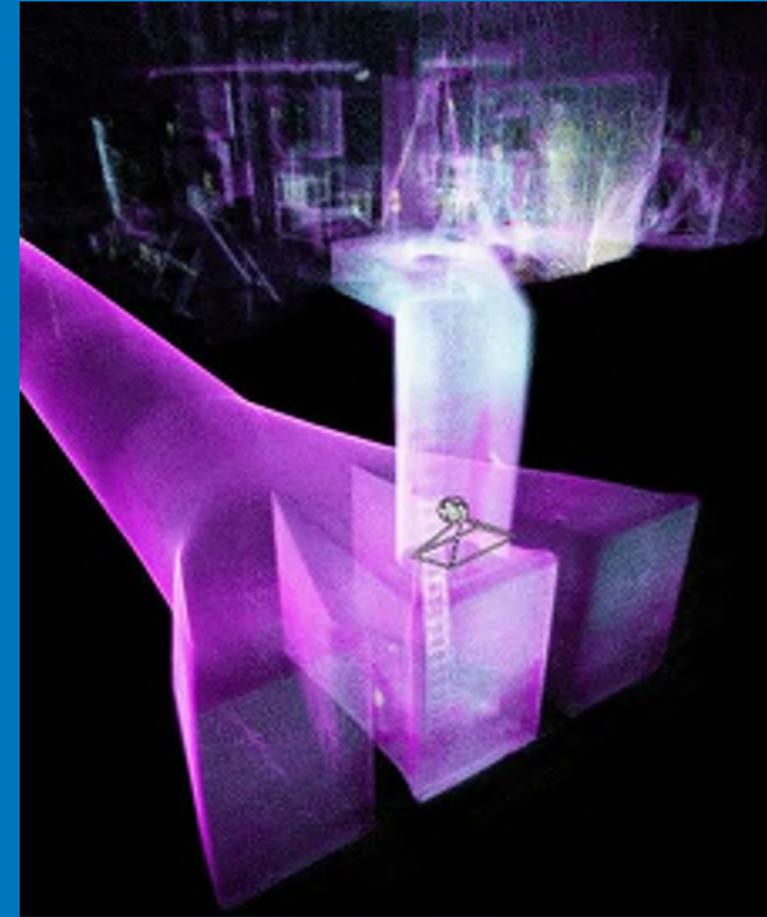# Penstock Inspections

With UAV Drones

Sean Urann, P.E., Jerin Tilson, P.E.
Civil Engineers
June 12, 2025

Introductions

Sean Urann, P.E.

Gonzaga University

       B.S. in Civil Engineering

Civil Engineer in Avista's Generation Production Department

       8 Years @ Avista

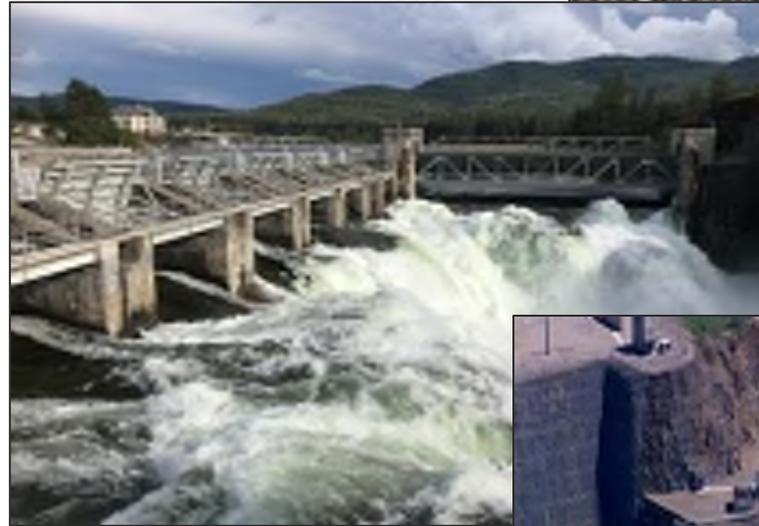   (4 Years) Dam Safety Surveillance and Monitoring Coordinator

