City of Oklahoma City
Project WM-0286
Various Improvements to Overholser Dam and Hefner Canal Inlet

ENGINEERING REPORT

FINAL | March 2022

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03-29-22

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THE OKLAHOMA CITY WATER UTILITIES TRUST

APPROVAL SHEET

Project No. WM-0286
Various Improvements to Overholser Dam and Hefner Canal Inlet

ENGINEERING REPORT

Prepared by:

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03-29-22

Recommended for Approval

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Eric J. Wenger, P.E., City Engineer

APPROVED by the Trustees and signed by the Chairman of the Oklahoma City Water Utilities Trust this 12th day of April, 2022.

ATTEST:

Amy K. Simpson
Secretary

OKLAHOMA CITY WATER UTILITIES TRUST OFFICIAL SEAL OKLAHOMA

CHAIRMAN

CONCURRED by the Council and signed by the Mayor of the City of Oklahoma City this 26th day of April, 2022.

Amy K. Simpson
City Clerk

SEAL OF THE CITY OF OKLAHOMA CITY

David Holt
Mayor

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Abbreviations

AACE	American Association of Cost Estimators
ATS	Automatic Transfer Switch
Carollo	Carollo Engineers, Inc.
City	Oklahoma City
CMU	Concrete Masonry Unit
DPP	Distribution Power Panelboard
LED	Light Emitting Diode
HOA	Hand Off Auto
NEMA	National Electric Manufacturers Association
mgd	million gallons per day
PCS	PVC Coated Steel Conduit
psi	pounds per square inch
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
TM	technical memorandum
OPCC	Opinion of Probable Construction Cost
OCWUT	Oklahoma City Water Utilities Trust
OG&E	Oklahoma Gas and Electric
USDOI	United States Department of Interior
WTP	water treatment plant

1.0 Executive Summary:

A multidisciplined condition assessment was conducted at the existing Overholser Gate House and Hefner inlet control structures to determine the costs of rehabilitation to improve structure reliability and resiliency. Recommendations include minor structural, architectural, electrical, and lighting improvements to the structures, and rehabilitation of the inlet sluice gates at both structures. In addition, recommendations include minor rehabilitation of the East and West Caterpillar gate gearboxes and selective replacement of gate rollers.

An analysis of the debris management within the North Canadian Bypass channel indicates that debris is making it past the debris catcher at the Hefner inlet control structure and impacting operations of the inlet sluice gates at both the Overholser Gate House and the Hefner inlet control structure. As a result, the proposed improvements include installation of a more robust glance boom at the Hefner inlet control structure to divert any debris away from the inlet control structure and into the North Canadian bypass channel and towards a second glance boom installed within the channel to deflect debris to a common capture point located adjacent to the Reservoirs and Canals facility.

Table 1 -WM-0286 Opinion of Probable Construction Costs (OPCC)

Cost Element	Total Cost
General Conditions/Mobilization	$382,433
Overholser Gate House Improvements	$588,500
North Canadian River Bypass Channel Improvements	$690,000
Hefner Canal Inlet Improvements	$428,000
Hefner Inlet Control Structure Improvements	$280,000
Taxes and Escalation	$337,774
Subtotal (Direct Costs)	**$2,706,708**
Contractor Overhead and Profit (20%)	$541,300
Contingency (25%)	$812,000
Class 4 Estimate Low Range (-30%)	$2,842,000
Total Construction Cost	**$4,060,000**
Class 4 Estimate High Range (+50%)	$6,090,000

The anticipated construction duration for a combined project is 18 months. This accounts for a 10-to-12-month lead time for the electrical equipment and gate actuators. It is anticipated that the on-site activities will be a total of 10 months once gate actuator and delivery of other critical path materials are on-site.

The improvements are not anticipated to impact staffing levels for these facilities. In fact, the diversion of most of the debris to a single location will improve the efficiency of debris management.

2.0 Introduction

2.1 Background:

Figure 1 on the following page presents an overall site plan of the Project WM-0286 indicatingthe major areas of improvements.

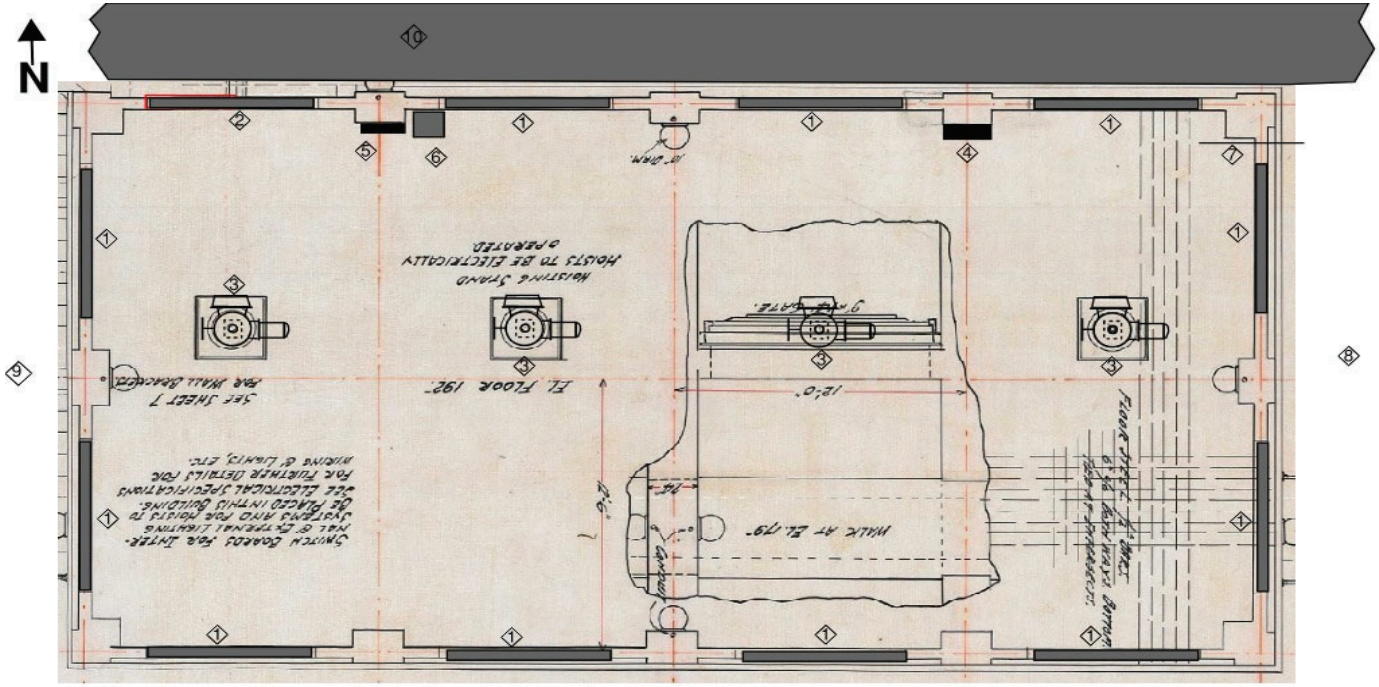
2.1.1 Overholser Dam Gate House:

Lake Overholser is owned and operated by Oklahoma City. It is located about one-half mile North of NW 10th Street in Oklahoma City, West of Council Road on the North Canadian River in eastern Canadian County. Completed in 1918 for water supply and recreation, it has a surface area of 1,500 SF and a drainage area of 13,222 square miles 4,899 which are non-contributing.

Lake Overholser Dam is a reinforced concrete buttress type dam 1,650 feet long and 68 feet high. The dam runs east/west and straddles the border of Oklahoma and Canadian Counties, at the southeast corner of the Lake. In 1924, the west end of the dam was extended, adding eight more gated spillways. The dam has two major sections, one which impounds the reservoir, and a second which regulates the flow of the bypass spillway from the North Canadian River. In 1922 and again in 1934, the dam was raised and re-configured due to flooding. By closing gates at the Hefner Canal gatehouse located on the northeast corner of the lake and raising the Tainter gates at the Overholser Dam, OCWUT diverts and stores North Canadian River water into the Lake. Since the decommissioningof the Overholser WTP in 2018, OCWUT has been maintaining water in the lake purely for recreational purposes.

Lake Overholser Gate House is located directly above the bypass spillway. Figure 2 on the following pages presents a plan of the gate house. The gate house contains four (4) electrically actuated sluice gates that are instrumental in controlling the river's flow into the northeast part of Overholser Reservoir and into the Hefner Canal leading to Lake Hefner. The Lake Overholser Gate House has a side-gabled, tile roof with a small brick chimney on the west end and two round ventilators equidistant on the ridge. The walls are constructed of three to four coursings of unreinforced brick with steel lintels; each side elevation has four window bays with large, steel sash industrial windows. There are 36 rectangular panes, in a 6-foot x 6-foot configuration, in each window. The east and west gable ends each have two windows. The north elevation's west-most window is truncated, and a pair of steel slab door allows entrance to the building. On the east wall of the first arched buttress is a bronze plaque that identifies the Ambursen Construction Company as the builder and lists patent numbers for designs used in the dam. Just below the bronze plaque is the cornerstone denoting the day of dedication, April 22, 1918, and acknowledging the Grand Lodge of Masons.

Figure 1 – Overall Project Site Plan



KEY NOTES:

1. 7'-0"X11'-0" WINDOW OPENING
2. 6-9" HIGH X 6'8" DOUBLE DOOR
3. LIMITORQUE 5HP GATE ACTUATOR.
4. 200 AMP 480V/277 3PH, 60HZ DISTRBUTION POWER PANELBOARD (DPP)
5. 125A 240/120V, 3PH, 60HZ LIGHTING PANEL
6. 30KV 480V/240V TRANSFORMER
7. 4-INCH CONDUIT CONTAINING MAIN FEED TO DPP
8. EAST CATERPILLAR GATE W/WALKWAY (NOT SHOW FOR CLARITY)
9. WEST CATERPILLAR GATE W/WALKWAY (NOT SHOW FOR CLARITY)
10. NORTH UPPER WALKWAY (GATE HOUSE ACCESS)

Figure 2 – Plan View of Overholser Dam Gate House

Two sets of stairs lead to an upper and lower walkway at the spillway section. A Pratt truss bridge spans the spillway and carries the upper walkway. On either side of the Gate House, a steel beam platform has been constructed which contains the supports for the caterpillar gates (west/east) and associated electric actuators. In the late 1990s, the walkways at the pump house were upgraded to return the dam back to its earliest design. A tubular steel balustrade was added along the walkway for safety. Period streetlights were added along the North edge of the upper walkways and along the south and west side of the lower walkways. Both the Dam and Gate House are on the USDOI List of National Historic Places (Registry Number 07000518.

The electrical system for the gatehouse is fed by a primary 480V, 3ph, 60 Hz 4-inch conduit from a CMU building housing the OG&E main feed panelboard and natural gas emergency generator. The electrical feed and associated 125 kW 480V, 3ph, 60 Hz generator only has sufficient capacity to operate one of the caterpillar gates at a time. As part of WT-0117, Overholser WTP Fish Screen Replacement, a new 400 amp NEMA 3R automatic transfer switch (ATS) and 200 amp main disconnect switch was provided to provide generator power to both the gate house and the fish screen house, respectively.

The main feed from the generator ATS is connected to a 200 amp, 480V, 3phase, 60Hz, 4 wire distribution power panelboard (DPP) which supplies power to the sluice gates (4), the caterpillar gates (East/West), electric unit heater, and a 15kVA transformer. A 125A 240/120 V single phase panelboard supplies the power for the gatehouse interior and exterior lights, gate control power, and gate communications system. The gatehouse contains the actuator controls for the caterpillar gates which are wired in a manner to activate strobe lights and alarm horns to sound gate actuation. OCWUT staff is in the process of upgrading this system. A switch is provided in the gatehouse to activate the exterior lights on a photocell circuit for automatic actuation of the exterior gatehouse lights.

277/3ph/60 Hz power for the exterior lighting along the dam and walkways originates from the generator building and is not part of the gate house electrical system.

2.1.2 North Canadian River Bypass Canal Debris Management:

Figure 3 on the following page provides a partial plan of the **North Canadian River** bypass channel. When the original dam was constructed in 1918, historical records show an overhead train trestle was constructed to deliver dam construction materials to the jobsite. When the dam was completed this railroad trestle was backfilled to form the western wall of the bypass channel. The lack of a proper debris catcher for the bypass channel is impacting operations of both the caterpillar gate and the sluice gates at the Overholser dam. Debris has the tendency to accumulate behind the gates and this must be freed prior to gate operation. Furthermore, the potential exists for

debris to become lodged in the gate tracks which can cause damage to the gate/structure in the event of a gate over torque situation due to a complete or partial blockage of the opening.

2.1.3 Hefner Canal Inlet Debris Management:

The Hefner Canal was constructed in the late 1940's as part of the construction of Lake Hefner (V.V. Long &Co. Bluff Creek Water Supply, Water Bond Issue No. 12). The entrance to thecanal is located on the North Canadian River just northeast of Lake Overholser (see Figure 1).

Upstream from this location, the **North Canadian River** flows easterly and parallel to State Highway 66 (SH 66). As the River turns to flow southward and under SH 66 , there is a sheet piling cutoffwall and a debris guard on the North bank (See Figure 4 on the following pages) . This marks thelocation of the entrance to the Hefner Canal. The sheet pile wall and associated debris catcher are located approximately 70 feet upstream from the canal inlet control structure gate house.

Figure 3 Partial Plan of North Canadian Bypass Canal

The debris catcher consists of timber piles with steel I-beam cross supports supporting a steel I- beam framed walkway with 42-inch metal guardrail which was constructed by Reservoir and Canal staff in 2010. The entrance to the debris catcher at either end is equipped with a bar door- gate which is locked when not in use. Current operations involve inspection of the debris catcherfollowing each rain event and the use of an extended pole to move captured debris to a recoveryarea located east of the debris catcher. (see Figure 4 on the following page).There is a lockable gate at the west end of Overholser Drive which is utilized to accessthe debris catcher recovery area. From there, debris is loaded from front end loaders to a centralized debris handling site.

The current debris catcher is largely ineffective a preventing the large timber, tree branches, and other debris from entering the Hefner canal. The unmitigated debris can cause long term damage to the inlet control structure sluice gates and block the box culverts at Wilshire Blvd andRockwell Ave canal crossings. Furthermore, debris lodged within the sluice gate actuation path has the potential to cause over torquing of the sluice gate actuators potentially damaging the gates or the gate house floor. As a result, a more robust debris catcher design is necessary to improve the capture rate and facilitate debris removal.

2.1.4 Hefner Inlet Control Structure Gate House

At this end of the Hefner canal entrance, a 6" concrete apron with 12" vertical wing walls leads to the inlet of a 50-foot long Hefner Inlet Control Structure. Figure 5 on the following page presents a plan view of the Hefner Inlet Control Structure. The first 11'-4" of the control structurehas four 2-foot wide by 9-foot tall pier noses that become the interior walls of a five cell 8'x9'x38'-8" reinforced concrete box culvert. An 8'x8' automatic electric operated sluice gate is fitted to the upstream end of each cell. Also included between the pier noses on the upstream end of the structure are 10-inch stop log grooves that hold 8"x8"x10" creosoted yellow pine stop logs. It is believed that these stop logs would be used to restrict flow for maintenance of the sluice gates.

A masonry block building with removable concrete roof was installed in 2000 to enclose the sluice gate electric actuators. The masonry block buildinghas four 4'x2' glass windows at the south end and a steel man door with protective bar screen at the north of the building. In addition, an 80"x 80" opening with heavy duty steel double doors has been installed in the north side of the building to permit installation/removal of the existing Natural gas generator.

The building electrical is fed by OG&E through a dedicated pole-mounted transformer (230V, 3ph, 60hz) with an external meter located on the east side of the building. A 230V, 3phase, 60 Hz, 200 amp panelboard is located at the east end of the building and is connected to a manual transfer switch connected to a 60 KW 230V,3ph, 60Hz natural gas-powered generator. The 230V,3phase, 60 Hz panelboard provides the 110V, 1phase, 60 Hz circuits for the interior and exterior wall pack

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holophane lights and GFIC receptacles, a 30 W electric heater, and the 230V, 3phase, 60 Hz power to the existing Limitorque 10 HP (25.2-amp FLA) actuators. A Hand-Off-Auto (HOA) switch is provided to actuate the lights. When the HOA switch is in the "Auto" position, the exterior and interior lights are actuated with an exterior mounted photocell.

