

# AQUASTOWING

An Effective Means of Curbing Large Karstic Inflows



Geohazards Impacting  
Transportation in Appalachia  
17<sup>th</sup> Annual Technical Forum  
Blacksburg, VA

Eric Smith – Engineer  
Sub-Technical Inc.

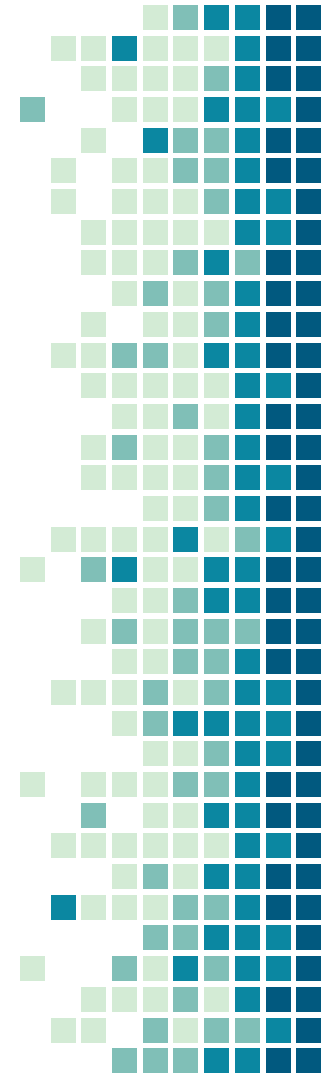
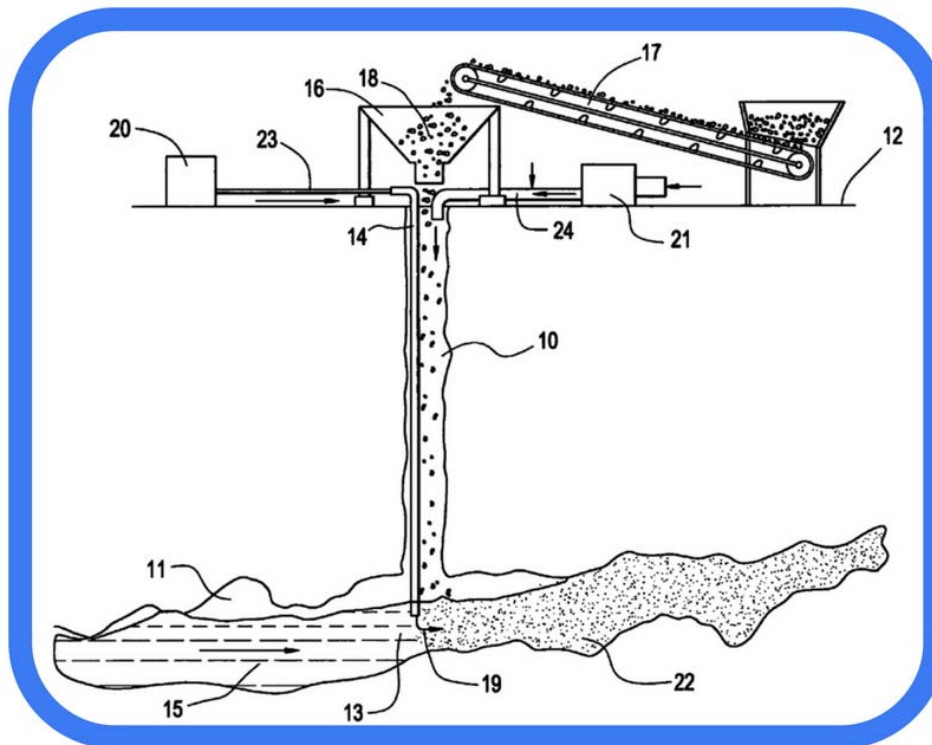


