



5.4.2.1 Change Cover Type

Description

A change in cover type to enhance stormwater management involves replacing surfaces that have a high coefficient of runoff with an absorbent, more permeable ground layer. Changing the surface cover of the ground can significantly reduce the volume and velocity of stormwater runoff and improve water quality. This BMP focuses specifically on improving the permeability and retention of stormwater with the use of high-performance vegetative cover.

Natural vegetation in the Tennessee Valley can be grouped into several, readily identifiable landscape types ranging from turf grasses to mature forest:

- Lawn (with European turf grasses)
- Annual, Biennial, and Perennial Meadows (primarily herbaceous—agricultural crops to native grasses, wildflowers, ferns, etc.)
- Old Fields and Savannas (woody vegetation within the matrix of a meadow)
- Young Woodlands and Mature Woodlands (woodlands generally have a few tree species growing densely together with only tree trunks and ground layer)
- Mature Forest and Old Growth Forest (mature forests have closed tree canopy, shade-tolerant plants, mixed species, mixed ages, and many layers, while old growth forests revert to only a few dominant canopy tree species with two major layers—canopy and ground layer)



Figure 5.4.2.1-1. Lawn.



Figure 5.4.2.1-2. Meadow.





Figure 5.4.2.1-3. Savannah.



Figure 5.4.2.1-4. Mature woodland.





Figure 5.4.2.1-5. Forest.

These landscapes represent a natural succession of development over time. Stormwater management benefits are related to soil infiltration capacity and vary from worst performance (soil under turf grasses) to best performance (spongy, absorbent soil under a mature forest).

The changes that make up this gradual succession show themselves in many ways, with different species, structure, and appearance. A typical succession or change of landscape type follows a progressive pattern from field to forest—from young, open, sunny landscapes with one or two major layers to old, closed, shady landscapes with multiple layers and sometimes a wide variety of species and plant ages.

BMP Functions Table

BMP	Applicability	Volume Reduction	Water Quality	Peak Rate Reduction	Recharge	Runoff Temperature Mitigation	Heat Island	Habitat Creation	Maintenance Burden	Cost
Change Cover Type	U/S/R	H	H	M	H	H	H	M	M	L*

KEY: U = Urban; S = Suburban; R = Rural; H = High; M = Medium; L = Low

*Initial cost may be high, but low in the long-term.





Key Requirements

- Identify areas that, after fitting the program onto the site, are appropriate for cover conversion during site assessment.
- Define which landscape type complements the proposed development, reduces maintenance costs, and increases stormwater management functions.
- Determine where cover can be converted.
- Design for a strong, simple image.
- Monitor and repair where necessary.

Advantages

- Substitutes high-maintenance areas with lower maintenance ones after establishment period.
- Provides greater permeability of soils and plant roots.
- Increases water-absorbing capacities of the soil.
- Lifecycle cost is less expensive than structural BMPs.

Disadvantages

- May not complement desired site character; site program must be compatible.
- Unfamiliar maintenance may be perceived as cumbersome and difficult.
- Lack of trained maintenance professionals.
- Establishment costs can be significant.
- May require extra time and expertise to design.

Applications

This BMP can be applied to any land development that has the land area and the program to allow for substitution of a meadow, old field, woodland, or forest for less permeable cover (i.e., lawn) or pavement.

- Lawn Conversion to Meadow – Steep slopes, edges between landscape types (such as between forest and lawn), property edges, and leftover spaces (between roads, service access areas, etc.) are particularly suitable locations for meadow conversion.
- Lawn Conversion to “No Mow” Lawn – High-visibility areas near walkways and buildings are particularly suitable locations for “no mow” lawn conversion.





- Lawn Conversion to Planting Beds (Trees/Ground Cover/Low Shrubs/Grasses) – Open areas around buildings, parking lots, and other facilities are suitable locations for this conversion.
- Conversion to Young Woodland or Forest – Road edges and property edges to screen views, to create or reinforce riparian corridors, and to screen problematic views or provide a boundary at major site divisions are suggested suitable locations for this conversion.
- Conversion of Construction-Staging Sites and Transition Areas – Sites that require stabilization for erosion control may be good candidates for conversion from lawn to meadow or lawn to woodland.



