Strategic Planning Reclaims Airspace at a Closed Landfill

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Solid Waste Authority

- Waste-to-Energy
  - REF #1 – 2,000 TPD RDF
  - REF #2 – 3,000 TPD Mass Burn
- Recovered Materials Processing Facility
- Biosolids Pelletization Facility
- Vegetative Waste Processing Operation
- HHW Collection Facilities
- 6 Transfer Stations
- 2 Active Landfills

Photo Credit: SWA

Palm Beach Renewable Energy Park (PBREP)

REF #1

REF #1 and #2

REF #2

Affluent Community

BPF

Class I Landfill

Class III Landfill

⇨N

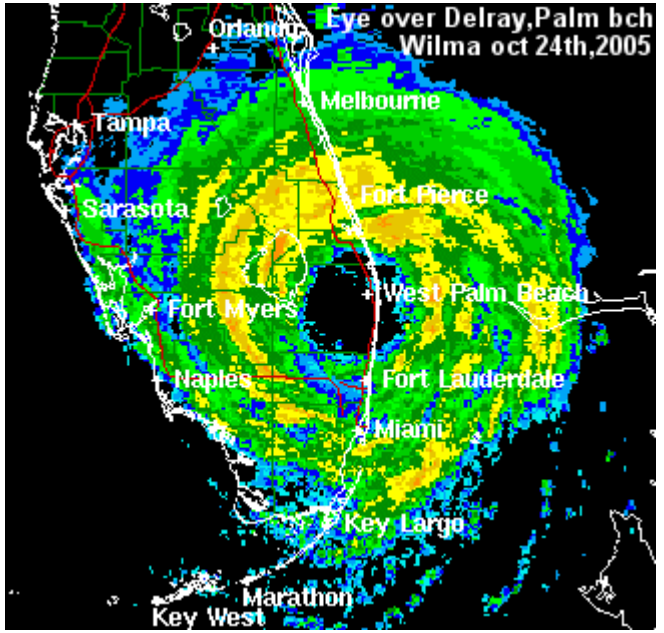
PBREP Landfills

- 262 Acre Class I Landfill
  - Cells 1-6 – Closed 2006
  - Cells 7-10 – Partially Closed 2010
- 72 Acre Class III Landfill

Photo Credit: SWA

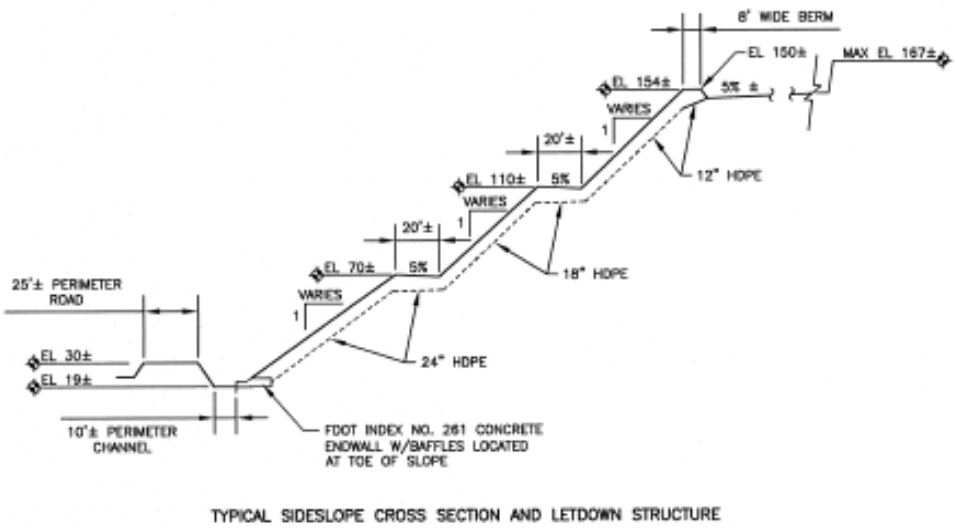
Rush to Closure

- Odor Complaints
- Leachate Seeps
- Hurricane Wilma
  - October 24, 2005
  - 3 million CY vegetation In
    - 900,000 CY Mulch to land app.
  - REF1 Outage – Divert to Landfill
- Cells 5/6 Closure
  - May 2006



