

wood.

# “Un-filling” Your CCR Landfill for Beneficial Use

Lessons Learned and Practical Considerations

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# Outline

- Background
- Case History
- Practical Considerations
  - Design practices
  - Plan today for future mining potential
  - Future landfill removal and closure

“The intersection  
between hindsight  
and foresight is  
insight”

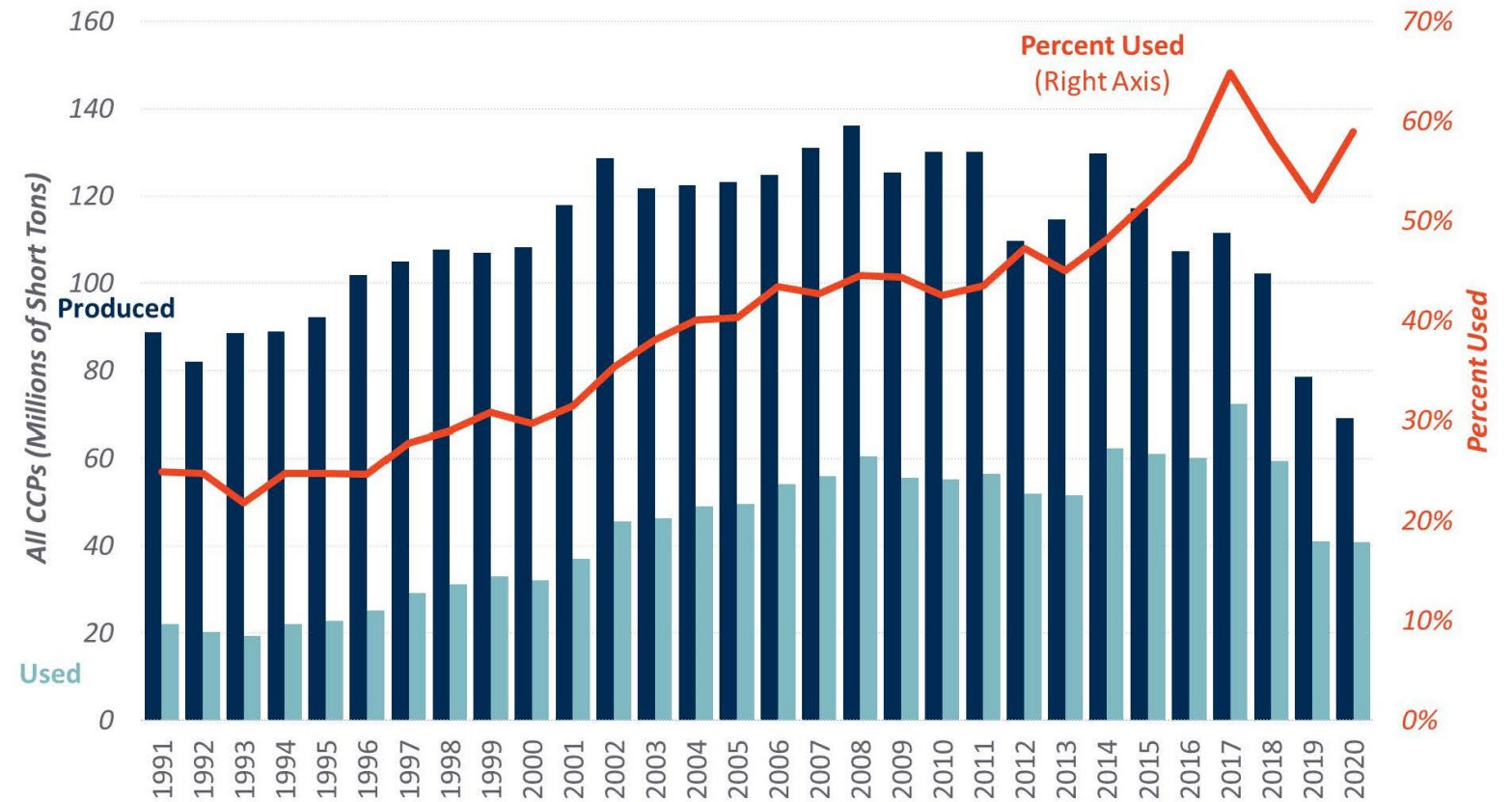
(Kaye, B., Winkle Giulioni, J., “Help the Grow or Watch Them Go”, 2019)

# Hindsight

# CCP (CCR) generation and beneficial reuse

- All CCP production...
  - Fly Ash
  - Bottom Ash
  - FGD Gypsum
- 2017 reuse peaks:  
72 MM tons = 64%
- 2019 reuse declines:  
41 MM tons = 52%
- 2020 reuse rebounds:  
41 MM tons = 60%

All CCP Production & Use (1991–2020)



Source: ACAA's 2020 Production and Use Survey as reported in <https://www.woc360.com/materials/coal-ash-recycling-rate-increases-2020>

