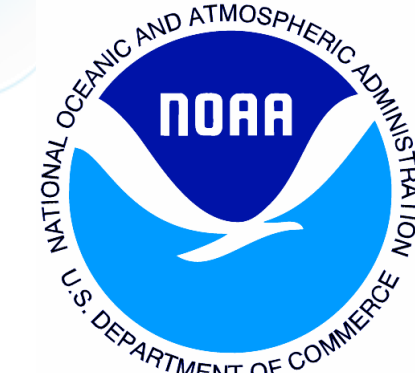


# Nitrogen Purging Restores Function To Water-Intruded Flexible

## PIT Antenna Cable, 2023

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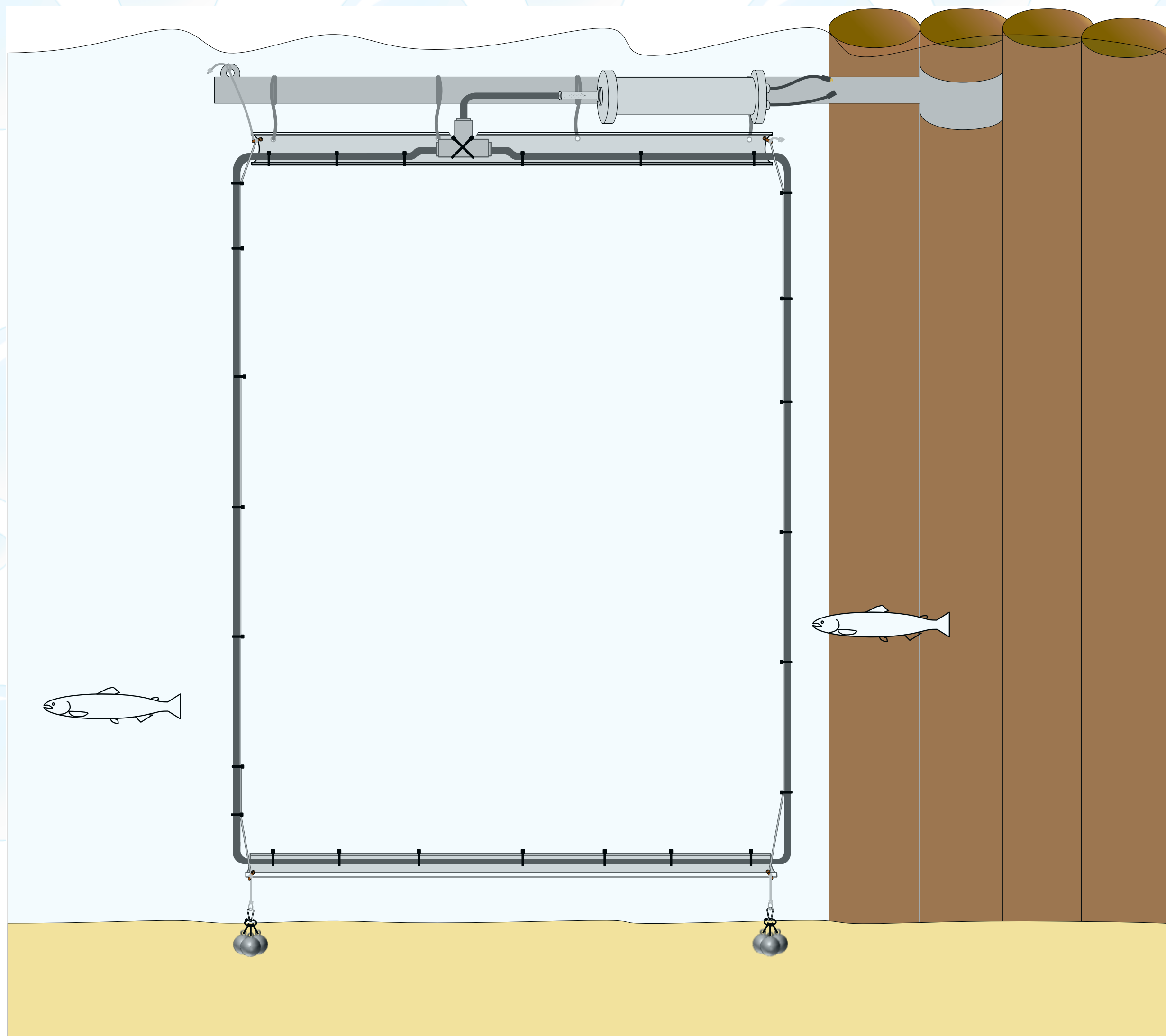
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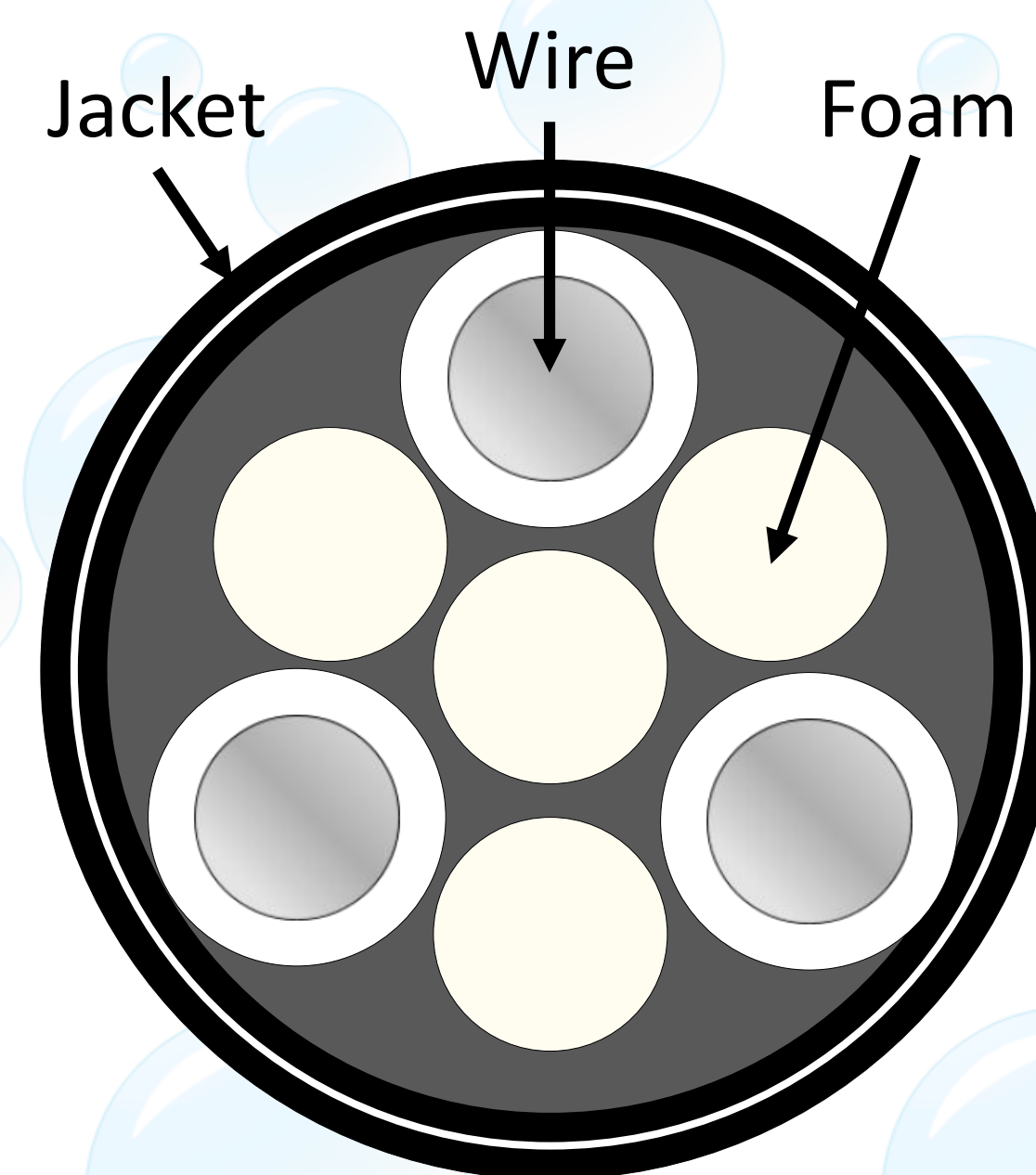
### Problem