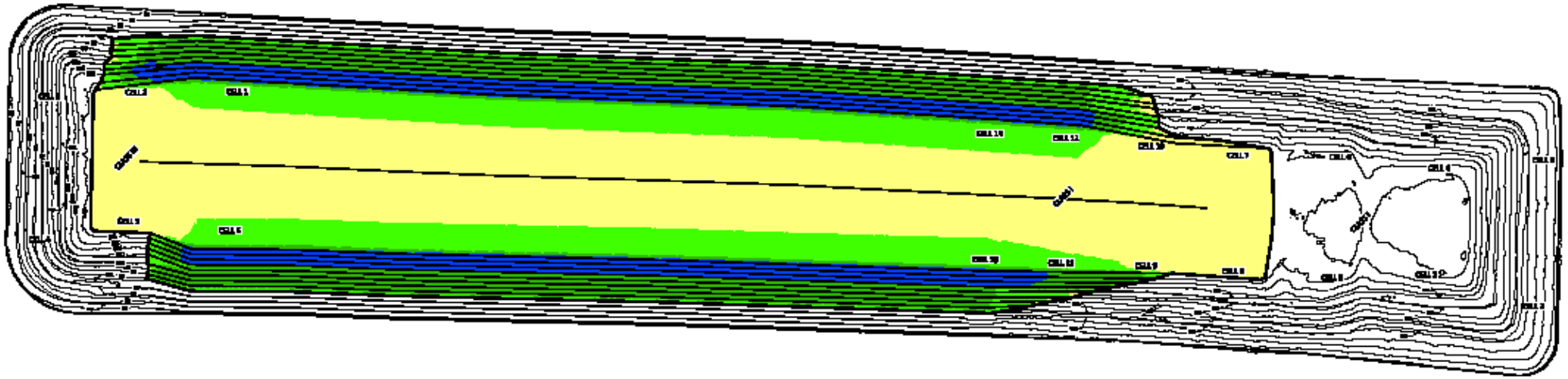
Conditions at Start of Project

- Filling and regrading of Cells 5-6 almost complete
- Filling of Cells 7-10 in progress



TYPICAL SIDESLOPE CROSS SECTION AND LETDOWN STRUCTURE

Conditions at Start of Project



Talking... TRASH

The Newsletter of the SWANA Florida Sunshine Chapter

Fall/Winter 2019

The Real Cost of Terraces on Landfill Slopes

Ali Khatami, Ph.D., P.E., SCS Engineers

Many landfill designers continue to incorporate terraces on the outside slopes of landfills, but not always for sound reasons. Sometimes, terraces are necessary to maintain landfill slopes in stable condition, due to low shear strength of the foundation soils, or when required according to the specific state or local solid waste rules.

Some designers continue to propose terraces on slopes to collect and convey surface water runoff from a landfill's higher slopes to a low point on the terrace where the downchute system is located. On paper, it is very easy to show nicely sloping terraces toward a low point, with transverse slopes toward the landfill slope, to control surface water. However, terraces cause significant operational issues for landfill operators. Some of these problems are very apparent, and some are realized when a portion of the landfill slope is scheduled to receive a permanent final cover. Consider these factors during permitting and design.

1. It is difficult to shape sloping terraces during waste placement operations; terraces can end up formed horizontally. When it is time to close the landfill's side slope, significant amounts of soil are placed along the terrace to make it slope toward a low point where the downchute system is located. Normally, permit drawings do not include sufficient details to illustrate these technical issues, and the operator would not have the specific knowledge of such issues at the time of closing the slope.
2. During waste placement, difficulties arise for the equipment operator (dozer pushing waste and compactor compacting and shaping surfaces) to shape the breaklines and compress waste properly to form the terrace. Lack of compaction near the outside breakline of the terrace makes it susceptible to excessive settlement and can cause the terrace to change shape over time.