# Fly ash generation and beneficial reuse

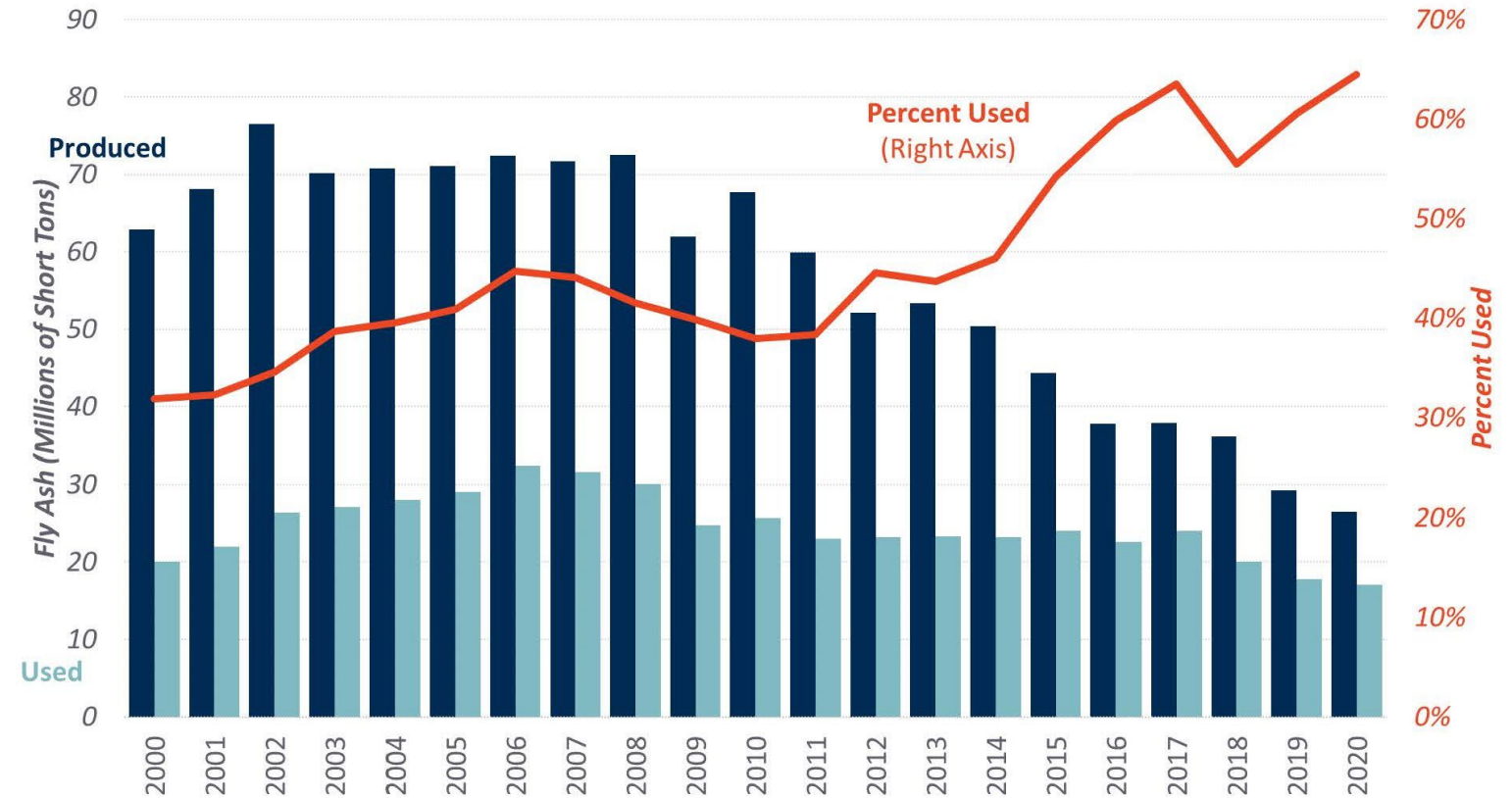
- Generation

- 2002 ≈ 77 MM tons
- 2020 ≈ 27 MM tons

- Reuse

- 2002 ≈ 27 MM tons (35%)
- 2020 ≈ 17 MM tons (65%)

Fly Ash Production & Use (2000–2020)



Source: ACAA's 2020 Production and Use Survey as reported in <https://www.woc360.com/materials/coal-ash-recycling-rate-increases-2020>



