Best Management Practices

Including Best Management Practices (BMPs) in local and regional planning activities improves existing habitat, assists in the restoration of potential habitats, prevents erosion, and increased sediment loading and non-point source pollution into the Blanco River and its tributaries. Some examples of BMPs for the Blanco watershed are listed below:

Prescribed Burns

Prescribed or controlled burns remove small re-growth junipers, but do not kill grasses and most forb species. This is an effective method for killing small junipers, but is typically ineffective against mature Ashe juniper, a critical element for the endangered golden-cheeked warbler.

Burning also supports the growth of deciduous trees utilized by black-capped vireos[1]. Removal of re-growth juniper and other "scrub trees" including several varieties of mesquite reduces subsurface water consumption, possibly increasing available subsurface flow in springs and seeps. Burn programs used in combination with other methods like grazing deferment or rotation programs can increase the quality and quantity of deer forage and reduce the occurrence of invasives. This leads to increasing overall plant diversity (White and Young 2000).

When Is Prescribed Burning Most Effective?

Planned burnings are most effective in the winter and early spring before the spring emergence of new growth or "green up". Burned grassland and pasture that is grazed immediately (new growth is preferred by most herbivores) will reduce grasses that compete with forbs and native plants. This allows herbaceous vegetation to be deferred or "rested" in order to allow for re-growth (White and Young 2000). Minimum areas be left in permanently unburned must be identified in order to ensure that fire-intolerant natives remain part of the ecosystem diversity.

Mechanical Control

Mechanical control is the removal of undesirable brush and small tree via hydraulic shears, chaining, bulldozing, or hand-cutting. Hand-cutting or use of hydraulic shears results in the least amount of soil disturbance, reducing erosion potential.

[1] White L.D. and C. W. Hanselka. 1991. Prescribed Range Burning in Texas. PWD-BK-7100-1967/91. Tex. Ag. Ext. Serv. Texas Parks and Wildlife. Austin, TX.

Chemical Control

Chemical control tends to be ineffective on several brush and tree species as well impractical to apply. Incorrect application of chemicals poses serious threats to wildlife and water quality. Although chemical control is effective in many regions and land covers in Texas, is not recommended for the Blanco Basin and surrounding Hill Country areas.

Erosion and Sediment Control BMPs on Construction Sites

Some Best Management Practices (BMPs) designed to control soil erosion and sedimentation are required by law in several states, but Texas is hindered by a lack of requirements in natural landscape development. All BMPs were designed to protect soils from wind, rain, and storm water runoff and thus preserve the ecologies of natural lands and waters. An active construction site is the most dangerous time for exposure of soils to storm water. Erosion is reduced by minimizing the amount of disturbed area through the utilization of the following BMPs:

Construction sequencing

Coordinating a construction schedule by the phases of planning activities leaves disturbed areas and land clearing with less exposed time to potential rainfall to lessen erosion potential[4]. Clearing target areas only when needed is easier than if the entire site were exposed at once. Here are the general rules for construction sequencing:

1. Before site disturbance occurs, perimeter controls, sediment traps, basins, and diversions should be in place.
2. Prioritize disturbed areas near water bodies, wetlands, steep grades, and long slopes for effective stabilization[2]
3. Graded areas should be seeded and mulched immediately and well-maintained construction entrances can prevent offsite sedimentation, messy roads, and reduce complaints.
4. Land disturbance is best scheduled during periods of low precipitation[3,4]

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[2] Walsh, C.J., Leonard, A. W. Ladson, A.R., and Fletcher, T.D. 2004. Urban Stormwater and the Ecology of Streams. Canberra: Cooperative Research Centre for Freshwater Ecology and Cooperative Research Centre for Catchment Hydrology. Monash University Vic.
http://freshwater.canberra.edu.au/publications.nsf/60da502789f083dbca256ee40
022a54e/4a9e84f78d24cc28ca256f71000073a1/$FILE/Urban_Stormwater_14%3
D2.pdf

[3] Dewiest, D.R. and E. H. Livingston. 2000. The Florida Stormwater, Erosion, and, Sedimentation Control Inspector's Manual. Florida Department of Environmental Protection. Stormwater/ Nonpoint Source Management Section.