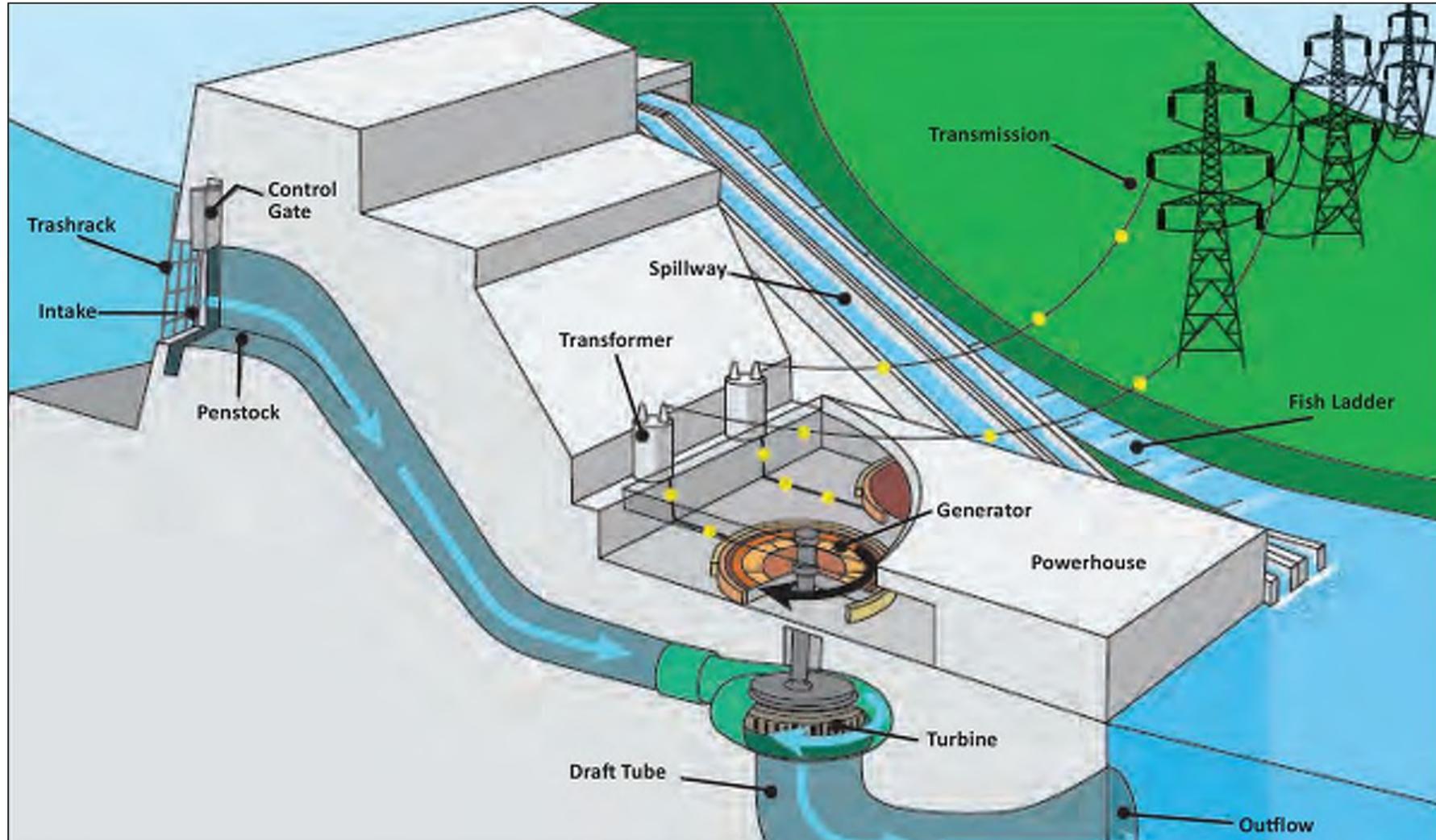   (4 Years) Project Engineer

Introductions

Hydroelectric Developments (HED)

- Noxon Rapids, MT   (High Hazard)
- Cabinet Gorge, ID   (High Hazard)
- Post Falls, ID   (High Hazard)
- Upper Falls, WA
- Monroe Street, WA
- Nine Mile, WA   (High Hazard)
- Long Lake, WA   (High Hazard)
- Little Falls, WA

Introctions

Agenda

1. The Impetus for Change
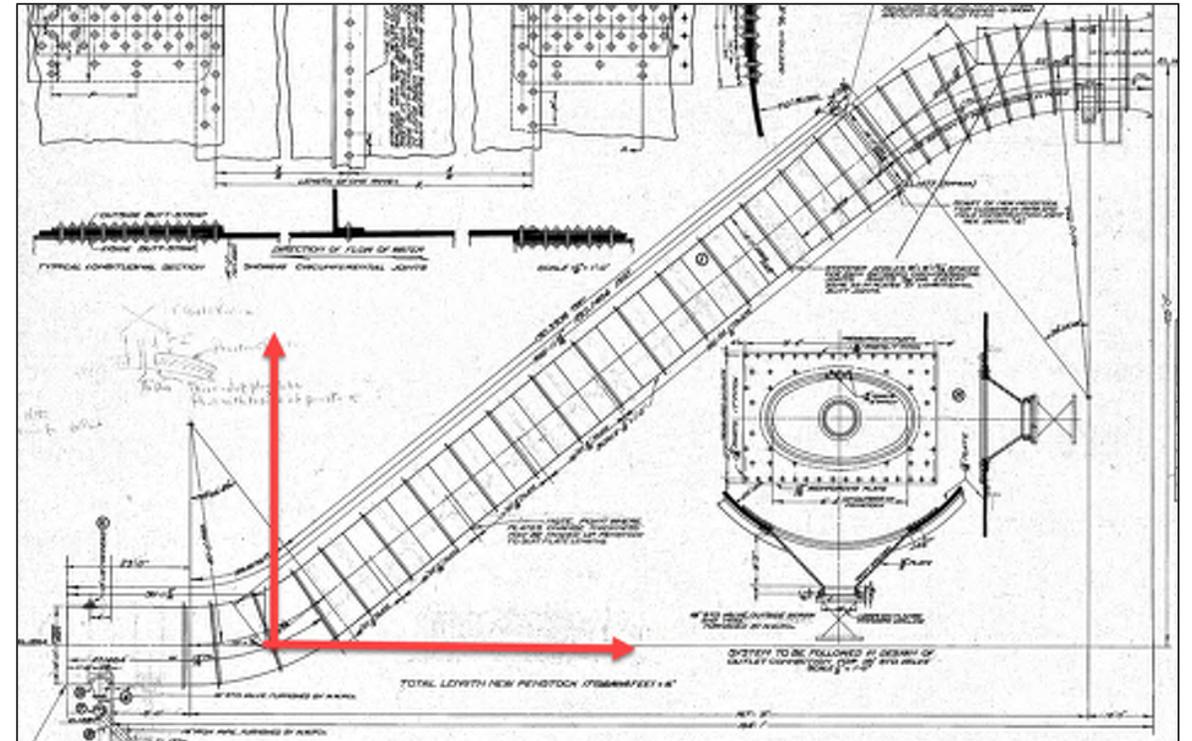
2. Equipment

3. Data Collection

4. Lessons Learned

Optional footer for data sources, etc.

Agenda

1. **The Impetus for Change**

2. Equipment

3. Data Collection

4. Lessons Learned

Optional footer for data sources, etc.