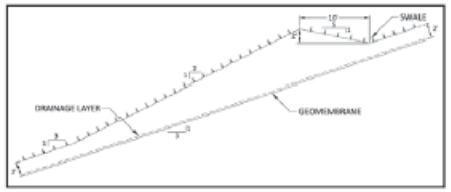


Diagram 1 - Tack-on berm and swale on landfill slope.

Photo 1 - Grading of tack-on berm and swale during construction.

3. Operators shape the transverse slope of the terrace either horizontally or sloping away from the landfill slope to manage surface water during the landfill's operational phase. In either case the slopes could end up formed differently, or in opposite direction of the slopes in the permit drawings. Closure of the landfill slope requires special attention along with large quantities of soil to shape the terrace similar to what is in the permit drawings. Again, the landfill operator would not have knowledge of the additional work and the soil quantities necessary to fix the terrace transverse slope properly.
4. Settlement in waste causes previously shaped terraces, at a certain elevation, ending up lower than the originally shaped terraces. Over time, the terrace originally constructed at a certain elevation and in accordance with the permit documents, ends up lower in elevation due to waste settlement. Continuously occurring settlement can cause the misalignment of terraces formed at different intervals. At the time of closing, the terrace misalignments become a major problem for the engineer and contractor to meet elevations and shapes previously permitted.
5. Downchute pipes extend from the highest terrace to the lowest terrace, and to the surface water management system at the perimeter of the landfill. The downchute pipes are designed to cross the width of each terrace and pickup surface water from each terrace. However, the pipe alignments, complicated by the terrace transverse slopes toward the landfill slope, cause construction complications and increase the risk of failing to properly collect surface waters at the low point. This particular risk can become drastic when considering waste settlement changes the surface geometry at the inlets to the downchute system, causing costly repairs.
6. Over the terrace surface, the geocomposite drainage layer in the final cover follows the transverse slope toward the landfill slope and across the width of the terrace. Water in the geocomposite from the higher slope and from the terrace reach the inside edge of the terrace, with nowhere to go except to follow the longitudinal slope of the terrace along the interior edge. Geocomposite is not designed to carry such a large quantity of water along the interior edge for the entire length of the terrace. Inevitably, problems arise, and potential failures

Concerns with Terraces

- Construction and Grading of Terraces
- Settlement
- Stormwater Management
- Leachate Management
- Access Road Crossing

