Emergency Action Plan

Shiras Steam Plant Holding Pond (WDS ID #478988)
City of Marquette, Michigan
Owned by Marquette Board of Light and Power

Project Number: 60445171

April 13, 2017

Emergency Action Plan For

Shiras Steam Plant Holding Pond

400East Hampton Street, Marquette, Michigan

County: Marquette

Owner: Marquette Board of Light and Power (MBLP) – Executive Director

Telephone: 906-228-0346

Cell: 906-228-0340 (24-hrs)

Operator: Shift Supervisor

Telephone: 906-228-0340

Cell: 906-228-0340 (24-hrs)

Owner Mailing Address: 2200 Wright Street

Marquette, Michigan 49855

Prepared for:

Mr. John Schultz
Marquette Board of Light and Power
2200 Wright Street
Marquette, Michigan 49855

Prepared by:

Shannon Allen, P.E.

AECOM
1230 Wilson Street
Marquette, Michigan 49855
aecom.com

Quality information

Prepared by	Checked by	Approved by
Shannon Allen, P.E.	Clifford Shierk, P.E.	Geoffrey L. Kruger, P.E.

Certification Statement

CCR Unit: Marquette Board of Light and Power, Shiras Steam Plant Holding Pond

I, Geoffrey L. Kruger, being a Registered Professional Engineer in good standing in the State of Michigan, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this Emergency Action Plan has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the Emergency Action Plan dated April 2017 meets the requirements of 40 CFR § 257.73.

GEOFFREY L. KRUGER
Printed Name

4/13/2017
Date

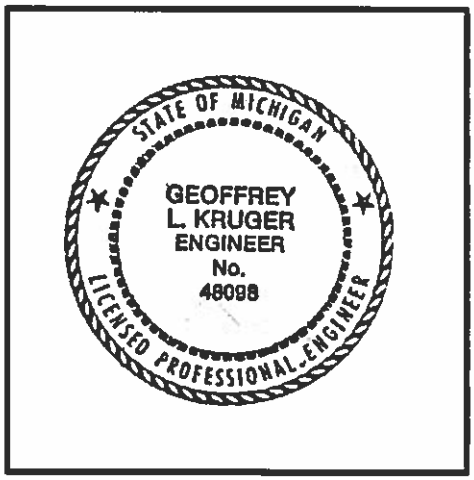


Table of Contents

1. Introduction

1.1 Purpose and Intent

This Emergency Action Plan (EAP) was developed to provide a single source of information in the event of an emergency as required for Coal Combustion Residual (CCR) impoundments determined to be either a high hazard potential or significant hazard potential CCR impoundment per section §257.73 of the U.S. Environmental Protection Agency (EPA) Final Rule: Disposal of Coal Combustion Residuals from Electric Utilities.

The purpose of an Emergency Action Plan (EAP) is to provide the owner/operator of the CCR impoundments with a clear plan of action when any emergency arises. An emergency is identified as any condition which:

- Develops unexpectedly;
- Endangers the structural integrity of the impoundment; and
- Could result in the impoundment's failure, requiring immediate action.

By writing and implementing an EAP the owner/operator of the impoundment can reduce the risk of human life loss or injury and minimize property damage during an unusual or emergency event.

This EAP is for the Marquette Board of Light and Power (MBLP) Shiras Steam Plant Holding Pond located in Marquette, Michigan. The EAP provides a description of the impoundment and the area at risk as well as contact information for all parties involved in responding to or affected by an emergency at the impoundment. The EAP outlines what actions are required in the event of an emergency.

1.2 EAP Summary

This document includes:

- Definition of the events or circumstances involving the CCR impoundment that represent a safety emergency and the procedures that will be followed to detect a safety emergency in a timely manner.
- Site location map delineating the downstream area which would be affected in the event of a CCR impoundment failure.
- Contact telephone numbers for individuals that must be contacted in the event of an emergency, their respective responsibilities, and notification procedures.
- Procedures following an emergency at the impoundment.
- Provisions for an annual face-to-face meeting or exercise between representatives of the CCR impoundment and the local emergency responders.

The plan will be implemented once events or circumstances involving the CCR impoundment represent a safety emergency is detected, including conditions identified during periodic structural stability assessments, annual inspections, and inspections by a qualified person. The responsibilities for responding to an incident and implementing the plan are included in the Summary of EAP Responsibilities and Summary of Owner Responsibilities in Appendix B. One copy of this plan will be kept at the Shiras Steam Plant.

The plan will be amended by the owner or operator of the CCR impoundment whenever there is a change in conditions that would substantially affect the EAP in effect. This plan will, at a minimum, be evaluated every five years to ensure the information required is accurate. If the owner or operator of the CCR impoundment determines during a periodic hazard potential assessment that the CCR impoundment is no longer classified as a significant hazard potential CCR impoundment, then the owner or operator is no longer subject to the requirement to prepare and maintain a written EAP.

1.3 Description of Impoundment

The Shiras Steam Plant is located at East Hampton Street in Marquette, Michigan along the shoreline of Lake Superior. The Shiras Steam Plant generating station has one CCR surface impoundment identified herein as the Holding Pond. The Holding Pond is located north of the generating station. The location of the impoundment is shown on the Site Location Diagram included in Appendix A.

The Holding Pond is composed of 5 interconnected cells which are enclosed by steel sheet pile walls and are in hydraulic communication via a set of weirs built into the walls. The south and west boundaries of the Holding Pond are formed by the shoreline of Lake Superior. The east and north boundaries are formed by sheet pile walls originally constructed in 1981. A new wall was placed on the inside of the existing north wall in 2013 due to the poor condition of the original wall. Inner walls for Cells 1, 2, and 3 were constructed in 1990. Abandoned sheet pile walls also remain in place from previous configurations.

The Holding Pond is operated as a zero-discharge facility during normal conditions and does not discharge water. All water discharged to the Holding Pond via sluicing or precipitation is held within the ponds, pumped to a 300,000 gallon equalization/reuse storage tank, and/or recirculated to the plant. Low, medium, and high service water pumps recycle the reclaimed water for plant use. The normal operating level of the holding pond varies, but is approximately at elevation 606.0 feet IGLD85. All elevations are given according to the International Great Lakes Datum of 1985 (IGLD85), unless noted otherwise. During emergency situations, an outfall weir at elevation 606.6 feet and an emergency overflow weir at elevation 607.4 feet, which are regulated via a NPDES permitted outfall (#004A), discharge water from the Holding Pond through the east wall directly into Lake Superior. However, discharge from the pond has been reserved for emergency situations and there have reportedly been only three to five discharges in the last fifteen years. The north and east perimeter sheet pile wall top elevation is 609.0 feet. The ordinary high water surface elevation of Lake Superior is 603.1feet as evaluated by the United States Army Corps of Engineers Detroit District. Additional information for the Holding Pond is provided in Table 1.

Table 1. CCR Surface Impoundment Description

Information	Holding Pond (WDS ID#478988)
Type of Impoundment	Combination of Earthen and Steel Sheet Pile Wall
Height of Impoundment	9 to 11 feet
Max Impoundment Storage	5,750 cubic yards
Use of Impoundment	CCR Operations
Hazard Rating	Significant

AECOM prepared a hazard potential classification assessment in October 2016 for the CCR surface impoundment. Significant upstream and downstream features which could be affected by a failure are included on the Location Map included in Appendix A.

2. Safety Emergency

2.1 Definition of Safety Emergency

A safety incident is an impending or actual sudden uncontrolled release or excessive controlled release (outside of the permitted allowances) of water from the Holding Pond. The release may be caused by damage to or failure of the structure, flood conditions unrelated to failure, or any condition that may affect safe operation. The release of water may or may not endanger human life, downstream property, or the operation of the structure.

2.2 EAP Response Process

There are generally four steps that should be followed when an unusual or emergency incident is detected. The steps constitute the EAP response process and are as follows:

1. Incident detection, evaluation, and emergency level determination
2. Notification and communication
3. Emergency Actions
4. Termination and follow-up

These steps are discussed further in the following subsections.

2.2.1 Incident Detection, Evaluation, and Emergency Level Determination

An incident would be considered an unusual or abnormal condition and could be observed using the following:

1. Detecting existing or potential failures.
2. Measuring water level. Normal water level within the impoundments should be below elevation 606.6 feet (outfall weir elevation), which is 2.4 feet below the design crest elevation of 609.0 feet.
3. Reviewing monitoring equipment such as movement monitoring targets.
4. Checking instrumentation.
5. Analyzing and confirming data.

After an unusual event or incident is detected and confirmed, the event should be categorized into one of the established emergency levels based on the severity of the initiating condition or triggering events. The levels of emergency are:

- Non-Failure
- High Flow
- Potential Failure
- Imminent Failure

It is important to determine the severity of the emergency before responding to an unusual event at the impoundments. The *Guidance for Determining the Emergency Level* table and *Level of Emergency Determination Chart* included in Appendix B are to be used to determine the severity of the emergency and to guide the owner/operator's actions during an emergency response. Descriptions of the levels of emergency are provided in the following subsections.

2.2.1.1 Non-Failure Level of Emergency

The Non-Failure emergency level is appropriate for an event that will not, by itself, lead to a failure, but requires investigation and notification of internal and/or external personnel. Examples are:

1. New seepage or leakage on the downstream side of the impoundment.
2. Presence of unauthorized personnel.
3. Malfunction of a gate.