**Sub-Technical**inc®  
Engineered Solutions in Ground and Water Control

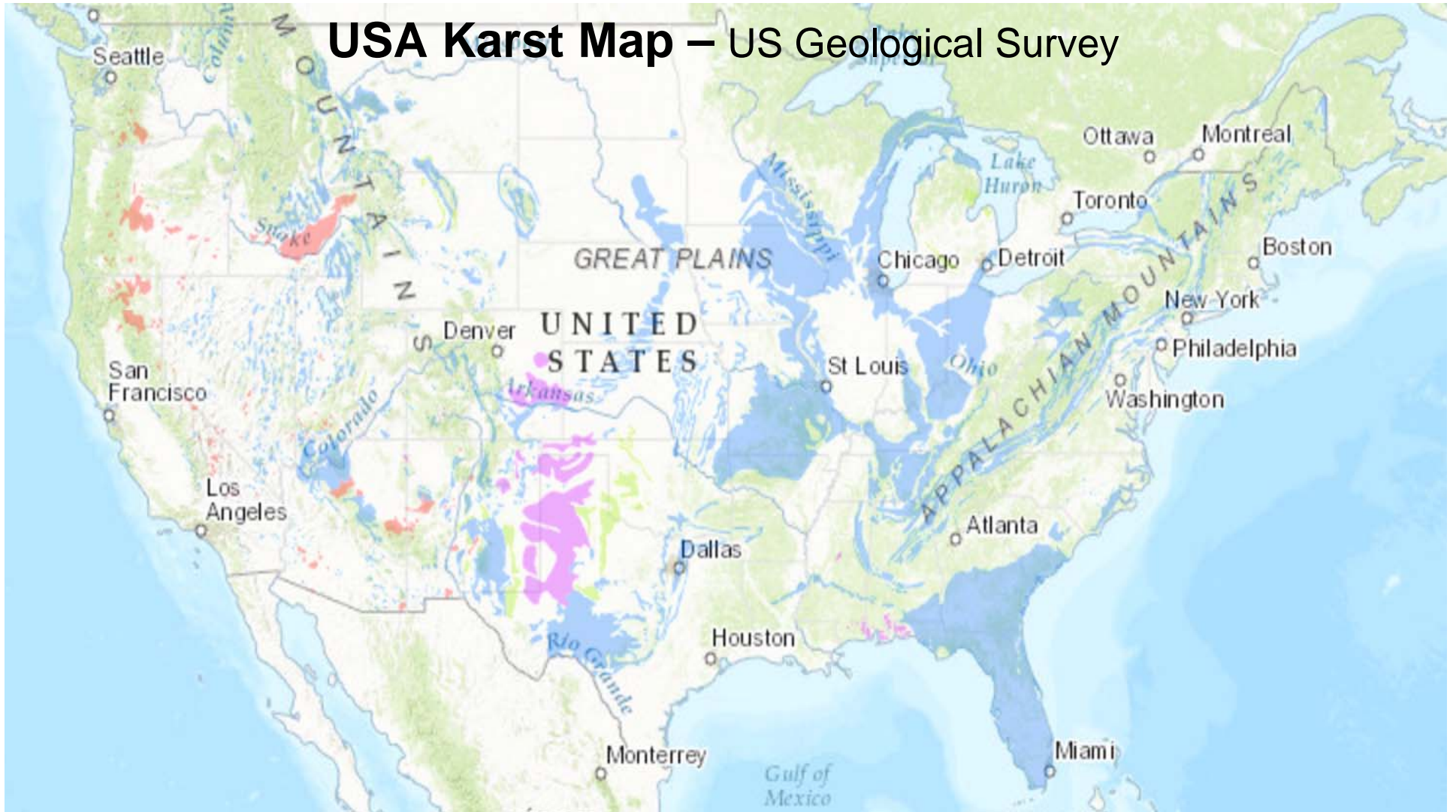
# WHAT IS AQUASTOWING?

US Patent #8,585,328

"Underground Filling and Sealing Method"



# USA Karst Map – US Geological Survey



# Appalachian Karst Map – US Geological Survey



# Problems Associated With Karst

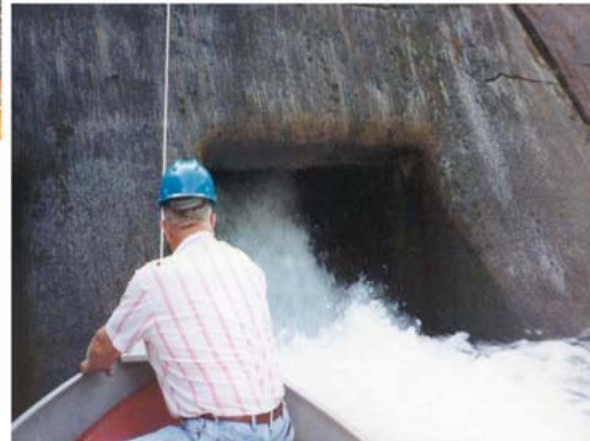
Kimballton Limestone Mine  
Karstic Aquifer 6,000 GPM  
Giles County, Virginia



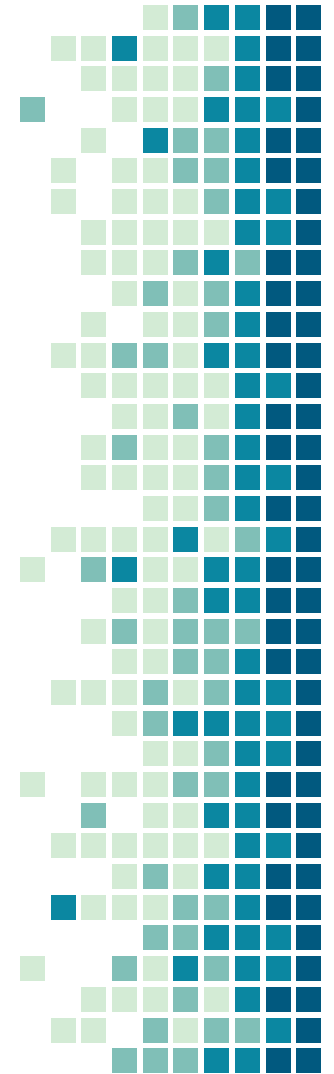
Hydroelectric Dam  
Karstic voiding 8,000 GPM  
York, Pennsylvania



