

NMDOT GSI Maintenance Field Guide






Best Management Practices

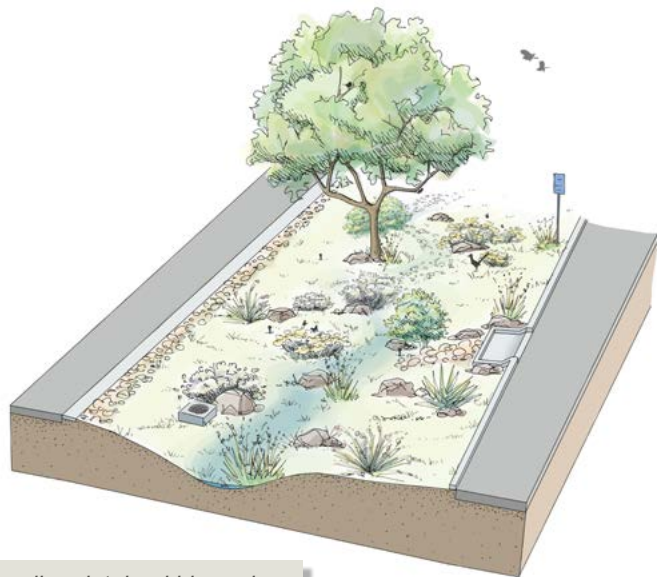
Fall 2023



New Mexico DEPARTMENT OF
TRANSPORTATION
MOBILITY FOR EVERYONE

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A well-maintained bioswale



Note to Reader

This field guide was created to familiarize NMDOT staff and contractors with the maintenance of green stormwater infrastructure (GSI) features, specifically stormwater harvesting basins and bioswales.

GSI features have both engineered and landscaped components, so their maintenance includes aspects of both. They are designed to capture, treat, and infiltrate stormwater. They provide other benefits, such as shade, habitat, and beauty.

To learn about the background of GSI and the benefits it provides, consult the accompanying NMDOT GSI Maintenance Manual.

Commonly Used Terms

Please refer to the following pages for definitions and examples of these commonly used terms.

- **Curb Treatment** (pg 5)
- **Overflow or Outlet** (pg 6)
- **Mulch** (pg 7)
- **Soil Sponge** (pg 8)
- **Bioswale** (pg 9)
- **Check Dam** (pg 10)
- **Stormwater Harvesting Basin** (p 11)



Curb Treatment

Any curb structure that allows stormwater runoff to leave a roadway or parking lot and enter a GSI structure. In some features, the curb treatment becomes the overflow once basin capacity is reached.

Also Known As:

- Curb cut
- Curb inlet
- Curb opening
- Sidewalk culvert
- Rundown
- Sediment trap
- Forebay

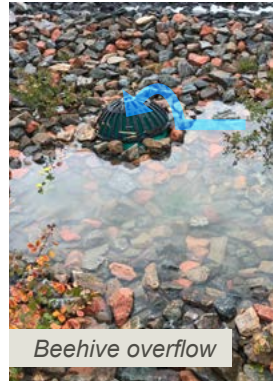


Overflow or Outlet

The point where excess water leaves a GSI feature. In some features, the inlet becomes the overflow once basin capacity is reached.

Also Known As:

- Weir
- Spillway
- Overflow drain
- Curb treatment (a curb treatment can be an inlet or an overflow)

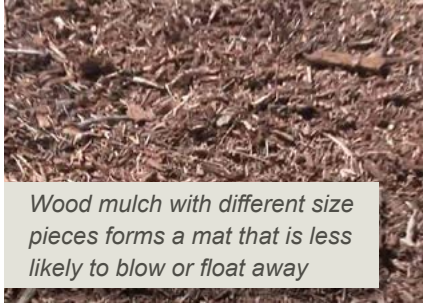


Mulch

A natural material that covers bare dirt, allows stormwater infiltration, helps retain soil moisture, reduces invasive species growth, and protects against erosion.

Also Known As:

- Organic mulch
- Wood chips
- Gravel
- Aggregate
- Rip rap
- Cobble



Bioswale

A conveyance feature with biological components, including plants, organic mulches, and/or compost.

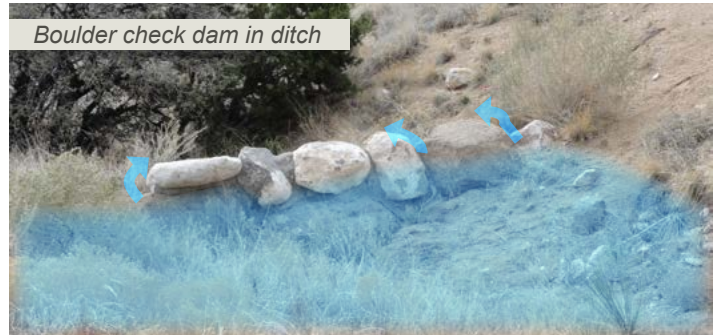
Also Known As:

- Bioretention swale
- Swale
- Ditch



Check Dam

A structure in a conveyance feature (such as a bioretention swale) designed to slow water, reduce erosion, drop out sediment, and increase infiltration. Can be used in roadside features, depressed medians, stormwater bumpouts.

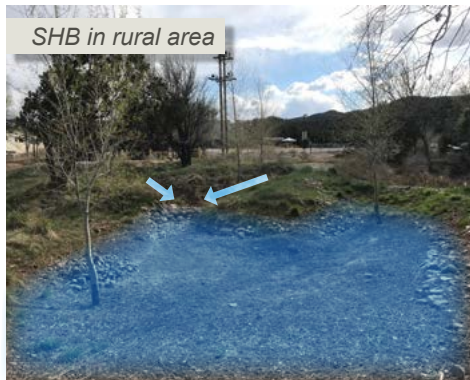
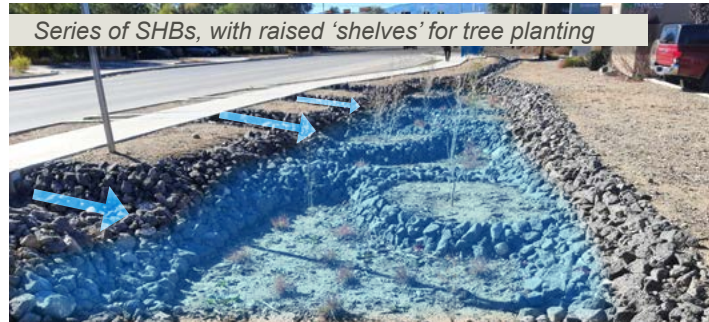


Stormwater Harvesting Basin (SHB)

A depressed area with biological components, including plants, mulches, and/or compost, where stormwater collects and infiltrates. SHBs may or may not have an overflow or outfall.

Also Known As:

- Bioretention basin
- Detention basins
- Retention basins
- Ponds

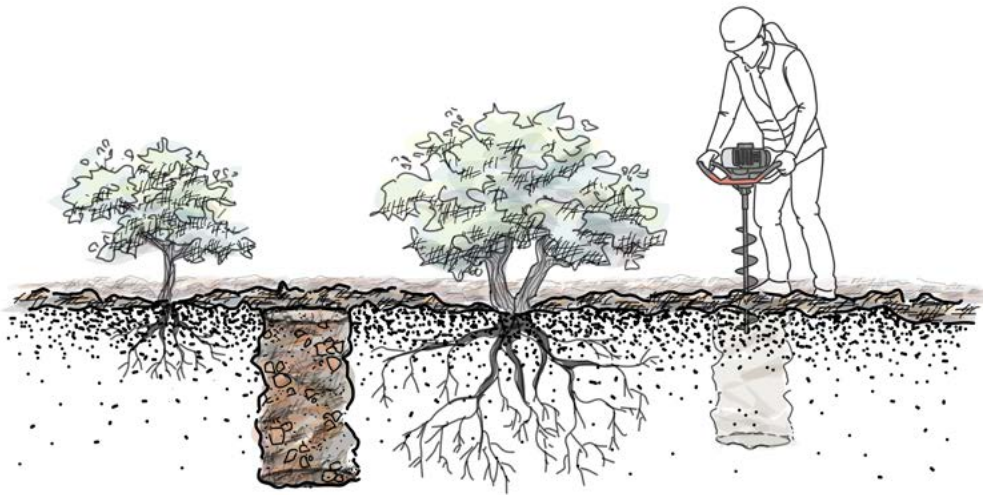


Soil Sponge

An excavated hole filled with a mix of pumice, compost, and wood chips. Soil sponges absorb and store rainwater and inoculate the surrounding soil with beneficial micro-organisms. They also improve infiltration and support plant health.

Also Known As:

- Water retention sponge
- Infiltration sponge



Soil sponges installed using a one-person, powered auger. Refer to GSI Maintenance Manual for installation instructions.

Tools and Materials

General

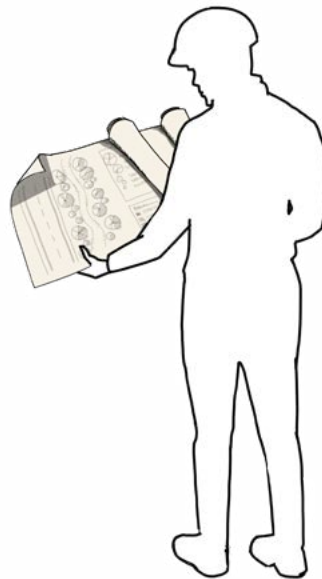
- As-built plans
- Gloves
- Safety equipment
Refer to NMDOT AD 802 and GSI Maintenance Manual for safety & PPE requirements



Wear gloves for activities such as rebuilding inlets after cleaning sediment from cobble



Always use safety equipment



Use as-built plans to identify planting and irrigation information

Plant Care

- Tarps
- Pruning shears/clippers/loppers
- Trash bag/bin for invasives and debris/trash
- Seed and binder/tackifier
- Mycorrhizal inoculant
- Line trimmer



Tarp for gathering trimmings



Pruning equipment



Line trimmer



*Bags of seed/binder/
mycorrhizal inoculant*

Mulch Repair

- Organic mulch
- 2"-4" crushed aggregate
- Rake
- Shovel
- Wheelbarrow



2"-4" crushed aggregate for mulch & erosion control



Hard rake for debris & material



Round point shovel & organic mulch for replenishment within basins



Wheelbarrow and mulch for repairs and replenishment



Sediment and Debris Removal

- Flat-bladed shovel
- Trash grabber
- Trash bag
- Bucket to collect sediment



Bucket to collect sediment and debris



Flat-bladed shovel



Trash grabber and trash bag

Irrigation

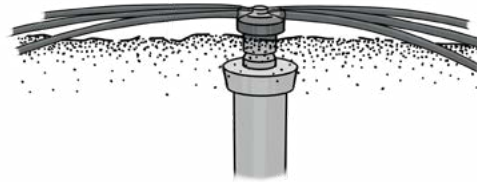
- Repair & cleaning tools
- Spare parts



*PVC and emitter components for typical **bubbler irrigation systems***

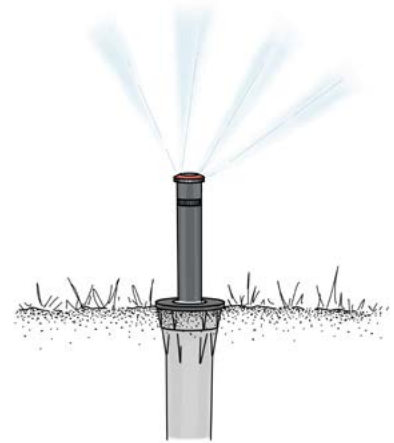


*Point source **drip emitters***



*Multi-port **drip emitters***

*Drip tubing, emitters, and PVC components for typical **drip irrigation systems***



*Spray bodies, heads, and PVC components for **spray irrigation***



Other

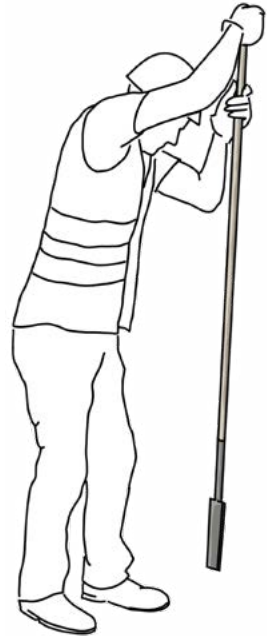
- Digging shovel
- Soil sponge material (composted wood chips, pumice)
- Digging bar
- Powered auger



Soil sponge material



Powered auger



Digging bar

TOOLS CHECKLIST		
TOOL TYPE	MATERIALS	GOT IT! ✓
General	<i>As-built plans</i>	
	<i>Gloves</i>	
	<i>Safety equipment</i>	
Plant Care	<i>Tarps</i>	
	<i>Pruning shears/clippers</i>	
	<i>Trash bag for invasives</i>	
	<i>Seed and binder/tackifier</i>	
	<i>Mycorrhizal inoculant</i>	
	<i>Line trimmer</i>	
Mulch Repair	<i>Small quantity of organic mulch</i>	
	<i>Small quantity of 2"-4" crushed aggregate</i>	
	<i>Rake</i>	
	<i>Wheelbarrow</i>	



TOOLS CHECKLIST CONT.

