

**ASCE | PIPELINES 2012 CONFERENCE**



# BLUE RIDGE PENSTOCK REHABILITATION



INNOVATIONS IN DESIGN, CONSTRUCTION, OPERATIONS AND MAINTENANCE *Doing More with Less*

**ASCE** | PIPELINES 2012 CONFERENCE

# BLUE RIDGE PENSTOCK REHABILITATION



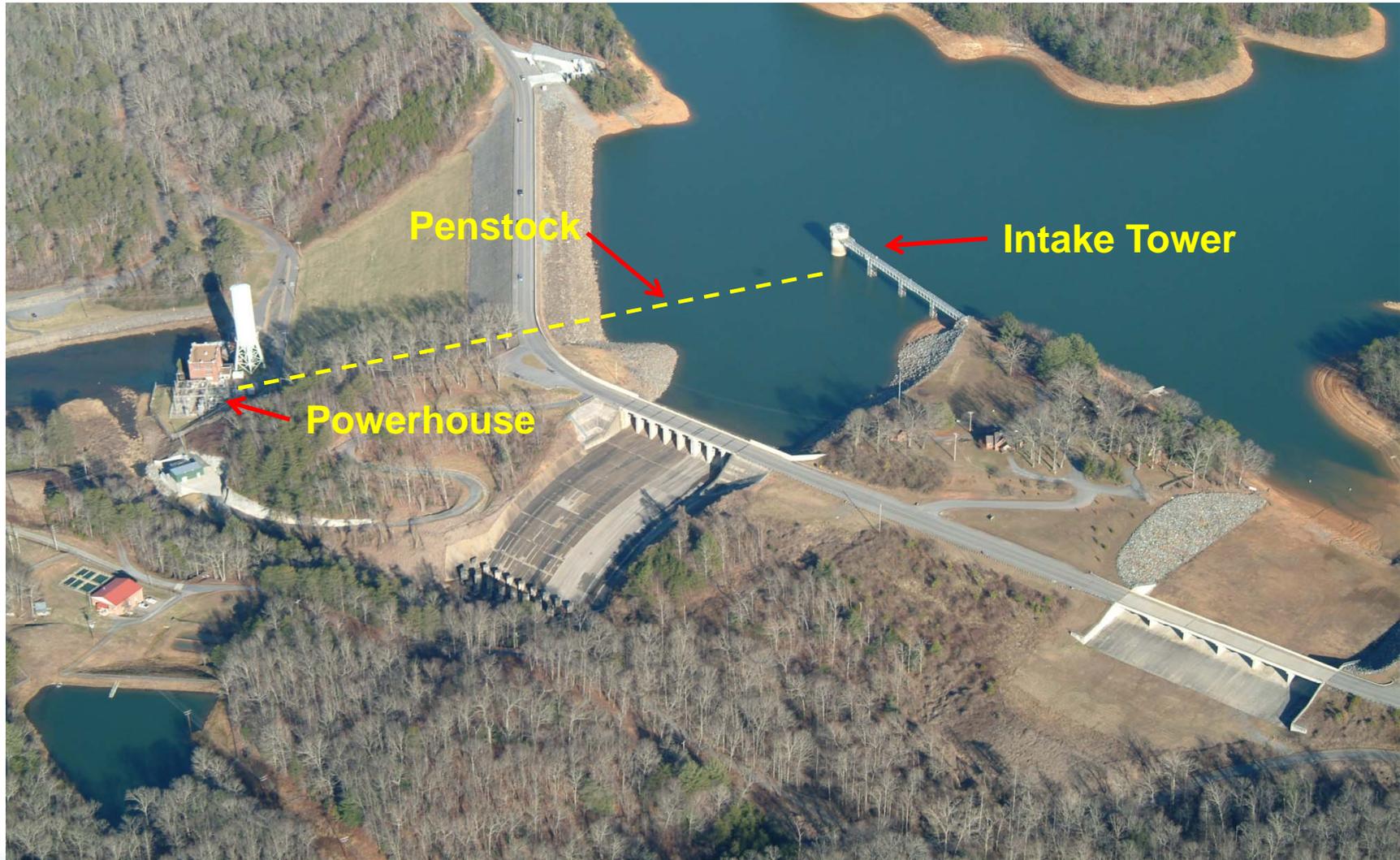
INNOVATIONS IN DESIGN, CONSTRUCTION, OPERATIONS AND MAINTENANCE *Doing More with Less*

