

CCR COVER CONSTRUCTION – STEEP SLOPES AND OTHER CHALLENGES

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CCR COVER CONSTRUCTION CHALLENGES – CASE STUDIES



Case Study #1

- ▶ Steep Slopes
 - > Prior to Aptim onsite an employee was injured due to equipment rollover
- ▶ Erosion & sediment control (ESC) regulations
 - > Limitation of open work areas
 - > Strict regulations and inspections
- ▶ Power Lines
- ▶ Schedule
 - > Regulatory deadline
- ▶ SIMOPS
- ▶ Weather
 - > Winter work
 - > Work through hurricane season and major storm events

Case Study #2

- ▶ Soft sediments

CASE STUDY #1 – PROJECT OVERVIEW



- ▶ Multi-site CCR closure program
- ▶ 90% self-performed
- ▶ Composite cover system: 40-mil HDPE geomembrane, 250-mil geocomposite drainage layer, 18-inches of cover soil and a 6-inch vegetative layer
- ▶ Project 3 was selected as the company’s annual Engineering & Construction Excellence in Safety Award. Each year, NRG select one project out of their company-wide portfolio that score the highest on their periodic assessments

| | Project #1 | Project #2 | Project #3 | TOTAL |
|---|------------|------------|------------|---------|
| Capping Area (acres) | 40 | 60 | 103 | 203 |
| CCR Excavated and Placement (cy) | 225,000 | 31,800 | 91,000 | 347,800 |
| Cover Soil Placed (cy) | 129,000 | 193,000 | 332,000 | 653,200 |



STEEP SLOPE CHALLENGES

- ▶ Landfill had several side slopes up to 2 vertical to 1 horizontal and greater
- ▶ Design called for 90% modified proctor compaction effort
- ▶ Native placed cover material was very sensitive to water and very slippery when wet.
- ▶ Majority of landfill haul roads, both permanent and the ones we temporary constructed were just as steep.



STEEP SLOPES SOLUTIONS

- ▶ **Equipment Selection** – During the bidding process, in order to be able to work as safely as possible we identified the safest equipment available. Selection included:
 - ▶ Low ground pressure and wide track equipment was selected whenever possible – mainly on the dozers.
 - ▶ 7-cubic yard tracked dump truck with a 360-degree rotating capability
 - ▶ Sakai Tracked Smooth Drum Roller



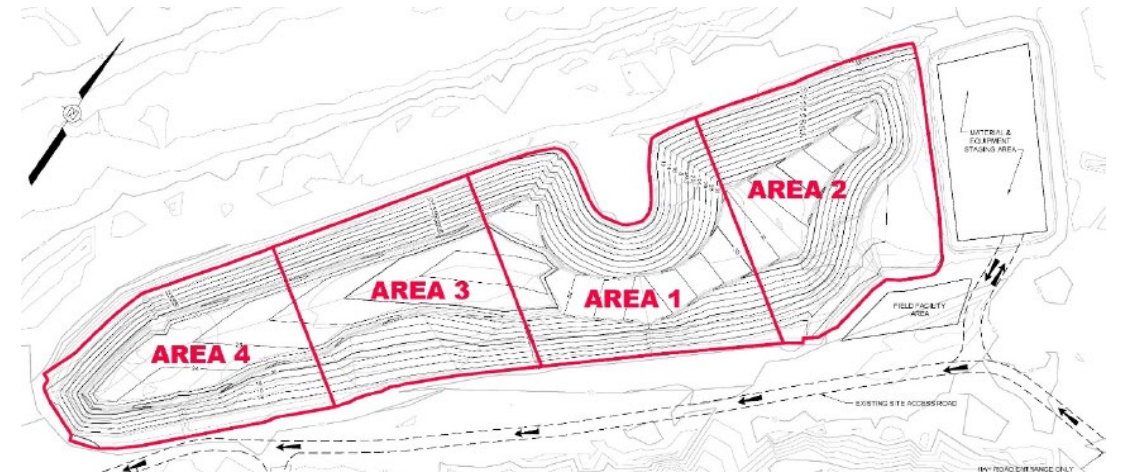
STEEP SLOPES SOLUTIONS

- ▶ APTIM established execution plan procedures for construction of the cover system on these steep slopes to ensure worker safety as a top priority
 - Only certain equipment allowed to traverse slope longitudinally
 - All work on steep slopes was halted during rain events.
 - Low productivity and performance was built into the cost and schedule on steep slopes to allow our crews to work their safest without any concern whatsoever.
 - When traversing the steep haul roads trucks were only partially filled to minimize spillage and potential for operator error.
 - We pre-identified risky situations and/or areas and only allowed our most experienced operators and truck drivers to work in these areas.
 - 20+ years working on steep slopes and fine grading
 - Ability to maneuver in tight locations and on temporary berm roads – only some roads had turnarounds other roads was drive in and back out



