maintain oil level in control stem covers.
- d - Keep gates chained and padlocked in control position as appropriate.
- e - Repaint material surfaces requiring protective covering.

5 - Fences

- a - Maintain fences in good condition.
- b - Maintain gates used for control of livestock and vehicular travel.

6 - Signs

- a - Repair or replace signs and plaques to keep them sightly and functional.
- b - Repaint as needed, all surfaces requiring protective covering.
- c - Post vandalism, ownership, and danger signs as appropriate.

C - Maintenance (Cont.)

11 - Right-of-Way Crossings (Cont.)

- c - Keep bridges, culverts, etc. free of debris and silt deposits.
- d - Divert drainage to proper inlets as needed to prevent erosion.

12 - Livestock Crossings or Ramps

- a - Maintain livestock crossings and ramps in good condition.
- b - Maintain fences and gates in good condition.

13 - Sediment Removal

- a - Remove and dispose of excess sediment deposits in designated areas within right-of-way limitations.
- b - Maintain aesthetic values pertaining to locale.

14 - Fish and Wildlife

- a - Maintain in proper working order fish and wildlife features such as fish ladders, traps, screens, water level control gates etc.
- b - Manage areas for optimum production in accordance with fish and animal guides.

15 - Irrigation Facilities

- a - Maintain irrigation crossings and related works in good condition.
- b - Post locations of underground works.
- c - Mutually inspect and supervise maintenance work on irrigation facilities.
- d - Restore eroded earth, damaged concrete, or rock riprap in and around facilities.
- e - Remove silt deposits or debris that would affect operation of irrigation works.
- f - Control growth of undesirable weeds or brush.

C - Maintenance (Cont.)

16 - Vegetation

- a - Introduce, protect, and encourage growth of indigenous vegetative cover.
- b - Seed during seasons of the year most conducive to plant germination and survival.
- c - Confine removal of natural vegetation to only that required to insure proper functioning of the works of improvement.
- d - Remove undesirable vegetation by cutting or spraying with approved herbicides.
- e - Control grazing to obtain optimum vegetative cover.
- f - Fertilize as practical to encourage and maintain a vigorous cover.
- g - Observe Federal, state, and local ordinances regarding spraying or burning as they pertain to environmental hazards.