

West Fork Upper Battle Creek Diversion

Jason H. Thom, P.E.



Agenda



Project Introduction



Remote Bidding



Information Management



Drones



Automated Sensors



Large HDPE Pipe



Future of Construction

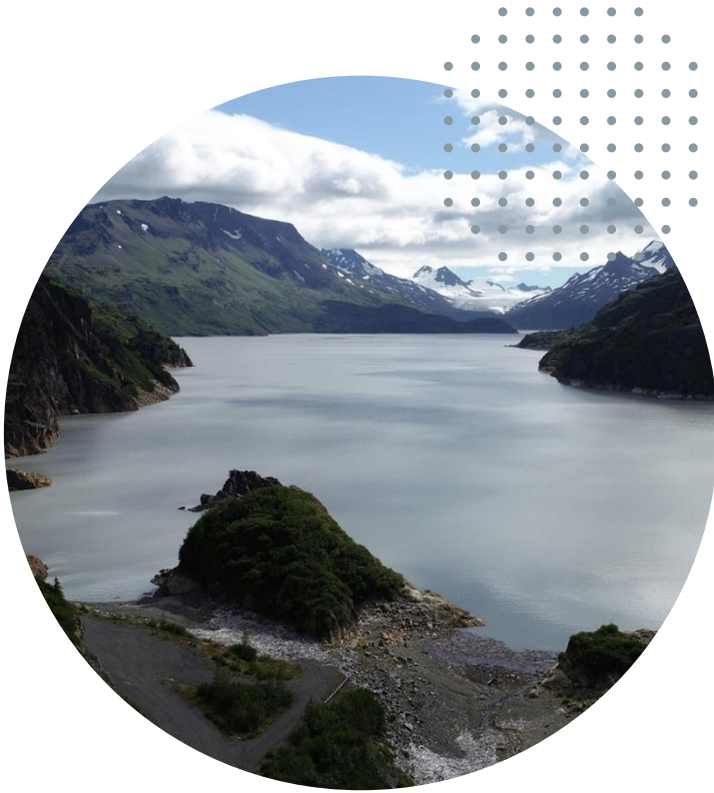


Project Introduction

Most everything
in Alaska is...

