

## 5.2 Auxiliary Building

### 5.2.1 Summary of Auxiliary Building

Baseline information for the Auxiliary Building is provided in Section 2.0, Site History, Description, and Baseline Condition.

The Auxiliary Building is located in the center of the PA. It is attached to the Turbine Building, Technical Support Building, CARP Building, and Rad Waste Building on its east, northeast, northwest, and west, respectively. The Auxiliary Building surrounds a majority of the Containment, which is located at its center.

The Auxiliary Building is a multi-story reinforced concrete Class I structure essential to plant operation. The building houses major systems and components, both CQE and non-CQE, in 81 designated rooms. The major function of the building is to provide the structural support and environmental protection necessary to ensure the functional integrity of the CQE systems and components under all operational and environmental conditions. The building also provides radiation shielding and mitigates radiological releases to the environment.

The Auxiliary Building basement floor elevation is approximately the same elevation as the basement slab for the Turbine Building (990 ft). The adjoining Technical Support Building, CARP Building, and Rad Waste Buildings are shallow-foundation structures with the ground level slabs roughly matching the ground level elevation of the Auxiliary Building (1007 ft). The basement floor elevation where it adjoins with the Technical Support Building and CARP Building is 989.00 ft. The basement floor elevation where it adjoins with the Rad Waste Building ranges from 971 to 989 ft. The grade-supported structures adjacent to the foundation walls apply a surcharge onto the foundation walls of the Auxiliary Building.

The Auxiliary Building is a reinforced concrete structure with a multitude of vertical concrete shear walls and concrete floor diaphragms that provide lateral support to the building. The building is supported on 20-in.-diameter open-ended steel piling extending into sound bedrock. Where solution cavities are located below the piles, the piles are underreamed and extended past the solution cavities. The piles are filled with sand up to 1 ft from the bottom of the mat, and the remainder of the piles are filled with concrete. The piles are capped with a 2-in.-thick ASTM A36 steel cap plate that is 22 in. by 22 in. The piles are spaced at approximately 9 ft on center. The pile-supported mat foundation varies in thickness from 12 ft to 1.5 ft, depending on the room use. The exterior walls are a minimum of 2.5-ft-thick reinforced concrete. The roof is cast-in-place reinforced concrete supported on concrete beams cast monolithically with the roof. Interior floors and walls are cast-in-place reinforced concrete. Thicknesses vary per room use and floor span.

The Containment, which resides at the center of the Auxiliary Building, is supported on 20-in.-diameter open-ended steel piling extending into sound bedrock. Where solution cavities are located below the piles, the piles are underreamed and extend past the solution cavities. The piles are filled with sand up to 1 ft from grade, and the remainder of the piles are filled with concrete. The piles are capped with a 2-in.-thick ASTM A36 steel cap plate that is 22 in. by 22 in. The number of piles in each circle is constant, with each pile circle 5 ft closer to the center. Therefore, the piling density increases as you reach the center of the Containment. The top of the foundation adjacent to the

Auxiliary Building is at el. 991 ft. The top-of-foundation elevations for the Auxiliary Building, where it adjoins the Containment, range from 971 to 1002 ft.

### 5.2.2 Inputs/References Supporting the Analysis

Table 5.2-1 lists references provided by OPPD and other documents used to support HDR's analysis.

<b>Document Title</b>	<b>OPPD Document Number (if applicable)</b>	<b>Date</b>	<b>Page Number(s)</b>
Incident Report Summary	CR 2011-5490	6/10/2011	All
Incident Report Summary	CR 2011-5560	6/14/2011	All
Incident Report Summary	CR 2011-5605	6/16/2011	All
Incident Report Summary	CR 2011-5609	6/16/2011	All
Incident Report Summary	CR 2011-5670	6/20/2011	All
Incident Report Summary	CR 2011-5837	6/28/2011	All
Incident Report Summary	CR 2011-5853	6/28/2011	All
Incident Report Summary	CR 2011-5961	7/4/2011	All
Incident Report Summary	CR 2011-5977	7/6/2011	All
Incident Report Summary	CR 2011-5978	7/6/2011	All
Incident Report Summary	CR 2011-6051	7/9/2011	All
Incident Report Summary	CR 2011-6051-6052	7/9/2011	All
System Design Basis Document	SDBD-AUX-502, Rev 18	1/19/2011	
Foundation Studies		3/19/1968	All
Soils Exploration Report		2/2/1967	All
Auxiliary Building Structural Inspection		5/22/1996	All
Naval Facilities Engineering Command, Design Manual 7.01, Soil Mechanics		9/1986	All

Detailed site observations—field reports, field notes, and inspection checklists—for the Auxiliary Building are provided in Attachment 8.

