Total System Services, Inc., Columbus, GA — Client chose Slopetame² over concrete block revetments for improved appearance with total grass slopes and considerable cost savings.

Invisible Structures, Inc.
20100 E. 35th Drive, Aurora, CO 80011-8160
800-233-1510 • Fax: 800-233-1522
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www.invisiblestructures.com

CD-ROM

Slopetame²

Above: Clift's Cove, Huntsville, AL — Swales are lined with coconut blankets and Slopetame² mats. The rings collected sediment and prevented rill erosion during housing construction. The installation was completed with topdressing and hydroseeding.

Front Cover: Total System Services, Inc., Chattahoochee River, Columbus, GA — Slopetame² and Bermuda grasses protect this slope from floods several times per year.

Part 2 — Products

2.01 Availability

A. Manufacturer: (Slopetame²) Invisible Structures, Inc., 20100 East 35th Drive, Aurora, Colorado 80011. Call from USA and Canada (toll free) Phone 800-233-1510, Fax 800-233-1522, International Phone 303-373-1234, Fax 303-373-1223, www.invisiblestructures.com

B. Local Sales Representative: (Contact Manufacturer, or visit www.invisiblestructures.com)

2.02 Materials

A. Slopetame² Units: Lightweight injection molded plastic units 0.5 × 0.5 × 0.025 m (20″ × 20″ × 1″ high, 2.7 ft² each) with hollow rings rising from a strong open grid, with full depth crossbars between rings joining every row, and a geotextile type fabric heat bonded to the bottom of the grid. Units may be shipped in preassembled 1 meter squares, or in rolls measuring 1.0, 1.5, 2.0 or 2.5 meters wide by custom lengths (Contractor to coordinate Unit measurements with Manufacturer). Standard color is black. Unit weight = 2.44 kg per m² (8.0 oz/sf) , volume = 8% solid.

B. Topsoil Fill: Shall consist of loose friable loam reasonably free of admixtures of subsoil, refuse, stumps, roots, rocks, brush, weeds, or other material which would be detrimental to the proper development of vegetative growth.

C. Anchors:

1. Primary anchorage shall be provided by Duckbill 68 anchors, or greater, with loop end of cable secured over 0.75″ dia steel reinforcing bar (with corrosion protection in aggressive soils). Duckbill anchor only to be supplied by Manufacturer at a rate of one anchor per 10 m². Surfaces subjected to heavy water submersion or action, shall require Duckbill/rebar anchors spaced at 1 per 2 m (6.6′) on center.
2. Secondary anchorage shall be anchor pins made of either heavy gauge (8–12) wire "U" shaped, or 8″ long nails with "fender" type washers 5 × 30 mm od (0.25″ id × 1.25″), all galvanized metal or similar coating to resist corrosion.

Quick, complete coverage on any slope is easy with large, lightweight rolls in variable widths and lengths to fit site dimensions.

PART 3 — EXECUTION

3.01 Inspection

A. Examine slope grading and soil compaction conditions. Do not start Slopetame² installation until unsatisfactory conditions are corrected. Check for improperly compacted or prepared surface soils, debris, and/or improper gradients.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance. If existing conditions are found unsatisfactory, contact Project Manager for resolution.

3.02 Preparation

A. Place Slopetame² Units over prepared grades as shown on plans. Allow 25 mm (1.0″) for Slopetame² unit thickness and "topsoil" fill to reach Final Grade.

3.03 Installation of Slopetame² Units

A. Install the Slopetame² units from the top of the slope to the bottom, by placing units with rings facing up, and using snap-fit fasteners provided along each edge to maintain proper spacing and interlock the units. Crossbars on the product shall be installed to be in opposition to the direction of primary water flow. Cutting can be performed with pruning shears and knife. Units shall be anchored with Duckbill/rebar anchors across the top of the mat (top of slope) and across the middle of the mat. If any part of a Slopetame² mat shall be covered by water (channel or pond surface), then the bottom and leading edges exposed to water flow shall receive additional Duckbill/rebar anchors as needed to prevent undercutting by water movement. Additional wire anchor pins shall be spaced at one per square meter, or more as required to secure units in place and resist sliding when filled. Tops of rings shall be flush, or slightly below the surface of adjacent hard surfaces. Remove Slopetame² product where existing trees, shrubs, rocks, or similar elements will project above the surface, and secure cut edges with anchor pins.

B. Install "topsoil" into rings after the units are anchored by "up-dumping" from a Gradall, or from buckets, taking care not to snag the mat with bucket edges or teeth. The "topsoil" is then spread using stiff bristle brooms in an uphill direction to fill the rings, with the finish grade no more than 6 mm (0.25″) above top of rings. Do not allow motorized equipment access over the Slopetame² area during installation and establishment.

