

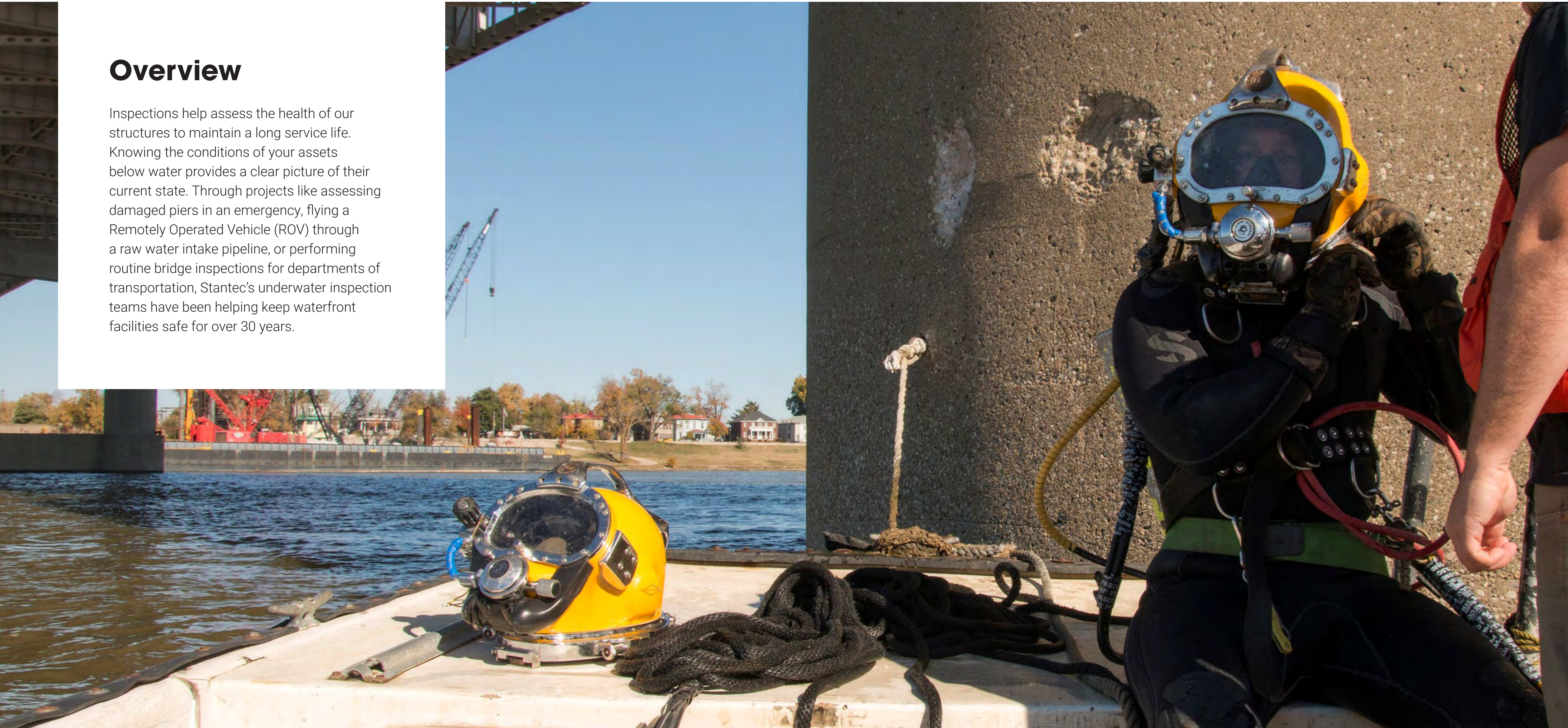


A deep dive into structural health

UNDERWATER INSPECTIONS

Overview

Inspections help assess the health of our structures to maintain a long service life. Knowing the conditions of your assets below water provides a clear picture of their current state. Through projects like assessing damaged piers in an emergency, flying a Remotely Operated Vehicle (ROV) through a raw water intake pipeline, or performing routine bridge inspections for departments of transportation, Stantec's underwater inspection teams have been helping keep waterfront facilities safe for over 30 years.



