Drone Surveying and Uses in Landfill Capping Construction

Prepared For:
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Overview

► What?
   ▪ UAV aerial mapping workflow for Liner CQA & As-Built

► Why?
   ▪ To demonstrate the benefits of UAV Aerial imagery for CQA

► Who benefits?
   ▪ Anyone installing geosynthetic membrane systems

► When?
   ▪ Construction of new waste cells and installing cap for closure
Background
Background

► Personal:
  ▪ 1.5 Years of sUAS Flight ops experience
  ▪ Surveyed ~5,412 acres to date

► Company:
  ▪ Full coverage UAV Insurance
  ▪ Maintains Federal Aviation Administration (FAA) Section 333 Exemption and FAA Part 107 Pilot Certifications
Background

► UAV Services Provided by CEC:
  - Aerial Photography and Mapping
  - Topography – Photogrammetry and LiDAR
  - Thermal Imagery
  - Crop Health Analysis
  - Methane Detection
Project Setup
Project Setup

► Airspace Check

► Confirm Personnel
  ▪ Licensed UAV Pilot
  ▪ Surveyor
  ▪ Visual Observer

► Flight Plan
  ▪ Pre-map the intended route
  ▪ Check weather and schedule flight

► Software Available

► Liner Conditions
  ▪ Liner installation is complete, all panels and repairs are marked w/ spray paint, and protective cover has not yet been installed.
Pre-Flight Setup

► Pre-Flight Airspace Checks
  ▪ Waivers needed?
  ▪ NOTAMS Required?

► Flight Plan
  ▪ App to use

► Weather Conditions
  ▪ Sunny
  ▪ Overcast
  ▪ Low wind speeds
Processing Software

► Photogrammetry
  ▪ The use of photography in surveying and mapping to measure distances between objects
► PIX4D - Stitching program
► ArcGIS - QA/QC
► Civil 3D - Edit, design, & deliverables
Data Collection

- Background
- Project Setup
- Data Collection
- Lessons Learned
- Advantages
Data Collection Workflow

► Step 1: Onsite
  ▪ Confirm suitable weather
  ▪ Set ground controls, checkpoints
  ▪ Perform aerial survey
  ▪ Take any other survey shots

► Step 2: Processing
  ▪ Initial processing in Pix4D

► Step 3: QA/QC
  ▪ Perform quality control to make sure the data is accurate within half a contour interval
Equipment Required

- iPads
- Survey Drone
- Flight Control App
- Ground Survey Equipment
- GCPs
Survey Controls

► Set Ground Control
  ▪ Within planned flight area

► Check shots
  ▪ Needed to compare aerial surface to traditional ground survey
Preform Flight

► Take off from highest site elevation
  ▪ Ensure drone is within visual line of site
► For Liner As-builts fly at a maximum of 200ft
Process data

► Pix4D
  ▪ Photogrammetry
  ▪ GCP Adjustments
Process data

► ArcGIS

• Accuracy Check

• Image Quality Check
Analyzing data

► ArcGIS

- Compare +/- Z accuracy of ground survey to aerial survey
Lessons Learned
Liner Temperature

1. Preform flight early in the day
   - Ensures liner will not expand due to heat
   - Not critical for identifying missed repairs, but will aid in more accurate topographic results.
Image Quality

2. “Low and Slow” Flight

- Less than 15mph
- Less than 200ft AGL
3. Use a terrain profile

- Allows drone to follow elevation change of landfill
- Automated terrain profiles may not account for the landfill as it is a man made structure especially in remote areas
Advantages
1. Date specific visual record of construction.
2. Easily identify repairs, destructs, and panels.
3. Missed locations can easily be marked in CAD in the office without needing to send a survey crew back in the field, saving time and money.
UAV CQA
Advantages

► Save time and money with rapidly completed liner as-builts with minimal field time.
Thank you

Please forward questions or inquiries to:

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