



# TRPA Permitting Guidelines for Residential Best Management Practices

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# INTRODUCTION

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Best Management Practices (BMPs) are systems that capture, dissipate, and infiltrate stormwater onto properties. Once installed and maintained, these BMPs reduce the amount of sediment and other pollutants that flow into Lake Tahoe and prevent soil erosion. Some examples include roof gutters, gravel driplines trenches, and rain gardens.

This document summarizes the Tahoe Regional Planning Agency's (TRPA) BMP requirements and standard designs for **typical residential projects**. Larger projects, including highly developed sites, commercial or multi-family land use, and projects in sensitive areas often need professional and/or engineered plans with specialized installations.

These guidelines will cover what to submit with a project application, as well as provide descriptions, examples, and design specifications for each BMP treatment type.

## Residential BMP treatment types include:

- Source Control
- Collection and Conveyance
- Stormwater Infiltration
- Fire Defensible Space
- Temporary Construction



## ADDITIONAL STORMWATER & BMP RESOURCES

### Interactive Graphics & Photos

Visit [TahoeBMP.org](https://TahoeBMP.org) for an interactive graphics showing BMPs on a [single family](#) and [multi-family residential](#) property. The website also includes a [photo gallery](#) of common BMPs.

### In-depth How-Tos

For a deep dive into specific BMP treatments and design options, see the [BMP Handbook](#) or visit [TahoeBMP.org](https://TahoeBMP.org).

### Speak with a Team Member

Call the BMP helpline at 775-589-5202 or email [BMP@TRPA.gov](mailto:BMP@TRPA.gov) to discuss BMP requirements and site considerations with the TRPA Stormwater Management Team.

## APPLICATION REQUIREMENTS & PLANS

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The [TRPA Code of Ordinances](#) Chapter 60: *Water Quality* requires the installation and ongoing maintenance of Best Management Practices (BMPs) with all projects. BMPs must be designed to infiltrate stormwater from a large precipitation event – a 20-year, one-hour storm which is equivalent to one inch of rainfall.

Properly designed and maintained BMPs will capture and infiltrate that stormwater flowing from development and other improvements on a property such as roof structures, driveways, walkways and other contributing resources. This helps to protect the clarity of Lake Tahoe by capturing sediment in the water runoff.

At the completion of a project and final inspection, TRPA will issue a BMP certificate of completion or may re-issue a certificate if the property already has one. Maintenance of existing BMPs is included in project inspections to ensure the continued effectiveness of each BMP treatment.

To review a property's BMP certificate status, visit the [Parcel Tracker](#) and search the property's address or Assessor Parcel Number (APN).

### WHAT TO SUBMIT WITH A PROJECT APPLICATION

The application checklist will include a requirement for a “Stormwater (BMP) & Fire Defensible Space Plan”. These plans must include a combination of BMP treatment types appropriate for the desired project design and the environmental constraints on each site. Residential BMP treatment types include source control, collection and conveyance, infiltration, fire defensible space, and temporary construction BMPs. The following sections of this guidebook provide an overview of each BMP treatment type with examples and hyperlinks to design specifications.

#### **A Stormwater (BMP) & Fire Defensible Space Plan must include the following:**

- Location, dimensions, and construction details of *existing* and *proposed* BMPs treatment types. Standard detail drawings are available in the [BMP Toolkit Chapter 4](#) and as hyperlinks throughout this document. Alternative detail drawings can be used if functionally equivalent.
- Parcel boundaries, all impervious coverage (e.g. building footprint, driveways, walkways, etc.), land capability boundaries and stream environment zones, if present.
- Identify distinct “contributing areas” for all impervious surface runoff. Contributing areas could be driveways, varying roof planes, walkways, and other site improvements that shed rainfall and precipitation.

- Stormwater flow lines for each contributing area. TRPA requires a properly sized infiltration BMP for each contributing area, with conveyance infrastructure and pre-treatment where required. The dimensions or area of each contributing surface will be used to calculate the size of the infiltration BMP.
- Engineer’s stamp of approval if required for complex stormwater treatments.