Team Credentials

Our inspection and investigation teams are led by ADCI certified, commercially trained engineer divers. Working alongside them are highly trained commercial diver inspectors skilled in advanced inspection techniques and diving practices. Our teams have all the equipment needed to safely and efficiently perform Level I and II inspections. Our teams can also provide complete destructive and non-destructive testing (NDT) services required to perform Level III inspections. To allow our clients to “see” below the water’s surface, we implement underwater imaging technology, including 2D and 3D acoustic scanning, to provide overall views of the structure.



**OUR UNDERWATER
INSPECTION
TEAMS HAVE
PERFORMED
THOUSANDS OF
INSPECTIONS
LED BY ENGINEER
DIVERS.**



**ALL OF OUR
UNDERWATER
INSPECTORS AND
DIVE SUPERVISORS
ARE ADCI CERTIFIED**

Equipment

Our dive teams face a wide variety of conditions and working environments. Having the right equipment is paramount to safely conducting a detailed underwater inspection.

To support our dive teams, we maintain a large fleet of boats, surface supplied air (SSA) and commercial SCUBA diving gear fitted with communications equipment, underwater cameras and video systems, "clear water" boxes, acoustic imaging and hydrographic sonars, non-destructive testing (NDT) equipment, and specialized safety and first aid equipment.

We conduct all diving operations in compliance with OSHA/USCG regulations and ADCI Consensus standards, using only formally trained commercially certified divers and approved commercial diving equipment.



Suite of services

We help you manage your infrastructure more efficiently – and cost-effectively – by using databases, interactive computer software, and GIS to record, archive, analyze, and report inspection and assessment data. Stantec has experience applying these technologies to our projects and has developed software programs to facilitate electronic reporting of underwater inspection and data.

**OUR PROFESSIONAL
ENGINEER DIVERS HAVE
LOGGED OVER 5,000
WORKING DIVES TO
DEPTHS OF OVER 180'**



INSPECTIONS AND INVESTIGATIONS:

- Topside Inspections
- Hydrographic Surveying
- Ultrasonic Thickness Testing
- Level I, II and III Underwater Inspections
- Excavations
- Timber Coring
- Destructive and Non-Destructive Testing
- Topographic Surveying
- Underwater Photography and Video
- Laboratory Testing
- ROV Inspections
- Soil Borings and Rock Coring
- Acoustic Imaging
- Cathodic Protection Testing
- Concrete Coring
- GPS Surveying

CONDITION ASSESSMENT REPORTS:

- Structural and Scour Condition Documentation
- Condition Ratings
- Cost Estimates
- Prioritized Maintenance and Repair Recommendations
- Estimates of Remaining Service Life
- CADD Drawings and Sketches

KENTUCKY TRANSPORTATION CABINET STATEWIDE UNDERWATER BRIDGE INSPECTIONS

The Kentucky Transportation Cabinet (KYTC) launched their bridge substructure inspection program in 1989. We have been a continuous trusted partner, providing underwater inspections and related services for over 30 years.

Through KYTC's program, we have performed multiple inspections on each of nearly 250 bridges currently requiring underwater inspections. We have compiled and reviewed construction drawings and previous inspections reports; performed stream bed cross sections for scour analysis; performed detailed Level I, II and III underwater inspections following FHWA bridge inspection standards; and condensed inspection notes into a state-established rating system. We also provided remedial actions as required and entered inspection data into KYTC's on-line Bridge Management Software system.

Our dive personnel have encountered a variety of water conditions and river sizes that required specialized equipment and techniques. Visibility is frequently nonexistent, so a professional engineer diver carries out zero-visibility inspections. For completely submerged culverts that are blocked at one end, we use confined space and zero-visibility dive techniques.

Other challenges included inspecting bridges in 180 feet of water with hollow piers that required interior and exterior inspection. Divers performed decompression diving and utilized surface decompression with pure oxygen in an on-site recompression chamber to reach that depth.



30+ YEARS OF UNDERWATER INSPECTIONS CONDUCTED

SOUTH FLORIDA REGIONAL TRANSPORTATION AUTHORITY (SFRTA) RAILROAD BRIDGE ENGINEERING SUPPORT SERVICES FOR CONTRACTOR TRANSDEV RAIL

The SFRTA runs a 26-train passenger rail service that extends between Miami and West Palm Beach, Florida. The doubled tracked rail lines are also used by Amtrak and freight trains. To ensure the safety of rail systems across the country, the SFRTA developed a 10-year inspection program in accordance with Federal Railroad Administration requirements.

