

Zebra mussel & Asian Clam Progression And Impact In Gavins Point Power House

Invasive Mussels And Clams Found In Lewis And Clark Lake

Zebra Mussel



Asian Clam



History Of Zebra Mussels At Gavins Point

- Boatyard – Fall 2014
- Spillway – Fall 2015
- Pwr. Plant Piping – Summer 2016
- Increasing In Amount Each Year



First mussels found on a stop log

History of Asian Clams at Gavins Point

- HVAC Strainer – Fall 2015
- Generator Coolers – Summer 2016
- Decreasing In Amount Because Of Mussels



Stator cooler, bottom cover

Impacts to the power plant

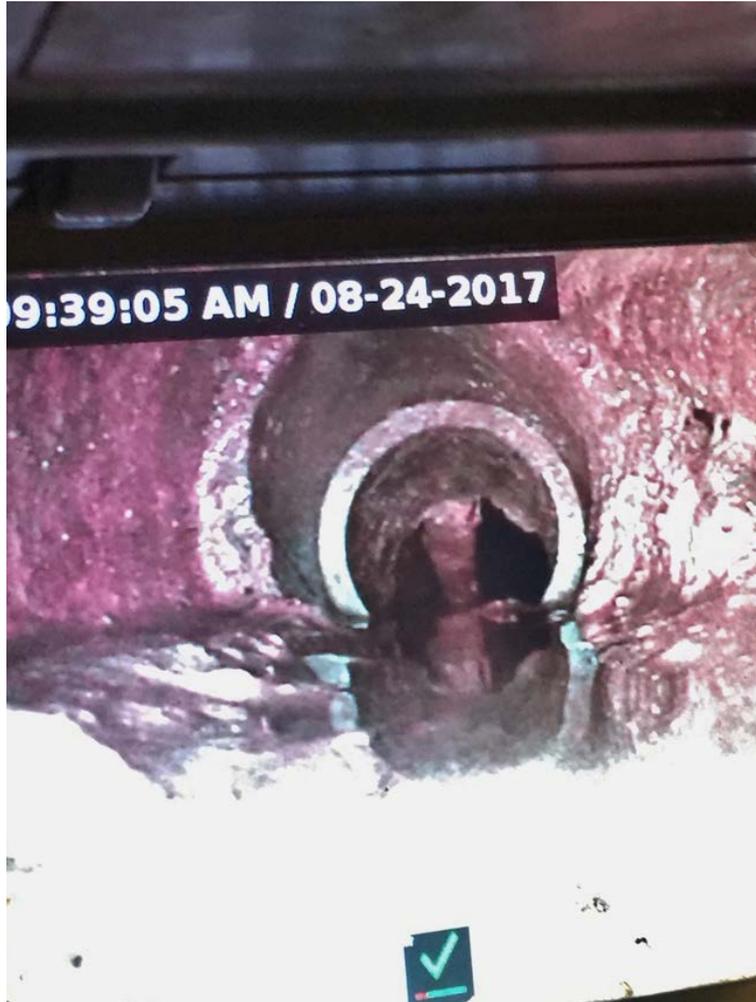
- Drain Lines
- Plant Raw Water Piping & Irrigation System
- Generator Cooling (Air And Oil)
- HVAC System
- Plant And Spillway Deicing Systems
- Plant Station And Unwatering Sumps
- Plant Intake And Tailrace Bulkheads

Drain Lines

Areas Impacted:

- Drains Backing Up From:
 - Mussel/Clam Shells
 - Calcium/Sediment
- Plant Sumps Were Full Of Shells