Strip Mine Operation  
Acid Mine Drainage  
Indiana, Pennsylvania



# Problems Associated With





**Clinton Point Quarry  
Poughkeepsie, NY**



# Rock Products

With which is  
Incorporated

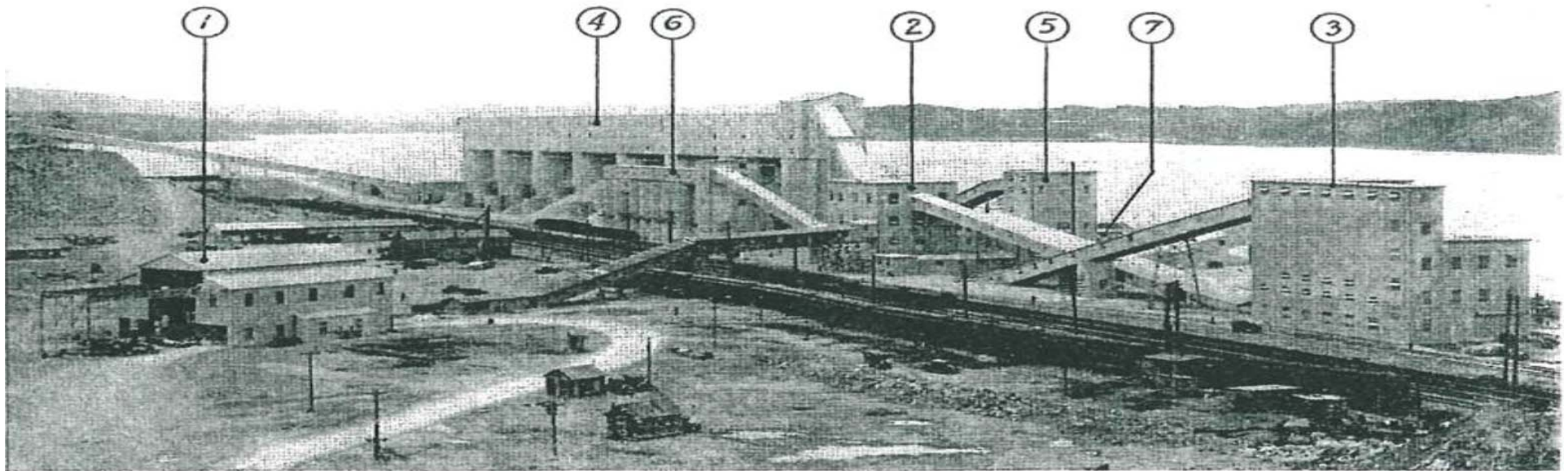
CEMENT *and* ENGINEERING  
NEWS

Founded  
1896

Volume XXXIII

Chicago, December 20, 1930

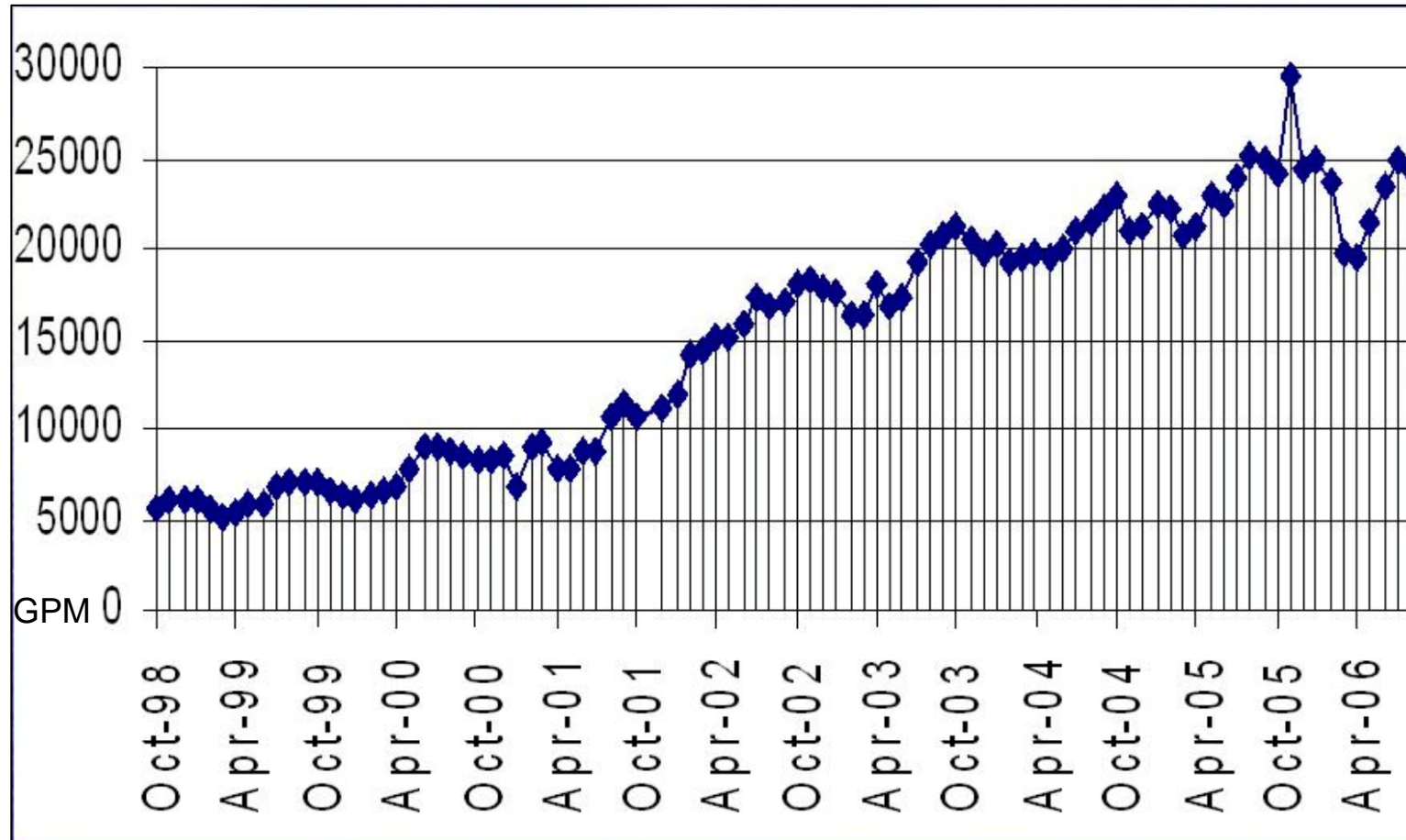
Number 26



*Clinton Point plant of New York Trap Rock Corp. looking over Hudson river. (1) Primary crusher. (2) Secondary crushers. (3) Scalping screens. (4) Main screening plant and storage silos. (5) Washer. (6) Silo for truck and rail loading. (7) Office, compressor room and shops*