We are providing the bridge inspection and capacity ratings on SFRTA's rail bridges. We are also providing engineering assistance on all bridges that the passenger and freight trains traverse as well as a review of overhead bridges the rail line goes under. The program also includes two moveable bascule rail bridges.

For all underwater bridge elements, we conduct biennial underwater inspections using surface-supplied air diving equipment with built-in communications systems. All our underwater inspections are conducted by an OSHA-compliant team of formally trained commercial divers. The dive team is led by a registered professional engineer-diver, who is responsible for the structural as well as scour evaluations of the bridges. The two moveable bascule rail bridges also receive monthly inspections of the electrical/mechanical components.

We also complete bridge inspection reports with recommendations for repairs if required and an annual overall summary. We are currently in year six of the 10-year program to keep the corridor in a steady state of service.



TENNESSEE DEPARTMENT OF TRANSPORTATION UNDERWATER BRIDGE SUBSTRUCTURE INSPECTIONS

Over the past 21 years, we have performed underwater bridge inspections for the Tennessee Department of Transportation (TDOT). To date, approximately 600 underwater bridge inspections have been completed for TDOT.

We have performed Level I and II underwater bridge inspections for most of the bridges in central and eastern Tennessee since 1996. These inspections are conducted in water conditions consisting of heavy current, deep water, heavy debris, and zero visibility.

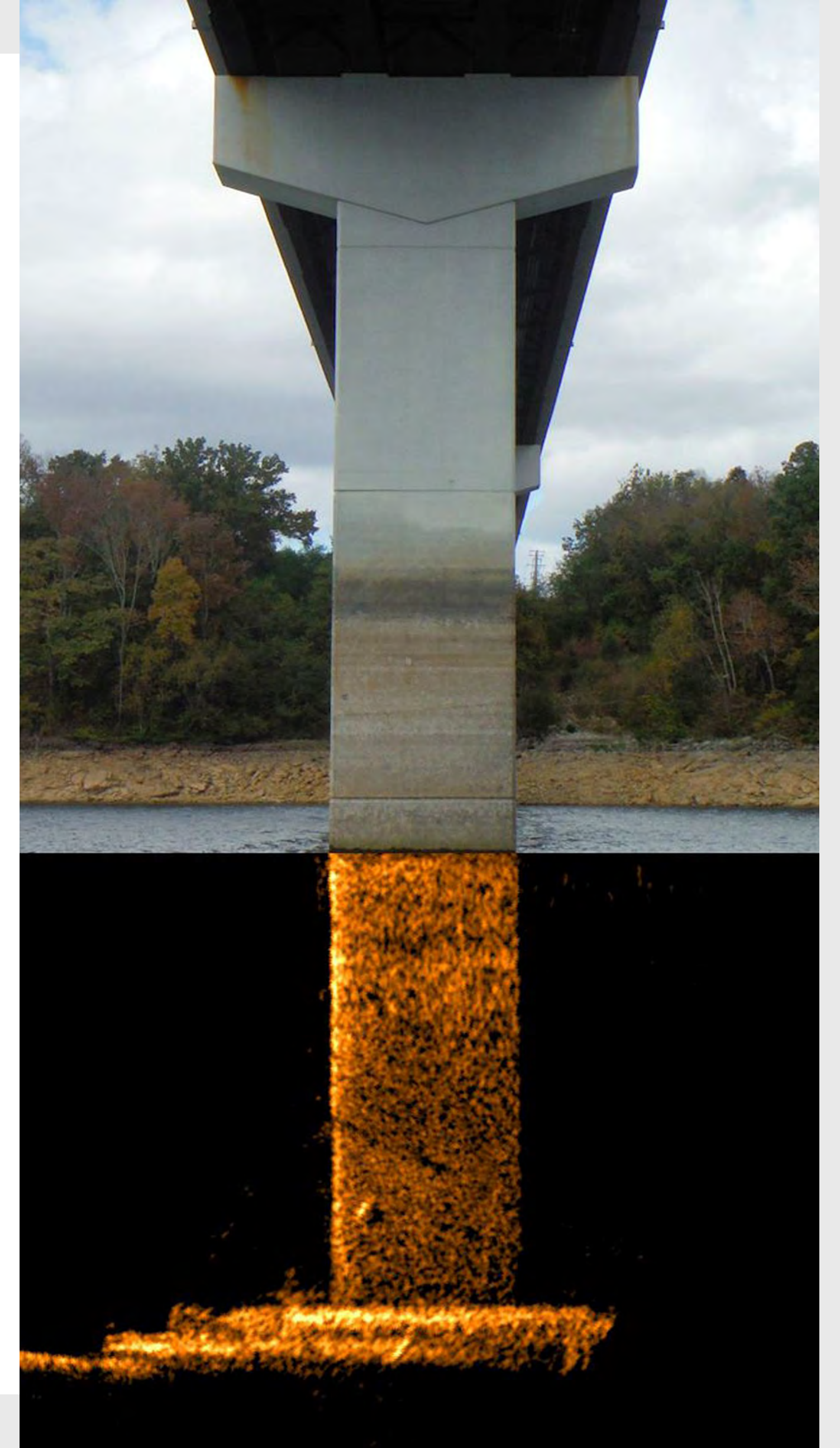
Providing all equipment and personnel to complete the underwater inspections, we mobilize three-man dive teams equipped with surface-supplied air (SSA) and Commercial SCUBA diving equipment, diving platforms, sonar and sounding equipment (including