The Impetus for Change

Safety Concerns: Ingress, Egress, Rescue, Training, Confined Space

The Impetus for Change

Safety
Concerns:
Ingress, Egress,
Rescue,
Training,
Confined Space

Long Lake HED

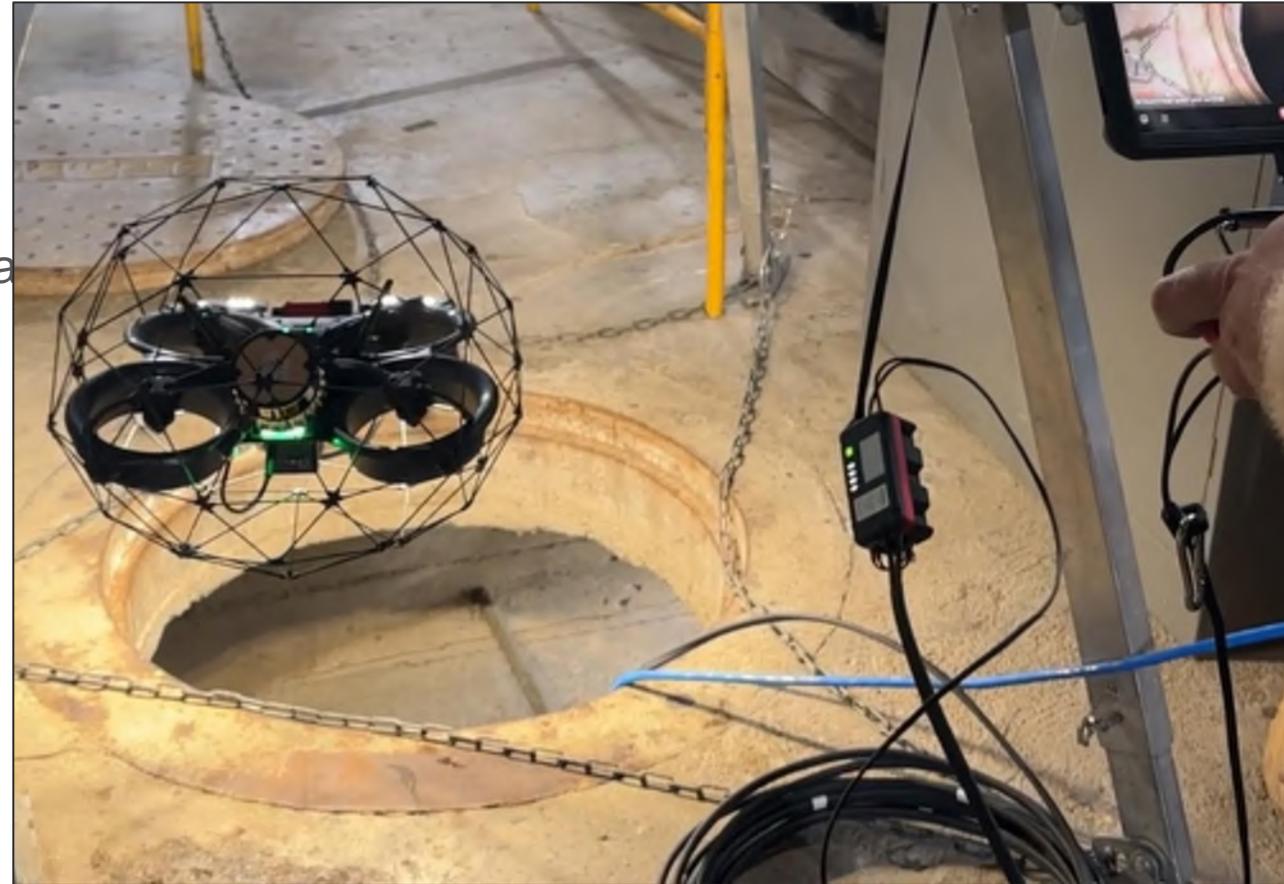Little Falls HED

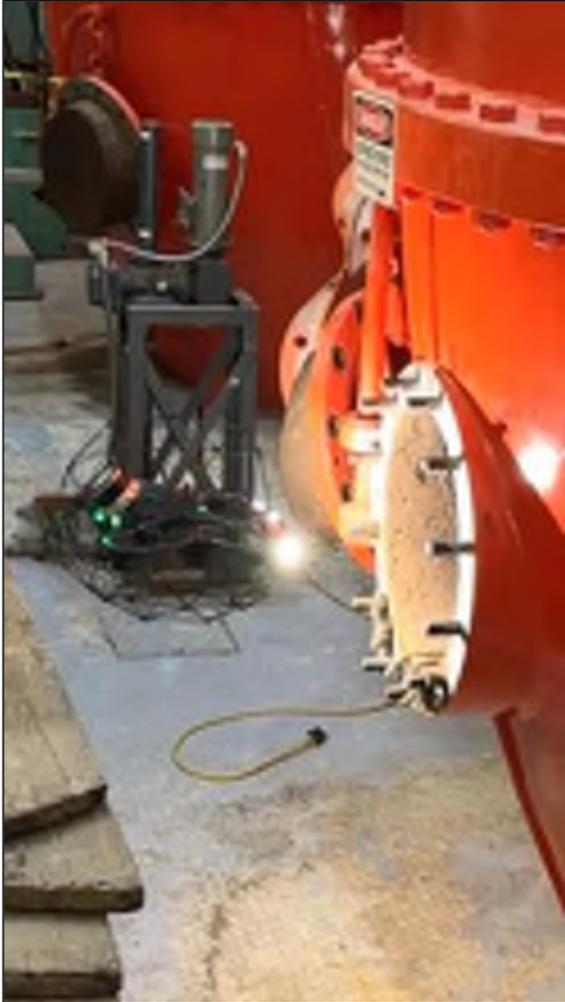# The Impetus for Change

Quality of Data

Optional footer for data sources, etc.

