STATE OF MICHIGAN
DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY
LANSING

GRETCHEN WHITMER
GOVERNOR

PHILLIP ROOS
DIRECTOR

February 7, 2024

VIA EMAIL

Michael Brahm-Henkel
Huron-Clinton Metropolitan Authority
13000 High Ridge Drive
Brighton, Michigan 48114-9058

Dear Michael Brahm-Henkel:

SUBJECT: Flat Rock Dam, Dam ID No. 556; Wayne County

The enclosed Dam Safety Inspection Report and recommendations for the Flat Rock Dam, Dam ID No. 556, located in Wayne County was conducted by the Department of Environment, Great Lakes, and Energy (EGLE) at the request of the Huron-Clinton Metropolitan Authority, as provided by Section 31518(4) of Part 315, Dam Safety (Part 315), of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).

The purpose of this inspection was to evaluate the structural condition and hydraulic capacity of this dam, as required by Part 315 (Dam Safety), of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended.

The Flat Rock Dam is in fair condition overall. The inspection report contains several recommended actions for monitoring and maintenance of deficiencies that should be addressed in the timeframes provided in the report. Specifically, the report recommends the following:

1 Debris (Action: Maintenance): Remove debris. Complete action as soon as possible.
    a Principal Spillway: Weir Wall

2 Deteriorating Material (Action: Maintenance, Material: Concrete): Remove the deteriorated concrete and install new concrete. Remove all deteriorated concrete, additional concrete may have to be removed to ensure the patch is a minimum of 3 inches thick. Roughen existing concrete surface to improve the patch bond. Install high strength concrete. Complete action by December 31, 2024.
    a Principal Spillway: Abutment - Right Wall
    b Principal Spillway: Bridge

3 Depression (Action: Maintenance): Reshape and stabilize area affected by depression. Remove vegetation and unsuitable fill material. Regrade the area to the original grade with material that matches the adjacent material. Install surface protection that matches the adjacent surface protection. After the depressions is filled the area should be monitored for another depression. If another depression is observed the Dam Safety Unit should be notified. Complete action by December 31, 2024.
    a Embankment - Upstream Slope, Downstream Slope
    b Fish Ladder: Abandoned Conduit

4 Sink Hole (Action: Maintenance, Type: Conduit): Completely fill sink hole with MDOT class II sand. Dig around sink hole area to ensure void can be filled. Notify the Dam Safety Program if water flow is observed in the sink hole. Complete action by December 31, 2024.
    a Fish Ladder: Abandoned Conduit

5 Erosion (Action: Maintenance): Reshape and stabilize area damaged by erosion. Regrade the area to original condition with suitable fill material and install appropriate surface protection. Complete action by December 31, 2024.
    a Auxiliary Spillway: Downstream

6 Seepage (Action: Monitor, Type: Chute): Inspect monthly for an increase in seepage or erosion from seepage area. Start preparing for future maintenance to adequately seal the chute to ensure the flow stays within the chute. Notify the Dam Safety Program if any changes in seepage is observed. No adjacent erosion was observed from the flow, so the seepage appears to be stable.
    a Fish Ladder: Chute

7 Seepage (Action: Monitor, Type: Embankment): Inspect monthly for an increase in water flow from seepage area. Notify the Dam Safety Program if any changes in seepage is observed.
    a Embankment - Downstream Slope

8 Create an operation and maintenance plan. A proper operation and maintenance plan will increase the dam's service life and maintain the dam's hydraulic and structural condition.

If you have any questions or concerns regarding the inspection report or the recommendations, please contact me at 517-230-5866; ThelenM21@Michigan.gov; or EGLE, P.O. Box 30458, Lansing, Michigan 48909-7958.

Sincerely,

Mitchel Thelen, P.E., Regional Engineer
Dam Safety Unit
Water Resources Division

Enclosure

DAM SAFETY INSPECTION REPORT
FLAT ROCK DAM – DAM ID NO. 556
HURON RIVER
WAYNE COUNTY – SW 1/4 SECTION 31, T 04S, R 10E

OWNER(S)/OPERATOR(S): Huron-Clinton Metropolitan Authority
Michael Brahm-Henkel
13000 High Ridge Drive
Brighton, MI 48114-9058

HAZARD POTENTIAL CLASSIFICATION: High

INSPECTION DATE: November 9, 2023

REPORT DATE: February 7, 2024

PREPARED AND INSPECTED BY:

Mitchel K. Thelen, P.E.
Registration Number: 09306
Dam Safety Unit
Water Resources Division
Department of Environment, Great Lakes, and Energy
P.O. Box 30458
Lansing, Michigan 48909
517-280-5866

INTRODUCTION

The purpose of this inspection was to evaluate the structural condition and hydraulic capacity of the Flat Rock Dam, as required by Part 315 (Dam Safety), of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. This inspection was conducted by the Department of Environment, Great Lakes, and Energy (EGLE) at the request of the Huron-Clinton Metropolitan Authority, as provided by Section 31518(4) of Part 315, Dam Safety (Part 315), of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).

The report is limited to a discussion of observations based on a visual investigation and review of any available previous inspection reports, plans, and data. This report should not be considered an in-depth engineering investigation. All references to “right” and “left” in this report are based on the observer facing downstream.

CONCLUSIONS AND RECOMMENDATIONS

The Flat Rock Dam is in fair condition. No existing dam safety deficiencies are recognized for normal loading conditions. Rare or extreme hydrologic and/or seismic events may result in a dam safety deficiency. Risk may be in the range to take further action.

The following recommended actions are listed by priority:

1. **Debris (Action: Maintenance):** Remove debris. Complete action as soon as possible.
    a. Principal Spillway: Weir Wall
2. **Deteriorating Material (Action: Maintenance, Material: Concrete):** Remove the deteriorated concrete and install new concrete. Remove all deteriorated concrete, additional concrete may have to be removed to ensure the patch is a minimum of 3 inches thick. Roughen existing concrete surface to improve the patch bond. Install high strength concrete. Complete action by December 31, 2024.
    a. Principal Spillway: Abutment - Right Wall
    b. Principal Spillway: Bridge
3. **Depression (Action: Maintenance):** Reshape and stabilize area affected by depression. Remove vegetation and unsuitable fill material. Regrade the area to the original grade with material that matches the adjacent material. Install surface protection that matches the adjacent surface protection. After the depressions are filled the area should be monitored for another depression. If another depression is observed the Dam Safety Unit should be notified. Complete action by December 31, 2024.
    a. Embankment - Upstream Slope, Downstream Slope
    b. Fish Ladder: Abandoned Conduit

4 **Sink Hole (Action: Maintenance, Type: Conduit):** Completely fill sink hole with MDOT class II sand. Dig around sink hole area to ensure void can be filled. Notify the Dam Safety Program if water flow is observed in the sink hole. Complete action by December 31, 2024.
    a Fish Ladder: Abandoned Conduit

5 **Erosion (Action: Maintenance):** Reshape and stabilize area damaged by erosion. Regrade the area to original condition with suitable fill material and install appropriate surface protection. Complete action by December 31, 2024.
    a Auxiliary Spillway: Downstream

6 **Seepage (Action: Monitor, Type: Chute):** Inspect monthly for an increase in seepage or erosion from seepage area. Start preparing for future maintenance to adequately seal the chute to ensure the flow stays within the chute. Notify the Dam Safety Program if any changes in seepage is observed. No adjacent erosion was observed from the flow, so the seepage appears to be stable.
    a Fish Ladder: Chute

7 **Seepage (Action: Monitor, Type: Embankment):** Inspect monthly for an increase in water flow from seepage area. Notify the Dam Safety Program if any changes in seepage is observed.
    a Embankment - Downstream Slope

8 Create an operation and maintenance plan. A proper operation and maintenance plan will increase the dam's service life and maintain the dam's hydraulic and structural condition.

The dam’s current high hazard potential rating remains appropriate.

PROJECT INFORMATION

The current Flat Rock Dam was constructed in 1924 by Henry Ford to generate hydroelectric power. Hydropower generation has long since been abandoned, and the dam currently maintains an impoundment used primarily for recreational purposes, providing fish and wildlife habitat and providing swimming and boating opportunities. The former powerhouse building now houses Flat Rock Metal, Incorporated, a local metal manufacturing plant.

The Dam consists of the following parts:

Principal Spillway			
Spillway Type:	Weir	Primary Material:	Concrete
Weir Wall			
Material:	Concrete	Crest Length:	492'
Abutment			
Material:	Concrete		
Bridge			
Material:	Concrete		

Auxiliary Spillway			
Spillway Type:	Chute	Primary Material:	Concrete
Left and Right Chute			
Material:	Concrete	Width:	4'

Fish Ladder			
Spillway Type:	Sluice Gate/Conduit/Chute	Primary Material:	Metal/Concrete/Wood
Abandoned Conduit Inlet Gate			
Gate Type:	Sluice	Gate Material:	Metal
Bay Material:	Concrete	Diameter:	4'
Operation:	Manual		
Outlet 1 and 2 Gate			
Gate Type:	Sluice	Gate Material:	Metal
Bay Material:	Wood	Diameter:	20"
Operation:	Manual		
Abandoned Gate			
Gate Type:	Sluice	Operation:	Manual
Bay Material:	Concrete	Gate Material:	Metal
Chute			
Material:	Wood		

Embankment	
Material:	Earth

The Dam has the following measurements:

Structural Height (ft):	16.5	Normal Freeboard (ft):	4.5
Normal Head (ft):	9	Flood Freeboard (ft):	0.6
Hydraulic Height (ft):	15.9	Normal Impoundment (acre):	188

Reconstruction to both principal spillway abutment walls and the right wall of the abandoned lock system were completed in 2007, under the authority of EGLE (formerly DEQ) Permit No. 07-82-0168-P.

The dam was originally inspected under the National Dam Safety Program in 1979 by Ayres, Lewis, Norris, & May, Incorporated (ALMN). Subsequently, the dam has been inspected under Part 315 by ALMN in 1987; by EGLE Staff in 1999, 2002, 2011, 2014,2017, and 2020; and by Stantec Consulting Michigan, Incorporated (Stantec) in 2005. A supplemental condition survey and conceptual design report was completed by Stantec in 2006. Copies of these reports along with engineering plans for the dam are on file with the Dam Safety Program.

SITE INVESTIGATION

The following discussion of the dam's physical condition and appurtenances is based on observations and photographs obtained on the inspection date.

In addition to the specific findings listed below, it is important to continue good maintenance practices. These practices include regular inspection of the dam embankments and hydraulic structures for any deficiencies. Some of the more common issues that are found include growth of trees and brush, development of erosion areas, and animal burrows.

The following data was collected on the date of the inspection and includes deficiencies observed during the inspection and necessary actions for remediation of the observed deficiencies.

