



CATEGORY I
SPECIAL PROJECTS

2025 ACEC SUBMISSION

**JIM HINKLE SPRING RIVER STATE FISH
HATCHERY IMPROVEMENTS**
FOR ARKANSAS GAME AND FISH COMMISSION

SUBMITTED NOVEMBER 15, 2024

CRIST ENGINEERS, INC.
1 EXECUTIVE CENTER COURT
LITTLE ROCK, AR 72211
(501) 664-1552

CRISTENGINEERS.COM



ACEC **ENGINEERING
EXCELLENCE AWARDS**

A wide-angle photograph of a construction site. In the foreground, a deep, narrow trench has been excavated, revealing dark soil. On either side of the trench, there are rows of large, circular concrete structures, possibly for water treatment or storage. The structures are partially covered with grey plastic sheeting. In the background, there are more construction materials, equipment, and a line of trees under a clear blue sky.

SECTION 1

OFFICIAL ENTRY

Furnish all information requested below for each entry. Firm, project and client typed or printed as they are to appear on the award. Please limit the project name to 35 characters. A fee of \$375 per entry for ACEC/A members (\$675 for non-ACEC/A members) must be paid during the digital submission process. (Small project entries are \$275 for members and \$575 for non-members). **NOTE: Submissions are not considered final until payment step has been completed in the online submission process.**

ABOUT THE PROJECT

Project Name (Limit: 35 Characters) Jim Hinkle Spring River Fish Hatchery Renovations

Judge the Entry in the Following Category (check one): ☐ Small Entry Level ☒ Large Entry Level

☐ A. Studies, Research, and Consulting Engineering Services

☐ E. Environmental

☒ I. Special Projects

☐ B. Building/Technology Systems

☐ F. Water and Wastewater

☐ J. Small Projects

☐ C. Structural Systems

☐ G. Water Resources

☐ K. Energy

☐ D. Surveying and Mapping Technology

☐ H. Transportation

☐ L. Industrial and Manufacturing Processes and Facilities

Project Location: Address (no P.O. Boxes) 895 State HWY 342

City Mammoth Spring

State AR

Zip 72554

Complete Relative to the Entrant's Portion of the Project: (Budgeted and/or actual costs may not apply to some studies in Category A)

Completion/Use Dates: Scheduled May 4, 2023

Actual August 4, 2023

Category A Costs: Budgeted \$ N/A (Category I Project)

Actual N/A (Category I Project)

Construction Costs: Budgeted \$ 6,392,192.37

Actual \$6,734,192.37

ABOUT THE FIRM(S) SUBMITTING THE PROJECT

Entering Firm(s) Crist Engineers, Inc.

Firm Representative Craig A. Johnson, PE

Title of Representative Vice President

Address (no P.O. Boxes) 1 Executive Center Court

City Little Rock

State AR

Zip 72211

Phone (501) 664-1552

Cell (501) 993-2922

Fax (501) 664-8579

Email cjohnson@cristengineers.com

I hereby authorize submission of this project in the American Council of Engineering Companies of Arkansas' 2025 ACEC/A Engineering Excellence Awards competition.

Senior Executive/Principal Craig A. Johnson

Title Vice President

Signature Craig A. Johnson

Date November 14, 2024

Address (no P.O. Boxes) 1 Executive Center Court

City Little Rock

State AR

Zip 72113

Phone (501) 664-1552

Cell (501) 993-2922

Fax (501) 664-1552

Email cjohnson@cristengineers.com

ABOUT THE CLIENT/OWNER(S) SUBMITTING THE PROJECT

Client/Owner(s) Arkansas Game and Fish Commission

I currently believe the work of the engineer meets the intended uses and expectations for the project and hereby grant permission to enter this project in the ACEC/A 2025 Engineering Excellence Awards competition, and authorize publication of its outstanding features, unique aspects, or innovations. I confirm that the project was substantially completed and ready for use between November 1, 2021 and October 31, 2024.

