



Hitting the Bulls-Eye

How to Cut-In a 108" Outlet to a 108" Vertical Shaft 230' Beneath a Lake



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Presentation Breakdown



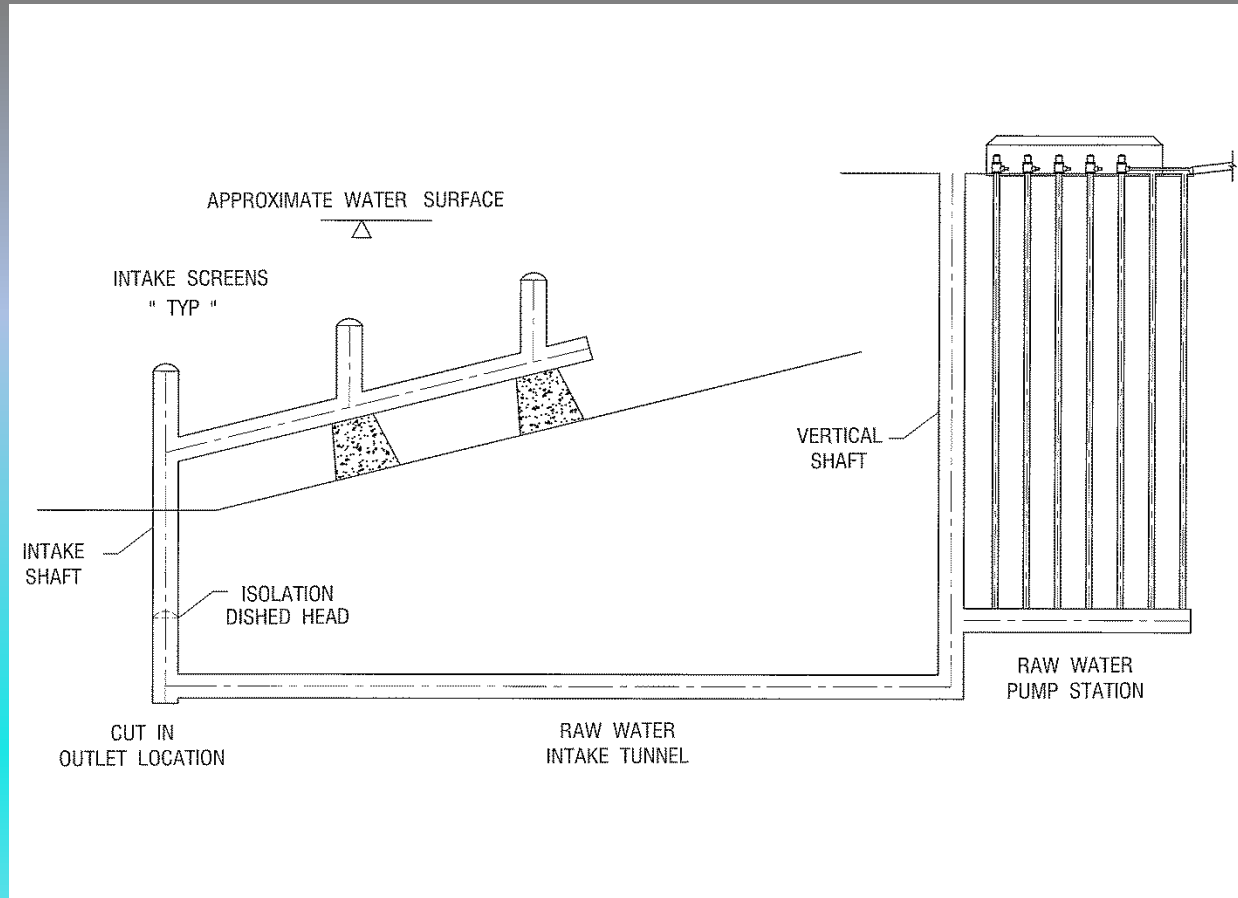
**Manufacturer's Perspective-Presented
by Glenn Davidenko**

**Installation Perspective-Presented
by Gedas Grazulis**

Closing-Presented by Glenn Davidenko

Q & A-Both Presenters

Manufacturer's Perspective



Hydraulic Profile Schematic for Austin Water Treatment Plant No. 4.

Project Specification Requirements for Field-Installed Outlets



Specifications called out for the Cut-In Outlet meet AWWA Manual M11-Steel Water Pipe: A Guide for Design and Installation, Manual of Water Supply Practices, Fourth Edition (AWWA 2004). Chapter 13, Supplementary Design Data and Detail outlines the procedure for reinforcement for fittings.

Pressure-Diameter Value (PDV)



$$PDV = \frac{Pd^2}{D \sin^2 \Delta} \quad (\text{Equation 1})$$

AWWA Manual M11 Requirements



Pressure Diameter Value (PDV)

(All values are in US customary units)

Where P = Design Pressure (from Hydraulic Profile), in psi

d = Branch OD, in inches

D = Main Pipe OD, in inches

Δ = Outlet Angle, in degrees

Main Pipe and Branch OD = 110 ½"

Design Pressure = P = 150 psi

Delta = 90 Degrees

AWWA Manual M11 Requirements



Pressure Diameter Value (PDV)

Based upon the above requirements, the PDV for this Outlet is around 16,575. According to the AWWA M11 Guidelines, this application would require a 3" thick crotch plate type reinforcement with a depth of plate, d_w and d_b of around 70" and a width of plate, d_t around 23", resulting in the fitting being over 10 feet long and nearly 13 feet wide.

