

Alternative Final Cover Systems for Closure of Florida's Solid Waste Landfills Regulation and Innovation

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First A Little Background



Closing Class I Landfills in Florida

- FDEP final cover (i.e., Traditional Closure) typically requires a geomembrane barrier layer overlain with 24 inches of soil and additional design features to remove storm water and landfill gas without damaging the final cover.
- Some alternate final covers that have been discussed in Florida are:
 - Exposed Geomembrane Covers (EGCs)
 - Evapotranspiration Covers (ET Covers)
 - Engineered Turf Covers (ETC, i.e., ClosureTurf)



EGCs

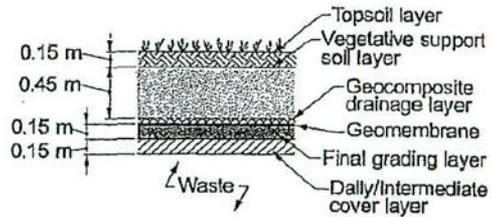


Figure 1. Typical Final Cover System

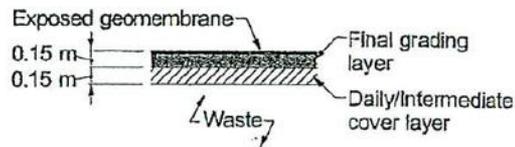
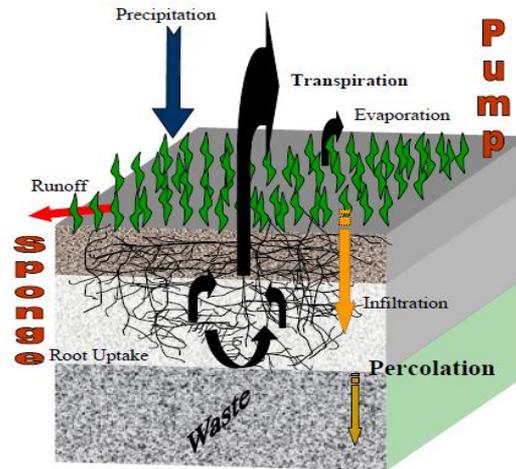


Figure 2. Exposed Geomembrane Cover System



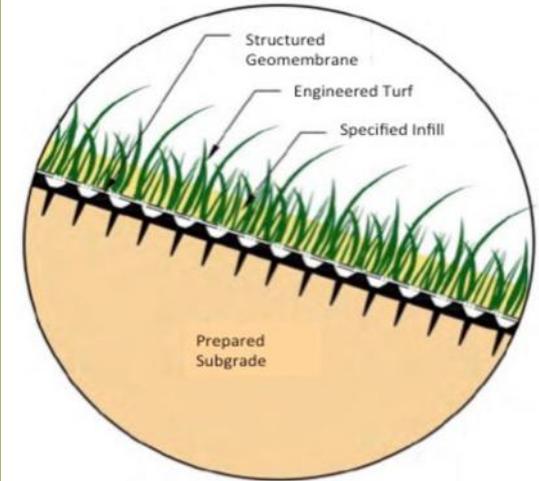
Sabine Parish Landfill, LA
(permitted as final cover in 1999)

ET Covers



ET Cover Designs

ClosureTurf®



Saufley C&D, FL

What are the Regulatory Requirements for Approval of Alternate Final Cover Systems?



EPA Alternate Closure Regulations

- 40 CFR 258.60(b). Approved States may authorize alternate closure designs that include:
 - An Infiltration Reduction Layer with $k \leq 1 \times 10^{-5}$ cm/s or $k \leq$ permeability of bottom liner system, whatever is less, and reduction from 18 inches of earthen material.
 - An Erosion Layer that provides equivalent protection from wind and water erosion as 6 inches of earthen material that is capable of supporting vegetation.
- EPA's requirements focus on reducing infiltration and controlling erosion.
- Some states, with EPA approved solid waste programs, have allowed the use of EGCs as final covers to close landfills, such as the Sabine Parish Landfill in Louisiana.



