
Tilcon New York, Inc.
Clinton Point Quarry

# Water Infiltration Mitigation Project

Gregory H. Sovas, P.E.
Spectra Environmental Group, Inc.

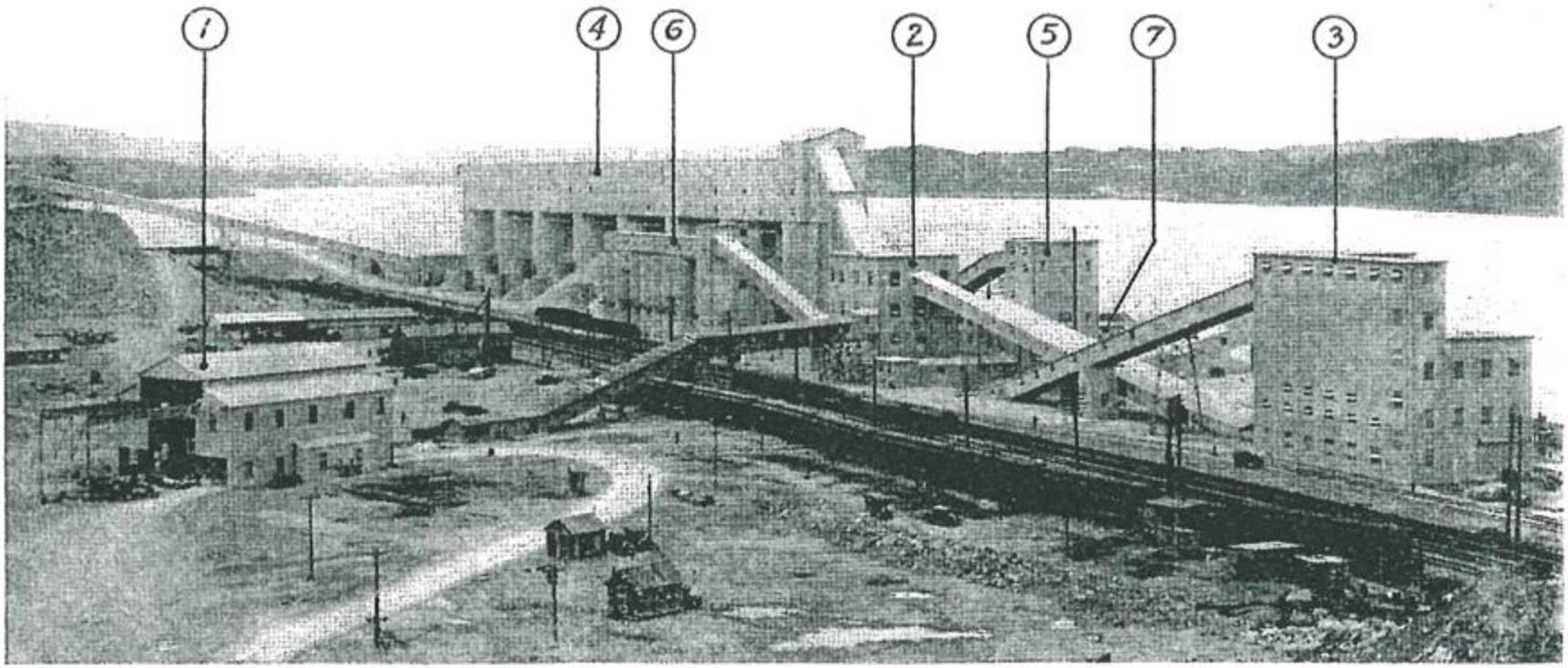
Jason C. Kappel, P.G.
Spectra Environmental Group, Inc.