# FGD gypsum generation and beneficial reuse

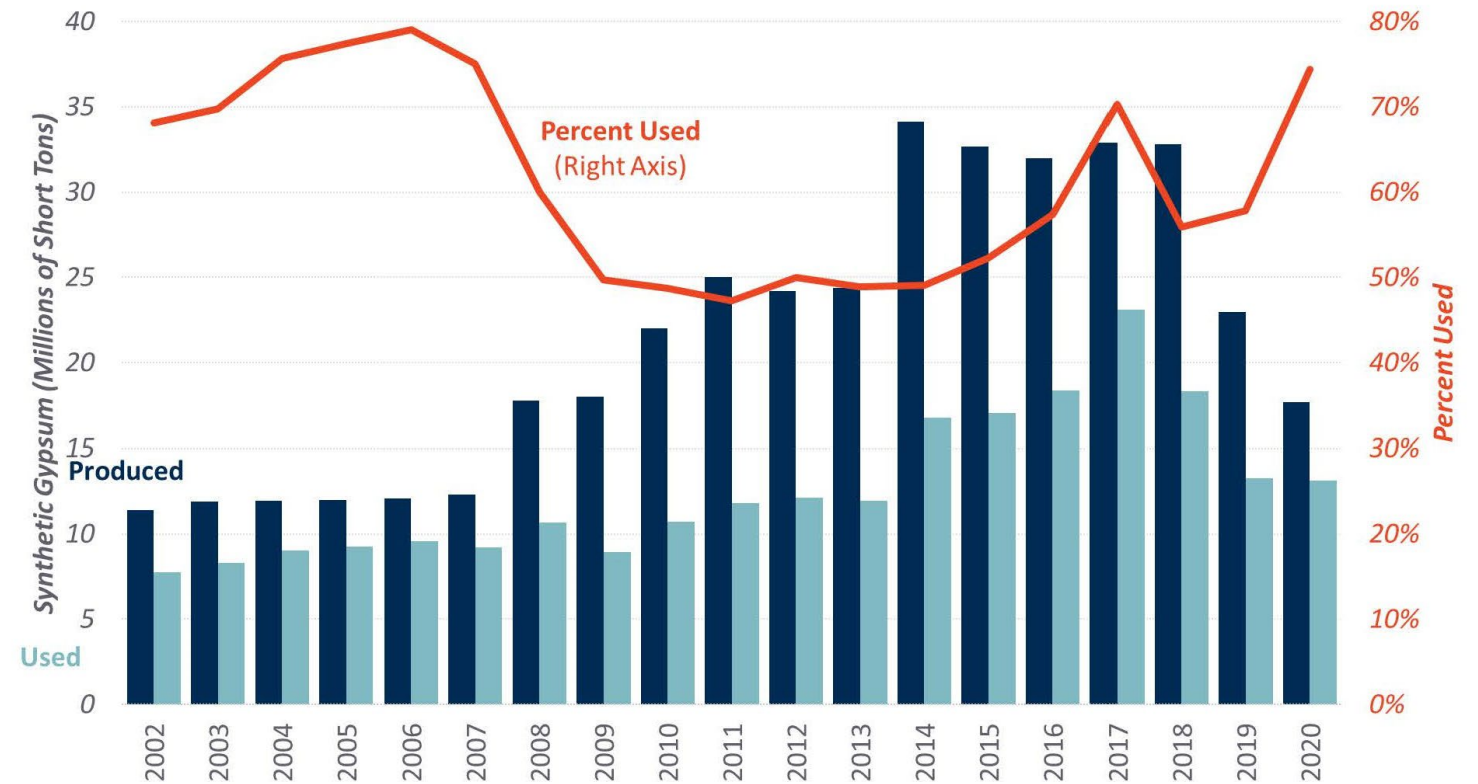
- Generation

- 2014 ≈ 34 MM tons
- 2020 ≈ 18 MM tons

- Reuse

- 2014 ≈ 17 MM tons (50%)
- 2020 ≈ 13 MM tons (74%)

Synthetic Gypsum Production & Use (2002–2020)



Source: ACAA's 2020 Production and Use Survey as reported in <https://www.woc360.com/materials/coal-ash-recycling-rate-increases-2020>

# Foresight

# Coal-fired generation is declining...

## **Southern Company Announces Closure of Majority of its Coal Fleet by 2028**

Friday, November 5, 2021

## **Duke Energy says it will eliminate coal for power by 2035**

WFAE | By David Boraks

Published February 10, 2022 at 4:50 PM EST

COAL | ELECTRIC POWER — 13 Apr 2020 | 20:03 UTC — New York

## **Bulk of Virginia's coal plants must shut down before 2025 under new state law**

Sources:

<https://www.sierraclub.org/press-releases/2021/11/southern-company-announces-closure-majority-its-coal-fleet-2028#:~:text=Atlanta%2C%20GA%20%2D%2D%20Southern%20Company,and%20Plant%20Barry%20in%20Alabama>

<https://www.wfae.org/energy-environment/2022-02-10/duke-energy-says-it-will-eliminate-coal-for-power-generation-by-2035>

<https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/coal/041320-bulk-of-virginias-coal-plants-must-shut-down-before-2025-under-new-state-law>