Exiting Terraces

Side slopes prior to Cells 7-10 Partial Closure

Existing Side slopes

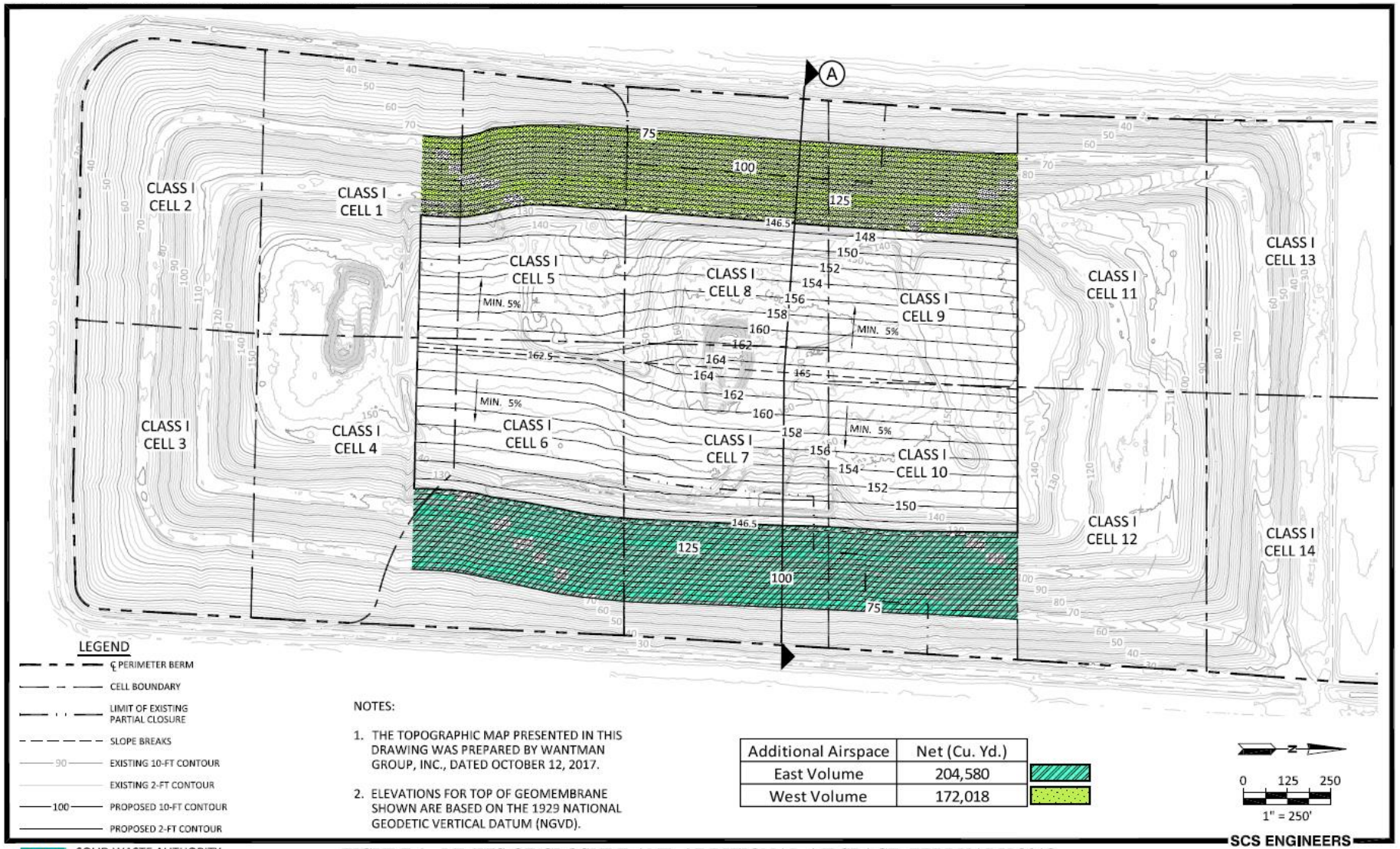

WHAT IF....?

Cost Benefit Analysis

- Determine feasibility of opening the partially closed areas of Cells 7-10 above elevation 70 ft
- Regrade side slopes 3:1
- Remove terraces

- Advantages:
  - Airspace Gain
  - Simplify Grading
  - Improve stormwater drainage

