DESIGN OF UNDERGROUND ELEMENTS FOR THE RAW WATER INTAKE FACILITIES

CITY OF AUSTIN WATER TREATMENT PLANT NO. 4

Gregg Sherry – Brierley Associates, LLC
Shelby Eckols - AECOM
William Stauber – City of Austin, TX
Project Background

- Planning began in 1980’s
- Original design 1984 to 1986
  - 60 MGD Treatment Plant
  - Three separate intakes (550, 605 & 640 MSL)
  - Tunnel - 11,000 ft, 10 ft dia
  - Pump station at Water Treatment Plant
- Bid in 1986 then paced on hold
Project Background

- City of Austin retains Carollo in 2002 to design current WTP # 4 project
  - AECOM lead designer for Raw Water Intake Facilities
  - Brierley Associates lead designer for underground facilities

Project Location
Raw Water Intake facilities
Hydraulic Profile – Raw Water Facilities

Tunnel & Intake - 300 MGD

Pump Station - 50 MGD

Transmission Tunnel - 150 MGD
Geotechnical investigations


- “Geotechnical Data Report, City of Austin, Water Treatment Plant No. 4, Raw Water Facilities and Tunnels, Austin, Texas,” prepared by Fugro Consultants, Inc., for TCB, February 2010.
Raw Water Tunnel Geology
Transmission Tunnel Geology
Pump Station Site

Site Excavation Performed on Previous Contract
Pump Station Site
Pump Station Site

- Site excavation done under previous contract
- Access shaft
- Pump station
- Pump wells
- Transmission Main Portal
Pump Station
Raise Bore
Raise Bore

- Robbins 7-SP Drilling Machine
- 250hp DC Motor
- Breakout Torque of 252,000 Ft-lbs.
- Hydraulic Reaming Thrust of 800,000 Lbs.
Raise Bore
• Micon Rotary Vertical Drilling System (RVDS)
Cutter Head

Sandvik 8’ dia reamer head
Cutter Head in Suction Chamber
Raise Bore
Raise Bore
Reaching Surface
Completed Shaft
Upper Structural Support Clamp
Well Casing Installation
Well Casing Installation
Well Casing Installation
Lower Falsework

[Diagram of Lower Falsework with annotations: Lookup Per Leg Shoring, Work Deck, Shoring Cross Beam, Grout Buck Line, Lookup Per Leg Shoring.]

Elevation
Set of Lower Falsework
Grouting Operations
Grouted Well Casing
Surveying
Access Shaft

- Located at pump station site
- 25.5 ft dia. Elev. 870 to 445 msl (425 ft)
- Suction cavity – 12.5 by 12.5 ft horseshoe.
- Pump suction wells – 60 dia. inch steel
- Future tunnel connection – 9 ft by 9 ft horseshoe excavation
- Intake tunnel connection
Access Shaft Construction

- Confined Construction site
- Roadheader - 28.5 ft excavated
- Cast-in-Place Lining - change order (shotcrete & bolts originally)
Suction Cavity

- 12.5 by 12.5 horseshoe excavation by Roadheader
- Concrete lining
- Suction well shaft connections
Future tunnel connection

- 9 ft x 9 ft horseshoe excavation by Roadheader
- Steel lined
- Bulkhead for future connection
Intake tunnel

- Access Shaft to Intake Riser - 4386 ft
- Probe holes
- Initial support two bolts typical
- Weak ground - shotcrete, 4 bolts and mesh
- 9 ft diameter Cast-in-place concrete lining
Connection to Intake shaft

- Shaft done before tunnel excavation is within 60 ft
- Mandatory probing and grouting
- Excavation proceeds to shaft riser pipe
- Constructed a steel tee connection.
- Construct a reinforced concrete transition section
- Begin unreinforced concrete lining
Raw Water Intake
Intake

- Marine construction in approximately 150 ft of water
- Three intakes at 652, 607 and 568 msl
- Riser shaft, 9 ft diameter steel pipe, grouted annulus
- Caisson foundations (subject to value engineering)
Transmission Main Tunnel

- Portal at Pump Station Site
- 3873 ft long, 7 ft diameter
- Initial support two bolts typical
- Weak ground - shotcrete, 4 bolts and mesh
- 7 ft dia. Steel lining backfilled with cellular grout
- Blind bore shaft with 7 ft dia. riser at Treatment Plan Site
Transmission Main Tunnel

Roadheader excavation

Portal in South wall of Pump Station Site
Construction

- Construction Management At Risk – MWH
- Subcontractor for Underground and Marine work – Hill Country Constructors (Obayashi & Manson)
- Began in Spring 2011
- Finished Summer 2014
“Creating Space Underground”
Environmental Review
Tolerance Checks
Well Casing Installation
Grouting Operations
Raise Bore
24 Hour Operations