# Beneficial reuse demand

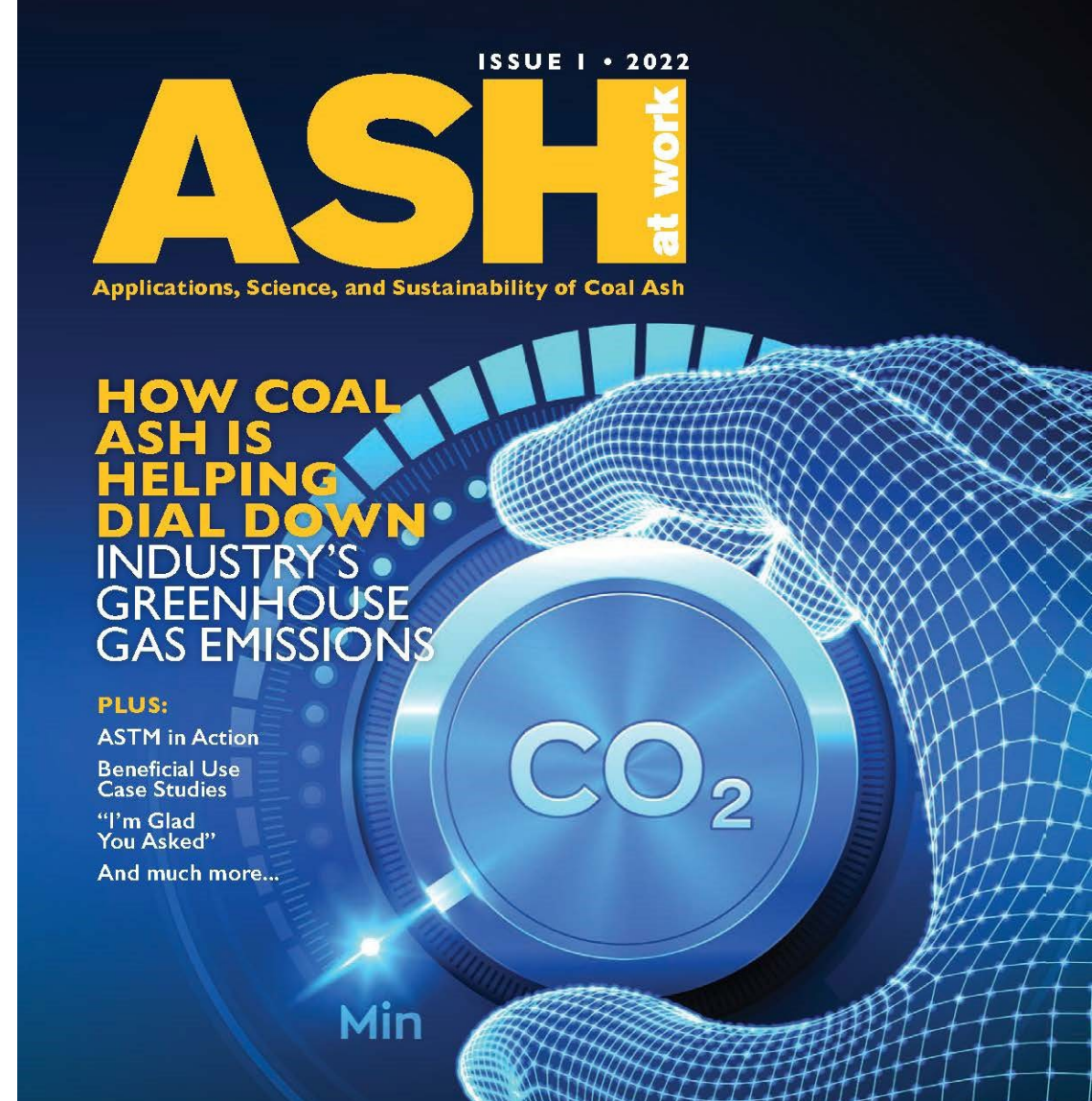
*"The reversal of a downward trend in recycling rates and the utilization of a significant volume of **harvested coal combustion products "CCP"** shows that **beneficial use markets are adapting to the decline in coal-fueled electricity generation** in the United States,"* said Thomas H. Adams, ACAA Executive Director."

Source: American Coal Ash Association, World of Concrete 360, "Coal Ash Recycling Rate Increases in 2020", Dec 01, 2021; <https://www.woc360.com/print/1292>

ESG = Environmental, Social, and Corporate Governance (ESG)

*"But now ESG presents us with the perfect opportunity to go "back to the future." **The environmental benefits that were at the core of this industry's foundation are becoming strategic tools for accomplishing corporate goals.**"*

Source: Benza, Steve, "Back to the Future with ESG", Ash at Work, 2022, Issue 1, American Coal Ash Association



## Insight...

**As coal fired generation declines, CCP(CCR) declines  
If CCP(CCR) beneficial reuse demand remains  
Then reclamation becomes more viable (necessary)**

# Case history – FGD gypsum landfill

- 2006: landfill design - gypsum monofill
- 2007:
  - Start operations
  - FGD “Scrubbers” on-line at several fleet plants
  - Owner contracts = fleetwide obligation to supply gypsum to wall board manufacturer
- 2016: 1<sup>st</sup> mining plan developed
- 2020: evaluate landfill design basis vs. mining plans
- 2022: accelerate mining to meet demand



“Begin with the end in mind”  
(S.R. Covey, 1989)