# Average Discharge Rates (GPM)

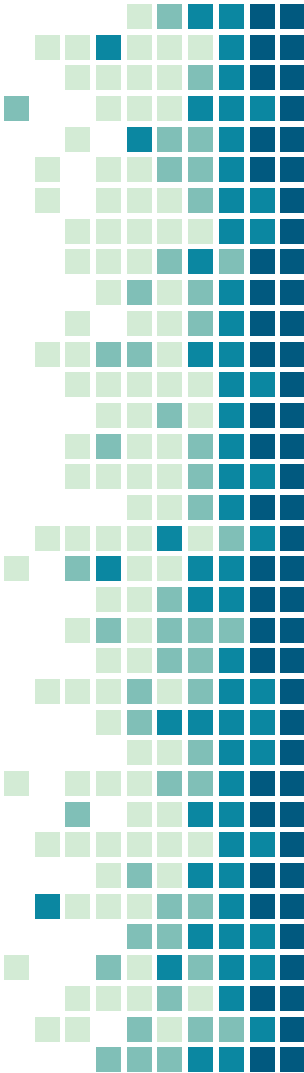




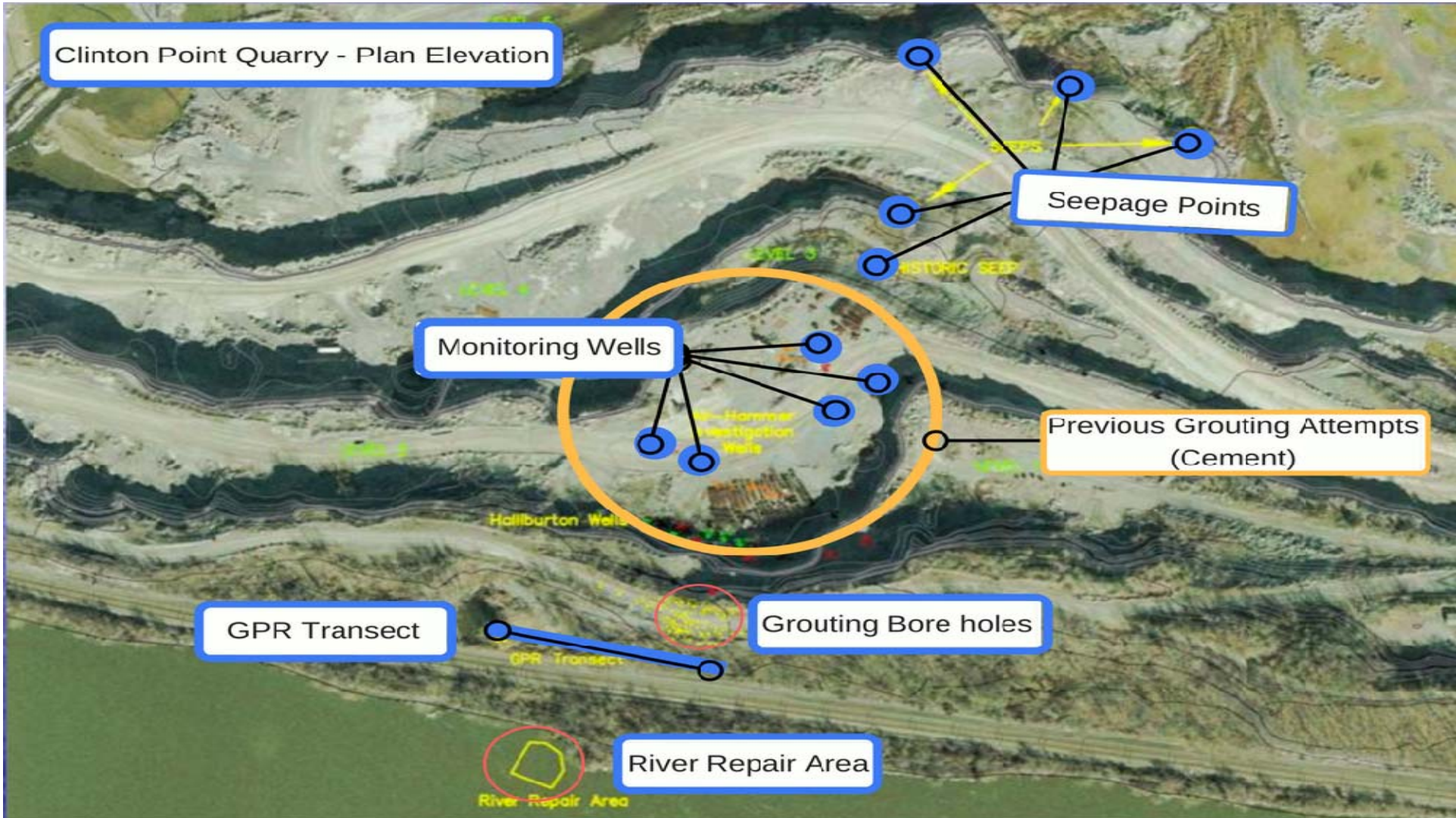