BIG

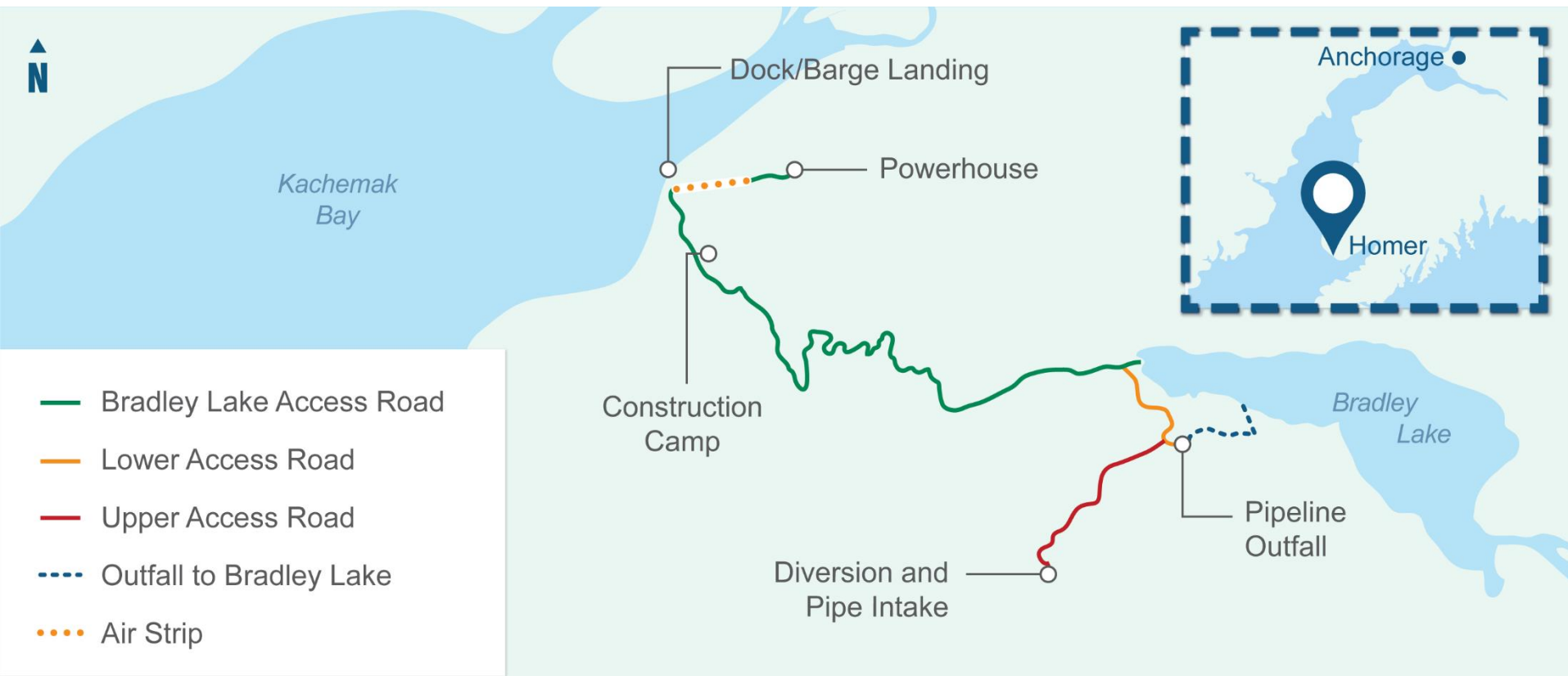




Bradley Lake Hydroelectric Plant

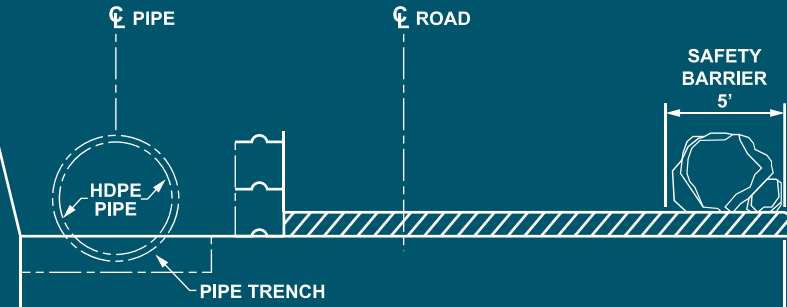
- Originally constructed between 1989-1991
- Alaska's largest hydroelectric facility - 120 MW
- Provides 10% of the Railbelt Area electric needs
- 25% of Alaska's hydroelectric power
- ~20-minute plane ride from Homer

Project Location

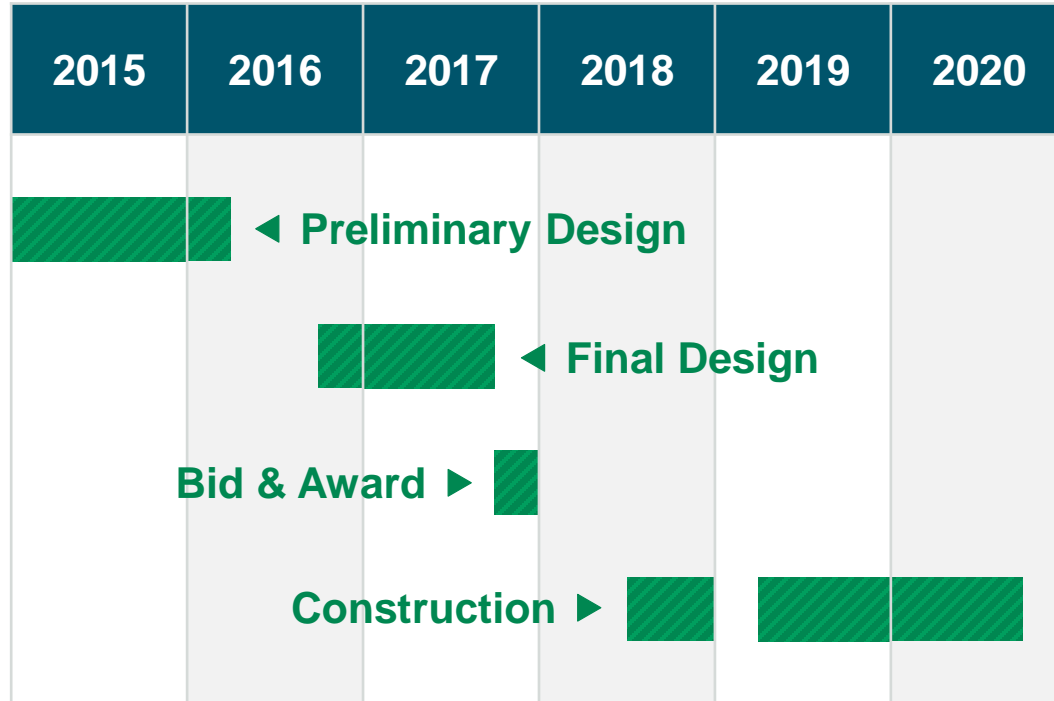


Project Overview

- 3 miles of new roads
- 2 miles 63" HDPE pipe
- 1,000 CY diversion cast-in-place concrete
- Large (96") Fiber Reinforced Pipe (FRP)
- 250,000 CY of rock excavation (blasting)
- 150,000 CY embankment and sub-base
- 5,000 Ecoblocks (pipe containment blocks)



Project Timeline/Challenges



Complex owner



Rugged and inaccessible site



Alaska weather



Regulatory approvals (FERC)



CREBS funding



Remote Bidding



Managing Unknowns



Inaccessible



Costly geotechnical investigations



Limited communication



Alaska weather



Cost variability – no turning back

Design Considerations



- Manage client expectations
- Large contingencies
- Decisions on the spot
- Improved communications
- Ample construction time
- Material delivery logistics
- Adaptable components
 - *Wire-faced MSE walls*
 - *Micro-piles*
 - *Rock bolts*
 - *Rock netting*