Obstructed Drain Line



Cleaned Drain Line



Epoxy Lined Drain Pipe



Shells/Muck From Sump

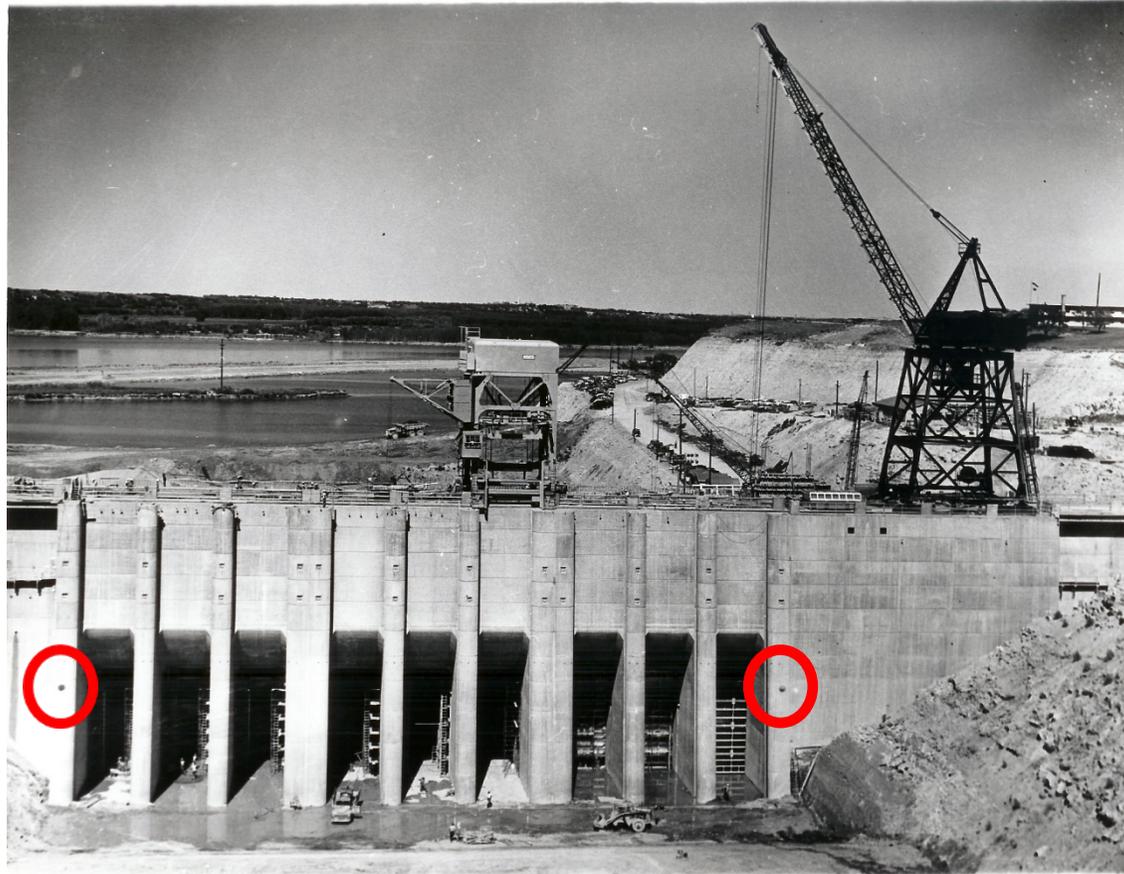


Plant raw water piping

Areas Impacted

- HVAC Heat Exchangers
- Plant Raw (Lake Water)
Cooling Water
Strainers/Intakes
- Turbine Shaft Packing Water
Strainers
- Irrigation Piping