FDEP Alternate Closure Regulations

- 62-701.600(3)(g)6. FDEP may approve an alternate design for the barrier layer or protective soil layer upon a demonstration that the design will “result in a substantially equivalent rate of storm water infiltration through the final cover.”
- However, the process for FDEP approval of these alternate designs is for the applicant to obtain an Approval of Alternate Procedures and Requirements (AP) in accordance with rule 62-701.310, F.A.C.
- The key tests to obtain this approval are the applicant must demonstrate the proposed remedy:
 - provides an equal degree of protection for the public and the environment; and,
 - is as effective as what is required by rule.



Why has Florida Resisted Approving Some Alternate Cover Systems as Final Closure?

- While many alternate covers will provide good erosion control and reduction of infiltration, FDEP had uncertainty about their longevity.
- This led to questions about whether or not their use in Class I landfills was good public policy (equivalent degree of protection test).
- For example, covers in Traditional Closures are expected to last ~400 years. Is an alternate cover good public policy if it lasts only 50 to 100 years?
- Consequently, the “good public policy” question has been the key barrier.



What Has Been Allowed in Florida?

- North Central Class I Landfill (2001)
 - AP Approval and Closure Permit issued. The AP Approval allowed use of an EGC without the 24-inch thick protective soil layer required by rule, and the permit was modified to include the AP Approval.
 - Use of the EGC treated as temporary closure not final closure. Financial Assurance for Traditional Closure still required.
 - This case has provided good information on performance of EGCs at subtitle D landfills in Florida.
- Saufley C&D Debris Disposal Facility Closure (2011)
 - AP Approval issued. Allowed use of ClosureTurf in place of the 24-inch thick soil cover required by rule.
 - Treated as final closure of the C&D Debris Disposal facility.
 - This case has provided good information on performance of ClosureTurf at a C&D debris disposal facility in Florida.



What Has Been Allowed in Florida?

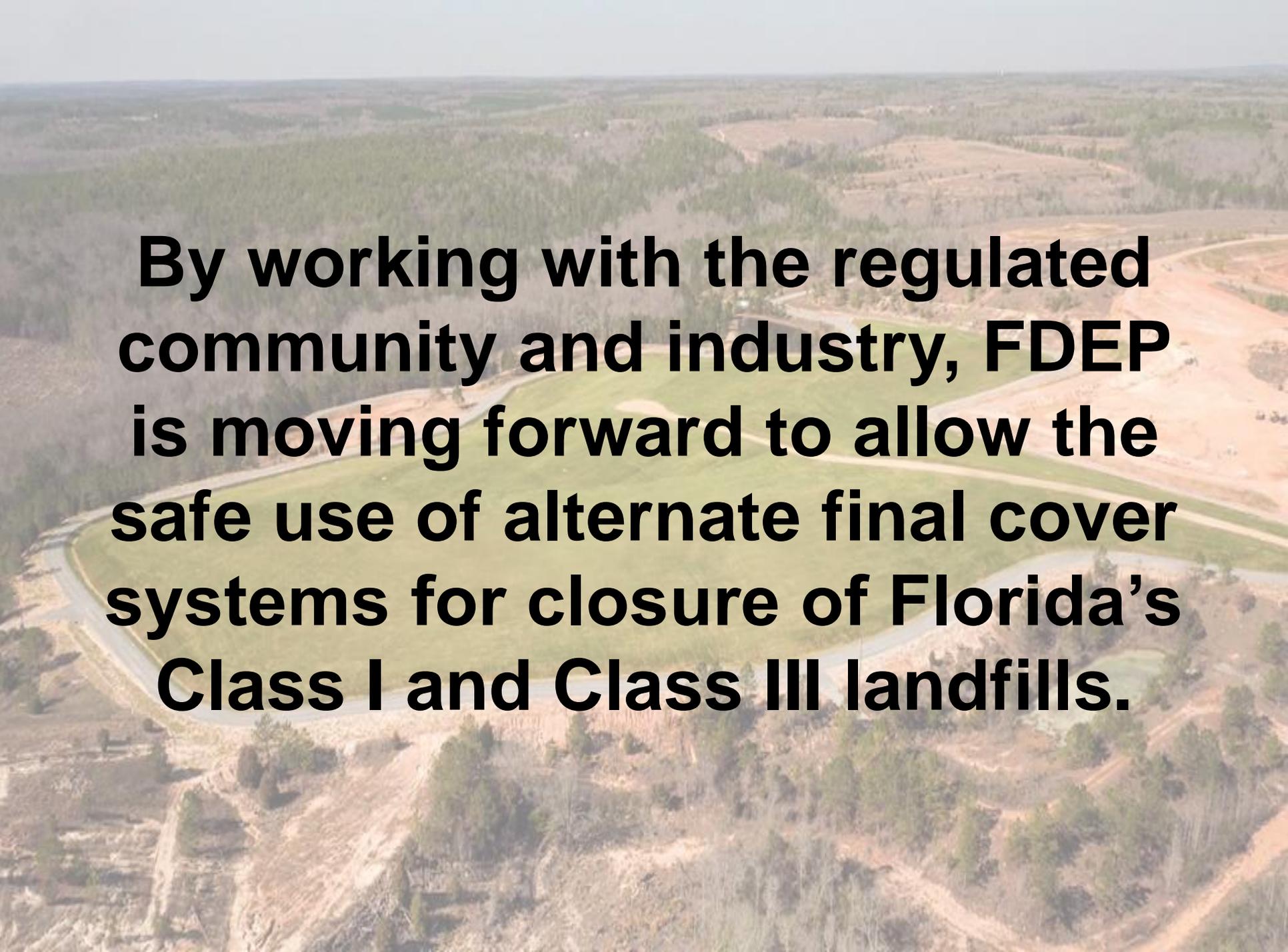
- New River Class I Landfill (2015 and 2017)
 - AP Approval issued 2015 to allow use of an EGC for Final Cover provided:
 - Soil Conversion Fund is created to convert the EGC to Traditional Closure by 30 years after starting the LTC period or when the material strength half-life of the EGC has been reached. This fund addresses the “good public policy” concern by the FDEP.
 - Seed money must be placed in the Soil Conversion Fund to ensure adequate funds are available by the time of Traditional Closure or by 30 years after starting the LTC period, whichever comes first.
 - Normal Financial Assurance for closing and LTC still needed but amount for closing can be reduced when EGC installed.
 - Permit issued 2017 to allow use of EGC in accordance with AP Approval and required:
 - Seed money of \$3,000,000 initially placed into Soil Conversion Fund (~30% of estimated soil conversion costs).
 - Annual costs updates and payments as needed to Soil Conversion Fund to ensure it being fully funded within the 30-year window after starting LTC.