Some incidents may only require internal response, whereas others may lead to unexpected high releases that could pose a hazard to the downstream public and would require the notification of outside agencies.

2.2.1.2 High Flow Level of Emergency

The High Flow emergency level indicates that flooding is occurring on the system, but there is no apparent threat to the integrity of the impoundment. The High Flow emergency level is used by the owner to convey to internal resources that downstream areas may be affected by the impoundment's release and close monitoring of the situation is warranted. Although the amount of flooding may be beyond the control of the owner, information on the timing and amount of release from the impoundment may be helpful to authorities in making decisions regarding warnings and evacuations.

2.2.1.3 Potential Failure Level of Emergency

The Potential Failure emergency level indicates that conditions are developing that could lead to a failure. Examples are:

1. Rising reservoir levels that are approaching the top of the non-overflow section of the impoundment.
2. A verified security threat.
3. Wave action from Lake Superior.

Potential Failure should convey that time is available for analyses, decisions, and actions before the impoundment could fail. A failure may occur, but predetermined response actions may moderate or alleviate failure.

2.2.1.4 Imminent Failure Level of Emergency

The Imminent Failure emergency level indicates that time has run out, and the impoundment has failed, is failing, or is about to fail. Imminent Failure typically involves a continuing and progressive loss of material from the impoundment. It is not usually possible to determine how long a complete breach of the impoundment will take. Therefore, once a decision is made that there is no time to prevent failure, the Imminent Failure warning must be issued. For purposes of evacuation, emergency management authorities may assume the worst-case condition that failure has already occurred.

2.2.2 Notification and Communication

2.2.2.1 EAP Notification Flowchart

After the emergency level at the impoundment has been determined, notifications are made in accordance with the EAP Notification Flowchart. The purpose of the EAP Notification Flowchart is to provide a visual map of who is to be notified the order of notification and who is responsible for notifying various individuals and agencies/organizations. The Notification Flowchart can be customized based on the level of emergency as determined under the Level of Emergency Determination Chart.

The Emergency Action Plan Notification Flowchart for the Holding Pond can be found in Appendix B and was last updated on the date shown on the bottom of the page. The Notification Flowchart will be activated with a telephone call to the Shiras Steam Plant Shift Supervisor. Contact with the local law enforcement will be maintained throughout the emergency by phone. See Appendix B for the Emergency Communication Plan.

2.2.2.2 Notification to Emergency Management Authorities

When performing notification and communication activities, it is important that people speak in clear, nontechnical terms to ensure those being notified understand what is happening, what the current emergency level is, and which actions to take. To assist in this step, prescripted messages to help the caller adequately describe the emergency situation to emergency management authorities are included on the Notification Flowcharts included in Appendix B.

2.2.2.3 Status Updates

After initial notification, the owner should make periodic status reports to the affected emergency authorities and other stakeholders in accordance with the Notification Flowcharts. If it appears that the situation is continuing to deteriorate despite actions being taken to moderate or alleviate the failure, local authorities may decide to change their course of action.

2.2.3 Emergency Actions

After the initial notifications have been made, the owner will act to save the impoundment and minimize impacts to life, property, and the environment. During this step, there is a continuous process of taking actions, assessing the status of the situation, and keeping others informed through communication channels established during the initial notifications. The EAP may go through multiple emergency levels as the situation improves or deteriorates. The following subsections include specific actions to minimize impacts.

2.2.3.1 High Water Level

In the event that pool elevations rise to 2.4 feet below the design embankment crest elevation (609.0 feet), the Pond Level Reduction required by Procedure OP-AUX-24 for pond drawdown should be followed.

2.2.3.2 Embankment and Sheet Pile Wall Deficiencies and Seepage

In the event that deficiencies or seepage are observed in the western and southern perimeter earthen embankments or northern and eastern sheet pile walls, the following procedures should be followed:

1. Lower the water within the impoundment to a level below the observed deficiency or seepage to a minimum level equal to the Lake Superior elevation.
2. Install temporary controls as necessary to control the deficiency or seepage.
3. Perform a field investigation to determine the cause of the deficiency or seepage.
4. Determine and implement corrective measures.

2.2.4 Termination and Follow-Up

Generally, the owner, or owner's impoundment safety expert is responsible for notifying the authorities that the emergency condition has been stabilized. Marquette County Emergency Management is responsible for declaring an end to the public emergency response.

The following subsections discuss termination and follow up procedures once the incident has been resolved. An Emergency Termination Log is included in Appendix B to document conditions and decisions.

2.2.4.1 Reentry and Recovery

The emergency at the Shiras Steam Plant Holding Pond will not be considered over until inspected by the owner's engineer and the Marquette County Emergency Management Coordinator has been consulted.

Once the emergency is declared over, the owner's engineer will inspect the impoundments for any damage. A post-disaster review of the inspection will be held to determine what actions may be needed to ensure that the impoundment is in compliance with state and federal standards. The review may result in formal orders issued to the owner and may require the submittal of plans and specifications for repair.

2.2.4.2 After Action Review

After an impoundment emergency is ended, a review of the event should take place as soon as practicable. If the review does not take place within 10 to 15 days of the emergency, valuable data may be lost. The following should be discussed and evaluated:

1. Events or conditions leading up to, during, and following the incident.
2. Significant actions taken by each participant and improvements for future emergencies.
3. All strengths and deficiencies found in the incident management process, materials, equipment, staffing levels, and leadership. The review will determine what was done correctly during the EAP activation, what was done incorrectly and what could be improved.
4. Corrective actions identified and a planned course of action to implement recommendations.

The results should be documented in an After Action Report and used as a basis for revising the EAP. Any needed changes to the Shiras Steam Plant Holding Pond EAP will be made by the Shiras Steam Plant. An updated EAP including an updated Approval/Concurrence will be provided to all holders of the EAP. A copy of the updated EAP will be kept in the Shiras Steam Plant Control Room.

3. Hydraulic Shadow Map

The purpose of the Hydraulic Shadow Map, or inundation map, is to provide a picture of the area that would be affected by a complete failure of the impoundment in order to determine who must be notified and/or evacuated in an emergency and the timeliness to facilitate notification and evacuation. The Hydraulic Shadow Map identifies individuals and other infrastructure such as building, bridges, roads, power lines, sewer, gas and water lines that could be affected by the failure of the impoundment.

Due to the site configuration and topography, a site specific Hydraulic Shadow Map showing inundation zones was not produced. In the unlikely event there is a failure, the impounded water would either be released directly into Lake Superior to the north or onto a generally unoccupied portion of land to the west which would then drain directly to Lake Superior. Adjacent streets, buildings, and other significant features are indicated on the Site Location Diagram included in Appendix A. Primary and Secondary points of access to the site are also included on the map.

4. General Responsibilities

The owner is responsible for developing and maintaining the EAP. Owners and emergency management authorities are responsible for implementing the EAP. The Emergency Incident Log form in Appendix C should be used to document incident-related events by all entities involved with EAP implementation. The following subsections specify the responsibilities of all entities to ensure that effective and timely action is taken if an emergency occurs.

4.1 Owner Responsibilities

The owner is responsible for detecting and evaluating the safety incident, classifying the incident, notifying emergency management authorities, and taking appropriate response actions. Refer to Section 2.2.3 of this EAP for operator duties for given emergency response situations.

4.2 Notification and Communication Responsibilities

4.2.1 Notification Flowchart

Notifications are made in accordance with the EAP Notification Flowchart. Refer to Section 2.2.2.1 of this EAP for additional information and the Notification Flowchart in Appendix B.

4.2.2 Emergency Notification Lists

Emergency Notification Lists are lists of the names, addresses and telephone numbers of individuals, businesses, critical facilities and other entities who would be affected by a failure of the impoundments and who must be notified and/or evacuated in an emergency. The lists have been grouped based on the severity of the emergency. The Emergency Notification Lists for the Shiras Steam Plant Holding Pond can be found on the Notification Flowchart included in Appendix B and were last updated on the date shown on the bottom of the page.

4.2.3 Media Contact

Interaction with the media should be implemented through the local or State emergency management authority. These agencies should have a Public Information Officer (PIO) and/or a Joint Information Center for disseminating information and handling inquiries.

Local emergency management authorities may activate an Emergency Operations Center (EOC) to serve as a central co-ordination center for emergency response, warning, and evacuation activities. The owner or their representative should go to the EOC to help agency personnel understand the project specific information and inundation maps.

Proper co-ordination and communication between the on-site technical personnel, PIOs and emergency personnel at the EOC are of critical importance to the successful implementation of the EAP. These activities should be thoroughly tested during comprehensive EAP exercises and modified as necessary.

4.3 Evacuation Responsibilities

Warning and evacuation planning and implementation are responsibilities of local emergency management authorities with the legal authority to perform these actions. Under the EAP, the owner is responsible for notifying the appropriate emergency management authority when an incident is anticipated, is imminent, or has occurred.

Owners should not assume or usurp the responsibility of government entities for evacuation of people. However, there may be situations in which routine notification and evacuation will not be sufficient. In some cases, owners may arrange to notify affected individuals directly. Such procedures should be coordinated with the appropriate authorities before an emergency situation develops.

4.4 Monitoring, Security, Termination, and Follow-up Responsibilities

A person should be designated as an onsite monitor from the beginning of a safety incident until the emergency has been terminated. This person should provide status updates to the owner so the owner can keep all those involved with the implementation of the EAP informed of developing conditions.