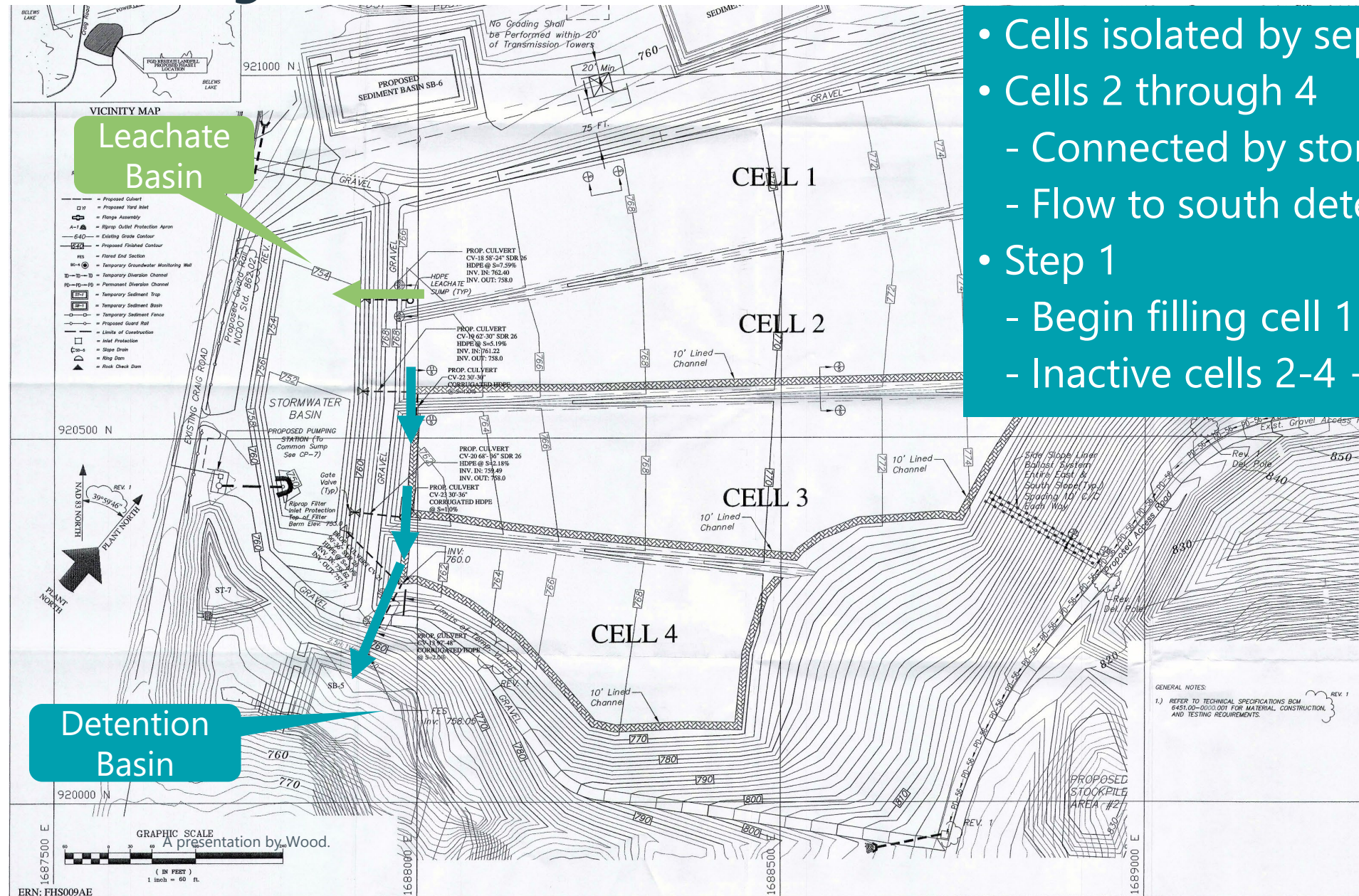
Landfills were designed to fill  
and close...  
...not fill, empty, and  
remove







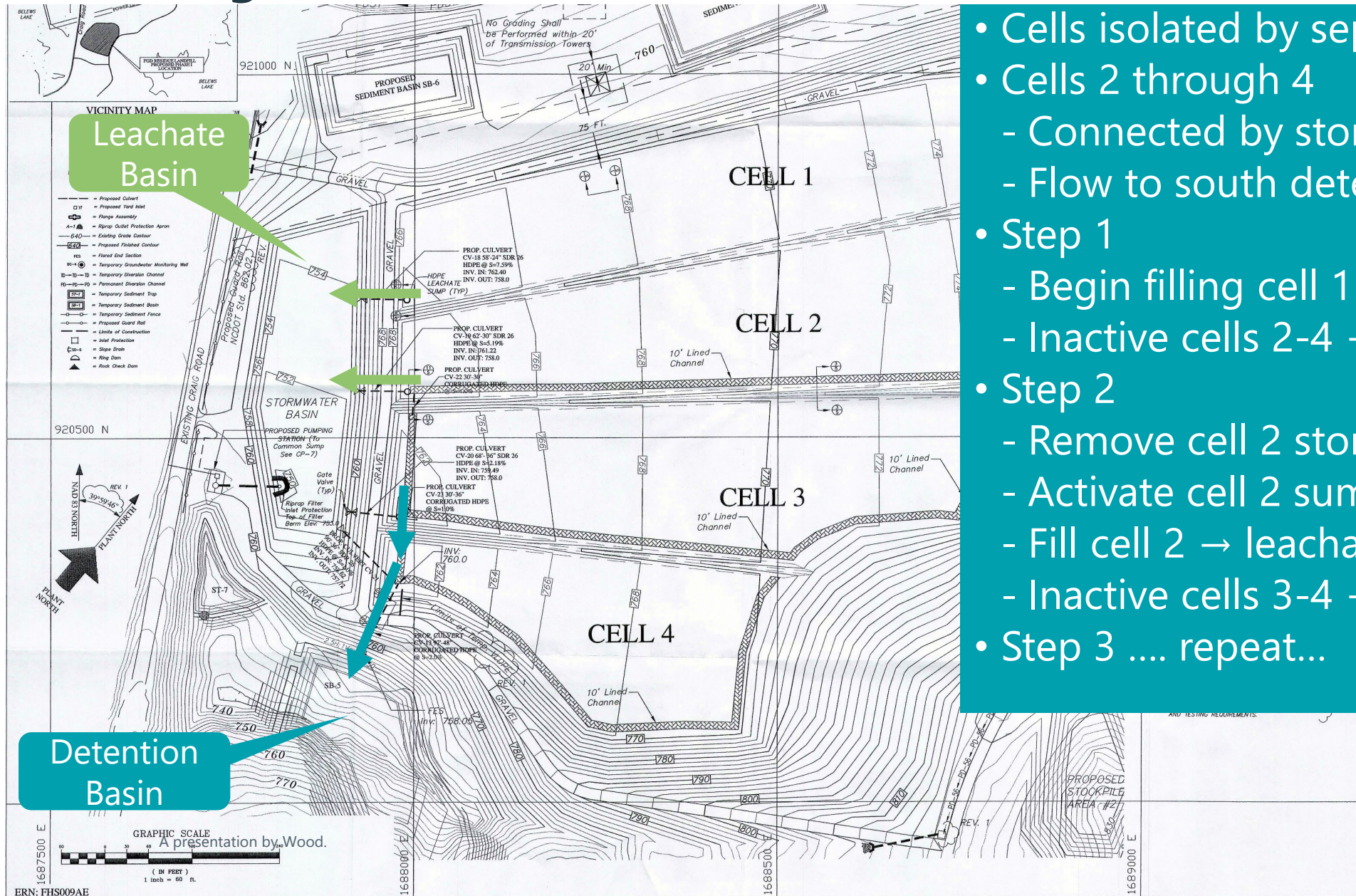
# Contact and stormwater management goal: reduce leachate generation