### **How do I know which BMPs to propose and the appropriate size?**

Each BMP plan will include a combination of the five treatment types (e.g. infiltration, conveyance, fire defensible space, etc.). There are four options for determining the appropriate BMPs for a project depending on the type of development and a property’s land capability. In all circumstances, property owners typically consult with a hired professional or contractor to design and install BMPs appropriate for their project and property.

#### **OPTION 1: USE A STANDARD BMP PLAN SHEET.**

This option takes the guesswork out of designing BMPs for smaller scale projects. TRPA provides a plan sheet that includes which BMPs should be installed on a property. This option is ONLY for residential projects with four units or less and non-sensitive land (Class 4-7 or IPES  $\geq 725$ ). To determine the land capability, visit the [Parcel Tracker](#) and search the property’s address or Assessor Parcel Number (APN). No BMP calculation spreadsheet is required for this option. **Click here for the [Standard BMP Plan Sheet](#). OR;**

#### **OPTION 2: DESIGN BMPS SPECIFIC TO A PROJECT AND PROPERTY.**

This option can be used for larger projects, unique site conditions, or for projects on sensitive lands (land capability Class 1-3 or IPES  $< 725$ ). To determine the land capability, visit the [Parcel Tracker](#) and search the property’s address or Assessor Parcel Number (APN).

All items listed under the “A Stormwater (BMP) & Fire Defensible Space Plan” section above are required at the time of the project application submittal. A [BMP Calculation Spreadsheet](#) is also required to size the infiltration BMPs and verify the infiltration capacity, that is then shown on a plan sheet. See the step-by-step guide for completing the calculation spreadsheet at the end of this document. **OR;**

#### **OPTION 3: PARTICIPATE IN AN AREA-WIDE WATER QUALITY TREATMENT PROGRAM.**

These are neighborhood-scale stormwater treatment systems. To select this option, a property must be recognized as a “participant” in a TRPA approved area-wide treatment program. To check if a property is a participant in an area-wide treatment program, visit the [Parcel Tracker](#) and search the property’s address or Assessor Parcel Number (APN). **OR;**

#### **OPTION 4: WORK WITH THE STORMWATER MANAGEMENT TEAM TO CUSTOMIZE BMPS.**

BMPs may be customized or waived in accordance to [TRPA Code Section 60.4.8](#) in special circumstances, such as limited ability to infiltrate runoff due to the presence of seasonal high groundwater, soils with slow infiltration rates, or other [site constraints](#). TRPA requires [source control BMPs](#) in these situations. Call the BMP helpline at 775-589-5202 or email [BMP@TRPA.gov](mailto:BMP@TRPA.gov) to discuss BMP requirements and site considerations with a Stormwater Management Team member.

# RESIDENTIAL BMP TREATMENT TYPES

The following sections provide descriptions, examples, and design specifications for each BMP treatment type. Each BMP plan will include a combination of the five treatment types. Click on the hyperlinks provided throughout the document to view factsheets and more detailed information.

## Residential BMP treatment types include:

- Source Control
- Collection and Conveyance
- Stormwater Infiltration
- Fire Defensible Space
- Temporary Construction

## SOURCE CONTROL BMPS

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[Source control BMPs](#) are used to stabilize soil and prevent or minimize the initial movement of sediment, nutrients, and other pollutants from stormwater on developed sites. Source control BMPs include paving driveways and parking areas, parking barriers, stabilizing slopes, dedicated snow storage areas, restoration and revegetation of disturbed areas, and armoring below roof driplines, gutter downspouts, decks, and other elevated structures.



## EXAMPLES

Click on the hyperlinks in the descriptions below to see design specifications and examples of source control BMPs.