Embankment		
Upstream Slope		
What issues are present:	*Depression*	
Depression		
Photo:	*31,32*	
Action Required:	*Maintenance*	
Describe action required:	*Reshape and stabilize area affected by depression.*	
Crest		
What issues are present:	*None*	
Downstream Slope		
What issues are present:	*Depression, Seepage*	
Depression		
Photo:	*34*	
Action Required:	*Maintenance*	
Describe action required:	*Reshape and stabilize area affected by depression.*	
Seepage		
Photo:	*33*	
Type:	*Flow*	
Action Required:	*Monitor*	
Describe action required:	*Inspect monthly for an increase in water flow from seepage area.*	

Spillways		
Principal Spillway		
What issues are present:	*Debris, Deteriorating Material*	
Debris		
Component:	*Weir Wall*	
Photo:	*3,4,5,6*	
Action Required:	*Maintenance*	
Describe action required:	*Remove debris.*	
Deteriorating Material		
Component:	*Abutment*	*Bridge*
Part:	*Right Wall*	
Photo:	*9*	*11, 12*
Material:	*Concrete*	
Action Required:	*Maintenance*	
Describe action required:	*Remove the deteriorated concrete and install new concrete.*	

Auxiliary Spillway	
What issues are present:	*None*
Fish Ladder	
What issues are present:	*Depression, Seepage, Sink Hole*
Depression	
Component:	*Abandoned Conduit*
Photo:	*16*
Action Required:	*Maintenance*
Describe action required:	*Reshape and stabilize area affected by depression.*
Seepage	
Component:	*Chute*
Photo:	*27,28*
Type:	*Flow*
Action Required:	*Monitor*
Describe action required:	*Inspect monthly for an increase in seepage or erosion from seepage area.*
Sink Hole	
Component:	*Abandoned Conduit*
Photo:	*17*
Action Required:	*Maintenance*
Describe action required:	*Completely fill sink hole with MDOT class II sand.*

General notes about the issues observed are shown below:

Debris

Debris reduces the hydraulic capacity of the dam and can cause damage to components.

Depression

Depressions are sunken areas that do not match the adjacent grade. Depression can be caused by internal erosion, poorly compacted material, uneven material settlement, or a high stress loading. The depressed areas are more susceptible to erosion or cracking and can cause damage to adjacent components. They can also inhibit maintenance of the dam and make detection of stability or seepage problems difficult. When an increase in depression size is observed the Dam Safety Program should be notified.

Depressions above conduits can be a sign that piping around the conduit has started or the conduit is collapsing.

Deteriorating Material

All materials deteriorate over time but proper maintenance can extend the service life of the material and reduce the life cycle cost of maintenance and operation of the dam.

Erosion

Erosion is caused when the water has enough energy to dislodge and carry the surface material. Once the surface protective barriers (vegetation, rock, concrete, metal etc.) has been removed the remaining soil will much more easily be eroded by the water.

Seepage

All embankments have seepage which is caused from groundwater flow through the embankment material. Seepage becomes a concern when the seepage flow has increased or has a dirty color. Also, when seepage is observed higher up on the embankment there is a slope stability concern because embankment material losses its strength as it becomes saturated.

Flow can bypass a chute through voids in the chute. Once the flow is outside the chute, the flow can cause damage to adjacent components through erosion, deterioration, or material stress.

Sink Hole

Sink holes are sudden voids observed in a material. Sink holes can be caused by internal erosion, animal burrows, or high stress loadings. Sink holes increase the risk of piping failure in a material. When an increase in sink hole size is observed the Dam Safety Program should be notified.

Sink holes above conduits can be a sign that piping around the conduit has started or the conduit is collapsing.

The above monitoring and maintenance items should be addressed in accordance with the Conclusions and Recommendations section of this report.

STRUCTURAL STABILITY

Based upon observations during the inspection, there were no indicators of any conditions that represent an immediate threat to the dam's stability. No remedial action is required at this time.

HYDROLOGY AND HYDRAULICS

The contributing drainage area to the Huron River at the Flat Rock Dam is approximately 876 square miles. The design discharge for this high hazard potential dam is the 0.5-percent annual chance (200-year) flood discharge, which is estimated to be 11,700 cubic feet per second (cfs). Neglecting flow through the former powerhouse and abandoned lock, the principal spillway can pass 11,700 cfs with approximately 0.6 feet of freeboard at the earthen abutments. Additional freeboard could be achieved by operating the abandoned lock gate and/or powerhouse gates. Therefore, the dam has sufficient spillway capacity to pass the design flood.

Copies of the hydraulic calculations used to make this determination are on file with the Dam Safety Program.

OPERATION AND MAINTENANCE

Operation and maintenance (O&M) of the dam is performed by Huron-Clinton Metropolitan Authority. A written O&M Plan is not on record with the Dam Safety Program. The Dam Safety Program recommends creating an O&M Plan to ensure proper operation and maintenance of the Dam. The Dam Safety Program should be provided any future or current O&M Plans.

EMERGENCY ACTION PLAN

An Emergency Action Plan (EAP) is required under Part 315 (Section 31523) for high or significant hazard potential dams. The owner is required to prepare, and keep up-to-date, an EAP for the dam, in coordination with Wayne County Emergency Management. Our records indicate that an EAP has been developed for the dam. An updated EAP has been provided for this inspection cycle.

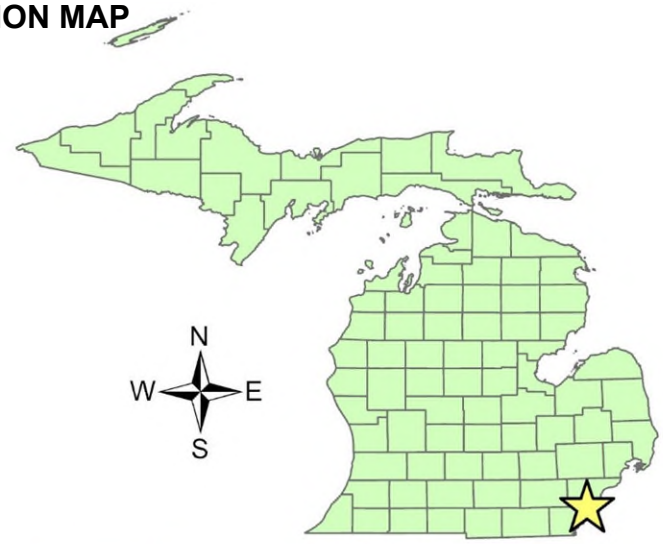
APPENDICES

Appendix A - Location map,
Appendix B - Inspection photographs
Appendix C - Hydrologic Data

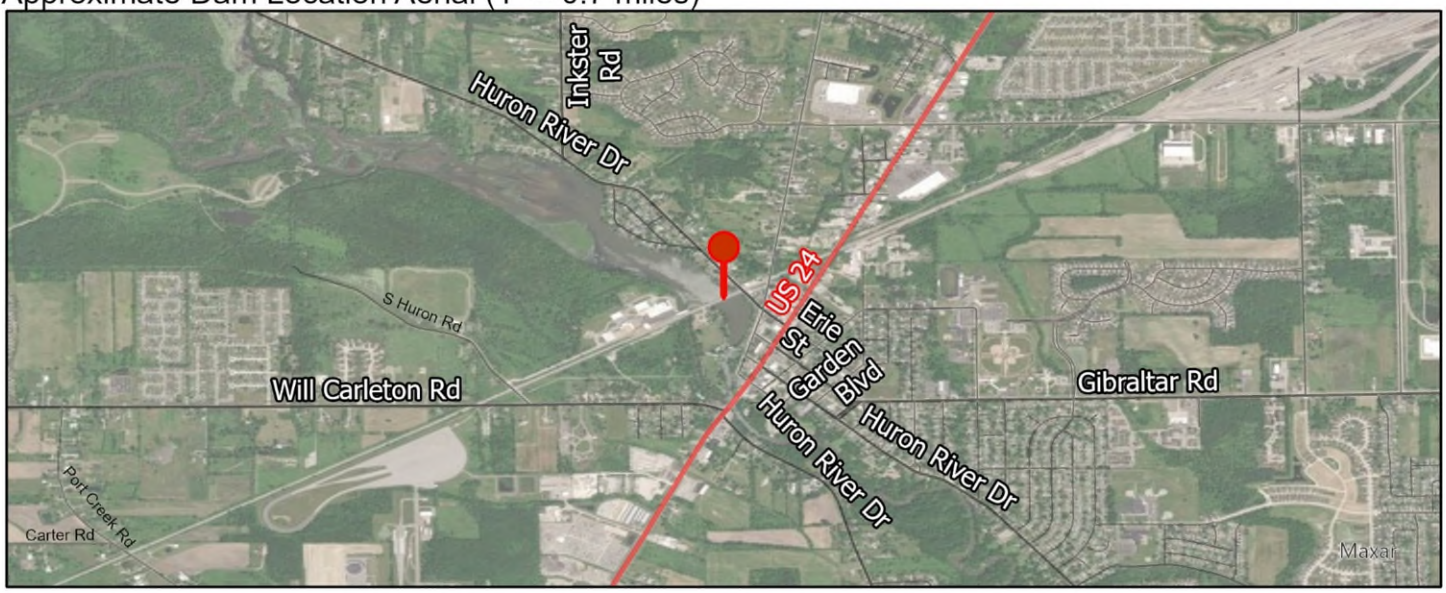
FLAT ROCK DAM
WAYNE COUNTY
DAM ID NO. 556

APPENDIX A – LOCATION MAP

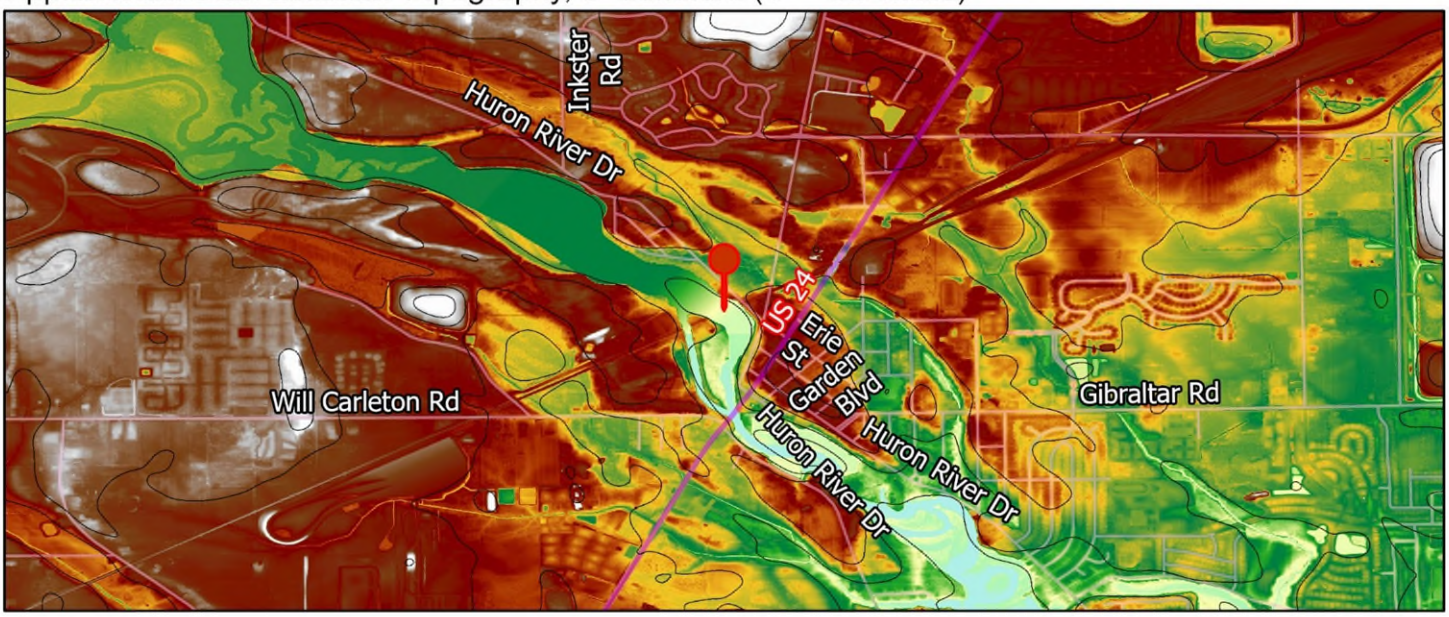
Flat Rock Dam
Dam ID No. 556
Section 31
T 04S
R 10E
Wayne County