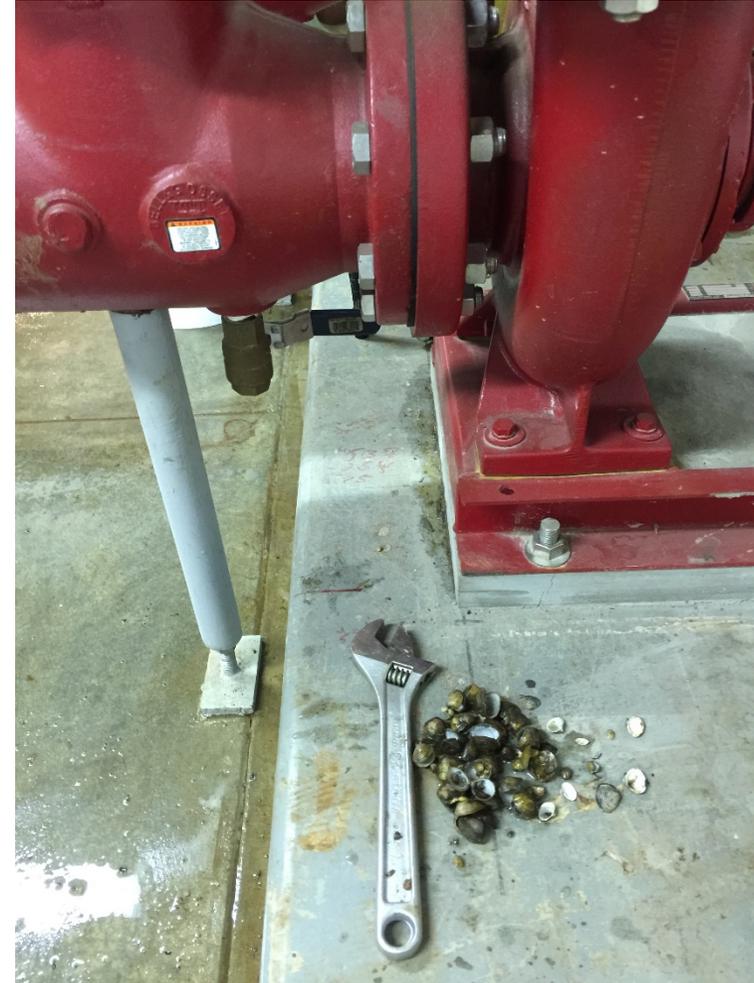
Plant Raw Cooling Water Intakes, North/South



Raw Cooling Water Strainer



HVAC Booster Pump



HVAC Heat Exchanger



Packing Water Strainer



Irrigation Strainer



Supply Fitting To Irrigation Piping



Generator Air Housing/Thrust Bearing Coolers

Areas Impacted:

- Air Housing Cooler Heat Exchangers
- Thrust Bearing Cooler Heat Exchangers
- Cooler Supply Piping

