Talybont Reservoir – Innovations in Pipework Replacement

Presenting:
Adam Bush-DCWW
Talybont Reservoir Overview

**Dam location:**
Brecon Beacons National Park, South Wales.
Approx. 30 miles North of Cardiff and Newport
History:

- Constructed between 1932 and 1939
Scope of works

• Survey of the Reservoir toe drainage and its measurement
• Tunnel & tower drainage reviewed
• Improve access to the tunnel
• Improve the lighting in the tower and tunnel structures
• Remove broken equipment from the asset
• Enhanced releases project
• Review the recommissioning of the Turbine
Talybont water Treatment Works (WTW) max flow of 65MLD

- The WTW flow must remain uninterrupted throughout construction.
- No live mains in the tunnel or tower during construction.
- Compensation flow must remain continuous throughout construction.
- All equipment on the reservoir must be removed before 1st January 2019
- All temporary pipework is to be in commission for as short a time as possible.
Scope Constraints

- Reservoir Level cannot be reduced to facilitate works
- Age of the asset
- Unknown condition of elements
- Isolation of equipment must conform to HSP119
- Various internal DCWW departments interests
- Dam crest road must remain open to at all times.
- A maximum 44T weight limit is in place on the Dam crest road
- A Maximum 2T weight limit for vehicles and plant that tracks along the berm of the reservoir
- No excavation works are to be undertaken in the Dam structure
- Compensation of the raw water must remain unaffected for treatment
- Confined space working
- Specialist Diving activities are required
Project Design

- Design Philosophy
  - Enabling works - Temporary Supply to WTW
    - Temporary supply pipework
    - Temporary chemical Dosing
    - Temporary electrical supply
    - Associated Temporary works
  - Permanent works
    - Isolation Philosophy (Double isolation)
    - Pipework Materials
    - Lifting equipment
    - Other Elements of permanent works
Enabling works - Design Calculations

**Compensation Siphon Flow Capability with Varying Reservoir Level**

- **Peak flow achievable from 1 No. Compensation Siphon: 46 Ml/d**
- **Actual Proved Value: 46.7 Ml/d**

**Note:**
Flow achieved when maintaining a pressure of -7.5m (-76.5 N/m²) at the dam crest (Highest Point).
Pressure is not to reduce below this value due to risk of vaporisation.

**12.5 Ml/d Compensation flow achievable from 1 No. Siphon down to a level of 184.4m AOD**

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**DCWW Engineering Delivery Design**
Title: Compensation Flow with Varying Reservoir Level
Status: Information
Figure No.: 2505-CD15825-SE-U-I01
Produced by: Michael James
Position: Chartered Mechanical Engineer
Enabling works - Temporary Overpumping

Upstream Arrangement

500mm Dia. Siphon Connection

300mm Dia. Temp Pump Pipework
Enabling works - Temporary Overpumping

Upstream Dam Temporary Pump pipework arrangement.
Enabling works - Design Resilience

Pipe materials - Siphon Pipework

- 500mm HDPE SDR11 16 Bar
- Welded to reduce number of joints and aid with restraint.
- High Hoop Strength
- Good Thermic properties
- High Deflection for ease of installation
- 50mm wall Thickness
- Lighter than Metallic alternatives
- Selected for ease of installation
Pipe materials-Manifold Pipework
- 700mm Carbon Steel 16 Bar
- Flanged sections as under positive pressure.
- 16 Bar rated

Other Design Resilience
- Siphon Arrangement (shared duty)
- On site alarm for Pressure and flow
- Telemetry
- Out Of Hours cover
- Trending data to predict loss of siphon
- Back up pumps and spares
Permanent works
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Construction Challenges
Temporary Siphons

Construction
37

Temporary Siphons

Operation

1976

2018
Challenges

- Replacement of all pipework
- Single isolation
- Unprecedented technique
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Diving Challenges
Installing the Siphons

- This now enabled us to finally survey the two tower draw offs.

- The top draw off was going to be straightforward, we could see the pipe and all we had to do was fix the penstock valve, remove the grille and insert the plug pipestopper.

- The middle draw off was going to be difficult but we did not expect what we found.
Videoray mini Inspection ROV (Remotely Operated Vehicle) with sonar imaging
1. Design Philosophy
   a. Design parameters & Constraints
   b. Enabling works
      i. Temporary supply
      ii. Isolations
   c. Permanent works
      i. Isolation Philosophy
      ii. Materials
      iii. Elements of permanent works
Talybont Reservoir - Valve Replacement