Maintaining electronics in aquatic environments always comes with the risk of flooding your equipment. We use flexible antenna cable to detect PIT-tagged fish. When water enters flexible antenna cable, the result is reduced current, detection range, and site efficiency.



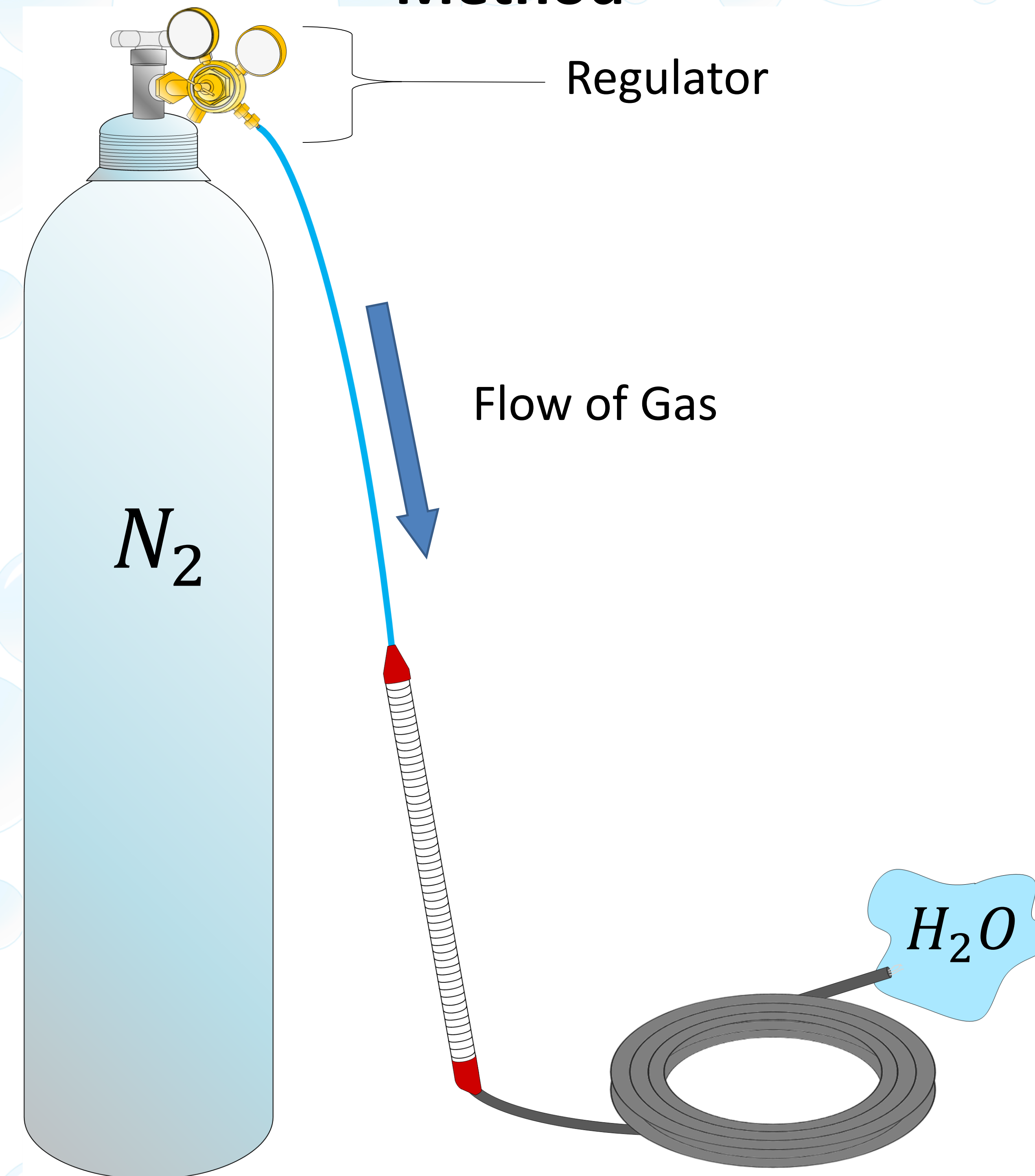
Due to the costs associated with building antennas, we explored a method to reclaim water-intruded cable.

During a flooding incident, water may become trapped in the inner cable jacket, foam spacers, and the antenna wire itself. By flushing these spaces with dry gas under pressure, water can be forced from difficult to reach places.



Cross-section of flexible antenna cable.

### Method



$N_{2(g)}$  is forced through the flexible antenna cable at 40psi for approximately 2hrs, successfully displacing  $H_2O$  from the interior.



Purged antennas are evaluated for current, signal noise, capacitance and read range prior to re-deployment. If parameters do not meet criteria, antennas are placed in direct sun to heat up or "bake." Repeated purging and baking cycles improved function in cable with deep water intrusion.