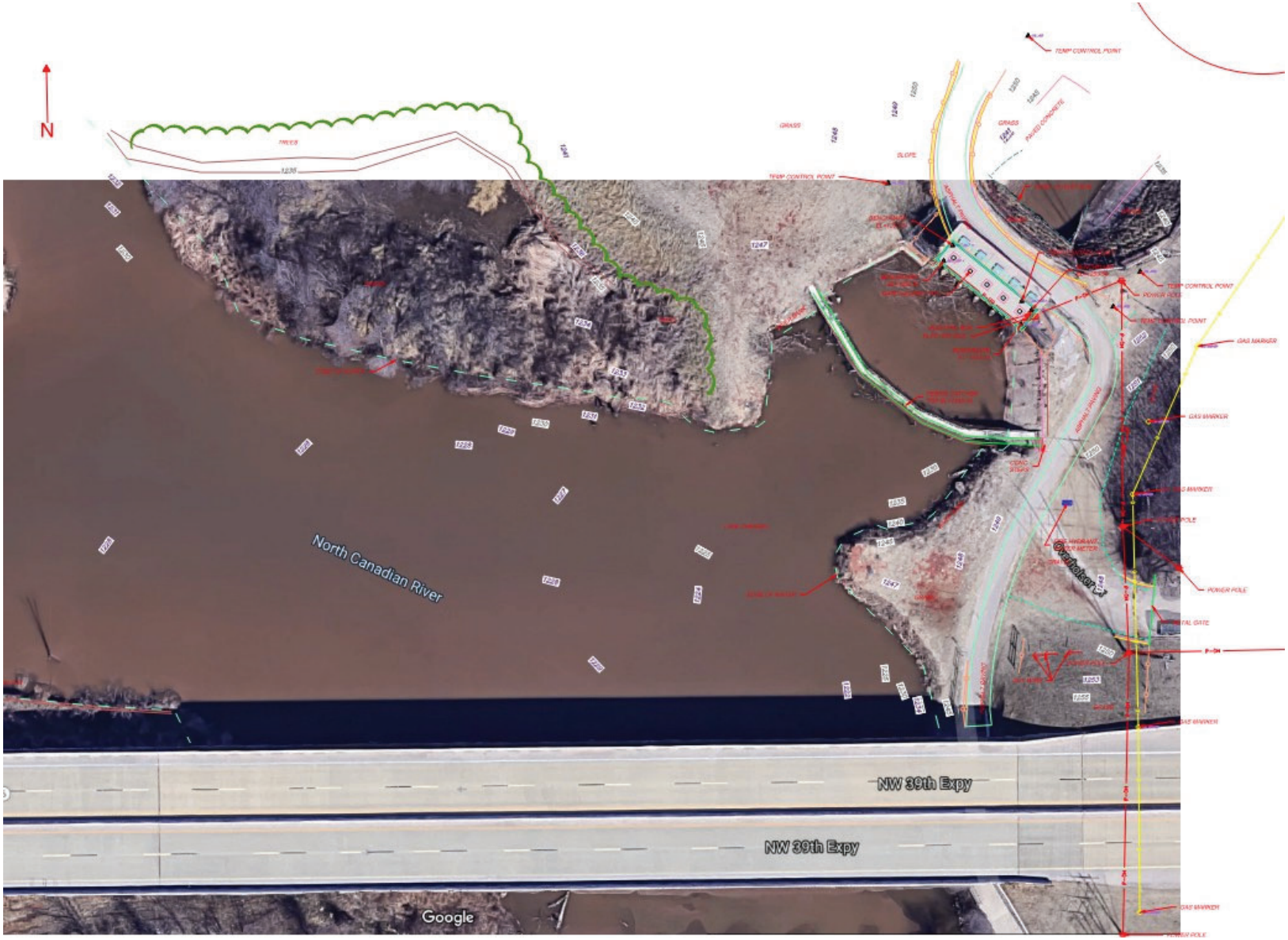
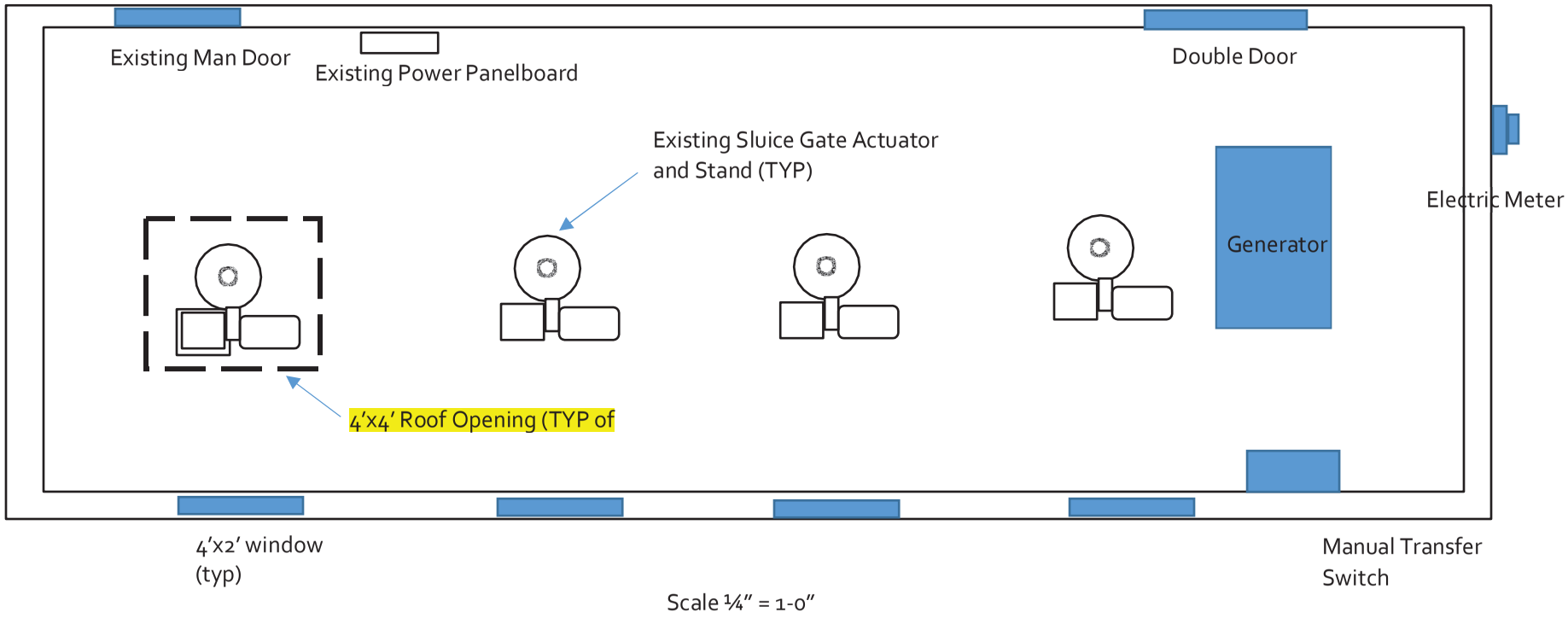


Figure 4 – Hefner Canal Debris Management

Figure 5 – Plan of Hefner Inlet Structure Gate House



2.2 Purpose

The overall goal of this project is to conduct a condition assessment of, recommend capital improvements for, and develop AACE Level IV construction costs for the following facilities:

- Overholser Dam Gate House Improvements
- North Canadian River Bypass Channel Improvements
- Hefner Canal Inlet Improvements
- Hefner Inlet Control Structure Gate House Improvements.

3.0 Overholser Dam Gate House Improvements

3.1 Existing Conditions and Recommended Improvements:

As previously stated, the Overholser Dam Gate House is on the USDOI List of National Historic Places (Registry Number 07000518). As a result, any improvements proposed herein must be reviewed by and coordinated with the State Historic Preservation Office to maintain the historic integrity of the structure.

The paragraphs below detail the existing conditions of the Overholser Dam Gate House.

3.1.1 Structural/Architectural:

On January 5, 2021, a multidisciplined condition assessment was conducted at the OverholserDam Gate House. As a result of the condition assessment the following is recommended:

- Roof: Figure 6 presents a drawing of the existing A-frame roof. Numerous locations of roof leaks were identified within the gate house structure indicating the need for maintenance and repair. Since the roof was designed to be removable, it is recommended that the repairs involve the following:
    - Prepare for removal of roof by temporarily removing and supporting existingconduits.
    - Removal of the roof.
    - Removal of tiles/wood cross members.
    - Repair/refurbishment of roof members and connectors.
    - Installation of new roof subsurface and Spanish tiles deigned to match theoriginal design intent of the roof.
    - The contractor will be required to provide a temporary roof while the off-siterestoration/replacement/repairs are completed.
    - Installation of the refurbished roof with new flashing.

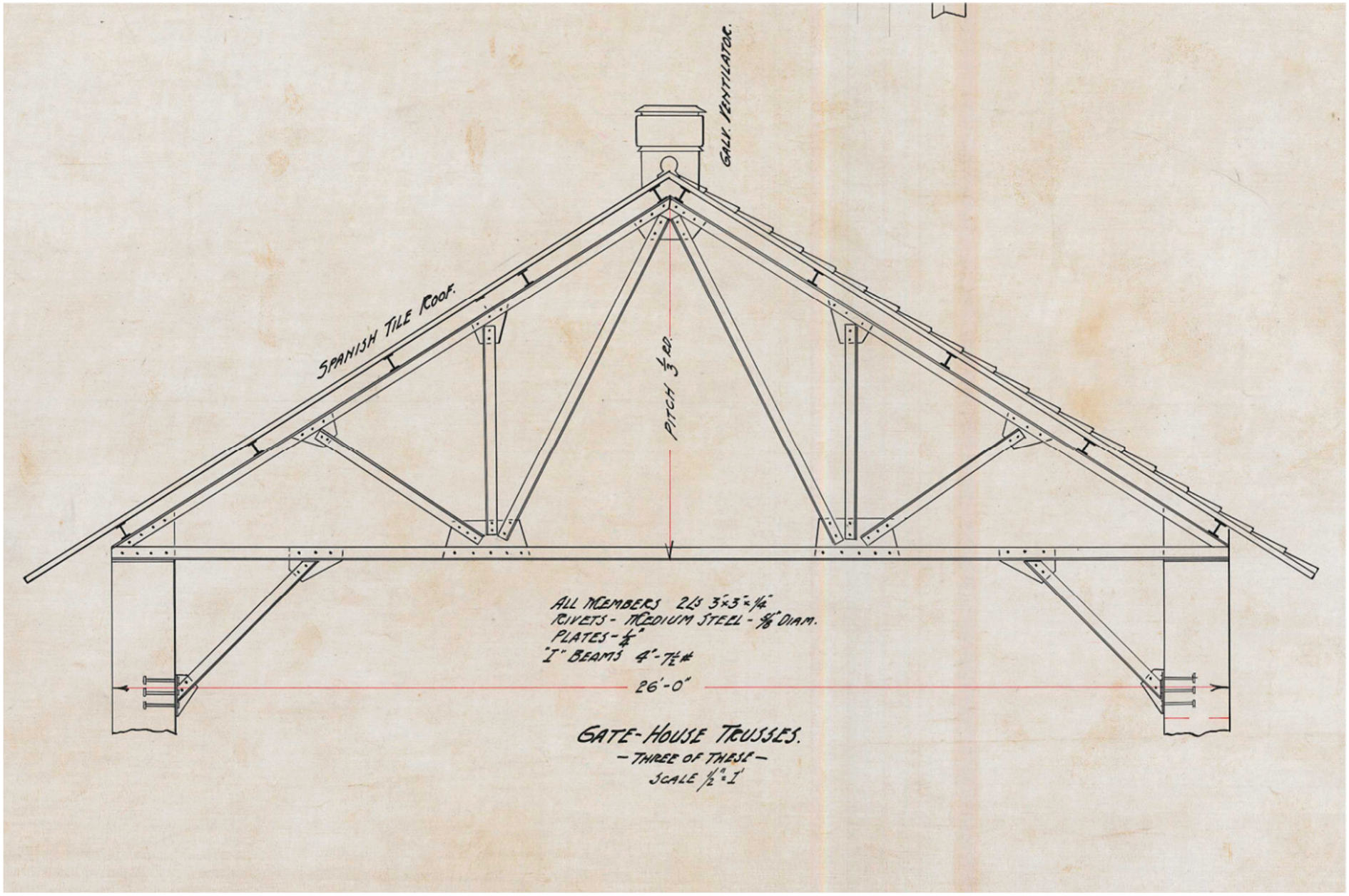


Figure 6 – Gate House A-Frame Roof Details

- Floors: Figure 7 on the following pages presents a photograph illustrating the condition of the floors. As indicated by Figure 7, there is evidence of damage to the floor caused by an over-torque of the existing sluice gates. Since the actuators are currently beyond their useful service life, the following is recommended:
    - Remove existing actuators and stands. Replace damaged stands.
    - Chip away loose concrete and repair floor utilizing a high strength, self-leveling epoxy grout such as Sika Crete or equal.
    - Crack injection/repair using an epoxy resin such as Sikadur or equal.
    - Cleaning and sealing floor
- Walls -Interior: Figure 8 on the following pages presents a photograph illustrating the condition of the interior brick/mortar walls. In general, the walls are in good condition with some evidence of cracking and paint deterioration. Given this, the following is recommended:
    - Washing and preparation of walls.
    - Selective removal of existing coating (lead-based paint) to enable mortar repair and brick tuckpointing.
    - Encapsulation of existing lead-based paint with new coating.
    - It is recommended that prior to conducting improvements that a lead paint and asbestos survey be conducted on the buildings to determine if lead paint and asbestos remediation will be required as part of the project.
- Exterior Improvements: Figure 9 on the following pages presents photographs of the building exterior. The exterior of the building is in good condition except for the doors and windows which require a significant upgrade. Given this, the following is recommended:
    - Removal of all windows and frames for reglazing and refurbishment. Contractor will be required to provide temporary wood partitions in place of the windows.
    - Blasting and coating of existing window lintels and installation of reglazed windows with new caulking.
    - Removal of the existing double door and frame and replacement with new double door/frame with electronic key-card scanner conforming to OCWUT security standards.
    - Acid washing of brick exterior and tuckpointing of bricks and mortar. Application of protective brick sealant.
    - Placing a netting or false ceiling at the bottom of the roof eave to prevent pigeons to stop from roosting in the roof interior.

3.1.2 Gate House Equipment:

As previously stated, the existing sluice gate actuators (see Figure 7) are beyond their useful life and should be replaced with new electric actuators with torque limiting cutoffs to prevent further damage to the concrete floor. The sluice gates are in good condition; however, it is recommended that an allowance be made in the contract

documents for the underwater investigation and repair/replacement of the gate hardware (gate stem guides, gate retaining glands, etc.).

3.1.3 Mechanical/HVAC Systems

The existing mechanical/HVAC system consists of passive vents in the roof and a thermostatically controlled unit heater on the wall. Since there are no elements in the building that would require conditioning or would be subject to freezing, improvements to the HVAC systems of the building are not recommended. The new actuators will be specified with electricmotor winding heaters and will be rated for outdoor service.

Figure 7 – Gate House Floor Condition

Figure 8 – Gate House Interior Wall Condition

Figure 9 – Gate House Exterior Condition

3.1.4 Electrical/Site Lighting

Figure 10 presents a series of photographs illustrating the condition of the electrical system.