New York State DEC
Mined Land Rec. Conference
Syracuse, New York
March, 2007

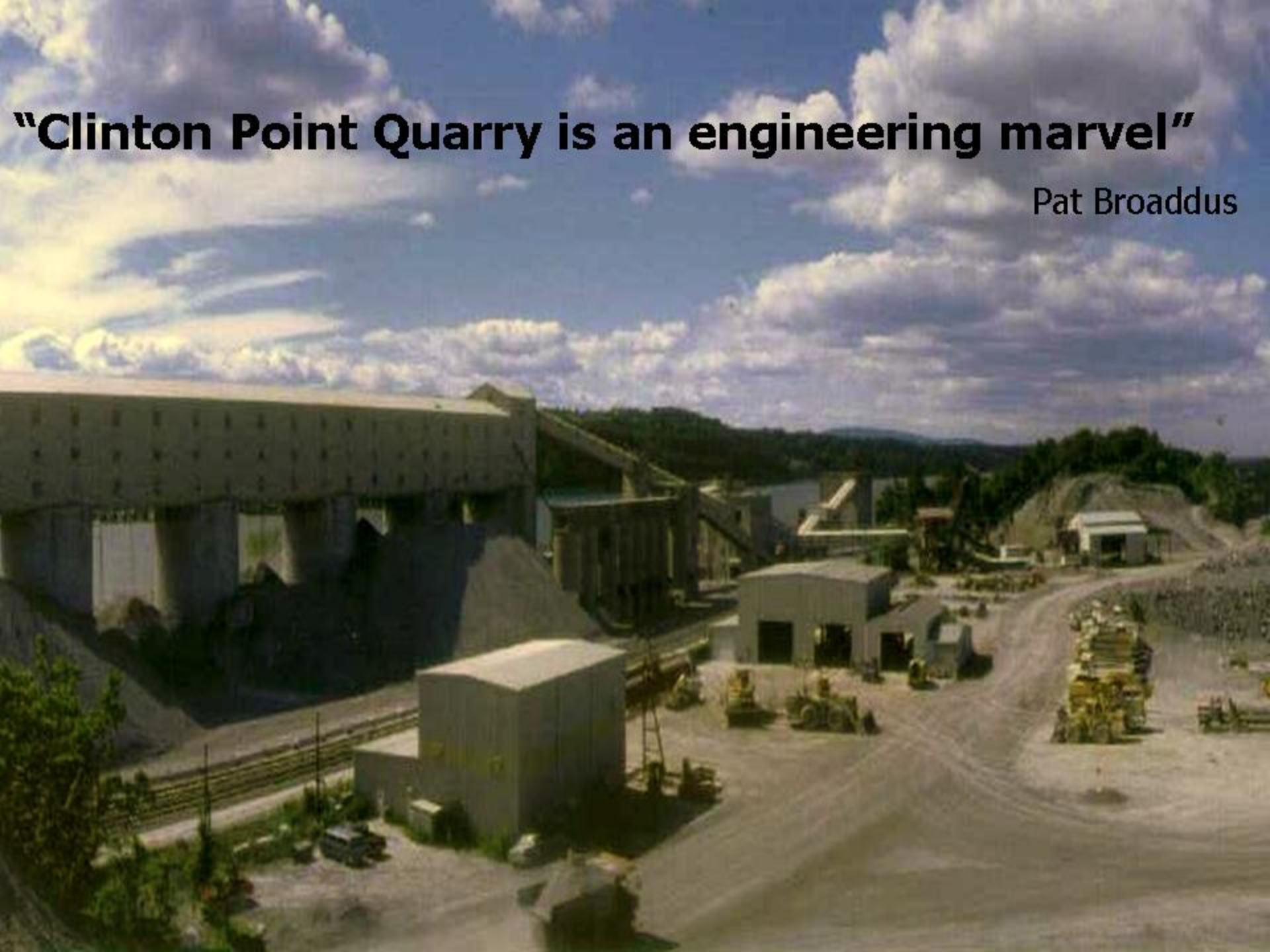
# Rock Products

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*

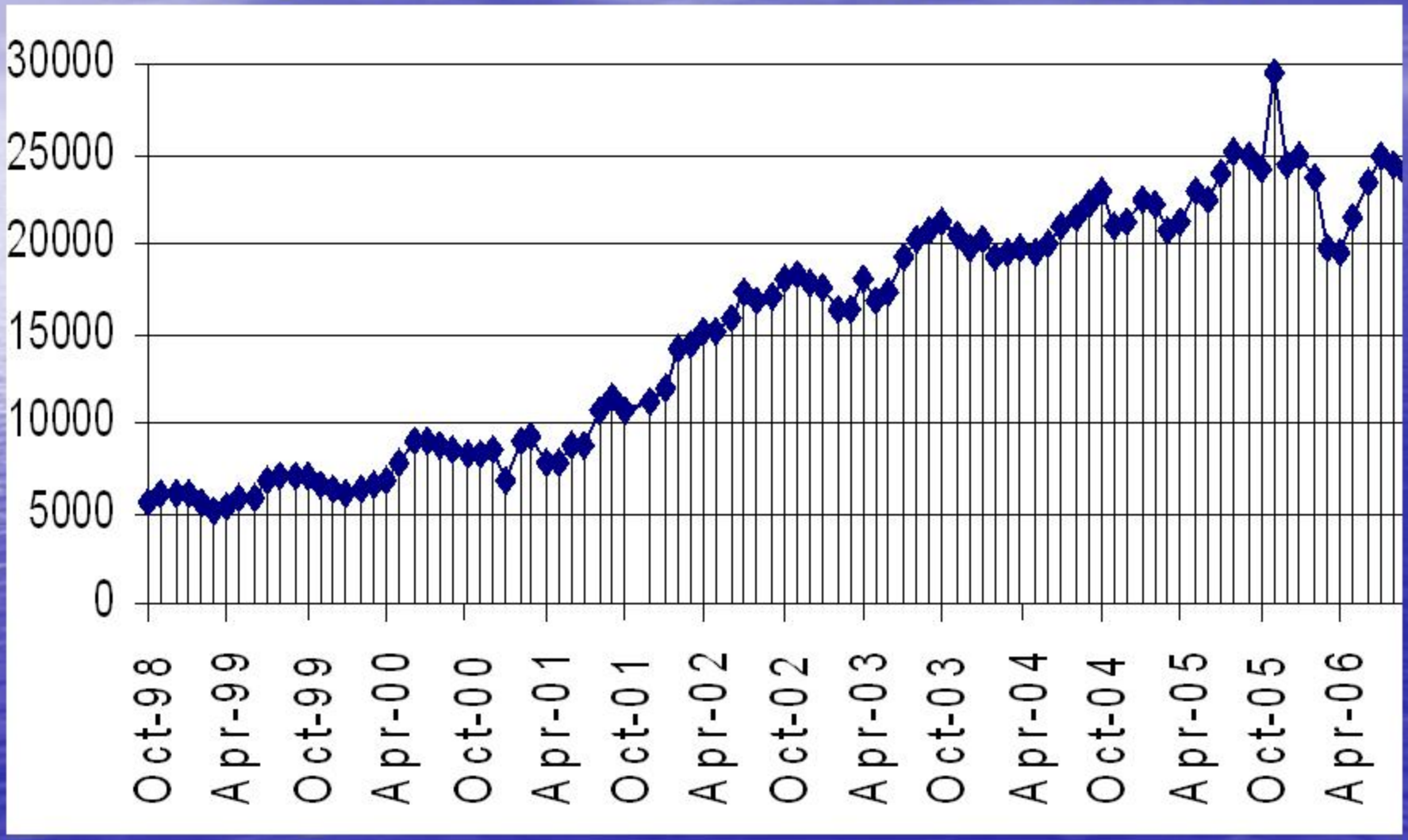

"Clinton Point Quarry is an engineering marvel"
Pat Broaddus


HANAN

# Previous Efforts To Mitigate Water Infiltration

| Date | Contractor | Work Items |
|---|---|---|
| 10/87 | Budnik | Hydrogeologic study |
| 11/88 | Halliburton | Quarry west wall grouting – Level 2 |
| 5/96 | Cont. Placer | Hydrogeologic report, drill & aggregate fill |
| 6/96 | Halliburton | Drill and grout quarry west wall |
| 6/97 | Hager-Richter | Geophysical survey, quarry to river |
| 6/98 | LMS | Dye study river to quarry |
| 7/98 | Drake Assocs. | Fathometer survey, side scan sonar, video river bottom, place grout bags |
| 9/98 | Hayward Baker | Benseal and Holeplug grout in quarry wall |
| 10/98 | Drake Assoc. | Blue tarps, tremie pour bentonite concrete |
| 9/01 | Drake Assoc. | Emergency repairs in river using grout bags |