# The Project

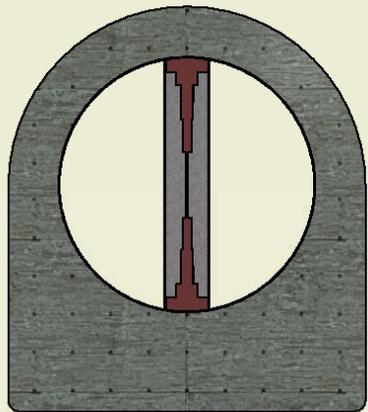
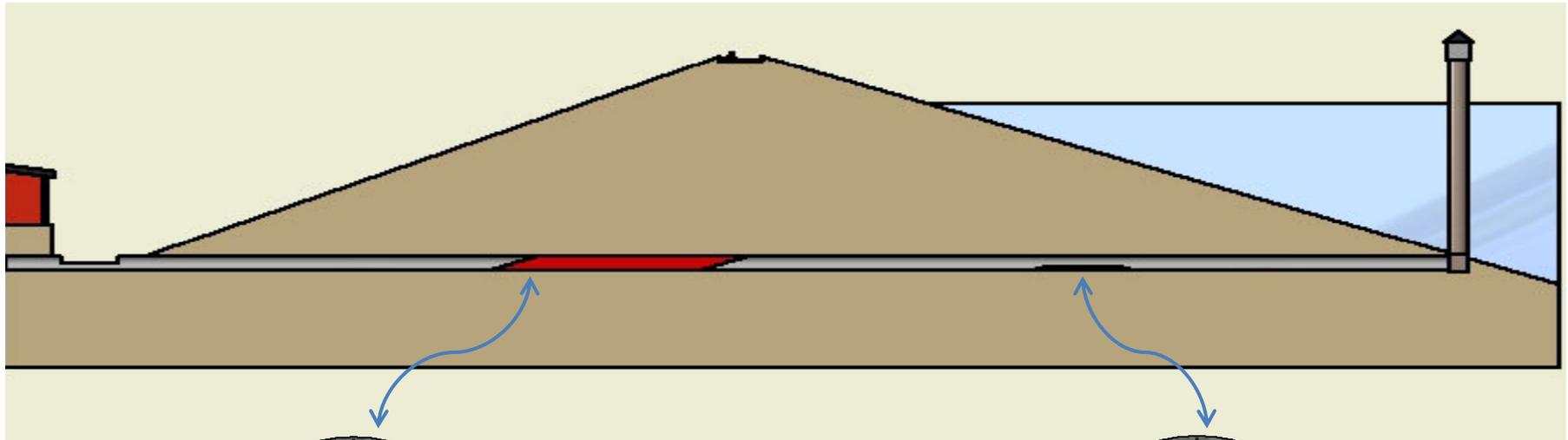
- TVA (Tennessee Valley Authority) is the owner and operator of the Blue Ridge Dam which is nearly 90 years old
- A 168" riveted steel penstock under this dam leads to a 25 MW hydroelectric power plant at dam base
- Shortly after construction a section of the penstock began to deform from external loading and required structural reinforcement.
- Original remedy was to install a steel reinforced, concrete filled girder through the center of the penstock 160' long by 18" thick and weighing 300 tons
- TVA/Paul Rizzo Assoc. Engineers remedy was to remove the girder and install a 147" x 1" thick steel liner within the penstock then grout the annular void
- **National Welding Corp.** was hired by **Garney Companies** to remove the girder, develop the installation means and install the new penstock
- **Northwest Pipe** laid out and provided the new penstock and reducers