Evaluating ClosureTurf® in Florida

- FDEP now willing to consider use of ClosureTurf for closing Class I landfills in Florida if conditions similar to using the EGC are followed.
- On March 23, 2017 FDEP issued a letter stating use of ClosureTurf will be subject to the following:
 - An AP Approval will be required to allow the use of the ClosureTurf at a landfill without the 24 inches of protective soil cover required by rule.
 - The applicant must create and fund a Soil Conversion Fund for converting to Traditional Closure prior to reaching the material strength half-life of the ClosureTurf.
 - The monetary value of the Soil Conversion Fund will be evaluated and adjusted as needed at five-year intervals.
 - If the AP Approval is granted by FDEP then the applicant will seek a modification of the landfill solid waste permit to include use of ClosureTurf authorized by the AP Approval.



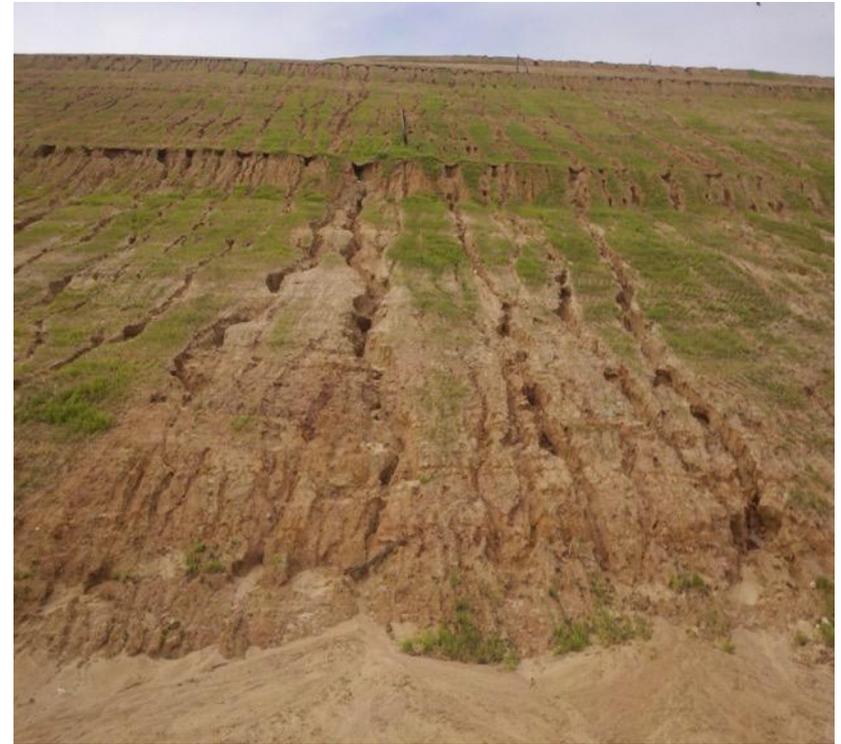
An aerial photograph of a large landfill site. The central area is covered with a vibrant green material, likely a final cover system, which contrasts with the surrounding brown, excavated earth and sparse vegetation. The site is surrounded by a dense forest of trees. The text is overlaid on the green cover area.