Client Owner/Representative Mike Cantrell

Title Facility and Operations Manager

Signature _____

Date November 14, 2024

Address (no P.O. Boxes) 2 Natural Resources Drive

City Little Rock, AR 72205

State AR

Zip 72205

Phone (870) 297-4331

Cell (870) 404-7579

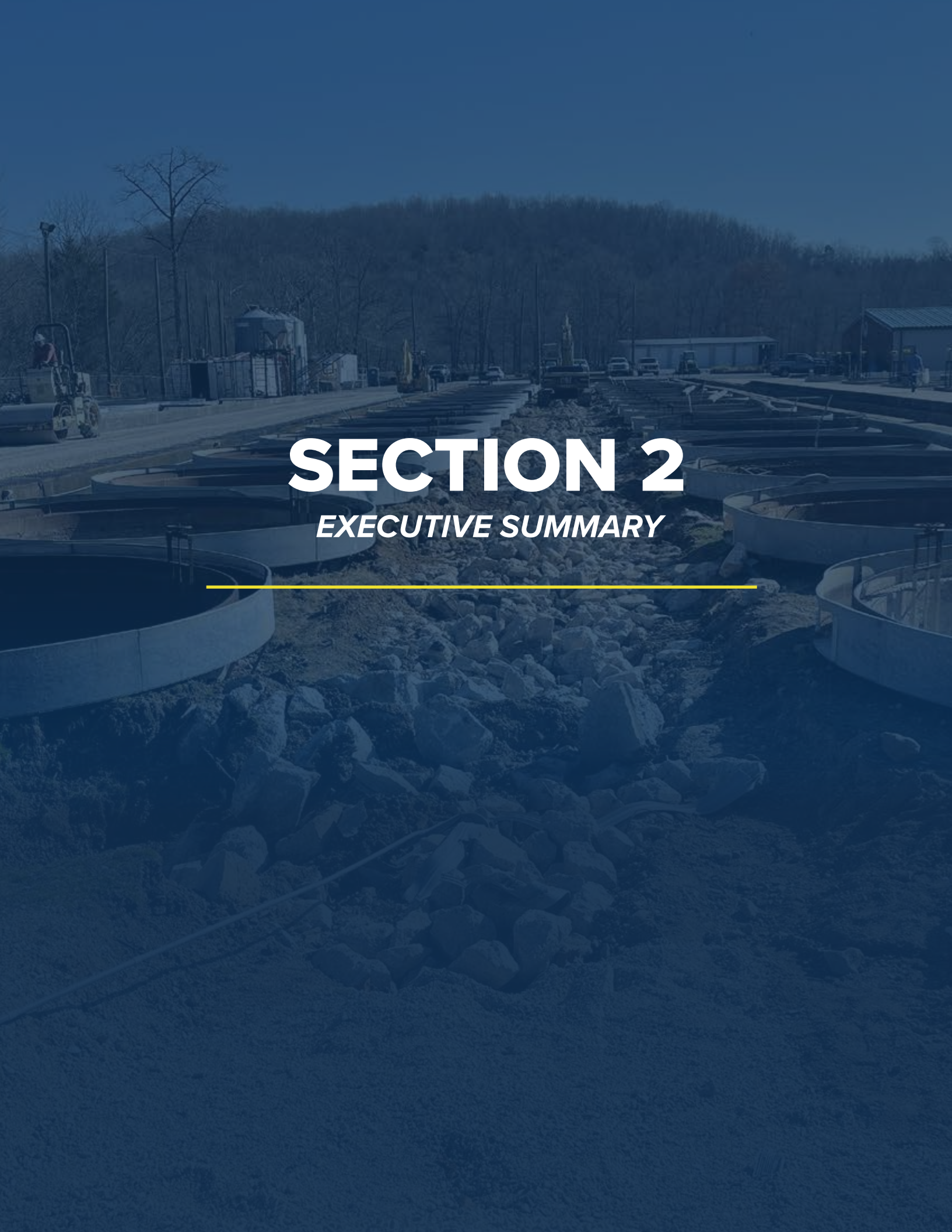
Fax () _____

Email michael.cantrell@agfc.ar.gov

ALL required materials to be digitally submitted by November 15, 2024 at: eea.arkansasengineers.com

- **Project Information Submittal:** 1 PDF (Containing all sections (1-5) of the project information submittal.)
- **Project Photography:** TOP SIX PHOTOS (for marketing purposes) SUBMITTED IN A POWERPOINT FILE
- **Project Fee:** Payment will be the final step of submission. Entries will not be considered final until the payment step has been completed in the online submission process.

ACECArkansas

A construction site featuring several large, circular concrete structures, possibly for water treatment or storage. A path of large, dark rocks leads through the center of the site. In the background, there are construction vehicles, including a yellow excavator and a white truck, and a line of trees under a clear sky.

