SENIOR CAPSTONE 2021-2022

CALIFORNIA STATE UNIVERSITY, LOS ANGELES
DEPARTMENT OF CIVIL ENGINEERING

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CAJALCO CREEK SUSTAINABLE WATER DELIVERY SYSTEM

CIVIL ENGINEERING DESIGN PROCESS: | 1. DEFINE THE PROBLEM | 2. BACKGROUND RESEARCH | 3. IDENTIFY CONSTRAINTS | 4. BRAINSTORM SOLUTIONS | 5. IDENTIFY ALTERNATIVES | 6. SELECT BEST ALTERNATIVE | 7. MEET ALL REQUIREMENTS | 8. COMMUNICATE RESULTS

PROJECT OVERVIEW

PROBLEM

- Mining companies based in Corona, California request the design and construction of a water system
- Current water supplier is unable to supply water demand needed for daily operations
- Primary water source provides more than enough water needed
- Regulations and requirements of the jurisdictional and regulating agencies must be met

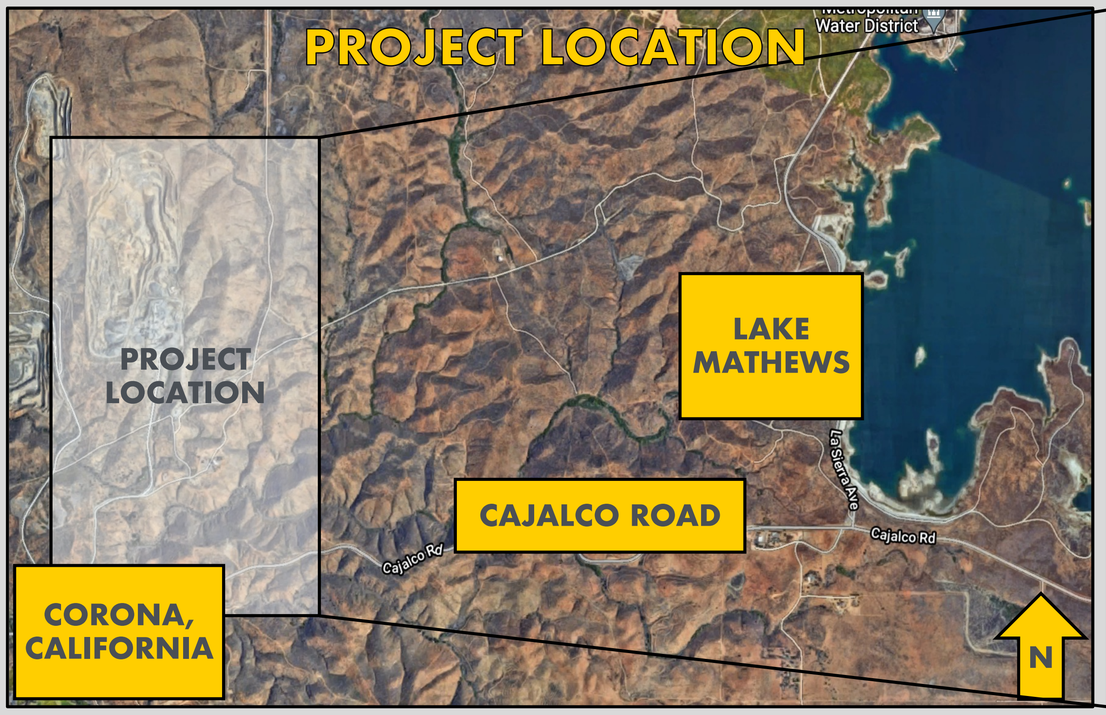
GOALS

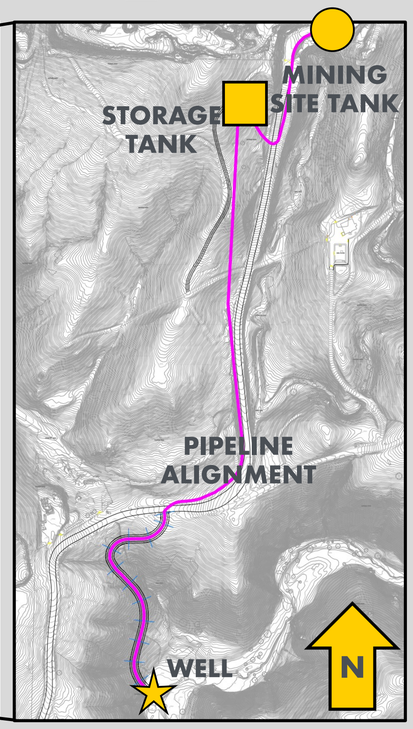
- Design a well, pump, water storage, and pipeline system with an accompanying access road that transports and stores water into a tank before being utilized
- Use a multidisciplinary approach that encompasses all aspects of civil engineering
- Follow the Civil Engineering Design Process to complete project
- Apply sustainable design principles

OUTCOME

- A well, pump, water storage, and pipeline system with an accompanying access road
- Design that is sustainable, environmentally friendly, cost-effective, and integrated into the environment with minimal interference with existing utility roads and structures
- Client is now able to control water supply before use

PROJECT LOCATION





THE MULTIDISCIPLINARY APPROACH

ENVIRONMENTAL

- NEPA/CEQA checklist
- Mitigation requirements

WATER RESOURCES

- Pump and well design
- Groundwater flow
- Hydraulics
- Tank capacity

STRUCTURAL

- Analysis of large-diameter water tanks
- Design of retaining walls
- Anchor Design