Digital Information

- Digital renderings
- Google Earth KMZ
 - *High resolution aerial*
 - *Alignment/footprint*
- LiDAR topography
- Surface models and templates
- Limited geotechnical data

Pre-Bid Video Placeholder



Information Management



Web-based CA Platform

- Contract/change management
- Electronic submittals/RFIs
- Field reports
- Communications
 - *Transmittals*
 - *Emails*
 - *Meeting minutes*
- Access to information
 - *Internal*
 - *Owner*
 - *Contractor*





Field Reporting

- Smart-device compatible
 - *Field notes with photos*
 - *Dictation transcription*
 - *Documents on tablet*
- Automatic synchronization to DOWL's server – near real time
- Automated report generation
- Office staff support (Controller)

Information Management

- Multiple databases
- Photo log
- Submittals, RFIs, etc.
- Filtering, not searching

Modify a Daily Report

Report Date: Sunday, August 16, 2020 ID: 00748

Created By: John Stout (DOWL) Status: Final

To: Bryan Carey (Alaska Energy Authority); CC: Ron Rebenitsch (Energy Engineering, Inc.);

Form Template: 1_WFUBC_DailyRpt

Observations Weather Subcontractors Internal Personnel Visitors Equipment **Preview** Email Log (0) Supporting Documents (0) Related Items (5) Change Log

Select in Explorer

 **Daily Report**
813 W. Northern Lights Blvd., Anchorage, AK 99503

PROJECT: Battle Creek Construction Services
1136.90070.01 DATE: 8/16/2020

AUTHOR: John Stout DAY OF WEEK: Sunday

TO: Bryan Carey Alaska Energy Authority

COPIES: Ron Rebenitsch Energy Engineering, Inc.

Keywords:

☐ Next Action: View Form OK Cancel Help



!		From	To	CC	Subject	Sent ▼	Size	Attachments



Drones



Drones

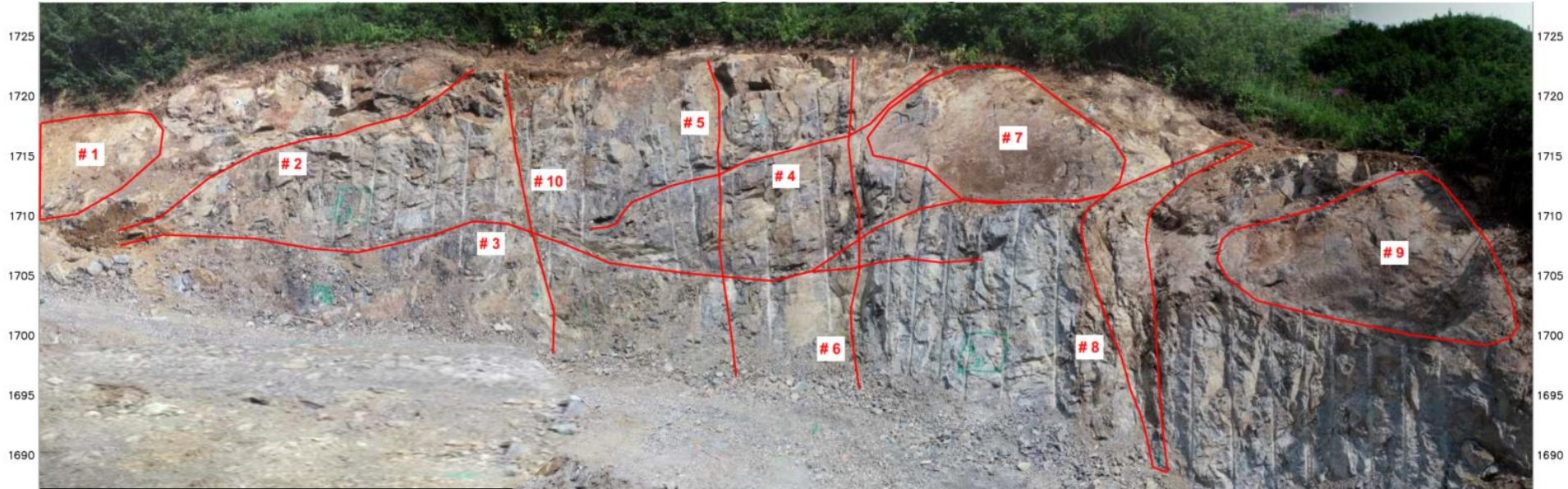
- Progress records
- Geologic mapping
- Rock stabilization
- Quantities
- Construction changes



Progress Records

- Weekly progress flights
- Current ground surfaces
- Production records
- Grade verification
- Pay quantity verification
- Road design changes