# Tilcon New York Clinton Point Quarry
# Average Monthly Dewatering Rate (GPM)




Standing Water on Floor

# High Velocity - High Volume Infiltration Into Quarry Leads to Operational Constraints

- Mine Planning
- Quarry Development
- Higher Operating Costs
- Access Limitations
- Managing The Elements

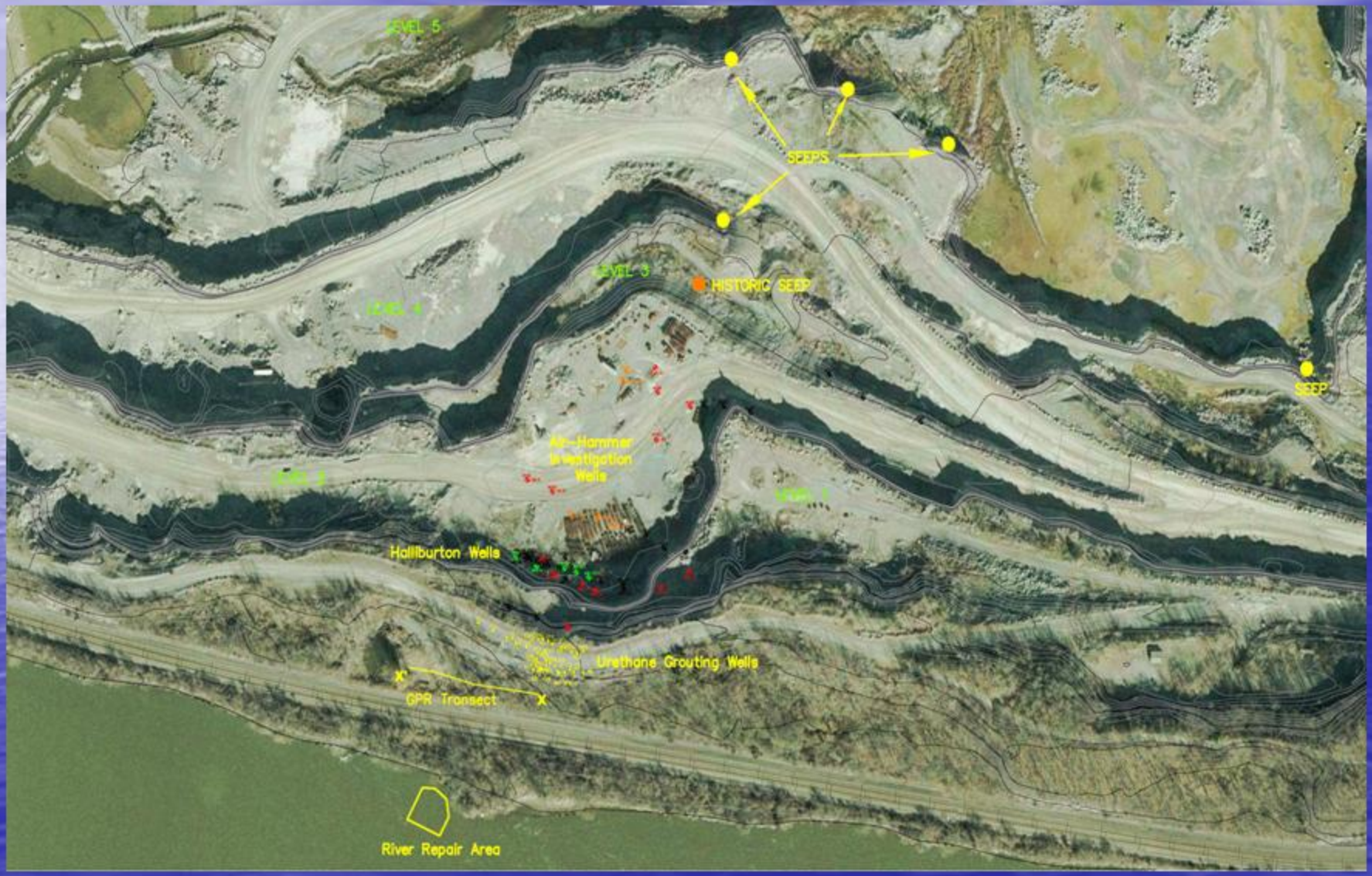
# Understanding the Problem

Two-Pronged Geologic Investigation

- River

- Quarry

# Investigation Site Location Map



# River Investigation Components

- Side scan sonar, bathymetry, magnetometry
- Historic dive video review
- 2004 dive investigation
  - Assess condition of previous repair
  - Determine why previous repair failed
- Geotechnical investigation (river bottom)

