# Spring Development (No.) 574

**DEFINITION**

*Collection of water from springs or seeps to provide water for a conservation need.*

**PURPOSE**

*Improve the quantity and/or quality of water for livestock, wildlife or other agricultural uses.*

**CONDITIONS WHERE PRACTICE APPLIES**

In areas where a spring or seep will provide a dependable supply of suitable water for the planned use.

**CRITERIA**

**General Criteria Applicable to All Purposes**

Spring developments shall be planned, designed, and installed to meet all Federal, State, Local, and Tribal laws and regulations.

*An investigation of site conditions shall be made, including:*

*a. Soil borings*

*b. Water quality for the intended purpose*

*c. Water quantity for the intended purpose*

*d. Suitability of the spring location for the intended purpose*

*e. A determination that the farmer has the appropriate water rights or permits to develop the spring*

*f. An assessment to determine existing ecological functions and potential losses from the spring development.*

*g. A certified wetland determination*

*h. An assessment of the cultural resource associated with the spring.*

Impacts to existing wetland functions shall be assessed. USDA wetland conservation provisions apply. The practice must comply with NRCS wetland technical assistance policy in GM 190, Part 410.26 and National Food Security Act Manual, 3rd edition.

The landowner is responsible for obtaining any State, Federal, and local permits where applicable. *Projects that may impact a threatened or endangered species require consultation with the U.S. Fish and Wildlife Service for Federally-listed species and the Michigan Department of Natural Resources for state-listed species. These agencies will further evaluate the threatened or endangered species impacts of the project and help determine if the project is feasible.*

*Develop springs by removing obstructions to the flow, collecting the water flow and storing the water, if flow from the spring is not sufficient to meet the peak demand of the intended use.*

*Remove obstructions to spring flow such as fine-grained sediments, rock, slope-wash materials and vegetation to allow the spring to flow freely. Design the development of the spring to prevent obstructions from reoccurring.*

**Fracture and tubular springs.** This type of spring is associated with cavernous rock. If water *flows* from rock fractures, the individual openings shall be cleaned and enlarged, as needed, to improve *flow.* The water from these individual openings shall be collected by means of tile or perforated pipeline or by a gravel-filled trench. The collection works shall be constructed and adequate distance below the elevation of the openings to permit free drainage.

If water flows from a single opening, such as a solution channel in a soluble rock formation, the opening shall be cleaned or enlarged as needed. A collection system usually is not required.

If a spring box or sump is used, it shall be installed at an elevation low enough that water will not pond over the spring opening to a depth that will restrict the yield.

**Perched or contact spring.** Perched or contact springs occur when an impermeable layer lies beneath a water –bearing permeable layer. Collection trenches shall be used to intercept and divert flows from the water-bearing formation.

**Artesian spring**. Artesian springs normally occur at a fissure or break in the impervious stratum with the water source being an under-lying pervious water bearing layer so positioned that the water surface elevation (water table) is always above the outlet point of the spring. Remove obstructions, clean or enlarge joints or fractures, or lower the outlet elevation as needed to improve flow. Sumps or spring boxes shall be located as needed. Free outlet discharge or minimum restriction to the spring flow is required to protect and maintain yield. Ponding over the spring outlet shall be minimized.

**Collection systems.** *The type of collection system used for the spring development is dependent upon the type of spring and site geology. Design the collection system to collect sufficient water for the intended purpose of the spring. Collection systems generally consist of a restrictive barrier that forces water to collect in a perforated pipe that flows to an outlet.* The collection trench shall be excavated so that it extends into the impervious layer. Minimum length of the trench shall be based on site conditions and pipe length to collect the amount of needed water, preferably the entire length of the water-bearing outcrop.

When needed a cutoff wall shall be constructed along the downstream side of the trench if needed to ensure that the flow enters the collection system. The cutoff wall may be constructed of plastic sheeting, well-tamped clay, masonry, concrete, or other impervious materials.

The collection system shall consist of subsurface drainage tubing or perforated pipe not less than 4-inch diameter, wood box drain, or other suitable manufactured system. Surrounding the collector with geotextile fabric or sand-gravel filter is recommended. Cleanouts are recommended for all collection systems.

Crushed rock or gravel backfill, not less than 1-foot thick (0.3m), may be used as a collection system if site conditions warrant, in lieu of other material.