Geologic Mapping





2a

Road shoulder

Loss of road section

2b

Rock Stabilization



2a

2b

Rock Stabilization

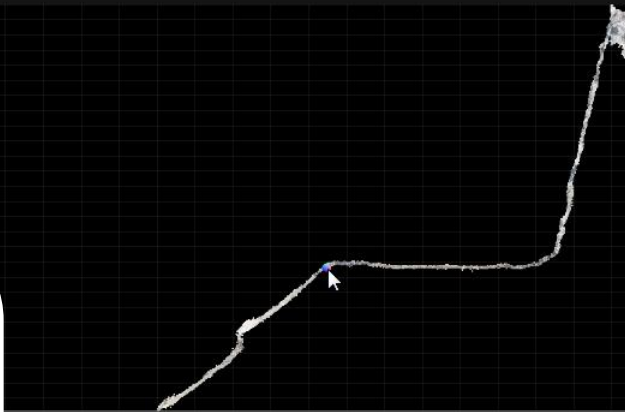


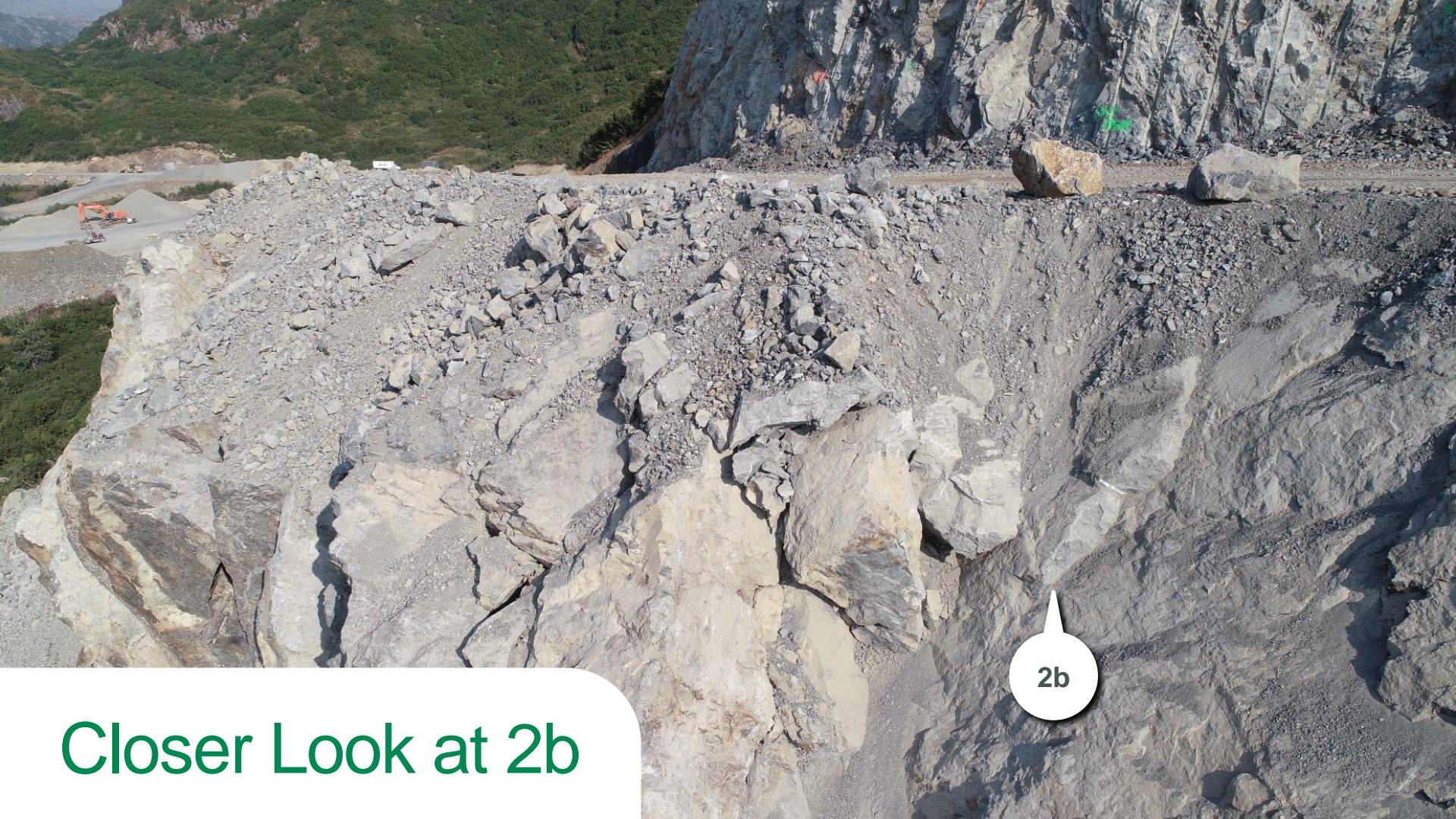
ght profile

Number of Points: 24,365

38	x	1479256.75
36	y	2096738
34	z	1205.32 ft
32	color	196, 196, 199, 0
30		
28		
26		
24		
22		
20		
18		
16		
14		
12		