Approximate Dam Location Aerial (1" = 0.7 miles)



Approximate Dam Location Topography, 5' Contours (1" = 0.7 miles)



APPENDIX B – INSPECTION PHOTOS

Overview Map

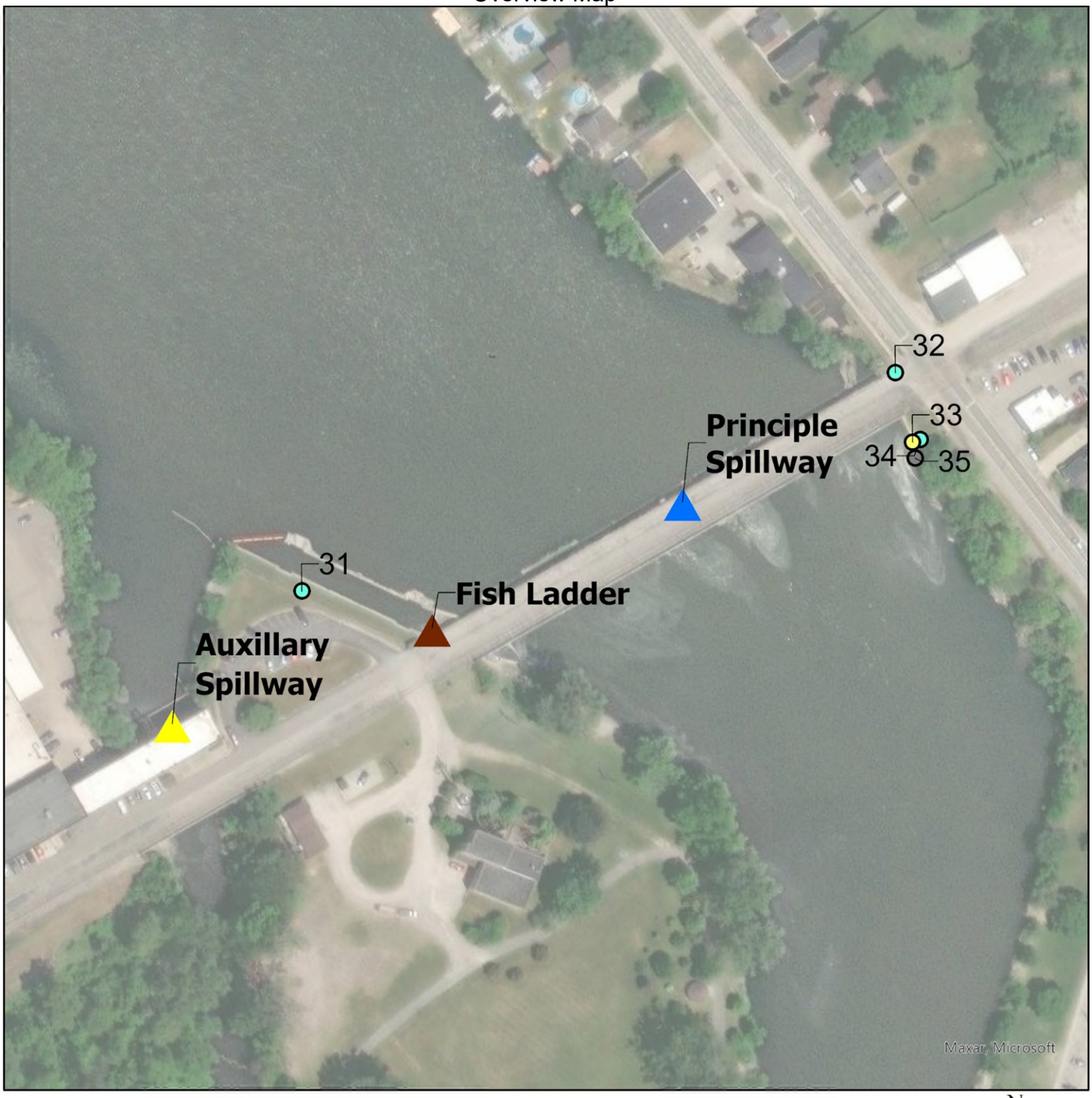


Photo #1: Principal Spillway Downstream.

Photo #2: Principal Spillway Downstream.

Photo #3: Principal Spillway Weir Wall.
Issue: Debris, Action: Maintenance.

Photo #4: Principal Spillway Weir Wall.
Issue: Debris, Action: Maintenance.

Photo #5: Principal Spillway Weir Wall.
Issue: Debris, Action: Maintenance.

Photo #6: Principal Spillway Weir Wall.
Issue: Debris, Action: Maintenance.

Photo #7: Principal Spillway Weir Wall.

Photo #8: Principal Spillway Abutment Left Wall.

Photo #9: Principal Spillway Abutment Right Wall.
Issue: Deteriorating Material, Action: Maintenance.
Material: Concrete.

Photo #10: Principal Spillway Abutment Right Wall.

Photo #11: Principal Spillway Bridge.
Issue: Deteriorating Material, Action: Maintenance.
Material: Concrete.

Photo #12: Principal Spillway Bridge.
Issue: Deteriorating Material, Action: Maintenance.
Material: Concrete.

Photo #13: Auxiliary Spillway Left Chute.

Photo #14: Auxiliary Spillway Right Chute Outlet.

Photo #15: Fish Ladder Upstream.

Photo #16: Fish Ladder Abandoned Conduit.
Issue: Depression, Action: Maintenance.

Photo #17: Fish Ladder Abandoned Conduit.
Issue: Sink Hole, Action: Maintenance.

Photo #18: Fish Ladder Inlet Gate.

Photo #19: Fish Ladder Inlet Gate.

Photo #20: Fish Ladder Outlet 1 Gate.

Photo #21: Fish Ladder Outlet 1 Gate.

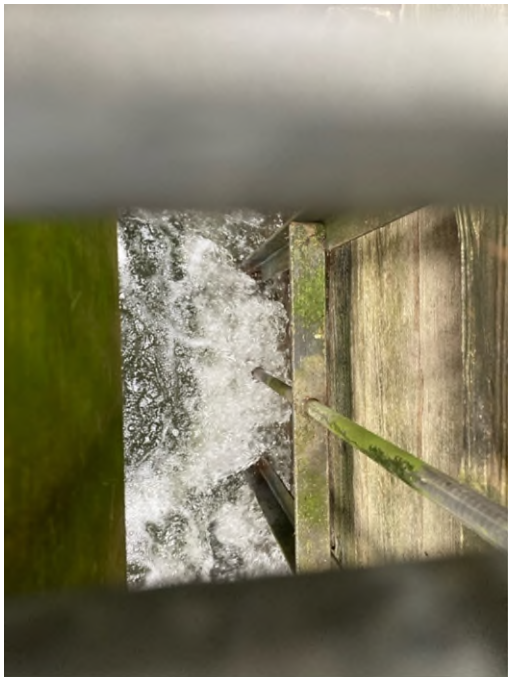


Photo #22: Fish Ladder Outlet 2 Gate.

Photo #23: Fish Ladder Outlet 2 Gate.

Photo #24: Fish Ladder Abandoned Gate.

Photo #25: Fish Ladder Abandoned Gate Flow observed through gate.

Photo #26: Fish Ladder Chute Inlet.

Photo #27: Fish Ladder Chute.
Issue: Seepage, Action: Monitor.
Type: Flow.

Photo #28: Fish Ladder Chute.
Issue: Seepage, Action: Monitor.
Type: Flow.

Photo #29: Fish Ladder Chute.

Photo #30: Fish Ladder Chute.

Photo #31: Embankment Upstream Slope.
Issue: Depression, Action: Maintenance.

Photo #32: Embankment Upstream Slope.
Issue: Depression, Action: Maintenance.

Photo #33: Embankment Downstream Slope. Might be from storm sewer.
Issue: Seepage, Action: Monitor.
Type: Flow.

Photo #34: Embankment Downstream Slope. Right above storm sewer from Rhodes.
likely from seepage observed.
Issue: Depression, Action: Maintenance.

Photo #35: Embankment Downstream Slope. Drainage pipe for roads.

Photo #36: Impoundment.

Photo #37: Impoundment.

APPENDIX C – HYDROLOGIC DATA

We have processed the discharge request submitted by email on October 18, 2023 (Process No. 20230536), as follows:

Huron River at Flat Rock Dam, Dam ID 556, Section 31, T4S, R10E, City of Flat Rock, Wayne County, has a total drainage area of 876 square miles and a contributing drainage area of 832 square miles. The design discharge for this dam is the 0.5% chance (200-year) flood. The 0.5% chance peak flow is estimated to be 11700 cubic feet per second. (Watershed Basin No. 15 Huron).

These estimates should be confirmed by our office if an application is not submitted within one year. If you have any questions concerning the discharge estimates, please contact Ms. Susan Greiner, Hydrologic Studies and Floodplain Management Unit, at 517-927-3838, or by email at: GreinerS@michigan.gov.

From: EGLE-Automated <EGLE-Automated@michigan.gov>
Sent: Wednesday, October 18, 2023 12:08 PM
To: EGLE-wrd-qreq <EGLE-wrd-qreq@michigan.gov>
Subject: Flood or Low Flow Discharge Request

Requestor: Mitchel
Company: EGLE
Address: 525 W. Allegan
City/State: Lansing
ZIP Code: 48933
Phone: 5172305866
Date: 10/18/2023
0.5 percent
Contact Agency:
Contact Person:
Watercourse: Huron River
Local Name:
County: Wayne
City/Township: ?
Section: 31
Town: 04S
Range: 10E
Location: Flat Rock Dam #556
FFR1: Dam
Email: ThelenM21@michigan.gov

DAM SAFETY INSPECTION REPORT
FLAT ROCK DAM – DAM ID 556
HURON RIVER
WAYNE COUNTY – SW ¼ SECTION 31, T04S, R10E

OWNER/OPERATOR:

Huron-Clinton Metropolitan Authority
13000 High Ridge Drive
P.O. Box 2001
Brighton, Michigan 48116-8001
810-227-2757

HAZARD POTENTIAL CLASSIFICATION:

High

INSPECTION DATE:

July 23, 2020

REPORT DATE:

December 22, 2020

PREPARED AND INSPECTED BY:

Lucas A. Trumble, P.E.
Registration Number: 58295
Hydrologic Studies and Dam Safety Unit
Water Resources Division, EGLE
P.O. Box 30458
Lansing, Michigan 48909
517-420-8923

INTRODUCTION

The purpose of this inspection is to evaluate the structural condition and hydraulic capacity of the Flat Rock Dam pursuant to the requirements of Part 315, Dam Safety, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. The Department of Environment, Great Lakes, and Energy (EGLE) conducted this inspection at the request of the dam's owner, the Huron Clinton Metropolitan Authority (HCMA).

The report is limited to a discussion of observations based on a visual investigation and review of any previous inspection reports, plans, and data that are available. This report should not be considered an in-depth engineering investigation. All references to "upstream" indicate the lakeside of the embankment, and references to "downstream" indicate the outside of the embankment. All references to "right" or "left" are from the viewpoint of the observer facing downstream.