underwater acoustic imaging capability), and other specialized equipment. Each of the three-man dive teams include FHWA certified underwater substructure inspectors, engineer divers, and certified commercial divers. Dive personnel perform the underwater inspections from our dive boats, bridge decks or the banks of the water bodies using SSA, Commercial SCUBA and wading techniques as water conditions require.

We also perform decompression diving techniques on four bridges located in water deeper than 100 feet. The inspections require additional equipment and personnel including a decompression chamber, and floating barge platforms. The diver's findings are relayed via either hard-wire radio communications or wireless voice communications to top-side personnel who record the findings

and verify previously noted conditions. Soundings of the stream bottoms are performed using graduated sounding rods and sonar equipment to determine whether scouring has occurred compared to previous inspections.

For bridges with substructure units situated in water depths exceeding 33 feet, TDOT requires acoustic imaging sonar images of those elements be obtained. Upon completion of the inspections, field notes and sketches are verified against previously noted conditions, and separate underwater bridge inspection reports are produced for each bridge, incorporating multiple quality control and quality assurance checks.





NEW MEXICO DOT INAUGURAL UNDERWATER INSPECTIONS

To ensure the safety of their in-service bridges, the New Mexico Department of Transportation (NMDOT) bridge inspection program includes a list of structures requiring underwater inspection. Stantec provided the inaugural round of underwater bridge inspections for NMDOT in the winter of 2019, followed by a second round of inspections in the winter of 2020.

Our team conducted Level I & II underwater bridge inspections on fourteen bridges in NMDOT Districts 2 and 5. The inspections included structural and scour evaluations of concrete bridge piers and abutments as well as timber bridge piers and abutments, using element-level inspection methods.

Led by a registered engineer diver, our commercial diver inspectors were faced with a variety of water conditions, including heavy currents, ice-covered waterways, limited underwater visibility, and heavy debris accumulations at the bridge piers. To overcome these challenges, our team employed surface-supplied air diving equipment, maximizing safety through the use of 'hard hat' diving helmets, redundant air supplies and hard-wired communications systems, allowing them to safely conduct the inspections. Our findings were provided in a report that included recommendations for maintenance and repairs.

CITY OF NORTH PORT MYAKKAHATCHEE CREEK WATER TREATMENT PLANT RENEWAL AND REPLACEMENT PROGRAM

The City of North Port, Florida has a 4.4 mgd Myakkahatchee Creek surface water treatment plant (WTP). This facility operates in concert with the City's new reverse osmosis WTP to stabilize and blend finished water prior to pumping out into the distribution system. As an integral part of the City's infrastructure, the WTP needs to be in good working condition to function properly.

To provide the City with a detailed understanding of the plant's current conditions, we performed underwater inspections of the three raw water intake pipelines and associated wet wells and intake water pumps. The inspections of the pipeline exterior components were conducted using conventional commercial diving methods, while a Remotely Operated Vehicle (ROV) was used to inspect the inside of the 24" diameter pipelines and the confined spaces within the pumphouse wet well structures. We also provided high-definition video of the inspections.