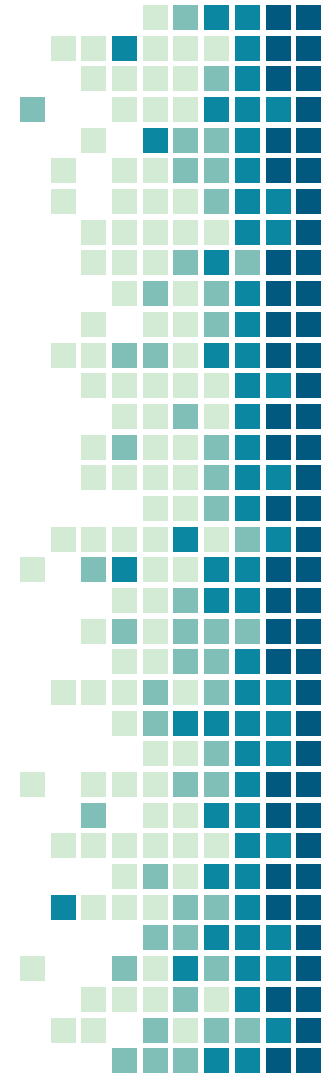
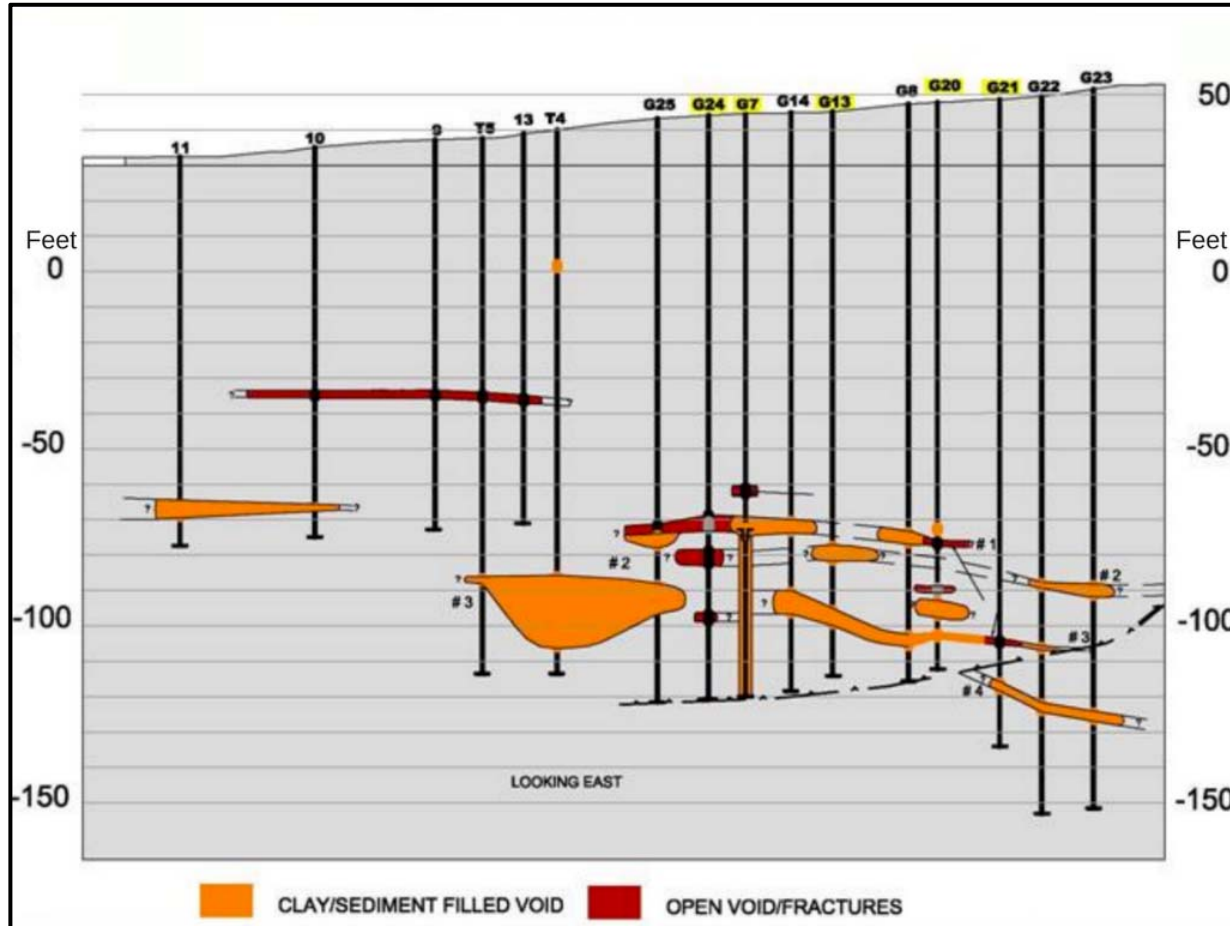
# Compounding Problems