- Interior Electrical:
  - The existing 480V/277 panelboard is in good condition and has sufficient spare capacity to provide for future needs. As previously stated, the existing backup generator does not have sufficient power to allow the east/west gates to be actuated simultaneously; however, any improvements to the backup generation system will be addressed as part of a future project caterpillar gate replacementand is outside the scope of the capital improvements associated with the construction project.
  - The existing 120/240V 125-amp panelboard and associated transformer are inpoor condition, past their useful life, and should be replaced in its entirety.
  - The existing interior lighting and fixtures should be replaced with new LEDlighting fixtures.
- Exterior Electrical: Figure 11 illustrates the areas of the Overholser Dam in which theexterior lighting/fixtures will be upgraded as part of this project.
  - The existing light fixtures and PVC rigid steel conduits are in good condition and should be reused as part of the exterior lighting design.
  - The existing light fixtures will be removed, upgraded with LED fixtures, andreinstalled.
  - The existing conduit/wires will be reused as these are in excellent condition.
  - During design, the original manufacturer of the light fixtures will be engaged toduplicate the design/look of these fixtures to ensure that all new fixtures will closely match the existing fixtures.

3.1.5 Instrumentation and Controls

As previously indicated, OCWUT staff are currently upgrading the 120V, 1phase, 60 Hz alarm lights and horns designed to indicate actuation of the caterpillar gates. The existing instrumentation and control system telemetry is non-functional and needs to be replaced in itsentirety. The following is recommended:

- Include door switches on new doors for reporting door actuation to SCADA.
- Replace existing PLC system with new AB compact logic PLC and HMI for local control of sluice gates and alarm system. Include sufficient points for incorporation of caterpillargate controls once gates are upgraded (as part of
- Provide new antenna and telemetry equipment in accordance with the City of OklahomaCity SCADA standards for reporting of gate house station status to SCADA system. SCADA interface will only report status and not be utilized for gate actuation.

- Inlet Sluice gate actuators will be provided with a hardwired switches to automatically stop gate prior to over torquing of sluice gate.
- Inlet Sluice gate actuators will be provided with a hardwired relay to activate the beacon and alarm system to indicate gate actuation. Due to the need to activate the alarm and beacon light system to inform anyone at the base of the bypass channel of gate actuation, this should remain a manual operation. However, relay will be provided within the actuator to indicate gate position and alarm (over torquing) to the SCADA system.
- Caterpillar gate actuators will be provided with external relays on the motor starters and position switches to indicate gate actuation and gate position in SCADA.

Figure 10- Gate House Electrical Condition

① Spillway Walkway Lighting Circuit:
- Fixtures, Conduit, Wires, J-Boxes are in Good Condition.
- Replace with LED Lamps

② Dam Walkway Lighting Circuits (3):
- Fixtures, Conduit, Wires, J-Boxes are in Good Condition.
- Replace with LED Lamps

③ Building First Floor Lighting - Exterior Circuits
- Fixtures, Conduit, Wires, J-Boxes are in Good Condition.
- Replace with LED Lamps

④ Building Mezzanine Floor Lighting - Exterior Circuits
- Fixtures, Conduit, Wires, J-Boxes are in Good Condition.
- Replace with LED Lamps

⑤ Dam Viewing area/steps sidewalks - Exterior Circuits
- Conduit, J-Boxes are in Good Condition.
- Replace Fixtures with LED Lamp's
- New wiring and selective conduits/J-boxes

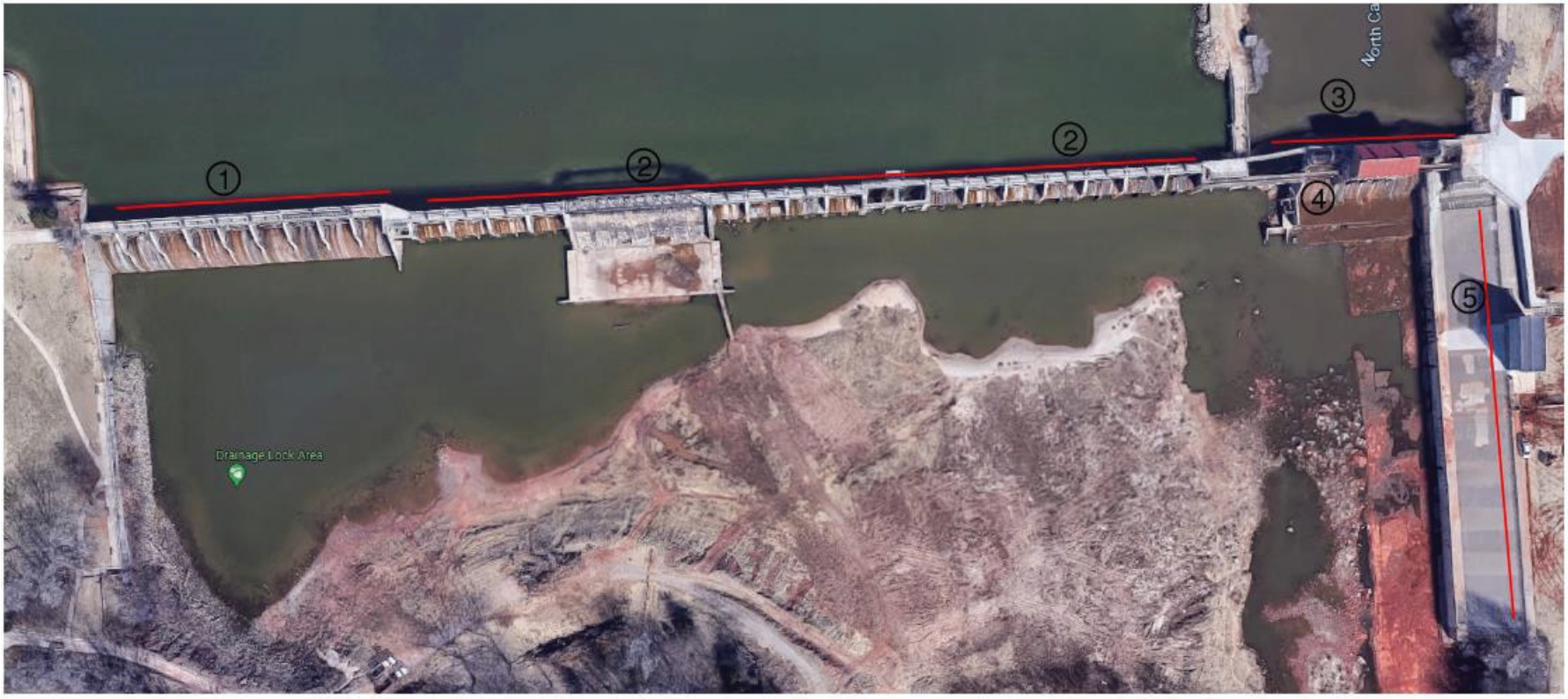


Figure 11- Overholser Gate House Exterior Electrical Improvements

4.0 North Canadian River Bypass Canal Improvements

4.1 Existing Conditions:

Figure 12 provides a partial plan view of the existing North Canadian River bypass canal with recent bathymetric survey and geotechnical information collected in June 2021 and January 2021. The bypass channel varies in bank-to-bank width during normal operating anywhere from 100 ft to 150 feet. The bathymetric survey of the channel bottom indicates channel bottom at anywherefrom 12 to 15 feet in depth due to sediment accumulation in the channel bottom.

4.1.1 Current Operations:

Currently, there are no facilities dedicated to the capture and diversion of debris prior to the Overholser Dam. Consequently, during a controlled release of flow through the bypass channel, debris will accumulate in and behind the caterpillar and/or sluice gate which must be removed toprevent jamming and over torque of the gate actuators.

4.1.2 Geotechnical Conditions:

During the January 2021 site visit, excavations were performed on the west side of the North Canadian Bypass canal, between the canal and the lake to determine the geotechnical conditions for potential location of the foundation block for the proposed boom catcher. Figure 13 provides photographs taken during these investigations. The following observations were made:

- The top 6-8 inches consists of loosely compacted topsoil.
- 8 inches to 5 feet below the surface consists of hard clays with good bearing capacities of 2,000 lb./ft.
- The abandoned rail trestle tracks are located approximately 5-6 feet below the existingsurface.

The conclusions of these investigations indicated that the soils at the west side of the North Canadian Bypass Channel have sufficient bearing capacity to accommodate the foundation of the glance boom without the need for adeep foundation system (piers, piles, etc.).

4.1.3 Site Access and Debris Loading/Unloading:

As indicated on Figure 12, there is an existing 50' x 30' concrete pad located on the west side of the channel adjacent to the existing Reservoirs and Canals facility that can be utilized as a staging area for the storage and loading of debris. Improvements to clear the vegetation from the banks and install a gravel operating area for storage of debris will be necessary to fully utilize the space as a means of receiving the debris from the proposed glance boom.

4.1.4 Electrical and Instrumentation/Controls:

Currently there is no power to the proposed location for the glance boom unloading

facility. However, as indicated in Figure 12, the existing generator and main power supply to the Overholser Dam House is located approximately 300 feet to the south of the proposed unloadingarea.

Figure 12 – North Canadian River Bypass Canal Improvements – Overall Plan

Figure 13 – Photos of Geotechnical Investigations at West Side of North Canadian Bypass Channel

4.1.5 Stormwater and Drainage:

There are currently no stormwater and/or drainage facilities located in the area. All stormwater currently drains to Lake Overholser from the east end of the North Canadian bypass channel and the proposed area for the debris loading/unloading.

4.2 Design Criteria:

Figure 14 on the following page illustrates the conceptual design of the proposed debris glanceboom. Table 2 provides a summary of the design criteria for the glance boom:

Table 2 North Canadian River Bypass Channel Glance Boom Design Criteria

Designation	Design Element	Unit of Measurement	Measurement	Comments
A.	Total Length	Ft	150	1.
B.	Walkway Width (clear)	Ft	5	
C.	Angle to Flow stream	Deg	15-20	2.
D.	Max Channel Depth	Ft	15	3.
E.	Face of Boom Depth	Ft	7	
F.	Boom Depth Below	Ft	4	
G.	Boom Angle	Deg	5-7	2.
H.	Diameter of Pontoons	Inch	24	
I.	Decking Material	NA	Galva Steel Serrated Grating	
J.	Guardrail Material	NA	Galva Steel	4.
K.	Pontoon Material	NA	½" thick Steel Pipe	5.
L.	Corrosion Protection	NA	Sacrificial Anodes	6.

(1) Total bank to bank length of glance boom.
(2) Angles will be set during final design and analysis of estimated flow range in bypass channel and type of floating debris.
(3) Channel depth based upon 1 ft above dam spillway elevation and latest channel bathymetry.
(4) Guardrail to be 42-inches and removable with lockable caged doors on each end to prevent non-authorized pedestrian traffic from entering.
(5) Pontoon material to be selected during final design. Costs currently based upon butt welded steel coated with high solids epoxy system.
(6) Sacrificial anodes included in costs, exact quantity and weight of anodes to be determined during final design.

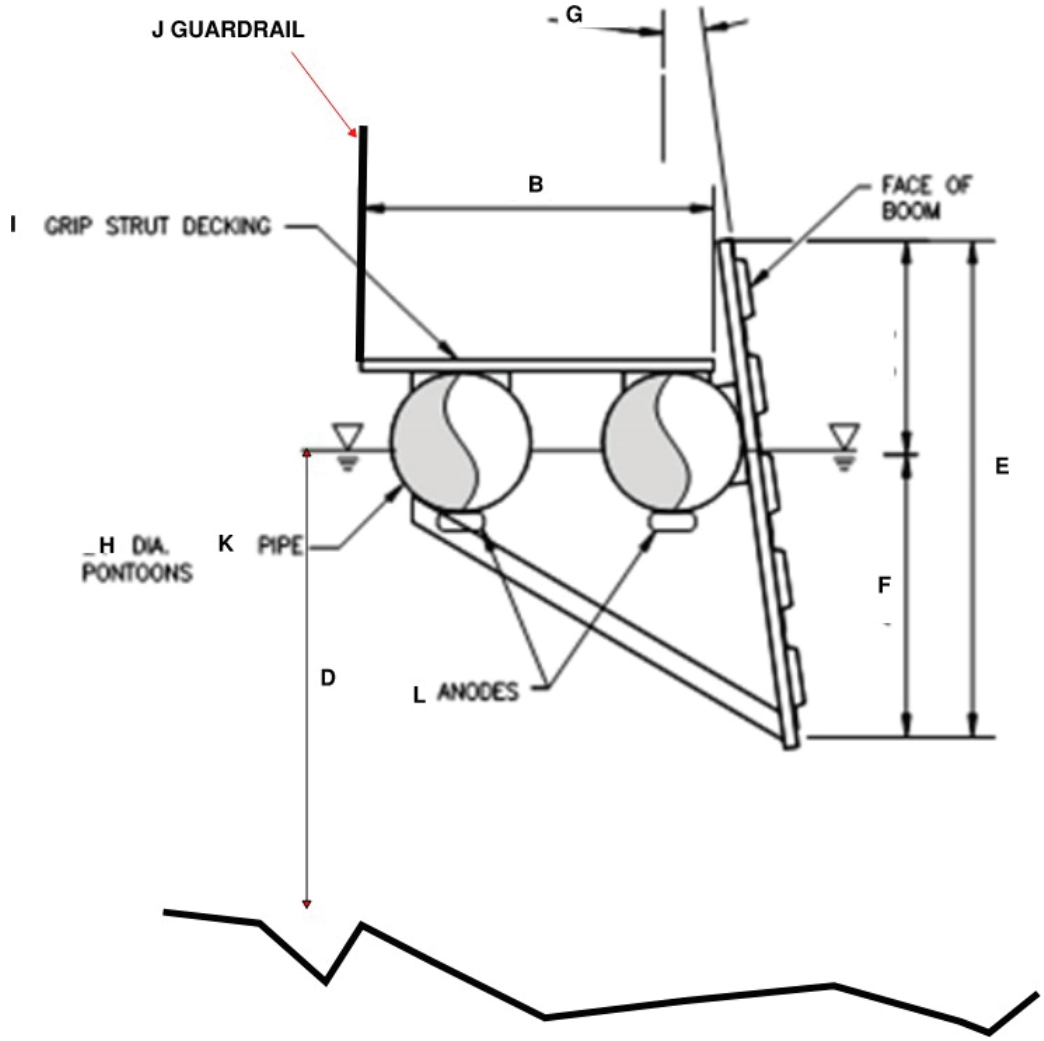


Figure 14 – Overholser Glance Boom Details

4.3 Recommended Improvements

The recommended improvements are summarized below.

4.3.1 Operational Improvements:

The purpose of the improvements to the North Canadian River bypass canal and Hefner Canal inlet will be to reconfigure the debris catcher to install a new glance boom with the purpose to divert most of the debris away from the Hefner Canal inlet toward the new North Canadian River bypass canal glance boom. In this manner, the collection and handling of debris can be centralized while improving protection of the Hefner Canal Inlet and the North Canadian River bypass canal.

4.3.2 Debris Catcher Boom:

As indicated by Figure 12 on the previous pages, the debris catcher boom is proposed to be installed in the following manner.

- The east end of the North Canadian bypass channel will be excavated to approximately to the top of the existing rails. It is anticipated that some measure of dewatering will be necessary to maintain the excavation and this excavation should take place during the months of low anticipated rainfall.
- A buried mass concrete block will be installed within the east side of the North Canadian bypass channel to provide an anchorage point for the glance boom. The glance boom will ~~relate~~ be connected to the buried block by stainless steel chains. A flexible walkway will be provided to permit OCWUT staff to access the glance boom walkway.
- A mass concrete block will be installed at the west side of the bypass channel to provide an anchorage point for the glance boom and enable diversion of debris to the proposed gravel receiving area.
- The glance boom entrances will be framed to include metal bar doors to prevent unauthorized entrance. This is only meant to protect against "free" access to the glance boom with the understanding that other security measures, such as a completely caged walkway will obstruct operational access to the glance boom.

4.3.3 Site Access Improvements:

Figure 15 presents a partial site plan of the glance boom receiving area. The features of this area are outlined below:

- The existing trees will be removed (see permitting discussion)
- Bank stabilization improvements will be performed to maintain the elevation of the receiving pad with respect to the loading pad.
- New concrete road will be provided for dump trucks to access the concrete pad.
- A new compacted gravel receiving pad will be provided to divert debris for loading onto the dump trucks parked on the concrete pad.

- All improvements will be conducted and graded to maintain existing grade and prevailing drainage of stormwater to the bypass channel.