DE CORDOVA BEND DAM AND STERLING C. ROBERTSON DAM ANNUAL MAINTENANCE INSPECTIONS

Our inspection teams performed the 2018 and 2019 annual maintenance inspection at De Cordova Bend Dam (Lake Granbury) and Sterling C. Robertson Dam (Lake Limestone). In June 2020, we also conducted underwater commercial diving inspections of the Robertson Dam Spillway basin, including the end sill, baffle blocks and cleanouts.

For both dams and appurtenant facilities, our team reviewed operation, maintenance, and inspection records, reviewed the dam operation and maintenance plan and other relevant reports and drawings, and performed visual inspections for the embankments, dam monitoring instrumentation, spillway structure including Tainter gates and stilling

basin, low flow outlet facilities, and other mechanical equipment. Inspections were performed in accordance with the Texas Administrative Code. Underwater inspections were conducted using surface-supplied air diving equipment, in conformation with OSHA commercial diving regulations.

We prepared an inspection report including recommendations for maintenance actions to be addressed within 1-year and 5-year timeframes. We also prepared and followed comprehensive and site-specific health and safety plans.

Through the performance of multiple inspections at Sterling C. Robertson and De Cordova Bend Dams, our lead inspectors have become very familiar with the history, operations, and conditions of these facilities and will be very well-suited to perform the 5-year engineering inspections at these facilities as a natural extension of previous inspection work.

OLENTANGY RIVER FRESHWATER MUSSEL SURVEYS

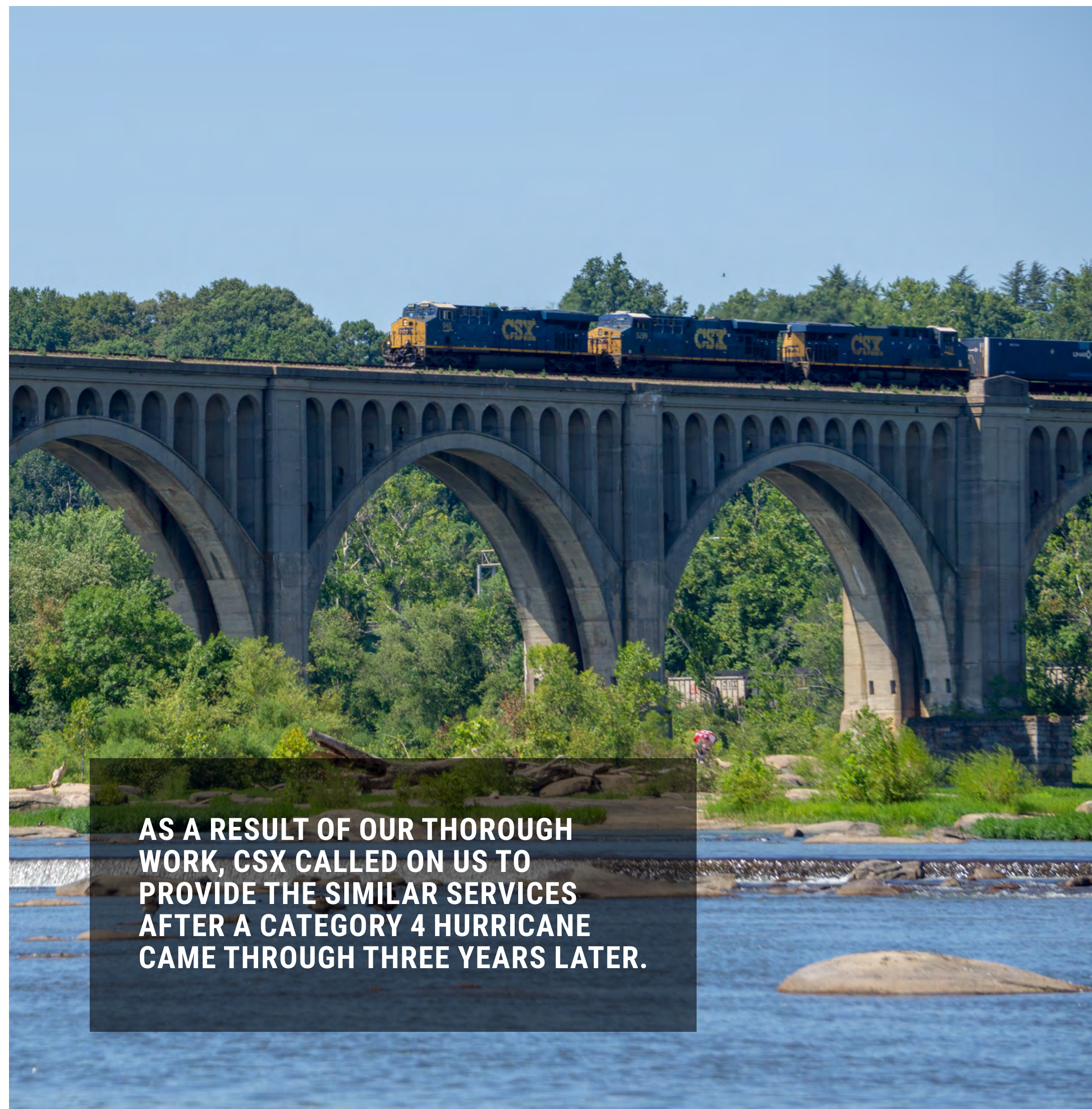
Columbia Gas of Ohio plans to install a new 20" steel welded, natural gas pipeline below the Olentangy River in one of two locations upstream of Doddridge Dam. The Ohio Department of Natural Resources (Ohio DNR) completed a review of the proposed project and requested a survey of freshwater mussels in the vicinity of the pipeline.