- Cells isolated by separation berms
- Cells 2 through 4
  - Connected by stormwater culverts
  - Flow to south detention basin
- Step 1
  - Begin filling cell 1 → leachate
  - Inactive cells 2-4 → stormwater



# Contact and stormwater management goal: reduce leachate generation



- Cells isolated by separation berms
- Cells 2 through 4
  - Connected by stormwater culverts
  - Flow to south detention basin
- Step 1
  - Begin filling cell 1 → leachate
  - Inactive cells 2-4 → stormwater
- Step 2
  - Remove cell 2 stormwater culvert
  - Activate cell 2 sump
  - Fill cell 2 → leachate
  - Inactive cells 3-4 → stormwater
- Step 3 .... repeat...



# Leachate basin

- 1.5 acres
- Original design basis
  - Capacity for "2 Open Cells" = 18.6 acres
  - 500 gpm pump out to WWTS
- Overall landfill is 4 cells = 22.6 acres
- Conclusion: leachate basin capacity constrains planned mining operations
- Options:
  - Increase leachate basin capacity
  - Limit open landfill cells
  - Sequentially mine & deactivate cells





# Gypsum processing

- Operational soil cover
  - More used during initial operations
  - Cells 1 and 2 soil lenses affect gypsum quality
- Cementation = gypsum cobbles
- Results...
  - Larger areas needed for blending and processing
  - 2021 – One screening plant
  - 2022 – Two screening plants





# Processing (single)





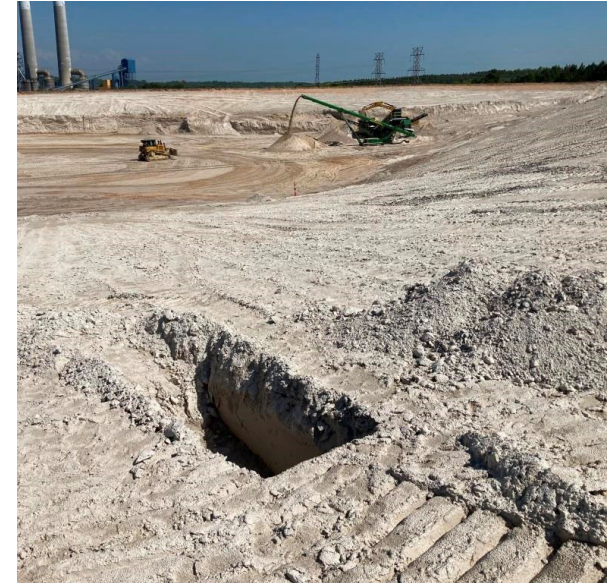
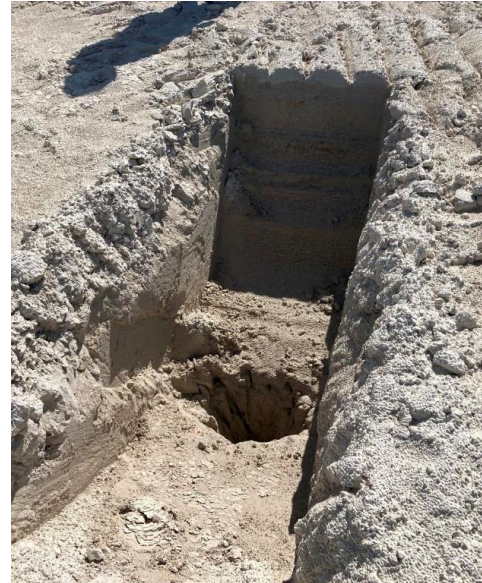
# Processing(double)