[4] Environmental Protection Agency (EPA). 1999. Preliminary Data Summary of Urban Storm Water Best Management Practices, Chapter 6: Costs and Benefits of Storm Water BMPs. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

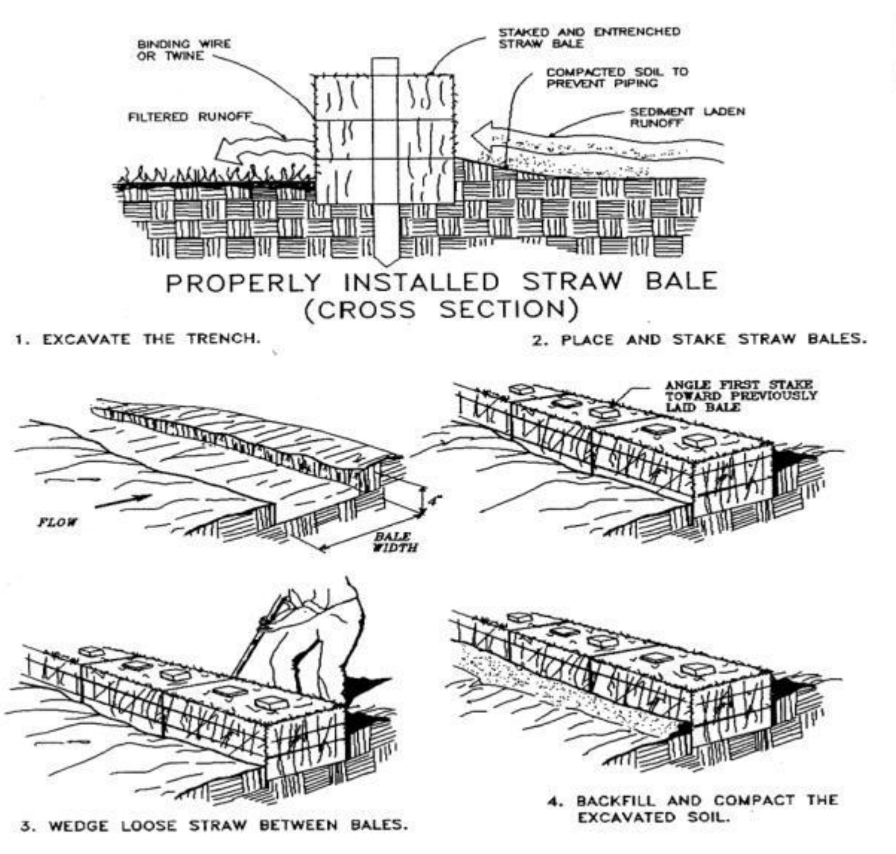
Pollution Source Controls

Using pollution source controls reduces the productions of construction-related non-point source pollutants. These controls and practices include sediment control, proper equipment maintenance and repair, storm sewer inlet protection, waste collection and disposal, demolition areas, washing areas, materials storage, sanitary facilities, dust control, and dewatering (the removal and disposal of water from excavations).

Temporary gravel construction entrances and roads can be stabilized with stone to reduce the amount of sediments transported onto public roads by vehicles and runoff.

Straw Bale Barriers

These are temporary sediment barriers consisting of a row of entrenched and anchored straw bales which detain small amounts of sediment from disturbed areas and decrease the velocity of sheet and channel flows.



CONSTRUCTION OF STRAW BALE BARRIER

Brush Barriers

Brush barriers are temporary perimeter sediment barriers composed of organic litter and spoil material from site clearing operation.

Brush barriers trap sediment and remove pollutants from stormwater

Brush barrier. Photo Courtesy of the Environmental Protection Agency's National Pollutant Discharge Elimination System (NPDES)

Storm Drain Inlet Protections

Storm drain inlet protection may be a sediment filter or excavated impounding area around a storm drain drop inlet or curb inlet. This prevents sediments from entering storm water conveyance systems prior to permanent stabilization of disturbed areas. An example of an eco-friendly storm drain inlet protector, the Rice Straw Wattle, can be used in the protection of storm drain inlets. Because of the flexibility of this system, the fiber rolls can be adapted to curb inlets as well as area drains. As with all sediment control devices, the fiber rolls should be inspected after each significant rain event, for sediment and debris to be removed and disposed of properly.