4.3.4 Electrical Improvements:

Figure 15 on the following page indicates a partial plan of the site electrical for the glance boom receiving area. The features of the electrical improvements include the following:

- New 480V/240V NEMA 3R Mini load center located on the existing generator building.
- New HOA switch located in the generator building:
  - In Hand – Lights will be on.
  - In off – lights will be off
  - In Auto – Lights will be controlled by a photocell mounted on the roof of the existing generator building.
- New 1-inch direct buried PVC coated steel (PCS) conduit containing circuits for the new area lights.
- New LED Pole Mounted area lights for illuminating the glance boom receiving area and entrance to the glance boom.
- The glance boom itself will be provided with permanent lighting with flexible conduit with breakaway fitting and a HOA light switch for illuminating the glance boom walkway when in use.

See Appendix A for a cutsheet of the proposed light poles.

Figure 15 Partial Plan – Glance Boom Receiving Area

5.0 Hefner Canal Inlet Improvements

5.1 Existing Conditions:

Figure 15 provides a partial plan view of the existing Hefner Canal Inlet indicating the location of the existing sheet pile wall, wood piling associated with the existing debris catcherand the Hefner Inlet Gate House.

5.1.1 Current Operations:

When the Overholser bypass gates and Tainter gates are raised and the sluice gates are opened at the Hefner Canal Inlet Gate House, flow is diverted from the North Canadian River into the Hefner Canal. The existing wood piling acts as an obstruction to "catch" debris prior to entering the sluice gates. This was installed to reduce the likelihood of flow obstructions at the sluice gates orin the box culverts at Wilshire Blvd and Rockwell Ave canal crossings.

Following a large diversion event, OCWUT staff utilize the bridge constructed above the wood piles to inspect the debris area. Any debris caught in the piling is poled by staff to an area whereit is collected and loaded into dump trucks for disposal off-site.

5.1.2 Geotechnical Conditions:

Preliminary investigations of the geotechnical conditions through examination of previous subsurface reports in the vicinity of the proposed location for the glace boom foundation indicate potential bearing capacities favorable for construction of the glance boom Deadman without the need for a deep foundation system. Additional geotechnical investigations will be conducted during the design to confirm these assumptions.

5.1.3 Site Access and Debris Loading/Unloading:

As indicated on Figure 16, the existing debris collection area will be reused for accumulation andstorage of debris collected by the new glance boom. .

5.1.4 Electrical and Instrumentation/Controls:

Currently there is no power to the proposed location for the glance boom unloading facility. Exterior lights are provided on the Hefner Inlet Gate House but only on the north side, awayfrom the debris catcher and unloading area.

Figure 16 – Hefner Inlet Debris Management Site – Overall Plan

5.1.5 Stormwater and Drainage:

There are currently no stormwater and/or drainage facilities located in the area. All stormwater currently drains to the North Canadian River from the current debris management area.

5.2 Design Criteria:

Figure 17 on the following page illustrates the conceptual design of the proposed debris glance boom. Table 3 provides a summary of the design criteria for the glance boom:

Table 3 Hefner Inlet Glance Boom Design Criteria

Designation	Design Element	Unit of Measurement	Measurement	Comments
A.	Total Length	Ft	80	1.
B.	Walkway Width (clear)	Ft	5	
C.	Angle to Flow stream	Deg	25	2.
D.	Max Channel Depth	Ft	8	3.
E.	Face of Boom Depth	Ft	6	
F.	Boom Depth Below Water	Ft	3	
G.	Boom Angle	Deg	5-7	2.
H.	Diameter of Pontoons	Inch	30	
I.	Decking Material	NA	Galva Steel Serrated Grating	
J.	Guardrail Material	NA	Galva Steel	4.
K.	Pontoon Material	NA	½" thick Steel Pipe	5.
L.	Corrosion Protection	NA	Sacrificial Anodes	6.

(1) Total bank to bank length of glance boom.
(2) Angles will be set during final design and analysis of estimated flow range in bypass channel and type of floating debris.
(3) Channel depth based upon 1 ft above dam spillway elevation and latest channel bathymetry.
(4) Guardrail to be 42-inches and removable with lockable caged doors on each end to prevent non-authorized pedestrian traffic from entering.
(5) Pontoon material to be selected during final design. Costs currently based upon butt welded steel coated with high solids epoxy system.
(6) Sacrificial anodes included in costs, exact quantity and weight of anodes to be determined during final design.

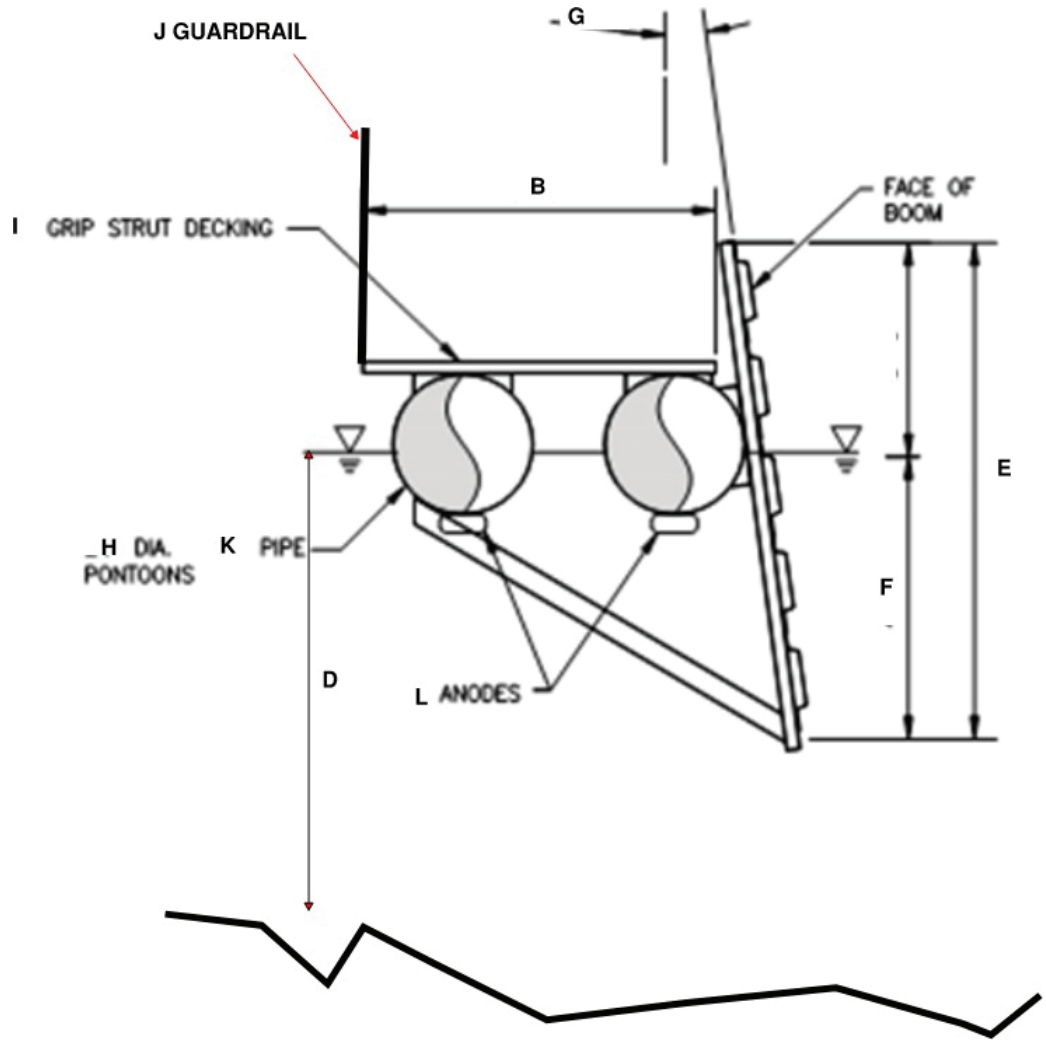


Figure 17 – Hefner Canal Inlet Glance Boom Details

5.3 Recommended Improvements

The recommended improvements are summarized below.

5.3.1 Operational Improvements

The purpose of the improvements to the North Canadian River bypass canal and Hefner Canal inlet willbe to reconfigure the Hefner canal inlet debris catcher to install a new glance boom with the purpose to divert most of the debris away from the Hefner Canal inlet toward the new North Canadian River bypass canal glance boom. In this manner, the collection and handling of debris can be centralized while improving protection of the Hefner Canal Inlet and the North Canadian River bypass canal.

5.3.2 Debris Catcher Boom:

As indicated by Figure 16 on the previous pages, the glance boom is proposed to be installed inthe following manner.

- The area at the shore of the river to the southwest of the existing sheet pile wall and debris catcher will be excavated to a depth of approximately 8 feet. It is anticipated that some measure of dewatering will be necessary to maintain the excavation and this excavation should take place during the months of low anticipated rainfall.
- A buried mass concrete block will be installed within the area to provide an anchorage point for the glance boom. The glance boom will be connected with stainless steel chains to the buried block and a flexible walkway will be provided to permit OCWUT staff to access the glance boom walkway from the west side.
- A mass concrete block will be installed at the west side of the bypass channel to provide an anchorage point for the glace boom and enable diversion of debris to the bypass channel.
- The glance boom entrances will be framed to include metal bar doors to prevent unauthorized entrance. This is only meant to protect against "free" access to the glance boom with the understanding that other security measures, such as a completely caged walkway will obstruct operational access to the glance boom.

As shown in Figure 16, the purpose of the Hefner Canal glance boom is to divert debris fromthe entrance of the Hefner canal and allow the debris to be collected at the North Canadian River bypass channel glance boom. This has the following advantages:

1. Debris diversion and collection will be centralized at a single location within view of theReservoirs and Canals facility.
2. Most of the debris collection will occur at timed intervals during planned releases from North Canadian River/Canton Lake when the prevailing flows

are in the direction of the bypass canal and glanceboom.

5.3.3 Site Access Improvements:

Given that most of the debris will now be diverted towards the North Canadian River bypass channel, therewill not be as great a need to conduct improvements to the existing debris collection area.

However, some minor bank stabilization measures near the SH 66 abutments may be necessary to ensure diversion of debris to the North Canadian River bypass canal and avoid collection ofdebris in this area.

5.3.4 Electrical Improvements:

It is not anticipated that significant electrical improvements will be required in this area. .

6.0 Hefner Inlet Control Structure Gate House

6.1 Existing Conditions and Recommended Improvements:

The paragraphs below detail the existing conditions of the Hefner Inlet Control Structure Gate House.

6.1.1 Structural/Architectural:

On January 5, 2021, a multidisciplined condition assessment was conducted at the Hefner InletControl Structure Gate House. Figure 18 on the following page presents a summary of photographs associated with the structural and architectural condition assessment of the inlet control structure gate house. As a result of the condition assessment the following is recommended:

- Roof: Numerous locations of roof leaks were identified within the gate house structure indicating the need for maintenance and repair. The recommendations are as follows:
    - Remove the existing modified bitumen roof and seal plates above valveactuators.
    - Install new roof curbs at the existing openings and OSHA rated walkableskylights.
    - Install new Thermoplastic Polyolefin (TPO) roofing system and flashing.
    - Install OKC DB Salia standardized fall protection system on roof.
- Floors: No work, floor is in good condition.
- Walls/Ceilings– Interior:
    - Existing coating will be removed in accordance with SSPC-SP7
    - No new coating will be applied to minimize future maintenance needs
- Doors and Windows:
    - Existing windows will be removed/demolished and replaced with bullet proof glazing to minimize damage as past incidents have occurred with damage from gunshots. Windows will be capable of being actuated. Security bars will be installed around window openings. Windows will be actuated to allow for passive ventilation into the space.
    - Entrance Door: Existing door and frames will be removed and replaced with newheavy duty steel doors with continuous hinges. Door coating will be graffiti resistant. A new steel bar security door will be provided with door hardware guard to reduce the likelihood of damage to the new door.
    - Generator Access Double Doors: Door coating will be removed on exterior andrepainted with graffiti resistant paint.
- Walls – Exterior:
    - Existing coating will be blasted in accordance with SSPC SP-7.
    - CMU blocks will be cleaned and tuckpointed.

  - New graffiti resistant sealer will be provided.

- Floors: Since the actuators are currently beyond their useful service life, the following is recommended:
  - Remove all existing sluice gate actuators and stand and replace with new actuators and stands.
  - Chip away loose concrete and repair floor utilizing a high strength, self-levelingepoxy grout such as Sikacrete or equal.
  - Crack injection/repair using an epoxy resin such as Sikadur or equal.
  - Blasting concrete floor to SPCC-SP7 and sealing floor

6.1.2 Gate House Equipment – Sluice Gates:

Figure 19 provides a summary of the condition of the existing gate house equipment and associated electrical systems. As previously stated, the existing sluice gate actuators are beyond their useful life and should be replaced with new electric actuators with torque limiting cutoffs toprevent further damage to the concrete floor. The sluice gates are in good condition; however, itis recommended that an allowance be made in the contract documents for the underwater investigation and repair/replacement of the gate hardware (Gate stem guides, gate retaining glands, etc.). This is due to the potential damage caused to the sluice gates from debris that has been passed through the existing debris catcher and has hung up on the gate frame.

6.1.3 Mechanical/HVAC Systems

The existing HVAC system consists of a small 40-watt electric unit heater with thermostatic controls mounted at the east end of the building. Currently, the building contains no ventilationother than the natural ventilation provided by the windows when opened. Since there are no elements in the building that would require conditioning or would be subject to freezing, improvements to the HVAC systems of the building are not recommended. The new actuators will be specified with electric motor winding heaters and will be rated for outdoor service.

Figure 18 – Hefner Inlet Control Gate House Structural/Architectural Condition Assessment

6.1.4 Electrical/Site Lighting

Figure 19 presents a series of photographs illustrating the condition of the electrical system.

- Interior Electrical:
  - The existing 480V/277 panelboard is in good condition and has sufficient sparecapacity to provide for future needs.
  - The existing natural gas generator and manual transfer switch are in goodcondition and can be retained.
- Interior and Exterior Electrical Lighting:
  - A new 120V, 1phase 60, Hz mini load center will be installed to provide 120V,1phase, 60 Hz circuits for the new interior and exterior LED lighting.
  - New Interior and exterior LED lighting fixtures will be provided.
  - Exterior lighting will be upgraded to illuminate the south side of the building toprovide lighting for the glance boom area. Fixtures will be designed to be replaced from accessing from the roof.
  - Exterior lighting will be provided with a new HOA switch:
    - In Hand lights will be on
    - In Off lights will be off
    - In Auto lights will be automatically actuated by an HOA switch.

6.1.5 Instrumentation and Controls

There is currently no telemetry equipment in the gatehouse, and this should be improved as partof this project.

- Include door switches on new doors for reporting door actuation to SCADA.
- Provide new RTU unit with new antenna and telemetry equipment in accordance with the City of Oklahoma City SCADA standards for reporting of gate house station statusto SCADA system. SCADA interface will only report status and not be utilized for gate actuation.
- All gate actuation shall remain a local activity due to the potential for gate damage if gates are actuated while debris is in the gate.
- Gate actuators will be provided with torque monitoring and switches to shut down gate actuation and send an alarm to SCADA.
- Gates will be provided with switches to permit indication of gate permission at SCADA.

Figure 19- Equipment and Electrical Assessment Photos

7.0 Permitting:

7.1 USACE 404 Permitting:

7.1.1 NEPA Assessment:

The improvements at the North Canadian River bypass canal and Hefner Canal will require approval bythe USACE under the 404 nationwide permitting process. As part of this permitting effort, an environmental assessment under the National Environmental Policy Act (NEPA) of 1969 will be conducted as part of this project.

Permitting under the NEPA program will be conducted as part of the 404 nationwide permitapplication which will include desktop evaluations and exhibits necessary to obtain FONSI concurrence from:

- Oklahoma Department of Wildlife Conservation and United States Fish and Wildlife Service (USFWS) Endangered Species Conservation Act.
- Cultural Resources Evaluation and State Historic Preservation Office (SHPO)Review
- Oklahoma Department of Environmental Quality (Section 401)
- Oklahoma Conservation Commission (wetlands)

7.1.2 404 Nationwide Permitting:

An application and supporting documentation for a 404 Nationwide General Permit will be submitted to the Tulsa District of the USACE. The results of the NEPA environmental assessment will be utilized to complete the application along with draft contract documents (90% level) indicating the location of major project elements with respect to the Waters of the United States.