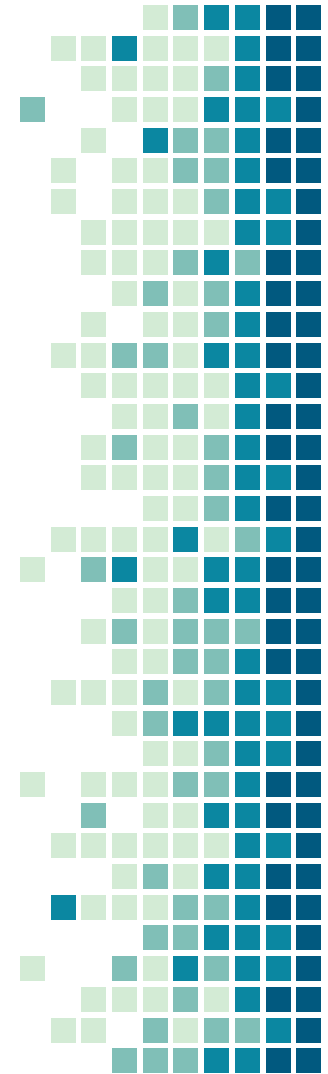
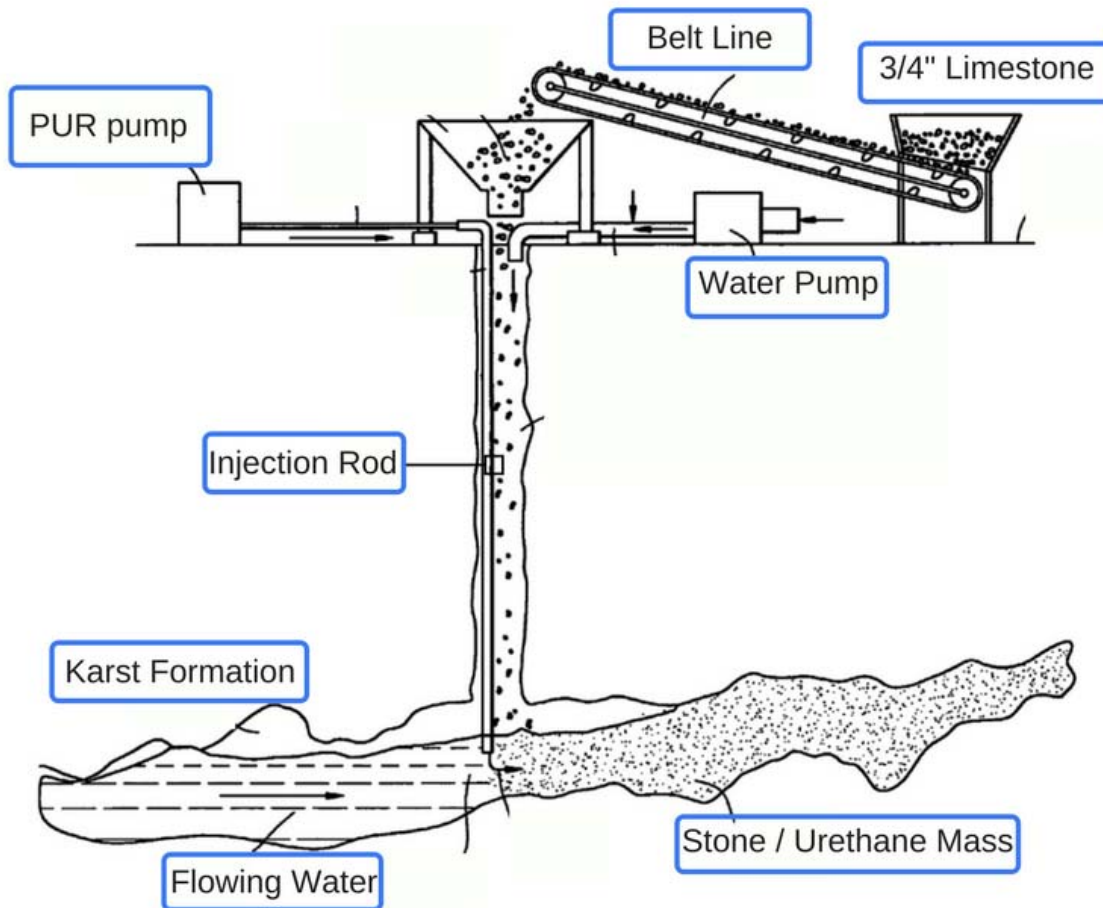


# Clinton Point Quarry - Karstic Features (Side Elevation)





# AquaStowing Setup

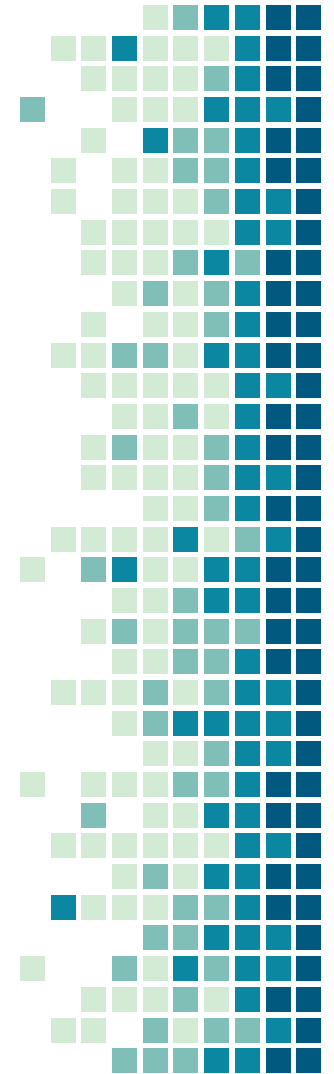






# Polyurethane Specs

- **Single Component – Moisture Activated**
- **Pre-Catalyzed**
- **Hydrophobic**
- **NSF-61 Approval**
- **Several Minute Reaction Time**
- **2-lb Density – Free Rise**
- **Flexible Foam**