Termination of a safety emergency is usually twofold. The entity that activates the EAP is usually responsible for determining when the safety situation has stabilized. This is typically the owner in consultation with engineers and safety experts but may include other State and Federal regulatory entities. The applicable emergency management authorities, on the other hand, are responsible for termination of the emergency response activities, including termination of an evacuation. Both the owner and the emergency response authorities should coordinate closely while making decisions to terminate both the safety event and response efforts.

Recovery activities will continue on different levels for all involved in the safety incident after the emergency has been terminated.

The owner should coordinate a follow-up evaluation after any emergency. All participants should be involved in this evaluation and should keep logs and records during the incident. An Emergency Incident Log and Emergency Termination Log are included in Appendix C. The results of the follow-up evaluation should be documented in a written report (After Action Report) and used to improve future response actions.

4.5 EAP Coordinator Responsibilities

The EAP Coordinator will be responsible for overall EAP-related activities, including but not limited to preparing revisions to the EAP, establishing training seminars, and coordinating EAP exercises. The Shiras Steam Plant Holding Pond EAP coordinator is the Executive Director, who is also the EAP contact for questions about the plan.

5. Preparedness

Preparedness typically consists of activities and actions taken before the development of an incident. Preparedness activities attempt to facilitate response to an incident as well as prevent, moderate, or alleviate the effects of the incident. The following subsections relate to preparedness actions.

5.1 Surveillance and Monitoring

Prompt detection and evaluation of information from instrumentation and physical monitoring is critical to the effectiveness of the EAP and timely emergency response.

The water level in the pond is monitored via ultrasonic instrumentation in cell 5 on a continuous basis. Data is provided to the operations personnel via the Distributed Control System (DCS). An alarm is generated when the pond level rises prior to discharge so that pond drawdown procedures can be implemented. A second alarm is generated at the point of discharge. Movement monitoring targets were installed in October 2015 near the top of the sheet pile walls to check for horizontal movement. Readings are taken on a yearly basis and would be compared over time to monitor for stability issues.

AECOM performed a structural inspection and analysis of the Holding Pond in 2013. Subsequent inspections were completed by AECOM in December 2015 and December 2016. No seepage was evident during the evaluation. The east steel sheet pile wall of the holding pond was observed to be in fairly good condition and the north sheet pile wall was observed to be in excellent condition during the structural analysis. The south and west sides of the Holding Pond are incised into the ground and were considered to pose no threat of failure during the structural inspection.

5.2 Evaluation of Detection and Response Timing

Total EAP implementation time from the initiation of an actual incident to determination of an emergency situation and is adequate based on continuous monitoring and rapid detection procedures in place.

5.3 Access to the Site

The primary access to reach the site by vehicle in Marquette is from South Front Street to East Hampton Street. In the event that the entrance at East Hampton Street is blocked, there is a secondary plant entrance off South Lake Street from South Front Street. Access to the site from local police and fire departments is anticipated to take about 5 to 10 minutes from both the primary and secondary route.

Several boat launches for Lake Superior, including the US Coast Guard office, are located just north of the site along North Lakeshore Boulevard and could be used as a secondary means of access to the site if necessary.

Primary and secondary access routes for reaching the site are shown on the site location map included in Appendix A.

5.4 Response During Periods of Darkness

The Shiras Steam Plant Holding Pond does not have any on-site lighting around the impoundment. If an event is identified during periods of darkness, action could be taken to illuminate the area where failures could occur, if necessary. During a power failure, on-site backup generators or rented generators could be used to operate equipment where manual operation is not feasible.

5.5 Response During Weekends and Holidays

The Shiras Steam Plant is operated 24 hours a day, 7 days a week. The phone number provided in the Notification Flowchart for the Shift Supervisor is manned 24-hours a day. Therefore, no special response is needed during weekends and holidays. Normal procedures should be followed.

5.6 Response During Adverse Weather

The Shiras Steam Plant is operated 24 hours a day, 7 days a week. Therefore, no special response is needed during adverse weather. Normal procedures should be followed. Refer to Section 5.3 for primary and secondary access to the site.

5.7 Alternative Sources of Power

Alternative sources of power are available on-site, which include portable gas powered generators.

5.8 Emergency Supplies and Information

Planning and organizational measures that can help the owner and emergency management authorities manage an emergency situation more safely and effectively include stockpiling materials, as a situation is developing, and equipment for emergency use and coordinating information between organizations.

5.8.1 Materials and Equipment

In the event of a high water excursion event that could result in an impoundment failure, on-site low, medium, and high pumps will be used by plant staff to direct water to the equalization/reuse storage tanks. In the event the equalization/reuse storage tanks are full and water continues to rise, water will discharge through the outfall weirs located on the east side of the impoundment. Additional pumps may be required to be rented and operated by plant staff should the water continue to rise above the emergency outlet weir.

In the event of embankment or sheet pile wall deficiencies, water within the impoundments should be lowered by plant operators below the observed deficiency using the pumping system currently in place unless those systems are not able to address the issue efficiently. In those situations, additional pumping equipment should be rented and excess water could be discharged to the sanitary sewer. Temporary controls such as sand, rip rap, and sheet pile may be installed by an outside contractor to control the deficiency, and earth moving or sheet pile installation equipment may be necessary for address corrective measures following a field investigation. Earth moving or sheet pile installation equipment is anticipated to be operated by a contractor hired to perform repairs to the impoundment.

Due to site constraints, additional material and equipment is not stockpiled on-site, but as stated above, can be brought in as a situation develops.

5.8.2 Available Resources

During an emergency, the owners/operators may need to bring in outside resources such as heavy equipment, sandbags, pumps, siphons or divers. A listing of the resources including provider names, addresses and telephone numbers available to the owner/operator of the Shiras Steam Plant Holding Pond can be found in Appendix B and was last updated on the date shown on the bottom of the page.

5.9 Co-ordination of Information

Refer to the Notification Flowchart in Appendix B when informing responsible parties of an emergency.

Information on weather should be obtained from the National Weather Service (NWS) at http://www.weather.gov/ or by phone at 317-856-0367. Co-ordination with the NWS is recommended to monitor storms, Lake Superior and river stages, and flood waves resulting from a failure.

5.10 Annual Review, Training, and Testing

The EAP should be reviewed on an annual basis to ensure that all contact information listed is accurate and that personnel are familiar with the EAP and understand their role in responding to an emergency.

Training and exercise plans should be designed and developed by those entities with responsibilities identified in the EAP. EAP action items and procedures should be exercised periodically for all individuals involved in its implementation so that individuals are familiar with their roles and responsibilities. Review of and training for the Shiras Steam Plant Holding Pond's EAP will occur on an annual basis. Based on changes identified in the annual review, copies of updated pages will be provided to all holders of the EAP. A copy of the most current EAP will be kept in the Shiras Steam Plant control room.

At least every five (5) years, the owner/operator of the Shiras Steam Plant Holding Pond will meet with the Marquette County Emergency Management Coordinator to discuss what changes have been made to the Marquette County All Hazards Emergency Response/Operations Plan and to determine what opportunities exist for exercises. Also, the owner/operator of the Shiras Steam Plant Holding Pond will review the Site Location Diagram to identify any significant land use changes in the hazard area.

The owner/operator should work with local emergency management to determine what opportunities exist to conduct or participate in impoundment related EAP exercises.

5.11 Alternative Systems of Communication

The list below provides information on the forms of communication that are available at the Shiras Steam Plant Holding Pond and operating procedures during an emergency event:

- Gaitronics facility paging system: to be used as primary communication to alert Shiras Steam Plant personnel.
- Phones: to be used to communicate with Shiras Steam Plant personnel and outside entities
- Email: to be used as backup or follow up communication
- Intranet: to be used to update Shiras Steam Plant personnel
- Radios: to be used as a secondary communication to phones, where appropriate

5.12 Public Awareness and Communication

Lake Superior is located downstream of the Shiras Steam Plant Holding Pond. Although there are no residences located downstream of the Holding Pond, public awareness measures include posting required documents in the operating record. Emergency management authorities will convey necessary information to the public during an event as necessary.