CONCLUSIONS AND RECOMMENDATIONS

The Flat Rock Dam is in fair overall condition. Based upon observations at the time of the inspection, there were no apparent structural deficiencies that may lead to the immediate failure of the dam. The dam has adequate spillway capacity to safely convey the design flood. It was previously determined that the HCMA owns the principal spillway and abandoned lock portions of the dam, while Flat Rock Metal, Incorporated owns the former powerhouse structure. The following recommended actions are listed by ownership responsibility and by priority:

HCMA:

1. Continue to monitor the condition of both downstream concrete abutment walls of the principal spillway structure on a semi-annual basis. Implement repairs as necessary.

2. Remove all trees and brush from both earthen abutments. This recommendation has been repeated since the 2011 inspection report and should be completed as soon as reasonably possible. After clearing, both abutments should be mowed a minimum of two times per year to prevent further establishment of woody vegetation and to facilitate visual inspection.

3. Remove all vegetation from the left wall of the abandoned lock system. This recommendation is repeated from the 2014 and 2017 inspection reports and should be completed as soon as reasonably possible.

4. Backfill, compact, and seed the eroded areas along the downstream face of the left earthen abutment as soon as reasonably possible.

5. Continue conversations with Michigan Department of Natural Resources (MDNR) Fisheries Division, who maintain a fish ladder at the dam, related to repair or replacement of the fish ladder structure.

6. Review, and update as necessary, the dam's Emergency Action Plan in coordination with Wayne County Emergency Management. Provide the results of this review, and any updates, to the Dam Safety Program by December 31, 2020, or as soon as possible following this due date.

7. Prepare and keep current an operation and maintenance (O&M) plan for the dam. Provide a copy of the plan to the Dam Safety Program.

The dam's current high hazard potential rating remains appropriate.

PROJECT INFORMATION

The current Flat Rock Dam was constructed in 1924 by Henry Ford to generate hydroelectric power. Hydropower generation has long since been abandoned, and the dam currently maintains an impoundment used primarily for recreational purposes, providing fish and wildlife habitat and providing swimming and boating opportunities. The dam consists of a 492-foot wide concrete spillway with an abandoned lock system immediately to the right of the spillway. The abandoned locks now serve to control flow to a fish ladder constructed downstream of the head gates. The former powerhouse structure is located approximately 250 feet right of the spillway. The former powerhouse building now houses Flat Rock Metal, Incorporated, a local metal manufacturing plant.

The dam has a structural height of 16.5 feet, a hydraulic height of 15.9 feet, and maintains 9 feet of head with 4.5 feet of freeboard, creating a 188-acre impoundment under normal flow conditions. The dam is flanked by very short earthen abutments at each end.

Reconstruction to both principal spillway abutment walls and the right wall of the abandoned lock system were completed in 2007, under the authority of EGLE (formerly DEQ) Permit No. 07-82-0168-P.

The dam was originally inspected under the National Dam Safety Program in 1979 by Ayres, Lewis, Norris, & May, Incorporated (ALMN). Subsequently, the dam has been inspected under Part 315 by ALMN in 1987; by EGLE Staff in 1999, 2002, 2011, 2014, and 2017; and by Stantec Consulting Michigan, Incorporated (Stantec) in 2005. A supplemental condition survey and conceptual design report was completed by Stantec in 2006. Copies of these reports along with engineering plans for the dam are on file with the Dam Safety Program.

SITE INVESTIGATION

The following discussion of the physical condition of the dam and appurtenances is based on observations and photographs obtained on the date of this inspection. This inspection report does not include an assessment of the bridge located immediately downstream of the spillway. However, visual observations during the course of the dam inspection indicate that a further investigation of the structural condition of the bridge is warranted.

The dam's earthen abutments, shown in Photographs 1 through 6, are in fair condition. No sloughs, slumps, differential settlement, cracking, or major erosion was observed. However, both abutments have small trees and brush growing near the spillway structure walls, as shown in Photographs 1, 3, and 4. Trees and brush can provide shortened seepage pathways along their root systems that can lead to internal erosion (piping) of abutment fill material, cause large section loss in the event of a blow down, provide a haven for burrowing animals, and obscure underlying deficiencies. Therefore, all trees and brush should be removed from the earthen abutments. This recommendation has been repeated since the 2011 inspection report and should be completed as soon as reasonably possible. After clearing, both abutments should be mowed a minimum of two times per year to prevent further establishment of woody vegetation and to facilitate visual inspection.

Additionally, some minor foot traffic erosion is present along the downstream face of the left abutment, as shown in Photograph 6. This condition has not changed significantly since previous inspections and does not currently pose a threat to the stability of the abutment. However, in order to prevent a more serious erosion problem from developing, the area should be backfilled, compacted, and seeded as soon as reasonably possible.

The principal spillway, shown in Photographs 7 through 15, is also in fair condition. No misalignment, differential settlement, or severe cracking or deterioration was observed. Both upstream abutment walls were reconstructed in 2007 and are in excellent condition. Moderate spalling is present at both downstream abutment walls, as shown in Photographs 11 and 12. This condition does not currently pose a threat to the stability of the spillway structure but should continue to be monitored on a semi-annual basis and repaired as necessary.

The abandoned lock system, shown in Photographs 16 through 20, is also in fair condition. The right channel wall of the lock system was reconstructed in 2007 and remains in excellent condition. The left channel wall is original to the dam and is in poor condition. Moderate spalling and cracking are evident along the entire length of the wall. Additionally, vegetation was observed to be growing from cracks in the concrete. The failed log boom has been replaced with a Worthington Tuff Boom system which is in excellent shape. The 2014 inspection report recommended that all vegetation be removed from the left lock wall by October 1, 2015. This action should be completed as

soon as reasonably possible in order to prevent accelerated deterioration of the structural concrete.

The fish ladder, shown in Photographs 21 and 22, is in poor condition. Significant deformation of the wooden panel and leakage throughout the structure was observed. Though not critical to the stability or function of the dam, continued deterioration or failure of the fish ladder could impede the passage of fish and cause localized erosion downstream of the lock gate structure. It is understood that the MDNR Fisheries Division maintains and operates the fish ladder. As such, the MDNR should consider repairing or replacing the structure.

The former powerhouse, located approximately 250 feet to the right of the principal spillway, is owned by Flat Rock Metal, Incorporated. Dam Safety Program staff accompanied representatives from Flat Rock Metal and their consultant, Stantec, to perform a visual inspection of the former powerhouse structure in 2017. The former powerhouse structure was not accessed during this inspection of the dam. This structure, shown in Photographs 23 through 25, does not appear to have deteriorated significantly from 2017 and still appears to be fair condition. No misalignment, differential settlement, or major cracking or deterioration of the structural concrete or building foundation were observed. Several areas of spalling and exposed reinforcing steel were observed in 2017 at the structure's appurtenances. A thorough inspection of the head gates or internal structure was not completed in 2017 by EGLE staff, however, it was indicated during that inspection that Stantec would be completing a thorough structural analysis of the powerhouse building, including a dive inspection of the underwater portions of the building foundation and turbine bays. This report has been provided to EGLE and is currently under review.

STRUCTURAL STABILITY

Based upon observations during the inspection, there were no indicators of any conditions that represent an immediate threat to dam stability. No remedial action is required at this time.

HYDROLOGY AND HYDRAULICS

The contributing drainage area to the Huron River at the Flat Rock Dam is approximately 876 square miles. The design discharge for this high hazard potential dam is the 0.5-percent annual chance (200-year) flood discharge, which is estimated to be 11,700 cubic feet per second (cfs). Neglecting flow through the former powerhouse and abandoned lock, the principal spillway can pass 11,700 cfs with approximately 0.6 feet of freeboard at the earthen abutments. Additional freeboard could be achieved by operating the abandoned lock gate and/or powerhouse gates. Therefore, the dam has sufficient spillway capacity to pass the design flood.

Copies of the hydraulic calculations used to make this determination are on file with the Dam Safety Program.

OPERATION AND MAINTENANCE

According to our records, a written O&M Plan, outlining procedures for upkeep and operation of the dam, has never been prepared for this dam. Though not required under Part 315, it is strongly recommended that such a plan be prepared and reviewed and updated periodically. Updated copies should be provided to the Dam Safety Program.

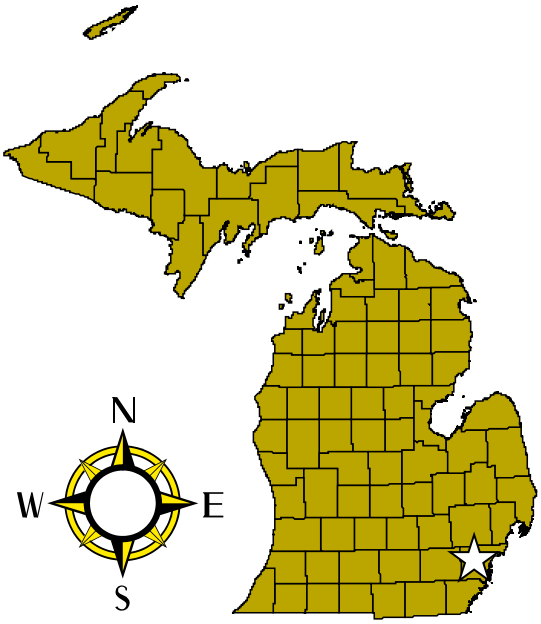
EMERGENCY ACTION PLAN

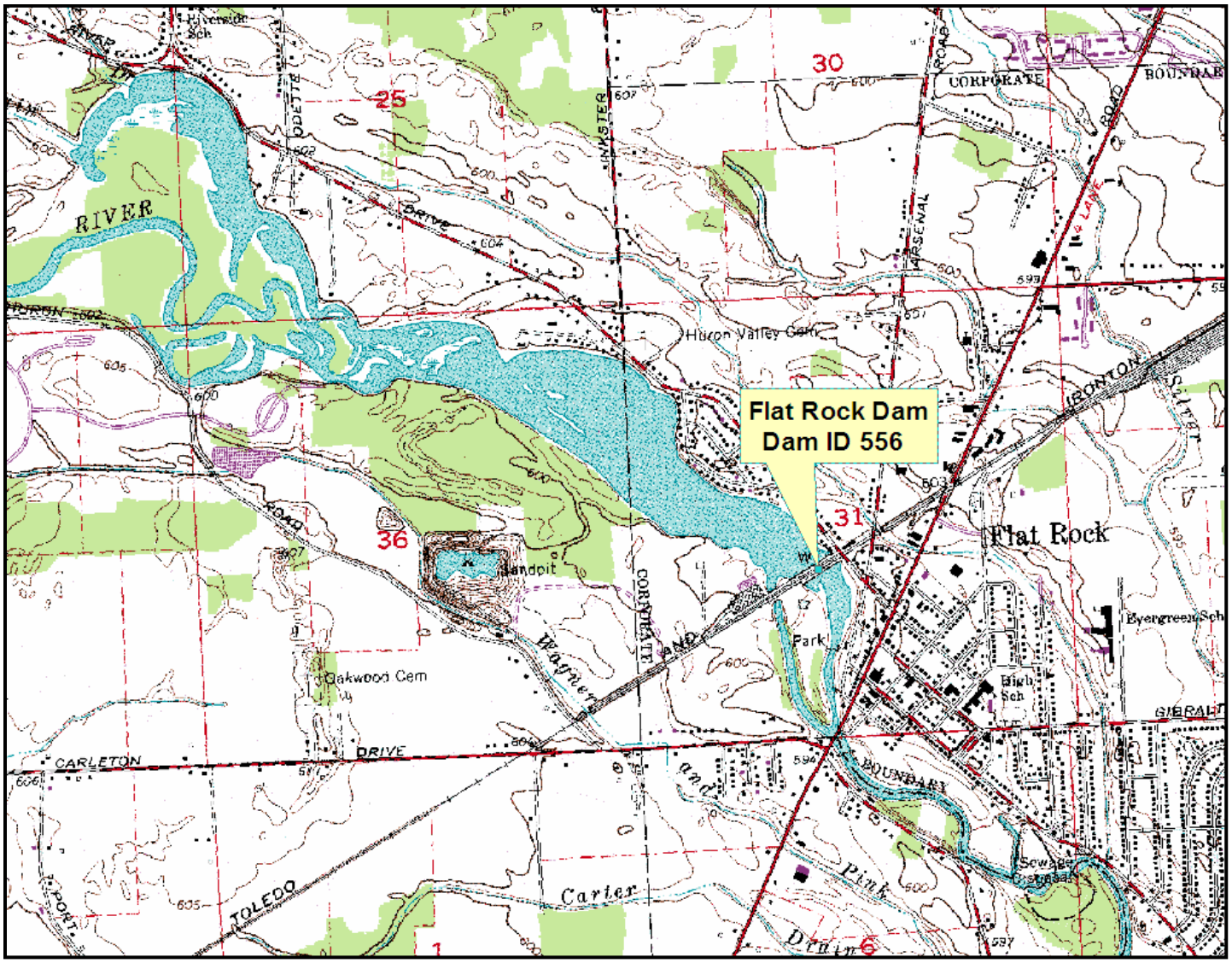
The Flat Rock Dam has been assigned a high hazard potential rating. As such, the owner is required under Part 315 to prepare and keep up to date an emergency action plan (EAP) for the dam. An EAP has been prepared and an updated copy was last provided to this office on December 9, 2015. The owner shall review, and update as necessary, the dam's EAP in coordination with Wayne County Emergency Management. The results of this review, and any updates, shall then be provided to this office by December 31, 2020, or as soon as possible following this due date.

