

EROSION CONTROL

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Soil on the Move

There is a wide spectrum of solutions.



Photo: ISTOCKPHOTO.COM/DA_PHOTOS

By Janet Arid

Silt and sediment management devices may not be as impressive as retaining walls or as subtly beautiful as rain gardens, but they're the first line of defense against soil that's on the move. They range from simple wattles to trackout devices to sophisticated polymer treatment systems that reduce turbidity in runoff.

The goal in choosing one or more of these devices for a project is to effectively contain the silt and sediment and prevent it from reaching areas outside the project limits. In some cases, it's possible to build a structure to divert the flow around the project. That's rare, however, because often the structure would destroy the native vegetation, says Jesus Jaramillo, owner of Eagle Environmental Consultants in Tucson, AZ, which designs stormwater pollution prevention plans (SWPPPs).

Designers have a multitude of choices for best management practices (BMPs) that can be used alone or in combination. Selecting BMPs for developed areas is often easier than for undeveloped areas because it's easier to determine where the stormwater will flow, Jaramillo adds. On the other hand, in developed areas, designers have to take the safety of pedestrians into consideration, as well as the safety of workers on sites where passing traffic cannot be stopped.

Among the most basic BMPs are wattles, snake-shaped tubes often made of biodegradable burlap or geosynthetic fabric and filled with straw or other material. Wattles shorten the length of slopes and slow erosion by slowing, spreading, and filtering the flow of stormwater. They also can stabilize soils and capture seeds with the sediment, allowing plants to revegetate. On flat ground, they can be configured around storm drains and construction sites and along roadways. Gator Guard is a longer-lasting, UV-resistant wattle stuffed with recycled foam. Filtrex manufactures socks that filter soluble pollutants in stormwater, such as phosphorus and petroleum hydrocarbons.

Sandbags are usually made of burlap or polypropylene. They can be filled with sand, nutrient-rich earth, and seeds to encourage revegetation, or, according to the Los Angeles County Department of Public Works, 10 parts of sand or soil mixed with one part of cement for a more durable bag with a longer effective life. While the bags themselves are porous, the contents tend to plug with sediment, so sandbag barriers on slopes also interrupt the slope length and reduce erosion.



Photo: GATOR GUARD

Silt, sediment, and standing water are trapped by Gator Guard.

A flexible and reusable alternative to silt fence and is used on residential construction sites. A center layer that filters stormwater is laminated to two outer layers that give the center layer support. SiltShield can bounce back to its original position after being hit, so it can be used near traffic. Damaged sections can be easily replaced.

They also can be used as sediment traps at culvert and pipe outlets, along site perimeters, around temporary stockpiles, and parallel to roadways to keep sediment off paved areas.

Check dams are small barriers, usually constructed of rock, gravel bags, sandbags, or fiber rolls, that are placed across a swale or drainage ditch. They reduce the velocity of stormwater, reducing erosion and allowing sediment to settle and vegetation to establish in the channel. The Triangle Silt Dike, a lightweight, durable, easily installed, and reusable alternative to check dams, conforms to curves and rough terrain.

Silt fencing, both reinforced and unreinforced, also impedes the flow of water. Sediment settles out, and clean water slowly passes through the openings. Silt-fence machines trench or slice into the soil to make installation faster, easier, and tighter than hand installation. Newer silt-fence machines are designed to turn tight corners. SiltShield is a

flexible and reusable alternative to silt fence and is used on residential construction sites. A center layer that filters stormwater is laminated to two outer layers that give the center layer support. SiltShield can bounce back to its original position after being hit, so it can be used near traffic. Damaged sections can be easily replaced.

Inlet protection products include geotextile sediment barriers, reusable bags, and filters that can be used at curb, median, and gutter inlets to capture silt, sediment, and construction debris before they enter the inlet.

The reusable SiltSack hangs from grates and collects silt and sediment from construction sites. The GutterBuddy is installed aboveground, either around or across curb inlets, to keep sediment from entering storm drains and inlets. It has built-in overflows so water can drain quickly during extreme storm events. Blocksom & Co. manufactures mats that attach to the tops of grates. After each rain event, silt and sediment can be swept away. Water from ponds, sumps, or holes around construction sites can be pumped into a DirtBag, which retains silt and sediment and allows the filtered water to drain out.

Trackout devices prevent silt and sediment from clinging to vehicles leaving a site. Trackout pads usually consist of washed gravel, crushed rock, or large stones that scrape sediment off tires as the vehicle rolls over them. The Grizzly Trackout Control Device consists of sections of steel abutted together to form a track that shakes vehicles as they drive

across it, knocking off dust, mud, and other debris.