Appendix A – Figures

A.1 Site Location Diagram

A.2 Site Features

A.3 Holding Pond Plan and Cross Sections

AECOM

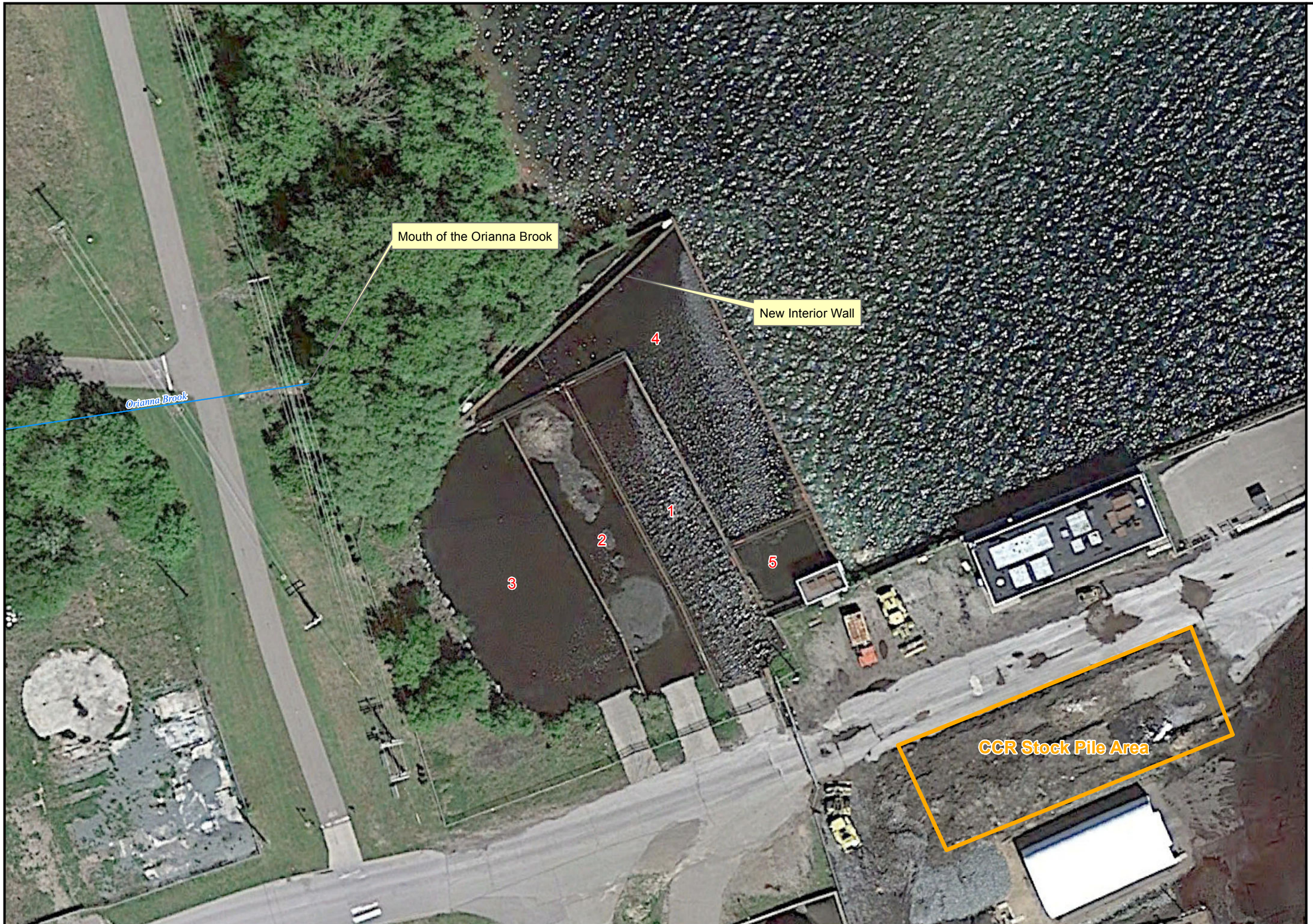
www.aecom.com

SITE LOCATION DIAGRAM
SHIRAS STEAM PLANT HOLDING POND
EMERGENCY ACTION PLAN
MARQUETTE BOARD OF LIGHT AND POWER

*The potential area of impact shown is approximate and should only be used as a guideline. The actual area of impact will depend on the actual failure conditions and may differ from the area shown on the map.

Drawn:	EN	4/13/2017
Approved:	AP	4/13/2017
Scale:	AS SHOWN	
PROJECT NUMBER	60445171	
FIGURE NUMBER	1	

\\172.25.156.10\12Projects\Projects\60445171_MBLP Shiras Steam Plant\900-CAD, GIS\920-929 GIS-Graphics\Site Location Diagram.mxd



AECOM

www.aecom.com

SITE FEATURES
SHIRAS STEAM PLANT CCR COMPLIANCE
MARQUETTE BOARD OF LIGHT AND POWER
MARQUETTE, MICHIGAN

Legend

- River
- CCR Stock Pile Area

N

0 20 40

Feet

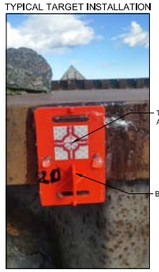
Drawn:	JW	10/7/2015
Approved:	IM	10/7/2015
Scale:	AS SHOWN	
PROJECT NUMBER	60445171	
FIGURE NUMBER	2	

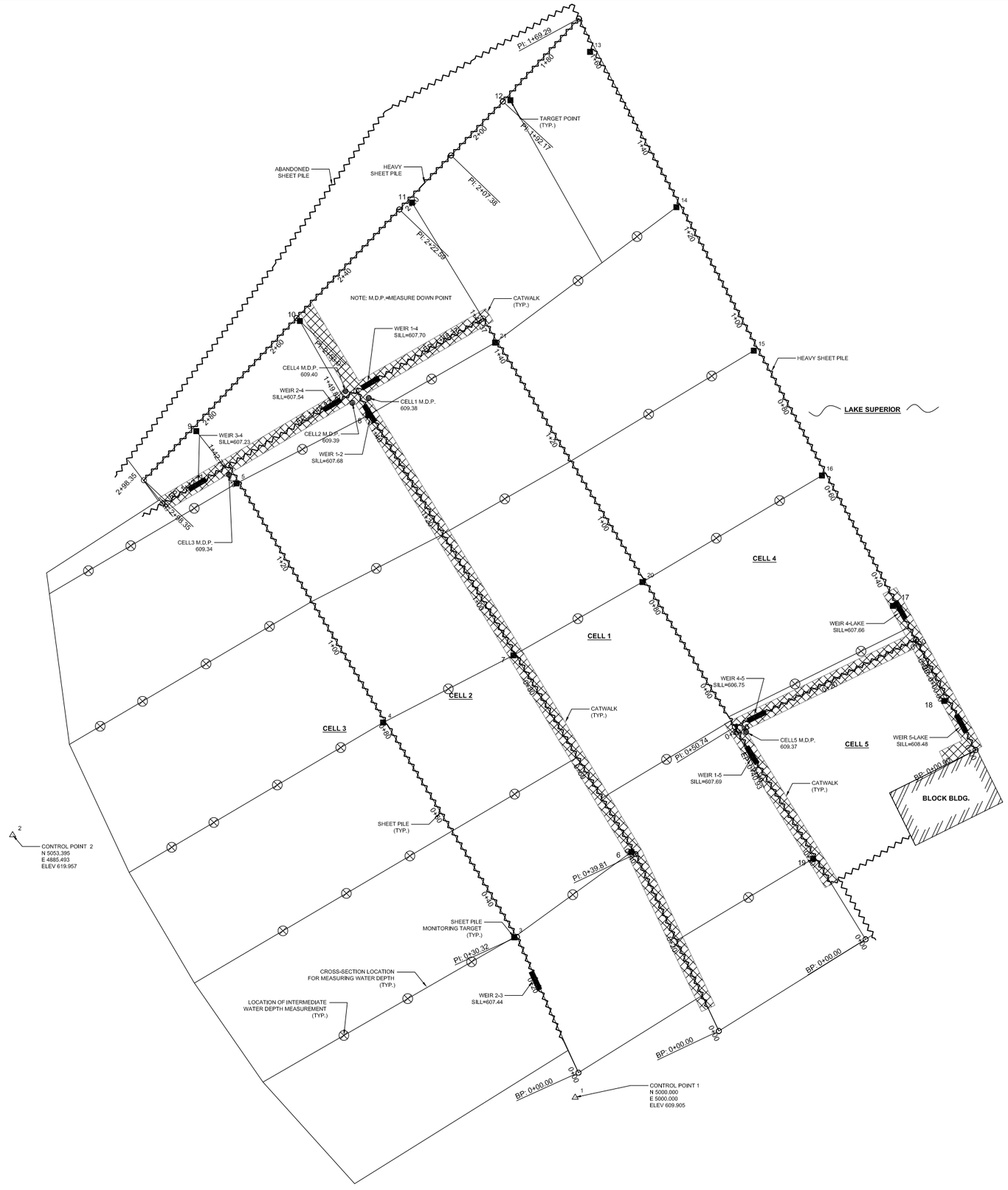
K:\Projects\60445171_MBLP_Shiras Steam Plant_CCR_Compliance\900_WorkingDocs_CAD\GIS\Fig2_Site_Features.mxd

DATE OF SURVEY: OCTOBER 15, 2015
ELEVATION DATUM IS NAVD88 AND ESTABLISHED BY DIFFERENTIAL LEVEL LOOP FROM NGS DISK LSC7B63 (RK0415) WHICH HAS A PUBLISHED ELEVATION OF 615.810'.
REFLECTIVE TARGET COORDINATES AND ELEVATIONS ESTABLISHED BY TURNING 2 SETS OF ANGLES FROM CONTROL POINTS 1 AND 2.
TARGET BENCHMARK ELEVATIONS ESTABLISHED BY DIFFERENTIAL LEVELING. SOME TARGET BENCHMARKS WERE INACCESSIBLE TO A LEVEL ROD AND HAD TO BE MEASURED DOWN TO FROM ABOVE.