TOOL TYPE	MATERIALS	GOT IT! ✓
Sediment and Debris Removal	<i>Flat-bladed shovel</i>	
	<i>Trash grabber</i>	
	<i>Trash bag</i>	
	<i>Bucket to collect sediment</i>	
Irrigation	<i>Repair / cleaning equipment</i>	
	<i>Spare parts</i>	
Other	<i>Digging shovel</i>	
	<i>Soil sponge material (composted wood chips, pumice)</i>	
	<i>Digging bar</i>	
	<i>Powered auger</i>	

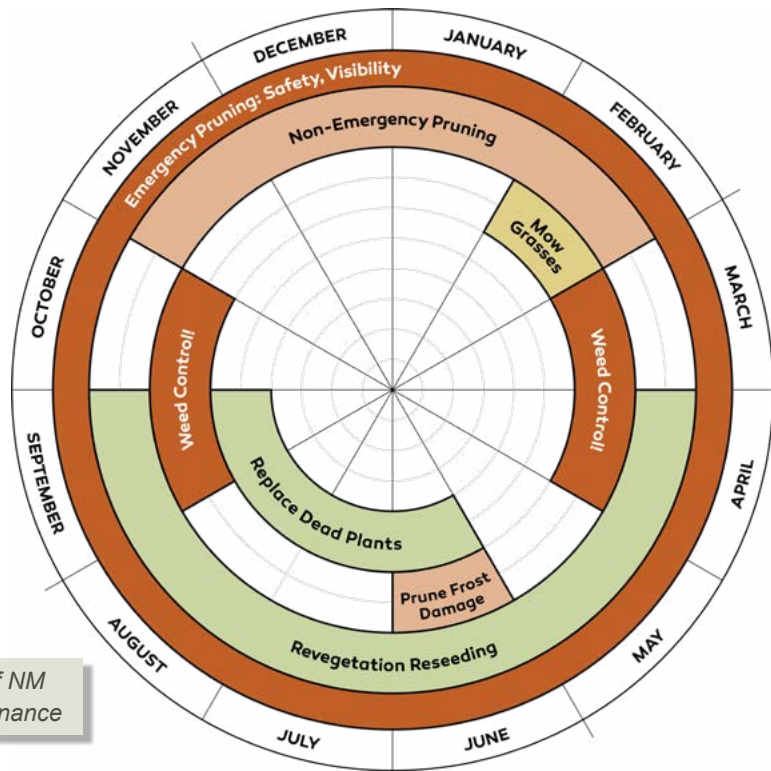
Vegetation Maintenance

Healthy plants are critical components of GSI features. They put the GREEN in green stormwater infrastructure. Their roots improve infiltration and stabilize soil. Some plants break down pollutants or pull pollutants out of the soil and into their leaves. Plants also provide shade that cools the surrounding area. They create habitat for pollinators and other species. Maintaining the plants in a GSI feature is a big part of the job.

This section is organized into 4 subsections:

- **Remove** invasive species
- **Replace** dead plants
- **Prune** as needed
- **Reseed** bare soil

*Calendar wheel of NM
vegetation maintenance*



Remove Invasive Species

NMDOT has prioritized (13) invasive species for removal. These species can quickly take over an area and decrease native plant biodiversity. Some of these species can increase erosion, fire hazard, and soil salinity.

In GSI features, herbicide can easily spread to non-target plants. Use herbicide only after consulting with the NMDOT by emailing:

GSI.Maintenance@dot.nm.gov

Mechanical methods of weed control are preferred in GSI features.

Refer to the *NMDOT Integrated Vegetation Management Best Management Practices: Evaluation and Recommendations* (QR Code at right) and the EPA's *Herbicide Regulations and Guidelines* for more information.

PRIORITY SPECIES:

- Siberian Elm
- Salt Cedar
- Russian Olive
- African Rue
- Cheatgrass
- Spiny Cocklebur
- Perennial Pepperweed
- Russian Knapweed
- Yellow Bluestem
- Musk Thistle
- Scotch Thistle
- Bull Thistle
- Canada Thistle

There are more than just these (13) priority invasive species. For more information on invasive species identification and removal, visit this website:



REMOVE

Siberian Elm - *Ulmus pumila*

LIFE STAGE

TREATMENT

Seed

Remove and dispose of seeds at all times, but especially before they germinate in late spring. Rake or blow seeds into piles; collect and dispose.

Sapling

(less than 6 ft height)

Remove and dispose of sapling; carefully spot treat base of stem with appropriate post-emergent systemic herbicide.

Large Plant

(greater than 6 ft height)

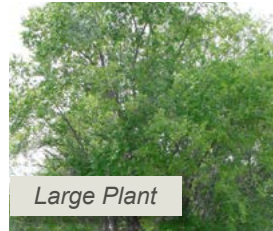
Remove tree entirely (primary stems and all branches) leaving a stump(s) no taller than 4". Carefully treat outer ring of stump (just inside the bark) with appropriate general herbicide. Herbicide must be applied immediately after cutting (maximum 15-min window) to ensure root uptake. Most effective in the fall when leaves are changing color. If NO SEEDS are present on branches, cuttings can be chipped and left as mulch within the basin. If seeds are present, remove and dispose of branches.



Seed



Sapling



Large Plant



Removal

REMOVE

Saltcedar - *Tamarix* spp.

LIFE STAGE

TREATMENT

Flower & Seed

Saltcedar reproduce by both seeds and sprouts. Many small flowers produce tiny, short-lived seeds that resemble pepper. Tufts of hair at seed tips aid in wind dispersal. One plant produces up to 500,000 seeds in one season, viable for five weeks and can germinate in 24 hrs. **Remove saltcedar before it goes to seed.**

Sapling (less than 6 ft height)

Narrow, scaly, blue-green leaves resemble evergreen needles. Dig up entire plant and root system with shovel, hoe, or weed tool. If roots remain, plant will re-sprout.

Large Plant (greater than 6 ft height)

Hand cut or chainsaw saltcedar trunk or stems to less than 4" from ground surface. Remove sawdust. Apply appropriate herbicide to cut stump surface by paintbrush and hand-held spray bottle. Herbicide must be applied immediately after cutting (within 15 mins) to ensure root uptake. Most effective in the fall when leaves are changing color.



Flower



Seed



Sapling



Large Plant



REMOVE

Russian Olive - *Elaeagnus angustifolia*

LIFE STAGE

TREATMENT

Flower & Seed

Russian olive seeds are highly valued by birds, coyotes, and deer. Animal droppings contribute to its spread. **Remove Russian olive before it goes to seed.** If seeds have fallen, rake or blow them into piles; collect and dispose.

Sapling (less than 6 ft height)

Dig up entire plant and root system with shovel, hoe, or weed tool. If roots remain, plant will re-sprout.

Large Plant (greater than 6 ft height)

Remove tree entirely (primary stems and all branches) leaving a stump(s) no taller than 4". Carefully treat outer ring of stump (just inside the bark) with appropriate general herbicide. Herbicide must be applied immediately after cutting (maximum 15-min window) to ensure root uptake. Not effective when temperatures drop below freezing.



Flower



Seed



Sapling



Large Plant



REMOVE

African Rue - *Peganum harmala*

LIFE STAGE

TREATMENT

Seed

Toxic to grazing animals and humans, especially the seeds.

Sprout (young plant)

Remove when plant is young and before it has developed an extensive root system. Use mechanical means (pulling, cutting, digging).

Mature Plant (greater than 1-1.5 ft height)

African Rue has a complex root system, so is extremely difficult to control using any a mechanical method. Herbicidal treatment is preferred. Growth stage and plant condition are crucial for successful control. When using foliar spray, plant should be healthy and robust in late summer (Sept-Oct is optimal). Do not spray if plant has been stressed from drought, disease, or insects as chemical treatment will not work efficiently.



Flower



Seed



Large Plant



REMOVE

Cheatgrass - *Bromus tectorum*

LIFE STAGE

TREATMENT

Seed

Preventing seed production for several consecutive years is required to control a Cheatgrass outbreak. **Remove before it goes to seed.** Suppress seed germination with revegetation of native species.

Sprout (young plant)

Mowing within a week after flowering will reduce seed production. Young plants have high forage value for grazing animals. Mob grazing can be effective in early Spring. This can reduce seed production by up to 90%.

Large Plant (greater than 1 ft height)

Mowing is an option for mature plants, but will need to be paired with other mechanical removal techniques to be effective. Plants can regrow from roots after defoliation.



REMOVE

Spiny Cocklebur - *Xanthium spinosum*

LIFE STAGE

TREATMENT

Seed

Do not leave immature burs (seeds) on the site, they can still develop into a viable seed and removal will need to be repeated. **Remove before it goes to seed.**

Sprout (young plant)

Mechanical methods (pulling, tilling, hoeing, mowing) are effective especially if burs have not developed and dispersed. Remove and dispose of cuttings if burs have developed.

Large Plant (greater than 3 ft height)

Mowing or disking at flowering stage will control cockleburs. Re-sprouts may occur so mowing will have to be repeated multiple times per growing season every year. Remove and dispose of cuttings if burs have developed.



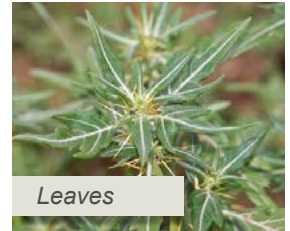
Flower



Seed



Large Plant



Leaves

REMOVE

Perennial Pepperweed - *Lepidium latifolium*

LIFE STAGE

TREATMENT

Seed

Seedlings are easily controlled by hand-pulling or tillage, but these techniques do not control established plants. Seedlings are not often encountered because the plant more often spreads through root system.

Sprout (young plant)

Shoots quickly re-sprout from vast roots thereby making tillage and cultivation ineffective. Doing so will break up the roots and exacerbate the outbreak. Herbicide is the preferred method.

Large Plant (2-5 ft height)

Mowing is not an effective control method, but can prevent seed formation if done before flowering. Herbicide is the preferred method.



Flower



Seed



Leaves



Large plant

REMOVE

Russian Knapweed - *Rhaponticum repens*

LIFE STAGE

TREATMENT

Seed

Prevention and early detection are essential to stop an outbreak. Large outbreaks are extremely difficult to control. Seed removal would be tedious and is not recommended as the only form of removal.