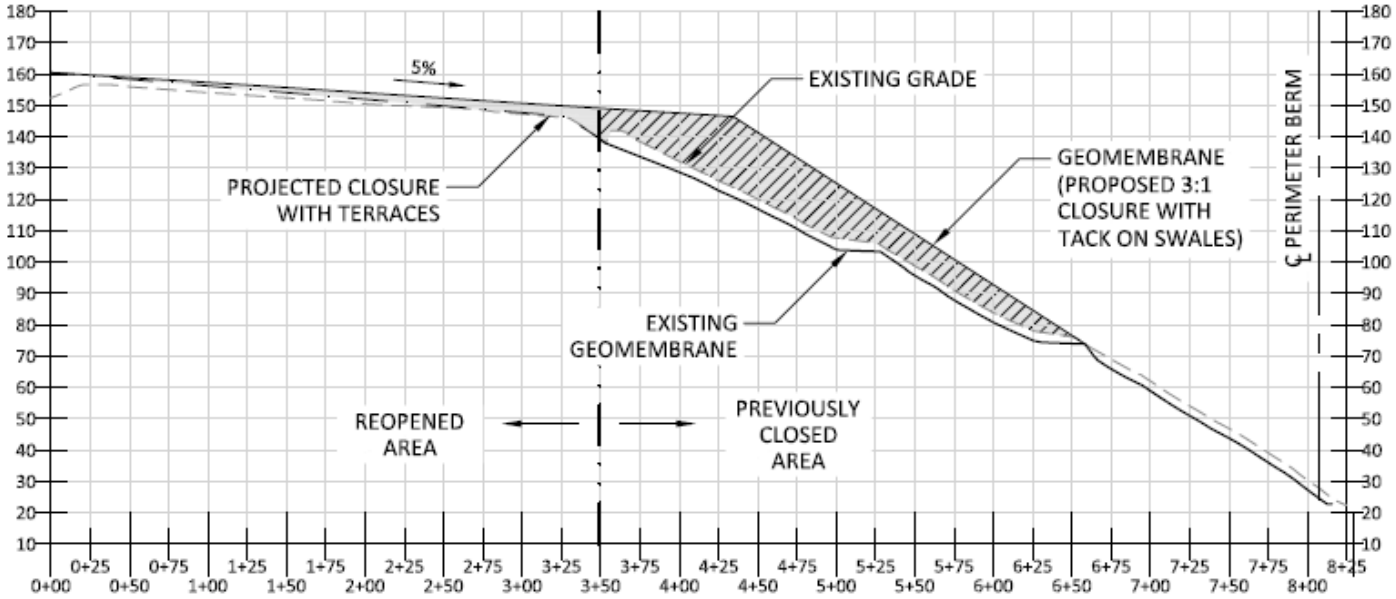
Cost Benefit Analysis



SOLID WASTE AUTHORITY
OF PALM BEACH COUNTY
7290 NORTH JOG ROAD
WEST PALM BEACH, FLORIDA 33412

FIGURE 1. LIMITS OF CLOSURE AND ADDITIONAL AIRSPACE, FEBRUARY 2018
SWA PALM BEACH RENEWABLE ENERGY PARK CLASS I LANDFILL

Cross Section



A CELL 6 CROSS SECTION
HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 50'

LEGEND

- POTENTIAL ADDITIONAL VOLUME
- POTENTIAL ADDITIONAL VOLUME NOT ACCOUNTED FOR IN COST BENEFIT ANALYSIS
- LIMIT OF EXISTING PARTIAL CLOSURE
- EXISTING TOPO
- EXISTING GEOMEMBRANE
- PROPOSED CLOSURE WITH 3:1 SLOPS AND TACK ON SWALES
- PROJECTED CLOSURE WITH TERRACES