Observed performance and pertinent background data are as follows:

- A sand boil/piping feature was observed (originally reported in CR 2011-7265) near the southwest corner of the Missile Shield Room. This room is located on the outside of the south wall of the Auxiliary Building (common wall to both spaces) and has an unfinished, pea gravel floor surface. Ingress/egress can only be made from Door 45 located outside of the Auxiliary Building (there is no connecting doorway between the Missile Shield Room and the adjacent Auxiliary Building). This feature was measured using a hand tape measure and vertically probed using a fiberglass T-probe. Field measurements showed the feature was about 3.5 ft in diameter and 1 ft deep. A high-water line was observed on the interior walls approximately 0.8 ft above the floor. Various utility conduits extend vertically into the ground along the outside wall at the southwest corner (a few feet west of the alignment of the boil/piping feature). The Main Underground Cable Bank,

MH-1 to the Auxiliary Building, passes through the subsurface, extending east to west below the location of the boil/piping feature.

- General observations of the interior of the structure showed minor concrete cracking in several walls and ceilings throughout the building. These hairline cracks could be associated with concrete shrinkage that is typically seen in concrete construction. The below-grade walls were dry at the time of inspection although there was evidence of past water infiltration. The observed cracks appear to be those previously recorded and monitored based on incident report summaries from OPPD listed in Table 5.2.1.
- The Auxiliary Building was protected from floodwater by an Aqua Dam for the majority of the 2011 flood; however, the Aqua Dam failed for a short period of time because it was damaged, which allowed floodwater to enter the area inside the perimeter of the Aqua Dam. This incident resulted in the flooding of the truck dock room along the south elevation. Floodwater reached approximately 2 ft in the dock room and infiltrated room 24A directly below the dock room through existing cracks in both the floor and walls.
- As early as 1993, excessive flow into a sump in the Turbine Building basement was observed. Subsequently, this flow was attributed to unfiltered groundwater entering breaks in drainage pipes under the Turbine Building basement floor slab. The Turbine Building is adjacent to and east of the Auxiliary Building.
- In 1997 a void, estimated to be approximately 10 x 8 x 1 ft, was documented below the basement floor slab in the Turbine Building. For further information see Section 5.8. A more detailed discussion of this KDI is presented in Section 4.1.
- The Maintenance Shop to the northeast has documented settlement issues. One building column footing had settled approximately 3 in. at the time of Revision 0. A section of floor slab on grade is settling. A more detailed discussion of this KDI is presented in Section 4.3.

### 5.2.3 Assessment Methods and Procedures

#### 5.2.3.1 Assessment Procedures Accomplished

Assessments of the Auxiliary Building included the following:

- A visual inspection of the interior of the structure's lowest levels
- A visual inspection of the exterior of the structure where accessible
- A visual inspection of sumps in the Auxiliary Building for the presence of water, water level, and the presence of sediment in water
- An assessment of collected survey data to date for indications of trends in the movement of the structure
- A review of previously documented condition reports, as-built building plans and geotechnical reports to determine possible weak points in the building's construction that could be affected by the flood

Additional investigations were performed. These included the following non-invasive geophysical and invasive geotechnical investigations:

- Seismic surveys (seismic refraction and refraction micro-tremor) in the PA. (Test reports were not available at the time of Revision 0.)
- Geotechnical test borings in the PA. Note that OPPD required vacuum excavation for the first 10 ft of proposed test holes to avoid utility conflicts. Therefore, test reports will not

show soil conditions in the upper 10 ft of test boring logs. (Test reports were not available at the time of Revision 0.)

- Four inclinometers were installed on site to determine the condition of the riverbank by detecting lateral movement of the soils. (Inclinometers were not installed and thus no data were available at the time of Revision 0.)

#### 5.2.3.2 Assessment Procedures Not Completed

No additional assessment procedures have been identified for this structure.

#### 5.2.4 Analysis

Identified PFMs were initially reviewed as discussed in Section 3.0. The review considered the preliminary information available from OPPD data files and from initial walk-down observations. Eleven PFMs associated with five different Triggering Mechanisms were determined to be “non-credible” for all Priority 1 Structures, as discussed in Section 3.6. The remaining PFMs were carried forward as “credible.” After the design review for each structure, the structure observations, and the results of available geotechnical, geophysical, and survey data were analyzed, a number of CPFMs were ruled out as discussed in Section 5.2.4.1. The CPFMs carried forward for detailed assessment are discussed in Section 5.2.4.2.