Sprout (young plant)

Hand-pulling or digging is effective for small, less established infestations and will need to be repeated over multiple years. Removal is easiest and most effective in late spring when soil is moist.

Large Plant (1 to 3 ft height)

Tillage and mowing of established plants should be avoided unless paired with an herbicidal spray or will make the infestation worse. Site should be revegetated with native vegetation to stop the re-invasion of Russian Knapweed or other invasives.



Flower



Seed



Large Plant



Leaves

Diffuse Knapweed and Spotted Knapweed have a similar appearance but do not spread by roots like Russian Knapweed. Mechanical control and revegetation work well with Diffuse and Spotted Knapweeds.

REMOVE

Yellow Bluestem - *Bothriochloa ischaemum*

LIFE STAGE

TREATMENT

Seed

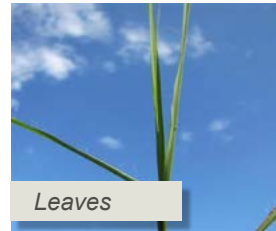
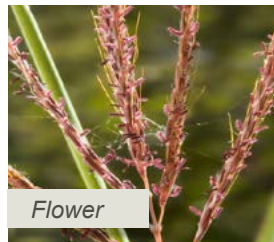
Prevention is the best management of seed dispersal. Combat outbreaks by planting native seed that can compete with Yellow Bluestem.

Sprout (young plant)

Hand removal is effective for small outbreaks, but not large infestations and can be difficult because of root matting that occurs.

Large Plant (1 to 2.5 ft height)

A combination of controlled burning and mowing mature vegetation may be an option. Tillage and cultivation can be used to remove Yellow Bluestem, but site will need to be revegetated with native vegetation afterwards to stop re-infestation from occurring. Conditions should be dry enough to desiccate root fragments.



Why So Many Thistles?

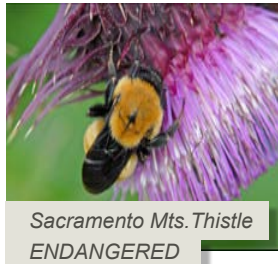
It is easy to confuse native thistles with invasive thistles, so identification before removal is very important.

There are 12 species of **native** thistles (examples at right) throughout New Mexico that need to be protected. There are 4 species of **invasive** thistles that are described on the following pages.

Reference this thistle identification guide for more information:



Examples of Native Thistles (always protect native species!)



REMOVE

Musk Thistle - *Carduus nutans*

LIFE STAGE	TREATMENT
Seed	Proper identification is important - can be confused with Sacramento Mountains Thistle. Prevention of seed dispersal is the best management method.
Sprout (young plant)	Mechanical method (pulling, tilling, hoeing, and mowing) are effective as long as the plant has not reached seed production. The plant must be cut off below the soil surface and no leaves should remain attached.
Large Plant (2 to 6 ft height)	Mowing/grubbing is an option but must be done before flowering and repeated if flowers regrow. Promoting competitive vegetation can slow spread and help prevent re-establishment. Herbicide can also be used. Biological controls are <u>not</u> recommended for thistles.

Musk Thistle can be distinguished by its large, drooping, solitary flower. The stems have long spines. Flower heads are reddish-purple.



Flower



Leaves



Large Plant

REMOVE

Scotch Thistle - *Onopordum acanthium*

LIFE STAGE	TREATMENT
Seed	Proper identification is important - can be confused with native thistles. Prevention of seed dispersal is the best management method.
Sprout (young plant)	Mechanical method (pulling, tilling, hoeing, and mowing) are effective as long as the plant has not reached seed production. The plant must be cut off below the soil surface and no leaves should remain attached.
Large Plant (4 to 12 ft height)	Mowing/grubbing is an option but must be done before flowering and repeated if flowers regrow. Promoting competitive vegetation can slow spread and help prevent re-establishment. Herbicide can also be used. Biological controls are <u>not</u> recommended for thistles.



Flower



Seed



Large Plant



Leaves

Scotch Thistle can be distinguished by grayish stems and leaves that are broad and spiny. It is one of the larger species of thistle that grows in NM.

REMOVE

Bull Thistle - *Cirsium vulgare*

LIFE STAGE	TREATMENT
Seed	Proper identification is important - can be confused with Sacramento Mountains Thistle. Prevention of seed dispersal is the best management method.
Sprout (young plant)	Mechanical method (pulling, tilling, hoeing, and mowing) are effective as long as the plant has not reached seed production. The plant must be cut off below the soil surface and no leaves should remain attached.
Large Plant (1 to 6 ft height)	Mowing/grubbing is an option but must be done before flowering and repeated if flowers regrow. Promoting competitive vegetation can slow spread and help prevent re-establishment. Herbicide can also be used. Biological controls are <u>not</u> recommended for thistles.

Bull Thistle can be distinguished by the numerous narrow spines on its leaves and stems.



Seed



Flower



Leaves



Large Plant

REMOVE

Canada Thistle - *Cirsium arvense*

LIFE STAGE

TREATMENT

Seed

Proper identification is important - can be confused with native thistles. Seed removal would be tedious and is not recommended as the only form of removal. Plant also reproduces by root shoots.

Sprout (young plant)

Canada Thistle spreads by seeds as well as roots. Disturbance by mowing or grubbing increases spread and is not recommended. Herbicide is needed.

Large Plant (1 to 4 ft height)

Mowing and grubbing are not recommended. Herbicide must be used. Any disturbed root fragments must be removed from the site. Promoting competitive vegetation can slow spread and help prevent re-establishment.



Flower



Seed



Leaves

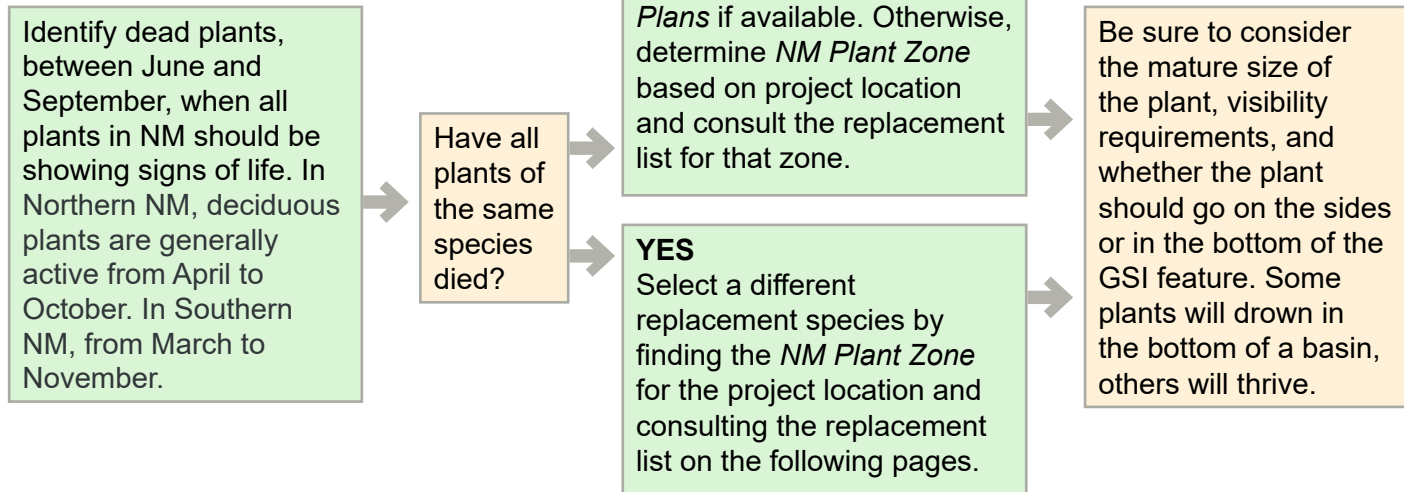


Large Plant

Canada Thistle can be distinguished by tiny pink flower heads with spines that are only 1mm long. Often found growing near water and in mountainous regions.

Replace Dead Plants

The following steps should be used to select replacement species for dead plants:



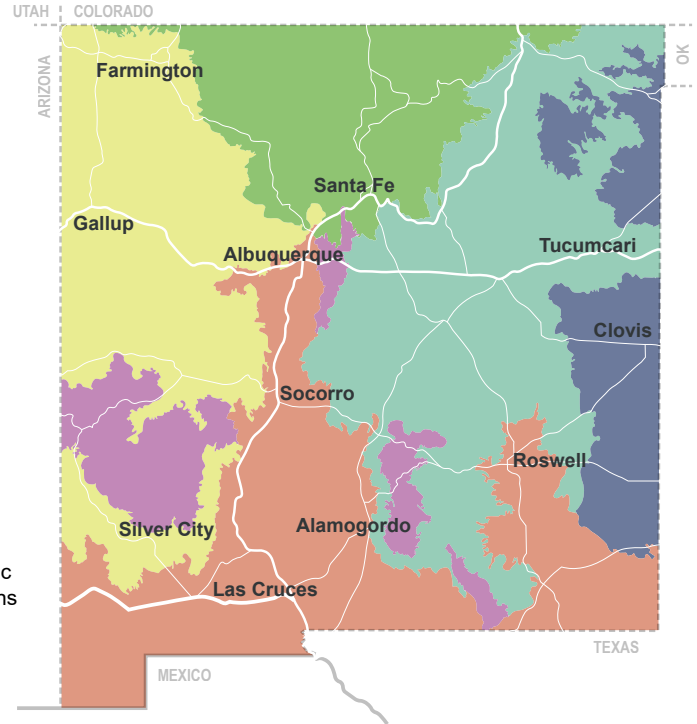
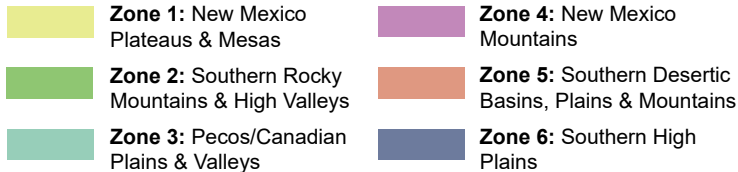
Replace Plants by Plant Zone

Plant species on the following standard replacement lists have been selected for their lower water needs, habitat value, and drought tolerance.

Trees on these lists should receive supplemental irrigation for 10-15 years after planting, either through a piped irrigation system or through regular waterings from a water truck.

Shrubs should receive supplemental irrigation for 3-5 years, grasses for 1-2 years.

NMDOT Plant Zones Map



ZONE 1: NEW MEXICO PLATEAUS AND MESAS

	<i>Bottom of GSI Feature</i>	<i>Sides of GSI Feature</i>
Trees	<i>Goodding's Willow (25'x25') **</i> <i>Netleaf Hackberry (25'x25')</i> <i>NM Olive (15'x15')</i> <i>Rocky Mountain Juniper (40'x20')</i>	<i>One-seed Juniper (15'x15')</i> <i>Scrub Oak (12'x12')</i>
Large Shrubs (taller than 3')	<i>False Indigo (8'x8') **</i> <i>Anderson Wolfberry (6'x6')</i> <i>Rabbitbrush (5'x5')</i> <i>Fernbush (6'x6')</i> <i>Three Leaf Sumac (6'x6')</i>	<i>Apache Plume (5'x5') **</i> <i>Sand Sage (4'x4') **</i> <i>Four-wing Saltbush (4'x4')</i> <i>Big Sage (4'x4')</i> <i>Arizona Rosewood (12'x10')</i>
Low Shrubs (shorter than 3')	<i>Winterfat (3'x3')</i> <i>Dwarf Rabbitbrush (2'x2')</i>	<i>Sand Sage (4'x4')</i> <i>Ephedra (3'x4')</i>
Grasses (Nursery-grown)	<i>Little Bluestem (2'x2')</i> <i>Alkali Sacaton (2'x2') **</i>	<i>Little Bluestem (2'x2')</i> <i>Alkali Sacaton (2'x2') **</i>

Use only low shrubs and small grasses within sight triangles.