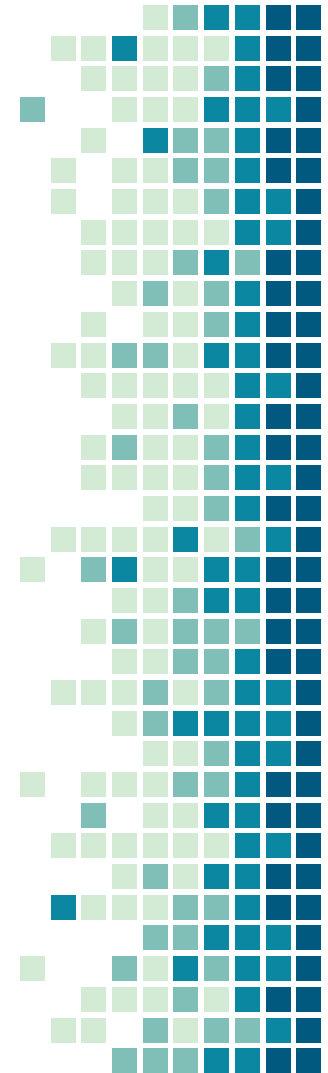


# AquaStowing in Action

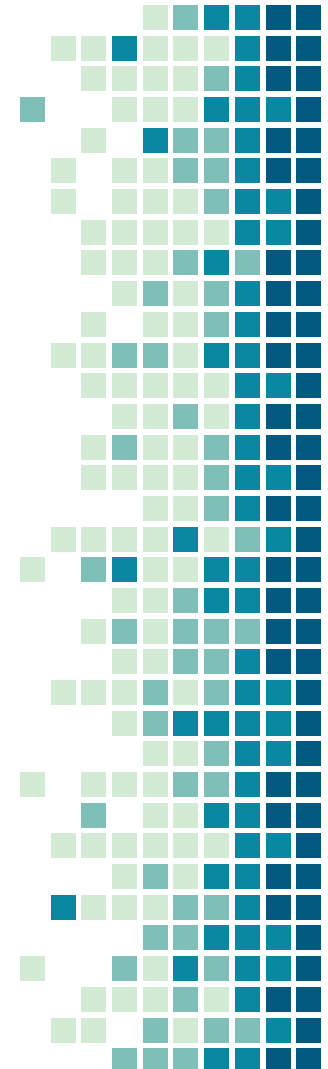
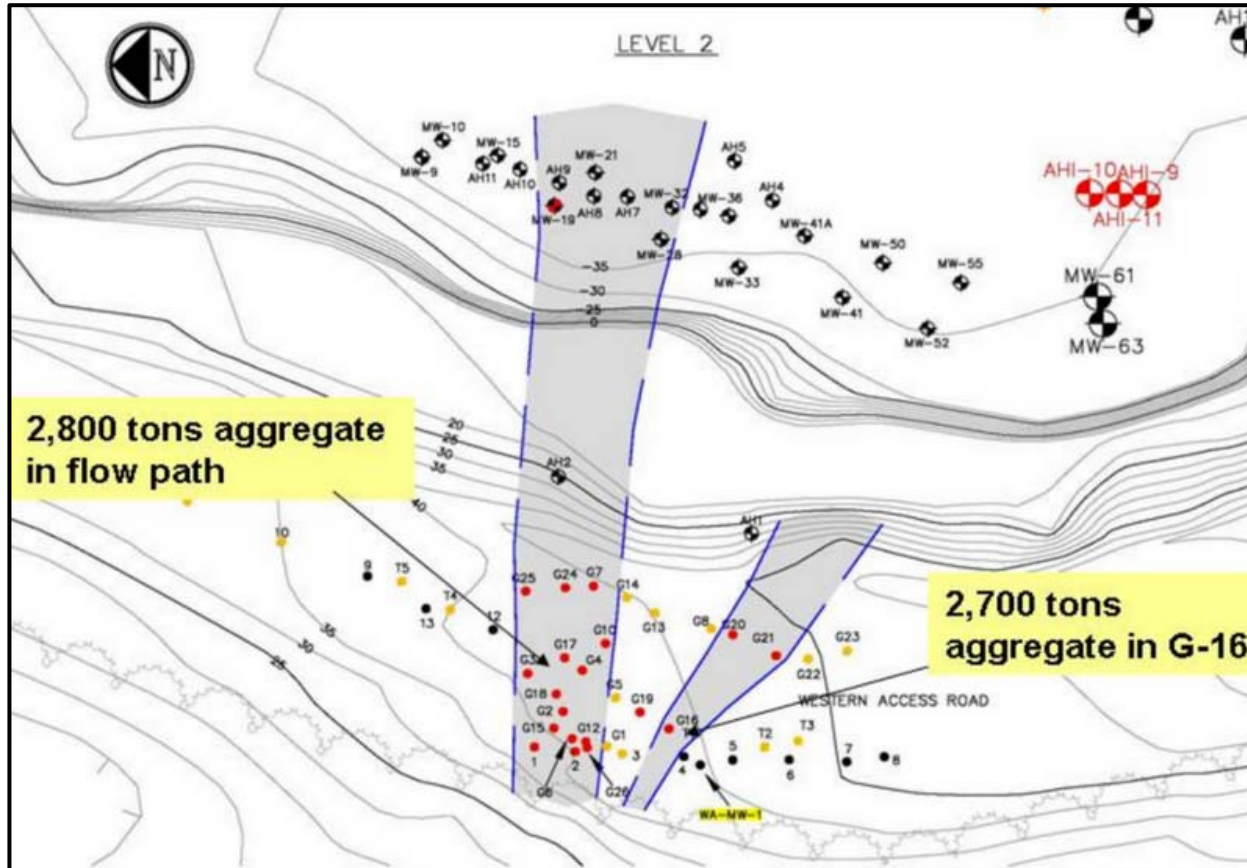
- **Gravel – ¾” Limestone**
  - Acts as a void filler
  - Agitates the void space
  - Becomes a carrier for the urethane
  - Increased density of the urethane ”plug”