ESC CHALLENGES

- ▶ State erosion and sediment control regulations dictated the allowable amount of work area that could be disturbed at one time.
- ▶ Weekly and after rain event inspections with strict requirements



ESC SOLUTIONS

- ▶ Only 2 acres of exposed CCR open at a time.
 - Aptim requested a variance to allow for 5 acres, which expedited earthworks and allowed for reduced mobilizations of geosynthetics installation
 - Cost savings
 - Schedule reduction
- ▶ A phased, sequenced approach was developed to maximize production and maintain schedule while meeting these requirements.



ESC SOLUTIONS

- E&S weekly inspections, sed traps oversized and 3 filter logs would control any offsite release of sediment



ESC SOLUTIONS

- ▶ Long reach excavator
 - Maintained safe required working distance from power lines
 - Allowed for work from within the landfill versus saturated wetland area, which would have been outside the limit of disturbance
 - Allowed for tracks to be positioned in dry material away from soft sediments being excavated



UTILITY CHALLENGES



- ▶ High voltage power lines everywhere
- ▶ Underground utilities



UTILITY SOLUTIONS

- ▶ Overhead utilities
 - Tattle tales
 - Spotters
 - 360 walk arounds
 - Constant communication
 - Long reach excavators
 - Mini excavator used in certain activities\
 - CM and superintendents involved in bid process to select equipment and maintain field crews working together for years
 - Rotating bucket is great for ditching, v ditches and butter bar important for smoothness of ditch



UTILITY SOLUTIONS



▶ Subsurface utilities

- Mats used To protect wetland vegetation and sensitive environments,
- 50 + haul trucks in and out each day
- Mats were for utility protection on road, light weight synthetic glass rock to lighten load over specific alignment



SCHEDULE CHALLENGES & SOLUTIONS

- ▶ Challenges
 - Adjusting production rates to account for working on steep slopes so that schedule and costs were accurately forecast.
 - 50-60% of contract time expended and 25% of work completed
- ▶ Solutions
 - To achieve estimated production rates and reforecast, specialty equipment was utilized for cover construction
 - Parallel sequencing to makeup schedule
 - Winter work and transparency on costs with client



SIMOPS *CHALLENGES & SOLUTIONS*

▶ Challenges

- ▶ Active CCR landfill – adjacent cell receiving CCR, shared access with:
 - Haul roads
 - Site entrance/exits
 - Plant roads
 - 100 trucks per day
- ▶ Dust control
- ▶ Road maintenance

▶ Solutions

- ▶ Strictly follow project plans – Haul Routes, Traffic Plans, Work Plans, Road Maintenance Plans, etc.
- ▶ Deliver on these promises
- ▶ Daily meetings and communications for changes in SOPs or daily activities
- ▶ Isolate work areas



WEATHER CHALLENGES

- ▶ Work wash-out and loss
- ▶ Water management
- ▶ Import material delivery
- ▶ Schedule delays



WEATHER SOLUTIONS



- ▶ Always checking the weather, looking ahead and planning for weather impacts
- ▶ Armor down chutes
- ▶ Timing of final ESC installation



WEATHER SOLUTIONS



- ▶ Onsite stockpiles
 - > Import material deliveries can vary depending on demands to supplier
 - > To avoid work delays work was phased to create a large open area for stockpiles



CASE STUDY #2 – PROJECT OVERVIEW



Pre-construction

- ▶ Ponded water
- ▶ Soft sediments, not accessible by conventional earthwork equipment



Construction – Working Surface

- ▶ Phased closure
- ▶ Create safe working surface with geotextile and soil layer
- ▶ Geotextile installed without accessing impoundment and working directly over soft sediments
- ▶ Created safe working surface to place final cover
- ▶ Water collection system installed
- ▶ Water management through the duration of construction
- ▶ Managed mud wave and air gaps under geotextile