Plant Name (Height x Spread)

** Indicates phytoremediation plant (preferred use)

ZONE 2: SOUTHERN ROCKY MOUNTAINS & HIGH VALLEYS

	<i>Bottom of GSI Feature</i>	<i>Sides of GSI Feature</i>
Trees	<p><i>Cottonwood (60'x60')</i> **</p> <p><i>Goodding's Willow (25'x25')</i> **</p> <p><i>Box Elder (40'x30')</i></p> <p><i>Chokecherry (10'x10')</i></p>	<p><i>Rocky Mountain Juniper (40'x20')</i></p> <p><i>Gambel Oak (25'x25')</i></p>
Large Shrubs (taller than 3')	<p><i>False Indigo (8'x8')</i> **</p> <p><i>Three Leaf Sumac (6'x6')</i></p> <p><i>Rabbitbrush (5'x5')</i></p> <p><i>Utah Serviceberry (10'x10')</i></p>	<p><i>Apache Plume (5'x5')</i> **</p> <p><i>Woods Rose (6'x6')</i></p> <p><i>Cliff Rose (6'x6')</i></p> <p><i>Antelope Bitterbrush (5'x5')</i></p>
Low Shrubs (shorter than 3')	<p><i>Prairie Sage (2'x3')</i></p> <p><i>Autumn Amber Sumac (1'x6')</i></p>	<p><i>Winterfat (3'x3')</i></p> <p><i>Prairie Sage (2'x3')</i></p>
Grasses and Perennials (Nursery-grown)	<p><i>Common Yarrow (1'x1')</i> **</p> <p><i>Little Bluestem (2'x2')</i></p> <p><i>Big Bluestem (5'x1')</i></p> <p><i>Indiangrass (4'x2')</i></p>	<p><i>Alkali Sacaton (2'x2')</i> **</p> <p><i>Blue Grama (2'x2')</i></p> <p><i>Little Bluestem (2'x2')</i></p>

Use only low shrubs and small grasses within sight triangles.

Plant Name (Height x Spread)

** Indicates phytoremediation plant (preferred use)

ZONE 3: PECOS/CANADIAN PLAINS AND VALLEYS

	<i>Bottom of GSI Feature</i>	<i>Sides of GSI Feature</i>
Trees	<i>Goodding's Willow (25'x25') **</i> <i>Chinkapin Oak (35'x35')</i> <i>Prairie Flameleaf Sumac (25'x20')</i> <i>NM Olive (15'x15')</i>	<i>One-seed Juniper (15'x15')</i> <i>Honey Mesquite (20'x20')</i>
Large Shrubs (taller than 3')	<i>Three Leaf Sumac (6'x6')</i> <i>Seep Willow (6'x6')</i>	<i>Apache Plume (5'x5') **</i> <i>Sand Cherry (4'x4')</i>
Low Shrubs (shorter than 3')	<i>'Autumn Amber' Sumac (1'x6')</i> <i>Leadplant (2'x3')</i>	<i>'Pawnee Buttes' Sand Cherry (2'x6')</i> <i>'Autumn Amber' Sumac (1'x6')</i>
Grasses (Nursery-grown)	<i>Alkali Sacaton (2'x2') **</i> <i>Buffalo Grass (8" x spreading) **</i> <i>Little Bluestem (2'x2')</i> <i>Big Bluestem (5'x1')</i>	<i>Alkali Sacaton (2'x2') **</i> <i>Blue Grama (2'x2')</i> <i>Little Bluestem (2'x2')</i>

Use only low shrubs and small grasses within sight triangles.

Plant Name (Height x Spread)

** Indicates phytoremediation plant (preferred use)

ZONE 4: NEW MEXICO MOUNTAINS

	<i>Bottom of GSI Feature</i>	<i>Sides of GSI Feature</i>
Trees	<i>Cottonwood (60'x60')</i> ** <i>Goodding's Willow (25'x25')</i> ** <i>Box Elder (40'x30')</i> <i>Chokecherry (10'x10')</i>	<i>Rocky Mountain Juniper (40'x20')</i> <i>Gambel Oak (25'x25')</i> <i>One-seed Juniper (15'x15')</i>
Large Shrubs (taller than 3')	<i>False Indigo (8'x8')</i> ** <i>Red Osier Dogwood (8'x8')</i> <i>Three Leaf Sumac (6'x6')</i>	<i>Apache Plume (5'x5')</i> ** <i>Three Leaf Sumac (6'x6')</i>
Low Shrubs (shorter than 3')	<i>'Autumn Amber' Sumac (1'x6')</i> <i>Leadplant (2'x3')</i>	<i>Winterfat (3'x3')</i> <i>Prairie Sage (2'x3')</i>
Grasses and Perennials (Nursery-grown)	<i>Common Yarrow (1'x1')</i> ** <i>Little Bluestem (2'x2')</i> <i>Big Bluestem (5'x1')</i> <i>Indiangrass (4'x2')</i>	<i>Alkali Sacaton (2'x2')</i> ** <i>Blue Grama (2'x2')</i> <i>Little Bluestem (2'x2')</i>

Use only low shrubs and small grasses within sight triangles.

Plant Name (Height x Spread)

** Indicates phytoremediation plant (preferred use)

ZONE 5: SOUTHERN DESERTIC BASINS, PLAINS, & MOUNTAINS

	<i>Bottom of GSI Feature</i>	<i>Sides of GSI Feature</i>
Trees	<i>Goodding's Willow (25'x25')</i> ** <i>Cottonwood (60'x60')</i> ** <i>Netleaf Hackberry (25'x25')</i> <i>Honey Mesquite (25'x30')</i> <i>Escarpment Live Oak (20'x20')</i>	<i>Desert Willow (20'x25')</i> <i>Screwbean Mesquite (20'x20')</i>
Large Shrubs (taller than 3')	<i>False Indigo (8'x8')</i> ** <i>Three Leaf Sumac (6'x6')</i> <i>Seep Willow (6'x6')</i> <i>Rabbitbrush (5'x5')</i>	<i>Wright's Silktassel (8'x8')</i> <i>Four-wing Saltbush (5'x5')</i> <i>Creosote Bush (5'x5')</i> <i>Sand Sage (4'x4')</i> **
Low Shrubs (shorter than 3')	<i>Autumn Amber Sumac (1'x6')</i> <i>Winterfat (3'x3')</i>	<i>Turpentine Bush (3'x3')</i> <i>Winterfat (3'x3')</i>
Grasses & Perennials (Nursery-grown)	<i>Alkali Sacaton (2'x2')</i> ** <i>Giant Sacaton (5'x5')</i> <i>Little Bluestem (2'x2')</i>	<i>Alkali Sacaton (2'x2')</i> ** <i>Desert Marigold (1'x1')</i> ** <i>Blue Grama (2'x2')</i> <i>Little Bluestem (2'x2')</i>

Use only low shrubs and small grasses within sight triangles.

Plant Name (Height x Spread)

** Indicates phytoremediation plant (preferred use)

ZONE 6: SOUTHERN HIGH PLAINS

	<i>Bottom of GSI Feature</i>	<i>Sides of GSI Feature</i>
Trees	<i>Prairie Flameleaf Sumac (25'x20')</i> <i>Honey Mesquite (20'x20')</i> <i>Escarpment Live Oak (20'x20')</i> <i>Texas Redbud (15'x15')</i>	<i>One-seed Juniper (15'x15')</i> <i>Honey Mesquite (20'x20')</i>
Large Shrubs (taller than 3')	<i>Three Leaf Sumac (6'x6')</i> <i>Seep Willow (6'x6')</i>	<i>Four-wing Saltbush (5'x5')</i> <i>Sand Sage (4'x4')</i> <i>Soapweed Yucca (4'x2')</i> <i>Sand Sage (4'x4')</i>
Low Shrubs (shorter than 3')	<i>Leadplant (2'x3')</i> <i>Winterfat (3'x3')</i>	<i>Trailing Indigo Bush (2'x6')</i> <i>Fringed Sage (1'x1')</i>
Grasses (Nursery-grown)	<i>Buffalo Grass (8" x spreading) **</i> <i>Little Bluestem (2'x2')</i> <i>Big Bluestem (5'x1')</i> <i>Switchgrass (4'x2')</i> <i>Deer Grass (3'x3')</i>	<i>Alkali Sacaton (2'x2') **</i> <i>Buffalo Grass (8" x spreading) **</i> <i>Prairie Dropseed (3'x2')</i> <i>Blue Grama (2'x2')</i>

Use only low shrubs and small grasses within sight triangles.

Plant Name (Height x Spread)

*** Indicates phytoremediation plant (preferred use)*

Index of Botanical Names


Trees

Box Elder	<i>Acer negundo</i>
Chinkapin Oak	<i>Quercus muhlenbergii</i>
Chokecherry	<i>Prunus virginiana</i>
Cottonwood **	<i>Populus deltoides</i>
Desert Willow	<i>Chilopsis linearis</i>
Escarpment Live Oak	<i>Quercus fusiformis</i>
Gambel Oak	<i>Quercus gambelii</i>
Goodding's Willow **	<i>Salix gooddingii</i>
Honey Mesquite	<i>Prosopis glandulosa</i>
Netleaf Hackberry	<i>Celtis laevigata</i>
NM Olive	<i>Forestiera neomexicana</i>
One-seed Juniper	<i>Juniperus monosperma</i>
Prairie Flameleaf Sumac	<i>Rhus lanceolata</i>
Rocky Mountain Juniper	<i>Juniperus scopulorum</i>
Screwbean Mesquite	<i>Prosopis pubescens</i>
Scrub Oak	<i>Quercus turbinella</i>
Texas Redbud	<i>Cercis canadensis var. texensis</i>

** *Indicates phytoremediation plant (preferred use)*

Large Shrubs

Anderson Wolfberry	<i>Lycium andersonii</i>
Antelope Butterbrush	<i>Purshia tridentata</i>
Apache Plume **	<i>Fallugia paradoxa</i>
Arizona Rosewood	<i>Vauquelinia californica</i>
Big Sage	<i>Artemisia tridentata</i>
Cliffrose	<i>Purshia stansburiana</i>
Creosote Bush	<i>Larrea tridentata</i>
False Indigo **	<i>Amorpha fruticosa</i>
Fernbush	<i>Chamaebatiaria millefolium</i>
Four-Wing Saltbush	<i>Atriplex canescens</i>
Rabbitbrush	<i>Ericameria nauseosa</i>
Red Osier Dogwood	<i>Cornus sericea</i>
Sand Cherry	<i>Prunus pumila</i>
Sand Sage **	<i>Artemisia filifolia</i>
Seep Willow	<i>Baccharis salicifolia</i>
Three Leaf Sumac	<i>Rhus trilobata</i>
Utah Serviceberry	<i>Amelanchier utahensis</i>
Woods Rose	<i>Rosa woodsii</i>
Wright's Silktassel	<i>Garrya wrightii</i>



Low Shrubs

'Autumn Amber' Sumac	<i>Rhus trilobata</i> 'Autumn Amber'
Finged Sage	<i>Artemisia frigida</i>
Leadplant	<i>Amorpha canescens</i>
Pawnee Buttes Sand Cherry	<i>Prunus besseyi</i> 'Pawnee Buttes'
Prairie Sage	<i>Artemisia ludoviciana</i>
Trailing Indigo Bush	<i>Dalea gregii</i>
Turpentine Bush	<i>Ericameria larcifolia</i>
Winterfat	<i>Krascheninnikovia lanata</i>