Cost Benefit Analysis Results

- Estimated Costs:
  - Removal = $1,400,000
  - Closure = $4,100,000

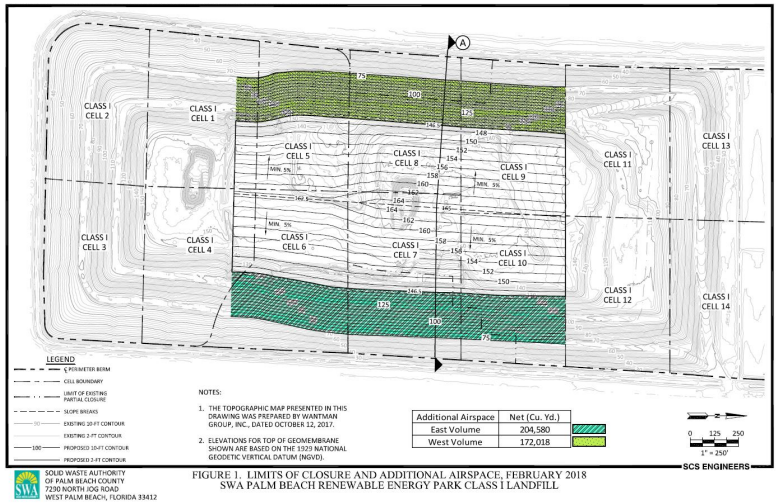


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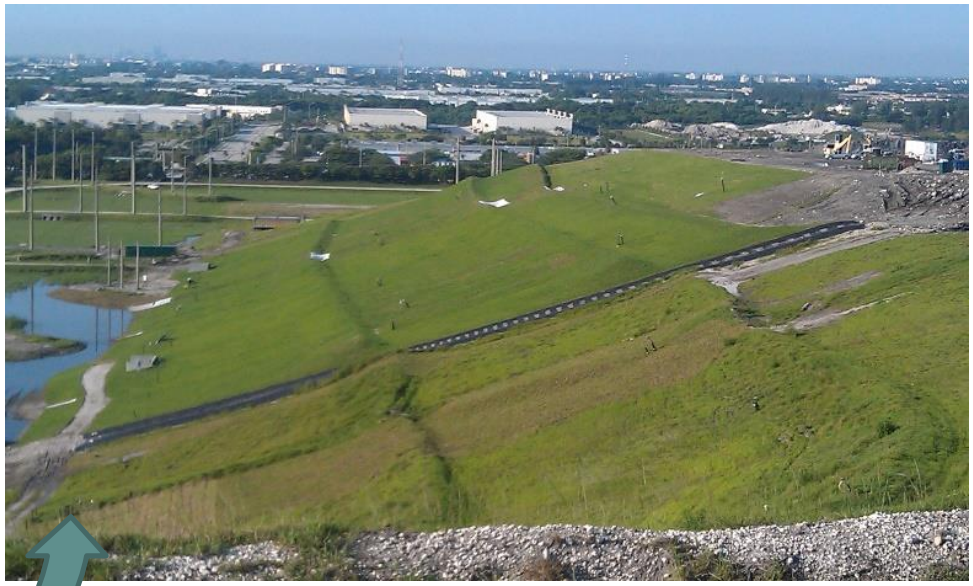
FIGURE 1. LIMITS OF CLOSURE AND ADDITIONAL AIRSPACE, FEBRUARY 2018
SWA PALM BEACH RENEWABLE ENERGY PARK CLASS I LANDFILL

Cost Benefit Analysis Results

- Airspace Gain Cells 5-10
  - East and West Side Slopes included
  - Volume = 400,000 CY
  - Value = ???
    - SWA value (operational cost)
    - Market value - $40/ton ~ $16 million
      - Estimated tipping fee

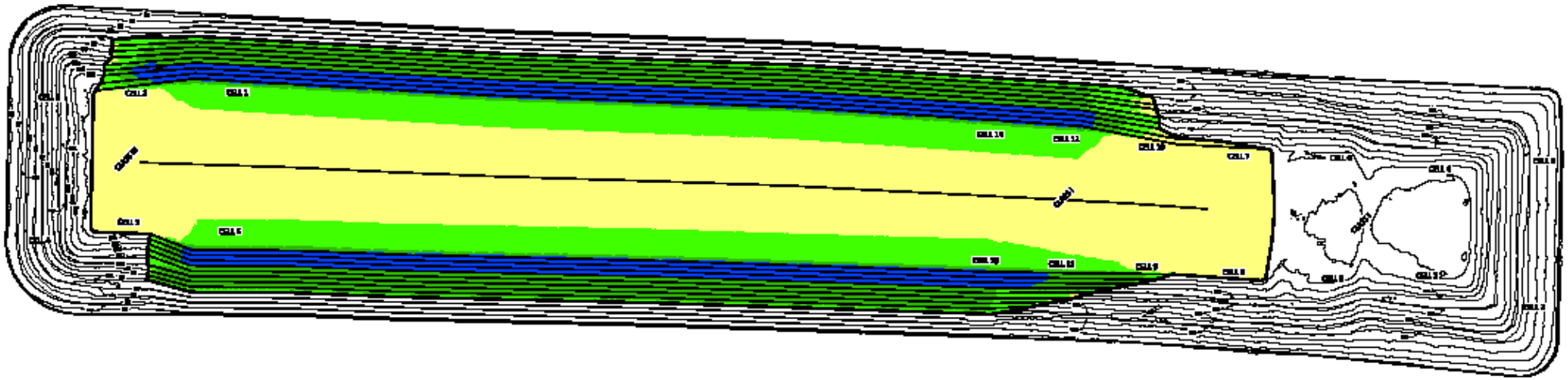
Next Steps

- SWA decided to proceed with removal of existing closure and regrade with 3:1 side slopes
- Closure Design Plan was completed
  - Permit application was approved by FDEP



Result

- Over 3 million CY additional airspace
- 5% Gain



Field Implementation

- Removal of Existing Closure Cap on Cells 5-10
- Stockpiling existing cover soils
- Reuse of liner for leachate management

Leachate and Stormwater Management

Progress Time Lapse


Questions?