TARGET	NORTH	EAST	TARGET ELEVATION	BENCH MARK ELEVATION
3	5032.562	4987.579	608.902	608.825
4	5076.237	4960.903	608.927	608.847
5	5124.911	4931.078	608.955	608.865
6	5049.888	5011.443	608.929	608.843
7	5089.939	4987.426	608.950	608.870
8	5138.743	4957.869	608.999	608.908
9	5135.519	4922.879	609.915	609.835
10	5157.940	4943.954	609.943	609.857
11	5182.039	4966.800	609.816	609.730
12	5202.844	4986.818	609.836	609.752
13	5212.675	5003.027	609.787	609.695
14	5181.111	5020.604	609.715	609.720
15	5151.909	5036.356	609.747	609.670
16	5126.503	5050.227	609.817	609.730
17	5099.988	5064.660	609.823	609.735
18	5080.634	5075.118	609.781	609.702
19	5048.539	5048.415	608.908	608.830
20	5104.828	5013.673	609.045	608.960
21	5153.524	4983.690	609.036	608.950

TYPICAL TARGET INSTALLATION





10 0 10 20
1" = 10'

X:\ADD_Settings_Autodeskempatesa\24x36.dwg 10/23/2008 11:28:29 AM AECOM4db

AECOM

847.279.2500

www.aecom.com

MARQUETTE BOARD OF LIGHT AND POWER
SHIRAS STEAM PLANT
CCR COMPLIANCE

HOLDING POND PLAN

Issued

Rev	Date	Description

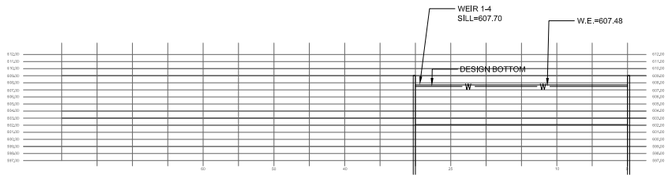
Designed:	CLC	10/19/2015
Drawn:	CLC	10/19/2015
Checked:	GHI	XX/XX/2008
Approved:	JKL	XX/XX/2008

PROJECT NUMBER
60445171

SHEET REFERENCE NUMBER
1

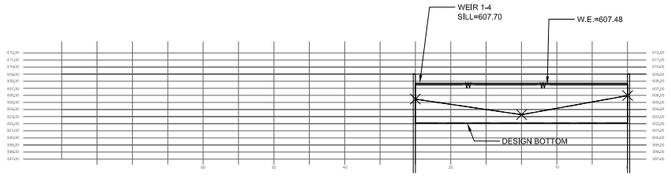
CELL 1

0+00



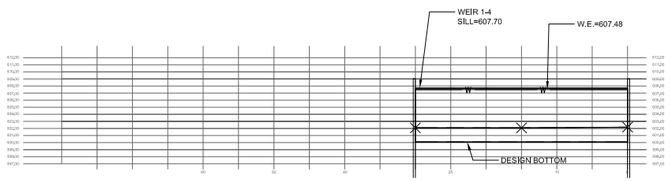
MATERIAL AREA = 0,0 SFT
MEASURED ADDITIONAL AREA= 0,0 SFT
TOTAL AREA = 0,0 SFT

0+20



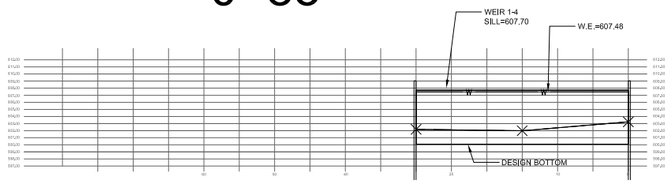
MATERIAL AREA = 72,8 SFT
MEASURED ADDITIONAL AREA= 95,9 SFT
TOTAL AREA = 168,8 SFT

0+52



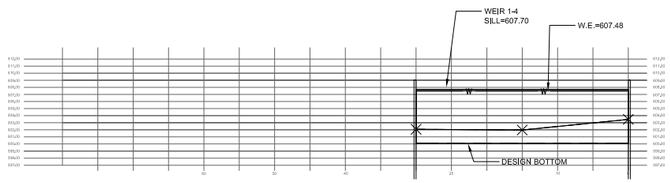
MATERIAL AREA = 60,8 SFT
MEASURED ADDITIONAL AREA= 167,9 SFT
TOTAL AREA = 228,7 SFT

0+85



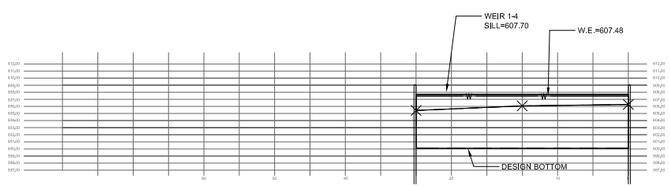
MATERIAL AREA = 68.0 SFT
MEASURED ADDITIONAL AREA= 160,7 SFT
TOTAL AREA = 228.7 SFT

1+15



MATERIAL AREA = 69.0 SFT
MEASURED ADDITIONAL AREA= 159,6 SFT
TOTAL AREA = 228.6 SFT

1+43



MATERIAL AREA = 176,6 SFT
MEASURED ADDITIONAL AREA= 52,0 SFT
TOTAL AREA = 228,6 SFT

AECOM

847.279.2500

www.aecom.com

MARQUETTE BOARD OF LIGHT AND POWER
SHIRAS STEAM PLANT
CCR COMPLIANCE

HOLDING POND CROSS-SECTIONS

Issued

Rev	Date	Description

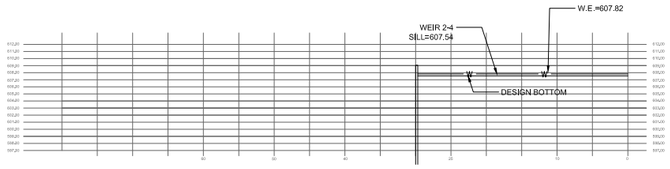
Designed:	CLC	10/19/2015
Drawn:	CLC	10/19/2015
Checked:	GHI	XX/XX/2008
Approved:	JKL	XX/XX/2008

PROJECT NUMBER
60445171

SHEET REFERENCE NUMBER
2

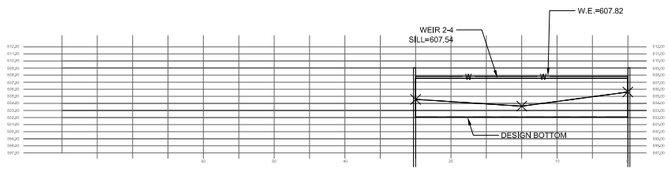
CELL 2

0+08



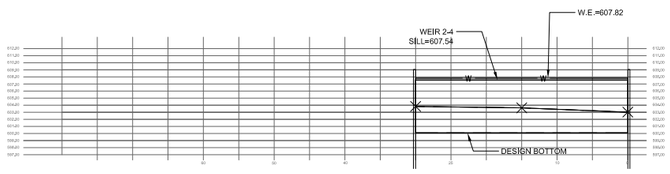
MATERIAL AREA = 0,0 SFT
MEASURED ADDITIONAL AREA= 0,0 SFT
TOTAL AREA = 0,0 SFT

0+40



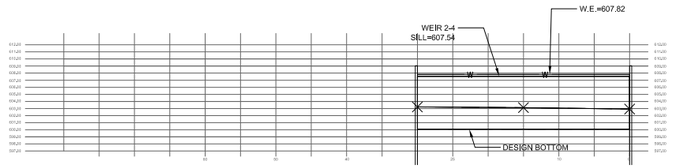
MATERIAL AREA = 68,3 SFT
MEASURED ADDITIONAL AREA= 95,5 SFT
TOTAL AREA = 163,8 SFT

0+63



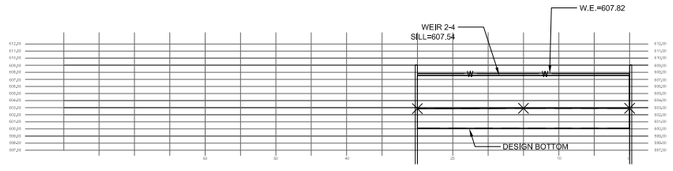
MATERIAL AREA = 103,2 SFT
MEASURED ADDITIONAL AREA= 120,6 SFT
TOTAL AREA = 223,8 SFT

0+87



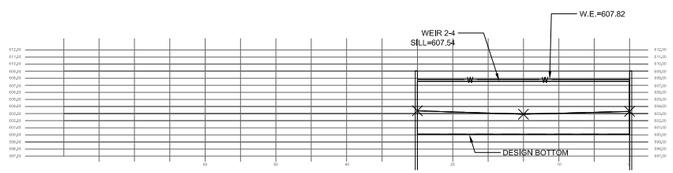
MATERIAL AREA = 90,5 SFT
MEASURED ADDITIONAL AREA= 133,4 SFT
TOTAL AREA = 223,9 SFT

1+16



MATERIAL AREA = 84,8 SFT
MEASURED ADDITIONAL AREA= 139,0 SFT
TOTAL AREA = 223,8 SFT

1+45



MATERIAL AREA = 91,8 SFT
MEASURED ADDITIONAL AREA= 132,0 SFT
TOTAL AREA = 223,8 SFT

AECOM

847.279.2500

www.aecom.com

MARQUETTE BOARD OF LIGHT AND POWER
SHIRAS STEAM PLANT
CCR COMPLIANCE

HOLDING POND CROSS-SECTIONS

Issued

Rev	Date	Description

Designed: CLC 10/19/2015
Drawn: CLC 10/19/2015
Checked: GHI XX/XX/2008
Approved: JKL XX/XX/2008