C. Identify locations of plant materials with root balls larger than 10 cm dia. (4″), remove topsoil and Slopetame² from an area two times (2×) the diameter of the root ball, excavate hole large enough for the root ball, place new plant, and backfill with "topsoil" material. Set the crown of the root ball and backfill material 12 mm (0.5″) below the top of the adjacent rings. Place anchor pins into the Slopetame² structure above and below the hole for the new plant.

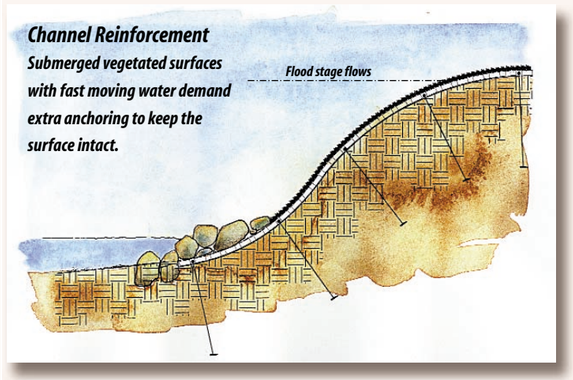
D. Install seeded vegetation by hydroseeding methods, incorporating an appropriate cellulose type mulch material in the hydroseeding mixture. This mixture shall have a distinctive green color to visually show the distribution of the mixture on the slope.

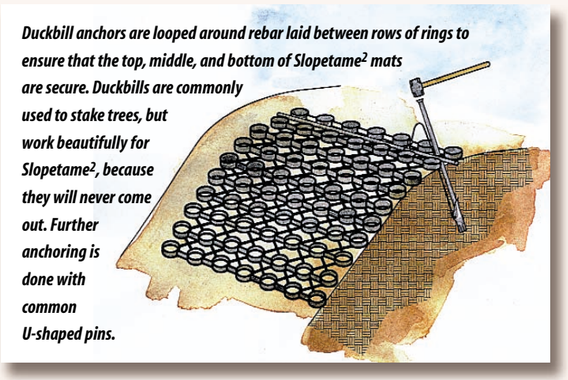
3.04 Cleaning

A. Remove and replace segments of Slopetame² units where nine or more adjacent rings are broken or damaged, reinstalling as specified, with no visible evidence of replacement.

B. Perform cleaning during the installation of work and upon completion of the work. Remove from the site all excess materials, debris, and equipment. Repair any damage to adjacent materials and surfaces resulting from installation of this work.

END OF SECTION. If you have any questions regarding this specification, please call Invisible Structures, Inc. 1-800-233-1510 Version 02/01





5. Fill the Slopetame² units with 1″ of topsoil in preparation for seeding.

6. Hydroseed and mulch the area for grasses and ground covers. Mulching with cellulose (preferred type) is necessary to assist germination and protect delicate seedlings until the roots have grown through the fabric layer.

7. Provide supplemental irrigation, as determined by local environmental conditions, to assure germination and plant root development.

Design and Technical Support

Invisible Structures welcomes the opportunity to review project designs and answer technical questions. Project Profiles and standard Slopetame² AutoCAD design details may be reviewed and downloaded from our website. ISI staff or representatives are available for telephone or on-site construction guidance.

Contact Information

Invisible Structures, Inc.
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Wallace Residence, Savannah, Georgia — Slopetame² is used to keep small embankment in place during heavy hurricane flooding.

Slopetame² Slope Protection

Section 02370

PART 1 — GENERAL

1.01 General Provisions

A. The Conditions of the Contract and all Sections of Division 1 are hereby made a part of this Section.

1.02 Description of Work

A. Work Included:

1. Provide Slopetame² units, anchors and installation per the manufacturer's instructions furnished under this section.
2. Provide and install "topsoil" fill material to fill the Slopetame² units.
3. Provide vegetation materials and installation.
4. Provide maintenance for Establishment period.

B. Related Work:

1. Grade and prepare the slope and surface soils to receive and support Slopetame² product and vegetation cover, under Section 02200 — Earthwork.

1.03 Quality Assurance

A. Follow Section 01340 requirements.

B. Installation: Performed only by skilled work people with satisfactory record of performance on landscaping or erosion control projects of comparable size and quality.

1.04 Submittals

A. Submit manufacturer's product data and installation instructions.

B. Submit a 10″ × 10″ section of Slopetame² product for review. Reviewed and accepted samples will be returned to the Contractor.

C. Submit material certificates for "topsoil" fill materials.

1.05 Delivery, Storage, and Handling

A. Protect Slopetame² material units from damage during delivery and store under tarp when time from delivery to installation exceeds one week. Fabric backing materials are photosensitive and can be permanently damaged by sunlight.