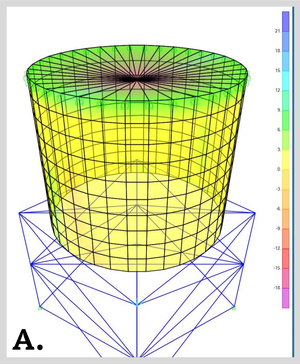
GEOTECHNICAL

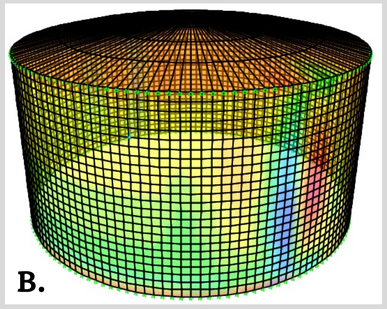
- Analyze properties of soil
- Size foundation for water tanks
- Integrate design of roadway and retaining walls

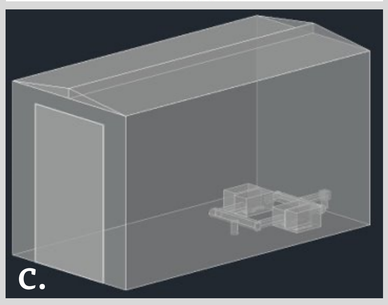
TRANSPORTATION

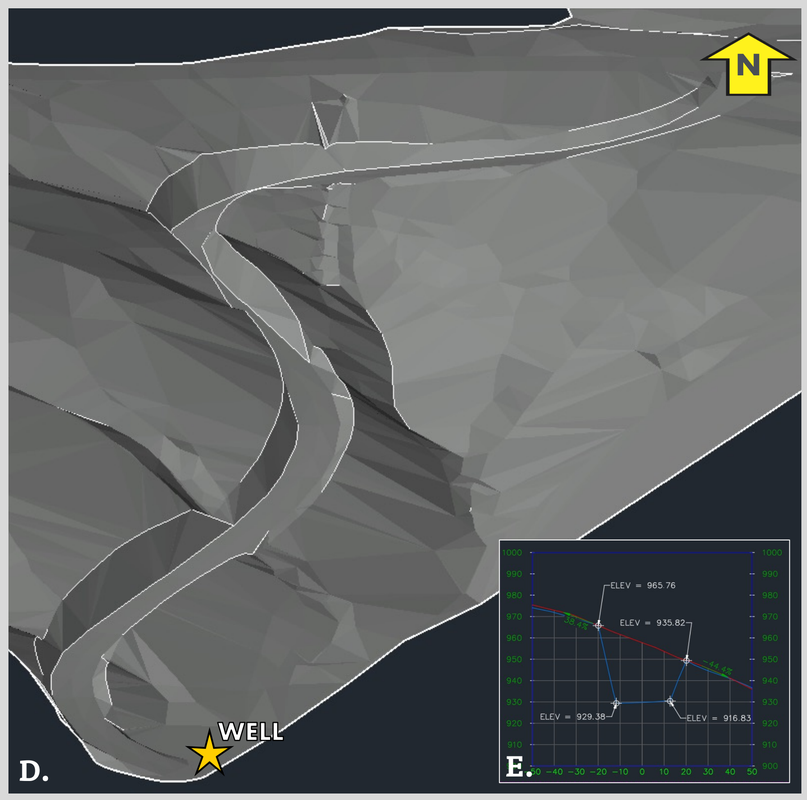
- Develop, compare, and recommend alignment for pipeline and access road
- Road design, cost and materials

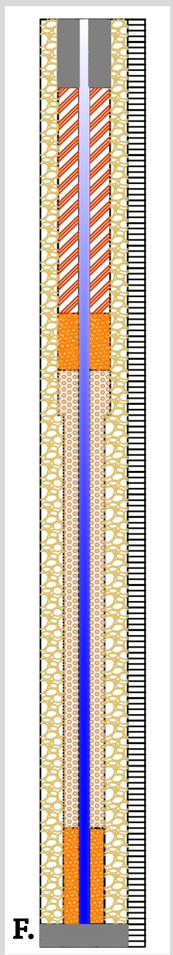
FINAL DESIGNS











A. Mining Site Tank
B. Storage Tank
C. Pump house
D. Well Access Road
E. Road cross section
F. Well design

COST ESTIMATE

$26.82M
(IN MILLIONS)

SKILLS AND KNOWLEDGE GAINED

PROFESSIONAL

- Project and time management
- Encouraging leadership
- Multidisciplinary teamwork
- Client interactions

COMMUNICATION

- Writing professional proposals, reports, and emails
- Developing PowerPoint presentations
- Presenting project to clients

TECHNICAL

- Applying coursework to resolve problems
- Creating drawings and models on AutoCAD, Civil 3D, and SAP 2000
- Producing cost estimates

ENVIRONMENTAL IMPACTS AND MITIGATIONS

AESTHETICS

- Minimize earthwork to conserve environment
- Visually screening of water tanks
- Minimal scarring of hillside due to access road (visually pleasing)

AIR QUALITY

- Dust control measures during construction and landscaping post-construction

BIOLOGICAL RESOURCES

- Protect endangered species in work area
- Preserve top-soil with seeds for reuse
- Reintroduce flora and fauna to the area after construction

GREENHOUSE GAS EMISSIONS

- Use of Tier-4 equipment
- Minimize emissions through scheduling

PROJECT TIMELINE: | AUGUST 2021: RESEARCH INITIATED | SEPTEMBER 2021: CONSTRAINTS IDENTIFIED | OCTOBER 2021: MULTIPLE SOLUTIONS CREATED | NOVEMBER 2021: ALTERNATIVE SELECTED | JANUARY 2022: START OF DESIGN PHASE | APRIL 2022: DESIGN COMPLETE | MAY 2022: PRESENT TO CLIENT