APPENDICES

A location map, inspection photographs, and the 2020 EGLE estimated flood flows are attached.

Flat Rock Dam
Dam ID 556
Section 31, T 04S, R 10E
Wayne County





FLAT ROCK DAM
WAYNE COUNTY
DAM ID NUMBER 556

Photograph 1 – Upstream face of right abutment viewed from right
Note the brush growth

Photograph 2 – Abutment crest viewed from right

Photograph 3 – Downstream face of right abutment viewed from right
Note the trees and brush

Photograph 4 – Upstream face of left abutment viewed from left
Note the tall weeds and brush

Photograph 5 – Left abutment crest viewed from left

Photograph 6 – Downstream face of left abutment viewed from left
Note the foot traffic erosion

Photograph 7 – Principal spillway viewed from downstream

Photograph 8 – Spillway crest viewed from right
Note the minor debris build up and delamination of bridge beams

Photograph 9 – Right upstream abutment wall

Photograph 10 – Left upstream abutment wall
Note the overgrowth of vegetation

Photograph 11 – Right downstream abutment wall
Note the spalling and delamination

Photograph 12 – Left downstream abutment wall
Note the spalling

Photograph 13 – Typical spillway bay

Photograph 14 – Downstream face of bridge over spillway
Note the spalling and delamination of piers

Photograph 15 – Typical pier spalling and delamination

Photograph 16 – Right abutment wall of abandoned lock

Photograph 17 – Left abutment wall of abandoned lock
Note the spalling and cracking

Photograph 18 – Right lock gate and operator
Note that this gate acts as the inlet to the DNR fish ladder

Photograph 19 – Left lock gate

Photograph 20 – Left gate operator

Photograph 21 – DNR fish ladder outlet
Note the major leaking at right wall

Photograph 22 – DNR fish ladder under bridge

Photograph 23 – Former powerhouse inlet viewed from upstream

Photograph 24 – Bypass channel at left of powerhouse
Note that there was flow through this channel during this inspection

Photograph 25 – Powerhouse outlet viewed from downstream
Note the flow from the right

Photograph 26 – Flat Rock Dam impoundment viewed from abandoned lock

Photograph 27 – Downstream Huron River viewed from bridge

Photograph 28 – Downstream tailrace viewed from powerhouse outlet

RE: flood or low flow discharge request (ContentID - 168812)
EGLE-wrd-qreq EGLE-wrd-qreq@michigan.gov
To: Trumble, Luke (EGLE) TrumbleL@michigan.gov
Mon 1/11/2021 9:22 PM

We have estimated the flood frequency discharges requested in your email of December 22, 2020 (Process No. 20200637), as follows:

Huron River at Flat Rock Dam, Dam ID 556, Section 31, T4S, R10E, City of Flat Rock, Wayne County, has a total drainage area of 876 square miles and a contributing drainage area of 832 square miles. The design discharge for this dam is the 0.5% chance (200-year) flood. The 0.5% chance peak flow is estimated to be 11700 cubic feet per second. (Watershed Basin No. 15 Huron).

Please include a copy of this letter with your inspection report or any subsequent application for permit. These estimates should be confirmed by our office if an application is not submitted within one year. If you have any questions concerning the discharge estimates, please contact Ms. Susan Greiner, Hydrologic Studies and Dam Safety Unit, at 517-927-3838, or by email at: GreinerS@michigan.gov.

-----Original Message-----
From: DoNotReply@michigan.gov <DoNotReply@michigan.gov>
Sent: Tuesday, December 22, 2020 10:01 AM
To: EGLE-wrd-qreq <EGLE-wrd-qreq@michigan.gov>
Subject: flood or low flow discharge request (ContentID - 168812)

Requestor: Luke Trumble
Company: EGLE
Address: 525 W Allegan St
City: Lansing, MI
Zip: 48933
Phone: 517-420-8923
Date: 2020-12-22
F0.5percent: Yes
ContactAgency: None Selected
ContactPerson:
Watercourse: Huron River
LocalName: Flat Rock Dam Impoundment
CountyLocation: Wayne
CityorTownship: City of Flat Rock
Section: 31
Town: 04S
Range: 10E
Location: Request is for the Flat Rock Dam, Dam ID No 556, located on the Huron River in Wayne County. Previous request was made in 2017, Process No. 20170138.
FFR1: Dam
fpReqEmailAddr: trumblel@michigan.gov

DAM SAFETY INSPECTION REPORT
FLAT ROCK DAM – DAM ID 556
HURON RIVER
WAYNE COUNTY – SW ¼ SECTION 31, T04S, R10E

OWNER/OPERATOR:

Huron-Clinton Metropolitan Authority
13000 High Ridge Drive
P.O. Box 2001
Brighton, Michigan 48116-8001
810-227-2757

HAZARD POTENTIAL CLASSIFICATION:

High

INSPECTION DATE:

July 31, 2017

REPORT DATE:

December 5, 2017

PREPARED AND INSPECTED BY:

Lucas A. Trumble, P.E.
Registration Number: 58295
Hydrologic Studies and Dam Safety Unit
Water Resources Division, MDEQ
P.O. Box 30458
Lansing, Michigan 48909
517-420-8923

INTRODUCTION

The purpose of this inspection is to evaluate the structural condition and hydraulic capacity of the Flat Rock Dam pursuant to the requirements of Part 315, Dam Safety, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. The Department of Environmental Quality (DEQ) conducted this inspection at the request of the dam's owner, the Huron Clinton Metropolitan Authority (HCMA).

The report is limited to a discussion of observations based on a visual investigation and review of any previous inspection reports, plans, and data that are available. This report should not be considered an in-depth engineering investigation. All references to "upstream" indicate the lakeside of the embankment, and references to "downstream" indicate the outside of the embankment. All references to "right" or "left" are from the viewpoint of the observer facing downstream.

CONCLUSIONS AND RECOMMENDATIONS

The Flat Rock Dam is in fair overall condition. Based upon observations at the time of the inspection, there were no apparent structural deficiencies that may lead to the immediate failure of the dam. The dam has adequate spillway capacity to safely convey the design flood. It was previously determined that the HCMA owns the principal spillway and abandoned lock portions of the dam, while Flat Rock Metal, Incorporated owns the former powerhouse structure. The following recommended actions are listed by ownership responsibility and by priority:

HCMA:

1. Continue to monitor the condition of both downstream concrete abutment walls of the principal spillway structure on a semi-annual basis. Implement repairs as necessary.

2. Remove all trees and brush from both earthen abutments. This recommendation is repeated from the 2011 and 2014 inspection reports and should be completed as soon as reasonably possible. After clearing, both abutments should be mowed a minimum of two times per year to prevent further establishment of woody vegetation and to facilitate visual inspection.

3. Remove all vegetation from the left wall of the abandoned lock system. This recommendation is repeated from the 2014 inspection report and should be completed as soon as reasonably possible.

4. Backfill, compact, and seed the eroded areas along the downstream face of the left earthen abutment. This recommendation is repeated from the 2011 and 2014 inspection reports and should be completed as soon as reasonably possible.

5. Begin conversations with Michigan Department of Natural Resources (MDNR) Fisheries Division, who maintain a fish ladder at the dam, to consider repair or replacement of the fish ladder structure.

6. Prepare and keep current an operation and maintenance (O&M) plan for the dam. Provide a copy of the plan to the Dam Safety Program.

Flat Rock Metal, Incorporated:

1. When complete, provide a copy of the structural analysis report currently being prepared by Stantec for the powerhouse structure. Implement any repairs recommended in that report as warranted.

The dam's current high hazard potential rating remains appropriate.

PROJECT INFORMATION

The current Flat Rock Dam was constructed in 1924 by Henry Ford to generate hydroelectric power. Hydropower generation has long since been abandoned, and the dam currently maintains an impoundment used primarily for recreational purposes, providing fish and wildlife habitat and providing swimming and boating opportunities. The dam consists of a 492-foot wide concrete spillway with an abandoned lock system immediately to the right of the spillway. The abandoned locks now serve to control flow to a fish ladder constructed downstream of the head gates. The former powerhouse structure is located approximately 250 feet right of the spillway. The former powerhouse building now houses Flat Rock Metal, Incorporated, a local metal manufacturing plant.

The dam has a structural height of 16.5 feet, a hydraulic height of 15.9 feet, and maintains 9 feet of head with 4.5 feet of freeboard, creating a 188-acre impoundment under normal flow conditions. The dam is flanked by very short earthen abutments at each end.

Reconstruction to both principal spillway abutment walls and the right wall of the abandoned lock system were completed in 2007, under the authority of DEQ Permit No. 07-82-0168-P.

The dam was originally inspected under the National Dam Safety Program in 1979 by Ayres, Lewis, Norris, & May, Incorporated (ALMN). Subsequently, the dam has been inspected under Part 315 by ALMN in 1987; by DEQ Staff in 1999, 2002, 2011, and 2014; and by Stantec Consulting Michigan, Incorporated (Stantec) in 2005. A supplemental condition survey and conceptual design report was completed by Stantec in 2006. Copies of these reports along with engineering plans for the dam are on file with the Dam Safety Program.

SITE INVESTIGATION

The following discussion of the physical condition of the dam and appurtenances is based on observations and photographs obtained on the date of this inspection. This inspection report does not include an assessment of the bridge located immediately downstream of the spillway. However, visual observations during the course of the dam inspection indicate that a further investigation of the structural condition of the bridge is warranted.