- **Driveway and Parking Areas Paving:** All access roads, driveways, and parking areas proposed for year-round use shall be paved with a hard, plowable surface. Bare soil along the driveway or parking area should also be [protected and stabilized](#) with a three-inch deep by 18 - 36 inch wide layer of rock armor. Plans shall show driveway slopes and areas with concentrated or [sheet flow](#) runoff. Infiltration along the driveway edge shall be provided wherever sheet flow runoff occurs. On many sites, a linear infiltration BMP will border the downhill side of the entire driveway. Other designs may first require conveyance to an infiltration BMP. Pervious driveways require redundant BMPs that infiltrate runoff as if the driveway was not pervious.
- **Parking and Vehicle Barriers:** Protects natural areas from disturbance. Plans shall include permanent [parking and vehicle barriers](#) such as large shrub and tree landscaping, bollards, fencing, or boulders to prevent vehicle damage to natural areas, particularly those adjacent to driveways and parking areas. Cluster and stagger boulder parking barriers for a more natural aesthetic.
- **Slope Stabilization:** Property owners are required to maintain the overall natural topography of a site to the greatest extent possible. A naturally steep slope that is already stable and not slated for permitted construction should be left undisturbed. Slopes created from cut and fill should be stabilized using one or more of the following options:
  - [Revegetated slopes](#) are appropriate for slopes up the 3:1. [Erosion control blankets](#) should be used for revegetated slopes over 4:1.
  - [Riprap slopes](#) are appropriate for slopes up to 2:1.
  - [Retaining walls](#) are appropriate as an alternative to riprap and for steeper slopes. Short retaining walls, generally no more than two feet tall, may be used as a design alternative in less steep areas. Engineer-stamped plans are required for retaining walls over three feet in height (one foot below grade, two feet above).
- **Armored Roof Driplines:** Required soil erosion protection beneath the driplines of roofs and other elevated structures. These will need to extend one foot beyond each end of the dripline length. Use rock to armor the soil surface with a minimum three-inch layer of angular gravel or cobble. Many projects include a three-inch layer of angular rock/gravel covering the entire five-foot non-combustible area to address BMPs and defensible space.



Minimum width, slopes, non-flammable borders, and baffles need to be consistent with the detail drawing. Pressure treated lumber as a border is allowed when the property is flat and when installed five feet away from the structure. For slopes over 10 percent, angular rock riprap works well for baffles to maintain level infiltration areas. Larger angular rocks should be used as the slope increases.

- **Driplines with Gutters and Downspouts:** Rock or gravel armor is required as [outlet protection](#) to dissipate runoff from gutter downspouts and prevent erosion before being diverted to an infiltration area. Armor shall cover at least one foot around each downspout outlet with a minimum depth of three inches. Heating systems (heat tape or alternative) are recommended for gutters and gutter downspouts to prevent freezing. Redundant [dripline armor](#) needs to be provided when gutters and downspouts are not heated.
- **Pervious decks and other elevated structures:** Required soil erosion protection beneath decks and other pervious [elevated structures](#). [Deck armor](#) needs to include a minimum three-inch layer of rock, extend one foot beyond the deck edge, and be contained within a non-flammable border. Treatments on slopes need to use larger angular rock and baffles as needed consistent with the detail drawing. See the TRPA Code Section 30.4.6.D.2, “Pervious Decks”, for detailed design specification requirements for decks to be considered pervious.
- **Restoration & Revegetation:** Required restoration and revegetation improvements for areas removing coverage, following soil disturbance, and in other compacted or denuded areas. Reference the [BMP Handbook](#) Chapter 5 for sample revegetation plans and recommended and approved plant species for different site type areas (sunny, shady, wetland/SEZ, dry upland, etc.).

Where the natural grade has not been substantially altered and restoration of sensitive land is not required, restoration may be addressed with a note on the site plan indicating: “All areas disturbed by construction shall be revegetated in accordance with the TRPA Handbook of Best Management Practices and Living with Fire, Lake Tahoe Basin, Second Edition.” Project inspectors will verify that revegetation has been successful before releasing the project security.