Sand, gravel, and crushed rock shall be composed of clean, hard, durable particles.

*Include measures in the collection system to prevent sediment from entering the system and/or provisions to trap and remove sediment that does enter the system.*

**Spring boxes.** *Include a spring box, if necessary, to allow sediment to settle out of the spring flow or to provide storage to meet peak demands on the water from the spring. Locate the spring box to allow water to flow by gravity from the spring to the spring box.* Construct the spring box of a durable material such as concrete, plastic, galvanized steel, *naturally rot resistant wood*, or other durable material, with a tight access cover. A "shoebox" type access cover or manhole attachment, with gasket, is recommended for tightness. The base of the spring boxes shall be concrete unless the underlying material is stable and impervious, or if inflow is from the bottom.

The spring box shall have a minimum cross-sectional area of $1^1/_2$ $ft^2$ (0.5m), and the floor of the box shall be not less that 6 inches (150mm) below the outlet of the collection system *in order to provide for the storage of sediment and any required storage of water. The cross-sectional area of the spring box shall be large enough to allow access for periodic cleaning. To prevent freezing, bury the spring box in the soil. Provide the spring box with a tight fitting cover to prevent trash and surface runoff from entering.*

*The spring development shall have an outlet pipe that carries the water to its intended use. Design the outlet pipe according to Conservation Practice Standard Pipelines, 516, Pipeline.*

*A pump will be needed if gravity will not carry water from the spring to where the water will be used. Base the type and size of the pump upon available power sources and the water delivery needs.*

*When flow from the spring, whether intermittent or continuous, will exceed the capacity of the collection system, an overflow is required. Sizes the overflow to carry the maximum flow expected from the spring during periods of wet weather, or follow the guidance for overflow requirements in NRCS Conservation Practice Standard 614, Watering Facility. Manage the overflow so that it does not create a resource problem.*

Flow control/restrictors on pipelines and/or floats shall be used as needed to reduce water withdrawn from the spring. If applicable, overflow water shall be returned to the spring site.

**Outlets.** The outlet pipe from a spring box shall be placed not less than 6 inches (150mm) above the base to provide a sediment trap. The spring outlet pipe should be at the same elevation or lower than the collector pie outlet to prevent reduced spring flow. The intake to the outlet pipe shall be screened as necessary, and installed to the box with a watertight connection.

The outlet pie must have positive grade away from the spring box or collection system unless vent pipe(s) are added to prevent air locks.

Shut off valve and/or a vent system shall be included on the spring outlet pipe for winter shutdown, flow control, and system maintenance.

The outlet pipe shall have a minimum $1^1/_4$ inch (32 mm) diameter. In lieu of site specific spring flow and pipe vent calculations, the outlet pipe shall have the following minimum size based on line grades:

1. $1^1/_4$ inch (32 mm) inside diameter for line grades greater than 1.0 percent.
2. $1^1/_2$ inch (38mm) inside diameter for line grades greater than or equal to 0.5 percent but less than or equal to 1.0 percent.
3. 2 inches (51mm) inside diameter for line grades less than 0.5 percent.

Pipe beyond 3 feet (0.9m) from the outlet may be sized per applicable criteria in NRCS Conservation Practice Standard 516, Pipeline.

Minimum outlet pipe material and strength requirements shall equal those found in NRCS Conservation Practice Standard 516, Pipeline.

Where there is no spring box or the spring box is covered and air tight, care must be taken to not have any reverse grade in the outlet pipe and/or to add a vent pipe at the upstream end to prevent air locks.

**Appurtenance Protection.** *Design the spring development so that it is protected from* damage by freezing, flooding, livestock, excess sediment, vehicular traffic and water quality contamination.

**Wildlife Habitat Protection.** Spring developments with potential to jeopardize wetlands, bogs, fens, threatened and endangered species, or other unique ecological sites shall be designed with measures required to maintain the existing habitat, unless acceptable mitigation is provided. A functional assessment will be made at potential spring development areas to determine existing ecological functions and/or potential losses. *If the assessment indicates the ecological value of the spring is very high and there are no suitable measures to maintain the existing habitat, then alternatives to spring development shall be pursued.*

Operation and maintenance plans for ecologically sensitive sites shall include specific valve installations and operation requirements to protect existing site habitat values.