3D Orthophoto





2b

Closer Look at 2b

Geologic Evaluation





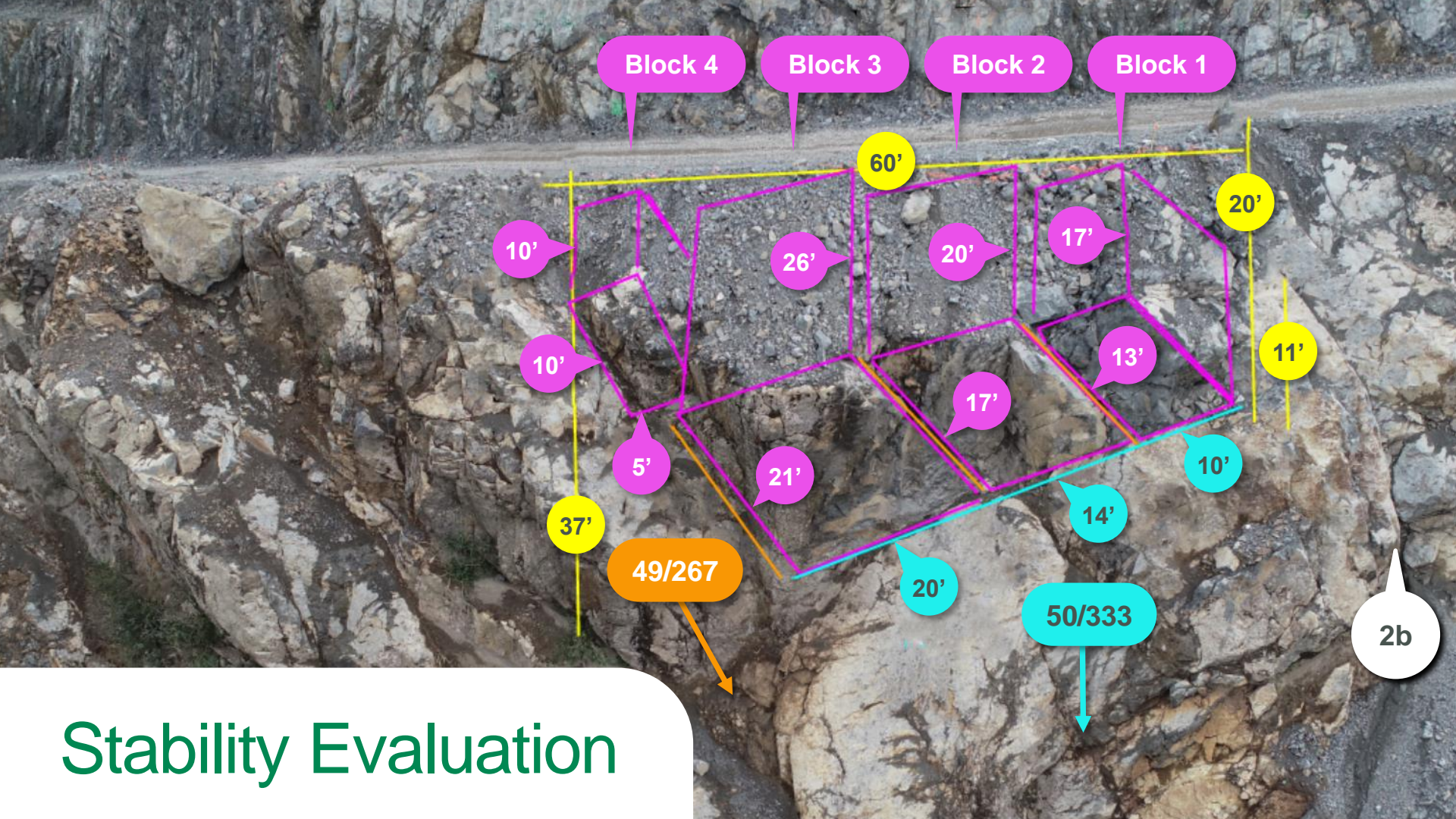
Joint Set 4

The image shows a rock face with three distinct joint sets highlighted by colored lines. Joint Set 4 is a horizontal line at the top. Joint Set 1 is a large red polygon covering the central and lower-left portions of the face. Joint Set 2 is a cyan polygon in the lower-right corner. A green polygon is also present in the center-right area. A yellow line runs horizontally across the top of the rock face.

Joint Set 1

Joint Set 2

Geologic Evaluation



Stability Evaluation

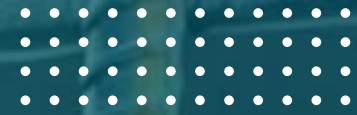


A photograph showing a cross-section of a rock stabilization project. The top part of the image shows a curved rock face with a dark, textured stabilization layer applied to it. Below this, a layer of gravel or crushed rock is visible. The bottom part of the image shows a large, light-colored rock mass with a dark, textured stabilization layer applied to its surface. The rock mass is surrounded by a layer of gravel or crushed rock. The image is labeled with '2a' in a white circle on the left and '2b' in a white circle on the right.