1.06 Project Conditions

A. Review installation procedures and coordinate Slopetame² work with other work affected.

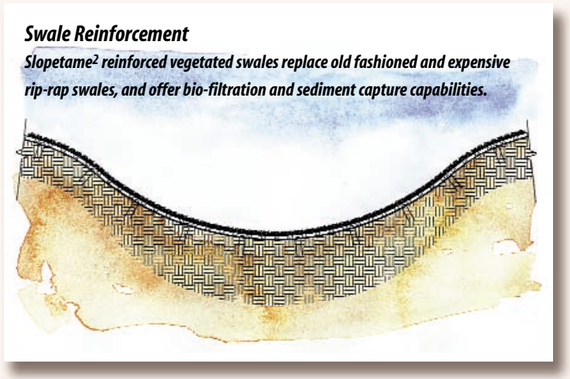
B. All hard surface construction adjacent to Slopetame² areas, including concrete and asphalt, must be completed prior to installation of Slopetame².

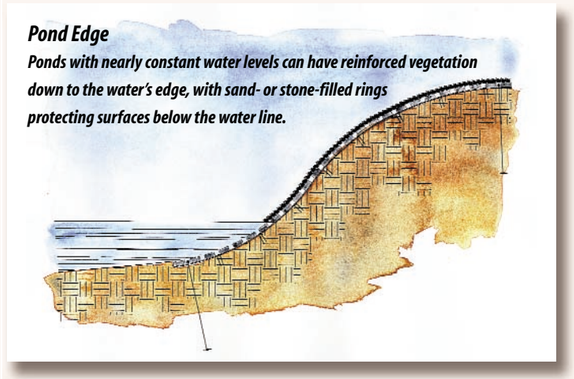
C. Cold weather:

1. Do not use frozen materials or materials mixed or coated with ice or frost.
2. Do not build on frozen work or wet, saturated or muddy subgrade.

D. Protect partially completed installation areas against damage from other construction traffic when work is in progress.

E. Protect adjacent work from damage during Slopetame² installation.





Introduction

Invisible Structures, Inc. has created a permanent slope stabilization mat that is positioned for difficult erosion control problems that are frequently solved by more expensive gabion, concrete block, and geo cell products. Slopetame² is a three-dimensional structure of 1″ high rings, connecting bars, and geogrid, attached to vegetation locking filter fabric. The main purpose is to completely cover steep slopes or swales with the Slopetame² interlocking structure, fill it with soil, and plant with grasses or other suitable vegetation. The Slopetame² reinforced root system will form a deep, knitted, and unified protection layer for soils.

Water must take a slower route over and through the Slopetame² system of structure, fabric, and knitted roots. Full depth cross bars connect each row of rings, forming containment and preventing surface soil from moving laterally. Water penetrating into soils must also drain through the polyester filter fabric, which slows it down while keeping soils in place above. The dense root growth knitting through the fabric layer, enables slow and deep water percolation.

Water passing over submerged Slopetame² surfaces, such as in swales or channels, will most often find a multiple layer of grass blades overlaying each other like shingles, with water passing in a smooth laminar flow fashion. This lack of turbulence reduces suction forces and loss of soil particles in the upper root zone.

Slopetame² Benefits

- True 3-dimensional containment of fill for increased stability.
- Small-scale confinement with rings and bars prohibiting soil movement.
- Shallow depth of fill material to reduce costs.
- Strong diagonal grid to disperse loads across slopes.
- Interlocked continuous structure across slopes for greater strength.
- Strong root matrix in geotextile fabric for additional support.
- Fabric backing to reduce chance of undercutting and slow water infiltration.
- Lightweight product for easy assembly and installation on difficult surfaces.

Merrill Lynch, Englewood, CO — Swale from flag area down to golf course was vegetated with seed mix of 27 different plants that took two years to mature.

- UV-resistant, 100% recycled plastics for environmental benefit and longer life.
- High durability and resistance to damage from normal horticultural chemicals.

Crossbars and Filter Fabric

The crossbars between rows of rings, perpendicular to water flow, prevent rill erosion from forming. The polyester filter fabric prevents water from rapidly moving below the structure, and gives grasses and other vegetation a foothold for micro scale confinement. The fabric also assists new vegetative covers by allowing them time to get established and protecting the root zone from soil removal due to water runoff.

Price Range

Slopetame² cost is in the mid-range of erosion control methods, which is appropriate to its capabilities for channel reinforcement, riverbank stabilization, and steep slope surface containment. Slopetame² can replace typical concrete block revetments at a price one-third the typical installation cost.

Replaces Rip-Rap

The old technology of unsightly rip-rap often can be replaced with Slopetame². A vegetated, grass swale, is much nicer looking, is easier to maintain, and improves property values in developments.

In most cases, vegetation will act as a bio-filter to clean pollutants from stormwater in swale applications. Slopetame² can also be used during site construction to capture displaced soils, thus satisfying EPA water quality regulations.