##### 5.2.4.1 Potential Failure Modes Ruled Out Prior to the Completion of the Detailed Assessment

The ruled-out CPFMs reside in the Not Significant/High Confidence category and for clarity will not be shown in the Potential for Failure/Confidence matrix.

##### **Triggering Mechanism 2 – Surface Erosion**

CPFM 2b – Loss of lateral support for pile foundation

##### Reason for ruling out:

- It was evident from HDR’s site observations that no surface erosion occurred in the vicinity of the Auxiliary Building.

##### **Triggering Mechanism 3 – Subsurface Erosion/Piping**

CPFM 3e – Loss of lateral support for pile foundation (due to river drawdown)

##### Reason for ruling out:

- The structure is a sufficient distance from the river to be outside the zone of influence of the CPFM.

**Triggering Mechanism 4 – Hydrostatic Lateral Loading (water loading on structures)**

CPFM 4c – Wall failure in flexure

CPFM 4d – Wall failure in shear

CPFM 4e – Excess deflection

Reasons for ruling out:

- The Auxiliary Building is designed to withstand an external water load due to flooding of the Missouri River to el. 1014 ft (see SDBD-AUX-502, Rev 18). The peak flood elevation in 2011 was approximately 1006.9 ft, which is less than the structural design basis.
- Visual observations did not identify distress to the structure that can be attributed to this CPFM.

**Triggering Mechanism 5 – Hydrodynamic Loading**

CPFM 5a – Overturning

CPFM 5b – Sliding

CPFM 5c – Wall failure in flexure

CPFM 5d – Wall failure in shear

CPFM 5e – Damage by debris

CPFM 5f – Excess deflection

Reasons for ruling out:

- The Auxiliary Building was protected from floodwater by an Aqua Dam for the majority of the 2011 flood; however, the Aqua Dam failed for a short period of time because it was damaged, which allowed floodwater to enter the area inside the perimeter of the Aqua Dam.
- The Auxiliary Building is designed to withstand an external water load due to flooding of the Missouri River to el. 1014 ft (see SDBD-AUX-502, Rev 18). The peak flood elevation in 2011 was approximately 1006.9 ft, which is less than the structural design basis.
- Visual observation did not identify distress to the structure that can be attributed to this CPFM.

**Triggering Mechanism 6 – Buoyancy, Uplift Forces on Structures**

CPFM 6a – Fail tension piles

CPFM 6b – Cracked slab, loss of structural support

CPFM 6c – Displaced structure/broken connections

Reasons for ruling out:

- The Auxiliary Building is designed to withstand an external water load due to flooding of the Missouri River to el. 1014 ft (see SDBD-AUX-502, Rev 18). The peak flood elevation in 2011 was approximately 1006.9 ft, which is less than the structural design basis.
- Visual observations and survey measurements show no structure movement. Therefore, it is unlikely that the tension piles failed (CPFM 6a) or that the structure was displaced or damaged (CPFM 6c) due to buoyancy effects.

**Triggering Mechanism 7 – Soil Collapse (first time wetting)**

- CPFM 7b – Displaced structure/broken connections
- CPFM 7c – General site settlement
- CPFM 7d – Piles buckling from down drag

Reasons for ruling out:

- The pile foundations are located below el. 971.0 ft. while the normal river level is at approximate el. 992.0 ft. It is therefore logical to assume that the soils below the mat foundation were previously wetted.
- The peak flood elevation prior to 2011 was document in 1993 as 1003.3 ft, which would show that the soils below and surrounding the building were saturated at that time.

**Triggering Mechanism 10 – Machine/Vibration-Induced Liquefaction**

- CPFM 10b – Displaced structure/broken connections
- CPFM 10c – Additional lateral force on below-grade walls
- CPFM 10d – Pile/pile group instability

Reasons for ruling out:

- The underlying soils were improved with vibroflotation to reduce the risk of liquefaction.
- Temporary pumping equipment located on the ground inside the perimeter of the Aqua Dam produced minimal localized vibration and was offset from the structure and therefore is deemed to have an inconsequential effect.
- Machine/vibration-induced liquefaction was not observed at the site.
- This is not a changed condition due to the flood. The Auxiliary Building has been in service for 38 years under similar saturated soils and machine vibration conditions.