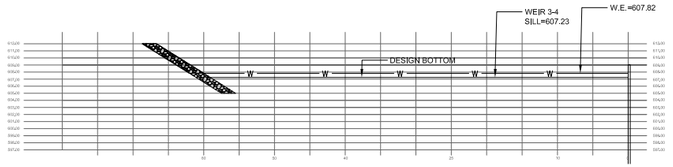
PROJECT NUMBER
60445171

SHEET REFERENCE NUMBER
3

SHEET 03 OF 06

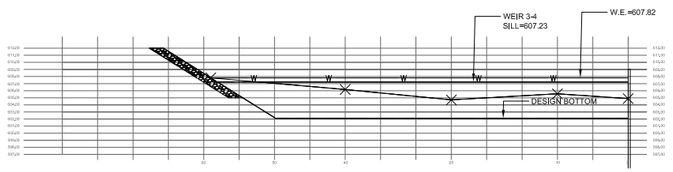
CELL 3

0+10



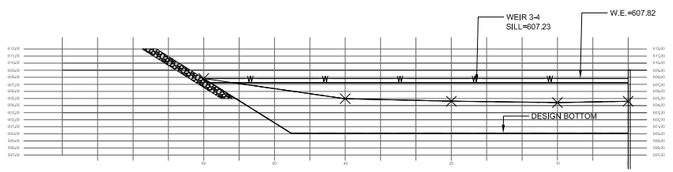
MATERIAL AREA = 0.0 SFT
MEASURED ADDITIONAL AREA= 0.0 SFT
TOTAL AREA = 0.0 SFT

0+30



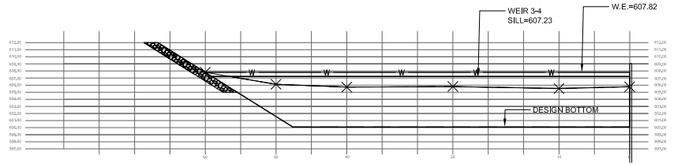
MATERIAL AREA = 192.8 SFT
MEASURED ADDITIONAL AREA= 85.0 SFT
TOTAL AREA = 277.8 SFT

0+55



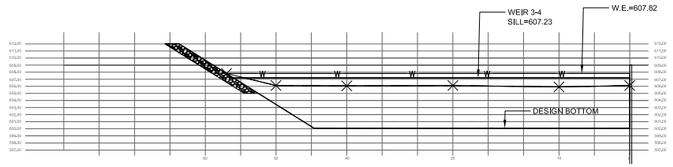
MATERIAL AREA = 259.1 SFT
MEASURED ADDITIONAL AREA= 122.2 SFT
TOTAL AREA = 381.3 SFT

0+81



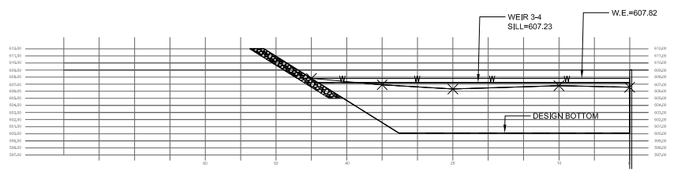
MATERIAL AREA = 303.2
MEASURED ADDITIONAL AREA= 78.2
TOTAL AREA = 381.4 SFT

1+10



MATERIAL AREA = 298.7 SFT
MEASURED ADDITIONAL AREA= 59.5 SFT
TOTAL AREA = 358.2 SFT

1+39



MATERIAL AREA = 251.8 SFT
MEASURED ADDITIONAL AREA= 22.3 SFT
TOTAL AREA = 274.1 SFT

AECOM

847.279.2500

www.aecom.com

MARQUETTE BOARD OF LIGHT AND POWER
SHIRAS STEAM PLANT
CCR COMPLIANCE

HOLDING POND CROSS-SECTIONS

Issued

Rev	Date	Description

Designed: CLC 10/19/2015
Drawn: CLC 10/19/2015
Checked: GHI XX/XX/2008
Approved: JKL XX/XX/2008

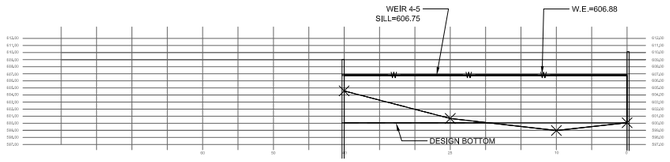
PROJECT NUMBER
60445171

SHEET REFERENCE NUMBER
4

CELL 4

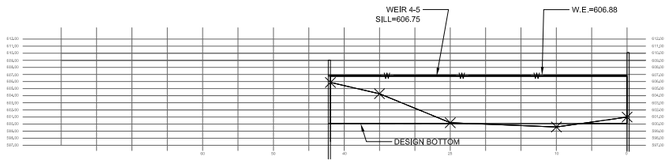
NOTE: CELL 4 BOTTOM HAS BEEN EXCAVATED BELOW 1990 SCA, CINDER POND IMPROVEMENT PROJECT, AT SOME LOCATIONS

0+28



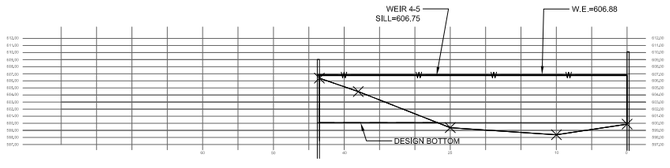
MATERIAL AREA = 39.8 SFT
MEASURED ADDITIONAL AREA= 237.8 SFT
TOTAL AREA = 277.6 SFT

0+64



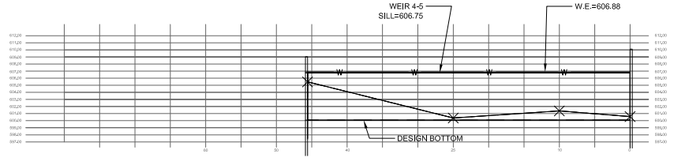
MATERIAL AREA = 59.2 SFT
MEASURED ADDITIONAL AREA= 224.5 SFT
TOTAL AREA = 283.7 SFT

0+93



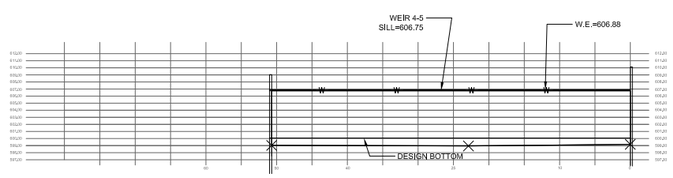
MATERIAL AREA = 54.1 SFT
MEASURED ADDITIONAL AREA= 264.2 SFT
TOTAL AREA = 318.3 SFT

1+26



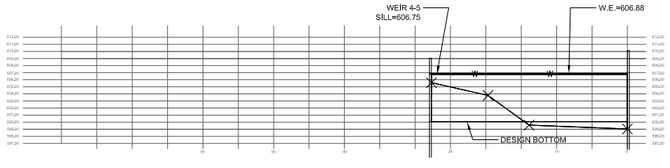
MATERIAL AREA = 79.7 SFT
MEASURED ADDITIONAL AREA= 224.4 SFT
TOTAL AREA = 304.2 SFT

1+69



MATERIAL AREA = 0.0 SFT
MEASURED ADDITIONAL AREA= 391.7
TOTAL AREA = 391.7 SFT

2+19



MATERIAL AREA = 46.3 SFT
MEASURED ADDITIONAL AREA= 149.5 SFT
TOTAL AREA = 195.8 SFT

AECOM

847.279.2500

www.aecom.com

MARQUETTE BOARD OF LIGHT AND POWER
SHIRAS STEAM PLANT
CCR COMPLIANCE

HOLDING POND CROSS-SECTIONS

Issued

Rev	Date	Description

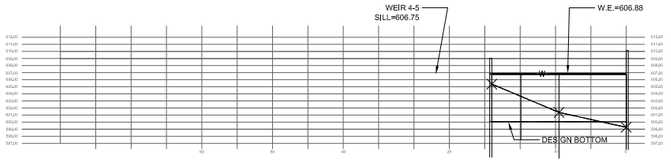
Designed:	CLC	10/19/2015
Drawn:	CLC	10/19/2015
Checked:	GHI	XX/XX/2008
Approved:	JKL	XX/XX/2008

PROJECT NUMBER
60445171

SHEET REFERENCE NUMBER
5

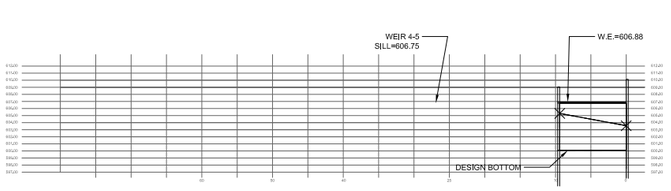
CELL 4 (Cont.)