Agenda

1. The Impetus for Change

2. **Equipment**

3. Data Collection

4. Lessons Learned

Optional footer for data sources, etc.

Equipment – Flyability Elios 3

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Equipment – DJI Mavic 3E

Agenda

1. The Impetus for Change

2. Equipment

3. **Data Collection**

4. Lessons Learned

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Data Collection

Year	HED	MW	Unit
2023	Noxon Rapids	527	Unit #2
2024	Nine Mile	35	Wet Pit #3
2024	Long Lake	82	Unit #2
2024	Little Falls	37	Unit #1
2024	Little Falls	37	Unit #4
2024	Upper Falls	10	Unit #1

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Data Collection – Collection and Deliverables

Flight	
Description:	
Time of image:	

Position X (ft):		Heading (Deg):	
Position Y (ft):			
Position Z (ft):			
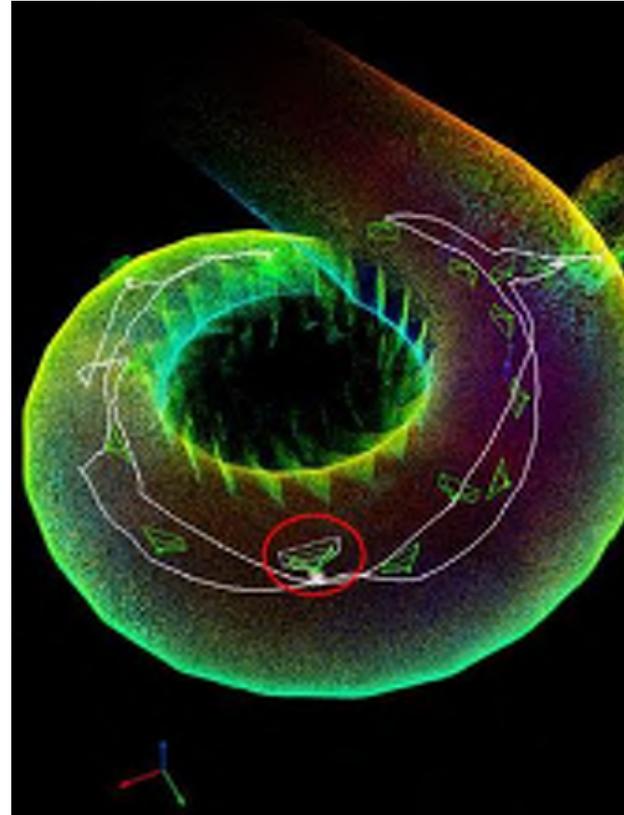
Drone collects:
1. Photographs
2. Video
3. Lidar
4. Flight path coordinates