## COLLECTION AND CONVEYANCE BMPs

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Collection and conveyance BMPs direct stormwater runoff from impervious surfaces to areas where it may infiltrate or discharge off-site. This can include swales and slotted channel drains with sediment traps as pre-treatment for driveways, gutter downspout systems for roofs, and/or dry creek beds for drainages.



### EXAMPLES

*Click on the hyperlinks in the descriptions below to see design specifications and examples of collection and conveyance BMPs.*

- **[Access/Cleanout \(A/C\) swales](#)**: Collects and conveys runoff from driveways and other paved areas and direct it to infiltration areas. A/C swales are appropriate on driveways with slopes of five percent or less.
- **[Slotted channel drains](#)**: Collects and conveys runoff from driveways and other paved areas and direct it to infiltration areas. Slotted channel drains with removable grates need to be used on driveways with slopes greater than five percent.
- **[Subsurface drains](#)**: Collects and conveys runoff and direct it to an [infiltration facility](#), often

down a steep slope or from the uphill side of a structure. Subsurface drains should not be used to convey natural runoff around a development site unless there are no other feasible alternatives. Access and cleanout ports need to be provided at any corners in subsurface drains to prevent clogging over time.

- **Sediment traps**: Included as pre-treatment at the downstream end of conveyance pipes that are used to convey runoff from driveways and parking areas to infiltration BMPs. On sensitive lands (Class 1-3 or IPES <725) and littoral (lakefront) parcels, sediment traps are also required at the downstream end of infiltration trenches that adjoin driveways and parking areas.
- **Driplines with Gutters and Downspouts**: Gutter downspouts convey water to infiltration areas. Heating systems (heat tape or alternative) are recommended for gutters and gutter downspouts to prevent freezing.
- **Drainage Channels**: Natural and constructed drainage channels on a site shall provide a stable path for stormwater to flow through the parcel. Natural drainage channels that are stable should be left undisturbed to the extent feasible. If disturbances cannot be avoided, use of vegetated or rock-lined swales that act as a dry creek bed best replicates natural functions and is the preferred method for stabilizing drainage channels. Swales that are pervious also provide infiltration functions. All littoral (lakefront) properties shall provide a stabilized flow-through path for stormwater runoff generated off-site (known as “run-on”), or runoff exceeding the design storm, to flow to the lake without creating soil erosion.

## STORMWATER INFILTRATION BMPS

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Stormwater infiltration BMPs capture runoff from hard, impervious ground surfaces (e.g. driveways, decks) and allows precipitation to dissipate on-site. Typical infiltration facilities can include infiltration basins, rain gardens, gravel trenches, filter strips for water spreading, vegetated or rock-lined swales, drywells, and other subsurface infiltration systems. These BMPs are required to infiltrate the volume from a 20-year, one-hour storm, which is equivalent to one inch of rainfall flowing from the “contributing surfaces”.



### EXAMPLES

*Click on the hyperlinks in the descriptions below to see design specifications and examples of stormwater infiltration BMPs.*

- [Rain Garden / Planter Bed](#): Routes stormwater runoff to a landscaped area designed for increased infiltration. Under roof driplines use turf or planter with non-woody herbaceous plants consistent with fire defensible space (sedums, bulbs for seasonal color) and rock mulch.
- [Vegetated Filter Strip](#): Distributes stormwater runoff, or water-spreads, into a gently

sloping landscape area. Filter strips may be installed along the downhill edge of a driveway where sheet flow runoff occurs.