Figure 5.4.2.1-6. No mow lawn, with meadow in background.



Figure 5.4.2.1-7. Old field plantings along road edge.





Figure 5.4.2.1-8. Lawn conversion to meadow bordering property boundary.

Applicable Protocols and Specifications

- Protocol 3 Soil Testing
- Protocol 5 Planting Guidelines

Design Considerations

During site assessment, the design team should identify areas that, after fitting the program onto the site, could be converted from pavement or turf to a later successional vegetation type. Some conversions may be more feasible than others but may not offer the same water management benefit. The designer should balance these considerations.

This BMP is eligible for SOV credits as defined in Chapter 7. A Criteria Checklist is provided at the end of this section as a summary of design and establishment considerations.

The following considerations are provided as guidance:

- Determine the size and location of the area for cover change.
- Determine the choice of landscape type (meadow, forest, woodland, etc.) and individual species based on site conditions (soil type, soil moisture, sun/shade, exposure/protection, etc.) combined with program requirements and the owner's wishes.
- Choose suitable landscape type and determine its character:
 - For any proposed area that is relatively small and close to people and activities, consider the following:
 - Design a strong structure for the landscape. Often these landscapes are perceived to be messy and unkempt. However, if framed well, people are more likely to understand that the design was intentional.





- Create visible transitions. Maintenance of the edges of natural landscape cover types is especially important so that these landscapes look orderly and attractive. An adjacent lawn needs to be healthy and well-mown. The grades from one landscape cover type to another should meet gracefully and without abrupt changes in elevation. Edges between meadow and lawn can be cut with a flail mower to create a shorter grass height as a transition. Maintain a strip of mowed lawn between walkways and meadow.
- Establish a miniature of the landscape type chosen with young plants, replicating the most evocative elements of the type being emulated.
- Choose species that are more ornamental, that are pleasing in all seasons, and that will thrive under the site conditions. For example, if meadow is substituted for lawn near a building, use a lot of flowers that bloom all summer.
- When establishing a more complex landscape, such as a woodland or forest, create the appropriate number of layers. With forest, structure the landscape with a few larger trees, use flowering understory, and provide a rich ground layer of ferns and wildflowers. With woodlands, structure the landscape as a “two-layer” forest consisting of closely spaced, even-aged young trees above, and shade-tolerant meadow below.
- Shady conditions and dense trees will help limit invasive exotics.
- For any proposed area with a cover type change that is primarily for stormwater management and will not be seen regularly, consider the following:
 - Plugs or young plants can be used for forests, woodlands, and meadows. They should be planted closely together. The goal is not to create an illusion of a finished cover type, but rather to set in motion the natural processes that will gradually create a finished cover type over time. A well-established ground layer is critical to the success of this approach. This also helps to control invasive plants and weeds.



Figure 5.4.2.1-9. Mown path through meadow with strategically placed flowering tree.



Figure 5.4.2.1-10. Ornamental meadow planting.





Figure 5.4.2.1-11. Meadow plugs being installed.

- For creating meadows in larger areas, seeding is a more cost-effective planting method.
 - The creation of a meadow need not be restricted to native grasses and wildflowers. Meadows can also be made of low shrubs and/or low woody ground covers, or even of ferns.



Figure 5.4.2.1-12. Fern meadow.





- Hayfields are another possible meadow presentation. These meadows are made of typical agricultural species (cereal crops, etc.). Although this solution is quick and easy and looks established shortly after planting, the stormwater benefits are not as significant. Agricultural meadows also require mowing and periodic over-seeding. This type of meadow is most viable where growing food or raising animals is part of the site program, or where there is a nearby farmer willing to cultivate the land.
- When considering transition to forest or woodland, consider creating a connection between other natural landscapes.

Conversion Methods

- Lawn Conversion to “No Mow” Lawn

“No mow” lawn is a special mix of fescues and/or woodland sedges selected to grow no more than 4 to 6 inches tall and that requires no mowing. There are many proprietary blends on the market, many of which are drought tolerant and some that will grow taller than 4 to 6 inches. To convert typical lawn to “no mow,” do the following:



Figure 5.4.2.1-13. No mow lawn.