*Follow Conservation Practice Standard 614, Watering Facility to design facilities to provide access for livestock and wildlife to water from the developed spring.*

**Vegetation.** Disturbed areas shall be established with vegetation or otherwise stabilized as soon as practical after construction. Seedbed preparation, seed fertilizing, and mulching shall conform to NRCS Conservation Practice Standard Critical Area Planting (342).

Use vegetation adapted to the site that will accomplish the desired purpose. Preference shall be given to native species in order to reduce the introduction of invasive plant species; provided management of existing invasive species; and minimize the economic, ecological, and human

health impacts that invasive species may cause. If native plant materials are not adaptable or proven effective for the plant use, then non-native species may be used. Refer to the Field Office Technical Guide, Section II, Invasive Plant Species, for plant materials identified as invasive species.

*Regrade areas disturbed by construction of the spring development to keep surface flow out of the spring. Revegetate disturbed areas as soon as possible after construction.*

**CONSIDERATIONS**

Consider the potential effects of installation and operation of the spring development on cultural, archaeological, historic and economic resources.

*A shutoff valve and vent system on the spring outlet pipe should be considered for winter shutdown, flow control and maintenance.*

Native vegetation adapted to wet conditions should be considered on wet sites *as an alternative to introduced grasses to stabilize areas after construction.*

*Consider how other conservation practices properly applied on the spring recharge area may increase infiltration of precipitation in order to conserve the spring's flows.*

*Consider how diversion of water from spring developments affects stream flows in the watershed.*

*Aquatic habitat quality may be conserved when a spring is developed near surface waters, or on a floodplain, by incorporating a float valve that shuts off flow to the tank, and*

*returns overflow via a stable outlet to the same watershed where it was collected.*

*Springs may represent islands of unique habitat in the landscape, supporting plant and animal populations that only occur in an area of a high water table. Consider options for developing the spring or seep that preserve the conditions that support these unique habitats.*

*Springs are sources of water for fish and wildlife. Maintain fish and wildlife access to water from the spring development where possible.*

*Brush removal, excavation, clean out and withdrawal of water are manipulations that may affect wildlife habitat and wetland functions and values. However, selective removal of undesirable brush and management for desirable native plants may reduce evaporative losses and conserve biodiversity.* Trees, stumps, and brush removed from the construction area may be piled for wildlife habitat when approved by the landowner/user.

Exclusion fencing should be considered in areas that are seasonally wet and/or to reduce trampling by livestock and wildlife. Fence construction shall be in accordance with NRCS Conservation Practice Standard 382, Fence.

Construction operations should be carried out in such a manner and sequence that erosion, air, and water pollution will be minimized and held within acceptable limits.

**PLANS AND SPECIFICATIONS**

Plans and specifications for spring development shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

Support data documentation requirements are as follows:

- Inventory and evaluation records
  - Conservation Assistance notes or special report
- Survey notes, where applicable
  - Design survey
  - Construction layout survey
  - Construction check survey
- Design records
  - Physical data, functional requirements and site constraints, where applicable
  - Soils/subsurface investigation report, where applicable
  - Water quality testing report, where applicable
- Design and quantity calculations
- Construction drawings/specifications with:
  - Location map
  - "Designed by" and "Checked by" names or initials

  - Approval signature
  - Job class designation
  - Initials from pre-construction conference
  - As-built notes
- Construction inspection records
  - Conservation Assistance notes or separate inspection records
  - Construction approval signature
- Record of any variances approved, where applicable
- Record of approvals of in-field changes affecting function and/or job class, where applicable

**OPERATION AND MAINTENANCE**

An Operation and Maintenance (O&M) plan shall be developed for this practice. The O&M plan shall be consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for the design.

**REFERENCES**

National Engineering Handbook - Part 650, Engineering Field Handbook, Chapter 12, Springs and Wells.

The Restoration & Management of Small Wetlands of the Mountains & Piedmont in the Southeast. Somers, A. B. et al. USDA, Natural Resources Conservation Service, Watershed Science Institute. November 2000.

National Engineering Manual, Part 531 Geology 531.31, USDA, Natural Resources Conservation Service,

Groundwater & Wells, Fletcher Driscoll, Johnson Division.

Water Supply Paper 2220, Basic Ground-water Hydrology, US Geological Survey.