2a

2b

Completed Stabilization

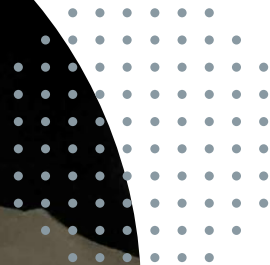


Automated Sensors

Concrete Temperature Sensors

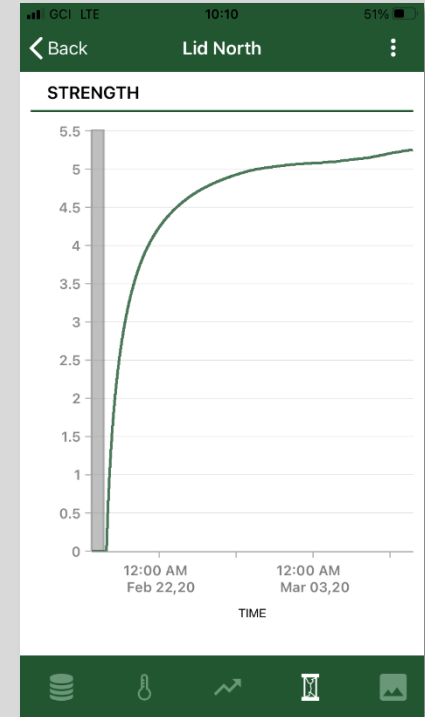
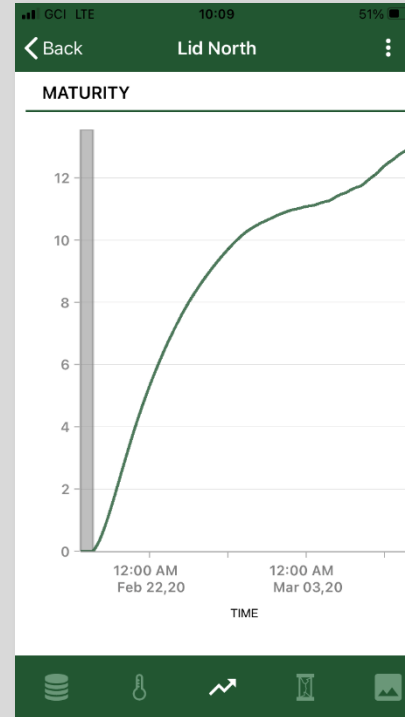
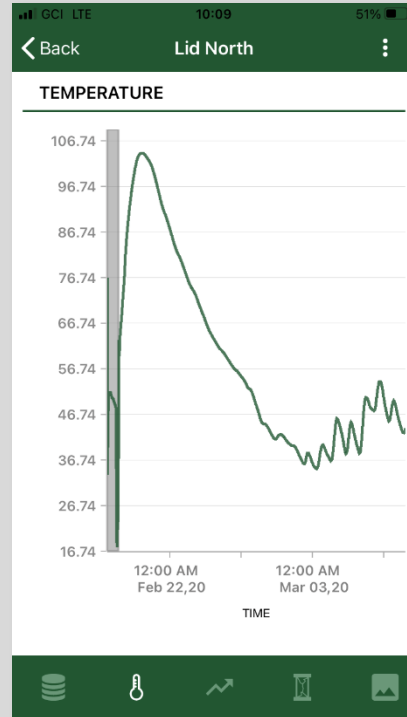
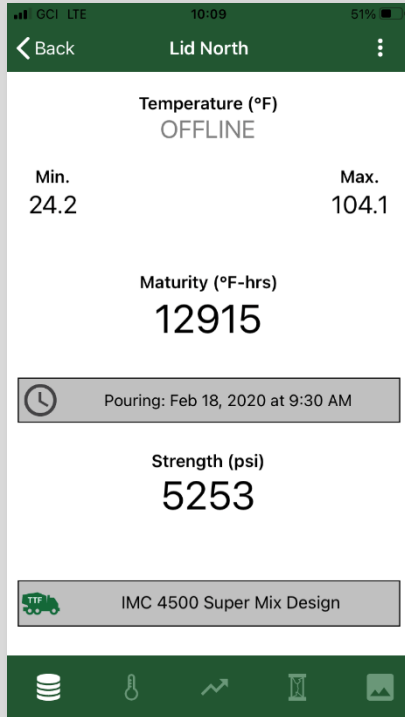
- Temperature sensors cast in concrete
- Data to mobile device via Bluetooth
- Temperature differentials in mass concrete
- Max/min curing temps in harsh setting
- Maturity method strength monitoring