7.2 State Permitting:

7.2.1 State Historic Preservation Office:

A permit from the Oklahoma SHPO will not be required. However, the SPHO will require a cursory review of the construction documents to ensure improvements to the Overholser Dam Gate House are conducted in a manner that preserves the original architecture as included with the 2006 permit application provided in Appendix C.

7.2.2 Oklahoma Water Resources Board:

Based upon discussions with the Oklahoma Water Resources Board (OWRB), permitting the project with OWRB will be required. As a result, a construction permit application will be filed with the 90 percent level plans for approval.

7.2.3 Oklahoma Department of Environmental Quality:

The nature of the project is such that it will not require review by the Oklahoma Department of Environmental Quality since the permitting process will be the responsibility of the Oklahoma Water Resources Board. .

8.0 Construction Costs and Schedule

8.1 Construction Costs

Construction costs have been developed for the recommended improvements to the Overholser Dam Gate House, North Canadian River Bypass Canal, Hefner Canal Inlet, and the Hefner Inlet Control Structure Gate House. It is assumed that all the projects will be bid as one construction contract.

The level of accuracy for cost estimates varies with the level of detail to which the project has been defined. Concept screening represents the lowest level of accuracy, while pre-bid estimates (based on detailed plans and specifications) represent the highest level of accuracy. The Association for the Advancement of Cost Engineering (AACE) publishes guidelines that define the class of estimate and the expected accuracy range. Based on these guidelines, the cost estimates presented in this study are Class IV estimates, which should be considered as conceptual or order-of-magnitude estimates. The expected range of accuracy for this type of estimate is +50 percent to -30 percent of the actual project cost.

Information from previous projects and budget level quotes from manufacturers have been used to develop costs, which include materials and labor/installation. Table 4 summarizes the cost estimating factors used in the estimate, including allowances for general requirements, contractor overhead and profit, and contingencies.

Table 4 Cost Estimating Factors

Cost Element	Cost Factor
Builders Risk and General Liability	1.25% of total direct
Contractor Overhead and Profit	20% of total direct cost including Builders Risk and General Liability Insurance
Performance and Payment	1.5% of total direct cost + Builders Risk and General Liability Insurance + Contractor Overhead and Profit
Contingency	% of total construction cost (total direct cost + Builders Risk and General Liability Insurance + Contractor Overhead and Profit + Performance and Payment Bond). Percentage between the elements vary between 25% and 15% based upon the level of undeveloped design details.

Construction costs for the recommended improvements are presented in Table 5. A more detailed cost breakdown is included in Appendix C.

Table 5 WM-0286 Opinion of Probable Construction Costs (OPCC)

Cost Element	Total Cost
General Conditions/Mobilization	$382,433
Overholser Gate House Improvements	$588,500
North Canadian River Bypass Channel Improvements	$690,000
Hefner Inlet Control Structure Improvements	$280,000
Hefner Canal Inlet Improvements	$428,000
Taxes and Escalation	$337,774
Subtotal (Direct Costs)	**$2,706,708**
Contractor Overhead and Profit (20%)	$541,300
Contingency (25%)	$812,000
Class 4 Estimate Low Range (-30%)	$2,842,000
Total Construction Cost	**$4,060,000**
Class 4 Estimate High Range (+50%)	$6,090,000

8.2 Schedule

The anticipated construction duration for a combined project is 12 months. This accounts forlead time for the electrical equipment and gate actuators.

8.3 Staffing Impacts:

The improvements are not anticipated to impact staffing levels for these facilities. In fact, thediversion of most of the debris to a single location will help to reduce the operational and maintenance activities for debris management.

Appendix A

LIGHT FIXTURE CUTSHEET

Dialight

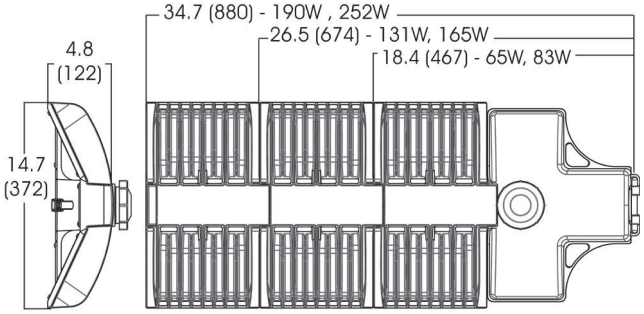
for Roadway and Area Illumination

StreetSense LED Street Light - UL

Standard Models

Certifications & Ratings

- UL1598
- CE
- CSA C22.2 No. 250.0-08



Dimensions in incr1es (mm)

Mechanical Information:

Fixture weight:

65W,83W:	16lbs (7.26kg)
131W, 165W:	25lbs (11.34kg)
190W, 252W:	34lbs (15.42kg)

Shipping weight:

65W,83W:	21lbs (12kg)
131W, 165W:	30lbs (16kg)
190W, 252W:	39lbs (20kg)

Mounting: Accommodates 1.25" (1.66" OD) - 2" (2.375" OD) 31.75mm (42.16mm OD) - 50.8mm (60.32mm OD) pipe. Provision for adjustment of +/- 5° at 2.5° increments

EPA (Sq. ft):

65,83W:	0.60
131W, 165W:	0.87
190W, 252W:	1.13

Electrical Specifications:

Operating Voltage: 100 - 277 VAC, 50/60 Hz
347 - 480 VAC, 50/60 Hz

Total system power consumption: See table

Operating Temp: 40°F to 165°F (-40°C to 74°C) ambient

Terminal Block: #14 AWG (1.6mm) to #6 AWG (4.1mm) wire and accessible via riinged tool less entry

Noise requirement /EMC: FCC Title 47, Subpart B, Section 15, class A device. RF Immunity; 10V/m, 80MHz-1GHz

Transient protection: Open circuit surge protection 10kV standard per ANSI/IEEE C62.41. 2.2002 cat C r1igh

THO: <20%

Power Factor: > 0.9

Construction:

Housing: Copper free aluminum

Finish: Superior dual coat finisr1
- Sealed polyester topcoat
- Cr1emical-resistant epoxy primer

Lens: Optically optimized, tempered glass

Photo controller socket: Standard NEMA three prong twist lock, socket witr1 sr1orting cap, as per ANSI C136.10

Photometric Information:

CAI: >70

CCT: 5000K (cool wr1ite)
4300K (neutral white)

Optics: IES Type III

All values typical unless otherwise stated (tolerance +/- 10%)

StreetSense LED Street Light - UL

Ordering Information & Accessories

Part Number	Number of Light Engines	EPA (SQ. ft)	Lens	CCT	Fixture Lumens	Wattage	LPW	Optical Pattern
Standard Models - 100-277 VAC								
SL3C5SLGG	3	1.13	Tempered glass	5000K (cool wr1ite)	23,400	228	103	Type III
SL3C5RLGG	3	1.13	Tempered glass	5000K (cool white)	18,700	182	103	Type III
SL3C5ILGG	2	0.87	Tempered glass	5000K (cool white)	15,600	156	100	Type III
SL3C5HLGG	2	0.87	Tempered glass	5000K (cool wriite)	12,500	125	100	Type III
SL3C5DLGG		0.60	Tempered glass	5000K (cool wr1ite)	7,800	78	100	Type III
SL3C5CLGG		0.60	Tempered glass	5000K (cool white)	6,400	62	103	Type III
Standard Models - 347-480 VAC								
SL3C7SLGG	3	1.13	Tempered glass	5000K (cool wr1ite)	22,000	218	101	Type III
SL3C7RLGG	3	1.13	Tempered glass	5000K (cool white)	18,900	180	105	Type III
SL3C7ILGG	2	0.87	Tempered glass	5000K (cool white)	15,700	154	102	Type III
SL3C7HLGG	2	0.87	Tempered glass	5000K (cool wriite)	12,500	121	103	Type III
SL3C7DLGG		0.6	Tempered glass	5000K (cool wr1ite)	7,800	77	102	Type III
SL3C7CLGG		0.6	Tempered glass	5000K (cool white)	6,400	61	106	Type III

All valu8s typical unbss othccrwise stated Lumen valu8S are typical (tolerance +,- 10%).
Part numbers listed in the above table are cool white. For n8utral white mod81, replace the 4th character with **N** Ex: SL3**Q**5CLGG becomes SL3**N**5CLGG

SLSHIELDKIT

- House side sr1ield

SL-PCOIR

- 105 - 305V AC Pr1otocoritroller

SL-PC02R

- 312 - 382V AC Pr1otocontroller

SL-PC03R

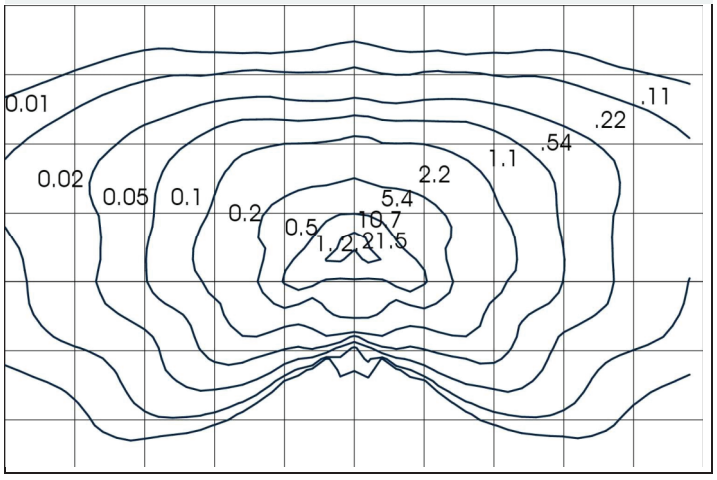
- 432 - 528V AC Pr1otocontroller

StreetSense LED Street Light - UL

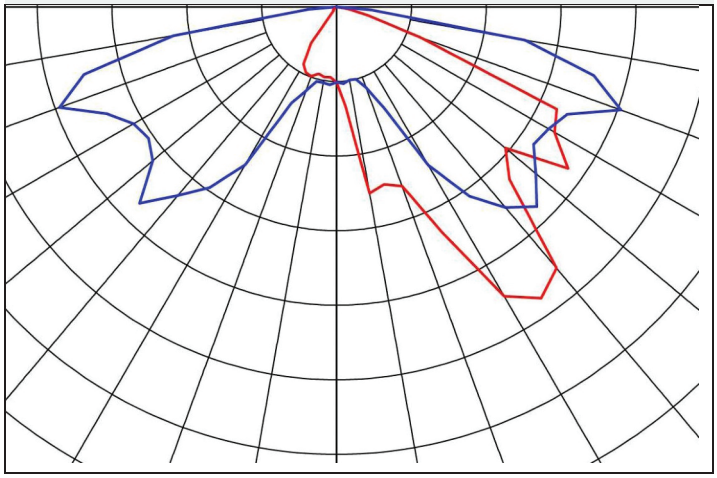
Light Distribution and Measurement Data - IES Type III

65 Watt

Iso-Illurninance Chart



Intensity Distribution Curve (cd)



M)unting hdgl1t - 25' (7.6m)

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Ex: 40' (12.2ml m,_unting l1eigl1t = eacl1 t,_,x is 40' (12.2m), 30' (9.1m) mwnting l18igl1t = ead1 t,_,x is 30' (9.1m)

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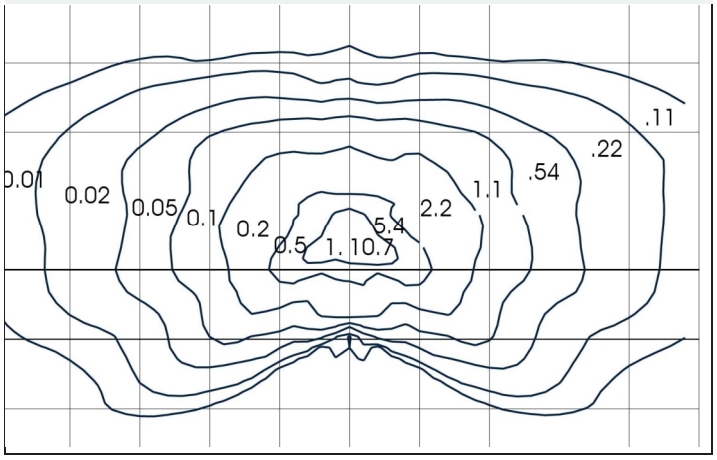
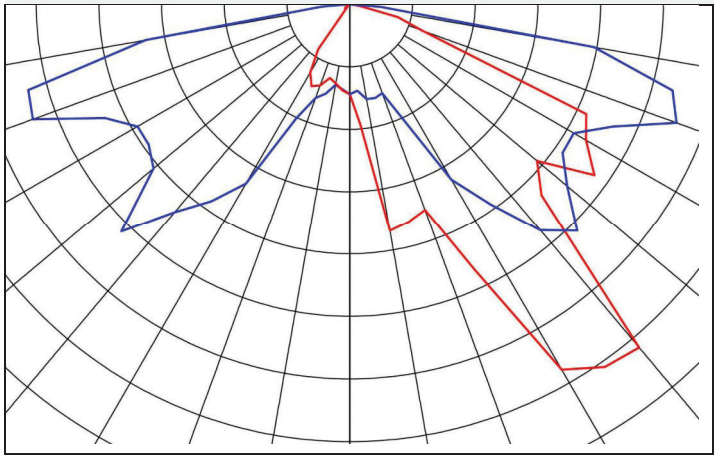
Mounting Heigr1t	10' (3.0m)	15' (4.6rn)	20' (6.1rn)	25' (7.6m)	30' (9.1m)	35' (10.7m)	40' (12.7m)	45' (13.4rn)	50' (15.2rn)
Multiplier	6.25	2.778	1.563		0.694	0.51	0.391	0.309	0.25

83 Watt

Iso-Illurninance Chart



Intensity Distribution Curve (cd)



Mc,unting height - 25' (7.6m)

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Spa:ing -,f Ba(:\l t \x is equal tri nY1unting height in feet (msters).