Our team performed a freshwater mussel survey in the Olentangy River to rule out any federal or state endangered species and make way for the installation of a natural gas pipeline. Due to the water depth, low visibility, and the close proximity of dams, our team of commercial and scientific divers searched for mussels

in the substrates along transects in the stream channel. Timed searches and fixed area substrate excavations were conducted in suitable habitats along the channel margins.

No federal or state endangered, threatened, or proposed endangered/threatened mussels were found during the surveys. A total of 133 live freshwater mussels, comprised of 12 species were found to occur within the project area. Due to the presumed absence of federal and state endangered and threatened species within the project area, an agency determination of may affect but not likely to adversely affect was anticipated.





AS A RESULT OF OUR THOROUGH WORK, CSX CALLED ON US TO PROVIDE THE SIMILAR SERVICES AFTER A CATEGORY 4 HURRICANE CAME THROUGH THREE YEARS LATER.

CSX TRANSPORTATION BRIDGE POST EVENT EMERGENCY UNDERWATER INSPECTIONS

After a category 5 hurricane wreaked havoc on the states of Louisiana, Mississippi, and Alabama, CSX needed to understand the condition of their transportation assets—including their bridges.

CSX called upon us to perform emergency substructure inspections for sixteen bridges. Inspecting the bridges post-hurricane came with lots of challenges. Many of the bridges had no vehicular or boat ramp access within 10 miles, so we had to provide transportation to and from each bridge for both our inspectors and STV inspectors. Underwater conditions at the bridges included deep water and heavy currents providing a difficult environment to work in.

We mobilized two field crews of engineer and commercial divers within 48 hours of involvement in the project. The teams inspected bridge substructural and fender system components both above and below the water surface—including 37 piers and 92 pile bents. Our team performed Level I and II underwater inspections of bridge substructures and elements, looking for evidence of physical distress, damage, or deterioration as well as scour of foundations or other relative conditions. Our team also conducted emergency work to clear channel obstructions and provided daily field reports and recommendations for reopening bridges. We successfully finished all sixteen bridge inspections over the 150 mile railway in less than three weeks.

Design with community in mind

Communities are fundamental. Whether around the corner or across the globe, they provide a foundation, a sense of place and of belonging. That's why at Stantec, we always design with community in mind.

We care about the communities we serve—because they're our communities too. This allows us to assess what's needed and connect our expertise, to appreciate nuances and envision what's never been considered, to bring together diverse perspectives so we can collaborate toward a shared success. We're designers, engineers, scientists, and project managers, innovating together at the intersection of community, creativity, and client relationships. Balancing these priorities results in projects that advance the quality of life in communities across the globe.

Stantec trades on the TSX and the NYSE under the symbol STN. Visit us at stantec.com or find us on social media.



CONNECT WITH US



[STANTEC.COM](https://stantec.com)