**Triggering Mechanism 11 – Loss of Soil Strength due to Static Liquefaction or Upward Seepage**

- CPFM 11b – Displaced structure/broken connections
- CPFM 11c – Additional lateral force on below-grade walls
- CPFM 11d – Pile/pile group instability

Reasons for ruling out:

- Visual observations and survey measurements show no structure movement. Therefore, degradation that can be attributed to this PFM did not occur.
- Sandboil/piping feature observed in the missile room was determined to be too shallow to be significant.
- The underlying soils were improved with vibroflotation to reduce the risk of liquefaction.

**Triggering Mechanism 12 – Rapid Drawdown**

- CPFM 12a – River bank slope failure and undermining surrounding structures
- CPFM 12b – Lateral spreading

Reason for ruling out:

- The Auxiliary Building is located a sufficient distance away from the river bank and therefore is outside the zone of influence of a bank slope failure.

**Triggering Mechanism 13 – Submergence**

- CPFM 13b – Corrosion of structural elements

Reasons for ruling out:

- The Auxiliary Building has not been subjected to corrosive circumstances that would be considered beyond the normal conditions. The structure was protected from floodwater by an Aqua Dam for the majority of the 2011 flood; however, the Aqua Dam failed for a short period of time because it was damaged, which allowed floodwater to enter the area inside the perimeter of the Aqua Dam. Therefore, structural elements being wetted by the 2011 flood were considered in the original design of the facility.
- This is not a changed condition due to the flood. The Auxiliary Building has been in service for 38 years under similar saturated soils conditions. Reviewed condition survey reports have not indicated signs of distress to the structure that would be attributed to corrosion due to submergence.

**Triggering Mechanism 14 – Frost Effects**

- CPFM 14a – Heaving, crushing, or displacement

Reason for ruling out:

- The Auxiliary Building foundation is approximately 25 ft below grade and therefore not frost susceptible. In addition, frost-susceptible connecting utilities are below the frost level.

**5.2.4.2 Detailed Assessment of Credible Potential Failure Modes**

The following CPFMs are the only CPFMs carried forward for detailed assessment for the Auxiliary Building as a result of the 2011 flood. This detailed assessment is provided below.

**Triggering Mechanism 3 – Subsurface Erosion/Piping**

- CPFM 3b – Loss of lateral support for pile foundation (due to pumping)

The Turbine Building, which is adjacent to the Auxiliary Building on its east, has a documented history of a void below the foundation slab dating back to 1997. This void was confirmed via cored holes in the foundation slabs and camera recordings of broken drain piping that lies under the floor slab. Conversations with OPPD personnel indicate that groundwater has been flowing at varying rates through these broken pipes into the sump from 1993 to the present day. The rate of flow into the sump is directly related to the hydraulic head of the groundwater. As the floodwater increased in elevation across the site, observed flow rates increased. The flow of groundwater into this drain piping system through the breaks in the

pipes is one of the KDIs discussed in Section 4. This drain pipe system was designed as a closed system; therefore, the pipes are not surrounded by appropriate filter systems to preclude the transportation of soils from the surrounding area under the slab. It is logical to assume that because the groundwater moves below the foundation and into the broken piping, some movement of the soil has occurred. If these voids were to continue under the Auxiliary Building, they could become large enough to create a loss of lateral support for the piling.

The Triggering Mechanism and CPFM could then occur as follows: multiple potentially connected seepage paths could exist in the soil backfill at the site, including soil backfill in utility trenches, granular trench bedding, and building floor drains with open/broken joints. The paths could be exposed at some locations to the river floodwater and high groundwater. This network of seepage paths could be connected to the sump pit in the Turbine Building. The breaks in the piping have been documented for an extended period (dating back to at least 1993), thus creating a continuous head differential on the potential seepage path networks. Gradient has been sufficient to begin erosion of surrounding soil. The gradient during the 2011 flood was increased, which could have led to higher flows through the seepage path networks. The unfiltered seepage condition will continue until the breaks in the piping system are repaired, which means the potential for further erosion remains. Erosion could create large voids under the Turbine Building base slab and potentially under adjacent building foundations, including the Auxiliary Building. The potential damage includes loss of soil support around piles leading to pile buckling, decreased pile capacity, and foundation failure.

The following table describes observed distress indicators and other data that would increase or decrease the potential for degradation associated with this CPFM for the Auxiliary Building.