Ex: 40' (12.2m) m.-,unting h8igl1t = 8a::h t,-,x is 40' (12.2ml, -30' (Sl.1m) m,-,unting hBight = ooch t,-,x is 30' (Sl.1m)

Valu8S slirwn are fr·r OY1l whit8 anii neutral wl1ite units, fr·r warm whit,:: multir1ly the Fe: rir Lux valu8 tiy .82

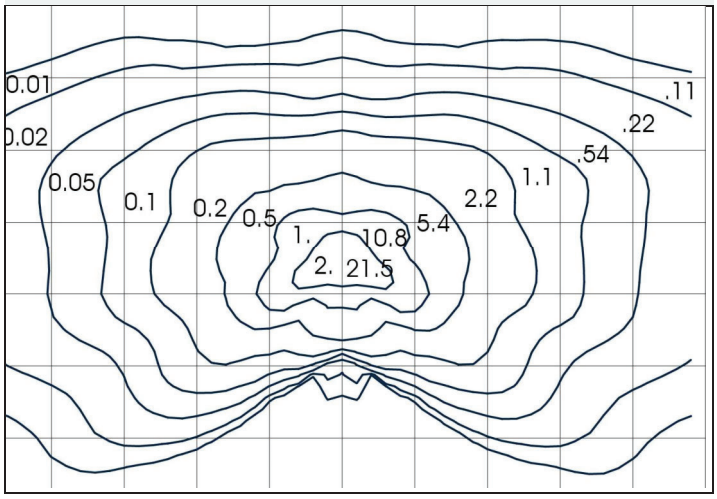
Mounting Heigr1t	10' (3.0m)	15' (4.6m)	20' (6.1m)	25' (7.6m)	30' (9.1m)	35' (10.7m)	40' (12.7m)	45' (13.4m)	50' (15.2m)
Multiplier	6.25	2.778	1.563		0.694	0.51	0.391	0.309	0.25

StreetSense LED Street Light - UL

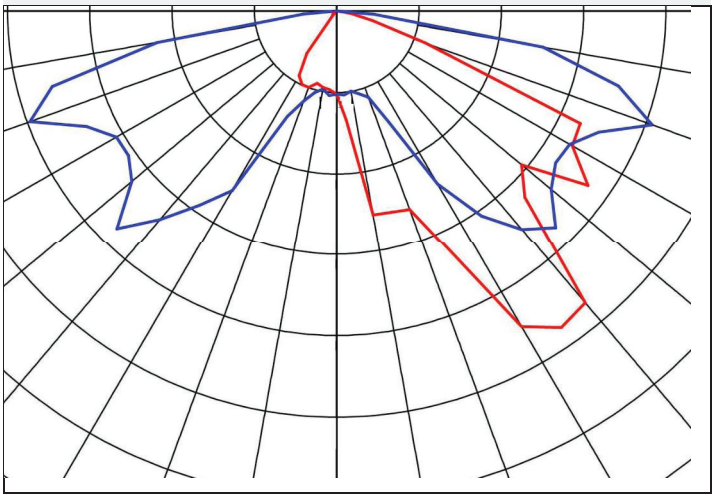
Light Distribution and Measurement Data - IES Type III

131 Watt

Iso-Illurninance Chart



Intensity Distribution Curve (cd)



Mounting heis1ht - 25' (7.6m)

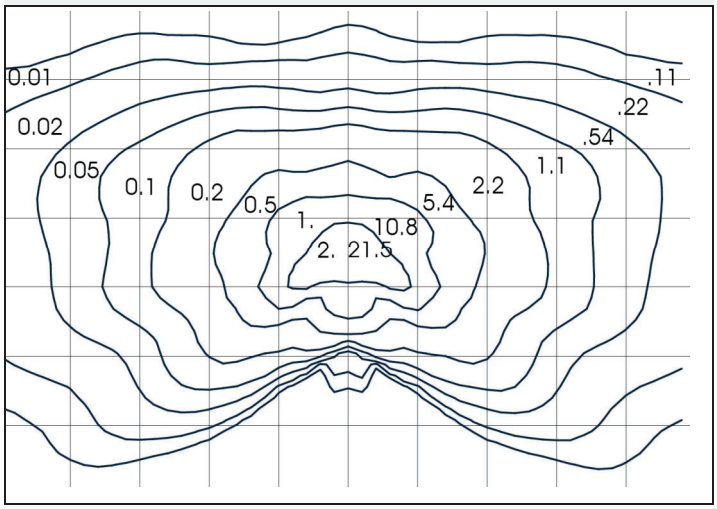
- Lu::ati,Jn (r streetlight

Spa:::ing of ea,.::;h box is equal to mountin(::.Jheight in feet (meters).
Ex: 40' (12.2ml mcrnting height= ea,ch bc,x is 40' (12.2m), 30' (9.1m) mc,unting height= each bc,x is 30' (9.1m)
Values sh,_wn are tir cool white and neutral white units, for warm vvhitg multii::.ly the Fe ,Jr Lux value by .82

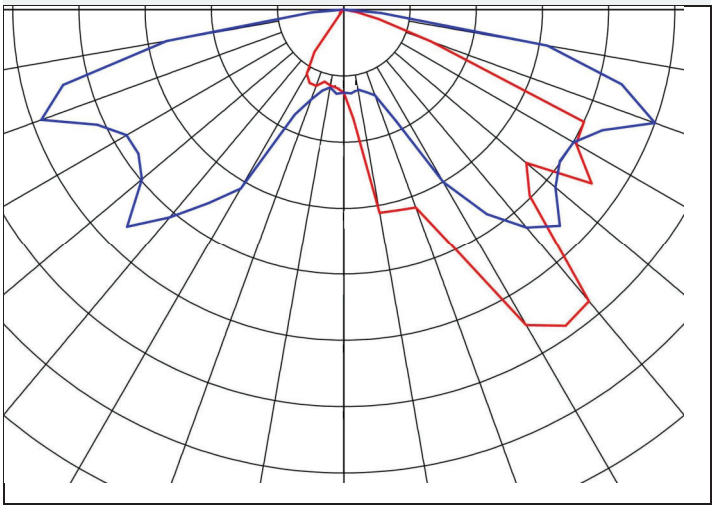
Mounting Heigr1t	10' (3.0m)	15' (4.6m)	20' (6.1m)	25' (7.6m)	30' (9.1m)	35' (10.7m)	40' (12.7m)	45' (13.4m)	50' (15.2m)
Multiplier	6.25	2.778	1.563		0.694	0.51	0.391	0.309	0.25

165 Watt

Iso-Illurninance Chart



Intensity Distribution Curve (cd)



M:rnting height - 25' (7.6ml

- Lo::ati,-in of strootlight

Spai::ing uf ear::h bc,x is equal tn mnunting height in f88t (msters).
Ex 40' (12.2m) m.-,unting heigl1t = ea,:11l:,nx is 40' (12.2m), 30' (9.1m) muunting heigl1t = each t,-,x is 30' (9.1m)
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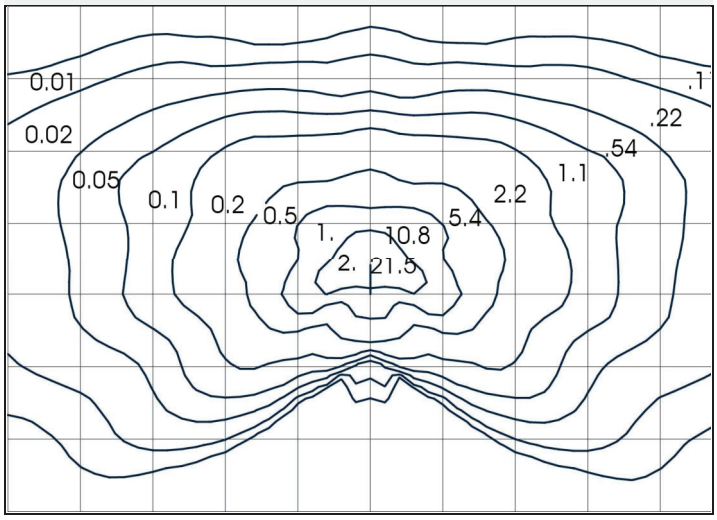
Mounting Heigr1t	10' (3.0m)	15' (4.6m)	20' (6.1rn)	25' (7.6rn)	30' (9.1m)	35' (10.7rn)	40' (12.7rn)	45' (13.4m)	50' (15.2m)
Multiplier	6.25	2.778	1.563		0.694	0.51	0.391	0.309	0.25

StreetSense LED Street Light - UL

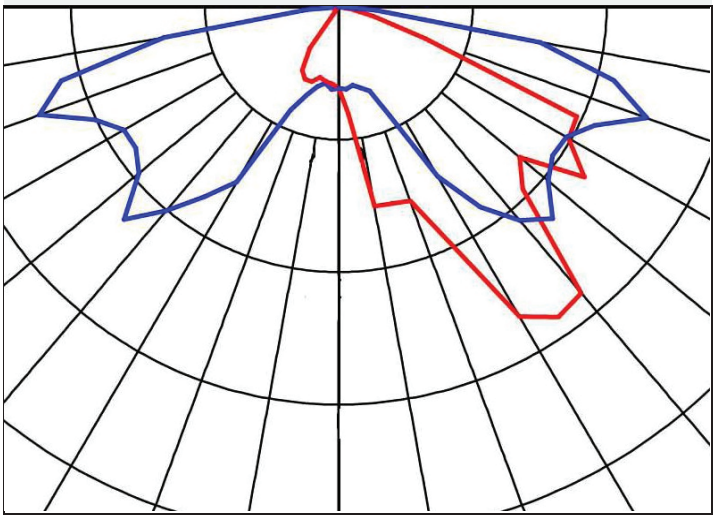
Light Distribution and Measurement Data - IES Type III

65 Watt

Iso-Illurninance Cr1art



Intensity Distribution Curve (cd)



Mcrntinsl height - 25' (7,6ml

- Location (r slr'3'3llight

Spac:ing of ea,:::;h b,:ix is equal ti:, mounting height in feet (meters).

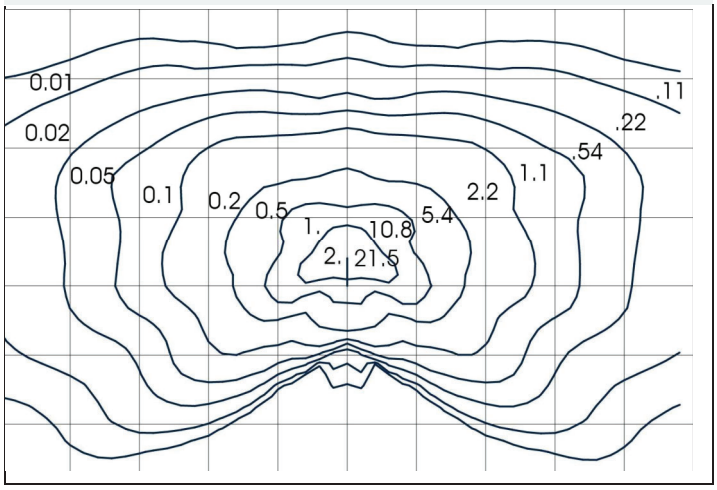
Ex: 40' (12,2ml mcrnting height= **ea,11** t,c,x is 40' (12,2m), 30' (9,**1m**) mc,unting height= ea,ch tox is 30' (9,1m)

Values shewn are for c:oj white anj rfflutral white units, for warm white multiply the Fe or Lux value by .82

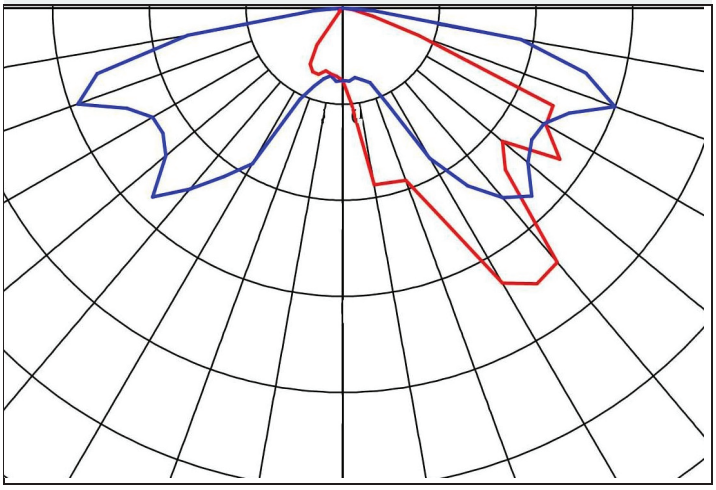
Mounting Heigr1t	10' (3,0m)	15' (4,6m)	20' (6,1m)	25' (7,6m)	30' (9.1m)	35' (10.7m)	40' (12.7m)	45' (13.4m)	50' (15.2m)
Multiplier	6,25	2,778	1,563		0.694	0.51	0.391	0.309	0.25

83 Watt

Iso-Illurninance Chart



Intensity Distribution Curve (cd)



M,_,uming l1digl1t - 25' (7.6ml

- Lo:::;ation of streetlight

SpB1.::ing of ea,:::;h t,ox is equal to mounting height in fegt (meters).

Ex: 40' (12.2ml m,:,unting height= eash to is 40' (12.2m), 30' (9.**1m**) m,:,un\ing height= eash t,:,x is 30' (9.1m)

Values shiJwn are for ecol white ancl neutral white units, f(,r warm white multiply the Fe or Lux value t,y .82

Mounting Heigr1t	10' (3.0m)	15' (4.6m)	20' (6.1m)	25' (7.6m)	30' (9.1m)	35' (10.7m)	40' (12.7m)	45' (13.4m)	50' (15.2m)
Multiplier	6.25	2.778	1.563		0.694	0.51	0.391	0.309	0.25

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Appendix B

2006 PERMIT APPLICATION TO SHPO

NPS Form 10-900

OMB No. 10024-0018

508

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determination for individual properties and districts. See instruction in *How to Complete the National Register of Historic Places Registration Form* (National Register Bulletin 16A). Complete each item by marking "x" in the appropriate box or by entering the information requested. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, architectural classification, materials and areas of significance, enter only categories and subcategories from the instructions. Place additional entries and narrative items on continuation sheets (NPS Form 10-900a). Use a typewriter, word processor, or computer, to complete all items.

1. Name of Property

historic name Lake Overholser Dam

other names/site number

2. Location

street & number NW 16th Street and East Lake Overholser Drive [N/A] not for publication

city or town Oklahoma City [N/A] vicinity

state Oklahoma code OK county Oklahoma code 109 zip code 73127

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act, as amended, I hereby certify that this ☒ nomination ☐ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property ☒ meets ☐ does not meet the National Register criteria. I recommend that this property be considered significant ☐ nationally ☐ statewide ☒ locally. (☐ See continuation sheet for additional comments.)

Signature of certifying official/Title — State Historic Preservation Officer — Date April 24, 2007

Oklahoma Historical Society
State or Federal agency and bureau

In my opinion, the property ☐ meets ☐ does not meet the National Register criteria.
(☐ See continuation sheet for additional comments.)

Signature of certifying official/Title — Date

State or Federal agency and bureau

4. National Park Service Certification

I hereby certify that the property is:

☑ entered in the National Register
☐ See continuation sheet.
☐ determined eligible for the National Register
☐ See continuation sheet.
☐ determined not eligible for the National Register.
☐ removed from the National Register
☐ See continuation sheet.
☐ other, explain
☐ See continuation sheet.

Signature of the Keeper — Date of Action

Edson H. Beall 6.5.07

5. Classification

Ownership of Property
(Check as many boxes as apply)

[ ] private
[X] public-local
[ ] public-State
[ ] public-Federal

Category of Property
(Check only one box)

[ ] building(s)
[ ] district
[ ] site
[X] structure
[ ] object

Number of Resources within Property
(Do not count previously listed resources.)

Contributing	Noncontributing	
0	0	buildings
0	0	sites
1	0	structures
0	0	objects
1	0	Total

Name of related multiple property listing.
(Enter "N/A" if property is not part of a multiple property listing.)

N/A

Number of contributing resources previously listed in the National Register.

0

6. Function or Use

Historic Function
(Enter categories from instructions)

INDUSTRY/PROCESSING/EXTRACTION:
Waterworks

Current Functions
(Enter categories from instructions)

INDUSTRY/PROCESSING/EXTRACTION:
Waterworks

7. Description

Architectural Classification
(Enter categories from instructions)

OTHER: Concrete Buttress Dam

Materials
(Enter categories from instructions)

foundation CONCRETE
walls CONCRETE
BRICK
roof CERAMIC TILE
other

Narrative Description
(Describe the historic and current condition of the property on one or more continuation sheets.)

8. Statement of Significance

Applicable National Register Criteria
(Mark "x" in one or more boxes for the criteria qualifying the property for National Register listing.)

[X] **A** Property is associated with events that have made a significant contribution to the broad patterns of our history.

[ ] **B** Property is associated with the lives of persons significant in our past.

[ ] **C** Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.

[ ] **D** Property has yielded, or is likely to yield, information important in prehistory or history.

Criteria Considerations
(Mark "x" in all the boxes that apply.)

Property is:

[ ] **A** owned by a religious institution or used for religious purposes.

[ ] **B** removed from its original location.

[ ] **C** a birthplace or grave.

[ ] **D** a cemetery.

[ ] **E** a reconstructed building, object, or structure.

[ ] **F** a commemorative property.

[ ] **G** less than 50 years of age or achieved significance within the past 50 years.

Narrative Statement of Significance
(Explain the significance of the property on one or more continuation sheets.)

Areas of Significance
(Enter categories from instructions)

Community Development and Planning

Periods of Significance
1916-1947

Significant Dates
1918
1922

Significant Person(s)
(Complete if Criterion B is marked above).
N/A

Cultural Affiliation
N/A

Architect/Builder
Ambursen Construction Company, designer
Ambursen Construction Company, builder

9. Major Bibliographical References

Bibliography
(Cite the books, articles and other sources used in preparing this form on one or more continuation sheets.)