Deliverables:
1. 4k Flight Videos
2. 4k Photographs
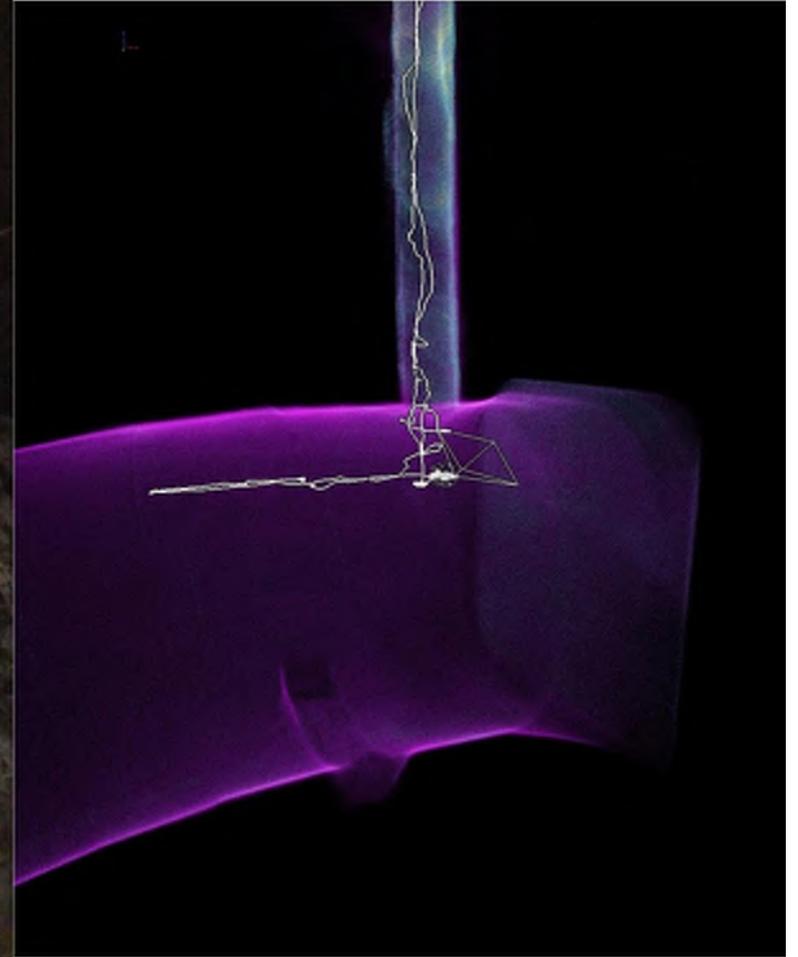3. PDF Inspection Report + Drawings
4. 3D Model Space
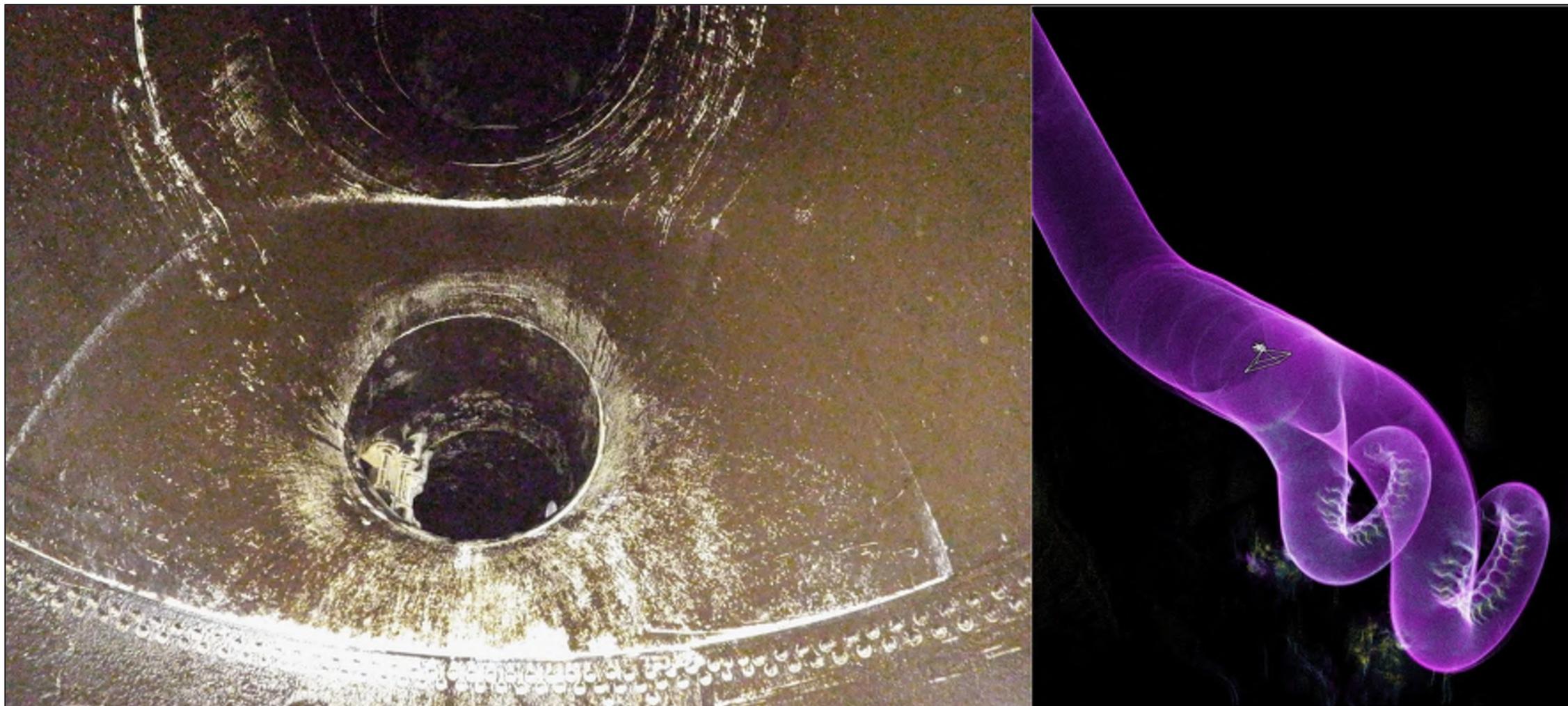
Data Collection - Noxon Rapids HED Runner Example

Optional footer for data sources, etc.

Data Collection – Long Lake HED Air Vent Example

Optional footer for data sources, etc.

Data Collection – Long Lake HED Headgate Example

Data Collection – Long Lake HED Bifurcation Example

Optional footer for data sources, etc.

Data Collection – Long Lake HED Pitting Detail Example

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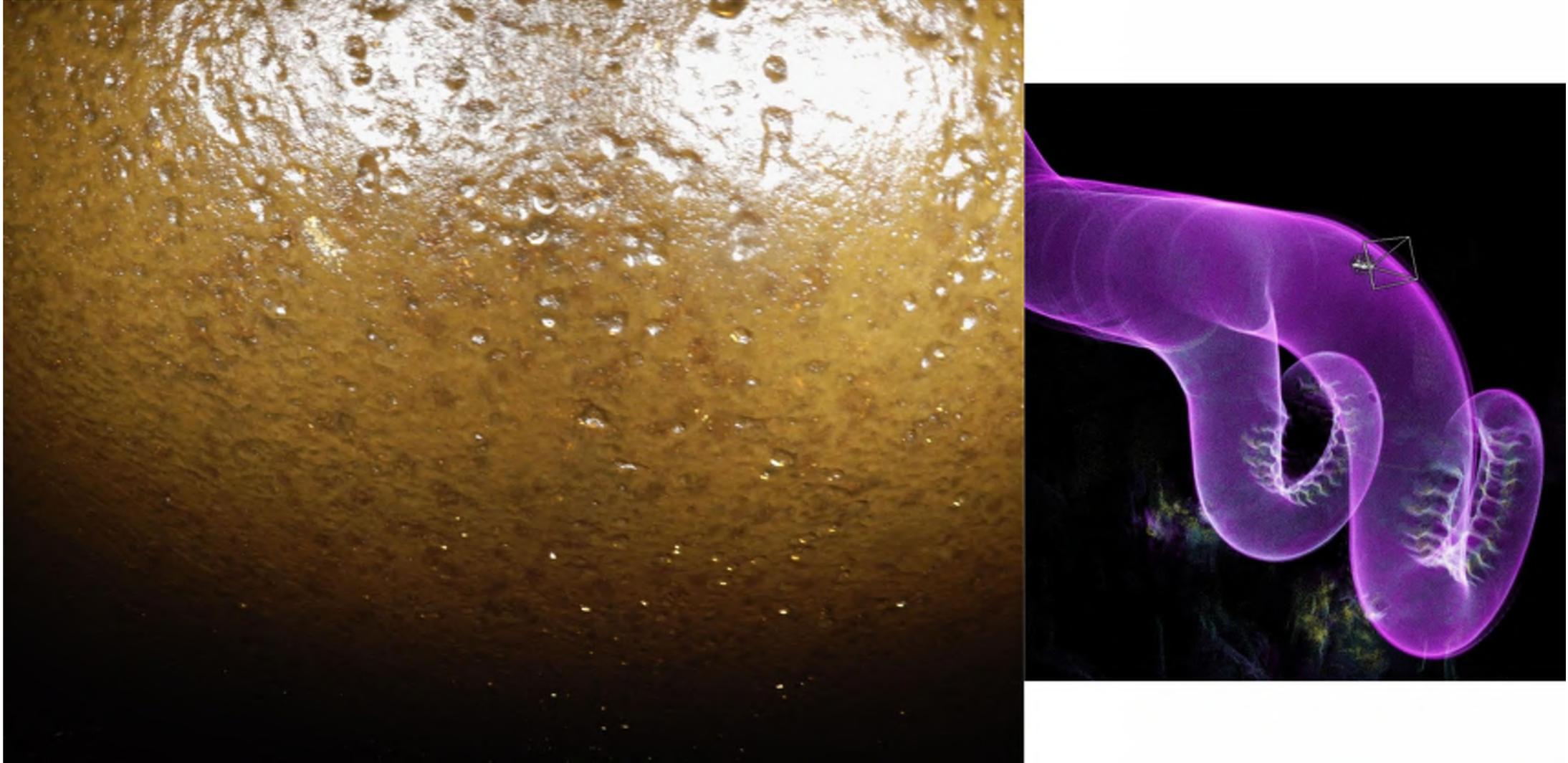
Data Collection – Nine Mile HED Wetpit Example