Air Housing Cooler



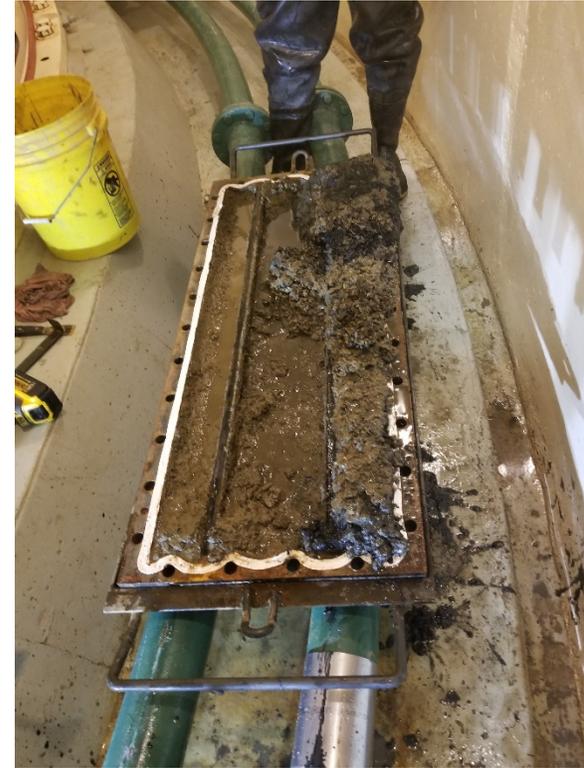
Top Cover



Lowered Bottom Cover



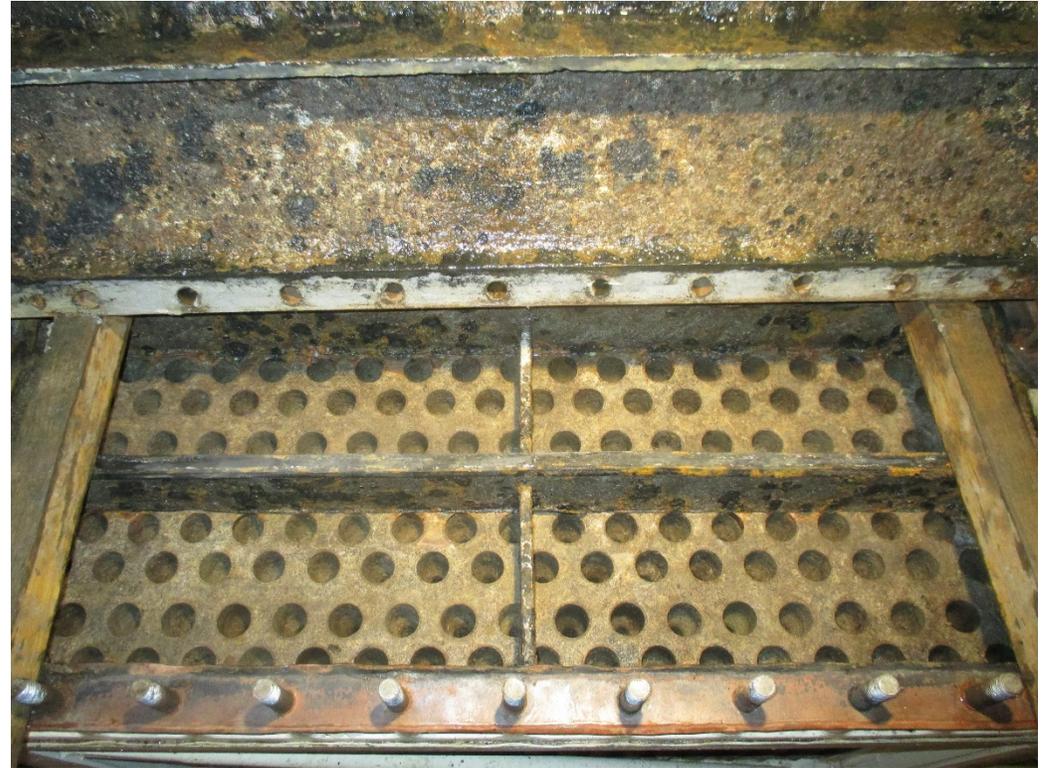
Bottom Cover Removed



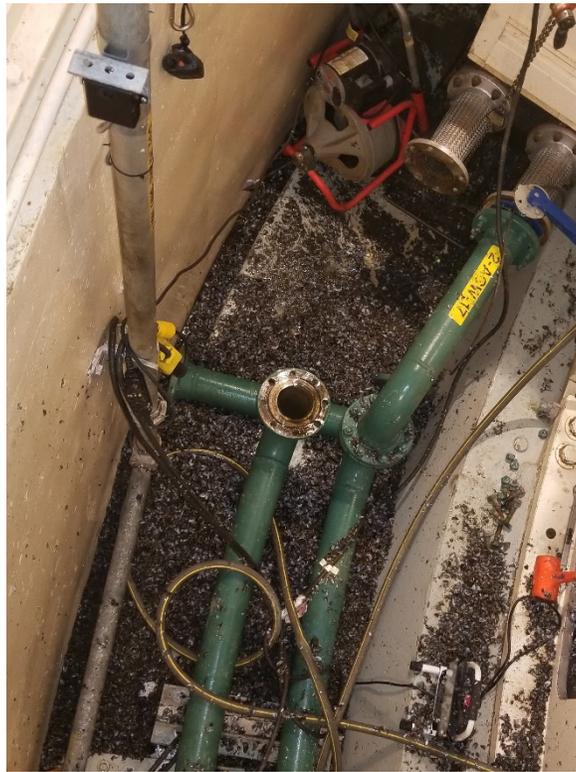
Air Housing Cooler (Dirty)



Air Housing Cooler (Cleaned)