Grasses and Perennials

Alkali Sacaton **	<i>Sporobolus airoides</i>
Big Bluestem	<i>Andropogon gerardii</i>
Blue Grama	<i>Bouteloua gracilis</i>
Buffalo Grass **	<i>Bouteloua dactyloides</i>
Common Yarrow **	<i>Achillea millefolium</i>
Deer Grass	<i>Muhlenbergia rigens</i>
Desert Marigold **	<i>Baileya multiradiata</i>
Giant Sacaton	<i>Sporobolus wrightii</i>
Indiangrass	<i>Sorghastrum nutans</i>
Little Bluestem	<i>Schizachyrium scoparium</i>
Prairie Dropseed	<i>Sporobolus heterolepis</i>
Switchgrass	<i>Panicum virgatum</i>

**** Indicates phytoremediation plant (preferred use)**

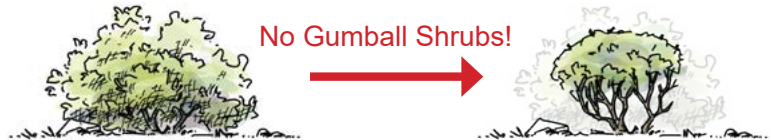
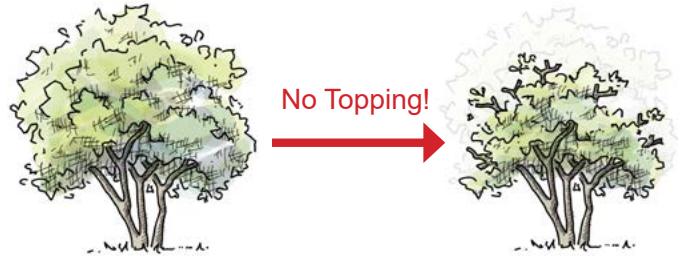
Prune Vegetation

Do:

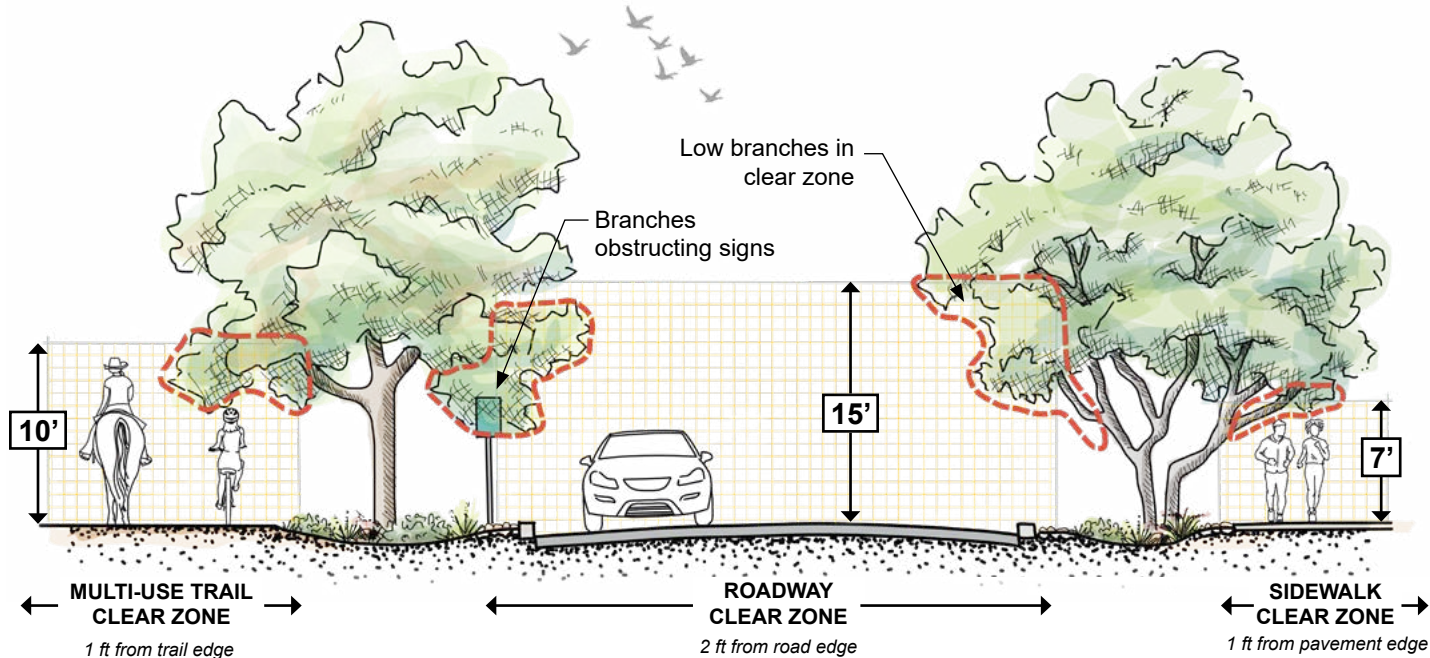
- Prune for safety of pedestrians, bikes, vehicles
- Prune for visibility of roadway signs
- Prune dead and diseased branches
- Chop and drop trimmings as mulch (if non-invasive)

Don't:

- Prune for aesthetics
- Top trees
- Liontail trees
- Non-selectively prune shrubs
- Chop and drop trimmings of invasive species

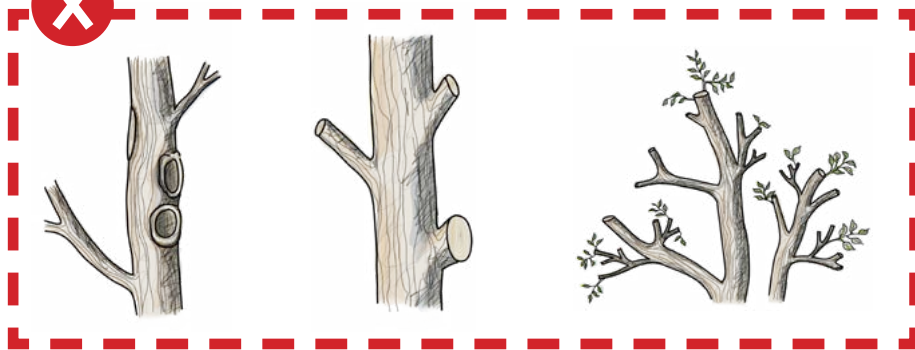


Prune only as needed for safety and visibility



Clear Zone Width Varies - Reference GSI Maintenance Manual for additional information

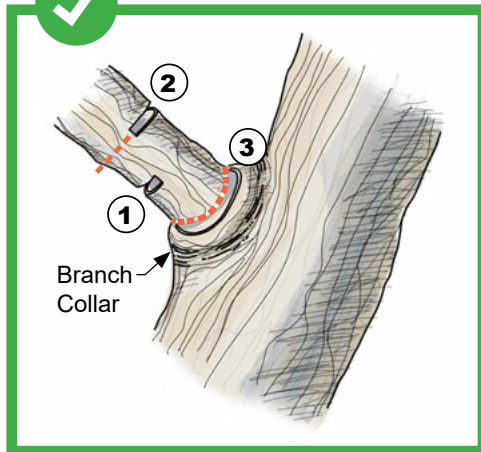
Improper and Proper Pruning Techniques



Flush Cuts create open wounds that often lead to disease & decay

Stub Cuts prevent tree from properly healing from a prune, creating pathways for decay

Topping or Tipping a tree causes it to create weakly attached shoots that grow quickly and are prone to breaking



Three-Cut Method

- (1) Undercut to prevent ripping
- (2) Second cut to remove limb
- (3) Cut stub but leave the branch collar



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Reseeding

Reseeding bare areas stabilizes soil through plant growth and increases biodiversity.

Four (4) easy steps for reseeding a small area:

1. **Ensure soil is loose** so that new roots can easily push through. If soil is compacted, loosen to a minimum depth of 6”.
2. **Hand-broadcast seed** per NMDOT specification for each seeding zone or mix. Make sure seed is evenly spread and has full contact with the soil (not sitting on top of mulch, rocks, debris, etc)
3. **Lightly rake** the seeded area so that seeds have 1/4” to 1/2” of soil cover. Use the back of the rake to lightly press the surface of the soil to make sure seeds are in contact with the soil.

4. **Cover the surface** of the seeded area with a thin layer of wood mulch (less than 1”) or a one-rock layer of Class C rock mulch.

Reference the *NMDOT Revegetation Zones* map for seed lists:





Introduction to Maintenance Checklists

The checklists on the following pages are broken down by specific area of stormwater harvesting basins and bioswales (see diagram opposite), as well as by Levels of Effort 1 and 2.

Level of Effort (LoE) 1 is a visual inspection that should be performed quarterly. Each component of the basin is quickly inventoried for issues that require maintenance or repair. Components needing repair or maintenance are noted.

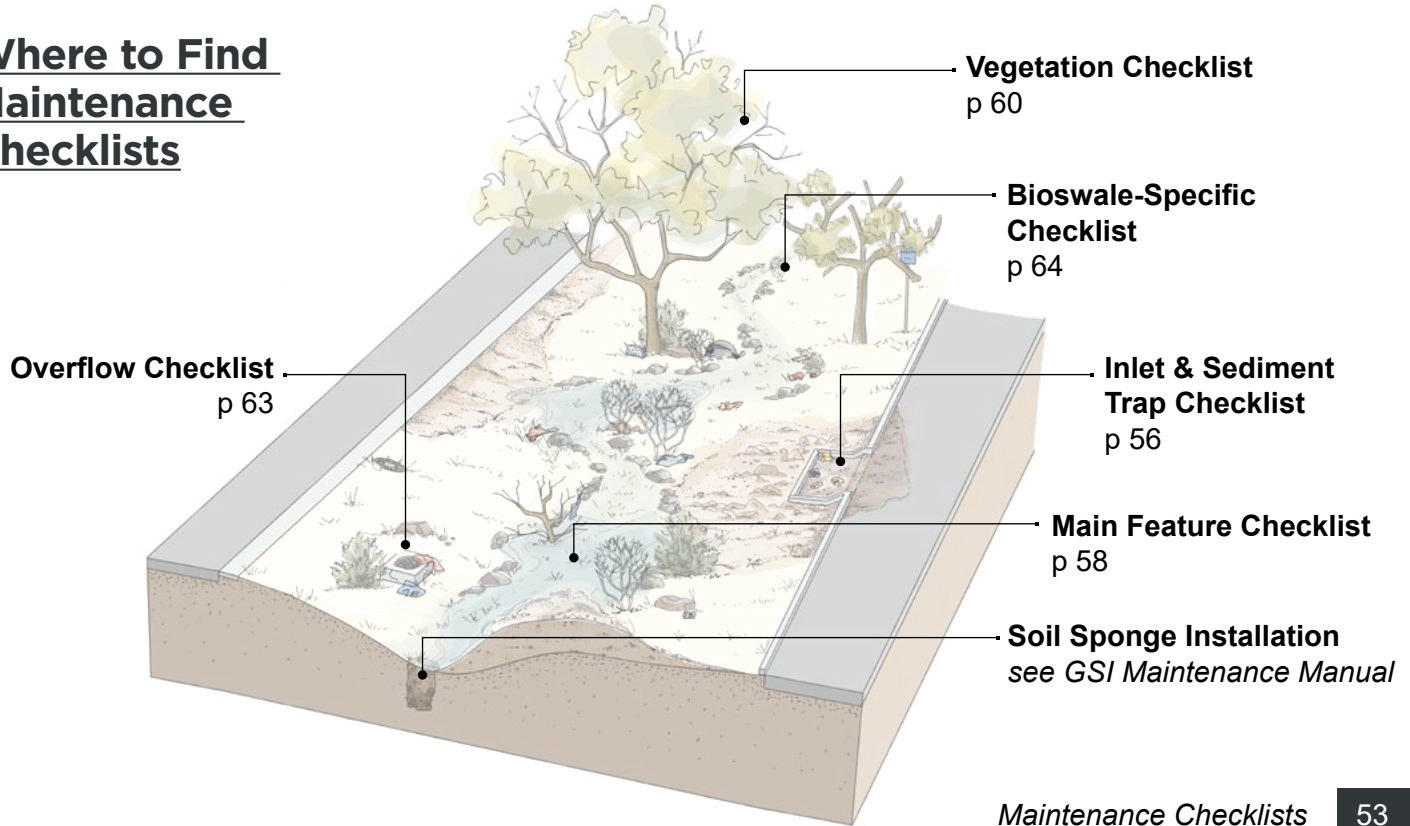
Level of Effort (LoE) 2 involves routine maintenance that is performed as needed. LoE 2 actions can be completed with the basic tools listed in this guide. These maintenance actions address issues noted in the LoE 1 inventory.