Optional footer for data sources, etc.
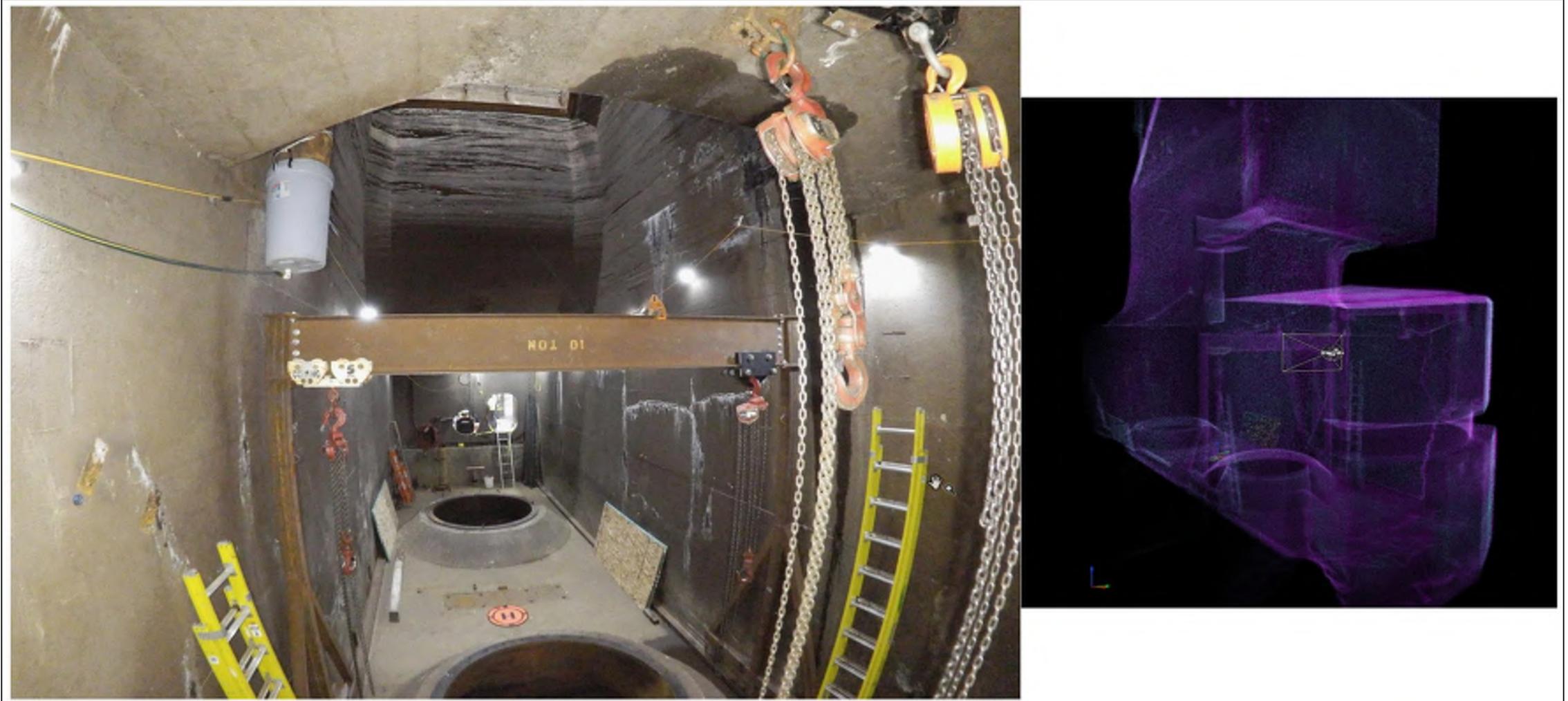
Data Collection – Nine Mile HED Draft Chest Example

Optional footer for data sources, etc.

Data Collection – Nine Mile HED Tailgate Example

Optional footer for data sources, etc.