One of the newest additions to the silt and sediment management arsenal is that of polymer treatment systems, which reduce turbidity in stormwater runoff and sediment ponds.

Dallas Zoo and Aquarium

Even zoos, which have elephant-size water-quality issues, still have to stay on top of runoff laden with sediment and trash.

Although the Dallas area receives only about 20 to 25 inches of rain throughout the year, it usually comes down in 2-inch rain events in a two- to three- hour period, says Gary Talley, vice president of Terradyne Group LLC, which is based in Dallas and has been providing SWPPP compliance services in Texas and Oklahoma since 1989. In addition, he says, the terrain is hilly, and "like any city, every day you wake up, there's more pavement."

At the Dallas Zoo itself, there are a lot of trees as well as a creek running through the property, says Deborah Zimmern, director of environmental services for the Dallas Zoo and the Dallas Aquarium at Fair Park. "Because of that, during rain events, runoff collects sediments in the form of soil as well as leaves and trash." The sediment used to flow from the storm-drain inlets into Cedar Creek and from there into the Trinity River and then to the Gulf of Mexico.

Recently, the city of Dallas received a grant to install a new kind of inlet protection device, the Curb Companion, manufactured by the Inlet Protection Co. (IPC) in Gonzales, TX. The Curb Companion has been installed in the zoo's service areas, in the parking lot, and along the main drive.

"We wanted to test the product to see if it would hold sediment back," Zimmern says. "Our objective is to keep the sediment and trash out of Cedar Creek."



Photo: GATOR GUARD

Gator Guard snakes around curves and utility poles.

A major feature of the Curb Companion is that the units fit flush with the curb. This greatly increases safety, because they don't interfere with pedestrian and vehicle traffic. It also facilitates street cleaning.

One of the biggest advantages of the Curb Companion is that its frames and screens are very adaptable, Talley says. The frames consist of two galvanized metal rods, one for the top and one for the bottom of the inlet. Each rod is cut to fit to the width of the opening, so it's important for them to be lined up properly with the bottom of the throat of the inlet. Brackets made of steel and rubber tubing attach the rods within the throat of the inlet by a tension system, so there's no penetration of the inlet.

The frames can be used with one of four different screens, which allow the units to stop debris of different sizes. Half-inch hardware cloth stops floatables and debris. A 300 polyscape landscaping fabric stops sediment, floatables, and debris. Fiberglass screening stops floatables, debris, and most sediment. And a new hybrid made of half-inch hardware cloth and polyscape landscaping fabric stops a wider variety of debris.

The different screen sizes allow optimum drainage, and these units have overflow built into their design, Talley says. Once the volume reaches a certain point, trash is trapped in a basket and runoff flows over it.

With the Curb Companion, one screen can easily replace another. For example, the original fabric used at the Dallas Zoo was landscape filter fabric, but when some areas flooded, the holes clogged with sediment.

"We're trying different fabrics," Zimmern says. "Where one works well, we left it. Where we get flooding, we replaced the filter fabric with screening that looks like window screen. It lets water through more quickly and stops trash and sediment. They're working quite well. We've been really pleased with IPC and their product," she adds. "They've been really receptive to any challenges we had."

Terradyne also maintains the Curb Companion. When they're full, you pull them out, clean them, and put them back in, Talley says. It takes no more than five or 10 minutes.

The cost is marginally higher than other inlet protectors, he says, but they're a good value when you consider their efficiency and safety. IPC is priced lower than other internal designs that are more difficult to install and whose maintenance costs are higher.

"It's a new product," he says. "As they gain exposure, there will be more and more municipalities interested. Cities have to be concerned not only about stormwater, but also safety."



Linear Projects in Tucson

Designing effective plans for silt and sediment management on linear projects has a number of special challenges. One is that there isn't one standard entrance and exit to the work site, so a BMP such as a construction entrance isn't feasible, says Jaramillo. The company designs SWPPPs, documents that describe site-specific controls to manage the discharge of pollutants in stormwater from construction sites.

Another challenge is that often the project is constantly moving. Jaramillo designed a SWPPP for a 3,000-foot sewer system for KE&G Construction Inc., a heavy contractor that works on a broad range of construction projects throughout southern Arizona, including asphalt paving and water and wastewater systems. The work took place in one continuous line, and Jaramillo's crew had to keep picking up and moving the wattles.

"A contractor might install 500 feet of water piping per day," he says. "In a week there can be a total of 2,500 feet of piping. And once the contractor is finished in certain sections, they might not return to those areas at all. So in reality, one must design [BMPs for] a SWPPP to be used temporarily—and if they are temporary, they must be cost efficient."