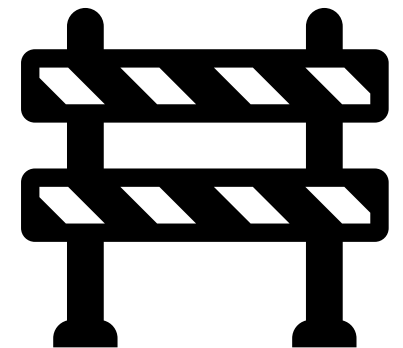
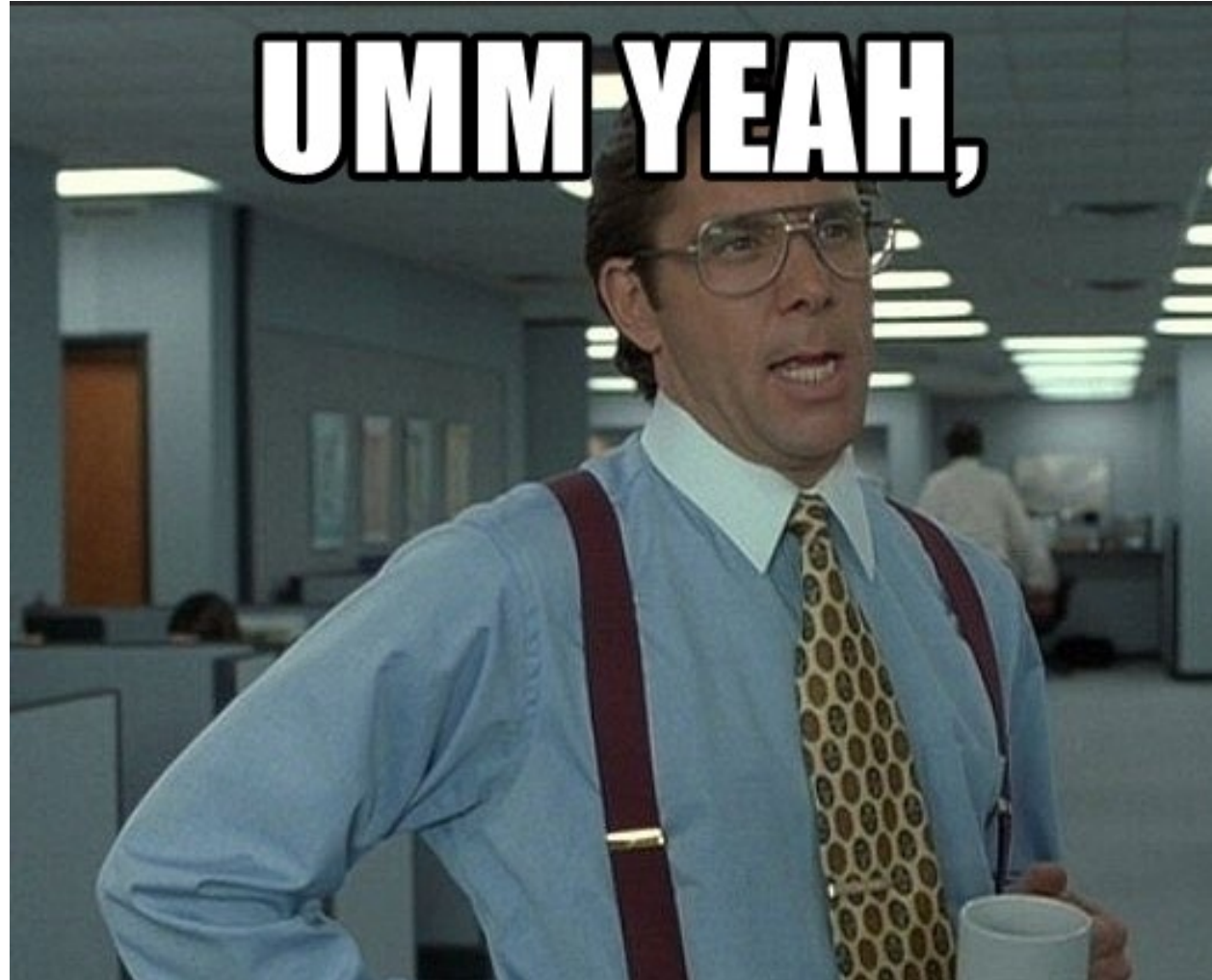
Construction – Final Cover