Air Housing Cooler Supply Piping



Thrust Bearing Cooler



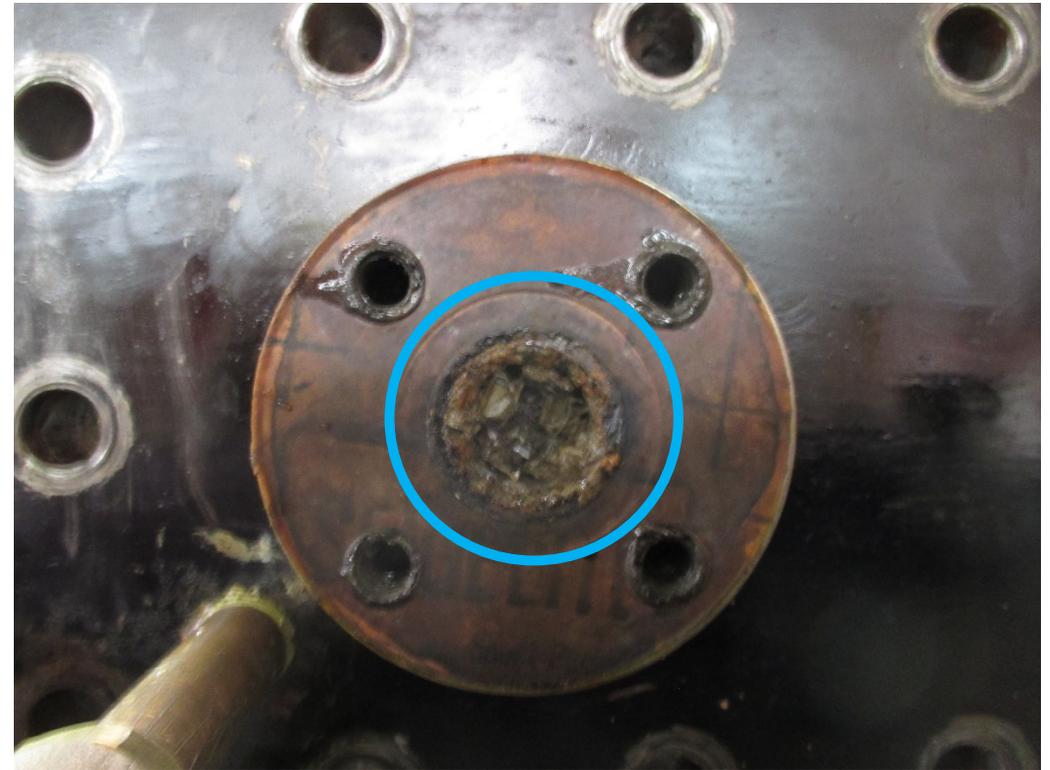
Thrust Bearing Cooler Close Up



Thrust Bearing Cooler Cover



Thrust Bearing Cooler Supply Line



Intake And Tailrace Bulkheads

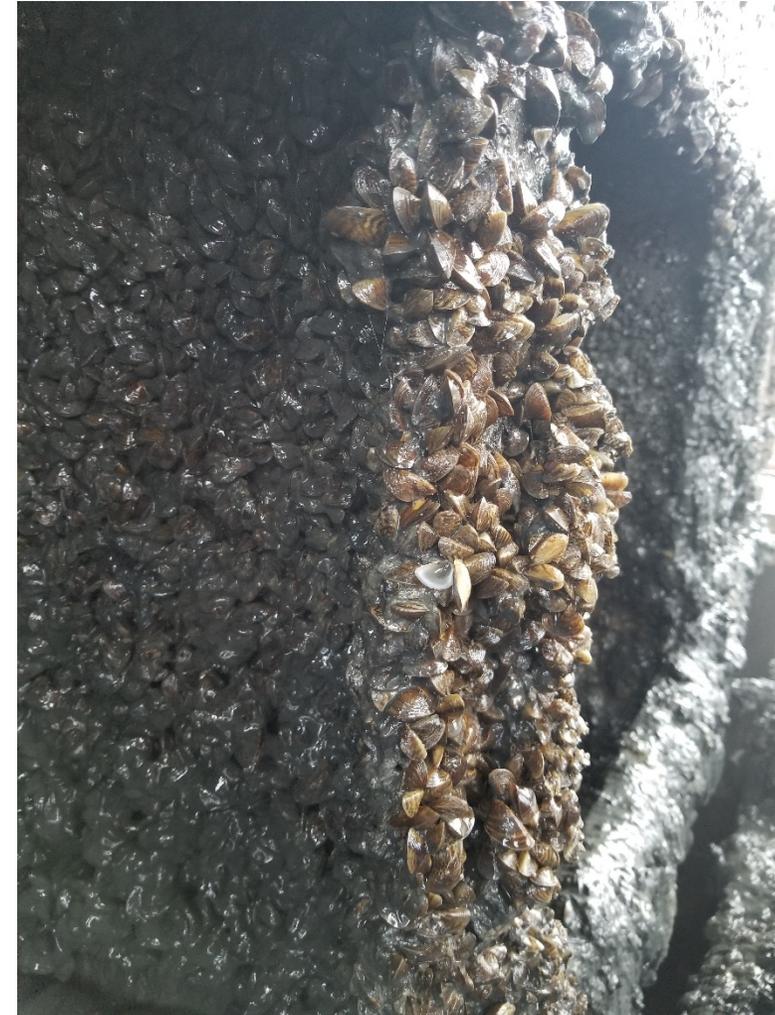
Problems:

- With The Buildup Of Mussels And Mud, Could We Overload Our Crane's Lifting Capacity?
- The Excrement Of The Mussels Is Known To Be Corrosive.
- Because Of The Way They Layer Up On Each Other, Could We Start To Have Clearance Issues With The Gate Anti-Friction Roller Chains?

Intake Bulkhead & Anti Friction Chain



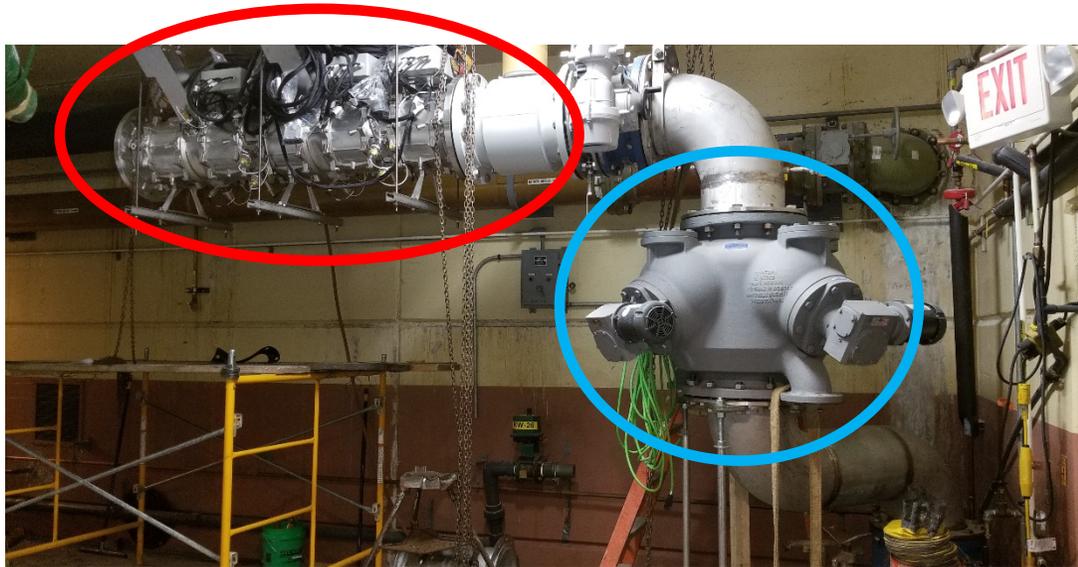
Intake Bulkhead (Close Up)



Raw Cooling Water Strainers
And UV Lights

New Versus Original

New Raw Water Strainer w/ UV Light



Original Raw Water Strainer



New Strainer:

- 1/8" Perforations In Strainer Screen
- Self Cleaning, 24 Hrs/Day
- Timer Or Differential Pressure
- Minimal Disruption To Water Flow
- Must Have A Drain