By working with the regulated community and industry, FDEP is moving forward to allow the safe use of alternate final cover systems for closure of Florida's Class I and Class III landfills.

So, Why ClosureTurf®?

It's the only solution that provides a predictable benchmark of performance for a Final Cover System

- Compare this to a prescriptive soil cover-
 - Engineered Structure...dependent upon unpredictable variables
 - Vegetation – establishment is just the first step
 - Weather – drought cycles followed by wet years

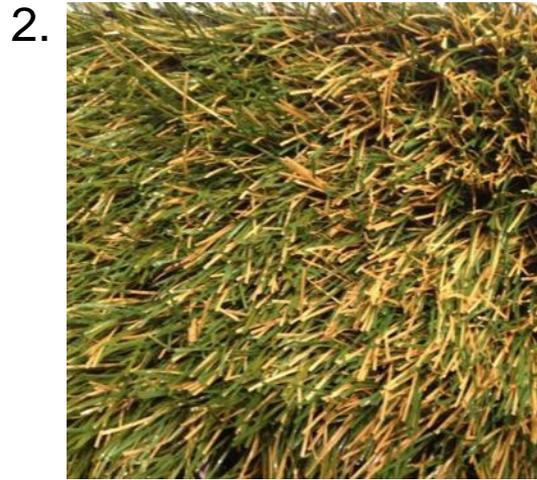
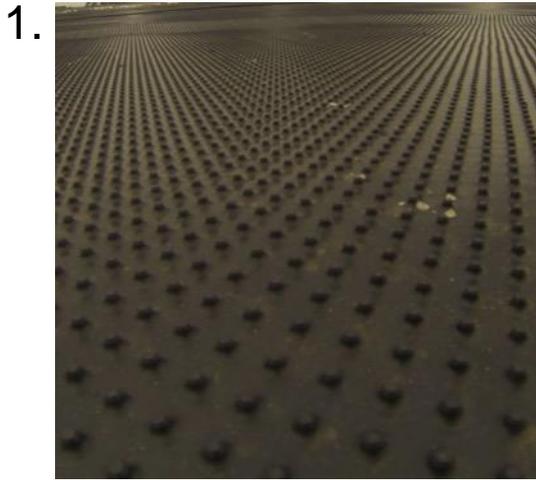


So, Why ClosureTurf®?

- Predictability of Performance-
 - Construction Cost
 - Construction Schedule
 - Technical Performance
 - No erosion
 - No turbid runoff water
 - Negligible infiltration-
 - No hydraulic head
 - No wind uplift
 - Maintenance cost
 - Design life



Three-Component HYBRID System:



1. **Structured Geomembrane** – may include integrated studs on top for drainage/ aggressive spikes on bottom for stability
2. **Engineered Synthetic Turf** – covers and protects the underlying geomembrane
3. **Specified Infill** – ASTM C-33 Sand; Polymeric Binder or Cementitious Infill
4. *OPTIONAL 4th component to enhance gas collection – geosynthetic gas transmission layer right underneath the geomembrane with vents and/or valves integrated into the EST System