- **Vegetated or Rock-lined Swale:** Routes stormwater runoff into a pervious swale or open linear basin for infiltration. Small check-dams can be used to reduce velocity and increase infiltration.
  - Swales or open linear basins installed under roof driplines may be a 2:1 rock-lined swale, minimum two feet wide and six inches deep or a 5:1 vegetated swale with herbaceous plants consistent with fire defensible space requirements, minimum five feet wide and six inches deep. Swale depth under roof driplines next to a structure's foundation cannot exceed 10 inches.
  - Swales or open linear basins can be installed along the downhill edge of a driveway to infiltrate sheet flow runoff. These linear infiltration BMPs are more effective and easier to maintain compared to gravel trenches that easily clog.
- **Infiltration Basin:** Routes stormwater runoff into an open basin for infiltration. Use pre-treatment to remove coarse material, facilitate maintenance, and preserve basin lifespan. Infiltration basins can be placed along swales to increase infiltration.
- **Infiltration Trench:** Routes stormwater runoff into a gravel-filled trench. Infiltration trenches are typically installed below roof eave driplines and used to increase the infiltration capacity of a gravel [armored dripline](#), and can be integrated with fire defensible space and source control BMPs for [bare soil protection](#). Dripline infiltration trenches shall extend one foot beyond each end of the dripline length, should not exceed 10 inches in depth adjacent to foundations, and should generally be avoided on the uphill side of structures. Minimum width, slopes, non-flammable borders, and baffles shall be consistent with the detail drawing. TRPA permits pressure-treated lumber as a border when the property is flat and when installed five feet away from the structure. For slopes over 10 percent, angular rock riprap works well for baffles to maintain level infiltration areas. Larger angular rocks should be used as the slope increases.
- **Drywell:** Routes stormwater runoff into a gravel-filled pit or [infiltration facility](#). Conveyance elements are typically used to connect the runoff source to the drywell. Drywells can be installed below gutter downspouts but should not exceed 10 inches in depth if next to a structure's foundation. Drywells can infiltrate driveway runoff when a sediment trap is first installed to provide pretreatment.
- **Subsurface Infiltration System:** A variety of engineered infiltration systems are available. If an engineered system is used, specifications must be provided addressing infiltration capacity and maintenance. Clean-out ports to maintain the system shall be identified on

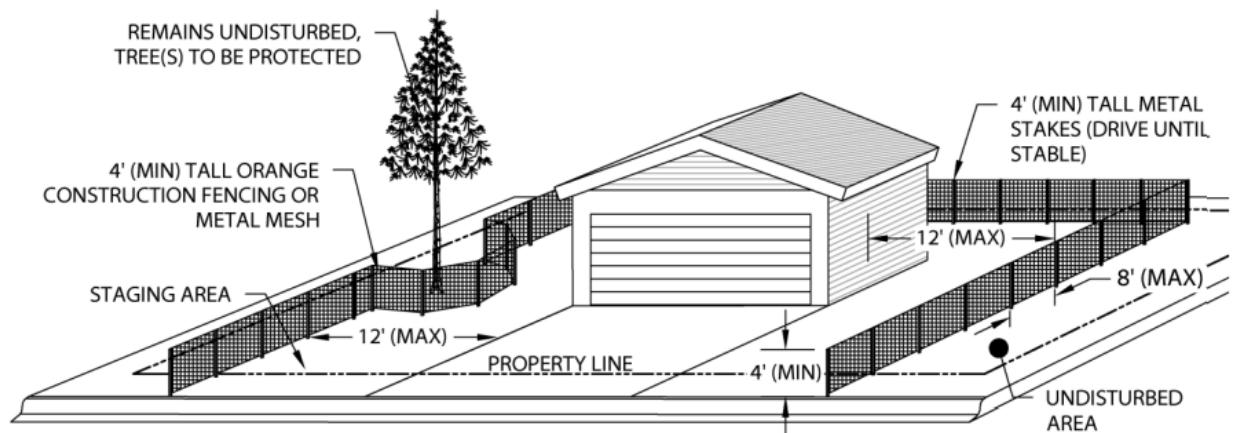
the plans and installation verified through photographs taken during the final inspection. Provide these installation photos of subsurface components as back-up documentation at final inspection.

## FIRE DEFENSIBLE SPACE

All development projects are required to maintain fire defensible space consistent with the local fire protection agency. Fire defensible space includes removing combustible materials within five feet of structures, as well as limbing tree branches within 10 feet of roofs, decks, and stairways. Woody vegetation and wood mulch shall only be used outside the five-foot non-combustible perimeter. For more information, refer to the [BMP Handbook Soil and Vegetation Management](#) Section 5.3.2.5, “Fire Defensible Space”, and the [Living with Fire](#) handbook.