# 2004 Well Video

# 1998 Dive Inspection Video

# Quarry Investigation Components

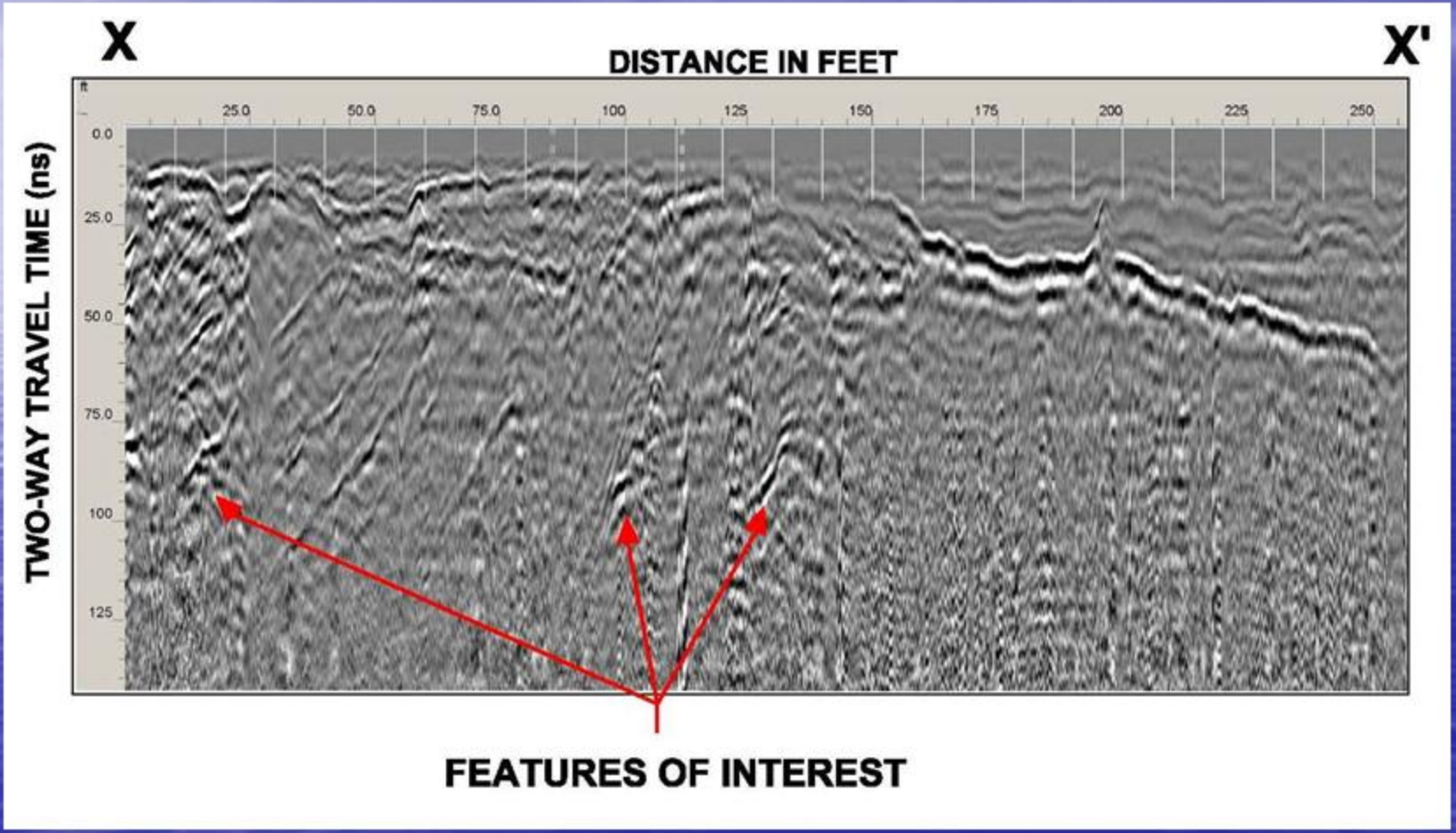
- Structural geology mapping
- Ground Penetrating Radar (GPR) Survey
- Corehole drilling western perimeter of quarry

# Geologic Investigation - GPR SURVEY

## Identified Features of Interest in the Subsurface

# Tilcon New York Clinton Point Quarry
# 2005 GPR Data

## Geologic Investigation - GPR Survey Data



# Geologic Investigation Drilling Program

- Confirmed GPR data
- Identified three (3) karst zones
- Open and sediment-filled karst
- Intercepted two (2) distinct infiltration paths
- Confirmed karst zone connections
- Scale of karst features – up to 20 ft.

# Corehole 2 Video Log

# Sometimes you get lucky...

Large Karst Feature - East wall of quarry.  Infiltration pathway?

# Remedial Solution Design Components

- Assimilate data and identify target areas
- Study previous mitigation efforts
- Understand reasons for failure of previous repairs
- Assess new techniques and technologies

# Remedial Solution Final Design Two Phase Strategy

- *Phase I* – River-based plug and seal to reduce velocities
  - Lightweight aggregate
  - Geosynthetic liners
- *Phase II* – Land-based grout of karst zones
  - Drill series of grout wells
  - Inject sized aggregate followed by polyurethane grout

# State and Federal Permit Requirements

## Phase I – River-based Remedial Repair

- NYSDEC Article 15 Permit/Water Quality Certification
  - Recognized sensitive species
  - Accepted limitation on dates of river activity
- U.S. Army Corps of Engineers
  - Coverage under Nationwide Permit #3
- NYS Office of General Services
  - Small work area, issued Letter of Approval
- NYS Department of State
  - Federal and State CZMA consistency

## Phase II – Land-based Karst Grouting

No Permits Required

# Why Lightweight Aggregate?

Satisfies four main design criteria:

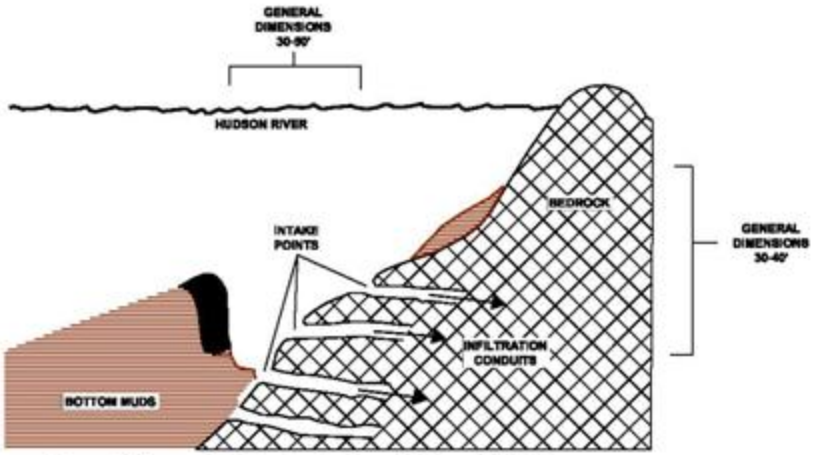
- Reduces permeability
- Entrained in flowing water
- Remains permeable
- Removable

# Lightweight Aggregate Is…

- Is less dense than conventional limestone or dolomite aggregate
- Has a specific gravity roughly 60% of conventional dolomitic aggregate
- Will flow with infiltrating water into and under the former repair area
- Is durable and resistant to abrasion and degradation in water