Invisible Structures — Standard Product Roll Sizes

	Width		Length		Diameter		Area		Weight	
Model	m	ft	m	ft	m	ft	m^2	ft^2	kg	lbs
1010†	1	3.3	10	32.8	0.5	1.7	10	108	19	41
1020	1	3.3	20	65.6	0.8	2.7	20	215	37	82
1050	1	3.3	50	164	1.2	4	50	538	93	205
1520	1.5	4.9	20	65.6	0.8	2.7	30	323	56	123
1550*	1.5	4.9	50	164	1.2	4	75	807	139	308
2020†	2	6.6	20	65.6	0.8	2.7	40	430	75	164
2050*	2	6.6	50	164	1.2	4	100	1,076	186	410
2520	2.5	8.2	20	65.6	0.8	2.7	50	538	93	205
2550*	2.5	8.2	50	164	1.2	4	125	1,346	233	513

†Most popular roll sizes, usually in stock.

*Roll sizes marked with asterisks should be installed by lifting machines only. All other rolls can be installed manually (2 people advised). Rolls apply to Grasspave², Gravelpave², Draincore², and Slopetame². Custom roll sizes available by request.

Slopetame² reinforcement matrix has small cellular three-dimensional containment for soils and plant material. Filter fabric backing provides excellent penetration for roots and allows mats to be pre-vegetated and pinned onto slopes.

Anchors and Pins

Duckbill anchors are provided with Slopetame² — one with each ten square meters. Insert a reinforcing rod between a row of rings at the top of the slope. Slip the loop end of the anchor around the rod and drive the anchor into the ground until secure. This will tie the top of Slopetame² mat to the top of the hill, bank, or channel. Some installations may require another reinforcing rod and Duckbill anchor to be used halfway down the slope and at the bottom. Further fasten the mat with standard landscaping U-shaped pins 6″–8″ in length — use as many as necessary for good contact to ground. Curving the mat and cutting out some rings to fit channels, may necessitate additional pins. Types of anchors and pins used may vary with substrata conditions.

Vegetation

Compatible forms of vegetation include grasses, ground covers, vines, and wildflower mixes. The selected form(s) should be matched with slope, soil types, moisture, maintenance and aesthetic requirements of the site. Ground covers other than grasses will usually be planted from pots ranging in size from 2″ to 1 gallon. Small plants may have the root system split to grow over and between rings, while larger plants may require some ring removal. Hydroseeding with a cellulose mulch is the best method for installing grasses, forbs, and most wildflowers, because the mulch helps retain moisture necessary for seed germination. As root systems develop, roots will penetrate and integrate with the fabric layer to establish a very strong surface.

Slopetame² mats can also be prevegetated, with plant materials grown into the mat at a nursery, or with established “sod” rammed into the mat with a vibrating plate or roller on site. Prevegetated mats or panels can be rolled or lifted into place for immediate slope, swale or channel protection.

Hydrogrow

Another element in the Slopetame² system is Hydrogrow Soil Conditioner, which is added to soils during preparation, before mats are laid down. Hydrogrow is an Invisible Structures’ mixture of Humate, Isolite, Polymer, and Zeolite that will aid in retaining extra moisture in the root zone of developing plants, and will provide fertilizer and micronutrients, and lower plant stress.

Cut-off Drains

Cut-off drains should be installed to intercept surface water generated from above slopes. The new slope will contend with water actually falling on the Slopetame², minimizing storm water volume build-up. At the toe of long slopes or at terrace levels, additional cut-off drains may be installed for similar purposes downstream. Cut-off drains may be as simple as shallow, reverse sloped surfaces covered with Slopetame² mats oriented with cross bars opposing water flow.

Installation Steps

1. Soil preparation should include tilling to a depth of 10 cm to 15 cm (if possible), incorporating fertilizers, and Hydrogrow spread over the surface at a rate of 0.5 kg per 10 m². Hydrogrow will be included with each order.

2. Preassemble, on flat firm ground, the Slopetame² mats, using the built-in snap-fit fastener to shorten or lengthen standard rolls, for sizes to fit the full length of each slope segment. Orientation of each roll dictates that the crossbars oppose the primary direction of moving water. Be sure to overlap the fabric of adjoining sections.

3. Start at the highest elevation and place the Slopetame² mat with rings up, fabric down, place and secure the rebar/Duckbill anchor between the 3rd and 4th rows at the top, tucking rows 1 and 2 into the soil, and unroll down the slope. Slopetame² should extend from “top to toe” of a slope in one continuous piece, 1 meter wide, or wider depending upon length.

4. Anchor the mat every 40″ on center, or closer as may be needed by local conditions. Place standard erosion pins (15–20 cm long × 25 mm wide × 2 mm gauge wire) 40″ on center down and across each mat. Each roll can be connected to each other with the snap-fit connectors, or placed side by side, with erosion pins placed along the edge on each side of each mat (equals more pins).