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Data Collection – Upper Falls HED Bifurcation Example

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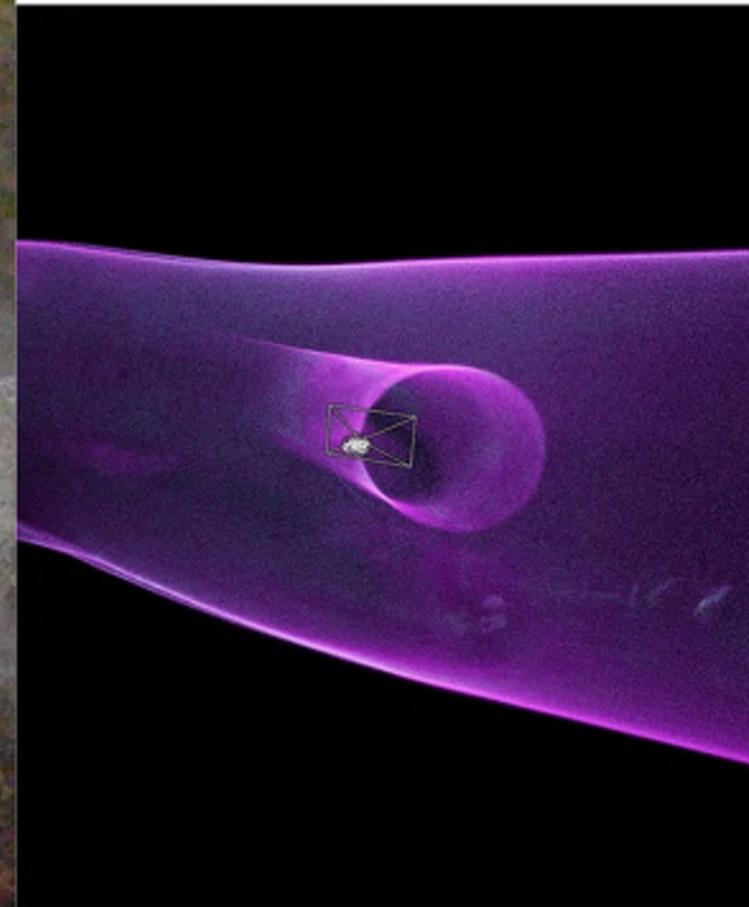
Data Collection – Exterior Inspection with a Drone

Optional footer for data sources, etc.

Agenda

1. The Impetus for Change

2. Equipment

3. Data Collection

4. **Lessons Learned**

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Lessons Learned – Reduced Man Hours / Labor

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Lessons Learned – Special Use Cases (Tether)
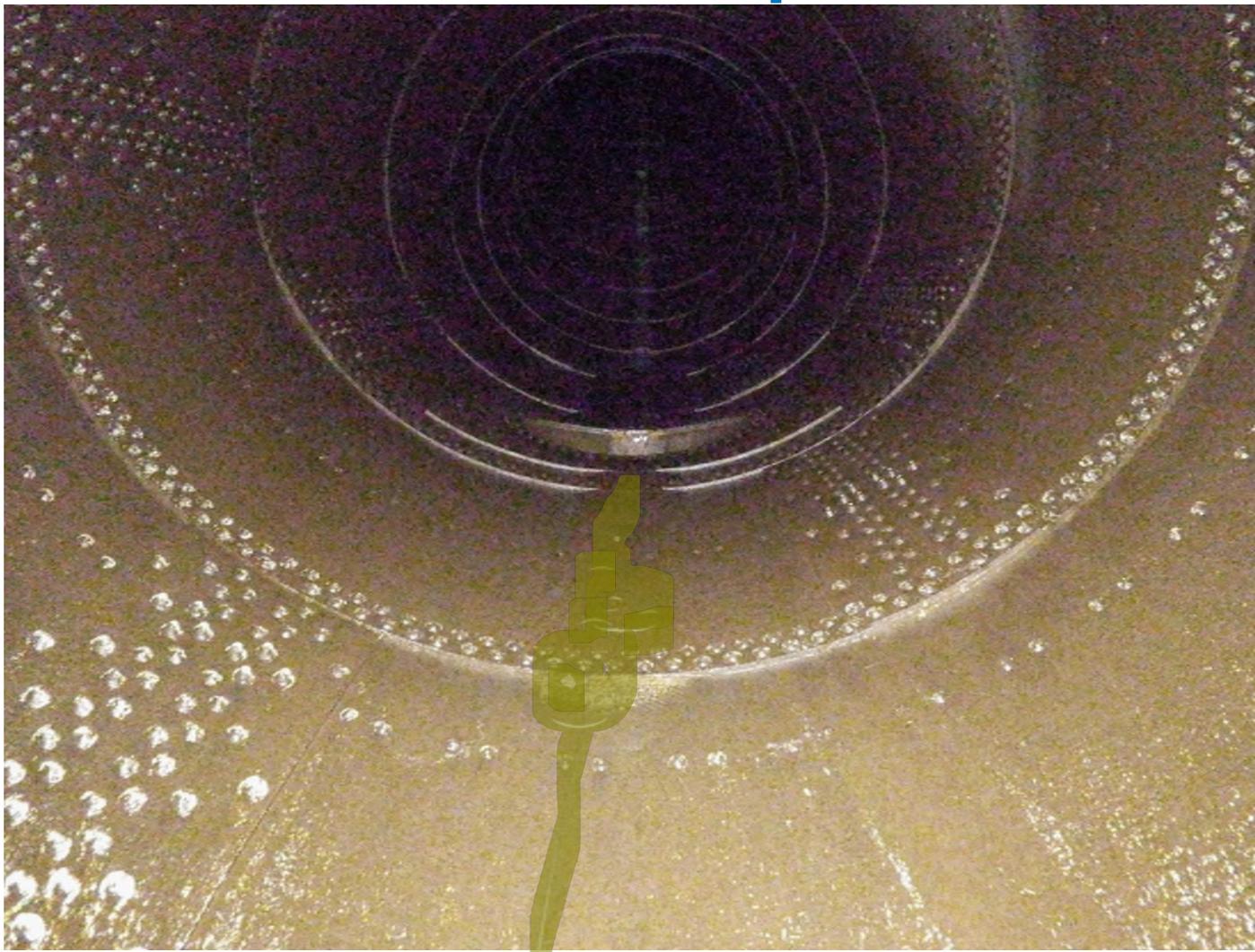
Lessons Learned - Drone Signal