Sample Full Diameter Outlets with Crotch Plate Reinforcement





Why would a fitting with Crotch Plates NOT work for this installation?

- Space Limitations within the work area
- Requirement for crotch plates to be cut into halves for movement down the intake tunnel
- Fit-up and welding concerns associated with field-installation of crotch plates

Proposed Design Alternatives



- Change Cut-In Outlet to 90° Elbow
- This Alternative was not accepted

Proposed Design Alternatives



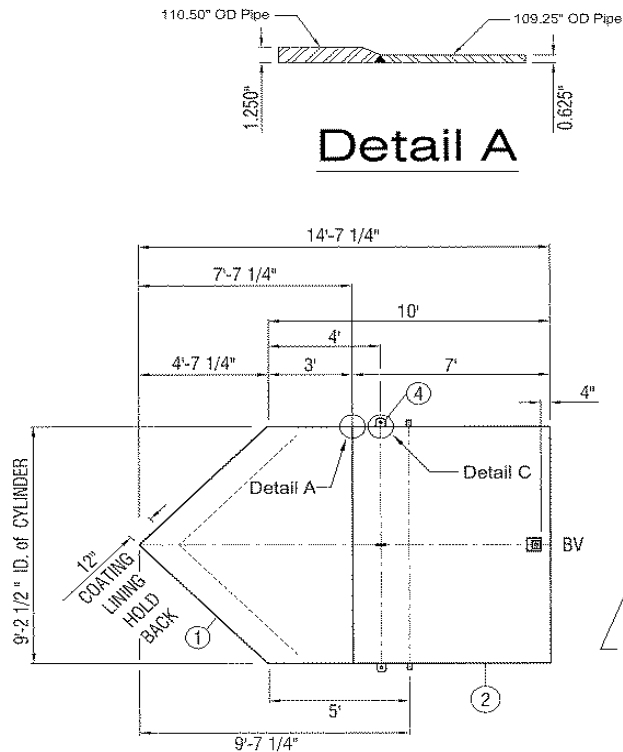
- Design the Outlet per a Design Methodology that would eliminate the crotch plates.
- Engineer would only accept a methodology that was recognized, been used previously, and could be fully documented as an acceptable practice.
- Pipe manufacturer required that the procedure be able to utilize current manufacturing practices.

THE SOLUTION

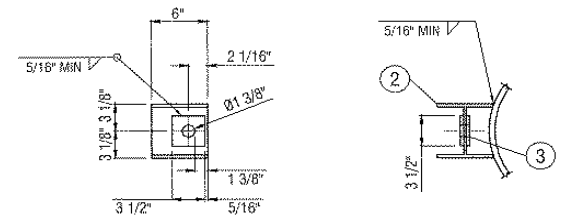


- Utilize the ASME Code – Section VIII-Division 1 as the design methodology.
- Allowed pipe and outlet steel wall thicknesses to fully reinforce the outlet without any additional reinforcement.
- Worked with engineer to develop design calculations for review and approval
- Engineer Accepted!!

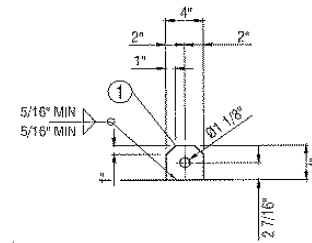
Pattern Detail for Cut-In Outlet



NOTE: WELDS TO BE 5/16" MIN.



Detail B



Detail C

Gedas Grazulis

National Welding Corporation-Specialty Installation Perspective



Transportation



Installation



Measure, Scribe, Cut and Repeat!!!!



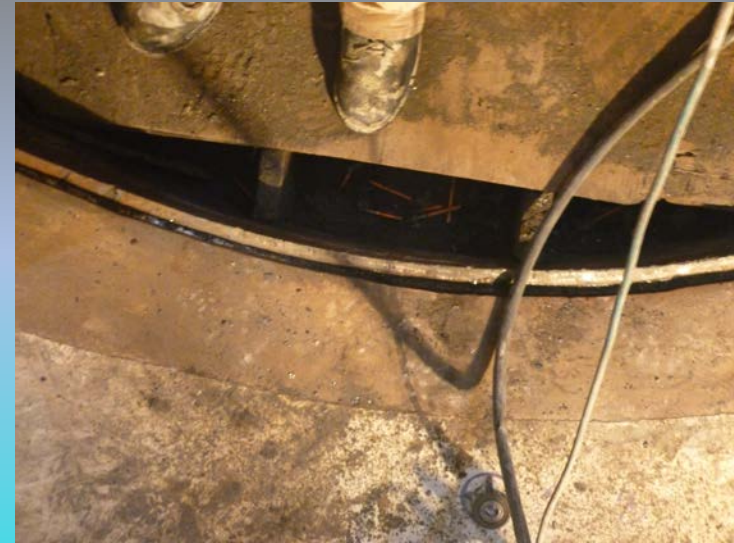
Measure, Scribe, Cut and Repeat!!!!



Measure, Scribe, Cut and Repeat!!!!



Changing Joint Profile



Bracing



- Weld on “ears” installed at location
- Angle iron at excessive length to allow for height variation



Welding Operations



- FCAW Flux Cored Arc Welding

- Inverter style welding machines



Conclusion



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WELDING