Temporary Diversion Dikes

Temporary diversion dikes are ridges of compacted soil located at the top or base of sloped disturbed areas that divert storm runoff from higher drainage areas away from unprotected slopes or too divert sediment-laden runoff to trapping facilities.

Sediment Traps

Sediment traps are small catchment areas formed by excavation or an embankment across drainage-ways. They detain sediment-laden runoff from small disturbed areas long enough to allow most of the sediment to settle out. Temporary sediment basins serve the same purpose but are basins with controlled storm water release structures, formed by constructing an embankment of compacted soil across a drainage way.

Floating turbidity barrier. Photo courtesy of Terra Erosion Control Ltd.

Check Dams

Check dams are small dams constructed across a swale or water conveyance channel that reduce the velocity of concentrated storm water flows. Check dams deepen shallow stretches of stream above the dam by impounding water. This increases the useable area longitudinally while maintaining fish movement potential.

Floating Turbidity Barriers

Floating turbidity barriers are made from geo-textile materials that minimize sediment transport from a disturbed area adjacent to or within a body of water. They provide sedimentation protection for a watercourse from up-slope land disturbances where conventional erosion and sediment controls cannot be used, or from dredging within the watercourse. Floating turbidity barriers allow sediment to settle out before being carried into adjacent or joining waters. These are made up of a top floatation boom, an impervious skirt extending downward under the water, and a heavy chain sealed into a hem along the bottom of the skirt to provide anchor weight.

Stormwater Management BMPs

Porous/Pervious Pavement

Porous or impervious concrete with a high percentage of void space that allows rapid percolation of liquids through the pavement. It consists of specially formulated mixtures of Portland cement, uniform graded coarse aggregate, potable water, and air entraining agents. Its purpose is to reduce volumes and peak rates of runoff associated with urban-type development that reduces potentials for sewer overflows, downstream channel erosion, and subsequent sediment pollution. Water quality is also improved by filtration and bacterial action and this BMP also assists groundwater recharge[5,] Otto et al 2002).

Porous/pervious concrete vs. impervious concrete. Photo Courtesy of www.sfgate.com

[5] American Society of Civil Engineers (ASCE). 2001. Guide for Best Management Practice (BMP) Selection in Urban Developed Areas. American Society of Civil Engineers, Reston, Virginia.

Pervious/Permeable Grid Pavements

These serve the same purpose as porous/pervious pavement allowing water to percolate back into the soil during rain events.

Figure Grid Pavements. Photos courtesy of: www.soilretention.com

Figure Grid Pavements. Photos courtesy of www.mytorontohomeimprovement.com/permeable-pavements.htm

Retention Basins

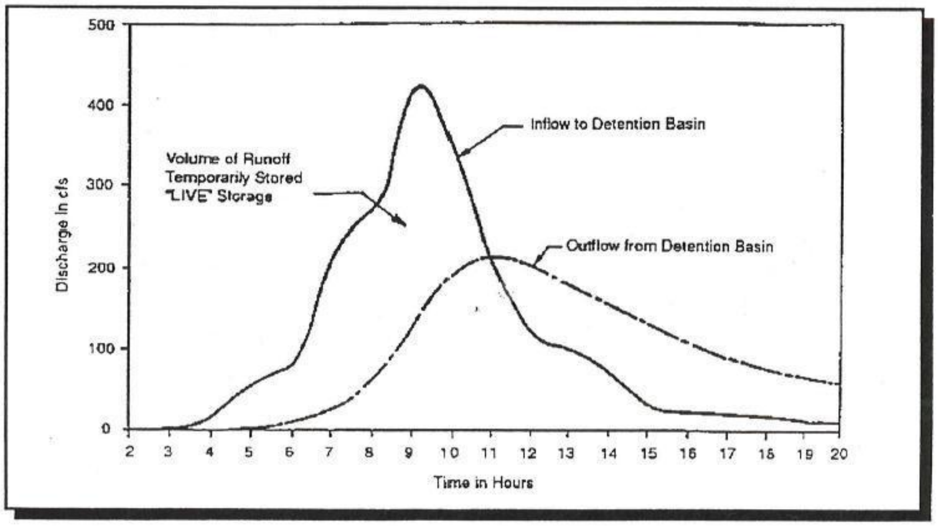
A retention basin is surface area BMP used to store runoff of a specified treatment volume. Their purpose is to reduce stormwater volume, peak discharge rates, and pollutants; and to recharge ground water and base flows.