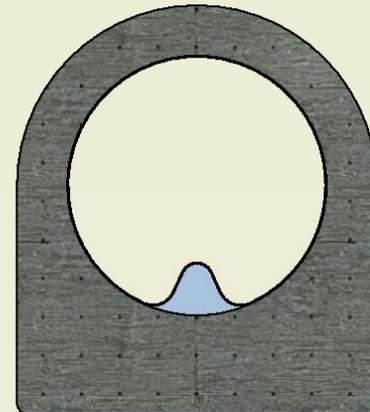
# Blue Ridge Dam Aerial View



## Dam and Penstock Section View



PENSTOCK GIRDER



PENSTOCK BULGE



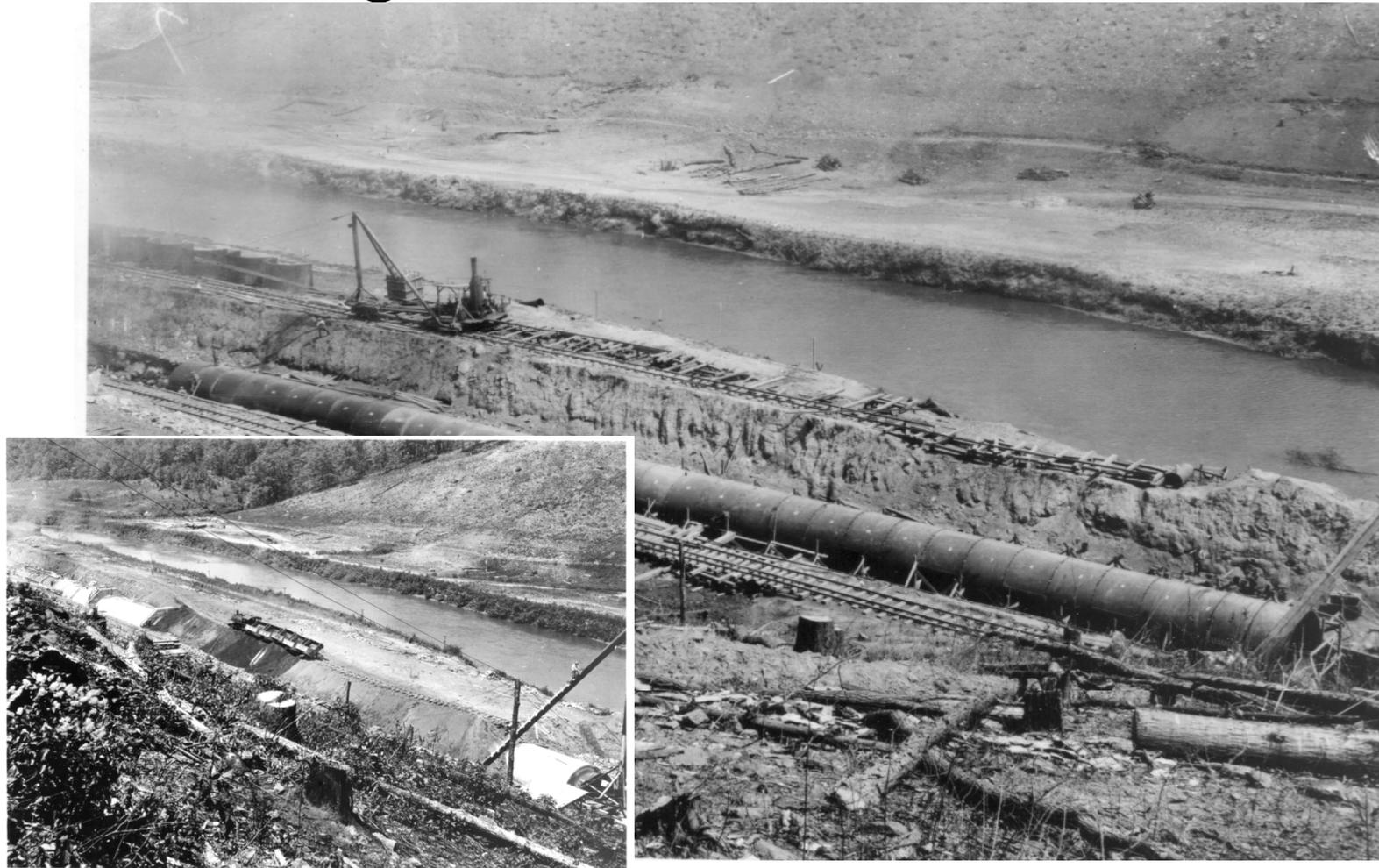
## Powerhouse



## Intake Tower



# Original Penstock Construction



- Penstock 1050 ft long x 14 ft diameter riveted steel , encased in 4 ft reinforced concrete
- Penstock/Dam constructed between 1923 - 1931



## Penstock Buckling 60' Long x 36" Tall



PENSTOCK BUCKLING OCCURRED DUE TO EXTERNAL LOADING. BULGE WAS A WATER FILLED CAVITY



## 300 Ton Steel/Concrete Girder



GIRDER MEASURED 160 FEET LONG X 18" THICK AND 14' TALL (FLOOR TO CEILING). CONTAINED STEEL AND CONCRETE MIX WITH LIMITED ACCESS.