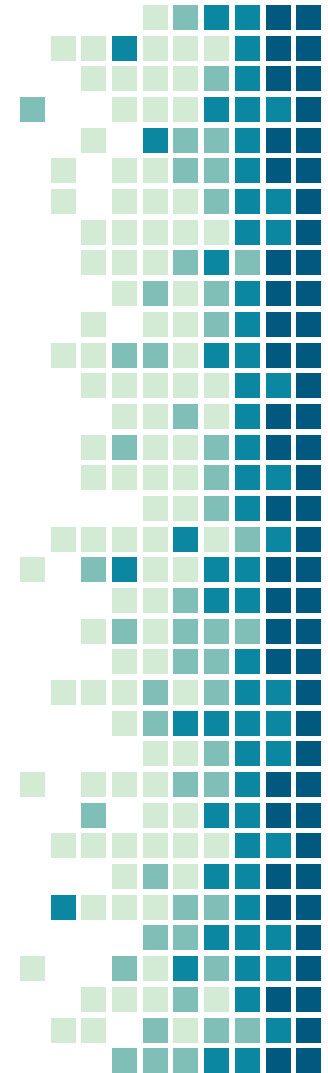
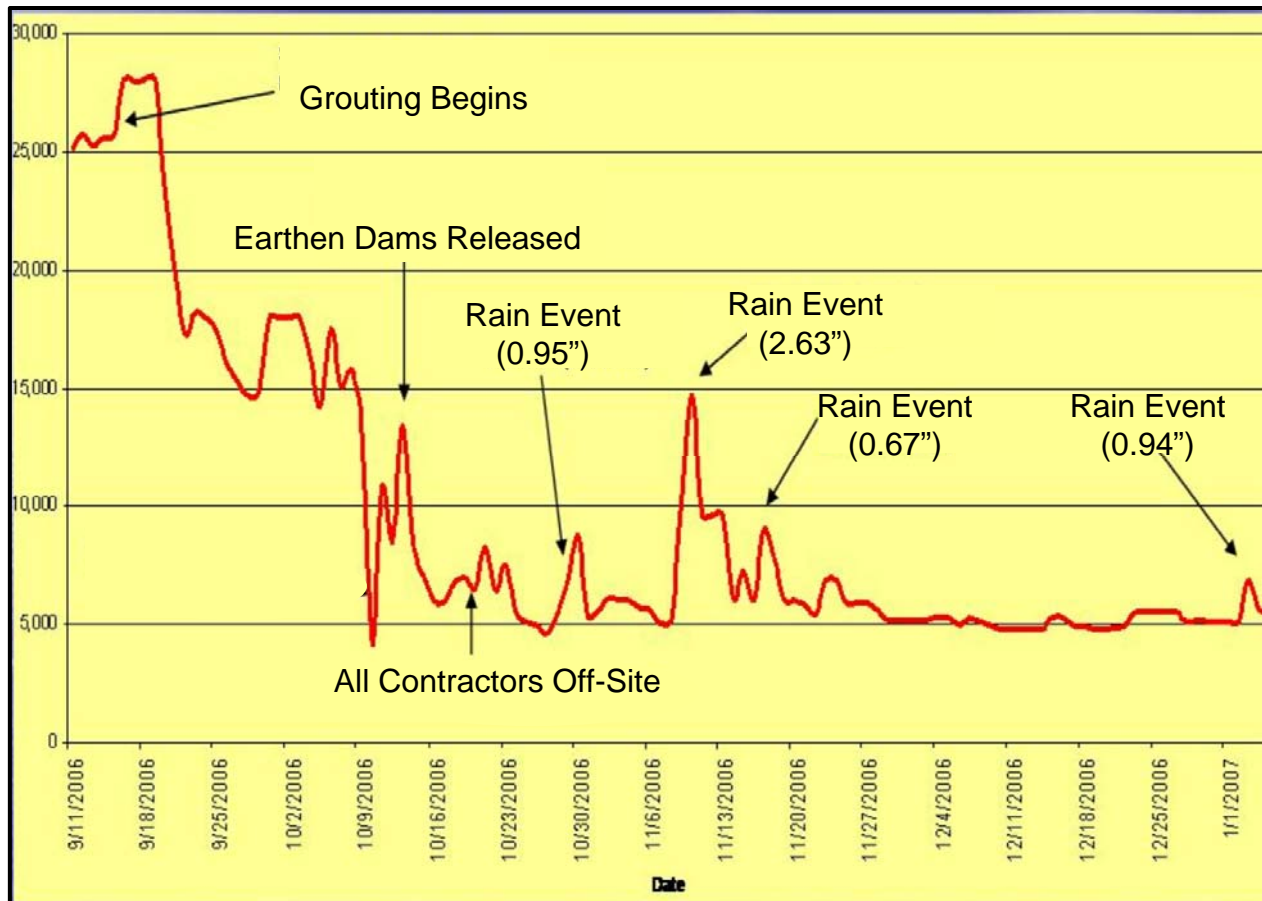
- **Single Component Polyurethane**
  - Becomes the binding agent
  - Migrates far from entry point
  - Highly expansive
  - Great adhesion to the strata



# Karst Flow Path



# DISCHARGE RATES







# THANK YOU!

## Any Questions?



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