SECTION 2

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The Jim Hinkle Spring River State Fish Hatchery (JHSRSFH) is located on a 7-acre island in the middle of the Spring River near Mammoth Spring in Fulton County, Arkansas. The hatchery is one of the largest state-owned trout-producing facilities in the southeastern United States and is the Arkansas Game and Fish Commission (AGFC)'s only coldwater facility.

The hatchery was built in 1974 to raise rainbow trout for the table market. The Kroger Company donated the facility to the AGFC in 1985. Today, the hatchery produces and stocks rainbow and cutthroat trout for Arkansas tailwater trout streams and spring creeks. It also provides trout for the seasonal Family and Community Trout Fishing Program and the winter trout-stocking program in southern Arkansas.

In 2018, the AGFC acquired the professional services of Crist Engineers, Inc. to provide professional design services to upgrade the JHSRSFH as old components of the facility were affecting the hatchery's ability to sustain fish reproduction and growth. Working with the hatchery staff and springboarding off a subsequent project to improve the dam's ability to regulate flow, an improvement project was outlined with the following components:

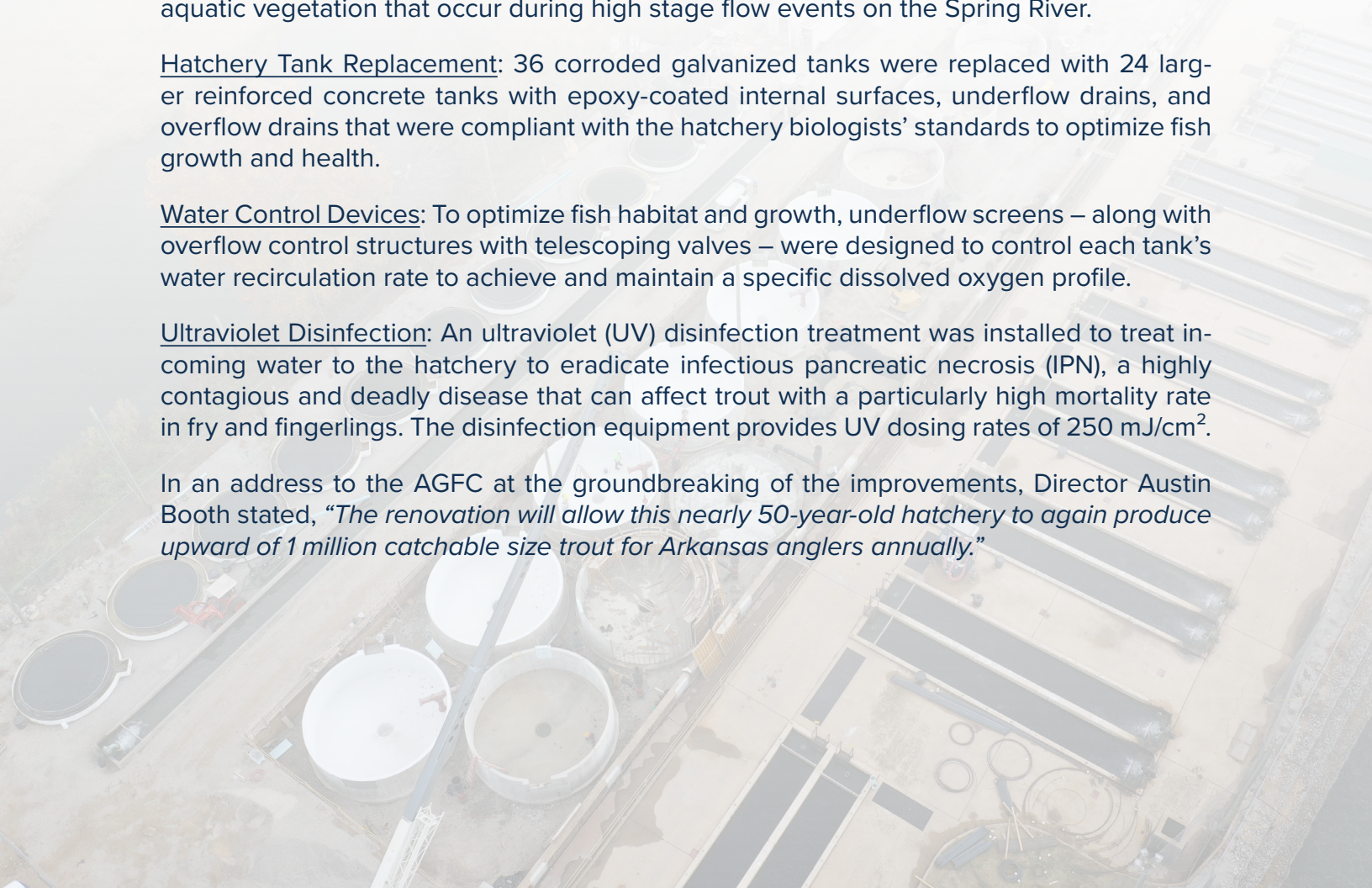
Mechanical Screens: The hatchery had two vegetative removal screens that functioned poorly. The project included replacing the existing screens with two new mechanical screens with a maximum flow rate of 25.6 MGD and 51.2 MGD, respectively with 3/8" openings. The screens were specifically designed to manage and remove high volumes of aquatic vegetation that occur during high stage flow events on the Spring River.