<b>Adverse (Degradation/Direct Floodwater Impact More Likely)</b>	<b>Favorable (Degradation/Direct Floodwater Impact Less Likely)</b>
A documented void exists under the foundation slab of the Turbine Building with a known hydraulic connection between groundwater elevation and flows into the building sump.	The in-situ and fill material around the piling was compacted to the requirements under the Class I structures (vibroflotation). This higher density granular material is less susceptible to erosion.
	There have been no observed signs of structural distress in the floor slab under the current loading conditions.
	Survey data to date does not identify movement of the building.
<b>Data Gaps:</b>	
<ul style="list-style-type: none"> <li>The size and location of the voids below the foundation slab</li> </ul>	

### **Conclusion**

#### Significance

#### *Potential for Degradation/Direct Floodwater Impact*

Indicators for this CPFM have been observed in the Turbine Building, which is adjacent to the Auxiliary Building. The voids below the base slab in the Turbine Building are known to exist with heavy flows of water being pumped from the sump. Because the 2011 flood caused

increased flow through the broken drain pipes, the potential that it caused further and more rapid degradation due to this CPFM is high. It is possible that these voids extend under the Auxiliary Building although the potential is low due to the vibro-compacted soils below the Auxiliary Building.

*Implication*

The occurrence of this CPFM on a large scale could negatively impact the capacity of the piling supporting the building. This could lead to excessive foundation movement and negatively impact the integrity or intended function of the Auxiliary Building. Therefore, the implication of the potential degradation for this CPFM is high.

Confidence

The extent of subsurface erosion and its potential impact on the building is not known due to the lack of data gathered on subsurface conditions. Because there is not enough information on the subsurface conditions at this time, and the pumping in the Turbine Building could have caused subsurface erosion, the confidence for this CPFM is low.

Summary

For CPFM 3b, as discussed, the potential for degradation is low due to the presence of vibrocompacted soils below the Auxiliary Building. This degradation could have caused enough erosion to impact the integrity or intended function of the structure. The combined consideration of the potential for degradation and the implications of that degradation to a structure of this type puts it in the "significant" category. The data currently collected are not sufficient to rule out this CPFM. Therefore, the confidence in the above assessment is low, which means more data or continued monitoring and/or inspections are necessary to draw a conclusion.

5.2.5 Results and Conclusions

The CPFM evaluated for the Auxiliary Building is presented in the following matrix, which shows the rating for the estimated significance and the level of confidence in the evaluation.

	Low Confidence (Insufficient Data)	High Confidence (Sufficient Data)
Potential for Failure Significant	CPFM 3b	
Potential for Failure Not Significant		

5.2.6 Recommended Actions

Further forensic investigations and physical modifications are recommended to address CPFM 3b for the Auxiliary Building. CPFM 3b is associated with unfiltered flow of groundwater into the Turbine Building basement drain piping system (KDI #1). These recommendations are described in detail in Section 4.1.

Continued monitoring is recommended to include a continuation of the elevation surveys of the previously identified targets on this structure and surrounding site. The purpose is to monitor for signs of structure distress and movement or changes in soil conditions around the structure. The results of this monitoring will be used to increase the confidence in the assessment results. Elevation surveys should be performed weekly for 4 weeks and biweekly until December 31, 2011. At the time of Revision 0, groundwater levels had not yet stabilized to nominal normal levels. Therefore, it is possible that new distress indicators could still develop. If new distress indicators are observed before December 31, 2011, appropriate HDR personnel should be notified immediately to determine whether an immediate inspection or assessment should be conducted. Observation of new distress indicators might result in a modification of the recommendations for this structure.

### 5.2.7 Updates Since Revision 0

Revision 0 of this Assessment Report was submitted to OPPD on October 14, 2011. Revision 0 presented the results of preliminary assessments for each Priority 1 Structure. These assessments were incomplete in Revision 0 because the forensic investigation and/or monitoring for most of the Priority 1 Structures was not completed by the submittal date. This revision of this Assessment Report includes the results of additional forensic investigation and monitoring to date for this structure as described below.

#### 5.2.7.1 Additional Data Available

The following additional data were available for the Auxiliary Building for Revisions 1 and 2 of this Assessment Report:

- Results of KDI #1 forensic investigation (see Section 4.1)
- Additional groundwater monitoring well and river stage level data from OPPD.
- Results of geophysical investigation by Geotechnology (see Attachment 6C).
- Results of geotechnical investigation by Thiele Geotech (see Attachment 6A).
- Data obtained from inclinometers by Thiele Geotech (see Attachment 6A).
- Results of continued survey by LRA (see Attachment 6E).