Infiltration Basins/Trenches

Infiltration basins or trenched promote on site retention of stormwater below the ground. They are excavated trenches backfilled with course-grade aggregate. Stormwater runoff is collected for temporary storage and infiltration. They often include a perforated pipe and filter contaminants before runoff reached receiving water supplies. Their purpose is to retain the “first flush” of stormwater runoff to promote water quality improvement. Infiltration basins also reduce runoff volume and peak discharge from sites, thus reducing downstream flooding.

Detention basins

Detention basins temporarily store excess runoff on site prior to its gradual release after the peak storm inflow has passed. Runoff is held for a short period and is slowly released to a natural or constructed water body. The objective is to regulate runoff of a given rainfall event and to control discharge rates to reduce the impact on downstream stormwater systems. Generally, detention facilities will not reduce the total volume of runoff but will redistribute the rate of runoff over time by providing temporary storage. The major benefit derived from properly designed and operated detention facilities is the reduction in downstream flooding problems.



Volume of Runoff compared with Discharge in Stormwater Detention Basins.
Source: NRCS

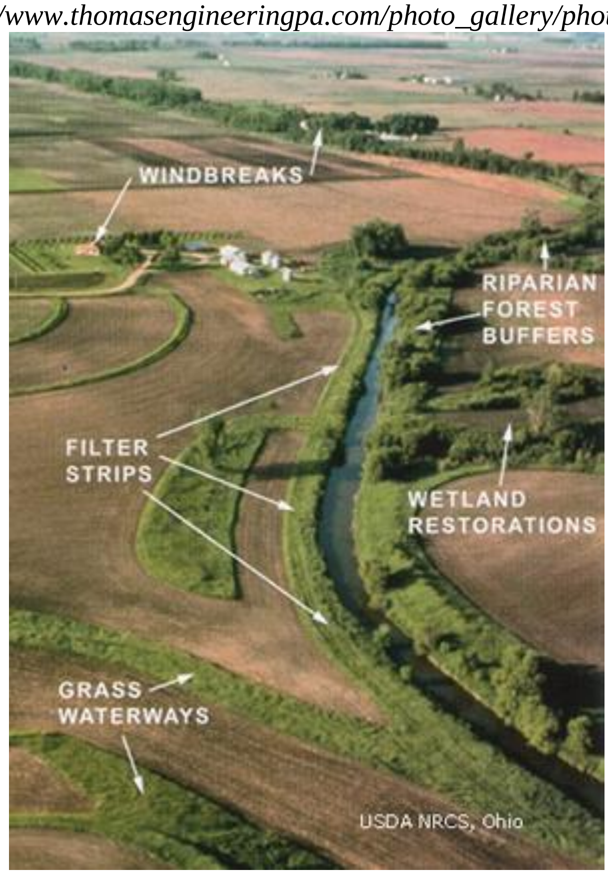
Underdrains and Stormwater Filtration Systems

Underdrains and stormwater filtration systems filter a portion of stormwater runoff contained in detention ponds prior to discharge to surface waters and improve infiltration and percolation. These systems consist of conduits that intercept, collect, and convey stormwater following infiltration and percolation through soil, aggregates, and/or filter fabric.

Vegetative waterways and swales

Vegetative waterways and swales are constructed conveyances shaped or graded to required specifications and established with suitable vegetation. Usually, these convey stormwater safely without erosion using existing topographic draws. Such systems are also used for the treatment and removal of pollutants from stormwater runoff in urban situations.

Grassed Swale. Photo Courtesy of: Thomas Engineering, PA.
http://www.thomasengineeringpa.com/photo_gallery/photo_gallery.htm



Riparian BMP's. Courtesy of the MN Dept. of Agriculture
http://www.mda.state.mn.us/protecting/conservation/practices/buffergrass.aspx

Waterway drop structure. Source: State of Delaware DOT

Outlet protections

Outlet protections prevent scour at stormwater outlets and reduce the velocity of concentrated stormwater flows. These structures consist of lined aprons or other energy-dissipating designs placed at the outlets of pipes or channel sections. Common types include riprap or concrete aprons with energy dissipater blocks or walls.

Riprap

A type of outlet protection, riprap is a large, loose, angular stone that protects soil from concentrated runoff and slows water velocity. These protections enhance the potential for infiltration and stabilize slopes.