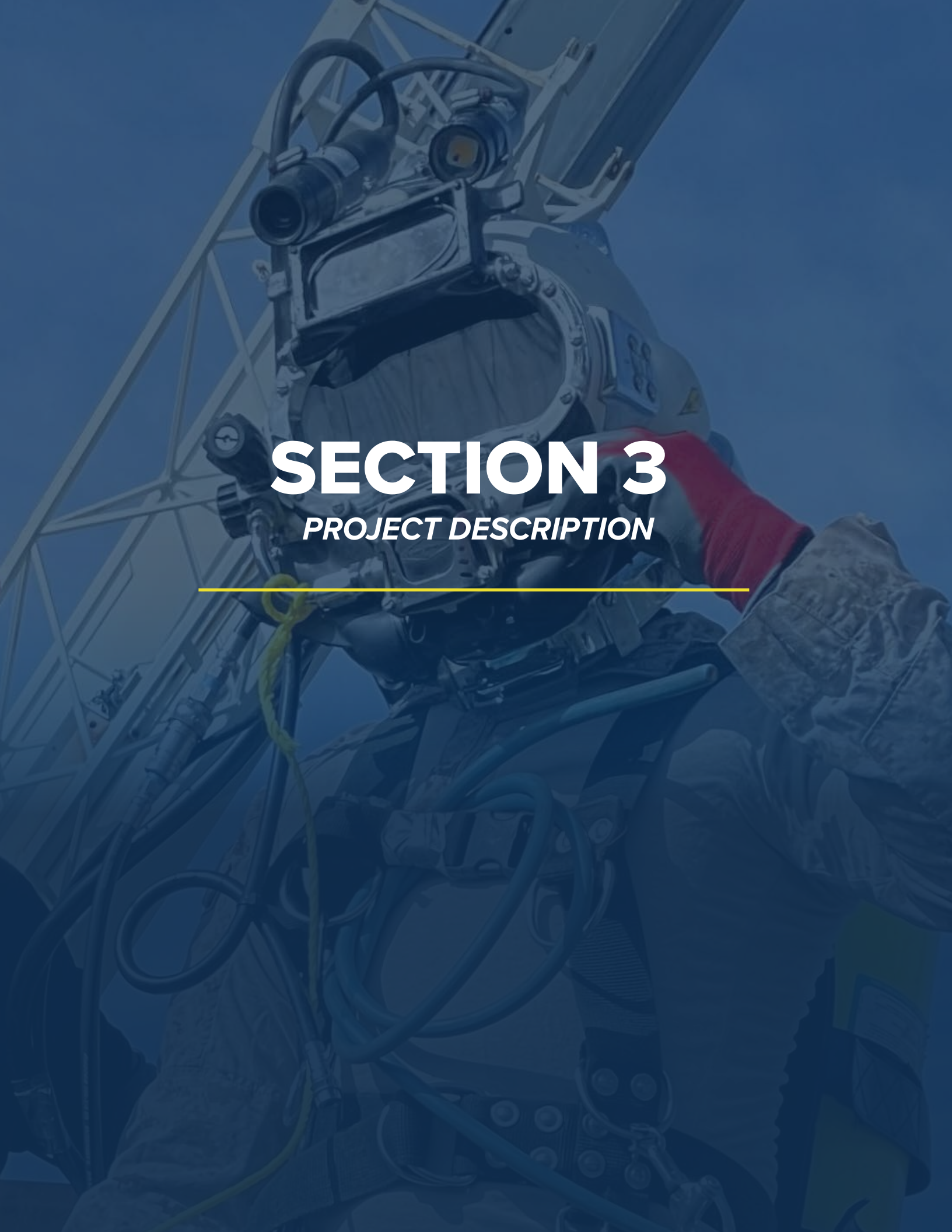
Hatchery Tank Replacement: 36 corroded galvanized tanks were replaced with 24 larger reinforced concrete tanks with epoxy-coated internal surfaces, underflow drains, and overflow drains that were compliant with the hatchery biologists' standards to optimize fish growth and health.

