Benchless Closure Design:
A Case Study of Baldwin County Landfill
Outline & Objectives

**Introductions**

ClosureTurf® Recap

Baldwin County Landfill Case Study

Recap of Savings & Benefits
About Agru America

Georgetown, South Carolina
Andrews, South Carolina
Fernley, Nevada

Charleston, SC
Agru Manufacturing Process

Extruder → Flat Die → Calender Rollers → Structured or Textured Sheet → Spark Tester → Finished Roll
About Watershed Geo

- Company founded in 2007 by Civil Engineers
- Based in Alpharetta, GA
- Over 100 years of landfill experience
  - Years of geosynthetic experience
  - Design, Construction, Maintenance and Management
  - Individual sites managed through closure & post-closure
- 20% ownership held by Shaw Industries, A Berkshire Hathaway Company
- Shaw Industries supplies the engineered turf component and Agru America supplies the geomembrane component
Agru & Watershed Geo Partnership

- Watershed Geo and Agru America are business partners
- Watershed Geo is the creator and patent holder of ClosureTurf®
- Agru does market development for Watershed’s ClosureTurf® system
- In addition, Watershed uses Agru’s structured geomembranes in their ClosureTurf® system
- Typically, as soon as any ClosureTurf® discussions become project-specific, Watershed gets directly involved as ClosureTurf® is an engineered solution, requiring their support from pre-design, through design, bidding, procurement, construction and post-construction operations and maintenance.
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**ClosureTurf® Recap**

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Recap of Savings & Benefits
• ClosureTurf is a HYBRID Final Cover System
  • A system that has all the advantages of a soil cover system with out the disadvantages

1. **Structured Geomembrane** – integrated studs on top for drainage/ aggressive spikes on bottom for stability
2. **Engineered Synthetic Turf** – covers and protects the underlying geomembrane
3. **Infill** – ASTM C-33 Sand; HydroBinder® or ArmorFill™
4. *OPTIONAL 4th component to enhance gas collection
Traditional vs. Closure Turf

Traditional Application vs. Closure Turf Application

- Traditional:
  - Topsoil
  - Vegetative Soil Support Cover
  - Intermediate Soil Cover
  - Waste

- Closure Turf:
  - Geotextiles
  - Agru 50-mil LLDPE Super Gripnet® with Spike Down
  - Foundation Soil
  - HDPE Grass
  - Sand Ballast

40 Mil Membrane DPE or LLDPE Liner

18" Typ.

101

18" Typ.
ClosureTurf® Advantages

- It’s the **only** solution that provides a predictable benchmark of performance.

- Compare this to a prescriptive cover, which is effectively an engineered structure reliant upon vegetation and weather to perform as designed.

**Predictable Performance Checklist**
- Construction Cost
- Construction Schedule
- Technical Performance
  - No erosion
  - No turbid runoff water
  - Negligible Infiltration (hydraulic head)
- Maintenance Cost
- Design Life
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Introductions

ClosureTurf® Technology/ Advantages

**Baldwin County Landfill Case Study**

Recap of Savings & Benefits
Baldwin County Landfill

- First Georgia EPD ClosureTurf® approved landfill
- Oasis Consulting Services was the Design/Build Contractor
- Came in $1.5 million under traditional procurement
  - Eliminated the costly standard clay liner
  - Eliminated the vertical in-waste gas collection wells
  - Featured new hydraulic design with ArmorFill™ technology eliminating tack-on berms and downchutes
ArmorFill™

- A polymer-based emulsion developed to bind the sand infill component

- Sand particles are coated to bind in place, however, the product is still permeable allowing storm water to flow through to the geomembrane (2x10^{-2} cm/sec)

- Appropriate for slopes and top decks. Virtually eliminating the critical slope length once required
Traditional caps and ClosureTurf w/o ArmorFill have critical slope lengths ranging from 90-100 ft.

With the use of ArmorFill on the ClosureTurf system we can comfortably stretch our critical slope length to over 600 ft.

If slopes exceed the aforementioned slope length the ratio of pure ArmorFill to water could be increased to increase the shear strength. However, this is fairly rare.
Channelizing Stormwater

- Mitigate the volume & shear forces with diversion berms
  - Channelize the storm water
  - Helps to convey off of cover system
- Benches go to downchutes
- Downchutes go to retention ponds
  - Stormwater has to be retained for a period of time to let sediment settle
ArmorFill™ Reduced Need for Concentrated Flow

- No drainage length limitation eliminating the critical slope length issue
  - Sand is bound in place
- Diversion berms and downslope channels were no longer required
- Storm water kept in sheet flow & shallow concentrated flow
- No Sediment from storm water run-off eliminating the sediment volume typically needed
- Perimeter ditch discharged directly to a detention pond rather than a retention pond.
  - 11 NTU discharge
The Baldwin Co. site had slopes steeper than 3:1 in some areas, and greater than 300’ long. Therefore, 50 mil Super GripNet® was used to achieve the desired factor of safety.

However, with ArmorFill you now have two geomembrane choices depending on your site specifics:

- Steepness of slope (3.5:1 or greater)
- Length of slope (150’ or less)
- 40-Mil MicroSpike w/ ArmorFill
As acknowledgement for their innovative approach, Baldwin County and Oasis Consulting Services was awarded the 2017 Georgia Chapter American Public Works Association engineering award for innovative, small/rural community projects.
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Savings & Benefits- ClosureTurf® with ArmorFill™

- No soil borrow
- 50% faster construction
- 90% less maintenance
- Cleaner water released into environment- 11 NTU’s
- Reduced costs associated with drainage design elements:
  - Reduction/elimination of diversion berms and down slope channels
  - Reduction/elimination of energy dissipation devices
  - Reduction/elimination of sediment storage and water quality volumes
  - Detention of storm water rather than retention allowing for smaller pond volume
  - Reduction of maintenance
Thank You!