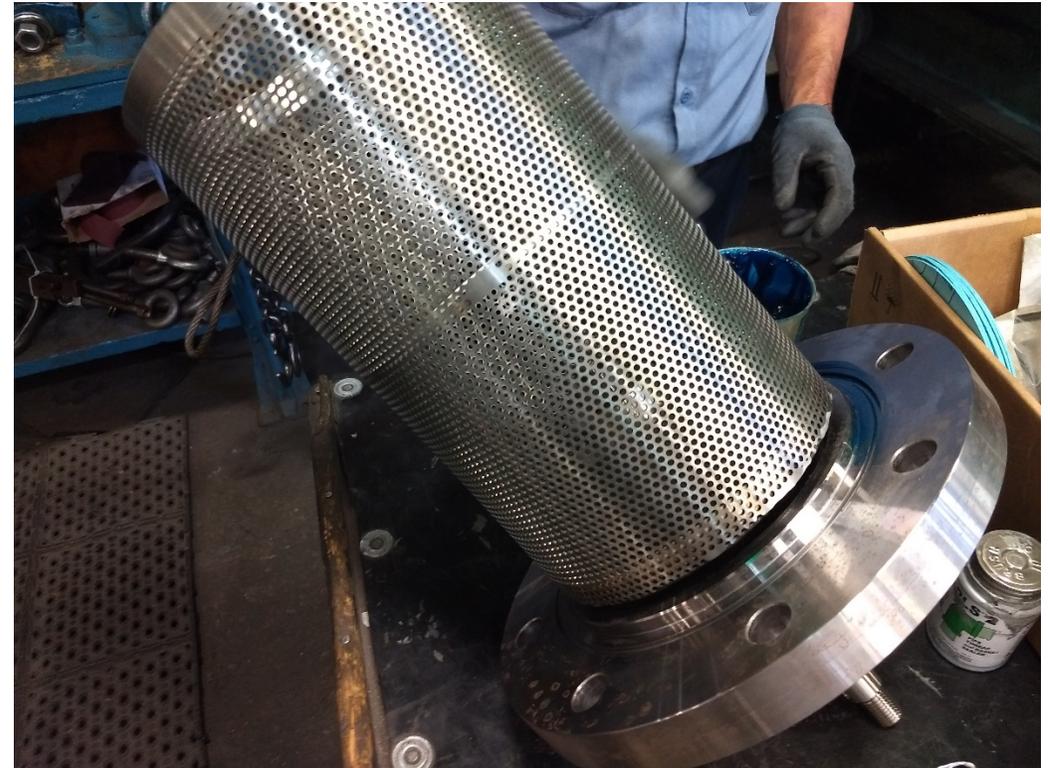
Original Strainer:

- 1/16" Perforations In Strainer Screen
- Manually Cleaned, Water Flow Stopped During Cleaning
- Personnel Call Ins If Needed Cleaning After Hours
- Did Not Need A Drain Due To Manually Cleaning