Previous documentation on file (NPS):

☐ preliminary determination of individual listing (36 CFR 67) has been requested
☐ previously listed in the National Register
☐ previously determined eligible by the National Register
☐ designated a National Historic Landmark
☐ recorded by Historic American Buildings Survey

#_____

☐ recorded by Historic American Engineering Record

#_____

Primary location of additional data:

☒ State Historic Preservation Office
☐ Other State Agency
☐ Federal Agency
☐ Local Government
☐ University
☐ Other

Name of repository:
Oklahoma Historical Society/SHPO

Lake Overholser Dam
Name of Property

Oklahoma County, Oklahoma
County/State

10. Geographical Data

Acreage of Property 5

UTM References
(Place additional UTM references on a continuation sheet.)

1.	14	620730	3927540
	Zone	Easting	Northing
2.	14	621100	3927560
	Zone	Easting	Northing
3.	Zone	Easting	Northing
4.	Zone	Easting	Northing

[ ] See continuation sheet

Verbal Boundary Description
(Describe the boundaries of the property on a continuation sheet.)

Boundary Justification
(Explain why the boundaries were selected on a continuation sheet.)

11. Form Prepared By

name/title Leslie Dixon, student (edited by Jim Gabbert, architectural historian, OK/SHPO)
organization University of Central Oklahoma date 12/2006
street & number 100 N University Drive telephone
city or town Edmond state OK zip code 73034

Additional Documentation

Submit the following items with the completed form:

Continuation Sheets

Maps
A **USGS map** (7.5 or 15 minute series) indicating the property's location.
A **Sketch map** for historic districts and properties having large acreage or numerous resources.

Photographs
Representative **black and white photographs** of the property.

Additional Items
(Check with the SHPO or FPO for any additional items)

Property Owner

(Complete this item at the request of SHPO or FPO.)

name City of Oklahoma City (James D. Couch, City Manager)
street & number 200 North Walker Ave. telephone (405) 297-2345
city or town Oklahoma City state OK zip code 73102

DESCRIPTION

Lake Overholser Dam is a reinforced concrete dam across the North Canadian River that impounds a lake of 700+ acres and a bypass channel that once served as the primary water supply for the City of Oklahoma City. The dam was completed in 1918. It is located on the west side of Oklahoma City; Lake Overholser straddles the Oklahoma and Canadian county lines. The dam stretches east/west across the river channel. Its immediate environs are a city park, with manicured lawns, parking areas and a driveway.

The dam is approximately 1,650 feet long and 68 feet high, constructed of reinforced, poured concrete. A brick and tile pump house is located at the east end atop an arched, buttressed spillway, over the bypass channel. The balance of the dam stretches westward. There are four distinct sections of buttresses spillways and a large, solid spillway. A concrete walkway carried by the buttresses covers the entire length of the dam, except at the large spillway. There, due to the lack of buttresses, the walkway is carried by a Pratt through truss.

The east end of the dam is anchored into the bank by a large, concrete wing wall. Two sets of stairs give access to an upper and a lower walkway. The support for the upper stairs has a bronze plaque denoting the various officials and engineers involved in the project. The first span of the dam is wide, between the wing wall and the pump house. The lower walkway is carried from shore to the first buttress, which also marks the first of a series of arched spillway gates and that support the pump house. The walkway carries on to the rest of the dam. The upper walkway, reached by a set of iron stairs, leads to and just beyond the pump house, where a second set of stairs returns to the lower walkway level. This first section is located at the bypass channel. The pump house is situated atop a series of four arched sluiceway openings. It has a side-gabled, tile roof with a small brick chimney on the west end and two round ventilators equidistant on the ridge. The walls are brick; each side elevation has four windows bays with large, steel sash industrial windows. There are 36 rectangular panes, in a 6x6 configuration, in each window. The east and west gable ends each have two windows. The north elevation's west-most window is truncated and a pair of steel slab door allows entrance to the building. On the east wall of the first arched buttress is a bronze plaque that identifies the Ambursen Construction Company as the builder and lists patent numbers for designs used in the dam. Just below the bronze plaque is the cornerstone denoting the day of dedication, April 22, 1918, and acknowledging the Grand Lodge of Masons.

Just west of the pump house section is a solid wall section, consisting of a five-part, open box system with a solid headwall. Beyond that is the first section of gated spillways. There are seven gates, each set between sloping buttresses, and each having a convex slopewall that terminates approximately halfway down to normal river level. Each slopewall is supported by a small buttress centered between the main buttresses. Pinned and riveted steel frames anchor the gates.

To the west of this section is another open box wall, this time with three sections. Four more gated spillways are west of this. The large, ungated spillway is next. This section has a spillway slopewall that extends from the top of the dam all the way to the bottom. The height of the wall equals the height of the gates; it relieves pressure on the dam when flooding is not serious, but still high enough to breach the dam. A Pratt through truss bridge spans the spillway, carrying the walkway. Beyond this spillway

are four more standard gated spillways. Just beyond these is the last section of dam, altered in 1924. Here, eight more gated spillways were added. These differ from the original in that the slopewall extends to the bottom of the dam.

The top of the dam is spanned by a walkway. In the late 1990s, the walkway was "upgraded." Historic photographs show pipe rail and lantern-type streetlamps on the south edge of the walkway. In the 1920s and later in the 1930s, when the city raised and reconfigured the dam in response to floods, the form and location of the walkway changed. The 1990s work was meant to bring the dam back into its earliest design intent. New, tubular steel balustrades were added for safety concerns. A series of "period" street lamps was added to the north edge of the walkway. These are black-painted steel posts, while the original 1918 were concrete posts.

At one time, there was a small building located in the middle of the dam that housed equipment to power the gate machinery. This building, identical in style to the existing pump/machinery building, was removed when the dam was raised in the 1930s. The original gate-lifting machinery is exposed along the walkway. Geared iron wheels connected by long axles are located over each floodgate.

The dam reflects its period of significance. It was completed in 1918, but changes over the years were necessary. Twice the dam was raised, first in 1922 and then again in 1934. Other changes were made to the spillways and gates. But the dam as it is today looks much the same as it did in the late 1940s, when Lake Hefner came online and diminished the importance of Lake Overholser as the city's main water supply.

SIGNIFICANCE

The Lake Overholser Dam is eligible for the National Register of Historic Places under Criterion A for its role in community development and planning for the City of Oklahoma City. The explosive growth of the city after its founding in 1889 necessitated a reliable and safe source of potable water. Relying for years on the North Canadian River, city leaders sought a more dependable source of water, one that would carry it through the drier summer months. In addition, city leaders sought to alleviate the damage inflicted by the oft-flooding, shallow river.

In 1918, the city of Oklahoma City, led by Mayor Edward Overholser, completed a reinforced concrete gravity dam across the North Canadian River. The purpose of dam and the lake behind it was to serve as a supply of water for the growing city as well as flood control for the city and surrounding areas. It was one of the city's largest public works projects. Soon after the dam's completion, the lake created was named Lake Overholser in honor of the mayor who championed it. The lake served as the primary water supply for the city until 1947.

The dam constructed across the North Canadian River is classified as a concrete buttress dam.[1] This type of dam is rare in a state where earthen or earthen & gravity dams predominate. It is also the earliest large dam constructed in the state that retains its historic design.

Background and Significance

Oklahoma City came into being with the opening of the Unassigned Lands in 1889. The story is well known, of folks on horseback, on mules, on foot, racing across the bare prairie to stake claims on quarter sections of land, or of jumping off rail lines at already-platted town sites to claim favorable town lots. Oklahoma sprang up as a tent city overnight; eventually the tents gave way to rude cabins, prefabricated buildings, and eventually substantial buildings. The new city – a city with a population of over 10,000 within the first week – had for its main water source the North Canadian River. The river, tenuously contained in low banks, was prone to alternatives of flood and drought. Floodwaters swept the low valley; as waters receded, the course of the river often changed. In between floods, the climate of the central plains often robbed the river of nourishing water, leaving a wide channel of sand broken by bare braids of water. The river was always thought of as the primary source for water, but since its inception, the city looked toward ways to improve its reliability.

By 1894, a brick pumping station had been constructed on the North Canadian River just west of South Walker Avenue, approximately a mile from downtown. A fourteen-inch main piped the treated river water into the city. Wells supplemented the river water; many of these were private, serving only the owner or his clients. The city looked to other places, other methods of obtaining water. Schemes for pumping water from the Arbuckle Mountains and the great aquifer there were proposed, as were plans for a similar pipeline from Woodward. These were all rejects due to costs. The North Canadian always came out as the most feasible water source.[2]

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[1] Mermel, T. W., ed., Register of Dams in the United States, New York: McGraw Hill Book Company, 1958. Page 150.
[2] "New Water Plan" *The Daily Oklahoman*, 21 December 1910.

In 1906, the city began construction of a modern waterworks plant located on the north bank of the North Canadian River, near present-day NW 4th Street and Pennsylvania Avenue. At that time, the river flowed up to that point (later, through improvements to the waterworks plant, the river's course would be cut off south of Reno Avenue, 7 blocks to the south). A year's worth of construction saw the establishment of a modern, sanitary system, drawing water directly from the river, supplemented by a low dam that helped create a ready water supply. The plant drew water from the river using three motor driven pumps and passed it through various stages of filtration and sterilization until it was forced into the main by a pump with a capacity of 10,000,000 gallons every day. The pumps, at the level of the riverbank, would in take the water and force it through a solution of sulfate of iron, and hydrate lime into settling basins. Here, much of the dirt and other suspended materials were removed from the water. From the settling basin, the water was pumped into the filter beds. After having passed through the filter bed, the water was then pumped through the last stage of sterilization, where it was treated with chlorine, and then pumped into two covered wells from which it was taken up by the large pumps that forced the water into the city mains.[3] The original small dam in the river soon proved to be inadequately designed; after a series of small breeches, a new dam was commissioned by the city in 1911. The dam would create a volume of water from the North Canadian River great enough to supply the city, or so the city commissioners thought.[4]

In 1913, engineers Hiram Phillips of St. Louis, J. W. Alford of Chicago, and J. W. Billingaly of Houston, investigated a water supply for Oklahoma City. They recommended to the Oklahoma City Commission eight alternatives for increasing the water supply for the city. The most feasible involved the securing of water from the North Canadian River near El Reno, Oklahoma. By securing the water with gravity canal and storing in a reservoir, water would be diverted from the North Canadian River sufficiently above El Reno without contamination from sewage. At that point, silt-settling basins would be constructed to remove all sand and heavy silt. The canal would convey the water twenty-seven miles to a location three miles west of the waterworks plant to the reservoir. The reservoir would cover 688 acres. It would involve the construction of a dam, which would be sixty feet high and 240 feet long. The impounded water could then be diverted through an aqueduct to the waterworks plant. Pumps would not be needed due to the elevation change. The reservoir would have the capacity of 10,200 acre-feet with an average depth of eighteen feet. The engineers estimated the total cost of such project for Oklahoma City would be $1,525,500. This was not the only recommendation, there were eight others; however, all of the other seven were million dollar projects.[5] However, the project was shelved due to a lack of funding and was not promoted again until Mayor Edward Overholser championed it in 1916.

Between 1911 and 1915, city administrators had to fight a battle with the water situation, only to be beat by taxpayers' objections to every dam proposition. Everybody acknowledged that Oklahoma City needed a big town water supply before it could become a metropolis or even before it could aspire to a population of 200,000 but their admissions and conversation did not express their tax receipts. On April

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[3] "City Water Works Place of Interest to Visitors." *The Daily Oklahoman.* July 19, 1914.
[4] " Substantial Dam to be Erected: City Commissioners Definitely Decide on Immediate Action." *The Daily Oklahoman.* July 06, 1911, p.5.
[5] "Reservoir Water System Proposed: Engineers Recommend Securing City Supply From Canadian River Point near El Reno." *The Daily Oklahoman.* February 20, 1913, 5.

18, 1916, an article in *The Daily Oklahoman* stated that Mayor of Oklahoma City, Ed Overholser, made a strong plea for a proposed $1,500,000-bond issue at the Electric Lunch League in the Lee-Huckins Hotel. He stated, "Now we have come to the point where we must have an adequate water supply and settle for all time the water problem which has faced Oklahoma City for several years. If this proposed bond issues carries, gentlemen, 25,000 people will be added to Oklahoma City within two years. If the plans we have under consideration now are carried out, graft in connection with the erection of the waterworks will be impossible, so far as we are able to prevent it. The taxpayers of the city would receive 100 cents for every dollar they spent."[6] On May 20, 1916, the city passed a $1,500,000 bond for the building of the reservoir and dam.[7] The city would use the dam as a water supply, for flood control, and the water could be utilized for irrigation purposes.[8]

The contracts were to construct two important sections of the city's new watering system. The two sections were the dam and a smaller spillway dam, known as the emergency dam. The new dam site was on the river approximately seven and half miles west of the city center. The spillway dam constructed about 10,000 feet above the main dam.[9] The spillway dam functions to slow the speed of the stream and to enhance the effectiveness of the settling ponds above the reservoir. The contract was let to the Ambursen Construction Company of New York.[10]

Unfortunately, there was a dispute over the dam and reservoir contracts. Taxpayers sued the board of commissioners. The injunction would hold back the board of commissioners from contracting with the Ambursen Construction Company for building of the main and subsidiary dams of the waterworks system. Frank Swanda, W.H. Butcher, and P.L. Stillwater brought the suit as taxpayers. They based the suit on a claim that the commissioners were trying to deceive the taxpayers by permitting the contract to the Ambursen Company for $509,800, while a contractor of the name J.A. Holmboe bid $476,000. H.A. Pressey, consulting engineer, Guy McClure, city engineer, and S.W. Stewart, representative of the Ambursen Company, all testified in court that the Ambursen Company reported to the city engineers several times before the conclusion of the plans for the reinforced concrete dam. The Ambursen Construction Company held the patent of that kind of construction, and it would require a royalty if another concern did the work.[11] The lawsuit was dismissed and construction began in 1917.

In designing and bidding on the dam project, Ambursen Construction Company considered every possible type, such as solid masonry, reinforced concrete, earth-fill, rock-fill, and wood. The solid masonry dam and the rock-fill dam were precluded because of scarcity of rock. They would have to ship all materials on trains. The expense would have been enormous. An earth-fill dam was designed for the dam, but was deemed not practical, on account of the wartime congestion of freight and scarcity of cars. Therefore, the engineers decided on reinforced concrete dam.[12]

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[6] "City Need Plan, Cries Mayor." *The Daily Oklahoman*. April 18, 1916, 9.
[7] Bob L. Blackburn. Heart of the Promised Land: Oklahoma County. California: Windsor Publication, 1982, 106.
[8] "Water From Oklahoma City's New Municipal Reservoir May be Used by Truck Growers for Irrigation Purposes." *The Daily Oklahoman*. September 22, 1918, p.
[9] "Reservoir Dam Contract Let to Eastern Concern." *The Daily Oklahoman*. December 8, 1916, 1
[10] Ibid, 9.
[11] "Suit Enjoins Contract on Dam." *The Daily Oklahoman*. December 12, 1916, 5.
[12] "Gigantic Problems Met and Solved in Construction of City's Reservoir by Corps of Highly Skilled

The first order of business for the Ambursen Construction Company was to construct cofferdams, which would divert the flow of the river during the period of construction. Excavation to bedrock was begun in the bed of the river; the stream was diverted through a temporary opening left in the construction. The contractor used local materials whenever possible. At a quarry east of town, the rocks for the concrete were crushed and the gravel was transported to the site on a spur constructed by the Rock Island railroad. A battery of concrete mixers converted the sand, stone, and cement into plastic concrete. In addition, wire rope cableways were extended across the river at the site from bank to bank and would be used to carry materials to different parts of the construction. The cableways were supplemented by derricks and hoisting engines.[13]

The dam's dimensions were 1,100 feet long and fifty-four feet high (it was raised early in the 1920s by four feet). The weight of the dam and pressure of the water are carried on a series of reinforced concrete supports, spaced at eighteen-foot centers and about fifty feet high. The sloping, up-stream end of these supports are built to reinforce the deck, or face of the dam, which extends from support to support and from a point well within the shale of the foundation to the top of the dam. The deck prevents the water passing through or under the dam. At the dam site, the valley was filled with silt and sand deposited in former times by the river. In order to provide a firm foundation and prevent percolation under the dam, the contractor excavated through material to a firm foundation into the shale. The concrete support walls were carried into the shale so that there could be no chance of settlement or slipping of the dam and the toe wall was carried into the shale to prevent any seepage under the dam.[14]

The dam is really two dams – one that impounds the reservoir and one that regulates the flow of the bypass channel. The bypass channel is located on the east edge of the reservoir; water flow into the channel and the reservoir is regulated first well upstream where the initial divide takes place between the river and the bypass, and then at the head of the reservoir, just north of 39th Street, where the diverting dam is located. The main dam structure (the nominated property) regulates the flow of water out of both the bypass and the reservoir. The water from the river would be diverted from its natural channel and from the reservoir. By diverting dam two miles above the main dam and the crossing of the El Reno interurban railway into the bypass, which had been built of such capacity and slope that it will carry the flow of the river at proper velocity both at the time of minimum flow and of the greatest flood. The bypass conducts the water two mile south, by the main lower dam and back into the old river channel below reservoir. No water form the river would reach the reservoir except through the gates, there were electrically operated and controlled by the city authorities. The reservoir two miles long and two miles wide at its widest point, and has a capacity of 7,000,000,000 gallons and is formed by the main dam, constructed at the narrowest point of the river valley and storing the water to be used as required by the city.[15]

Near the western end of the dam, a spillway was provided to carry excessive floodwater that might reach the dam via the reservoir. At the foot of the dam are gates used to empty the reservoir. Gates and

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Engineers." *The Daily Oklahoman.* April 21, 1918, 2.