- Lift and remove all existing grass with roots and rototill soil to a depth of 6 inches.
 - Allow land to lay fallow and let weeds sprout but not produce seeds. The time frame will depend on the type of weed species and climate conditions; monitoring is required. Smother or apply herbicide to weeds and leave area fallow for a month.
 - Rototill dead plants and any remaining weeds into the soil.
 - Amend soil mixture with organic matter and nutrients specific to soil test results.
 - Seed with “no mow” lawn.
 - Plant critical areas with plugs for an instant effect.
 - Mulch (see Protocol 5, Planting and Mulching, in this manual).
- Lawn Conversion to Planting Beds (Trees/Ground Cover/Low Shrubs/Grasses)
 - Remove turf (see options below).
 - Add organic matter and other soil amendments (per soil tests).
 - Rototill into the soil to a depth of 12 inches prior to planting.





- Lawn Conversion Meadow

There are different approaches to converting lawn to meadow:

- Reduce Mowing Frequency Gradually

A reduction in mowing frequency can gradually convert a lawn, especially a lawn in poor condition, into a tall-grass and/or wildflower meadow.

Reduced mowing works well if cost is an issue and appearance is not of great importance. This method is viable where native soils are relatively intact and where field observations suggest that natural regeneration of native meadow plants will occur from the existing seed bank. This conversion has the advantage of exposing no bare soil and maintaining meadow plants from the start. It may be summarized as follows:

- Change the mowing timing and height to favor the growth of native warm-season grasses over turf grasses.
- Monitor the native meadow species that emerge.
- Promptly remove weed species and invasive exotics before they can spread.
- Plant specific wildflowers or grasses, if desired, into the meadow as plugs (use this method only after finding some evidence of existing native grasses and wildflowers).
- The establishment of meadow can be advanced by over-seeding or plugging.
- Establish a mowing regimen for this conversion technique; the recommended regimen is to mow five times during the first year, four times the second year, three times the third year, two times the fourth year, and once in the fifth year.



Figure 5.4.2.1-14. Conversion area at the State University of New York – Buffalo.



Figure 5.4.2.1-15. Seeded meadow starting to germinate.





– Meadow Seeding

This method is appropriate for newly graded areas and other sites with bare soil. The advantage of this method is that it allows the designer to plant a specific species mix with a relatively high degree of control. The downside is that the existing plant cover must be killed first and the early meadow takes several years to establish.

- Remove lawn or pavement and prepare soil as discussed below under soil preparation.
- Seeding is generally the preferred and least expensive planting method in areas greater than 1 acre.
- Drill seeding is most effective because it ensures good seed-to-soil contact. For drill seeding, use a drill with a specialized seed box containing “picker wheels” to facilitate the handling of fluffy native grass seed through the seed chute. Drill seeders are available through state wildlife agencies, soil conservation districts, the Natural Resources Conservation Service, and some local chapters of Quail Unlimited (University of Tennessee Extension Service 2004).
- Seed can also be broadcast by hand or by mechanical seeder. When using a mechanical seeder, use one with “picker wheels” that allows fluffy seeds to pass. Alternatively, mix fluffy seed with a carrier (cracked corn, cottonseed hulls, clean sand, or perlite). After planting, use a “cultipack” to make sure there is firm seed-to-soil contact. Do not seed in winds exceeding 5 miles per hour.
- Seeded meadows take two to five years to fully establish and can look weedy during this period, but will develop structure over time.



Figure 5.4.2.1-16. Drill seeder.



Figure 5.4.2.1-17. Cultipack.

– Ornamental Meadows/Plugging

- Remove lawn or pavement and prepare soil as discussed below under soil preparation.
- If planting a tall grass and wildflower meadow and an immediate effect is required, consider using grass or wildflower “plugs.” Plugs are small herbaceous plants grown in trays, with root systems already started. They are more expensive than seed and require more labor to plant





(this planting method is similar to planting ground cover, such as ivy slips), but provide an immediate impact.

- Plant spacing is species specific, but it is more effective to plant densely to reduce weeds (maximum 12 to 18 inches apart).
- Consider supplementing seeded meadows with plugs in visible areas for immediate effect.