The dam's earthen abutments, shown in Photographs 1 through 5, are in fair condition. No sloughs, slumps, differential settlement, cracking, or major erosion was observed. However, both abutments have trees and brush growing near the spillway structure walls, as shown in Photographs 1 and 5. Trees and brush can provide shortened seepage pathways along their root systems that can lead to internal erosion (piping) of abutment fill material, cause large section loss in the event of a blow down, provide a haven for burrowing animals, and obscure underlying deficiencies. Therefore, all trees and brush should be removed from the earthen abutments. This recommendation is repeated from the 2011 and 2014 inspection reports and should be completed as soon as reasonably possible. After clearing, both abutments should be mowed a minimum of two times per year to prevent further establishment of woody vegetation and to facilitate visual inspection.

Additionally, some minor foot traffic erosion is present along the downstream face of the left embankment, as shown in Photograph 4. This condition does not currently pose a threat to the stability of the embankment, but was noted in the 2011 and 2014 inspection reports and should be backfilled, compacted, and seeded as soon as reasonably possible to prevent further erosion from developing.

The principal spillway, shown in Photographs 7 through 11 and 14, is also in fair condition. No misalignment, differential settlement, or severe cracking or deterioration was observed. Both upstream abutment walls were reconstructed in 2007 and are in excellent condition. Moderate spalling is present at both downstream abutment walls, as shown in Photographs 9 and 11. This condition does not currently pose a threat to the stability of the spillway structure, but should continue to be monitored on a semi-annual basis and repaired as necessary.

The abandoned lock system, shown in Photographs 15 through 17, is also in fair condition. The right channel wall of the lock system was reconstructed in 2007 and remains in excellent condition. The left channel wall is original to the dam, and is in poor condition. Moderate spalling and cracking are evident along the entire length of the wall. Additionally, vegetation was observed to be growing from cracks in the concrete. A log boom system that was present at the inlet to the lock system during the 2014 inspection report was damaged and removed. The 2014 inspection report recommended that all vegetation be removed from the left lock wall by October 1, 2015. This action should be completed as soon as reasonably possible in order to prevent accelerated deterioration of the structural concrete.

The fish ladder, shown in Photographs 11 and 16, is in poor condition. Significant deformation of the wooden panel and leakage throughout the structure was observed. Though not critical to the stability or function of the dam, continued deterioration or failure of the fish ladder could impede the passage of fish and cause localized erosion downstream of the lock gate structure. It is understood that the MDNR Fisheries Division maintains and operates the fish ladder. As such, the MDNR should consider repairing or replacing the structure.

The former powerhouse, located approximately 250 feet to the right of the principal spillway, is owned by Flat Rock Metal, Incorporated. For the first time, Dam Safety Program staff accompanied representatives from Flat Rock Metal and their consultant, Stantec, to perform a surface inspection of the former powerhouse structure. This structure, shown in Photographs 19 through 25, has held up remarkably well over the years and is considered to be in fair overall condition. No misalignment, differential settlement, or major cracking or deterioration of the structural concrete or building foundation were observed. Several areas of spalling and exposed reinforcing steel were observed at the structure's appurtenances, as shown in Photographs 20 and 23, but do not currently pose a threat to the structural integrity of the powerhouse. A thorough inspection of the head gates or internal structure was not possible on the date of this inspection given the presence of flow through the former turbine bays and confined space entry restrictions. However, it was indicated during the inspection that Stantec would be completing a thorough structural analysis of the powerhouse building, including a dive inspection of the underwater portions of the building foundation and turbine bays. Once complete, this report should be provided to the Dam Safety Program. Any necessary repairs should be implemented as outlined in that report.

STRUCTURAL STABILITY

Based upon observations during the inspection, there were no indicators of any conditions that represent an immediate threat to dam stability. No remedial action is required at this time.

HYDROLOGY AND HYDRAULICS

The contributing drainage area to the Huron River at the Flat Rock Dam is approximately 876 square miles. The design discharge for this high hazard potential dam is the 0.5 percent chance (200-year) flood discharge, which is estimated to be 11,700 cubic feet per second (cfs). Neglecting flow through the former powerhouse and abandoned lock, the principal spillway can pass 11,700 cfs with approximately 0.6 feet of freeboard at the earthen abutments. Additional freeboard could be achieved by operating the abandoned lock gate and/or powerhouse gates. Therefore, the dam has sufficient spillway capacity to pass the design flood.

Copies of the hydraulic calculations used to make this determination are on file with the MDEQ Dam Safety Unit.

OPERATION AND MAINTENANCE

According to our records, a written O&M Plan, outlining procedures for upkeep and operation of the dam, has never been prepared for this dam. Though not required under Part 315, it is strongly recommended that such a plan be prepared and reviewed and updated periodically. Updated copies should be provided to the Dam Safety Program.

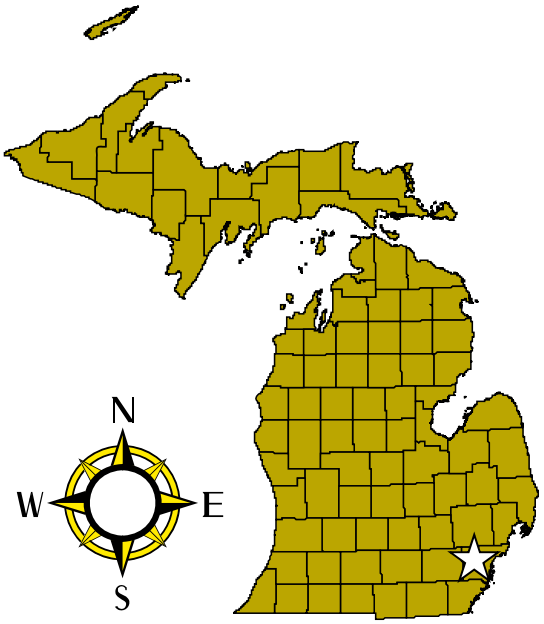
EMERGENCY ACTION PLAN

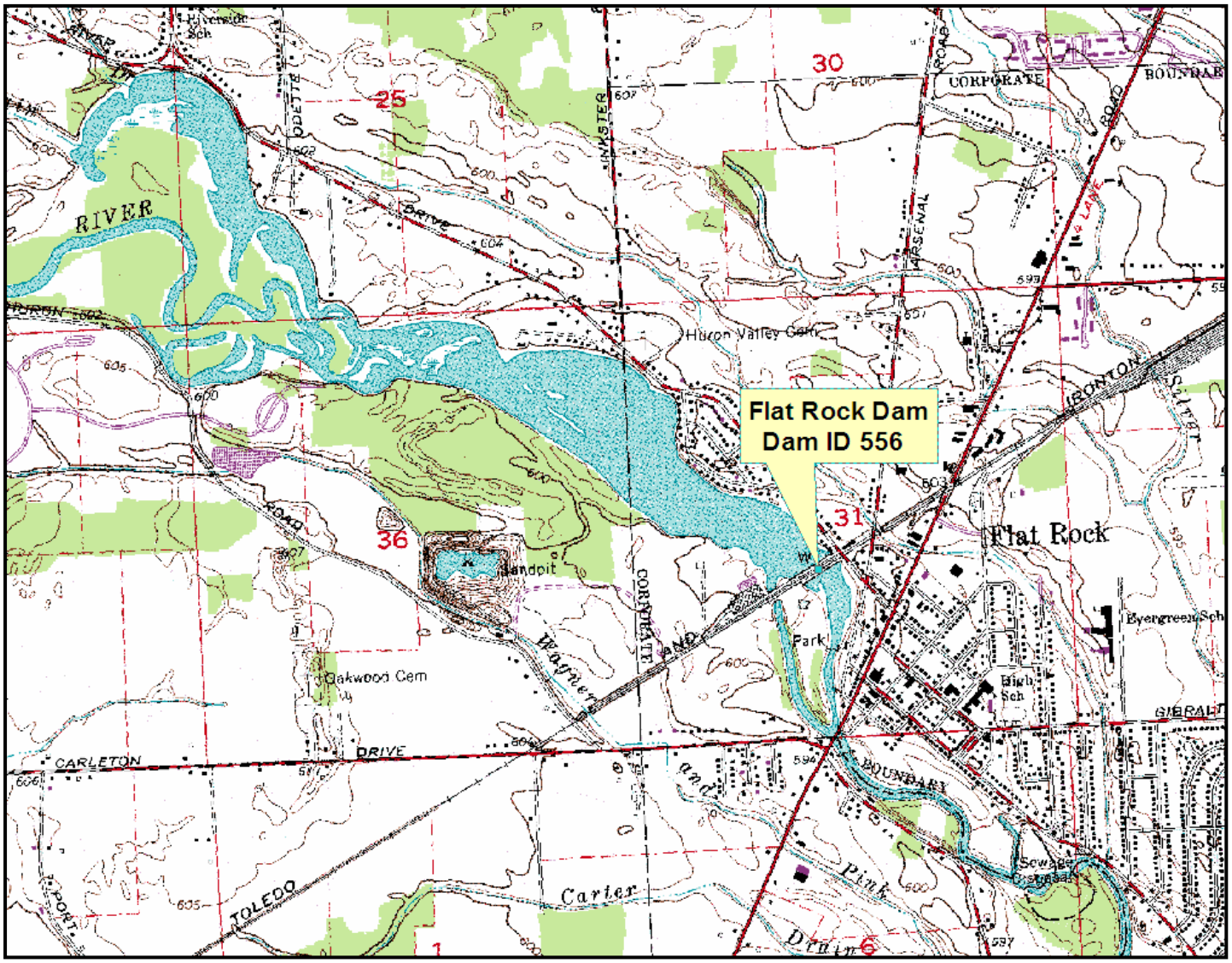
An emergency action plan (EAP) is required for this high hazard potential dam. An EAP has been prepared and an updated copy was last provided to this office on December 9, 2015. This fulfills your Part 315 periodic EAP review requirements for this inspection cycle.

APPENDICES

A location map, inspection photographs, and the 2017 DEQ estimated flood flows are attached.

Flat Rock Dam
Dam ID 556
Section 31, T 04S, R 10E
Wayne County





FLAT ROCK DAM
WAYNE COUNTY
DAM ID NUMBER 556

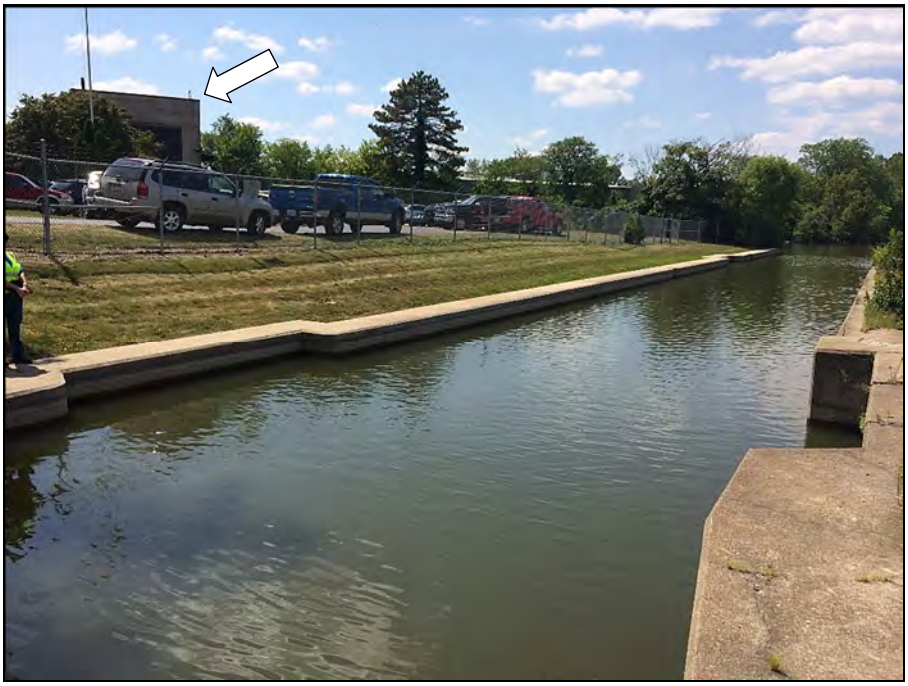
Photograph 1 – Upstream face of right abutment viewed from right
Note the small trees and brush near the spillway structure