- ▶ Final cap construction: 40-mil geomembrane, 18" cover soil and 4" vegetative layer/topsoil
- ▶ At this site the impoundment was restored as a surface water retention basin



SOFT SEDIMENTS *CHALLENGES*

- ▶ Liquefaction
- ▶ Ice-berging
- ▶ Mud waves



SOFT SEDIMENT SOLUTIONS

- ▶ Marsh masters
- ▶ Intermediate roads



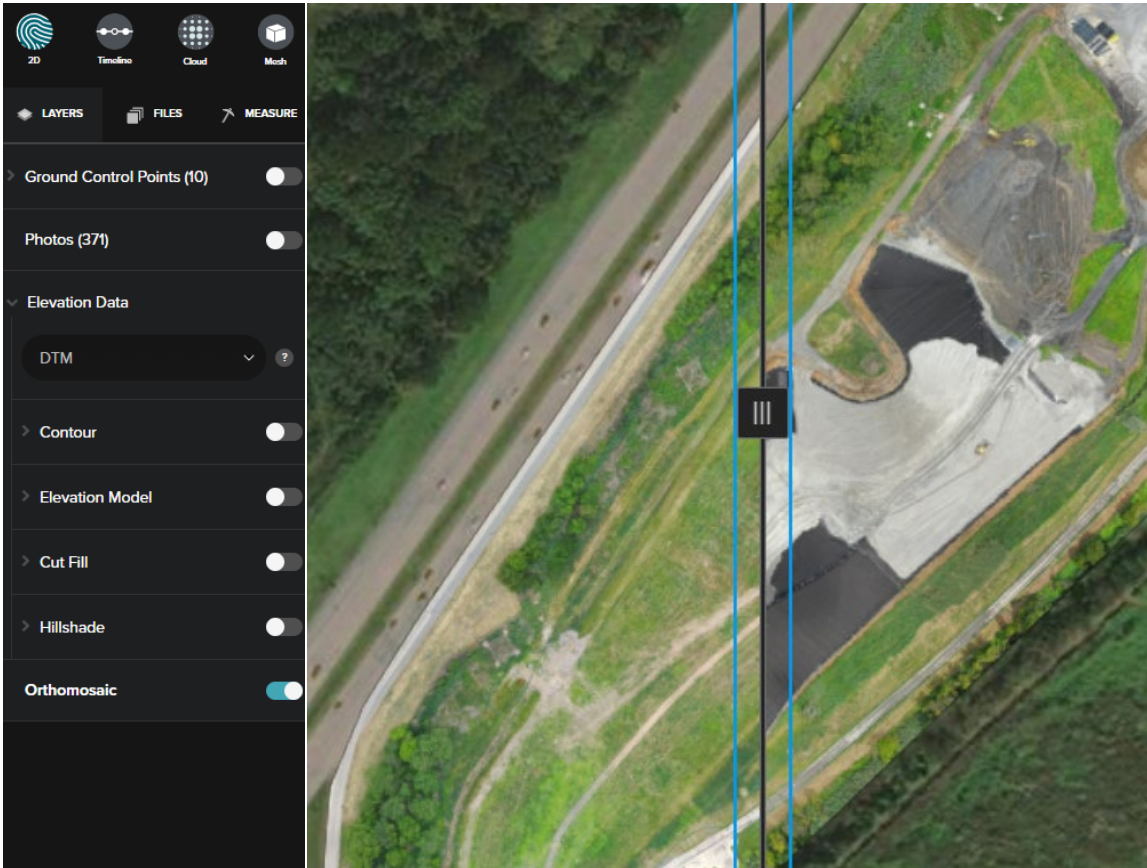


SOFT SEDIMENT SOLUTIONS

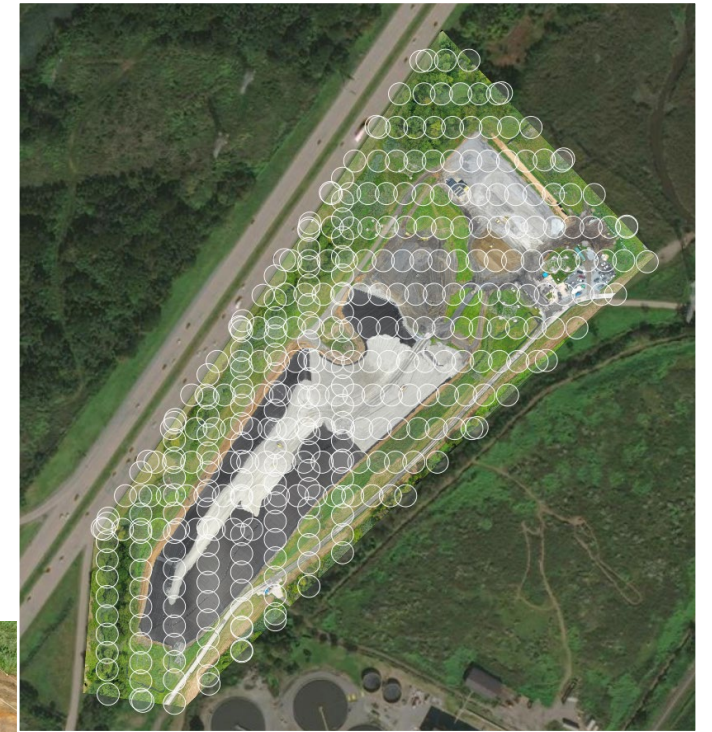
- ▶ Long reach excavator
- ▶ Sand slinger
- ▶ Geotextile installation
- ▶ Air boat with blade