Concrete Batching

Curing Temperatures & Maturity





Concrete Placement



Large HDPE Pipe Quality Assurance

Large HDPE Pipe Quality Assurance

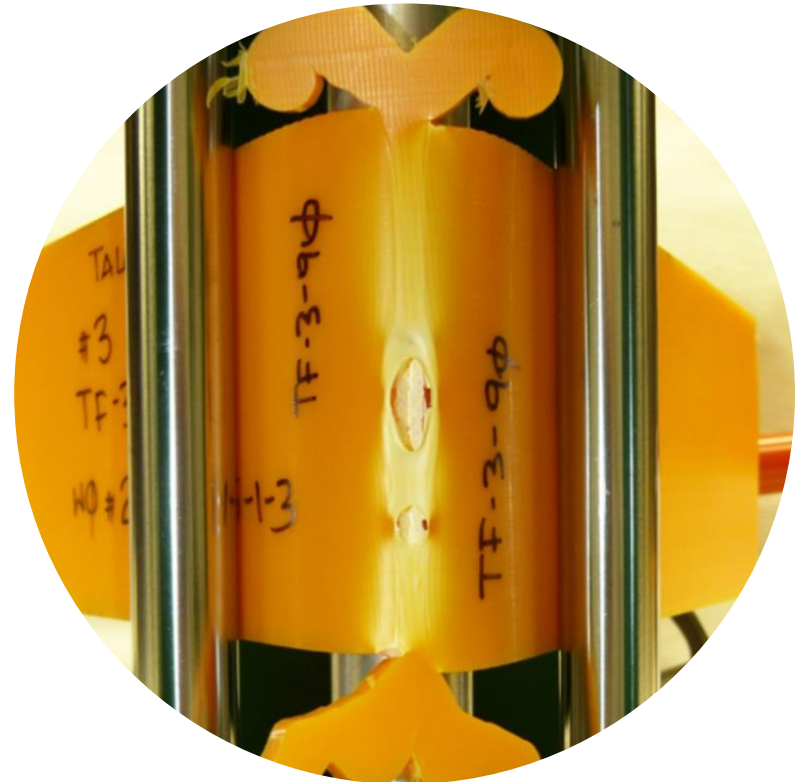
- Pre-production destructive joint tests
- Pre-weld cleaning and inspection
- Fusion machine joint report
- Post fusion offset check



Pre-Production Destructive Joint Tests

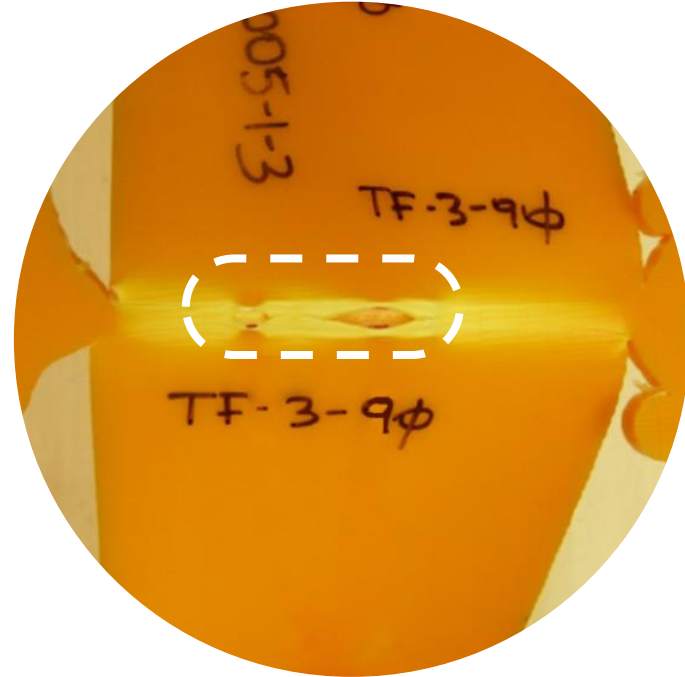
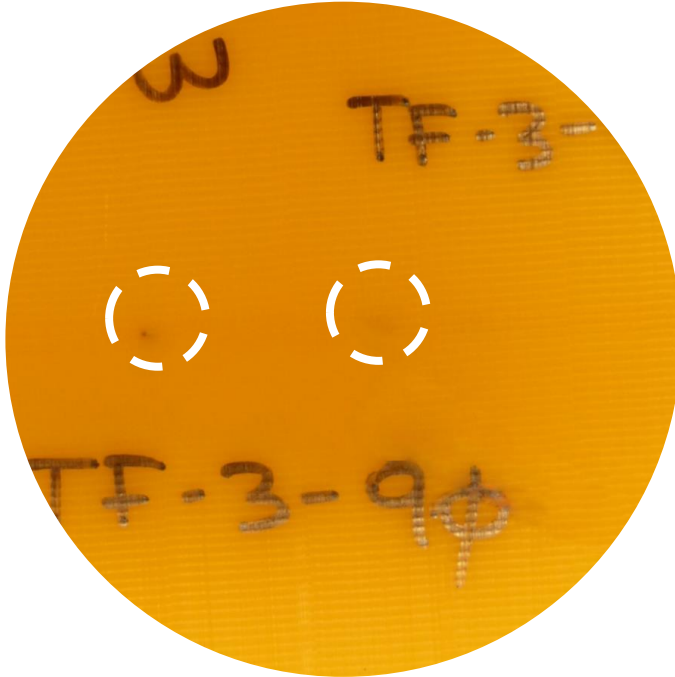