- Conversion to Young Woodland/Forest

There are several approaches to creating forest on a cleared site. All of these methods require careful monitoring of invasive species, especially in the first couple of years.

Stabilize soil with erosion control consisting of a leaf litter to a depth of 1 inch. Place open weave burlap on top of leaf litter and cover burlap with thin layer (no more than 1 inch) of leaf litter. Use additional leaf litter to fill any holes.

Approaches include:

- Planting four to five distinct layers in a matrix of species of varied ages (canopy, understory, high shrub, low shrub, and ground layer). Different plant sizes will help differentiate the layers. Use additional leaf litter between the plants and to fill any holes. Plant small woody plants and containers of herbaceous woodland plants through the burlap and leaf litter to establish a ground layer.
- Sow by hand fast-growing forest tree seeds, such as cherry and tulip poplar.
- Plant a meadow and intersperse with canopy trees that will act as seed sources and allow for succession.
- Plant dense cover of tree seedlings with volunteers.
- Many sites still have a seed bank in the soil containing native species. Eliminating disturbance to the system (mowing, etc.) may result in desired native woodland over time with minimal inputs.

Construction Considerations

- Identify areas designated for cover change and stake in the field.
- Protect these areas during construction (see Section 5.2.1, Protect Undisturbed and Healthy Soils, of this manual).
- Removal of Pavement or Lawn
 - Pavement
 - Pavements, including the gravel sub-base, should be dug up and removed. Remove concrete pieces, cement, large stones, and soils contaminated by oil, gas, and other extraneous materials that are harmful to plant growth. All turf grasses should be removed with particular care given to removing grasses with strong stolon/rhizome roots (i.e., Bermuda grass, Zoysia





grass) and tall fescues; this grass species is highly competitive and can crowd out new herbaceous plantings quickly if roots are left behind.



Figure 5.4.2.1-18. Pavement removal.

- Lawn (several removal options are effective)
 - Smother: Cover ground completely with plywood, layers of newspaper, or thick organic mulch (leaves, etc.; do not use any type of plastic sheeting because it will deteriorate in the sun and break up into many tiny shards). Leave area covered for two months.



Figure 5.4.2.1-19. Smothering lawn with newspapers and mulch.

- Cultivate: Remove existing sod with cutter, then rototill or plow soil. Repeat two to three times at one-week intervals. Rhizomatous grasses may require a longer tilling period.





- Herbicide: A method of last resort, but necessary in some cases. Use with caution around water bodies due to the susceptible nature of aquatic organisms. Use the least persistent pesticide available to accomplish the job. Note that some have the ability to change the structure of the soil. Apply herbicide according to the manufacturer's written instructions.
- Soil Preparation
 - Consider consulting with a soil scientist. Soil conditions and the needs of landscape types can vary greatly. Generalized suggestions are as follows:
 - Soil preparation for areas formerly under pavement:
 - For previously paved areas, replace topsoil (for forest, woodland, and no mow grasses), till soil to a minimum depth of 8 inches, and remove stones larger than 1 inch. Apply a 1-inch layer of organic compost and rototill into the top 4 inches of soil. Fertilizers are not required since the organic matter supplies the necessary nutrients without creating a nutrient-rich soil.
 - For meadows, harrow to break up clods (lumps of soil) and to provide a finer finish, good tilth, and suitable soil structure for seedbed.
 - Soils may also need to be amended with specific nutrients depending on soil tests.
Please note: Native meadows grow best in nutrient-poor conditions.
 - Soil preparation for areas formerly under lawn:
 - For drill seeding, remove thick thatch, stones, construction debris, etc., greater than 1 inch.
 - For broadcast seeding, loosen soil to a depth of 3 inches, and remove stones, construction debris, etc., greater than 1 inch.
 - For meadows, harrow to break up clods (lumps of soil) and to provide a finer finish, a good tilth, and suitable soil structure for seedbed.
 - In both cases, amend soils with organic matter and specific nutrients, depending on recommendations from soil tests. **Please note: Native meadows grow best in nutrient-poor conditions.**
- Plant Sources
 - Meadows
 - For tall grass and/or wildflower meadows, select quality seeds and/or plugs from reliable sources. Many vendors supply pre-mixed blends of native grasses and wildflower for various conditions and purposes. Vendors may also prepare a custom mix.
 - Woody and Herbaceous Plants
 - Tennessee is a major nursery state; therefore, sourcing of appropriate plants should not be an issue. Contract growing or use of plants rescued from construction sites are options if lead time permits.



