RECLAMATION
Managing Water in the West

U.S. Department of the Interior
Bureau of Reclamation

Underwater Corrosion Condition Assessment of Hydraulic Steel Structures

Exploring State-of-the-Art Technologies Available for Underwater Corrosion Condition Assessment of Hydraulic Steel Structures

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This project explored state-of-the-art technologies available for underwater corrosion condition assessment of hydraulic steel structures through literature and manufacturer surveys, equipment demonstrations, and a collaboration with USACE. Recommendations are provided for increased use of handheld devices, remotely operated vehicles, and photogrammetric analysis during inspections.

Mission Issue

This project has identified tools and techniques that can be adopted by Reclamation staff to improve the safety, frequency, and accuracy of underwater corrosion condition assessments of hydraulic steel structures.

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Problem

Hydraulic steel structures (HSS) at Reclamation are integral to the water infrastructure across the western United States. To maintain the integrity of these structures, periodic inspections for safety and function are required, especially as related to corrosion degradation. However, many HSS cannot be dewatered for periodic corrosion condition assessment of the steel and the corrosion mitigation system, and many require more specialized inspection methods than what is currently employed at Reclamation.

Solution

This project explored state-of-the-art technologies available for underwater corrosion condition assessment through literature and manufacturer surveys, laboratory and field equipment demonstrations, and a collaboration with the United States Army Corps of Engineers (USACE). Tools and techniques were studied in the following areas: steel section thickness and defect detection, coating condition assessment, cathodic protection system monitoring, advanced visual corrosion surveying and analysis, and remotely operated inspection robots.

"This research identified several techniques which can be immediately incorporated into Reclamation's toolbox for corrosion inspections. It also targeted near-term goals for top-side operated inspection by ROV."

Jessica Torrey
Materials Engineer
Reclamation

Collaborators

U.S. Army Corp of Engineers (USACE)

Engineer Research and Development Center (ERDC)

Information Technology Laboratory (ITL)

More Information

https://www.usbr.gov/research/projects/detail.cfm?id=4279

https://www.usbr.gov/research/projects/researcher.cfm?id=2352

Application and Results

Some of the key recommendations for implementation of quantitative underwater corrosion condition assessments at Reclamation include:

- Handheld corrosion condition assessment tools, including underwater ultrasonic thickness (UT), dry film thickness (DFT), and corrosion potential gauges, would be useful for implementation in splash zone inspections and by the Reclamation dive team.

- Remotely operated vehicles (ROVs) can be outfitted with quantitative corrosion condition assessment probes and provide opportunity for diver-less inspection of gate skin plates, trash racks, fish screens, large diameter siphons, and, especially, interior inspection of above ground storage tanks.

- Underwater photography and photogrammetric analysis techniques show promise for corrosion detection but have limitations regarding water turbidity and adequate lighting.

Photogrammetry would be most useful and accurate with a reference point for the steel surface and corrosion product coloring.

Future Plans

Reclamation Materials and Corrosion Laboratory is currently reviewing these recommendations. Instruments acquired as part of this research project will be incorporated into the portfolio of tools available for routine corrosion inspections.

Reclamation researchers perform 360° image capture of fabricated test gate for use in photogrammetric analysis and camera evaluation.