He often uses Gator Guard wattles from Gator Guard Environmental Products Inc. The cost efficiency comes from its durability, he says. Traditional straw wattles degrade quite rapidly, and usually once they're installed, you can't move them. Gator Guard is made of a UV-resistant geotextile stuffed with recycled foam. The wattles can be reused throughout a project, or they can be stacked in a yard when the project is finished and reused on a future project. KE&G Construction

purchased about 3,000 linear feet of Gator Guard and has used—and reused—it on about 15 projects that have lasted from one month to four or five months.



Gator Guard can be used on hills and steep grades as well as on flatter land to contain sediment, and it withstands the intense desert sun and heavy rain typical of Arizona. “The rainy season is between July and September, and we get monsoons of about an inch and a half of rain in two hours,” Jaramillo says. Traditional straw wattles fill with sediment and water, and rip because they get too heavy.

Its durability is also an asset in projects where equipment is moving. When straw wattles are run over, they need to be replaced, he says. Gator Guard can be run over a few times without being damaged. If it does get damaged, it can be repaired in a matter of minutes by cutting out the damaged section and tying the ends together with baling wire or just filling the tear with caulking.



Jaramillo uses other BMPs as well. He usually uses drain inlet gravel bags around inlets. They’re effective because they serve as a temporary dam and collect the sediment before it enters a storm drain, he notes. On some sites, he selects trackout pads or simply has a street sweeper available at the end of each shift.

There has been a report of the filler material blowing around when Gator Guard wattles are damaged, but that can be avoided quite easily by not running over them, Jaramillo adds. That is usually controlled by the contractors and how well they maintain their sites.

According to Bob Hanson of Gator Guard, “This is something we’ve been working on for a long time. We’ve been using a larger-size foam, about 2 inches thick and a little longer, since the beginning of 2010. It’s 15 times its original dimensions. The bigger pieces don’t get out of a rip as easily and there are fewer pieces to pick up.”

I-69 in Obion County

A new four-lane interstate highway, the I-69, is being built through the gently rolling countryside of west Tennessee. When it’s completed, it will stretch from the US-Mexico border at Laredo, TX, to the US-Canada border at Port Huron, MI. This leg begins at the Kentucky state line and extends 4.2 miles into Obion County, TN. Construction began in February 2010 and will take almost two years.



The project required reinforced silt fence to contain the area’s highly erodible sandy soil. If silt and sediment weren’t stopped, they’d make their way down a network of creeks and small rivers until they reached the Mississippi, says Dale Kraus, supervisor at Green Thumb of Dyersburg LLC, located in Dyersburg, TN. Green Thumb specializes in silt fencing, erosion control, seeding, and sodding. The company is installing Belted Silt Retention Fence (BSRF) along the right of way for the primary contractor, Ford Construction, which is also in Dyersburg. BSRF is made by Silt-Saver Inc.

Photos: RODNEY MCCLELLAN

From top, BSRF surrounds soil dug up during the construction of the I-69; BSRF is used when trenching for gas lines; BSRF shows where new highway will be built.

“It’s a very exciting project for us.” Kraus says. “It’s the first part of the I-69 that’s coming through the state.”

There’s an enormous amount of dirt work, he says. It includes grading for the highway, side roads, bridges, and culverts and trenching for the gas pipe that will go underground. With this much

disturbed ground, there’s a lot of silt fence: roughly 57,000 linear feet in this project alone.



Unlike traditional reinforced fencing, which consists of fabric backed with supporting wire, BSRF is a fiberglass scrim, or net, laminated between two layers of spunbond polyester, according to Silt-Saver. It costs a little less than wire-backed

silt fence, eliminates the problem of the fabric separating from the supporting wire, and also cuts down dramatically on labor costs for installation.

“We’ve used it in quite a few places,” Kraus says. “It’s very easy to install.”

Crews are using a tommy Silt Fence Machine to slice through the soil and install the fabric. Then they drive posts into the ground 4 feet apart, sandwich the fabric—which is marked with the locations of the posts—between a wooden post and a wooden bonding strip, and staple all three parts together.

They’re also using riprap in the ditches and straw to keep the soil in place on areas where dirt has been disturbed but isn’t being worked on.



Photo: STORMKLEAR
Treatment socks are installed.

“We put the straw through a machine where it’s chopped into pieces of 2 or 3 inches, and blow it on top of the dirt,” he says. “We put 75% coverage down—you can barely see the dirt through the straw. When it rains, the rain hits the straw first. When the soil is moved to another location, the straw gets incorporated into it.”