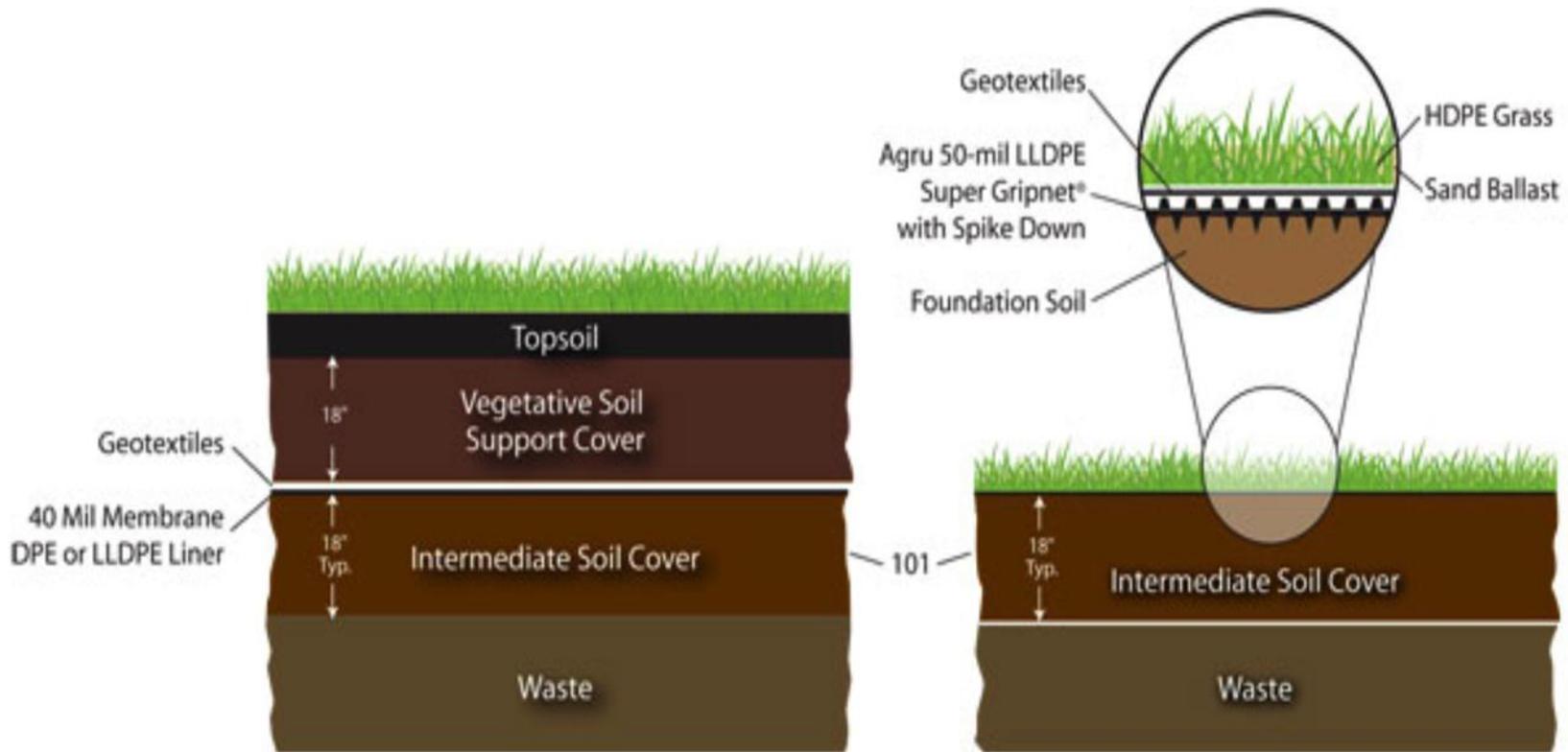


What *IS* meant by *HYBRID* System?