2+52



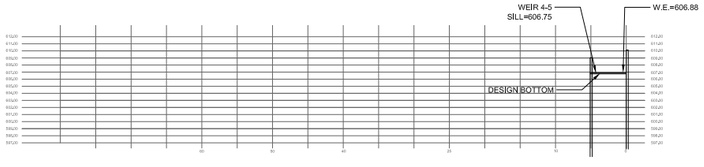
MATERIAL AREA = 35.2 SFT
MEASURED ADDITIONAL AREA= 93.0 SFT
TOTAL AREA = 128.2 SFT

2+83



MATERIAL AREA = 40.9 SFT
MEASURED ADDITIONAL AREA= 21.8 SFT
TOTAL AREA = 62.7 SFT

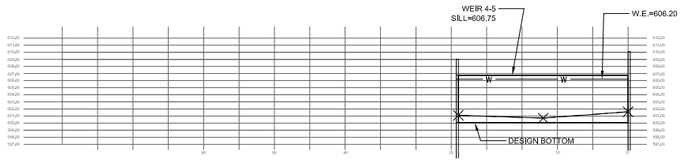
2+98



MATERIAL AREA = 0.0 SFT
MEASURED ADDITIONAL AREA= 0.0 SFT
TOTAL AREA = 0.0 SFT

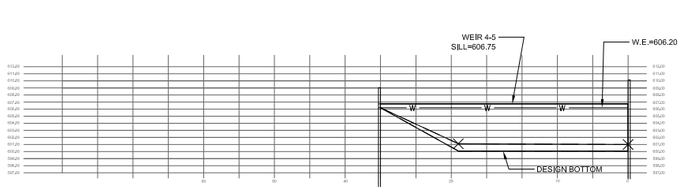
CELL 5

0+00



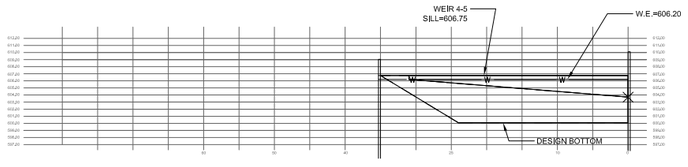
MATERIAL AREA = 23 SFT
MEASURED ADDITIONAL AREA= 137 SFT
TOTAL AREA = 160 SFT

0+20



MATERIAL AREA = 29 SFT
MEASURED ADDITIONAL AREA= 171 SFT
TOTAL AREA = 200 SFT

0+40



MATERIAL AREA = 141
MEASURED ADDITIONAL AREA= 56 SFT
TOTAL AREA = 197 SFT

AECOM

847.279.2500

www.aecom.com

MARQUETTE BOARD OF LIGHT AND POWER
SHIRAS STEAM PLANT
CCR COMPLIANCE

HOLDING POND CROSS-SECTIONS

Issued

Rev	Date	Description

Designed:	CLC	10/19/2015
Drawn:	CLC	10/19/2015
Checked:	GHI	XX/XX/2008
Approved:	JKL	XX/XX/2008

PROJECT NUMBER
60445171

SHEET REFERENCE NUMBER
6

Appendix B – Charts and Tables

Summary of EAP Responsibilities

Entity	Responsibilities
Owner/Operator	1. Verify and assess emergency conditions 2. Notify other participating emergency management agencies 3. Take corrective action at facility 4. Declare termination of emergency at facility 5. Update EAP on at least an annual basis 6. Respond to emergencies at the facility 7. Receive condition status reports from the operator
Marquette County Emergency Management	1. Receive condition status reports from owner 2. Notify Public within City of Marquette limits 3. Conduct evacuation from inundation areas within town limits, if required 4. Render assistance to Marquette County, as necessary 5. Render assistance to owner, as necessary

Summary of Owner Responsibilities

Entity	Responsibilities
24/7 Operations Command Center	1. Detect incident 2. Determine emergency level 3. Make calls on notification flow chart 4. Coordinate with Operator and Engineering on emergency procedures 5. Provide regular status reports to senior management
On-site Operator	1. Detect/confirm incident 2. Determine emergency level 3. Coordinate with Command Center and Engineering on emergency procedures 4. Implement emergency procedures
Engineering Manager	1. Support onsite Operator and Operations Command Center on emergency level 2. Determine emergency operation and construction procedures 3. Coordinate with Operator and Command Center emergency procedures 4. Dispatch engineers and construction crews as necessary 5. Dispatch engineer as technical liaison to County Emergency Operations Center 6. Provide regular status reports to senior management
Senior Management	1. Initiate periodic status report conference calls with site, command center, engineering, and public relations 2. Provide regular status reports to County Emergency Operations Center 3. Coordinate with upper management 4. Coordinate with public relations staff at County and technical liaison at County Emergency Operations Center
Public Relations	1. Mobilize to County Offices 2. Participate in periodic status report conference calls with site, command center, engineering, and management 3. Provide input to staff on emergency communications 4. Represent utility to media

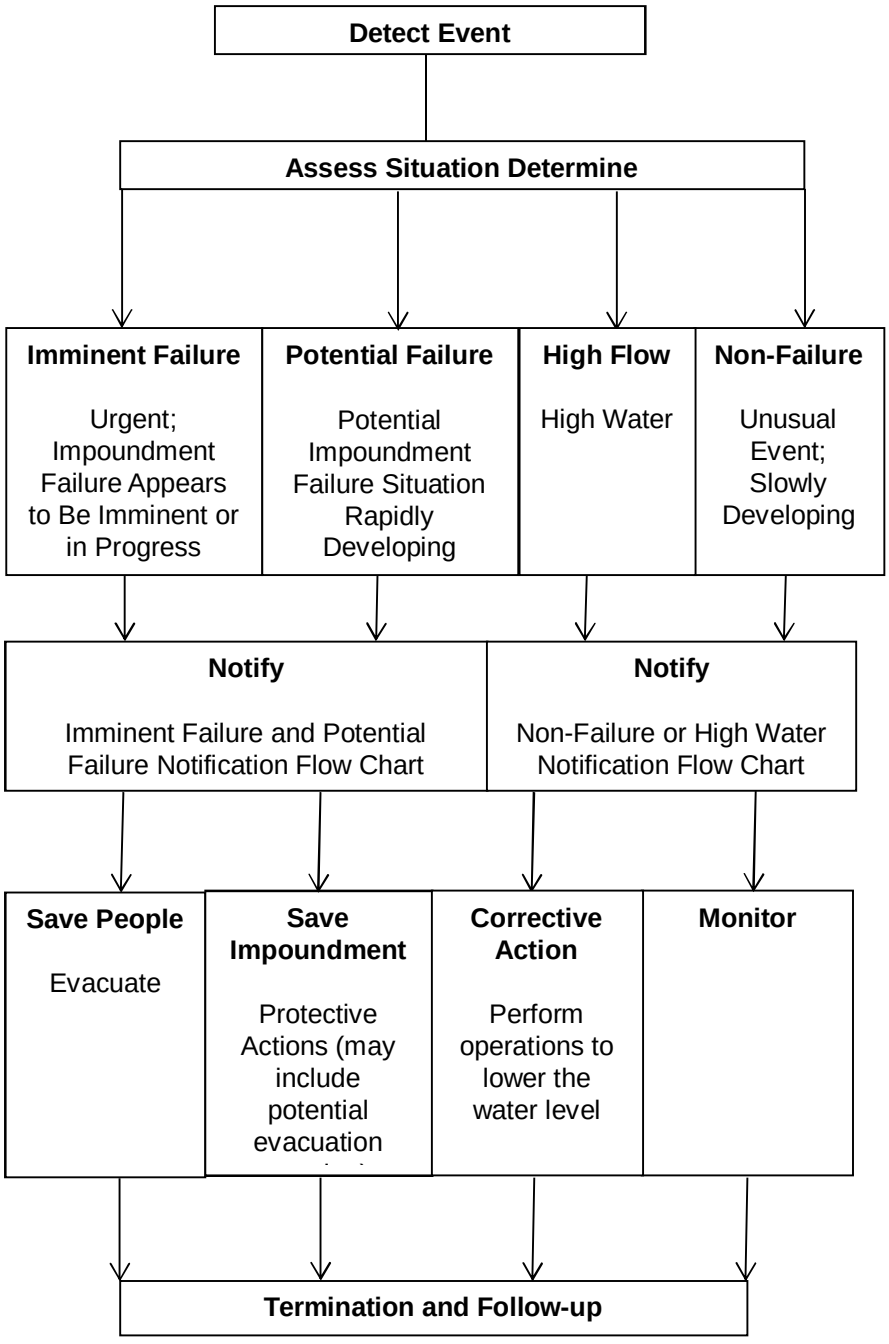
Guidance for Determining the Emergency Level

Event	Situation	Emergency Level*
Auxiliary/Earth Spillway Flow	Reservoir water surface elevation at spillway is flowing with no active erosion	Non-failure
	Spillway flowing with active gully erosion	Potential Failure
	Spillway flow that could result in flooding of people downstream if the reservoir level continues to rise	Potential Failure
	Spillway flowing with an advancing headcut that is threatening the control section	Imminent Failure
	Spillway flow that is flooding people downstream	Imminent Failure
Embankment Overtopping	Reservoir level is 1 foot below the top of the impoundment	Potential Failure
	Water from the reservoir is flowing over the top of the impoundment	Imminent Failure
Seepage	New seepage areas in or near the impoundment	Non-failure
	New seepage areas with cloudy discharge or increasing flow rate	Potential Failure
Sinkholes	Observation of new sinkhole in reservoir area or on embankment	Potential Failure
	Rapidly enlarging sinkhole	Imminent Failure
Embankment/ Structural Component Cracking	New cracks in the embankment/structural component greater than ¼-inch wide without seepage	Non-failure
	Cracks in the embankment/structural component with seepage	Potential Failure
Embankment/ Structural Component Movement	Visual movement/slippage of the embankment slope/structural component	Non- Failure
	Sudden or rapidly proceeding slides of the embankment slopes/structural component	Imminent Failure
Instruments	Instrumentation readings beyond predetermined values	Non- Failure
Security Threat	Verified bomb threat that, if carried out, could result in damage to the impoundment	Potential Failure
	Detonated bomb that has resulted in damage to the impoundment or appurtenances	Imminent Failure
Sabotage/ Vandalism	Unauthorized operation of the impoundment	Non- Failure
	Damage that could adversely impact the functioning of the impoundment or appurtenances	Non- Failure
	Modification to the impoundment or appurtenances that could adversely impact the functioning of the impoundment	Potential Failure
	Damage to impoundment or appurtenances that has resulted in seepage flow	Potential Failure
	Damage to impoundment or appurtenances that has resulted in uncontrolled water release	Imminent Failure

Last Updated: April 2017

Level of Emergency Determination Chart

Step 1:
Event Detection



Step 2:
Emergency Level Determination

Step 3:
Notification and Communication

Step 4:
Expected Actions

Step 5:
Termination and Follow-up

Last Updated: April 2017

Notification Flow Chart

The Notification Flow Charts for the various scenarios are maintained in the Shiras Steam Plant Control Room and are available for inspection by regulatory agencies during normal business hours.