Vegetation BMPs for Erosion Control

Vegetative cover controls erosion by shielding soil from the impact of falling rain. Soil particles are held in place and the capacity to absorb waste increases. Vegetative cover slows the velocity of runoff and removes subsurface water through evapotranspiration. BMPs in this section include the following:

- **Surface roughening** aids the establishment of vegetative cover with seeds that reduce runoff velocity, increase infiltration, reduce erosion, and provide for sediment trapping. The soil surface is roughened with horizontal depressions. All slopes steeper than 3:1 require surface roughening if they are to be stabilized with vegetation.
- **Topsoiling** provides a suitable growth medium for final site stabilization with vegetation.
- **Temporary seeding** reduces erosion and sedimentation by stabilizing disturbed areas that will not be brought to final grade for thirty days or more. It reduces the problems associated with mud and dust from bare soil during construction by establishing a temporary vegetative cover. This practice involves seeding with rapidly growing annual plants.
- **Permanent seeding** establishes perennial vegetative cover on disturbed areas.
- **Trees, shrubs, vines, and ground cover** all provide similar functions as well food and shelter for wildlife where habitat is desirable. This practice can be applied on steep or rocky slopes where mowing is not feasible.
- **Vegetative stream bank stabilization** is especially important in reaches downstream from urban development. In highly developed areas, locations that once were parabolic with banks covered with vegetation are transformed into wide channels with barren banks.

- Stabilization is achieved by creating zones along watercourses: **1) an aquatic plant zone, 2) an herbaceous flooded zone, 3) a shrub zone, and 4) an infrequently flooded tree zone.**

- **Tree preservation and protection** ensures the survival of desirable trees for erosion control, watershed protection, and other environmental benefits while land is converted from forest to urban – type uses.
- **Mulching** prevents erosion by protecting the soil surface from rain impact. It fosters the growth of vegetation by increasing moisture and reduces the velocity of overland flow.

On-Site/ On-Lot Interception and Treatment

This encompasses a range of practices for the treatment of runoff from individual residential lots and neighborhoods. The primary purpose of on-site/ on-lot interception and treatment is to manage runoff from rooftops and, to a lesser extent, driveways and sidewalks.

Rooftops reduce a watershed's overall imperviousness. The deleterious effects of urbanization on water quality can be traced to fundamental changes in the hydrologic cycle caused by increases in impervious materials, like roofs, covering the landscape. The BMPs for this sort of runoff management can be grouped into three categories:

1) Practices that infiltrate rooftop runoff;

2) Practices that divert runoff to a pervious area; and

3) Practices that store runoff for later use[6]

The incorporation of BMPs into the design of new development projects along with designated green belts or areas is cost effective in initial construction budgets. By holding excess stormwater on-site immediately after rain events followed by slowed release, drainage designs often have lower costs due to smaller diameter pipe systems (Best-Wong/EPA 2010).

- **Drywells** are the most often used practice to infiltrate rooftop runoff. Storm drains are directed to underground rock-filled trenches that are similar in design to an infiltration trench. Many times the long trenches are equipped with perforated pipes buried within the gravel to distribute flow throughout the length. Practices that store rooftop runoff, such as **cisterns** and **rain barrels**, are the simplest of all of the on-lot treatment systems.
- Runoff can be diverted to a pervious area or a treatment area using site **grading, or channels and berms.**
- **Stormwater ponds and rainwater gardens** (an on-lot filtration system) are landscaped depressions designed to incorporate many of the pollutant removal mechanisms functioning in forested ecosystems. They are ecologically friendly and require low maintenance. Utilizing creative design and landscape ecology retention ponds can be turned into desirable respites for employees in addition to serving as a wildlife sanctuary.

[6] Kloss, C. and C. Calarusse. 2006. Rooftops to Rivers: Green Strategies for Controlling Stormwater and Combined Sewer Overflows. Natural Resources Defense Council, Low Impact Development Center, and University of Maryland School of Public Policy. http://www.nrdc.org/water/pollution/rooftops/rooftops.pdf

Dry well being installed. Photo courtesy of Canela Landscaping.
http://www.canalelandscaping.com

Stormwater pond. Photo courtesy of Native Florida Consulting.
http://nativefloridaconsulting.com/projects.html