Photograph 2 – Abutment crest viewed from right

Photograph 3 – Downstream face of right abutment viewed from right

Photograph 4 – Left abutment viewed from left
Note the foot traffic erosion

Photograph 5 – Trees growing from left abutment



Photograph 6 – Earthen needle section located between lock and powerhouse
Note the arrow indicating the location of the former powerhouse

Photograph 7 – Principal spillway crest viewed from left
Note the minor buildup of woody debris

Photograph 8 – Upstream left spillway abutment wall

Photograph 9 – Downstream left spillway abutment wall
Note the minor spalling and cracking

Photograph 10 – Upstream right spillway abutment wall
Note that a portion of this wall was recently reconstructed

**Photograph 11 – Downstream right spillway abutment wall
Note the spalling and fish ladder outlet**

Photograph 12 – Downstream bridge viewed from right

Photograph 13 – Typical spalling of bridge piers

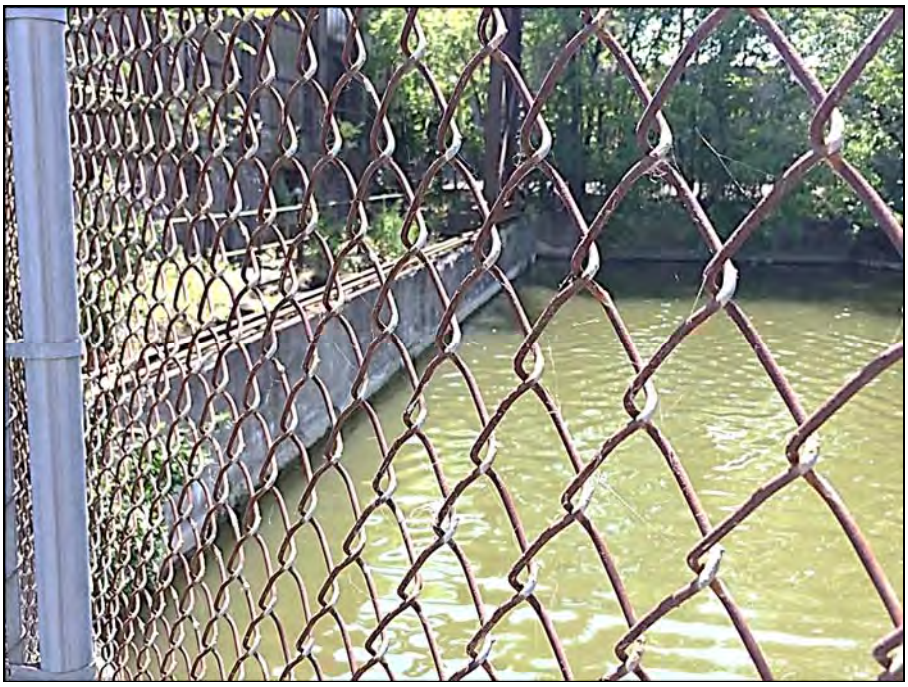
Photograph 14 – Typical spillway bay viewed from downstream

Photograph 15 – Abandoned lock viewed from upstream
Note that the right wall was recently reconstructed

Photograph 16 – Abandoned lock gates
Note that the right sluice gate feeds the fish ladder

Photograph 17 – Left wall of abandoned lock
Note that this is the original wall and shows signs of deterioration

Photograph 18 – Wooden fish ladder viewed from upstream



Photograph 19 – Powerhouse inlet viewed from left

Photograph 20 – Small powerhouse head gate viewed from right
Note the deteriorated concrete and exposed reinforcing steel

DAM SAFETY INSPECTION REPORT

FLAT ROCK DAM – DAM ID 556
HURON RIVER
WAYNE COUNTY – SW ¼ Section 31, T04S, R10E

OWNER/OPERATOR:

Huron-Clinton Metropolitan Authority
13000 High Ridge Drive
P.O. Box 2001
Brighton, Michigan 48116-8001
810-227-2757

HAZARD POTENTIAL CLASSIFICATION:

High

INSPECTION DATE:

September 15, 2014

REPORT DATE:

October 6, 2014

PREPARED AND INSPECTED BY:

Lucas A. Trumble, P.E.
Hydrologic Studies and Dam Safety Unit
Water Resources Division
Department of Environmental Quality
P.O. Box 30458
Lansing, Michigan 48909-7958
517-284-5581

INTRODUCTION

The purpose of this inspection is to evaluate the structural condition and hydraulic capacity of this dam as required by Part 315, Dam Safety, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. This inspection was conducted by the Michigan Department of Environmental Quality (MDEQ) in response to a request by the dam owner, the Huron-Clinton Metropolitan Authority (HCMA). The report is limited to a discussion of observations based on a visual investigation and review of any previous inspection reports, plans, and data which are available. This report should not be considered an in-depth engineering investigation. This inspection does not include an evaluation of the bridge located immediately downstream of the spillway. Further evaluation of the structural condition of the bridge by the bridge owner is warranted.

All references to “right” and “left” in this report are based on the observer facing downstream.

CONCLUSIONS AND RECOMMENDATIONS

The Flat Rock Dam is in fair overall condition. Based upon observations at the time of the inspection, there were no apparent structural deficiencies that may lead to the immediate failure of the dam. The dam has adequate spillway capacity to safely convey the design flood. As part of this inspection it was determined that the Huron-Clinton Metropolitan Authority owns the principal spillway and abandoned lock portions of the dam, while Flat Rock Metal, Incorporated owns the former powerhouse structure. The following recommended actions are listed by ownership responsibility and by priority.

Huron-Clinton Metropolitan Authority:

1. Monitor the spalled concrete of the principal spillway structure on a semi-annual basis. Consult a qualified engineer as conditions warrant.

2. Monitor the principal spillway for debris buildup on a quarterly basis and during high flow events. Remove debris as necessary.

3. Remove all small trees and brush from both earthen embankments. This recommendation is repeated from the 2011 inspection report and should be completed as soon as reasonably possible. After removal of trees and brush, the entire embankment should be mowed a minimum of two times per year to prevent further establishment of woody vegetation.

4. Remove all vegetation from the left lock wall and from the log boom at the inlet of the lock system by October 1, 2015.

5. Backfill, compact, and seed the eroded areas along the downstream face of the left embankment. This recommendation is repeated from the 2011 inspection report and should be completed as soon as reasonably possible.

6. Monitor the condition of the wooden fish ladder structure for deterioration and increased leakage on a quarterly basis. Implement repairs as needed.

7. Prepare and keep current an operation and maintenance (O&M) plan for the dam. Provide a copy of the plan to the Dam Safety Program.

Flat Rock Metal, Incorporated:

1. Provide access to Dam Safety Program staff to complete an inspection of the former powerhouse structure. Otherwise, if desired, enlist the services of a qualified engineer to inspect the structure as soon as practical. As part of the regulated dam, the powerhouse is required to be inspected every three years along with the remainder of dam.

The high hazard potential rating for this dam remains appropriate.

PROJECT INFORMATION

The current Flat Rock Dam was constructed in 1924 by Henry Ford to generate hydroelectric power. The dam is no longer used for power generation. The dam consists of a 492-foot wide concrete spillway with an abandoned lock system immediately to the right of the spillway. The abandoned locks now serve to control flow to a fish ladder constructed downstream of the head gates. An abandoned powerhouse is located approximately 250 feet right of the spillway. The former powerhouse building now houses Flat Rock Metal, Incorporated, a local metal manufacturing plant.

The dam has a structural height of 16.5 feet, a hydraulic height of 15.9 feet, and maintains 9 feet of head with 4.5 feet of freeboard, creating a 188-acre impoundment under normal flow conditions. The dam is flanked by very short earthen embankments at each end.

The dam was originally inspected under the National Dam Safety Program in 1979 by Ayres, Lewis, Norris, & May, Incorporated (ALMN). Subsequently, the dam has been inspected under Part 315 by ALMN in 1987; by DEQ Staff in 1999, 2002, and 2011; and by Stantec Consulting Michigan, Incorporated (Stantec) in 2005. A supplemental condition survey and conceptual design report was completed by Stantec in 2006. Copies of these reports along with engineering plans for the dam are on file with the Dam Safety Program.

SITE INVESTIGATION

The following discussion of the physical condition of the dam and appurtenances is based on observations and photographs obtained on the date of this inspection. This inspection report does not include an assessment of the bridge located immediately downstream of the spillway. However, visual observations during the course of the dam inspection indicate that a further investigation of the structural condition of the bridge is warranted.

The short earthen embankments, shown in Photographs 1 through 5, are in fair conditions. No sloughs, slumps, differential settlement, cracking, or major erosion was observed. However, both embankments were overgrown with small trees and brush. Trees and brush can provide shortened seepage pathways along their root systems that can lead to internal erosion (piping) of embankment materials, cause large section loss in the event of a blow down, provide a haven for burrowing animals, and obscure underlying deficiencies. Therefore, all trees and brush should be removed from the earthen embankments. This recommendation is repeated from the 2011 inspection report and should be completed as soon as reasonably possible. The entire embankment should be mowed a minimum of two times per year to prevent further establishment of woody vegetation.

Additionally, some minor foot traffic erosion is present along the downstream face of the left embankment, as shown in Photograph 5. This condition does not currently pose a threat to the stability of the embankment, but was noted in the 2011 inspection report and should be backfilled, compacted, and seeded as soon as reasonably possible to prevent further erosion from developing.

The principal spillway, shown in Photographs 6 through 10, is also in fair condition. No misalignment, differential settlement, or severe cracking or deterioration was observed. Moderate spalling is evident in all spillway bays, but does not currently pose a threat to the structural integrity of the dam. The spalled areas should be monitored on a semi-annual basis. Any major deterioration should be further analyzed by a qualified engineer and repaired as appropriate.

Additionally, large woody continues to become lodged between the principal spillway and the downstream bridge piers. This condition, shown in Photograph 6, does not currently pose a threat to the safety of the dam, but if enough debris built up below the spillway; its ability to convey flood flows would be compromised. Clogging of the spillway bays could result in premature overtopping of the earthen portions of the dam, potentially resulting in severe erosion damage or even breaching failure of the embankment. Therefore, the principal spillway should be monitored on a quarterly basis and during high flow events for buildup of debris. Debris should be removed as necessary to prevent clogging of the spillway bays.

Photographs 11 through 14 show the abandoned lock system which exists immediately right of the principal overflow spillway. This structure is in fair overall condition. The right channel wall of the lock system serves as the right abutment of the principal spillway structure. This wall was repaired in 2007, under the authority of DEQ Permit No. 07-82-0168-P, and remains in excellent condition. The left channel wall was not repaired in 2007, and is in considerably worse condition. Moderate spalling and cracking are evident along the entire length of the left wall. Additionally, vegetation was observed to be growing from cracks in the concrete wall as well as from the log boom system at the inlet of the lock channel. This condition, shown in photographs 11 through 13, does not currently impact the stability of the structure; however if left uncorrected will accelerate the deterioration of the concrete and boom logs. Therefore, all vegetation should be removed from the left lock wall and log boom by October 1, 2015.