## TEMPORARY CONSTRUCTION BMPs

Temporary BMPs are those that are put in place during construction and in disturbed areas to prevent sediment and pollutants from running off site and reaching waterways. Temporary BMPs may include construction boundary fencing, vegetation protection, erosion control, dust control, and material/vehicle staging.



## EXAMPLES

Click on the hyperlinks in the descriptions below to see design specifications and examples of temporary construction BMPs.

- [Construction site boundary fencing](#): Delineate the area of disturbance. Work outside construction site boundary fencing is not permitted.

- **Vegetation protection fencing**: Installed at the dripline of all retained trees within a construction site to the extent feasible. Where installation of driplines is not feasible due to site constraints, trunk protection should be installed. Additional protections may be required in conditions of approval.
- **Erosion control improvements**: Installed down slope of all site improvements. Typical erosion control methods include silt fences or fiber rolls.
- **Dust Control**: Can be addressed through sweeping and with a note on the plans: “Dust control measures shall be in place during construction. Broadcast mulch shall not be permitted as a dust control measure within 30 feet of structures.” Vehicle ingress egress management limits sediment from being tracked off disturbed areas.
- **Construction staging**: Areas for construction vehicles and materials shall be identified on the plan sheets. Staging areas shall be located within the construction boundary fencing. TRPA requires proper material handling and storage to protect water quality.

## APPENDIX: BMP CALCULATION SPREADSHEET GUIDE

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Large projects, properties with unique site conditions, or those on sensitive lands (Class 1-3 or IPES <725) will typically need to design and install BMPs specific for the project and property. (Option 2 as discussed in these guidelines.) A [BMP Calculation Spreadsheet](#) is required to size the infiltration BMPs and verify the infiltration capacity, that is then shown on a plan sheet.

### The basic steps for completing the spreadsheet include:

- Enter the property Assessor Parcel Number (APN) using the APN Lookup link. When a parcel number is entered, environmental data is accessed and the limits for depth of excavation and infiltration rate (Ksat) for that property are set within the sheet. Studies may be accepted to support alternative Ksat rates.
- Verify water table depth or other soil restrictions and the maximum depth of installations. BMP designs should maintain a one-foot separation between infiltration BMPs and the water table or other soil restrictions.
- Enter dimensions for each contributing area of impervious surface including driveways, roof surfaces, walkways, patios, etc. This will determine the volume of runoff that requires infiltration. Gravel trenches, drywells, and other subsurface infiltration systems should be entered in the upper tables. Dimensions of filter strips for water-spreading areas should be entered in the upper tables with a depth set to zero. Rain gardens, infiltration basins, and swales should be entered in the lower tables titled 'Basins'. If conveyance or drainage pipelines are included within an infiltration BMP, infiltration capacity only includes the volume located below the conveyance or drainage pipe elevation.
- Enter Average Void Space for subsurface infiltration systems. 40% should be used for standard gravel trenches and drywells. If using a subsurface product, use the Void Calculator sheet to determine the void space percentage. Example: Rainstore brand typically has a 94% void space.
- Enter dimensions for the treatments proposed and do not exceed the maximum depth of installation shown for the parcel. Sizes can be adjusted to determine the treatment capacities that will exceed runoff.
- Secondary infiltration BMPs may be used. If there is excess runoff from the initial treatment, enter that amount as a separate contributing area to size the secondary treatment. Use the two and three column groups in the upper tables to size secondary



infiltration for gravel trenches, drywells, subsurface infiltration systems, or filter strips for water-spreading.

- Verify the excess runoff line for each contributing surface is zero. Excess runoff may be allowed with a secondary infiltration area that is sized correctly with the calculation spreadsheet. Verify that rain gardens, infiltration basins, and swales are sized correctly in the Basin section of the calculation spreadsheet.