Water Control Devices: To optimize fish habitat and growth, underflow screens – along with overflow control structures with telescoping valves – were designed to control each tank's water recirculation rate to achieve and maintain a specific dissolved oxygen profile.

Ultraviolet Disinfection: An ultraviolet (UV) disinfection treatment was installed to treat incoming water to the hatchery to eradicate infectious pancreatic necrosis (IPN), a highly contagious and deadly disease that can affect trout with a particularly high mortality rate in fry and fingerlings. The disinfection equipment provides UV dosing rates of 250 mJ/cm².

In an address to the AGFC at the groundbreaking of the improvements, Director Austin Booth stated, *"The renovation will allow this nearly 50-year-old hatchery to again produce upward of 1 million catchable size trout for Arkansas anglers annually."*





SECTION 3

PROJECT DESCRIPTION

PROJECT DESCRIPTION

ROLE OF ENTRANT'S FIRM IN THE PROJECT

Crist Engineers, Inc. (Crist) was the prime consultant on the project that included the following roles:

- Overall professional in charge that provided mechanical, hydraulic design, and electrical design on the project
- Mechanical screen (vegetation removal) and conveyor design
- Hydraulic modeling and flow balance through hatchery tanks
- Ultraviolet disinfection design for the eradication of infectious pancreatic necrosis
- Coordination as required for geotechnical services, electrical services, and structural services



ROLE OF OTHER CONSULTANTS PARTICIPATING IN THE PROJECT

- UES (formerly Grubbs, Hoskyn, Barton, and Wyatt): conducted geotechnical field services and geotechnical engineer services
- Mark Ramm: conducted structural engineering services
- Steve Sharon (Owner's Biologist), S2 Aquaculture Consulting and Design, LLC: Provided hydraulic flow guidance to the mechanical and hydraulic design, establishing target overflow and underflow rates to achieve specific dissolved oxygen profiles for fish health and growth



BRIEF DESCRIPTION OF THE ENTRANT'S CONTRIBUTION TO THE PROJECT

Mechanical Screens: The existing screens were not sufficient to remove large volumes of vegetative debris during high flow events. Preventing debris infiltration to the hatchery keeps the tanks free of deleterious material and minimizes tank cleaning. The design team coordinated with a screen manufacturer to provide a uniquely designed vegetative removal screen that incorporated a front-clean rear return without needing to fully penetrate through the rack. The existing chain link-style screen design had difficulty removing the weight and mass of long stringy debris, while the new screens were specifically designed with mechanical devices with multiple horizontal scrapers. The screens had a width of 7.0-ft. and 8.0-ft. with 3/8-in. openings and a capacity of 25.6 MGD and 51.20 MGD, respectively.

RATING VALIDATION SUMMARY TABLE

Original or Innovative Application of New or Existing Techniques	Utilized new equipment technology to address vegetative removal.
Future Value to Engineering Profession	Alternative technology is available for the removal of vegetative debris.
Social, Economic, and Sustainable Design Considerations	Removal of vegetation maintains clean tank environment for fish health and growth.
Complexity	Design team utilized existing screen support structure for new screen installation, which required divers for measurement confirmation.
Exceeding Client/Owner Needs	The design team met owner's constraint to remove vegetative debris providing a cleaner environment for fish health and growth.



PHOTO 1: Existing chain link vegetative screen



PHOTO 2: New vegetative mechanical screen utilizing existing screen support structure

Mechanical and Hydraulic Considerations: The hatchery's existing circular tanks could not control overflow and underflow through the tank simultaneously. Through coordination with the fishery's biologist, specific criteria were given to the design team to target overflow and underflow rates whereby angular velocities through the tank could be adjusted to optimize growth and dissolved oxygen targets could be achieved. Trout must have variable water velocity profiles through the tank as the fish grow. The variable flow control regimes are a requirement for fish health and optimize growth. To refine angular velocity through the circular tank, the design team employed the use of adjustable baffles on the inlet feed water piping.