## Reduce Pressure & Remove Bulge



PENSTOCK STABILIZED BY REDUCING  
EXTERNAL PRESSURE WHICH ALLOWED  
REMOVAL OF BULGE



## Removed 300 Ton Girder



THERMIC (OXYGEN)  
LANCE CUTTING TO  
REMOVE STEEL AND  
CONCRETE GIRDER



# Reducer Assembly



168" TO 147" REDUCER  
INSTALLED IN QUARTER  
SECTIONS WEIGHING 4000  
LBS EACH



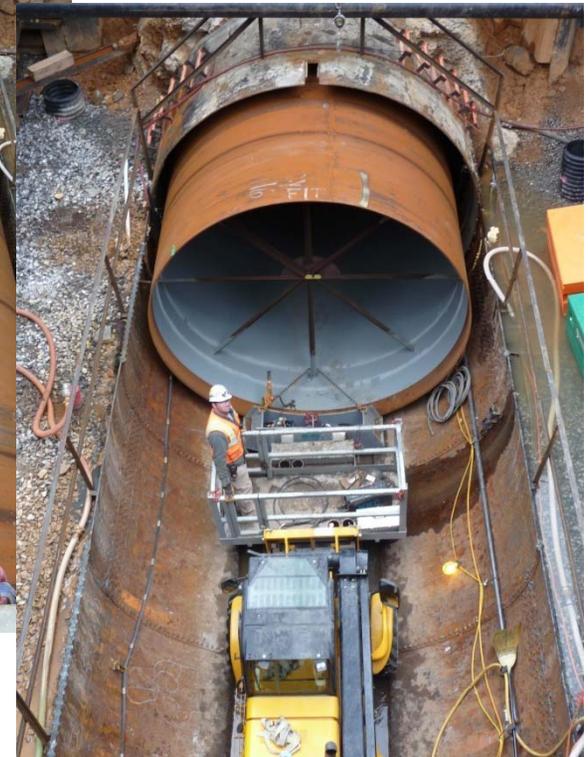
# Install Rail Sections & Carrier



RADIAL MOUNTED  
RAIL UNIQUE CARRIER



# Penstock Installation



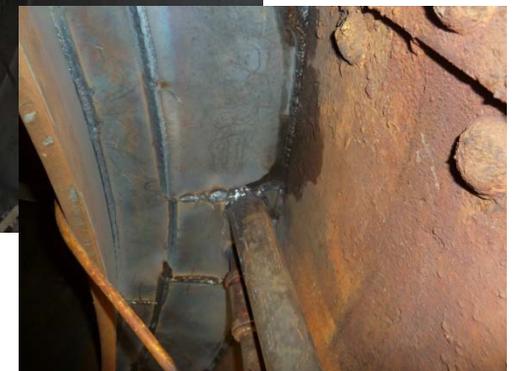
8" ANNULAR SPACE WITH  
50,000 LB PIPE REQUIRED VERY  
ACCURATE TOLERANCES &  
GOOD CONTROLS



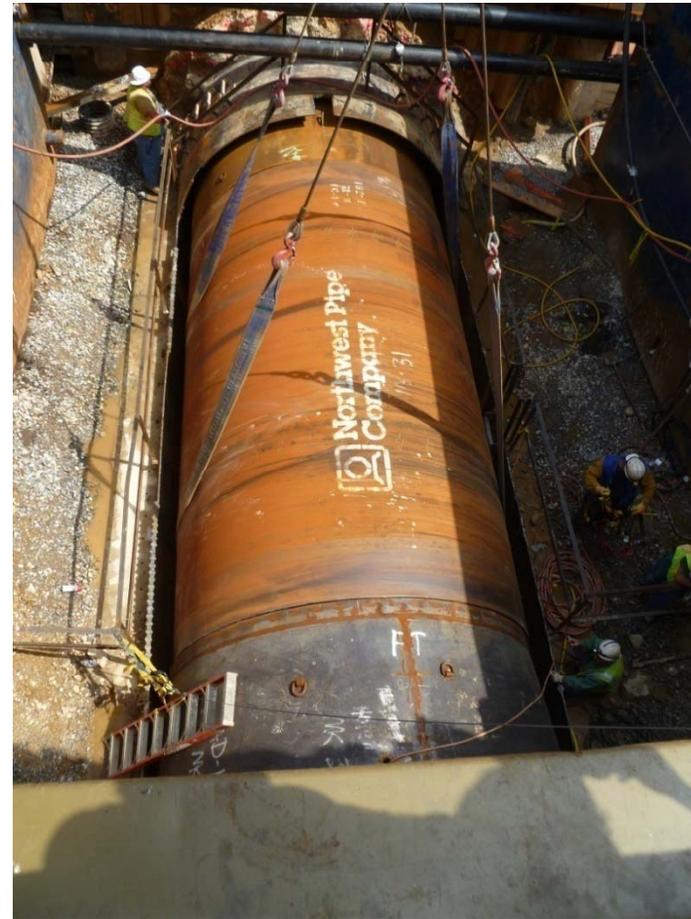
# Supports, Weld and Grout Dams



UNIQUE SUPPORTS,  
DAMS AND WELDING  
WERE REQUIRED



## Final Section (tight fit!)



# BLUE RIDGE PENSTOCK REHABILITATION

QUESTIONS ?