Some issues identified in the LoE 1 inventory may be more significant than what can be fixed with routine maintenance. Please consult the accompanying GSI Maintenance Manual for remediation at Level of Effort 3. See next section for examples of conditions requiring interventions at LoE 3.

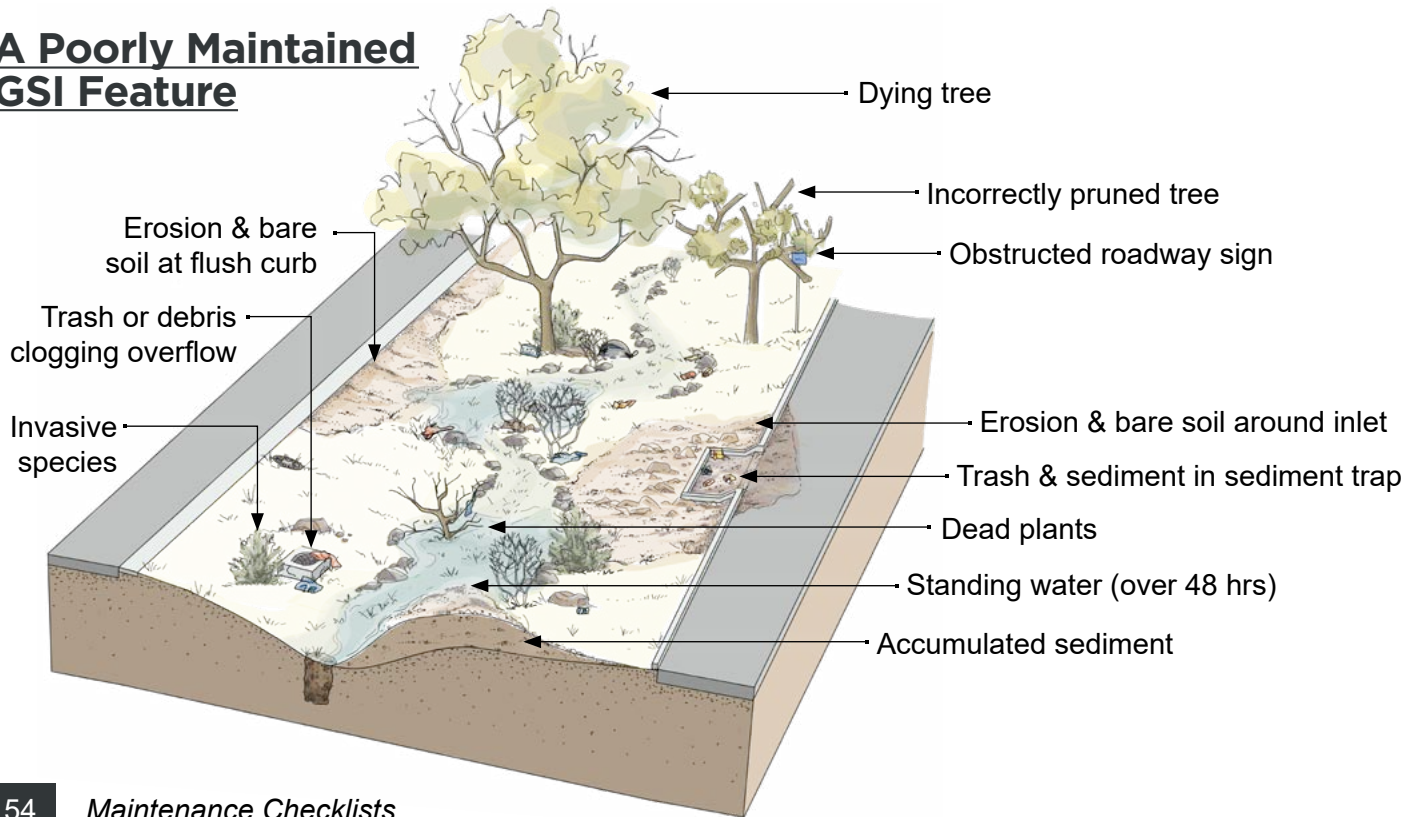
Issues or hazards requiring further action are to be coordinated with NMDOT Districts.



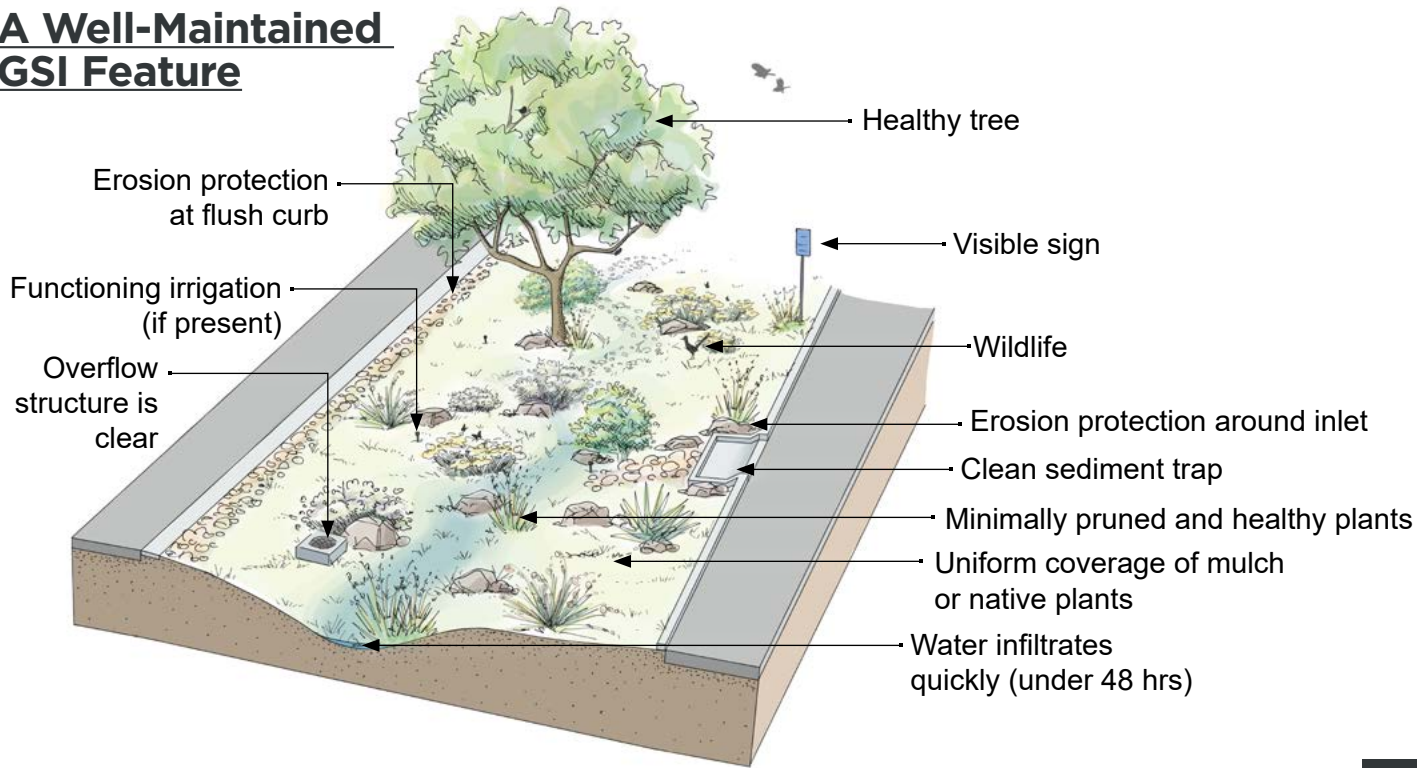
Where to Find Maintenance Checklists



A Poorly Maintained GSI Feature



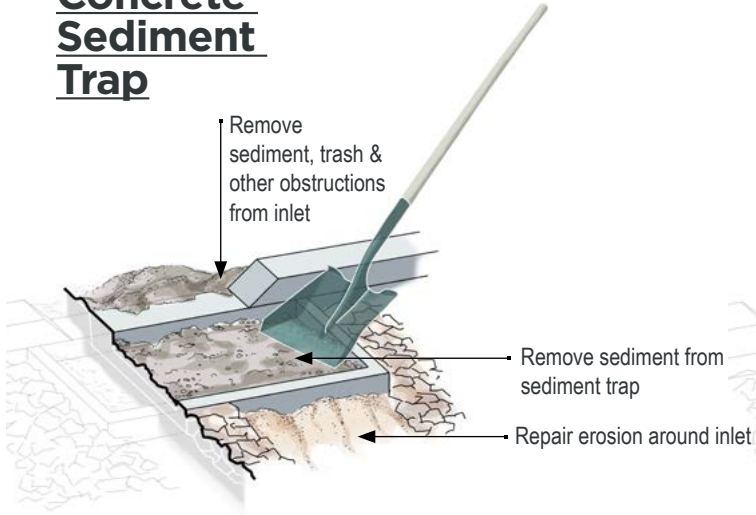
A Well-Maintained GSI Feature



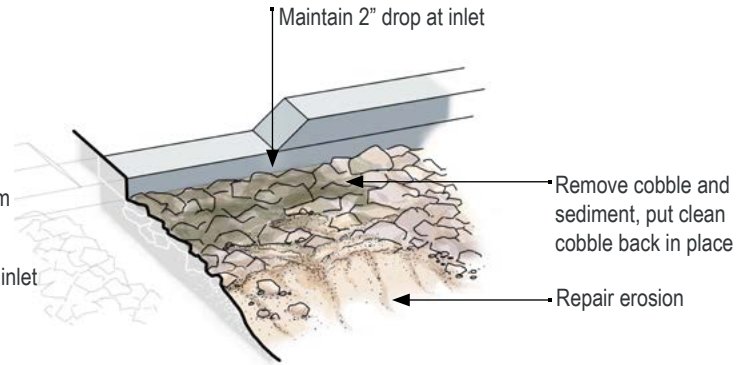
CHECKLIST AREA 1 - INLET AND SEDIMENT TRAP

LoE 1: VISUAL INSPECTION	LoE 2: ROUTINE MAINTENANCE/ON-SITE FIX
Can water flow into feature? Are inlets clear?	<i>Remove and properly dispose of sediment, trash, and any obstructions from sediment traps and inlets.</i>
Have sediment, cinders, or small trash collected at inlets or in sediment trap?	<i>Remove and properly dispose of sediment, cinders, trash, and any obstructions from sediment traps and inlets.</i>
Is there cracking or damage visible at inlet? (on curb, sediment trap, culvert, etc.)	<i>Report structure damage (cracking, chipping) for further repair.</i>
Is there erosion visible at inlet?	<i>If erosion at and around inlet can be repaired with 2"-4" aggregate and a shovel, repair on-site. Refer to GSI Maintenance Manual if erosion is significant or due to design flaw.</i>