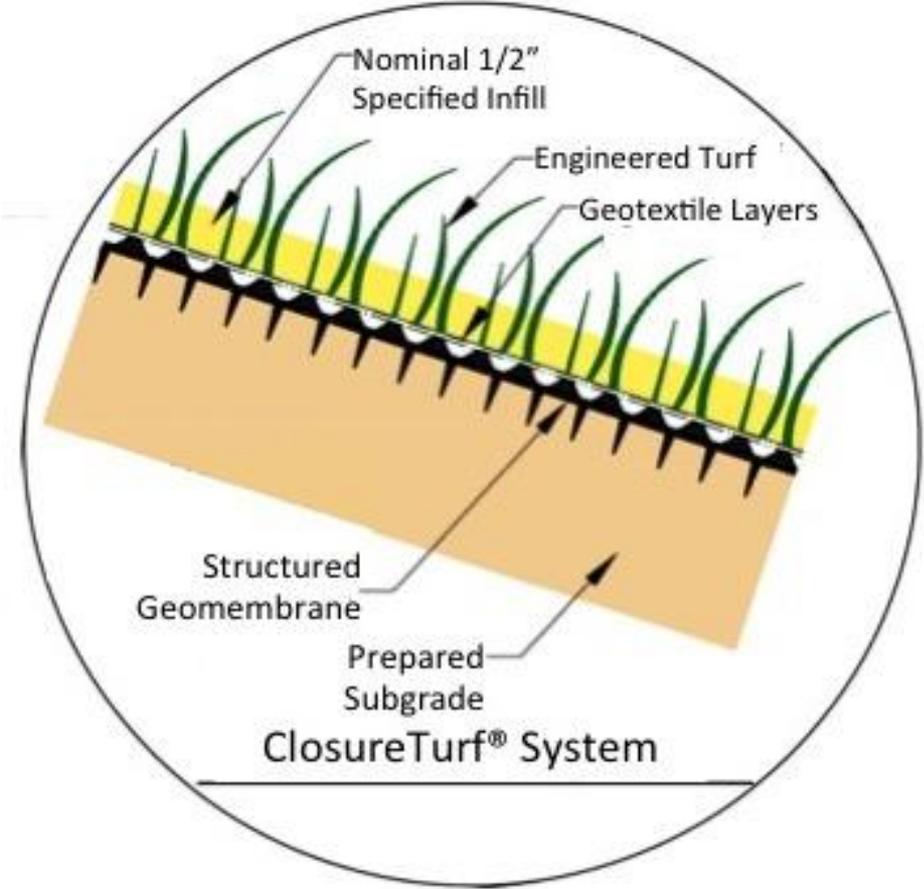
- It PROVIDES THE BEST of soil cover systems as well as exposed geomembrane systems
 - Provides protection of the geomembrane liner
 - Provides indirect visibility to the liner
- It ELIMINATES THE WORST of prescriptive soil cover systems and exposed systems
 - Eliminates typical problems with soil- borrow, erosion, maintenance, etc.
 - Eliminates damage to the geomembrane and extrusion welds from UV, wildlife, maintenance traffic, etc.