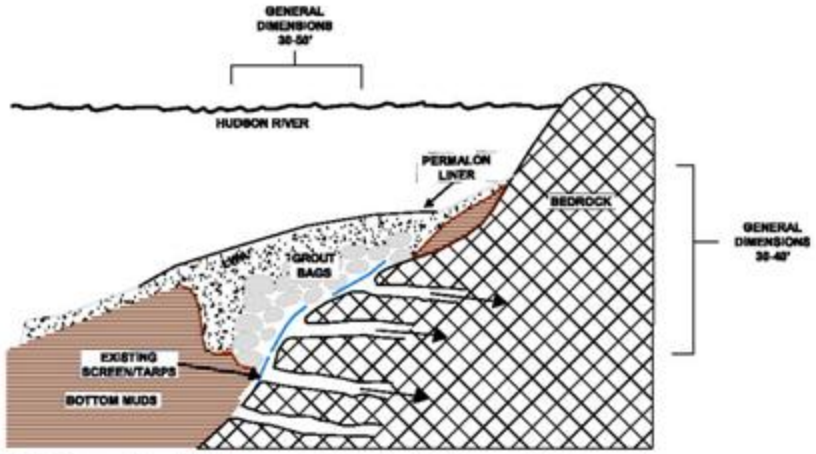
# Phase I - River-based Plug and Seal Remedial Repair