Concrete Sediment Trap

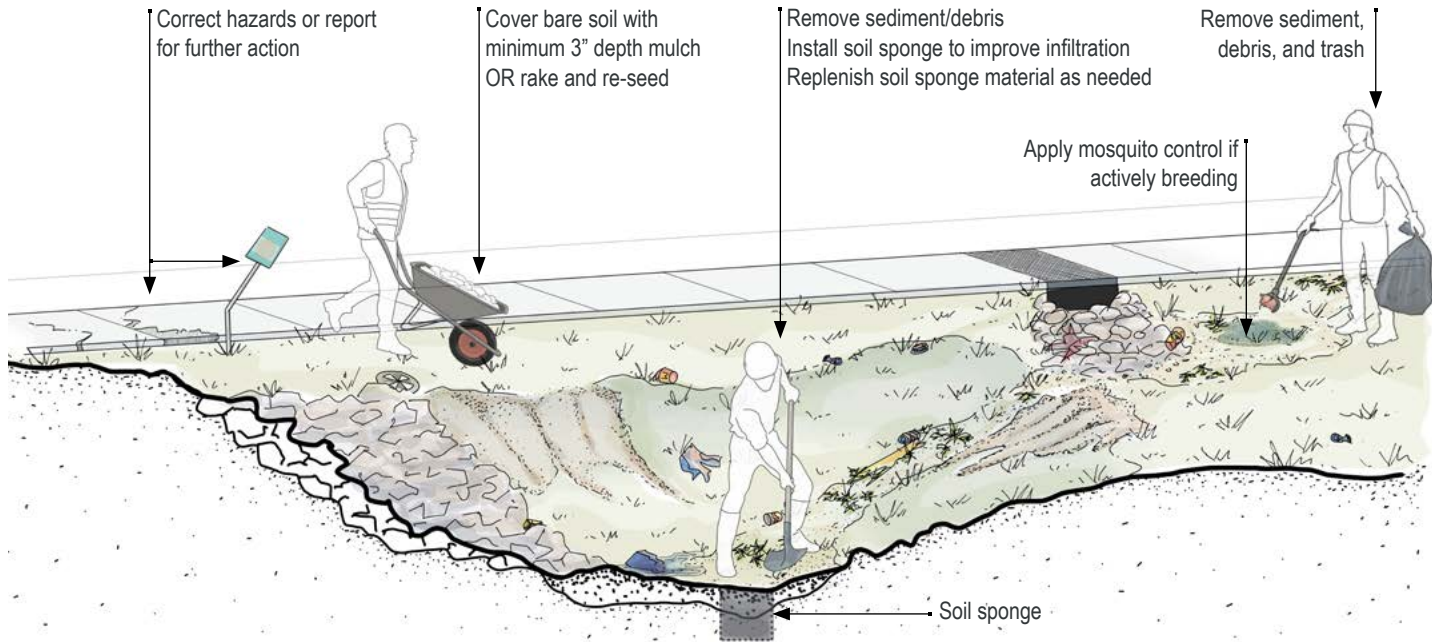


Cobble Sediment Trap



CHECKLIST AREA 2 - GSI MAIN FEATURE

LoE 1: VISUAL INSPECTION	LoE 2: ROUTINE MAINTENANCE/ON-SITE FIX
Is trash present?	<i>Remove and haul trash.</i>
Is there more than 2" of accumulated sediment or debris in the bottom of the basin/swale?	<i>Remove sediment and debris.</i>
Is mulch or vegetation covering all soil?	<i>Cover bare soil with 3" min. depth mulch to match existing OR rake & re-seed</i>
If organic mulch is present, is it at least 3" thick?	<i>Same answer as above.</i>
Is there evidence of erosion?	<i>If erosion is minor, rake and apply seed and/or mulch. If erosion is significant or due to design flaw, refer to GSI Maintenance Manual.</i>
Is there standing water or evidence of ponding lasting more than two days after a storm event?	<i>Remove accumulated debris or sediment. Install one soil sponge (min. 12" diameter, 18" depth) per 16 sq ft of feature. If ponding persists, refer to GSI Maintenance Manual.</i>
Are any hazards to the public observed in or around the GSI feature? (broken signs, heaved pavement, etc.)	<i>Correct any hazards or report for immediate action.</i>
Is there evidence of routine maintenance not being performed?	<i>Email GSI.Maintenance@dot.nm.gov to ensure regular maintenance is being performed.</i>
Mosquito season only (<i>varies by region & elevation</i>): Is there evidence of mosquitoes breeding in standing water?	<i>Refer to GSI Maintenance Manual, schedule corrective measures to improve infiltration.</i>



CHECKLIST AREA 3 - VEGETATION

LoE 1: VISUAL INSPECTION	LoE 2: ROUTINE MAINTENANCE/ON-SITE FIX
Is vegetation obstructing signage or visibility?	<i>Prune plants during winter and only as needed during the growing season to ensure visibility. Remove dead, diseased, or damaged branches. Plants DO NOT need to be shaped. Remove and replace dead plants or reseed. See calendar wheel of vegetation maintenance, p20.</i>
Are any plants dead, diseased, or damaged?	<i>Same as above.</i>
Late winter only: Is non-emergency pruning or mowing needed?	<i>Mow or trim grass in February or March unless needed more frequently for visibility.</i>
Is there any evidence of pest infestation?	<i>Contact NMDOT IVM specialist.</i>
Is there evidence of poisoned plants? (poisoning may be caused by heavy metals, road salts, improper herbicide application, etc.)	<i>Remove and replace plants, see p36. Schedule additional plant replacement if needed. Adjust plant species for better salt tolerance if possible. If contamination is observed, notify appropriate entity for proper disposal.</i>
Are there plants looking dry or overgrown? (indication of irrigation system issue)	<i>Test irrigation system and repair/adjust as needed (clean valves, repair drip tubing, replace or clean emitters, test controller, adjust run times as needed for plant health). If malfunction is significant, schedule larger service. This may be urgent if plants are drought stressed.</i>
If a test of the irrigation system was performed, was system functional?	<i>Same as above.</i>
Are invasive species present? What species?	<i>Remove invasive species. Refer to Vegetation section, p21.</i>

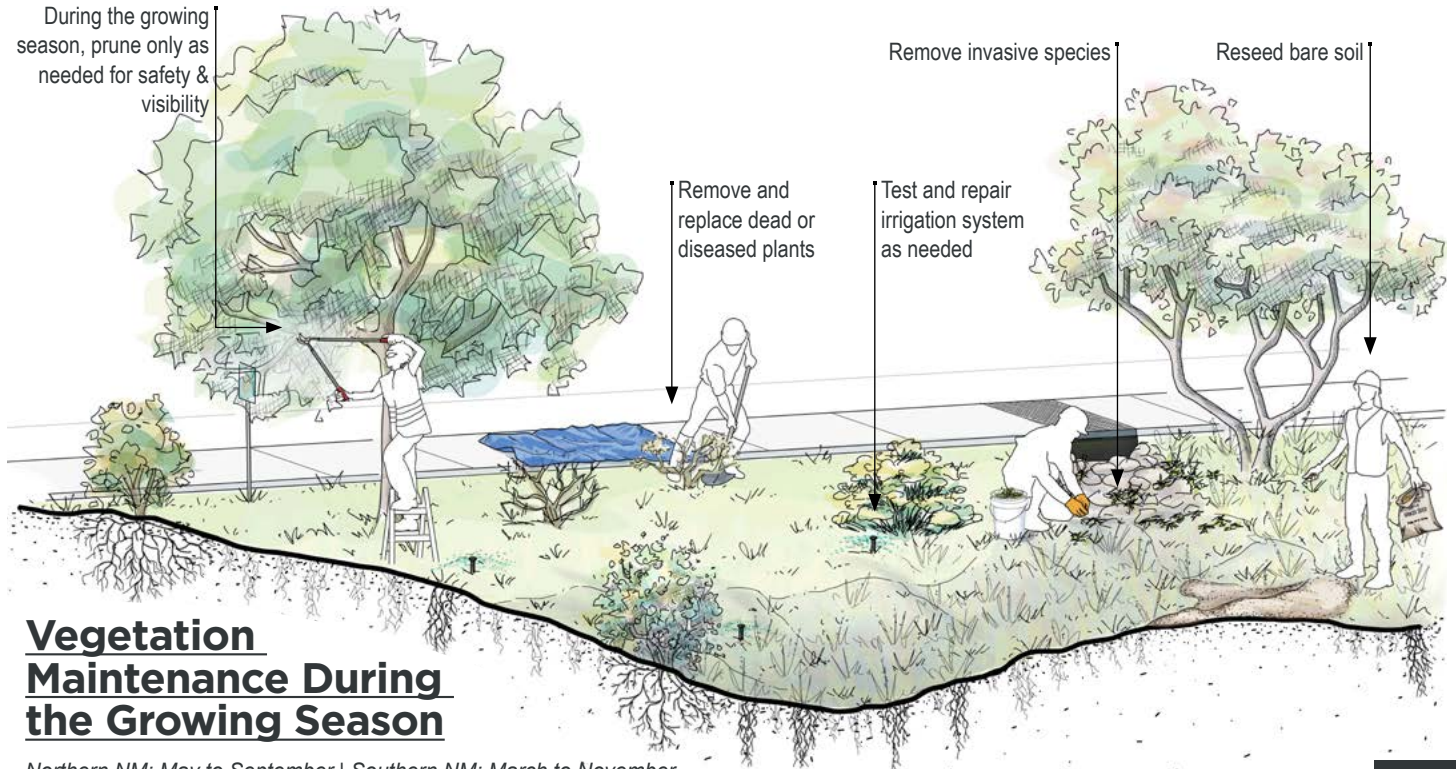
During the growing season, prune only as needed for safety & visibility

Remove and replace dead or diseased plants

Remove invasive species

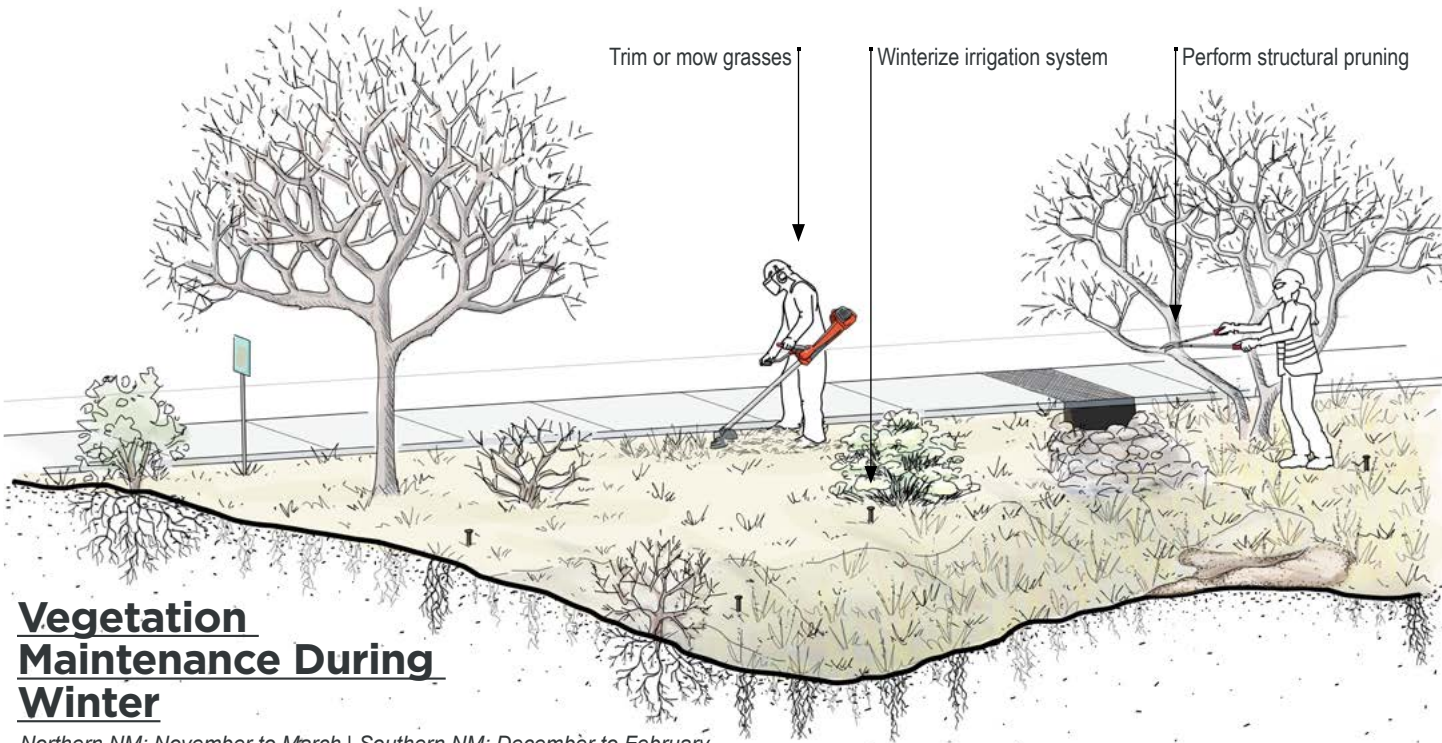
Test and repair irrigation system as needed