PHOTO 3: Installation of telescoping valves to regulate underflow



PHOTO 4: Flow control baffles to control angular velocity on inlet feed water piping

RATING VALIDATION SUMMARY TABLE	
Original or Innovative Application of New or Existing Techniques	Used hydraulic modeling techniques to establish overflow and underflow rates to uniquely achieve dissolved oxygen targets.
Future Value to Engineering Profession	Utilized of telescoping valves to control underflow water.
Social, Economic, and Sustainable Design Considerations	Flow regimes were accomplished without pumping utilizing the natural hydraulic pressure available from the dam.
Complexity	Water quality and flow modeling were utilized to achieve dissolved oxygen targets in the hatchery tanks.
Exceeding Client/Owner Needs	Utilizing the inherent river hydraulic of the dam, the biologist targets were met without pumping (induced energy) while providing an environment for fish health and growth.

Epoxy-Based Concrete Coatings: Along with hatchery feeding techniques and the target density of fish growth in the tanks, the fish come into contact with the interior walls of the concrete tanks. At times, this contact would cause damage to the fish's skin, resulting in infection. To overcome this concern, the design team elected to use a high-solids, high-build polyamide epoxy at a dry film thickness of 40 mils. This film thickness provided a smooth texture to the concrete surface, minimizing the rough texture typical of concrete and protecting the fish from damaged skin.



PHOTO 5: High-build epoxy coating to provide smooth surface

RATING VALIDATION SUMMARY TABLE	
Original or Innovative Application of New or Existing Techniques	Utilization of commonly available coating materials to address a hatchery need.
Future Value to Engineering Profession	Epoxy coatings can be utilized to address fish health and sustainability.
Social, Economic, and Sustainable Design Considerations	Used common epoxy-based coatings in a unique application.
Complexity	Several application passes were necessary to achieve desired smoothness.
Exceeding Client/Owner Needs	Design team met owner's constraint to provide a coating system that minimizes skin damage for the trout and sustain an environment for optimized fish growth and health.

Ultraviolet Disinfection: The hatchery had issues with fish mortality as a result of the trout contracting infectious pancreatic necrosis virus (IPN or IPNV), which is known to be detrimental to trout fry and fingerlings. IPNV is spread through piscivorous birds, blood-feeding parasites, and filter-feeding mollusks, which are present in the feed stock water. The fish contract the virus through their gills by the shed of urine and feces by the carrier. IPNV is not a risk to food safety and does not affect humans. To eradicate the virus, the design team utilized ultraviolet disinfection capable of dosing rates up to 250 mJ/cm² at two feed supply water points in the hatch house to protect the fry and fingerlings. A 40 gpm and a 260 gpm unit were installed.



PHOTO 6: Picture of the new 260 gpm UV disinfection unit to eradicate IPNV

RATING VALIDATION SUMMARY TABLE	
Original or Innovative Application of New or Existing Techniques	Used ultraviolet disinfection technology to eradicate IPNV.
Future Value to Engineering Profession	IPNV can be eradicated through the use of ultraviolet disinfection equipment
Social, Economic, and Sustainable Design Considerations	Eradication of IPNV benefits fish health and growth.
Complexity	Installation of the UV units in the hatch house proved challenging under existing hydraulic conditions.
Exceeding Client/Owner Needs	Design team met owner's constraint to sustain environment for optimized fish growth and health.

ACTUAL COST AT COMPLETION: \$6,734,192.37

ACTUAL DATE OF COMPLETION: August 4, 2023



SECTION 4

PROJECT SUMMARY

PROJECT SUMMARY

The Jim Hinkle Spring River Fish Hatchery improvements satisfy each contribution required for the entry, as demonstrated in Section 3, Project Description for innovation, engineering value, social and sustainable design, complexity, and satisfying the owner needs.

Further, and more importantly, is how important this project is to align with the mission of the Arkansas Game and Fish Commission (AGFC), the client/owner for the project. AGFC oversees the protection, conservation and preservation of various species of fish and wildlife in Arkansas, which is essential for ensuring healthy wildlife populations, while promoting sustainable use with public understanding and support.

The completion of the project sustains more than 400,000 additional trout to streams each year. The 2023 Trout Permit Holder Survey results concluded trout expenditures exceed \$236 million in expenditures. Respondents of the survey caught 2.6 trout per trip and typically spent \$703 per trip.

Simply put, this project will continue to sustain and increase these important economic drivers for the health of our state through the improvements outlined; new vegetative removal screens, 24 new concrete tanks with hydraulic flow controls, concrete tank coatings, and UV Disinfection. These improvements are to sustain and improve the growth and health of the trout industry for the state of Arkansas for today and for our future.





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