Traditional vs. ClosureTurf® System



ClosureTurf® Cross-Section



Case Study: Rainfall Resistance Saufley Field Landfill

Owner: Escambia County

Location: Pensacola, FL

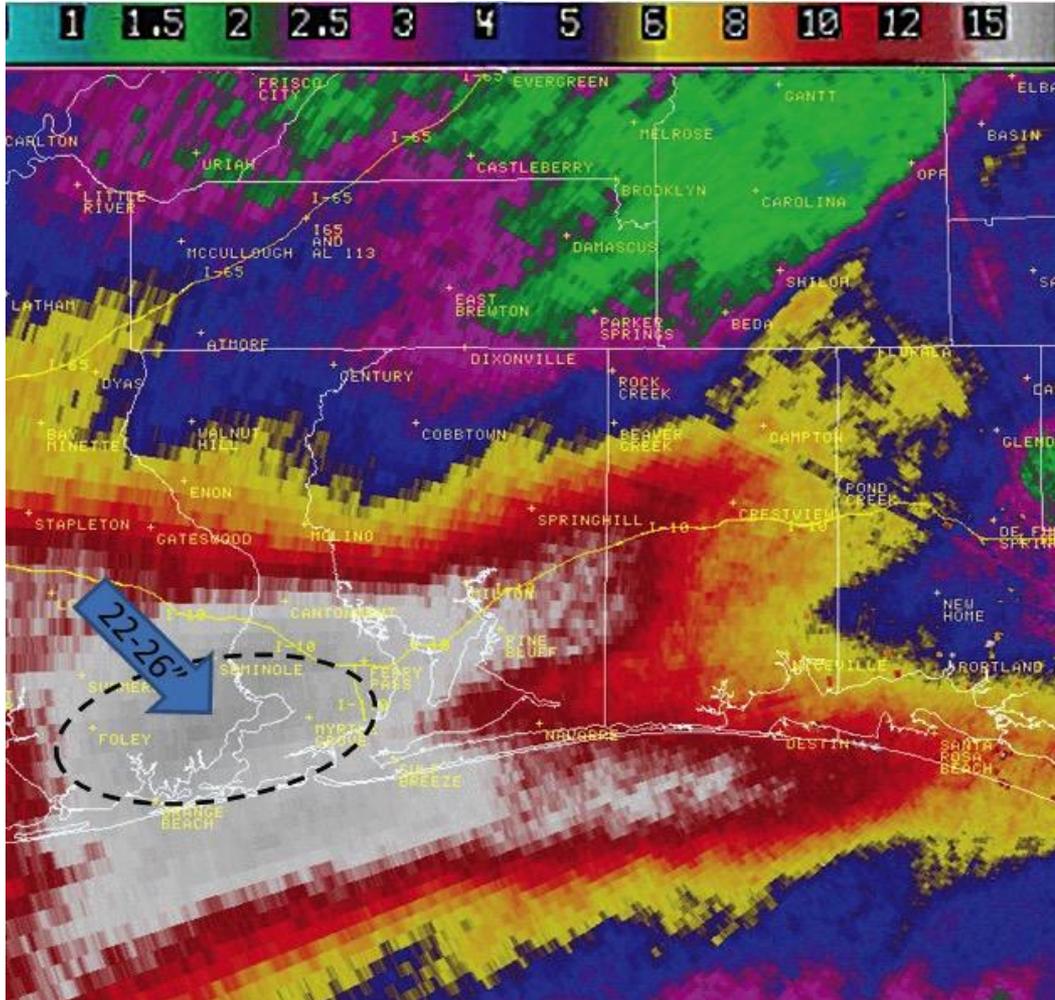
Completed: 2013

Closure Area: 25 acres





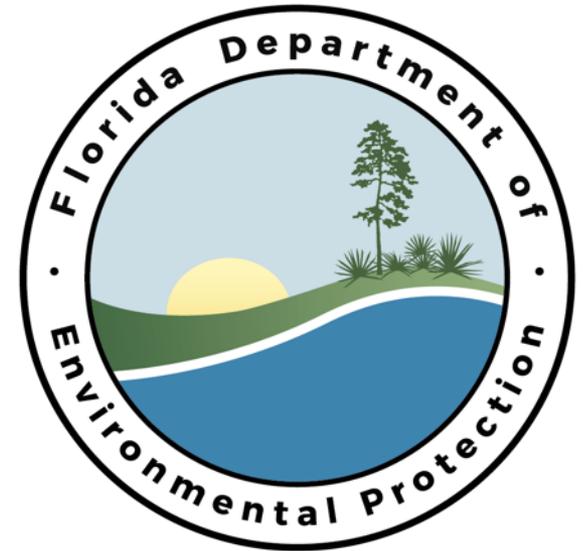
April, 2014 - 22" of rain fell in a 24 hour period 1 hour intensity - 500 year event



FL DEP Letter

RE: Use of ClosureTurf as Component of Final Cover at Landfills in Florida

- Watershed Geo & Geosyntec met with the Department on 12/7/16 to discuss the use of ClosureTurf on Class I & III landfills and the technical data that supports the system
- "The Department has reviewed your information and has no technical concerns..."
- The letter describes in detail the information required by the Owner/Engineer submitting the Alternate Procedure Request



ClosureTurf® as Component of Final Cover

- Per Rule 62-701.600, F.A.C. “A protective soil layer at least 24” shall be put on top of the geomembrane.”
- As a result of the above sentence, ClosureTurf can be used as a final cover system. However, soil will need to be placed above the ClosureTurf system when the turf fiber material reaches half-life (100 years).
- Even though soil will need to be placed on top of the system at half-life (100 years), the long-term care period for the landfill will begin upon completion of the ClosureTurf installation.



Soil Conversion Fund

- Soil Conversion Fund to be partially funded when ClosureTurf is initially installed and have it increase in value over the material service period (100 years)
- When material reaches half-life (100 years) the fund will cover the costs of converting the ClosureTurf system to a Traditional Cover. (i.e. placing soil and vegetation)
- Fund will use a financial instrument allowed in Rule 62-701.630, F.A.C.