Reseed bare soil



Vegetation Maintenance During the Growing Season

Northern NM: May to September | Southern NM: March to November



Vegetation Maintenance During Winter

Northern NM: November to March | Southern NM: December to February



CHECKLIST AREA 4 - OVERFLOW

LoE 1: VISUAL INSPECTION

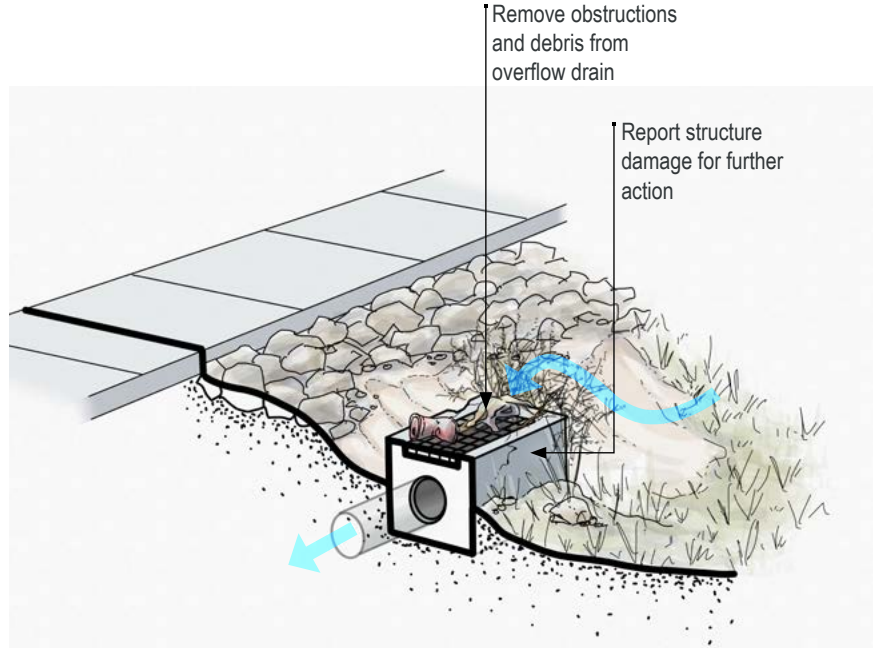
LoE 2: ROUTINE MAINTENANCE/ ON-SITE FIX

Can water flow into
outlet / overflow?

Properly remove and haul sediment, trash, and any obstructions from outlet. If significant blockage, refer to GSI Maintenance Manual.

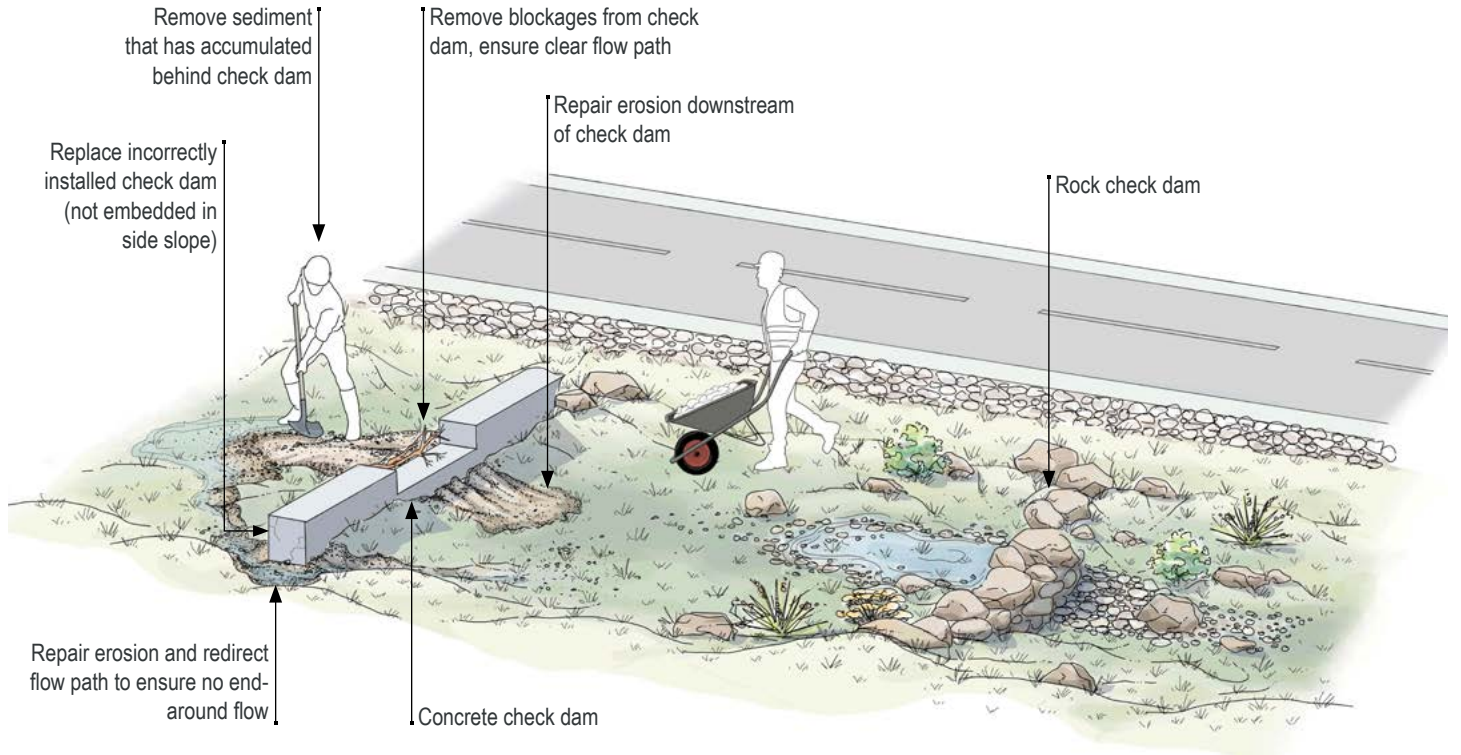
Is there cracking or
damage visible at
outlet? (drop inlet,
drain, etc.)

Report damage for further repair. Refer to GSI Maintenance Manual.



CHECKLIST AREA 5 - BIOSWALE SPECIFICS

LoE 1: VISUAL INSPECTION	LoE 2: ROUTINE MAINTENANCE/ON-SITE FIX
Has sediment collected behind check dams?	<i>Remove and properly dispose of sediment.</i>
Is water able to flow through entire length of structure?	<i>Remove blockages, make minor adjustments as needed to ensure flow.</i>
Is there erosion visible around check dam?	<i>Repair on-site if possible. If damage or erosion is significant, refer to GSI Maintenance Manual and schedule repair.</i>
Is there any damage to check dams? (if present)	<i>Same as above.</i>



Refer to GSI Maintenance Manual

Please reference the accompanying GSI Maintenance Manual for guidance on issues requiring more significant remediation (Levels of Effort 3 and 4). These issues may include the following:

- Erosion or undercutting at the inlet, side slopes, or around check dams that cannot be corrected with routine maintenance
- Sediment-clogged soil that causes water to pond more than 48 hours after a storm event
- Inlets or overflows that easily become blocked and cause water to back up
- Inlets or overflows that are not in a location where water can flow through
- Damaged concrete structures, such as curbs, culverts, forebays, check dams, or outlet structures
- Major infestations of invasive plant or insect species





Basin clogged with sediment no longer infiltrates water



Erosion and bare soil requiring significant remediation

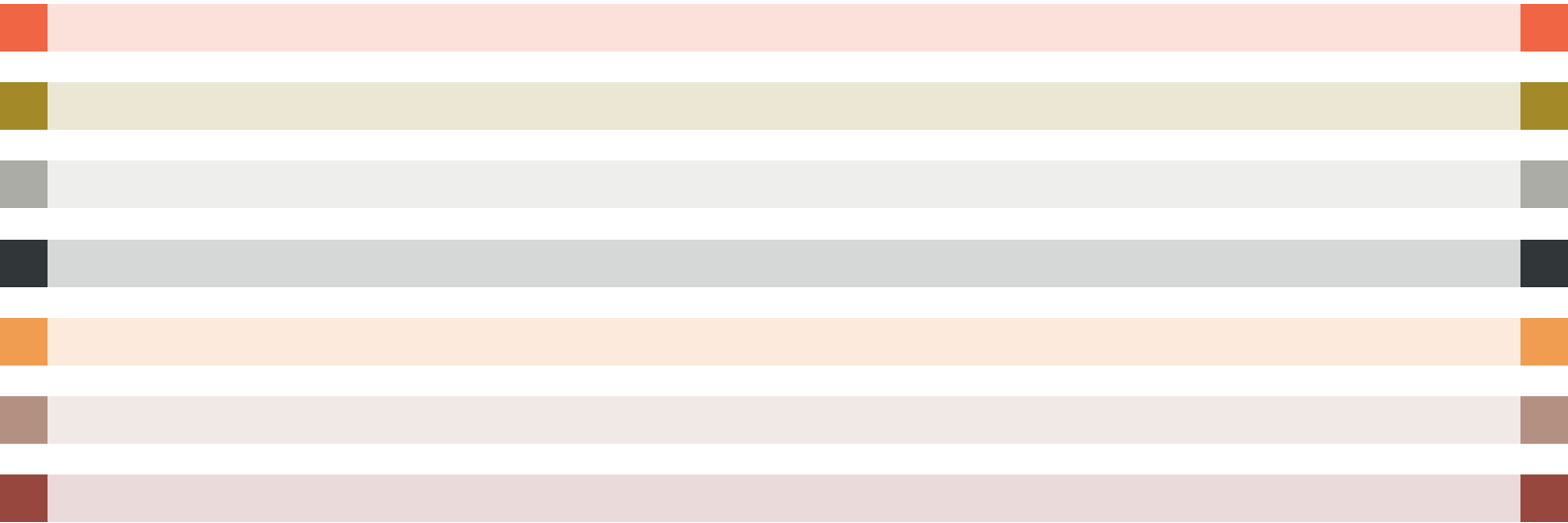


Basin graded incorrectly at time of install - water cannot flow through curb inlet



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TRANSPORTATION
MOBILITY FOR EVERYONE

GSI.Maintenance@dot.nm.gov