A



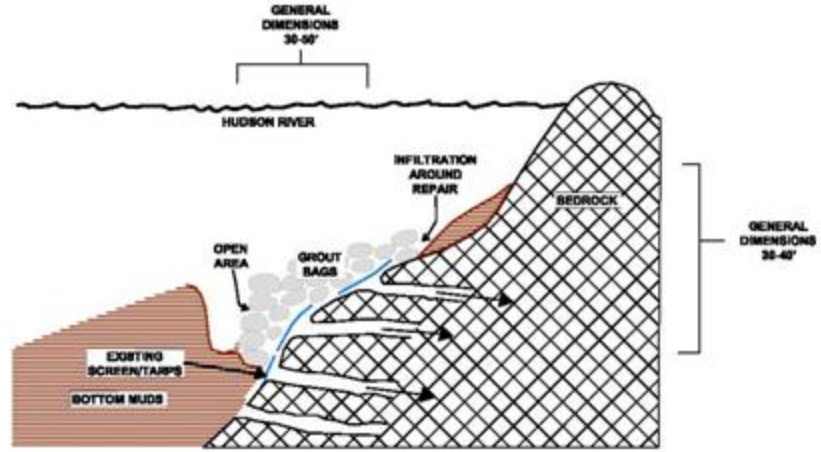

Conditions Prior to Repair in 1998

C



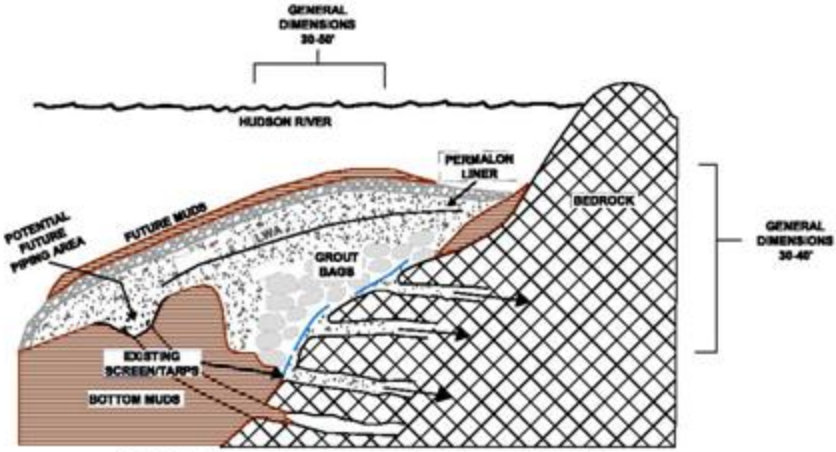

2006 Repair - Filling and Installation of Permalon

B



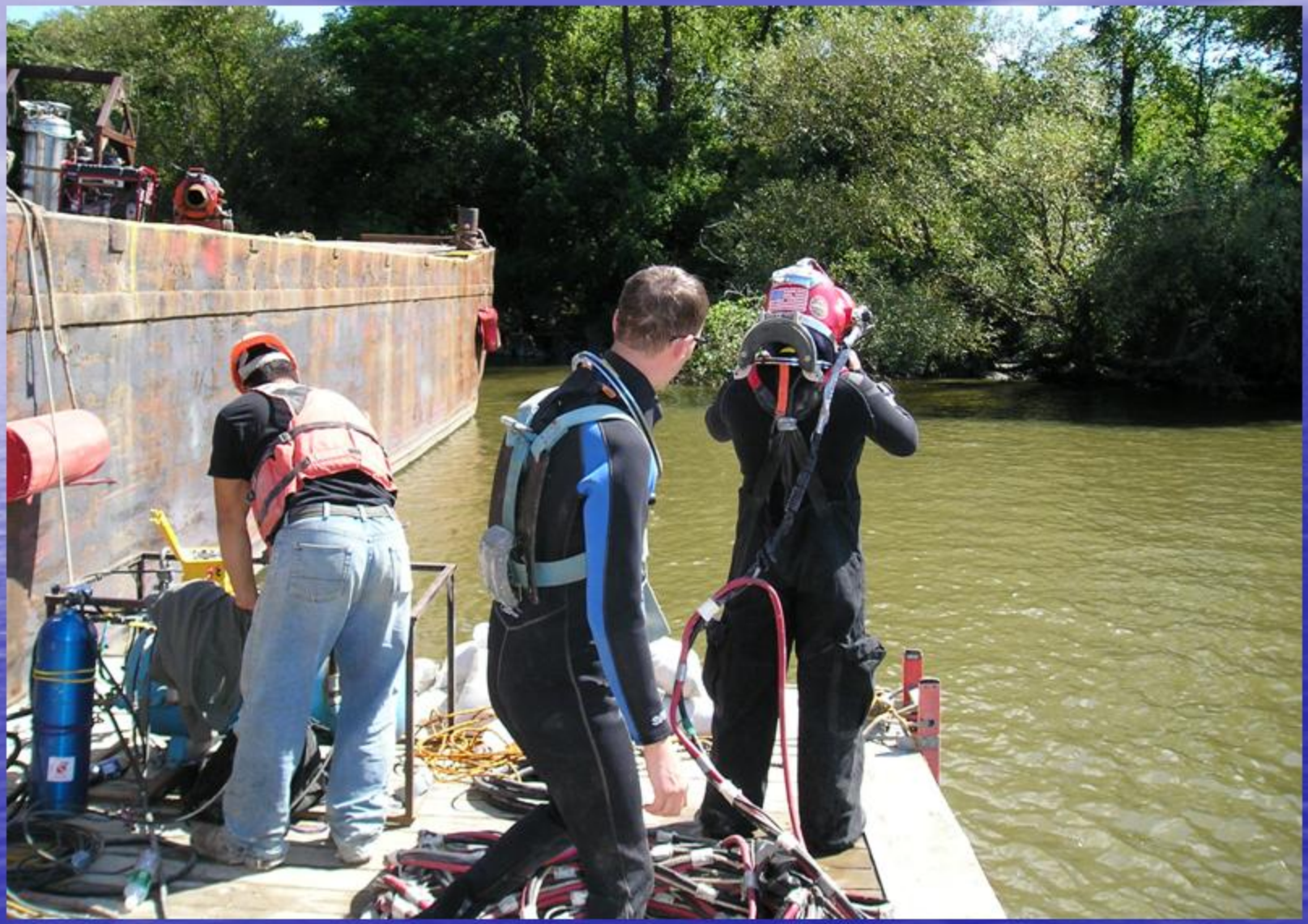

Initial Repair Effort and Subsequent Failure (1998-2001)

D




2006 Repair - Completion of LWA and Dolostone Blanket

# Dive Contractors Preparing for a Dive



# Buoys Mark Infiltration Points

# Marine Contractors Placing Lightweight Aggregate

# Marine Contractors Placing Geosynthetic Liner

Tilcon NY

Spectra Environmental Group

# Grout Well G6 Video Log – After River Work

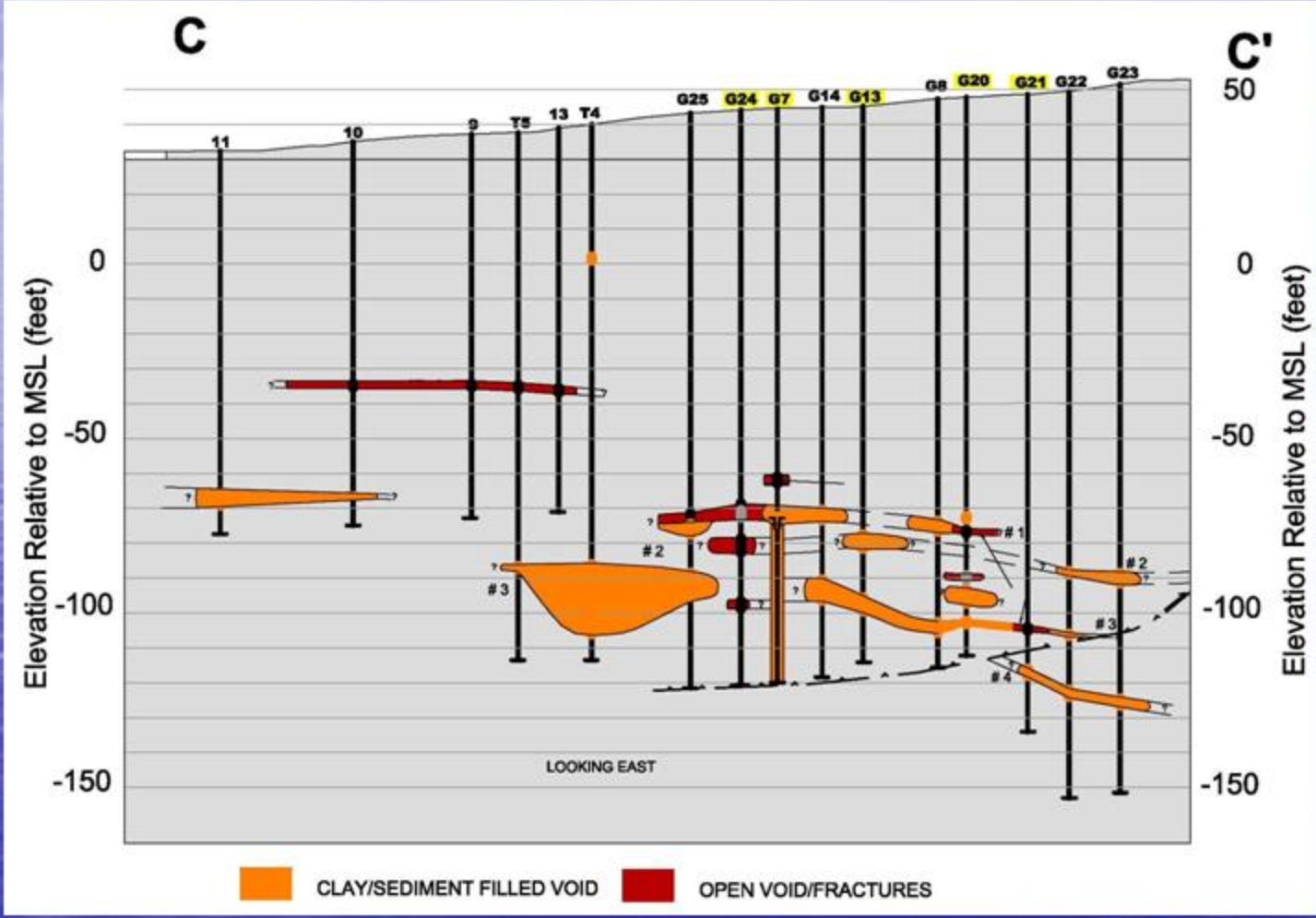
# Phase I – River-based Remedial Repair Summary

# Phase I – River-based Repair Summary

- Target zone reconnaissance – locate and mark all holes
- Placed 2,800 tons of lightweight aggregate
- 10,000 sq. feet of geomembrane
- Three to four feet of mixed aggregate blanket over geomembrane
- 40% initial reduction in infiltration volume

# Phase II - Land-based Grout Remedial Repair

Relationship of Open and Sediment-Filled Voids



# Why Polyurethane Grout ?

Satisfies three main design criteria:

- Rapid set time – reacts and sets in minutes
- Large voids – filling capacity – 20:1 expansion ratio
- Pliable once cured – resistant to blast vibrations

# Polyurethane Grout Is…

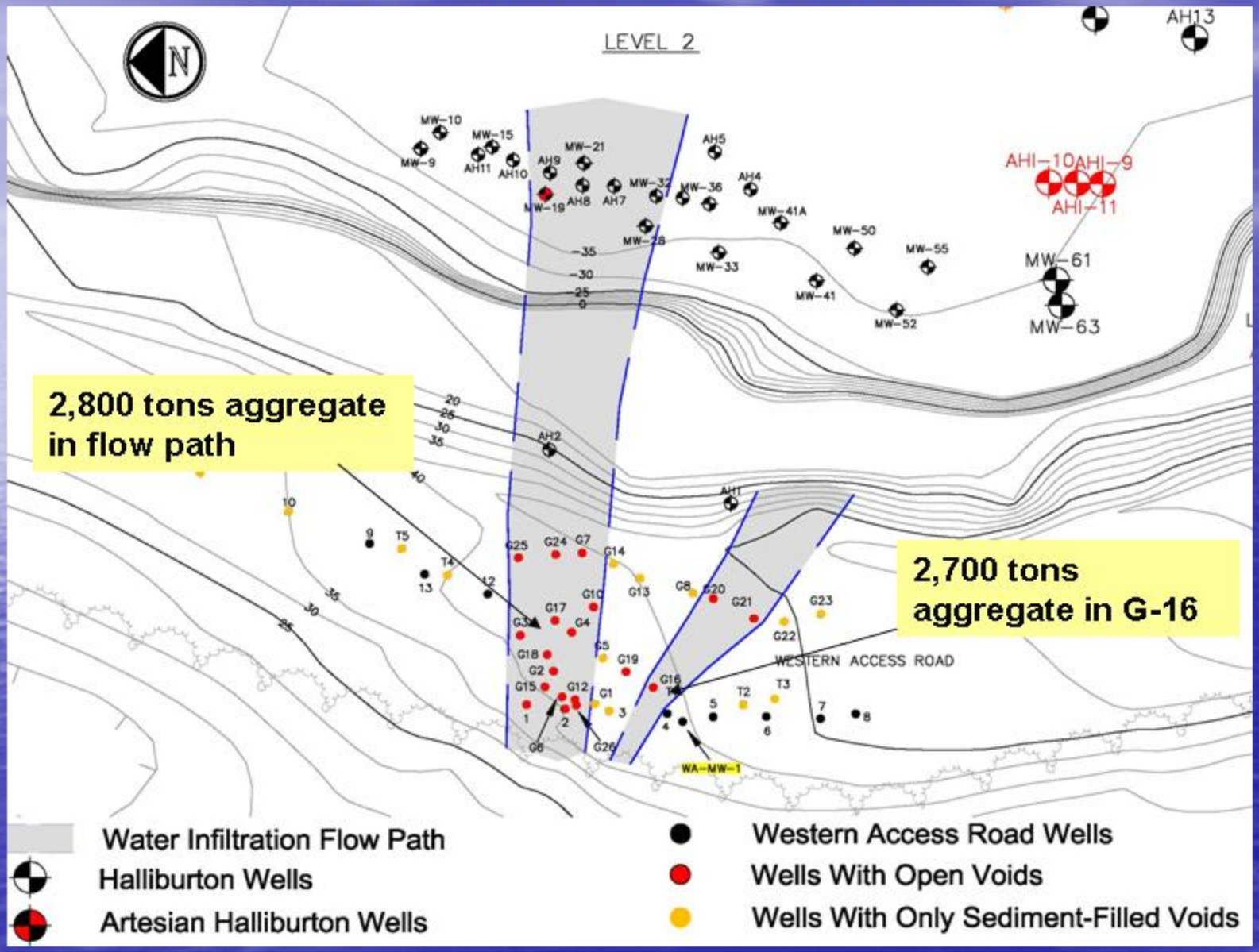

- NSF approved for drinking water
- Hydrophobic
- Rapid set time in water
- Durable and will not degrade in subsurface
- Easy to install
- Relatively expensive

# Aggregate Feed Conveyor

# Aggregate Feed Conveyor and Water Wash

# Polyurethane Grout in Grout Injection Well

# Water Infiltration Flow Paths



# Phase II - Land-based Grout Repair Summary

Groundwater response to grout injection

Work Performed/Materials Placed

- 31 wells drilled for grouting
- Larger karst zones than anticipated
- Identified three distinct karst zones separated vertically
- Two distinct infiltration flow paths
- 17 wells grouted
- 5,500 tons of sized aggregate
- 133,000 pounds of urethane grout

# Project Management

- Narrow window of opportunity
- Selected four contractors
  - Abyss Marine Construction - divers
  - Feeney - work barge and crane
  - ADT - drilling contractor
  - Sub-Technical - grouting contractor
- Developed project schedule
- Team effort