Destructive Joint Tests



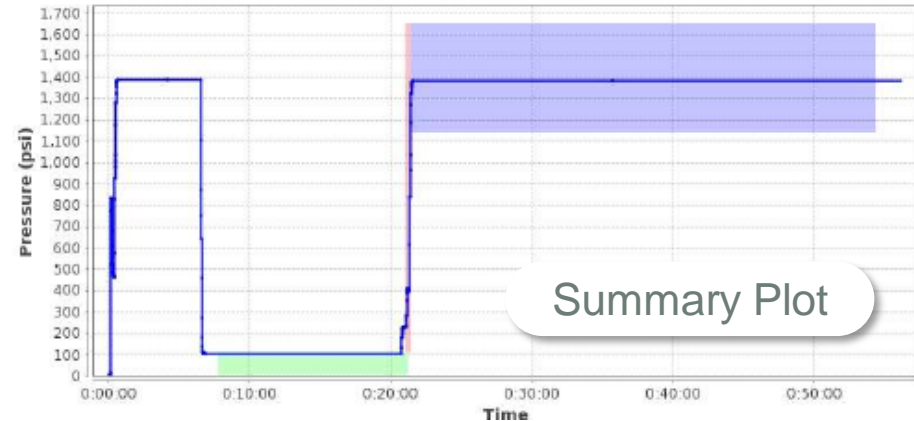
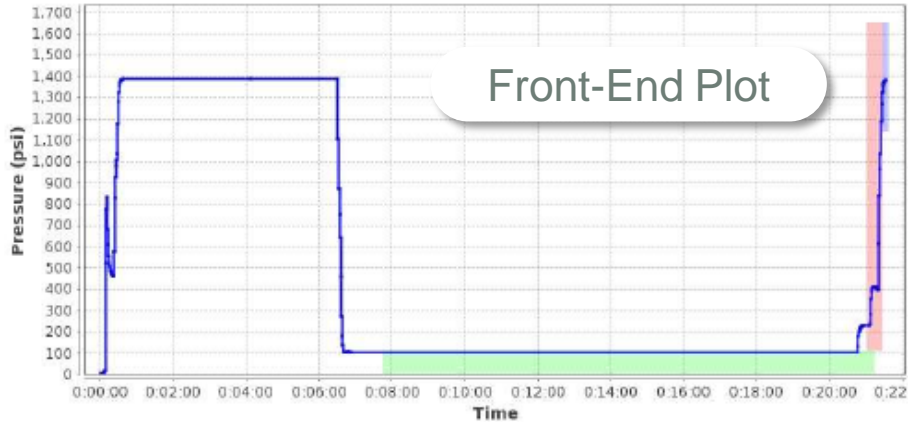
Destructive Joint Tests

Locations of contamination in fusion bead



Fusion Machine Joint Report

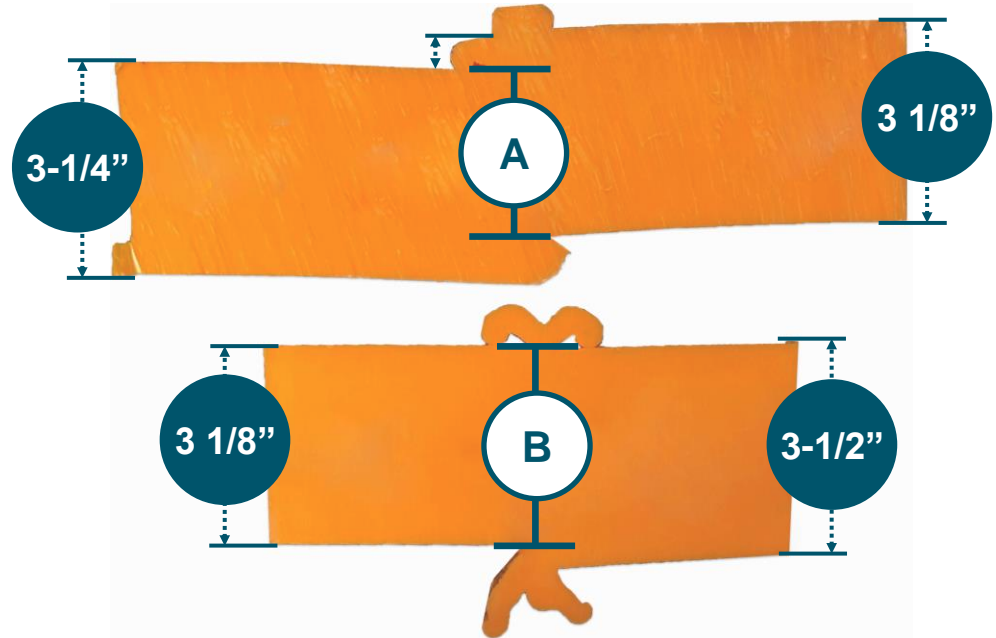
Source: McElroy Joint Report



HDPE Offset Check

- Low-tech method – jig and caliper measurement inside and outside pipe
- Remove/replace when fails

	Fusion Length	Joint Offset
A	2 5/8"	~3/4"
B	3 1/8"	~1/4"





HDPE Pipe Fusion



Technology - The Future for Civil Projects



Converting from Paper World

- 2D Drawings v. 3D virtual model
- Smart documents
- 3D digital construction model
(GPS/robotic equipment)
- Construction reporting
- Smart instrumentation
- Real-time, cloud-based data

An aerial photograph of a construction site on a steep, rocky mountain slope. A large yellow pipe is being laid along the edge of a road. Several construction vehicles, including an excavator and a bulldozer, are visible on the site. The background shows a dense forest of evergreen trees.

Questions?