Figure 5.4.2.1-20. Harrowing.





- Post Planting Protection
 - Meadows
 - Protect seeded areas from hot, dry weather or drying winds by spreading straw or hay mulch 1 inch thick. Crimp mulch or apply a tackifier to protect seed.
 - Mulch plugged areas with hay or straw.
 - Woody and Herbaceous Plants
 - The leaf litter and open weave burlap covering the bare soil should protect the newly planted plants. For additional protection measures, see Section 5.4.2, *Improve Native Landscape Cover Types*, in this manual.

Operations and Maintenance

- Initial Establishment
 - After initial planting, water new cover type with a fine spray at a minimum rate of ½ inch per week for eight weeks after planting, unless rainfall is adequate.
 - Mow meadows during the first growing season to a height of 6 inches. Annual and biennial weeds grow more quickly than perennial grasses and wildflowers. If weeds exceed 9 inches in height, remove flowering heads with a weed whacker.
 - Control of weeds and invasive plants is critical, especially prior to cover type planting and during the establishment period.
- Long-term Management
 - For highly visible landscapes of all cover types, regular monitoring and maintenance are critical to a tidy and pleasing appearance. Maintenance includes watering during droughts, weeding, removing invasive species, and replanting where plants are damaged.
 - For landscapes where the primary purposes of the cover type are erosion control and increased soil permeability, and the landscape is not regularly seen, maintenance can be reduced to an inspection twice a year for problems and immediate repair and mowing once or twice yearly for meadows: late winter/early spring and once in mid-summer.
 - Maintenance of the edges of natural landscape cover types is especially important so that these landscapes look orderly and attractive. An adjacent lawn needs to be healthy and well-mown. The grades from one landscape cover type to another should meet gracefully and without abrupt changes in elevation. Edges between meadow and lawn can be cut with a flail mower to create a shorter grass height as a transition.



Figure 5.4.2.1-21. Meadow mowing.





- **Controlling Invasive Plants**

- Regardless of cover type, removal of invasive species is critical to the success of this BMP. As soon as detected and when these pest plants are large enough, pull (mechanically or by hand), mow, spray with spot chemical applications, burn, or use a combination of techniques. Remove invasive species before seed formation to prevent reseeding. A link to a list of invasive species can be found in Protocol 5, Planting Guidelines, in this manual.



Figure 5.4.2.1-22. Hand removal of invasives.

- **Mowing**

- For all herbaceous cover types (including old fields and savannahs where woody plants are set in a matrix of meadow), mow once or twice a year to prevent takeover by woody species and to maintain a tight and attractive appearance. Mowing is the most often used, most familiar, and most widely accepted technique. Mow in late winter/early spring and again in mid-summer.
- Some native grasses grow in individual clumps. Avoid damaging the base of these grasses when mowing by setting the mower blade at a height of 4 to 6 inches.
- In ornamental meadows or if numbers of volunteers are available, it may be feasible to remove small woody plants by hand. Since mowing can disturb the soil, removal by hand reduces disturbance and discourages weeds.
- Mowing can be scheduled to favor particularly desirable species. For specific directions, consult the University of Tennessee (various departments of biological sciences, etc.), the USDA Agricultural Extension Service, and the Tennessee Department of Environment and Conservation (TDEC).
- For herbaceous landscapes, or old fields and savannahs (meadow matrix with woody shrubs and small trees), a yearly inspection and twice yearly mowing are adequate.

- **Controlled Burns**

- Controlled burning is mainly used in grasslands but can also be used in woodlands.
- Where possible for every cover type, consider a controlled winter (early February) burn. Burning is often the most cost-effective management option and yields the most visually attractive results.



Figure 5.4.2.1-23. Controlled burn on green roof meadow.





This management technique is particularly easy and effective with meadows and will create a tighter and more attractive landscape. It can also be used successfully with woodlands and forest to control invasive species and foster a rich ground layer.