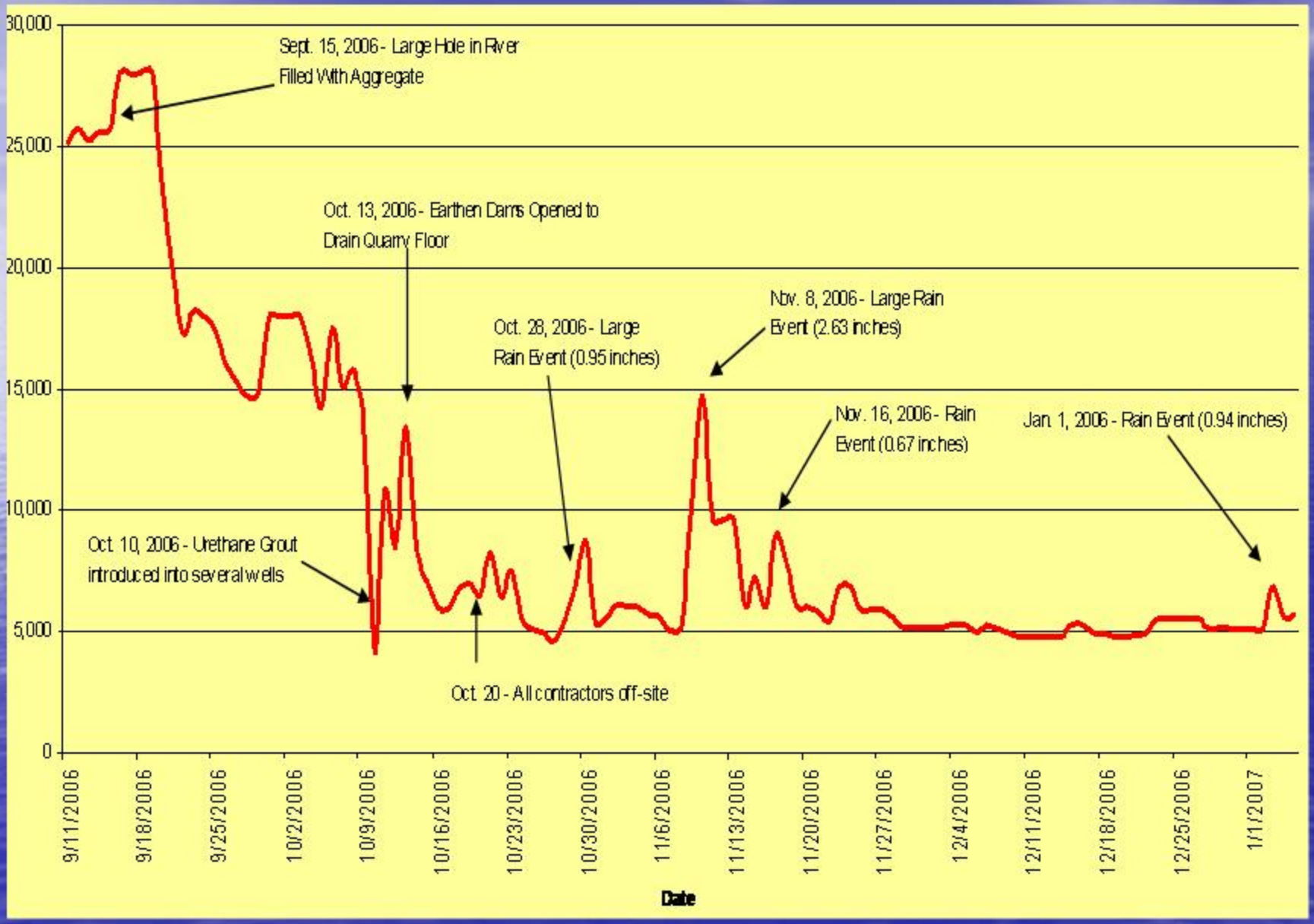
# Timeline

- July 20th - Receive NYSDEC Permit
- August 3rd – Receive ACOE Permit
- August – Solicit proposals & select vendors
- August 29th – Final Cost Estimate
- September 7th – ADT mob
- September 11th – Abyss & Feeney mob
- September 20th - Sub-Technical mob
- October 13th – Phase I complete
- October 20th – Phase II complete

# Mitigation Results

- Dewatering Discharge Rate Reduced to 5,000 gpm
- One Pump Cycling – approx. 20.5 hour/day
- Four Pumps Off-Line
- No standing Water on Quarry Floor
- Precipitation Events Managed More Quickly
- Greater Access to Quarry Floor

# Average Daily Discharge Rate (GPM)

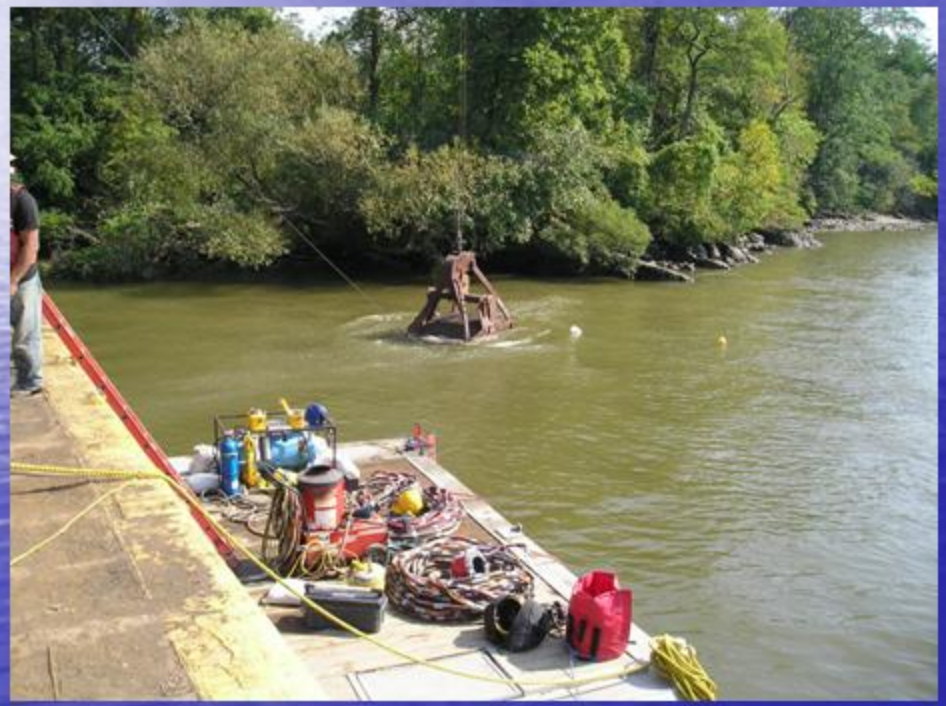


# Water Infiltration Remedial Construction Results (cont.)

Cost Recovery

- Electrical savings through January 2007
  - **2,904,166 kwh**
  - **$272,091**

# Post Repair Long-term Monitoring Strategy



River Repair Area

- Follow-up dive investigations – summer 2007
- Document changes
- Assess need for maintenance

# Post Repair Long-term Monitoring Strategy

Quarry and Grout Repair Area

- Monitor dewatering discharge rates – pump run time
- Monitor groundwater levels across repair area –dataloggers
- Limit blasting in repair zone
- Reconsider long-term mine plan

# Tilcon New York Clinton Point Quarry

## A DRY QUARRY FLOOR!