# Mining operations

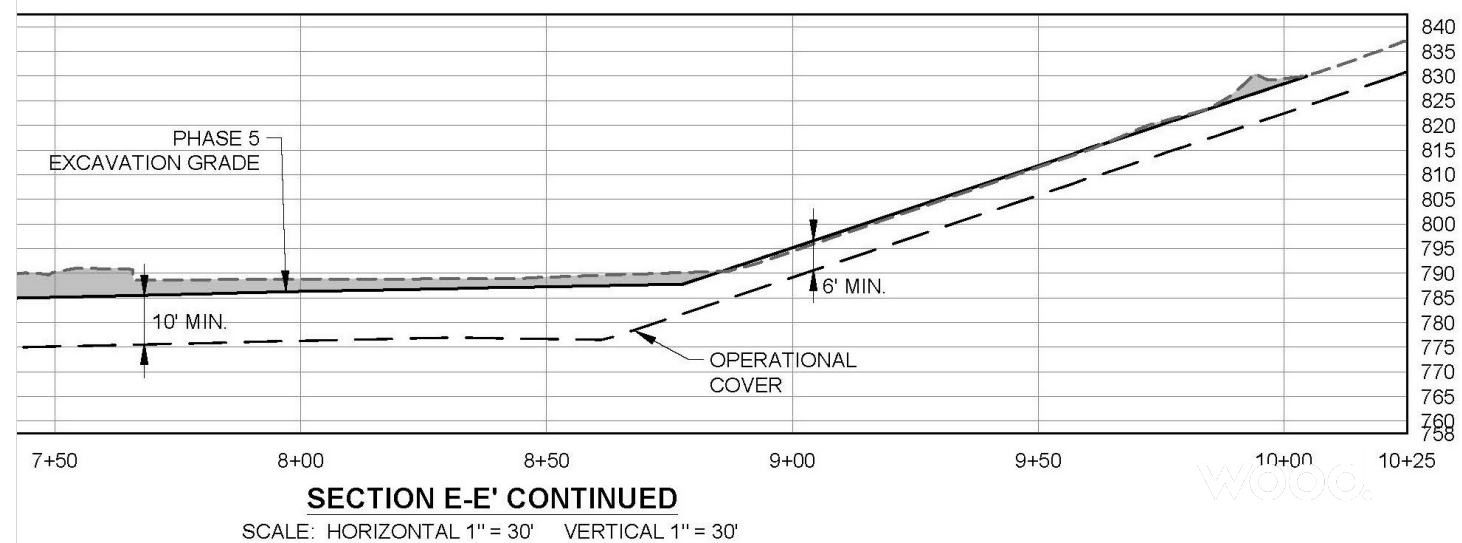
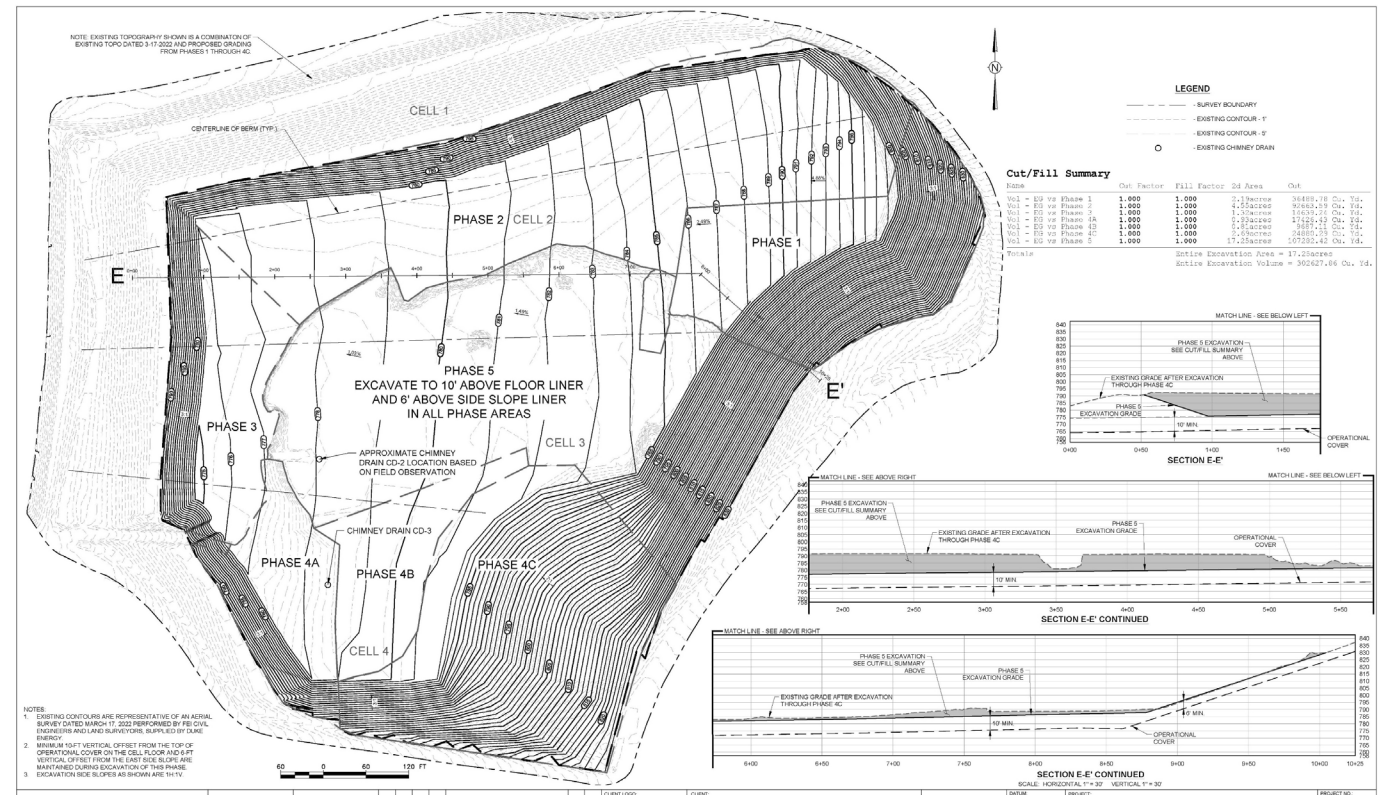
- Goal: Protect the liner system
- How?
  - GPS-guided equipment
  - 3D files - vertical & horizontal liner system offset
- Requires high-confidence liner system as-built drawings (in CAD)
- However, 2006 as-built drawings were "questionable"
- Solution: test pit excavations to verify liner system location