The fence keeps sediment out well, and it’s strong enough to contain water even when the water is overtopping it. After a period of time, the belting stretches a little bit from containing the water, Kraus says, but that doesn’t affect the performance. Also after some time, it seems to get a bit weakened from sun and water hitting it. If it tears, it isn’t too hard to replace a section.

The project is going well, says Rodney McClellan, assistant manager of Williams Equipment in Jackson, TN, which supplied the fencing and has offices in Tennessee, Arkansas, and Mississippi. “There’s been great cooperation between everyone involved—and it’s put some people back to work.”

SR-38 in Memphis

The wonders of chemistry have reached the world of silt and sediment management.

When a biopolymer called Gel-Floc, from HaloSource in Bothell, WA, is combined with the company’s charging agent, DBP-2100, they form a product called StormKlear. When silt- and sediment-laden water is pumped over StormKlear, the sediment drops out of suspension, leaving the water clarified.

“It’s the best thing I’ve ever seen in my life,” says John Griffin, of ILM Inc. in Falkner, MS. ILM specializes in seeding and erosion control and used StormKlear on the last leg of the SR-385 loop around the Memphis metro area to clear the water before discharging it. The project began November 2009 and is scheduled to be completed by

November 2012.



According to Jason Sholtz, P.E., a civil engineer with Allen & Hoshall in Memphis TN, who is charged with environmental oversight for the project, “The section of SR-385 is approximately 7 miles long; has eight bridges, including one measuring approximately 3,200 feet; requires approximately 1.5 million yards of excavation and fill, balanced on site; and crosses what is probably the most environmentally sensitive watershed in the area, the Wolf River bottom lands.”

Soil types in west Tennessee contain a tremendous amount of fines, which, left untreated, will remain suspended almost indefinitely, Scholtz says. Because of this, stormwater is nearly impossible to treat to the extent that discharge would not appear visually objectionable.



Photo: STORMKLEAR
The sediment trap from which the water came



Photo: TERRADYNE GROUP
The Curb Companion is seen here in action, trapping leaves and trash.

Though there is a very small amount of actual silt suspended in the water, and in many cases, almost none, the discharge from even the best erosion prevention and sediment control structures almost always appears an opaque brown—as if it is transporting large amounts of sediment.

Unlike competing products, which can be soil specific, StormKlear works on just about any type of soil, says Bobby Starling, vice president of engineered products for Hanes Geo Components, a Winston Salem, NC-based national distributor for geosynthetics and sediment and erosion control products.



Photo: JASON SHOLTZ
The bottle on the left is untreated water. The other two are treated. The one in the middle was discharged directly on riprap. The one on the right was discharged through a sediment bag, but they float to the surface.

“The two-part biopolymer system is why it works so well,” Starling says. “This will be used more and more in the future, given the new EPA Effluent Limitation Guidelines that passed in December of 2009.”

Because StormKlear clarifies water by removing sediment, pollutants that are attached to the sediment, such as phosphorus, nitrates, and metals, are also removed. Hydrocarbons are flocculated as well,

Water that needs to be clarified is pumped out of the basin or pond, over both substances in series, and then into a filter bag that looks something like an oversized air mattress, where the flocculated sediment is trapped. If the clarified water is being recirculated, it’s returned to the pond. If the pond is being dewatered, the clarified water is pumped to a discharge point on or off the job site. The filter bags are large and heavy once they’re full of sediment and are usually transported on a flatbed truck to a landfill. Occasionally they’re left at the site.

Gel-Floc and DBP-2100 can also be used passively. Both are packaged in segmented socks in dry form and should be set in a channel, in series, where stormwater is flowing prior to the discharge point.

“It’s important to make sure to determine the correct dosage before starting,” Starling says. “First, because it costs more without any added benefit to use more than you need, but, even more importantly, you don’t want chemicals to leave the site in the water.” It’s easy to monitor the dosage and discharge right in the field and to make adjustments if it’s either too high or too low.



The cost depends on factors such as how fast the silt and sediment come out of suspension, the volume of water to be treated, and the clarity that is required.

He's looking for additional ways to apply StormKlear around the site, Sholtz notes. "StormKlear is amazing. We pumped water directly from a sediment trap through the StormKlear socks and into a sediment bag. It came out looking like drinking water. The treatment is literally almost instantaneous."

Photo: TERRADYNE GROUP

The Curb Companion installs flush with the curb. This view shows one of the assembly parts.

Topics: [Sediment Control](#), [Slope Stabilization](#), [Regulatory Issues](#)