Hellan Strainer



Strainer Screen



Scraper Bar



Back Flush Manifold



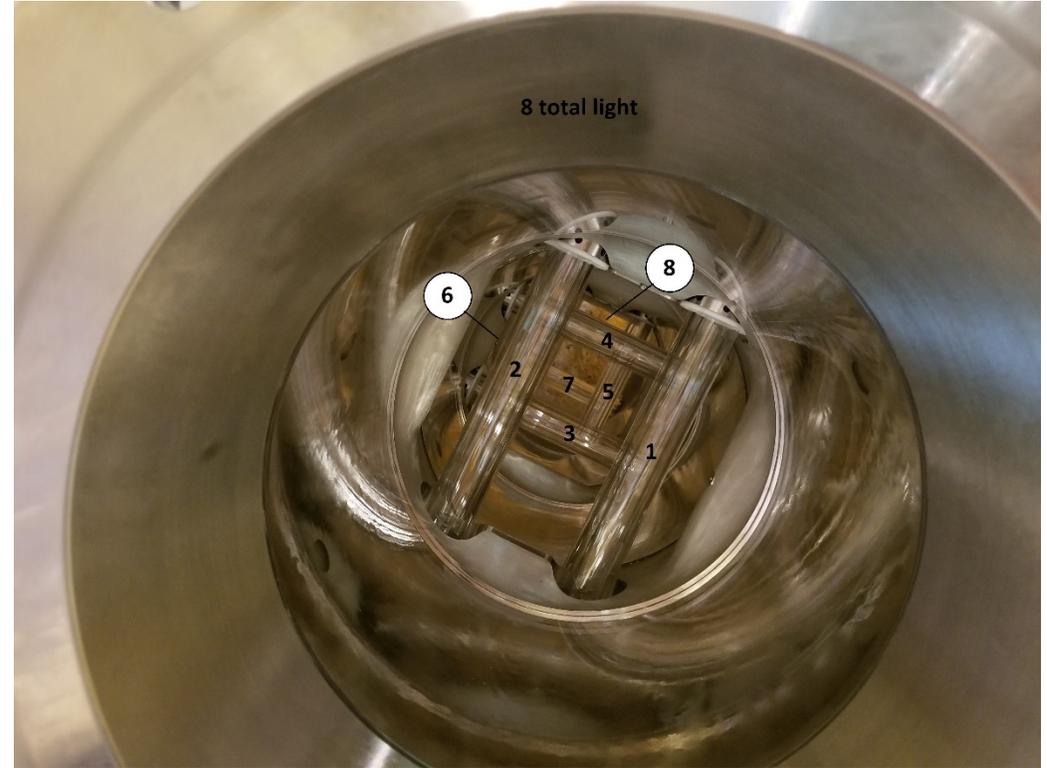
UV Light

- Kills Juvenile Mussels (Vilegars) And Clams (As Well As Some Bio Fouling) By Damaging Cell Proteins
- Has Real Time Monitoring, Automatically Adjusting UV Dose Based On Water Clarity
- Monitors Condition Of The UV Bulbs With A Colored Light Bar
- 6,000 Hr Life Span Per Bulb

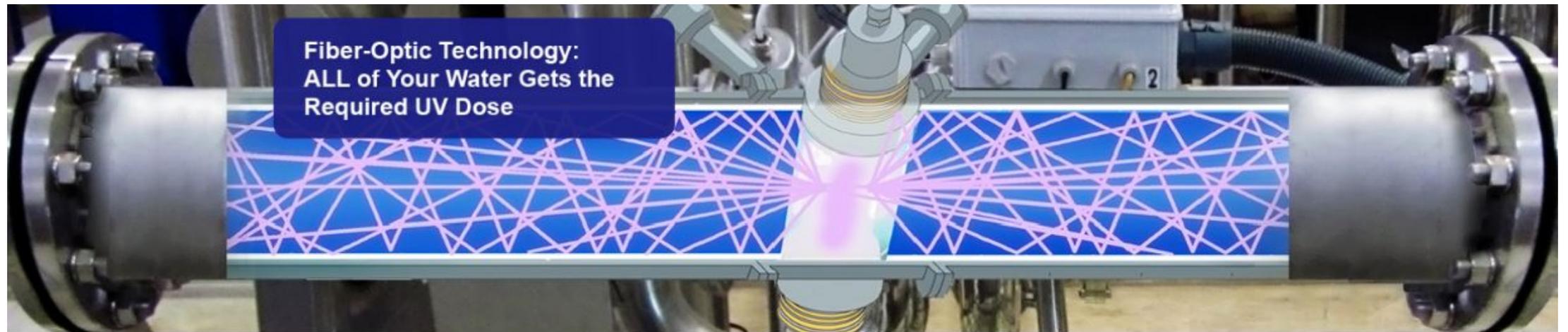
UV Light In Crate



UV Light Bulbs



How It Works



Take Away:

Additional Costs From Mussels/Clams:

- Drain Piping Contract: \$390,000
- Strainer/UV Light Contract: \$1,000,000 + \$20,000/yr. Maintenance Cost (Estimated)
- Air Housing/Thrust Bearing Coolers (Budgeted): \$1,200,000
- Man Hours: 2100 hrs @ \$48/Hr. = \$100,800 (Approx. \$ From 2014-Present)
- Additional Tools/Supplies In Plant: \$40,000 (Estimated)