The fish ladder, shown in Photographs 15 through 17, is also in fair condition. No major deterioration was observed. However, leakage between the boards of the wooden structure continues to be an issue. This leakage is not currently causing concern for erosion adjacent to the structure, but as the boards deteriorate; leakage will increase, potentially causing erosion concerns. Therefore, the wooden fish ladder structure should be observed quarterly for significant deterioration and increased leakage. Repairs should be implemented as needed.

The former powerhouse, located approximately 250 feet right of the principal spillway, is owned by Flat Rock Metal, Incorporated and was not entered as part of this inspection. Photographs 18 and 19 were taken from the exterior of the structure and show significant deterioration of the concrete foundation. Additionally, flow was observed in the channel adjacent to the left wall of the left wall of the powerhouse building, indicating open or deteriorated gates at the powerhouse inlet. To our knowledge, the powerhouse structure has not recently been inspected by a licensed professional engineer. As part of the regulated dam, an engineering inspection of the structure should be completed as soon as reasonably possible. The responsibility for completing this inspection lies with the owner of the structure, per Section 324.31518 of Part 315.

STRUCTURAL STABILITY

Based upon observations during the inspection, there were no indicators of any conditions that represent an immediate threat to dam stability.

HYDROLOGY AND HYDRAULICS

The contributing drainage area to the Huron River at the Flat Rock Dam is approximately 876 square miles. The design discharge for this high hazard potential dam is the 0.5 percent chance (200-year) flood discharge of 11,700 cubic feet per second (cfs). Neglecting flow through the former powerhouse and abandoned lock, the

spillway has a capacity of 11,740 cfs with 0.6 foot of freeboard. Therefore, the dam has sufficient spillway capacity to pass the design flood.

Hydraulic calculations are included in previous inspection reports and are on file with the MDEQ Dam Safety Unit.

OPERATION AND MAINTENANCE

A written O&M plan, outlining procedures for upkeep and operation of the dam, should be prepared for this dam. Once prepared, the plan should be reviewed and updated periodically. Updated copies should be provided to the Dam Safety Program.

EMERGENCY ACTION PLAN

An emergency action plan (EAP) is required for this high hazard potential dam. An updated EAP was last provided to this office on July 25, 2014. This fulfills your Part 315 periodic EAP review requirements for this inspection cycle. However, the business hours phone number for the Water Resources Division has changed. Please revise the EAP emergency notification flowchart to include the following contact information:

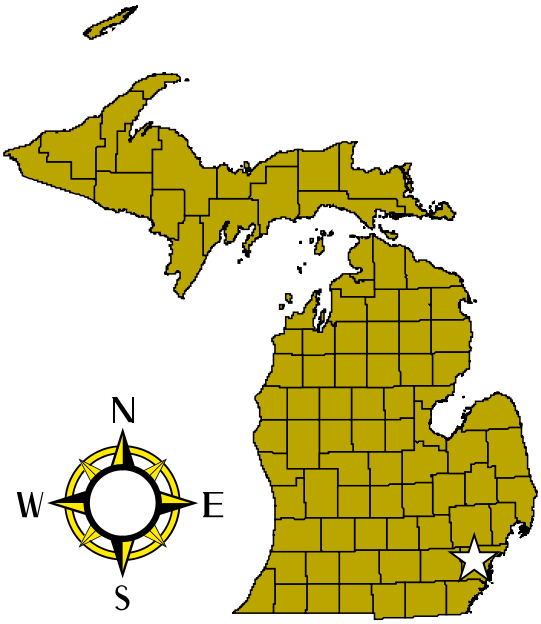
Department of Environmental Quality
Water Resources Division
Dam Safety Program
Office Hours: 517-284-5567
Non-Office Hours: 800-292-4706

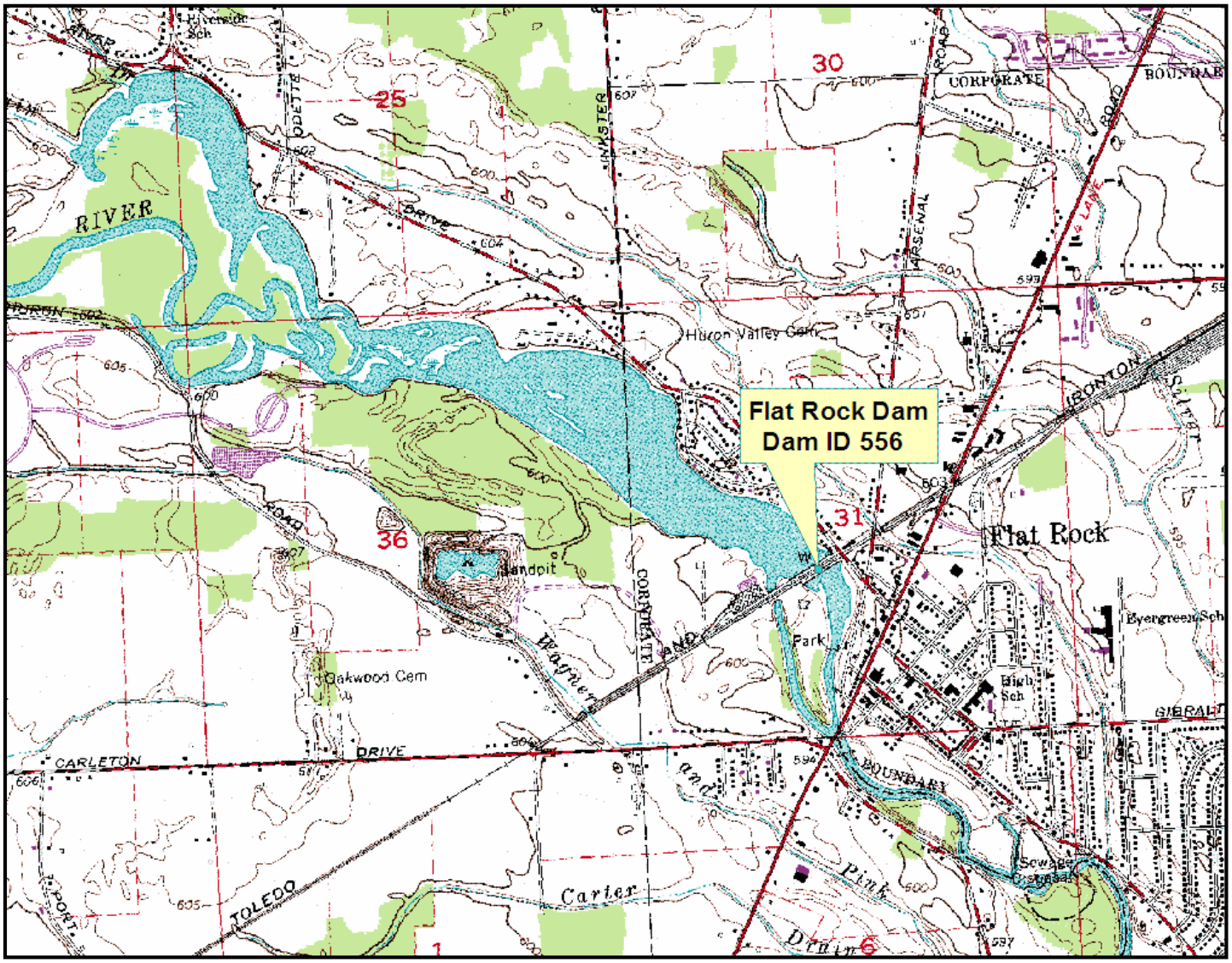
Please note that these are both general office numbers and persons calling to test the EAP notification flow chart or to report a dam safety emergency should ask for the Dam Safety Program staff on call.

APPENDICES

A location map, inspection photographs, and the 2014 Hydrologic Studies Unit estimated flood flows are attached.

Flat Rock Dam
Dam ID 556
Section 31, T 04S, R 10E
Wayne County





Photograph 1 – Upstream face of right embankment viewed from right.

Photograph 2 – Embankment crest viewed from right.

Photograph 3 – Downstream face of right embankment viewed from left.

Photograph 4 – Upstream face of left embankment viewed from left.

Photograph 5 – Downstream face of left embankment viewed from left. Note the foot traffic erosion.

Photograph 6 – Principal spillway crest viewed from right. Note the minor debris build up.

Photograph 7 – Upstream right principal spillway abutment wall viewed from upstream.

Photograph 8 – Downstream right principal spillway abutment wall. Note the outlet of the fish ladder.

Photograph 9 – Upstream left principal spillway abutment wall viewed from right.

Photograph 10 – Downstream left principal spillway abutment wall viewed from right.

Photograph 11 – Inlet to abandoned lock system viewed from upstream. Note the overgrowth of vegetation at the log boom.

Photograph 12 – Upstream portion of lock wall viewed from right. Note the deteriorated concrete vegetation growing from cracks.

Photograph 13 – Downstream portion of lock wall viewed from right. Note the deteriorated concrete and vegetation growing from cracks.

Photograph 14 – Gate system for abandoned locks. Note the raised gate now provides water for a downstream fish ladder.

Photograph 15 – Fish ladder as it passes under bridge downstream of dam.

Photograph 16 – Fish ladder as it outlets downstream of the bridge.

Photograph 17 – Fish ladder outlet viewed from downstream. Note the overgrowth of vegetation.

Photograph 18 – Abandoned powerhouse (now Flat Rock Steel) viewed from left.

Photograph 19 – Channel along right powerhouse wall.
Note that there was flow through this channel on the date of the inspection.

Photograph 20 – Impoundment viewed from downstream bridge.

FLAT ROCK DAM, WAYNE COUNTY
DAM ID NUMBER 556

Photograph 21 – Downstream Huron River viewed from bridge.

RE: flood or low flow discharge request (ContentID - 168812)
deq-wrd-qreq deq-wrd-qreq@michigan.gov
Sent: Tue 9/30/2014 5:56 PM
To: Trumble, Luke (DEQ) TrumbleL@michigan.gov

This reply is being sent via email only.

We have estimated the flood frequency discharges requested in your email of September 19, 2014 (Process No. 20140389), as follows:

Huron River at Flat Rock Dam, Dam ID 556, Section 31, T4S, R10E, City of Flat Rock, Wayne County, has a drainage area of 876 square miles. The design discharge for this dam is the 0.5% chance (200-year) flood. The 0.5% chance peak flow is estimated to be 11700 cubic feet per second. (Watershed Basin No. 15 Huron).

These estimates should be confirmed by our office if an application is not submitted within one year. If you have any questions concerning the discharge estimates, please contact Ms. Susan Greiner, Hydrologic Studies and Dam Safety Unit, at 517-284-5579, or by email at: GreinerS@michigan.gov.

-----Original Message-----
From: trumblel@michigan.gov [mailto:trumblel@michigan.gov]
Sent: Friday, September 19, 2014 10:17 AM
To: deq-wrd-qreq
Subject: flood or low flow discharge request (ContentID - 168812)

Requestor: Luke Trumble
Company: MDEQ
Address: 525 W Allegan St
City: Lansing, MI
Zip: 48933
Phone: 517-284-5581
Date: 9/19/14
F0.5percent: Yes
ContactAgency: None Selected
ContactPerson:
Watercourse: Huron River
LocalName: Flat Rock Dam Impoundment
CountyLocation: Wayne
CityorTownship: Flat Rock
Section: 31
Town: 04S
Range: 10E
Location: This request is for the Huron River at the Flat Rock Dam. I made the previous flood flow request in 2011, Job No. 20110291-3, processed by Susi Greiner.
FFR1: Dam