Soil Conversion Fund



(Inflation = 2%, Interest = 5%, Not to Scale)

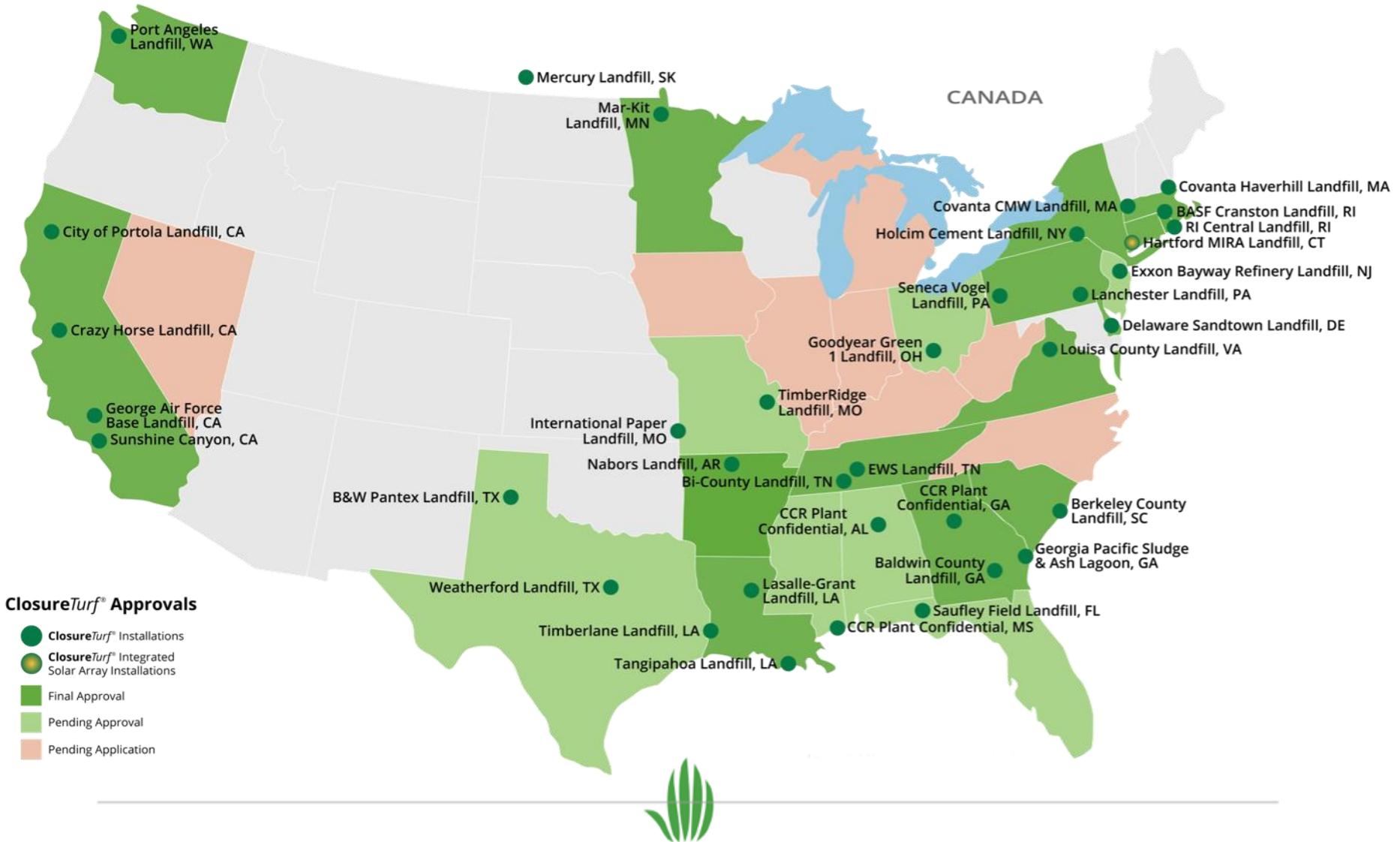
*CAPEX per acre cost includes the barrier layer (geomembrane) and up

Savings = \$4,776,882

Conversion Fund One-Time Payment
\$4,680(PV) per Acre



1,000 Acres and Counting...



Conclusions – ClosureTurf® System

- 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 (No hydraulic head)
 - Maintenance Cost
 - Design Life



Thank You!