Optional footer for data sources, etc.
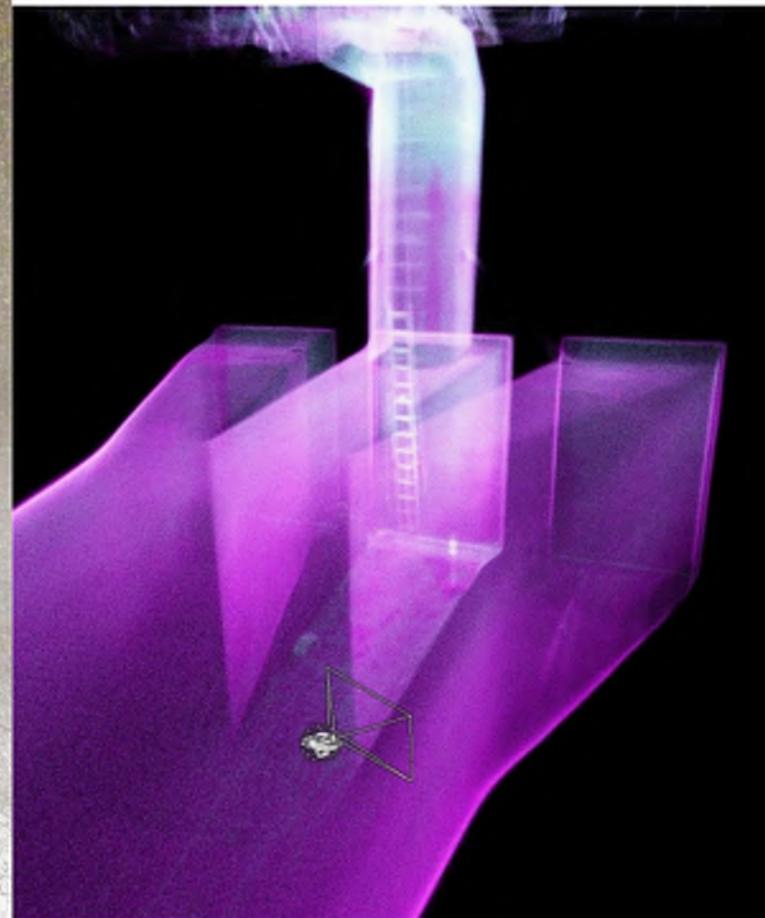
Lessons Learned – Flying Over Water

Optional footer for data sources, etc.
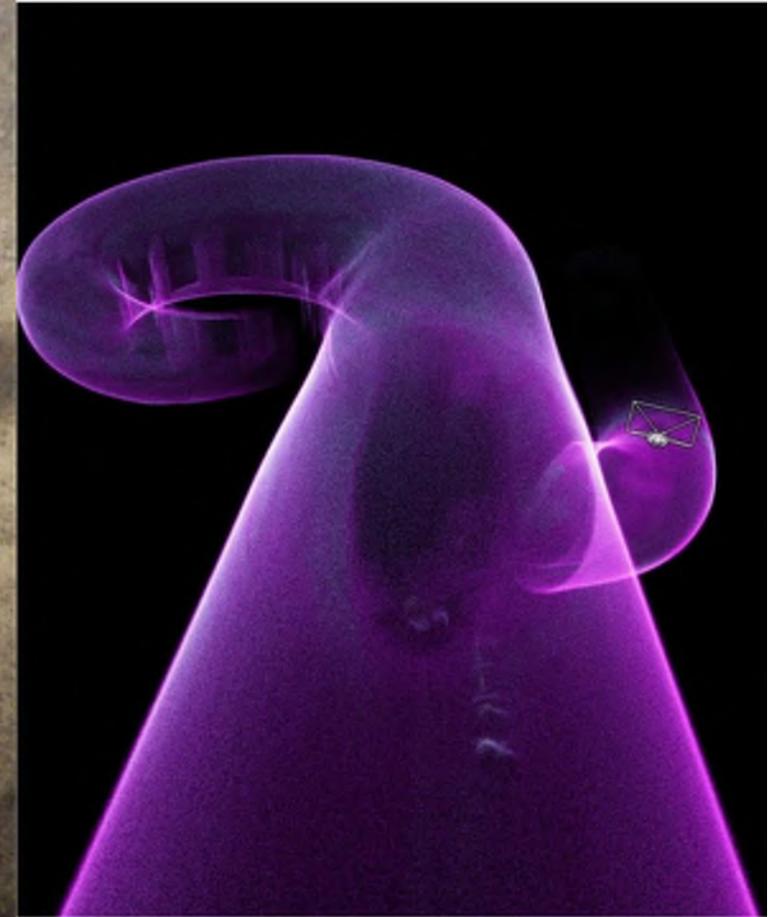
Lessons Learned – Summary Table

Pros	Cons	Added Benefits	Considerations
- **Safety**	- Steel Thickness Measurements	- 3D Model (3D Lidar Scan can feed CFD Model and be used for threshold development)	- Sealing Headgates
- Quality	- Inspection vs. Evaluation		- Sitting Water
- Repeatability (Coordinates, 3D Model to Reference)	- Cost ($10k-$20k / Inspection)	- Maintenance is better informed by the additional zones of inspection (Draft Chest/Runners/Air Vents	- Drone Signal
- Reduced Cost (Labor and Man Hours)			- Battery Life
- ~$			- Access for Drone
			- Not necessary for all Penstocks

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Thank You for the Opportunity to Present!

Questions or Comments?

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