[13] "Process of Going at the Building of Reservoir Dam Is Outlined by Contractors." *The Daily Oklahoman.* December 8, 1916, 11.

[14] "Gigantic Problems met and Solved in Construction of City's Reservoir by Corps of Highly Skilled Engineers." *The Daily Oklahoman*, April 21, 1918, 2.

[15] "Fish Ladder for City Dam." *The Daily Oklahoman.* April 21, 1918, 4.

spillways are provided at the lower end of the bypass directly through the dam. The diverting dam forms a sedimentation basin of a capacity of 3,500,000 gallons, which serves for preliminary sedimentation of the river water, preventing precipitation in the bypass. Manipulation of the gates at the lower end of the bypass controls stream flow, keeping the bypass free from sediment.[16]

The water that is conducted to the city is drawn into intake wells through any of three gates located at different elevations, giving access to the best quality of water, depending on conditions. The quality of water varies at different times of the year, depending upon the atmospheric temperature and the gates that would allow the city to take advantage of the varying conditions. From the intake well, the water would flow by gravity to the city through a forty-two-inch reinforced concrete conduit having a capacity of 20,900,000 gallons per day. Upon the arrival at the city, the water would be processed and purified at the city's waterworks plant.[17]

On April 23, 1918, the celebration marking the official opening of the dam was held. The Grand Lodge of Oklahoma performed the ceremonial laying the cornerstone. Speeches by dignitaries marked the day, in particular Mayor Edward Overholser remarked: "I am proud to be in any way connected with the celebration of the dedication of this gigantic project, which represents the solving of the water problem of this city for all time."[18] The day's events culminated in a marriage between Harry C. Hilton and Lois Noffsinger.[19]

The next day, the *Daily Oklahoman* expressed their tribute to Mayor Overholser. The editorial discussed the various suggestions for the new lake's name. One suggestion thought it fitting to use a name of Indian derivation; Mayor Overholser suggested that the city should honor the first Oklahoma City boy who fell in France by giving his name to the lake. In discussing the events of the dedication ceremony, the editors stated: "(It was) ... we believe, a deserved tribute to Mayor Overholser's work in connection with the waterworks dam. The services to the city of Mayor Overholser's father, Henry Overholser, were gratefully remembered, and suggestions were made that it would be an act of fine appearance on the city's part to name the waterworks lake 'Lake Overholser'."[20] And so, the new lake was named to honor the two men, father and son, who as citizens and mayors of the city, shepherded it into unprecedented growth.

Recreation was a by-product of the actual purpose of the construction of the lake. In 1917, Lakeside Country Club presented a petition requesting the city commissioners allow their members to fish, boat, hunt, and have bathing privilege in the lake. Mayor Overholser and many members of the commission called it scandalous. They decreed that the water, which was their drinking water, should be kept clean. Therefore, the commission denied the request.[21] It would not be until the 1930s that the city would allow people to fish, boat and swim in the lake. In May of 1930, Lake Overholser hosted the first

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[16] *The Daily Oklahoman*, April 21, 1918.
[17] Ibid.
[18] "About Ten Thousand See Dedication of City's Great Dam," *The Daily Oklahoman*. April 23, 1918, 1.
[19] "Features of Day." *The Daily Oklahoman*. April 23, 1918, 1.
[20] "The Name of the Lake." *The Daily Oklahoman*. April 24, 1918, 6.
[21] "Club Asks For Bathing in Reservoir." *The Daily Oklahoman*. April 27, 1917, 9.

Outboard races.[22] In addition, in 1930, an article in the *Daily Oklahoman* promoted picnicking at the lake. Throughout the 1930s and 1950s, Lake Overholser was host to many boat races, both motor and sail. Birdwatchers flock to the lake for its wide variety of avian occupants.

Lake Overholser was a boon to growth in the city, but it was not the 'the solving of the water problem of this city for all time.' True, it provided a ready source of water, but the 1920s saw the discovery of the Oklahoma City Oil Field and explosive growth. The new reservoir, thought sufficient for all future growth proved inadequate on many levels. First, the construction of the dam left a few flaws – the east bank washed out during a heavy rain and flood stage within four years of its construction. In 1922 the east bank was repaired using concrete to better anchor the dam and to prevent the bank from washing away. In the fall of 1923, another large flood caused damage to the bank on the west side to erode. An engineering study demonstrated that an increase in the number of floodgates would have alleviated pressure on the earthen banks. A contract was let to the Callahan Construction Company to rework the west end of the dam, adding more flood control gates, effectively doubling the original number.[23]

Even with improvements to the rollover dam at the north end, the lake was prone to silting; the silting basins upstream could not handle the heavy flow during the rainy season. As such, the lake itself lost capacity each year. The dam also worsened flooding upstream; farmers in the Yukon and El Reno areas continually complained about the loss of their valuable bottomland. By the late 1930s, the problem was acute. City engineers recommended maintenance of the silting basin as part of a $2,750,000 program of water and sewage plant improvements. The desilting process would prevent the silting of the reservoir.[24]

Lake Overholser served as the primary water supply for the City of Oklahoma City for nearly twenty-nine years, until a new reservoir, Lake Hefner, was opened. Planned in the 1930s as a project that would relieve the stress on Lake Overholser, Lake Hefner is a 2580-acre impoundment completed in 1947. The water for Lake Hefner was bought from the North Canadian River and from the Canton Reservoir in Blaine County. It was originally known as the Bluff Creek Water Supply Project.[25] After Lake Hefner, the city also began to draw water from other sources – Lake Stanley Draper, Lake Arcadia, and Lake Atoka. Lake Overholser receded in importance.

Conclusion

The Lake Overholser Dam is eligible for the National Register of Historic Places under Criterion A for its role in community development and planning for the City of Oklahoma City. The explosive growth of the city after its founding in 1889 necessitated a reliable and safe source of potable water. Relying for years on the North Canadian River, city leaders sought a more dependable source of water, one that would carry it through the drier summer months. In addition, city leaders sought to alleviate the damage inflicted by the oft-flooding, shallow river.

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[22] "First Outboard Races at Lake Overholser Today." *The Daily Oklahoman*. May 11, 1930, 50.
[23] "City Dam Contract Goes For $793,675," *The Daily Oklahoman*. March 21, 1924. 10.
[24] "Funds Needed For Dredging to Save the Lake." *The Daily Oklahoman*. November 14, 1937. 32.
[25] Jimmie Pigg, Mark S. Coleman, and Judy Duncan. "An Ecological Investigation of the Ichthyofauna of the North Canadian River in Oklahoma: 1976-1989. *Chronicles of Oklahoma*. June 1992, 21.

In 1918, the city of Oklahoma City, led by Mayor Edward Overholser, completed a reinforced concrete gravity dam across the North Canadian River. The purpose of dam and the lake behind it was to serve as a supply of water for the growing city as well as flood control for the city and surrounding areas. It was one of the city's largest public works projects. Soon after the dam's completion, the lake created was named Lake Overholser in honor of the mayor who championed it. The lake served as the primary water supply for the city until 1947.

As a concrete buttress type dam, the Lake Overholser dam remains the largest, oldest, and most intact buttress type dam in the state. Completed in 1918, it is younger than a buttress dam that impounded Lake Lawtonka in 1911, but that dam was later reconstructed in the 1930s as a masonry gravity dam of considerably different size. The Lake Ardmore dam, constructed in 1924, is the only other buttress type dam listed in the Register of Dams in the United States published in 1958. This dam, based on field survey, does not exist.

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GEOGRAPHICAL DATA

VERBAL BOUNDARY DESCRIPTION

The nominated property includes the dam and spillway. It is located nearly directly on the west half-section line of Section 30, T12N, R4W of the Indian Meridian. The dam and spillway, from bank to bank and extending 50' north and 50' south of the dam is included.

BOUNDARY JUSTIFICATION

This would include the entirety of the dam, its approaches, and the spillways.

PHOTOGRAPH LOG

The following information pertains to photograph numbers 1-8 except as noted:

Photographer: Jim Gabbert
Date of Photographs: 12/20/06
Negatives: .tiff files at NPS and OK/SHPO

Photo No.		Photographic Information
1	LakeOverholser1.tif	View to northwest from east bank
2	LakeOverholser2.tif	View to northwest showing pump house and bypass spillway
3	LakeOverholser3.tif	View to north showing pump house and bypass spillway
4	LakeOverholser4.tif	View to southwest across bypass channel
5	LakeOverholser5.tif	View to west showing walkway, floodgate mechanisms and new light standards
6	LakeOverholser6.tif	View to northeast from west bank
7	LakeOverholser7.tif	View to north showing westernmost section of flood control gates
8	LakeOverholser8.tif	View to southeast showing lake side of dam from west bank

Appendix C

CONSTRUCTION COST ESTIMATES

Preliminary Opinion of Probable Construction Cost

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Project: **WM-0286 Various Improvements to Overholser Dam and Hefner Canal Inlet**

Client: **City of Oklahoma City Water Utilities Trust**
Prepared By: **Thomas Crowley** **Date:** **27-Sep-21**

Base Items - Main Entrance Upgrades, Truck Scale and Plant Road Improvements

Description	Quantity	Unit	Unit Cost	Total
General Conditions:				**$ 210,467**
General Conditions - Project Manager	867	hours	$ 75	$ 65,000
General Conditions - Foreman	1,040	hours	$ 70	$ 72,800
General conditions - Trailers and Consumables	8	Months	$ 3,500	$ 28,000
General Conditions - Electrical Foreman	433	Hours	$ 80	$ 34,667
General Cleanup and Sodding of Trailer Area	1	LS	$ 10,000	$ 10,000
Overholser Gate House Improvements				**$ 428,000**
Potholing/Utility Location	5	EA	$ 1,000	$ 5,000
Utility Relocates/Protection	1	LS	$ 15,000	$ 15,000
Stormwater BMPS	1	LS	$ 10,000	$ 10,000
Chemical trench - Temporary Chem Feed Relocation	1000	LF	$ 15	$ 15,000
Remove Chemical Trench	45	LF	$ 100	$ 4,500
Excavation for Chemical Trench	200	cyud	$ 25	$ 5,000
Chemical Trench CIP Drop Structure	9	Cyd	$ 1,500	$ 13,778
New Chemical trench Section	45	LF	$ 500	$ 22,500
New Chemical Feed Piping	500	LF	$ 10	$ 5,000
Backfill Trench Section	100	cuyd	$ 45	$ 4,500
Pavement Cut & Removal	261	SY	$ 50	$ 13,050
Chain-link Fence Removal	1	LF	$ 10	$ 10
Structure Removal (Drainage Outlet)	1	LS	$ 1,500	$ 1,500
Relocate Light Pole	1	EA	$ 2,500	$ 2,500
Electrical Demolition	1	LS	$ 5,000	$ 5,000
Overholser Bypass Channel Improvements				**$ 690,000**
Pavement Replacement (Asphalt)	1265	SY	$ 100	$ 126,500
Pavement Replacement (Concrete)	66	SY	$ 100	$ 6,600
Curb & Gutter	315	LF	$ 80	$ 25,200
Chain-link Fence	560	LF	$ 20.00	$ 11,200
Vehicle Swing Gate	2	EA	$ 8,000	$ 16,000
Vehicle Lift Gate	2	EA	$ 2,000	$ 4,000
Relocate Existing Guard Shelter	1	LS	$ 25,000	$ 25,000
Drainage Structure Extension	100	LF	$ 2,000	$ 200,000
Drainage Structure End Section	1	EA	$ 10,000	$ 10,000
New Light Pole	2	EA	$ 7,500	$ 15,000
Electrical Improvements	1	LS	$ 50,000	$ 50,000
SCADA/I&C Improvements	1	LS	$ 25,000	$ 25,000
Sodding	11111	3	$ 3	$ 33,333
Hefner Canal Inlet Improvement				**$ 428,000**
Pavement Replacement (Asphalt)	1265	SY	$ 100	$ 126,500
Pavement Replacement (Concrete)	66	SY	$ 100	$ 6,600
Curb & Gutter	315	LF	$ 80	$ 25,200
Chain-link Fence	560	LF	$ 20.00	$ 11,200
Vehicle Swing Gate	2	EA	$ 8,000	$ 16,000
Vehicle Lift Gate	2	EA	$ 2,000	$ 4,000
Relocate Existing Guard Shelter	1	LS	$ 25,000	$ 25,000
Drainage Structure Extension	100	LF	$ 2,000	$ 200,000
Drainage Structure End Section	1	EA	$ 10,000	$ 10,000
New Light Pole	2	EA	$ 7,500	$ 15,000
Electrical Improvements	1	LS	$ 50,000	$ 50,000
SCADA/I&C Improvements	1	LS	$ 25,000	$ 25,000
Sodding	11111	3	$ 3	$ 33,333
Hefner Gate House Improvements				**$ 280,000**
Potholing/Utility Location	5	EA	$ 1,000	$ 5,000
Utility Relocates/Protection	1	LS	$ 15,000	$ 15,000
Stormwater BMPS	1	LS	$ 10,000	$ 10,000
Chemical trench - Temporary Chem Feed Relocation	1000	LF	$ 15	$ 15,000
Remove Chemical Trench	45	LF	$ 100	$ 4,500
Excavation for Chemical Trench	200	cyud	$ 25	$ 5,000
Chemical Trench CIP Drop Structure	9	Cyd	$ 1,500	$ 13,778
New Chemical trench Section	45	LF	$ 500	$ 22,500
New Chemical Feed Piping	500	LF	$ 10	$ 5,000
Backfill Trench Section	100	cuyd	$ 45	$ 4,500
Pavement Cut & Removal	261	SY	$ 50	$ 13,050
Chain-link Fence Removal	1	LF	$ 10	$ 10
Structure Removal (Drainage Outlet)	1	LS	$ 1,500	$ 1,500
Relocate Light Pole	1	EA	$ 2,500	$ 2,500
Electrical Demolition	1	LS	$ 5,000	$ 5,000
Raw Project Costs Subtotal				**$ 2,036,467**
Taxes and Escalation				
County Sales Tax			0.37%	$ 3,737
City Sales Tax			3.65%	$ 37,166
State Sales Tax			4.5%	$ 45,821
Material Escalation			5.0%	$ 101,823
Direct Costs				**$ 2,225,013**
Builders Risk and GL Insurance			*1.25%*	$ 27,800
GC OH&P			15%	$ 337,900
Performance and Payment Bond			1.5%	$ 38,900
Contingency			25.0%	$ 657,400
Total Construction Cost				**$ 3,287,013**
Class 4 Estimate Low Range (-30%)				*$ 2,301,000*
Class 4 Estimate High Range (+50%)				*$ 4,931,000*