#### 5.2.7.2 Additional Analysis

The following analysis of additional data was conducted for the Auxiliary Building:

- Groundwater monitoring well and river stage level data from OPPD.  
Data shows that the river and groundwater have returned to nominal normal levels.
- Results of geophysical investigation report by Geotechnology
- Seismic Refraction and Seismic ReMi tests performed around the outside perimeter of the power block identified deep anomalies that could be gravel, soft clay, loose sand, or possibly voids.
- Results of geotechnical investigation by Thiele Geotech
- Six test borings were drilled, with continuous sampling of the soil encountered, to ground truth the Geotechnology seismic investigation results as part of the KDI #2 forensic investigation. Test bore holes were located to penetrate the deep anomalies identified in the seismic investigation. The test boring data did not show any piping voids or very soft/very loose conditions that might be indicative of subsurface erosion/piping or related material loss or movement.

All of the SPT and CPT test results conducted for this Assessment Report were compared to similar data from numerous other geotechnical investigations that have been conducted on the FCS site in previous years. This comparison did not identify substantial changes to the soil strength and stiffness over that time period. SPT and CPT test results were not performed in the top 10 ft to protect existing utilities.

Data from inclinometers to date, compared to the original baseline measurements, have not exceeded the accuracy range of the inclinometers. Therefore, deformation at the monitored locations since the installation of the instrumentation has not occurred.

- Results of continued survey by LRA

Survey data to date compared to the original baseline surveys have not exceeded the accuracy range of the surveying equipment. Therefore, deformation at the monitored locations, since the survey baseline was shot, has not occurred.

- The CPFMs that could not be ruled out in Revision 0 are analyzed below based on the additional data available for Revisions 1 and 2 of this Assessment Report.

### **Triggering Mechanism 3 – Subsurface Erosion/Piping**

#### **CPFM 3b – Loss of lateral support for pile foundation (due to pumping)**

CPFM 3b for the Auxiliary Building is associated with KDI #1. Section 4.1 and 8.3 presents the results of the additional forensic investigation that was conducted to ascertain whether this CPFM could be ruled out. The results of these additional forensic investigations show that soils immediately adjacent to the Auxiliary Building have been negatively affected by this triggering mechanism, and that the possibility exists that the soil under the Auxiliary Building has also been negatively affected. It was not possible to test the soils under the Auxiliary Building for this Assessment. Therefore, no conclusions can be reached regarding the potential for failure for this CPFM. HDR recommends that OPPD employ the services of an Appendix B consultant to evaluate the potential for loss of lateral pile support under the Auxiliary Building from Subsurface Erosion/Piping (due to Pumping). Assuming that this analysis shows that there is no issue with the loss of lateral support for the pile foundation under the Auxiliary Building, this CPFM is moved to the quadrant of the matrix representing “No Further Action Recommended Related to the 2011 Flood.”

## 5.2.7.3 Revised Results

The CPFM evaluated for the Auxiliary Building is presented in the following matrix, which shows the rating for the estimated significance and the level of confidence in the evaluation.

	Low Confidence (Insufficient Data)	High Confidence (Sufficient Data)
Potential for Failure Significant		
Potential for Failure Not Significant		CPFM 3b

## 5.2.7.4 Conclusions

In the assessment of the FCS Structures, the first step was to develop a list of all Triggering Mechanisms and PFMs that could have occurred due to the prolonged inundation of the FCS site during the 2011 Missouri River flood and could have negatively impacted these structures. The next step was to use data from various investigations, including systematic observation of the structures over time, either to eliminate the Triggering Mechanisms and PFMs from the list or to recommend further investigation and/or physical modifications to remove them from the list for any particular structure. All CPFMs for the Auxiliary Building other than CPFM 3b had been ruled out prior to Revision 1. CPFM 3b was further investigated in KDI #1 as described in Sections 4.1 and 8.3. These forensic investigations have not provided enough information to rule out CPFM 3b for the Auxiliary Building. It is recommended that the physical modifications described in KDI #1 (Section 4.1 and Section 8.3) be implemented to stop the triggering mechanism, and that OPPD employ the services of an Appendix B consultant to evaluate the potential for loss of lateral pile support under the Auxiliary Building from Subsurface Erosion/Piping (due to Pumping). Assuming that this analysis shows that there is no issue with the loss of lateral support for the pile foundation under the Auxiliary Building, this CPFM is moved to the quadrant of the matrix representing "No Further Action"

Recommended Related to the 2011 Flood.” OPPD has informed HDR that they are utilizing the services of an Appendix B structural engineering firm to evaluate this structure.