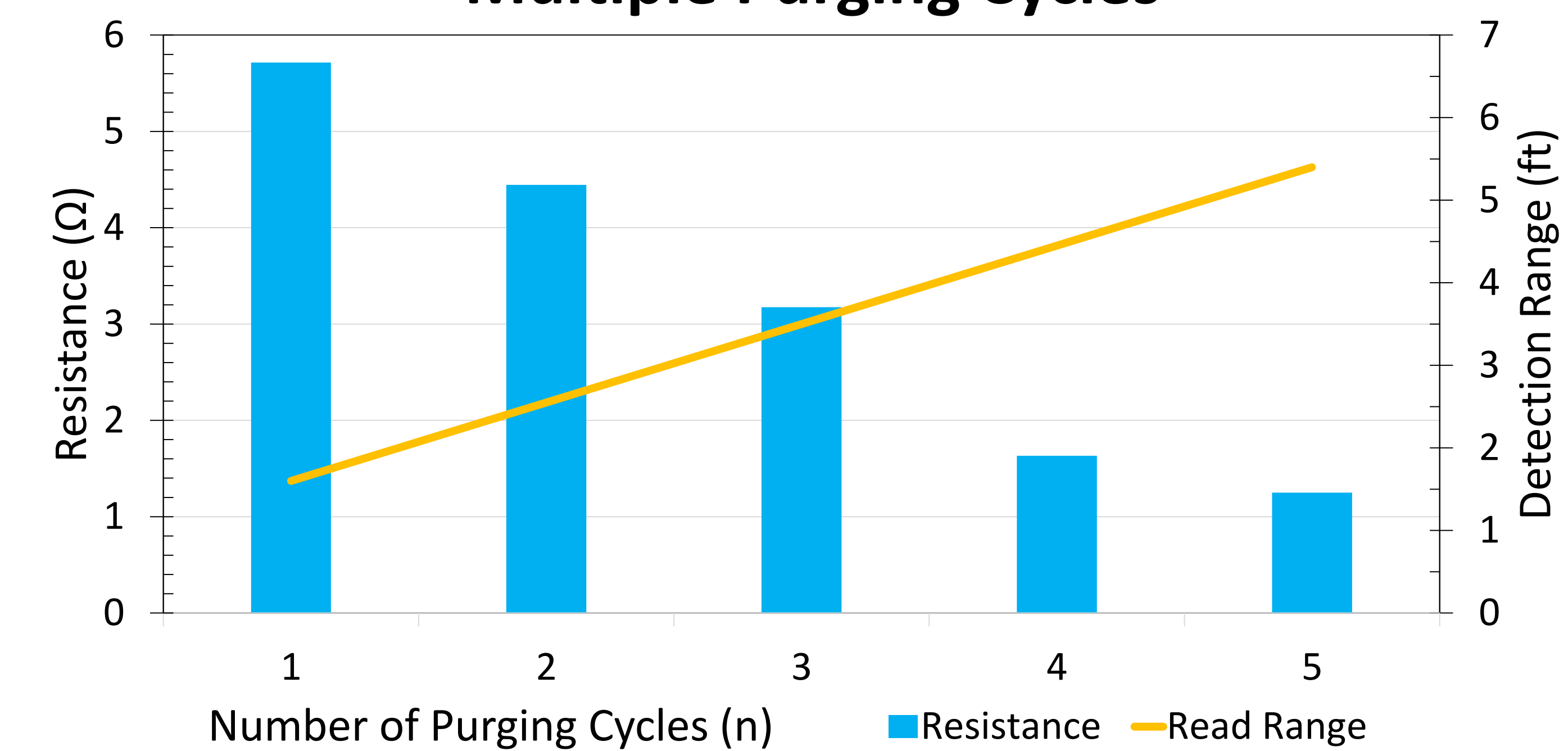
### Why Nitrogen?

- Compared to atmospheric air, commercial grade nitrogen gas is very dry, making it more efficient at removing moisture.\*
- $N_{2(g)}$  is inert, and therefore a relatively safe gas.
- Nitrogen gas is widely available at low-cost (~\$20/fill).\*\*

### Results

Of the seven antennas with water intrusion, all seven eventually regained full function and were returned to service. On average, 3.5 purge cycles were required.

#### Single Antenna Improvements Over Multiple Purging Cycles



Successive purging cycles resulted in reduced resistance ( $V = I \times R$ ) and an increase in read range.

Mean Antenna Resistance Before: 4.01 Ω  
Mean Antenna Resistance After: 1.52 Ω

### Conclusions

- Flexible antenna cable is expensive, as is the labor associated with constructing antennas.
- Additionally, valuable sample time is lost when antennas are out of service. By recovering and restoring these assets quickly, the cost of a flooding incident is significantly diminished.

Citations:  
\*\*Nitrogen Gas Purity Grades for Different Industry Uses." NiGen, NiGen, 3 Aug. 2021, nigen.com/nitrogen-gas-purity-grade-specification-industrial-medical-food/#:~:text=UHP%20nitrogen%20specifications%20are%20strict,part%20per%20million%20by%20volume).  
\*\*England Marine Industrial Supply, Astoria Oregon