- Note that controlled burning as a management method should be done in coordination with the local fire department and requires a permit issued by the Hamilton County Air Pollution Control Bureau (http://www.apcb.org/Open_Burning/Burning_Permits_copy.aspx). Burning is allowed October through April.
- If the meadow or other landscape types are extensive, the Nature Conservancy can be asked (for a fee) to bring trained staff to burn the area professionally.
- Benefits of Burning
 - Deposits nutrients, in a readily available form, into the soil
 - Stimulates plant growth
 - Provides a lush and neater appearance
 - Exposes the soil to the sun, by eliminating plant litter, allowing space for new seeds to germinate
 - Favors warm native grasses over cool-season European turf grasses
- Herbicides and Pesticides
 - Use of integrated pest management practices to minimize use of herbicides and pesticides.

References

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Sauer, Leslie J. 1998. *Once and Future Forest: A Guide to Forest Restoration Strategies*. Island Press.

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Criteria Checklist BMP 5.4.2.1

ITEM DESCRIPTION	YES	N/A
The following checklist provides a summary of design guidance for the owner/applicant for successful implementation.		
• Identify size and location of areas where cover can be converted.	<input type="checkbox"/>	<input type="checkbox"/>
• Cover conversion areas shall be clearly identified on the site plan.	<input type="checkbox"/>	<input type="checkbox"/>
• Define which landscape type complements the proposed development and increases stormwater management functions.	<input type="checkbox"/>	<input type="checkbox"/>
• Determine the choice of landscape type (meadow, forest, woodland, etc.) and individual species based on site conditions (soil type, soil moisture, sun/shade, exposure/protection, etc.), program requirements, and owner’s wishes.	<input type="checkbox"/>	<input type="checkbox"/>
• For areas close to people and activities:	<input type="checkbox"/>	<input type="checkbox"/>
○ Design a strong structure for the landscape.	<input type="checkbox"/>	<input type="checkbox"/>
○ Create visible transitions between cover types.	<input type="checkbox"/>	<input type="checkbox"/>
○ Choose species that are more ornamental, that are pleasing in all seasons, and that will thrive under the site conditions.	<input type="checkbox"/>	<input type="checkbox"/>
○ When establishing a more complex landscape, such as a woodland or forest, create the appropriate number of layers.	<input type="checkbox"/>	<input type="checkbox"/>
○ Use shady conditions and dense trees to help limit invasive exotics.	<input type="checkbox"/>	<input type="checkbox"/>
• For less visible areas primarily intended for stormwater management:	<input type="checkbox"/>	<input type="checkbox"/>
○ Plugs or young plants can be used for forests, woodlands, and meadows and should be planted closely together to set in motion natural processes that will create a cover type over time.	<input type="checkbox"/>	<input type="checkbox"/>
• When considering transition to forest or woodland, consider creating a connection between other natural landscapes.	<input type="checkbox"/>	<input type="checkbox"/>
• Use appropriate conversion methods outlined in in this BMP at 5.4.2.1.7 to achieve desired specific landscape conversion results.	<input type="checkbox"/>	<input type="checkbox"/>
• Identify areas designated for cover change and stake in the field and protect these areas during construction.	<input type="checkbox"/>	<input type="checkbox"/>
• Dig up and remove pavement including the gravel sub-base and other extraneous materials or pollutants harmful to plant growth.	<input type="checkbox"/>	<input type="checkbox"/>





• Remove lawn (removal options include smothering, cultivating, or, as a last resort, herbicide).	<input type="checkbox"/>	<input type="checkbox"/>
• Consider consulting with a soil scientist when preparing soil. Soil conditions and the needs of landscape types can vary greatly.	<input type="checkbox"/>	<input type="checkbox"/>
• Follow the soil preparation guidelines outlined in this BMP and Section 5.4.3 for areas formerly under pavement and areas formerly under lawn.	<input type="checkbox"/>	<input type="checkbox"/>
• For tall grass and/or wildflower meadows, select quality seeds and/or plugs from reliable sources.	<input type="checkbox"/>	<input type="checkbox"/>
• Protect seeded areas from hot, dry weather or drying winds by spreading straw or hay mulch.	<input type="checkbox"/>	<input type="checkbox"/>