- Test pit excavations
- Survey liner & compare to as-built
- 40% actual > than as-built:
  - avg = + 1.3 in.
  - max = + 4.4 in.

# Mining phasing plans

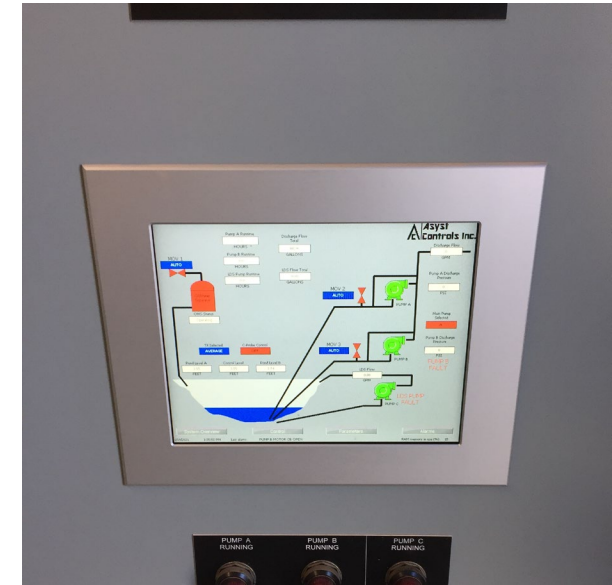
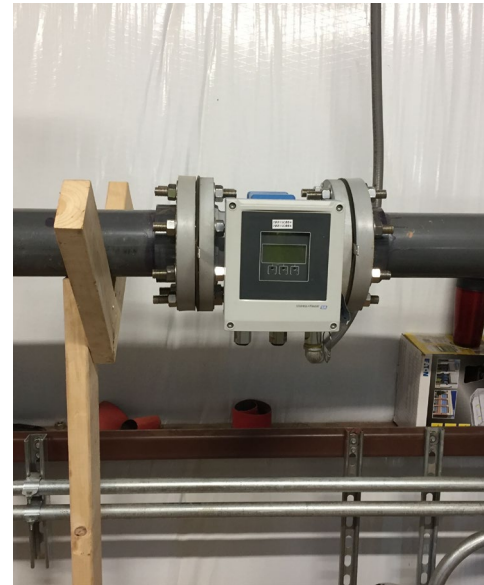
- Five sequenced grading plans
- Grade control:
  - Offset: 6-ft slope; 10-ft floor
  - w/in 3-ft - visual spotter
  - w/in 2-ft - mini excavator with smooth blade
- Define water management practices
- Define liner damage and repair procedures
- Revised LF Operations Plan



# Practical considerations

# Design practices

- Maintain high-quality and high confidence as-built drawings
  - Static PLS sealed original
  - Electronic format (AutoCAD)
- Maintain thorough design document records
- Obtain landfill data
  - Design is based on assumptions and modeling
  - Actual performance data can inform future design/decision making
    - Leachate generation
    - Contact water generation
    - Rainfall



## Helpful landfill performance data:

- Leachate flow meters
- Data collection & management
- Weather station



# Plan today for future mining potential

- Manage other wastes (contaminants) thoughtfully
  - Reduce soil cover use
  - Prohibit, reduce, or manage co-mingling fly ash, bottom ash, gypsum
  - Prohibit, limit, or track other wastes: organics, C&D, ACM
- Sample, survey, test, and archive CCP quality data
- Consider transportation infrastructure: truck or rail?

Many are focusing on fast-paced ash basin closures and closure landfills to meet regulatory deadlines ...  
remember future mining potential

# Future landfill removal and closure

- Consider possible landfill closure approaches
  - Complete removal
  - Reduced footprint closure landfill

<b>Consideration</b>	<b>Complete Landfill Removal</b>	<b>Reduced Footprint Closure Landfill</b>
Closure design and construction	similar	similar
Construction sequencing to control leachate & contact water	similar	similar
Offsite disposal	transportation and disposal costs	N/A
Bulky waste disposal (geosynthetics)	not your concern	your concern
Post closure care	limited	30 years (plus)
Leachate treatment	None	into post closure
Potential land reuse	Yes	Limited

# Questions?

- Thank you!
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