Notification Flow Chart

Available Resources

Resource	Company Name	Address	Telephone #
Heavy Equipment Service and Rental	Associated Constructors LLC	14 Industrial Park Dr. Negaunee, MI 49866	906-226-6504 (office) 906-226-8857
	Oberstar Inc.	1900 Industrial Pkwy Marquette, MI 49855	906-226-6799 (office)
Sand and Gravel Supply	A Lindberg & Sons Inc. Gravel Pit	1017 County Rd 480 Marquette, MI 59855	906-249-1815
	Lajeunesse Trucking & Excavating	407 Little Lk Rd. Marquette, MI 49855	906-249-1900
Ready Mix Concrete Supply	Fraco Concrete Products	200 Cherry Creek Rd. Marquette, MI 49855	906-249-1476
	Larfarge North America	2701 N. Lakeshore Blvd Marquette, MI 49855	906-226-2991
Pumps/Siphons	Midway Rentals and Sales	43 Industrial Park Dr. Negaunee, MI 49866	906-228-4200 888-547-6901
	Applied Industrial Technologies	100 Industrial Way Ishpeming, MI 49849	906-485-1015
Diving Contractor	Great Lakes Diving & Salvage	10476 Old 27 South Waters, MI	989-731-3489
	Underwater Construction Corporation	4295 N. Roosevelt Rd Stevensville, MI 49127	269-429-6550 800-422-3935
Sand Bags	Midway Rentals and Sales	43 Industrial Park Dr. Negaunee, MI 49866	906-228-4200 888-547-6901
	Grainger International, Inc. Green Bay Branch #326	751 Morris Ave Green Bay Wi	54304-4558
Generators and Emergency Lighting	Midway Rentals and Sales	43 Industrial Park Dr. Negaunee, MI 49866	906-228-4200 888-547-6901
	United Rentals	363 US Highway 41 Ste 4 Negaunee, MI 49866	906-225-7346
Additional Resources:			

Appendix C – Blank Forms and Log Sheets

C.1 Concurrence

C.2 List of Holders, Receipt Confirmation, and Emergency Action Plan Updates

C.3 Emergency Incident Log

C.4 Emergency Termination Log

Concurrence

By my signature, I acknowledge that I, or my representative, have reviewed this plan and concur with the tasks and responsibilities assigned herein for me and my organization.

1. _____
Signature *Owner* *Date*

Printed Name and Title: _____

2. _____
Signature *Operator* *Date*

Printed Name and Title: _____

3. _____
Signature *Local Emergency Management* *Date*

Printed Name and Title: _____

4. _____
Signature *Local Law Enforcement* *Date*

Printed Name and Title: _____

5. _____
Signature *Fire Chief* *Date*

Printed Name and Title: _____

Emergency Action Plan Updates

Rev #	Date	Sections Reviewed or Revisions Made	Revisions Made By
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

List of Holders, Receipt Confirmation, and Emergency Action Plan Updates

#	Name	Address	Telephone #	Date of Receipt
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Last Updated: April, 2017

Emergency Incident Log

Name: _____ Job Title:_____

Incident Start Date:_____ Incident Start Time: _____

Incident Description: _____

Initial Incident Level: _____

Incident Detection: _____

When did you detect or learn about the incident:_____

How did you detect or learn about the incident:_____

Log All Notifications and Activity in the Table Below

Date	Time	Action/Incident Progression	Action Taken By

Emergency Termination Log

Impoundment Name: _____ County: _____

Impoundment Location: _____ Stream/River: _____

Date/Time: _____

Weather Conditions: _____

General Description of Emergency Situation: _____

_____

Area of Impoundment Affected: _____

Extent of Damage to Impoundment & Possible Cause: _____

_____

Effect on Impoundment Operation: _____

_____

Initial Reservoir Elevation/Time: _____

Maximum Reservoir Elevation/Time: _____

Final Reservoir Elevation/Time: _____

Description of Area Flooded Downstream / Damage/ Loss of Life: _____

_____

Justification for Termination of Dam Safety Emergency: _____

_____

Other Data and Comments: _____

_____

_____

_____

Report Prepared By: _____

(Printed Name and Signature) (Date)

Appendix D – Glossary

Breach: An opening through the embankment resulting in partial or total failure of the impoundment.

Consequences: Potential loss of life or property damage downstream of an impoundment caused by floodwaters released at the impoundment or by waters released by partial or complete failure of impoundment. This includes effects of landslides upstream of the impoundment on the property located around the reservoir.

Emergency Action Plan (EAP): Formal document that identifies potential emergency conditions at an impoundment and specifies preplanned actions to be followed to minimize property damage and loss of life. The EAP describes actions the owner will take to moderate or alleviate a problem at the impoundment, as well as actions the owner, in coordination with emergency management authorities, will take to respond to incidents or emergencies related to the impoundment.

EAP exercise: Activity designed to promote prevention, preparedness, and response to incidents and emergencies, and may also be extended to include recovery operations. The exercise also demonstrates the EAP's effectiveness in an actual situation and demonstrates the readiness levels of key personnel. Periodic exercises result in an improved EAP because lessons learned are incorporated into the updated EAP document. Exercises consist of testing and performing the duties, tasks, or operations identified and defined within the EAP through a simulated event.

Emergency: Any incident, whether natural or manmade, that requires responsive action to protect life or property.

Emergency alert system: A federally established network of commercial radio stations that voluntarily provide official emergency instructions or directions to the public during an emergency.

Emergency management authority: State, local, Tribal, or Territorial agency responsible for emergency operations, planning, mitigation, preparedness, response, and recovery for all hazards. Names of emergency management authorities vary (e.g., Division of Emergency Management, Comprehensive Emergency Management, Disaster Emergency Services, Emergency and Disaster Services).

Emergency Operations Center: The location or facility where responsible officials gather during an emergency to direct and coordinate emergency operations, to communicate with other jurisdictions and with field emergency forces, and to formulate protective action decisions and recommendations during an emergency.

Flood hydrograph: Graph showing the discharge, height, or other characteristic of a flood with respect to time for a given point on a stream.

Flood routing: Process of determining progressively, over time, the amplitude of a flood wave as it moves past an impoundment or downstream to successive points along a river or stream.

Hazard potential: Situation that creates the potential for adverse consequences, such as loss of life, property damage, or other adverse impact. Impacts may be for a defined area downstream of an impoundment from floodwaters released through spillways and outlet works of the impoundment or waters released by partial or complete failure of the impoundment. They may also be for an area upstream of the impoundment from the effects of backwater flooding or the effects of landslides around the reservoir perimeter.

Headwater: Water immediately upstream from an impoundment. The water surface elevation varies due to fluctuations in inflow and the amount of water passed through the impoundment.

Incident: An incident in terms of impoundment operation includes an impending or actual sudden release of water caused by an accident to, or failure of, an impoundment or other water retaining structure, or the result of an impending flood condition when the impoundment is not in danger of failure, or any condition

that may affect the safe operation of the impoundment. The release of water may or may not endanger human life, downstream property and structures, or facility operations.

Impoundment Failure: Catastrophic type of failure characterized by the sudden, rapid, and uncontrolled release of impounded water. There are lesser degrees of failure, but any malfunction or abnormality outside the design assumptions and parameters that adversely affect an impoundment's primary function of impounding water is properly considered a failure. Lesser degrees of failure can progressively lead to or heighten the risk of a catastrophic failure. They are, however, normally amendable to corrective action.

Inflow Design Flood (IDF): Flow used in the design of an impoundment and its appurtenant works, particularly for sizing the spillway and outlet works, and for determining the maximum height of the impoundment, freeboard, and temporary storage requirements. The IDF is typically the flow above which the incremental increase in water surface elevation due to failure of an impoundment is no longer considered to present an unacceptable threat to downstream life or property. The upper limit of an IDF is the Probable Maximum Flood.

Inundation map: Map delineating areas that would be flooded as a result of an impoundment failure.

Inundation zone: Area downstream of the impoundment that would be inundated by the released water. This zone is typically demarcated by a boundary reflecting the vertical elevation of the peak flow of water for both a flood failure and "sunny day" failure situation.

Notification: To inform appropriate individuals about an emergency condition so they can take appropriate action.

Owner: Entity that owns the impoundment and associated facilities. The owner also includes the operator and operating organization.

Probable Maximum Flood (PMF): Flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that is reasonably possible in the drainage basin under study.

Tailwater: Water immediately downstream from an impoundment. The water surface elevation varies due to fluctuations in the outflow from the structures of an impoundment. Tailwater monitoring is an important consideration because a failure of an impoundment will cause a rapid rise in the level of the tailwater.