SOFT SEDIMENT SOLUTIONS



▶ Drone surveys

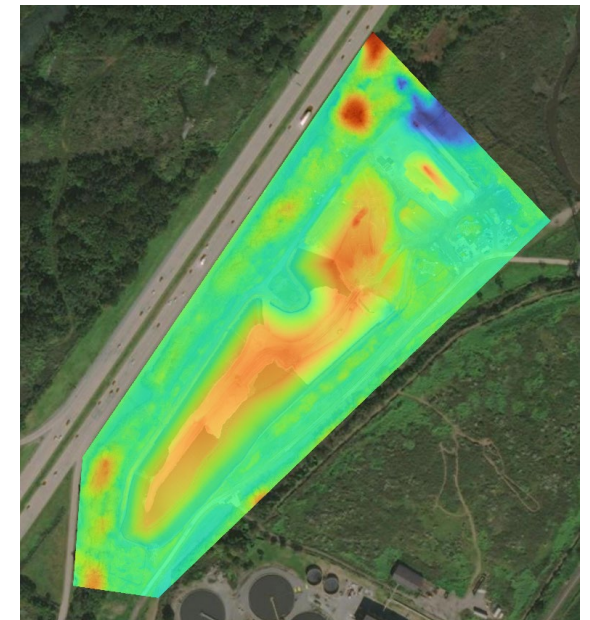
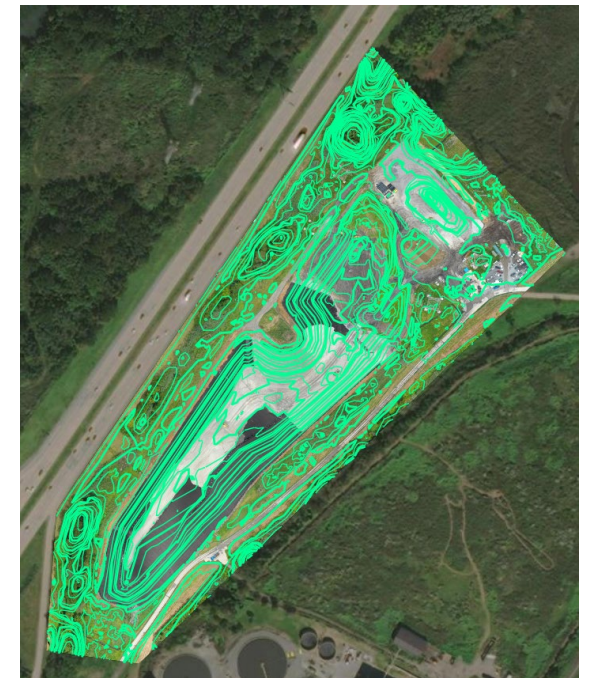


SOFT SEDIMENT SOLUTIONS



Drone Survey Analysis

- ▶ GIS & CAD integration
- ▶ Calculate – area, volume, cross sections, lengths
- ▶ Develop contours, cut/fill areas
- ▶ Performs photogrammetry to create orthoimages and elevation data for contours and cut/fill areas
- ▶ Quick exploratory analysis directly in browser





Expect the Extraordinary.



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