From:	Kuntz, Robert
To:	Miller, Ed
Subject:	Modified simple example integrated assessment
Date:	Wednesday, February 05, 2014 3:35:00 PM
Attachments:	Units1and2_IA_-SIMPLEHRA-R0.docx

Ed,

Attached is NEI's modified simple example integrated assessment. NEI discussed the development of this example at the January 14, 2014 public meeting. The NRC staff had not had time to review the attached, therefore the staff will provide comment at a future public meeting.

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Working Example Template

Integrated Assessment for External Flooding

Response to Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendation 2.1 of the enclosure to SECY-11-0093, "Recommendations for Enhancing Reactor Safety in the 21st Century, the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident"

Electric Generating Plant Unit 1

~~December 2013~~January 2014

DRAFT dated ~~12/19~~1/10/2014

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Acronyms and Abbreviations

ADAMS	Agencywide Documents Access & Management System
APM	Available Physical Margin
BBM	Blue Bluff Marl
CFR	Code of Federal Regulation
CLB	Current Licensing Basis
COL	Combined Operating License
CSI	Construction Specifications Institute
EE	Engineering Evaluation
EPP	Emergency Preparedness Procedure
FEMA	Federal Emergency Management Agency
Fig.	Figure
ft.	feet
FHRR	Flooding Hazard Reevaluation Report
FSAR	Final Safety Analysis Report
FWR	Flood Walkdown Report
HUC	Hydrological Unit Code
ISG	Interim Staff Guidance
JLD	Japan Lessons-Learned Project Directorate
LIP	Local Intense Precipitation
MST	Maintenance Surveillance Test
NAVD-88	North American Vertical Datum of 1988
NDE	Nominal Design Elevation
NRC	Nuclear Regulatory Commission
NSCW	Nuclear Service Cooling Water
NTTF	Near Term Task Force
NWS	National Weather Service
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
SRM	Staff Requirements Memoranda
SSC	System, Structures, and Components
TB	Technical Bulletin
USGS	United States Geological Survey
VBS	Vehicle Barrier System

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Preface

The following Integrated Assessment example intends to meet the guidance established in the Japan Lessons-Learned Directorate (JLD) – Interim Staff Guidance (ISG) 2012-05, "Guidance for Performing the Integrated Assessment for External Flooding." This Integrated Assessment example analyzes a "simple" case where a nuclear power plant site was reevaluated for flooding hazards using methodology consistent with the direction provided by the NRC in its March 12, 2012 10 CFR 50.54(f) letter and in response to NRC NTTF Recommendation 2.1 (Enclosure 2 of the March 12, 2012 10 CFR 50.54(f) letter) (Reference 1). The results of this reevaluation as documented in the site's Flooding Hazards Reevaluation Report (FHRR) (Reference 2) determined the current design basis for flooding events was exceeded with relation to two flood causing mechanisms. One of those flood causing mechanisms at the plant site now generates an enveloping scenario that governs the flood controlling parameters at the site which are evaluated in this integrated assessment. The reevaluated flood parameters result in a slight water level increase above the current design basis flooding elevation. However, as a result of this increase, a flood ~~door~~ barrier needed to be installed. This in turn created a manual action that was not in the Current Licensing Basis (CLB) and an analysis as required by Appendix C to JLD-ISG 2012-05.

Strategies included in this example do not necessarily represent endorsed actions for a particular event, but rather focus on the level of detail required to describe and justify the adequacy of a proposed external flood simple example.

As a general note, it is suggested that the preparer provide frequent references to the sections of the JLD-ISG 2012-05, as applicable. Also, references should be used for data or statements taken from the Flooding Hazard Reevaluation Report (FHRR).

An informative annex is provided at the end of this example with suggested formats of tables that may be used within the body of the text to present comparison data.

1.0 Overview

Following the accident at the Fukushima Dai-ichi nuclear power plant resulting from the 2011 Great Tohoku Earthquake and tsunami, the Nuclear Regulatory Commission (NRC) established the Near-Term Task Force (NTTF) and tasked it with conducting a systematic and methodical review of NRC processes and regulations to determine whether improvements are necessary.

The resulting NTTF report concludes that continued U.S. nuclear plant operation does not pose an imminent risk to public health and safety and provides a set of recommendations to the NRC. The NRC directed the staff to determine which recommendations should be implemented without unnecessary delay (Staff Requirements Memorandum [SRM] on SECY-11-0093) (Reference 3).

The NRC issued its request for information pursuant to 10 CFR 50.54(f) on March 12, 2012, based on the following NTTF flood-related recommendations:

- Recommendation 2.1: Flooding
- Recommendation 2.3: Flooding

Enclosure 2 of the NRC 10 CFR 50.54(f) letter addresses Recommendation 2.1 for the following purposes:

1. To gather information with respect to NTTF Recommendation 2.1, as amended by the SRM associated with SECY-11-0124 (Reference 4) and SECY-11-0137 (Reference 5), and the Consolidated Appropriations Act, for 2012 (Pub Law 112-74), Section 402 (Reference 6), to reevaluate seismic and flooding hazards at operating reactor sites and sites having a construction permit or 10 CFR 52 (Reference 7) combined license.

2. To collect information to facilitate NRC's determination if there is a need to update the design basis and systems, structures, and components (SSCs) important to safety to protect against the updated hazards at operating reactor sites.

3. To collect information to address Generic Issue 204 (Reference 8) flooding of nuclear power plant sites following upstream dam failures.

Recommendation 2.1 (Enclosure 2 of the NRC 10 CFR 50.54(f) letter) contains a "Requested Information" section detailing two items being requested from each licensed reactor site. The first requested item is the Flooding Hazard Reevaluation Report (FHRR), which has already been submitted to the NRC by the Electric Generating Plant Units 1.

The second requested item of Recommendation 2.1 is an Integrated Assessment (IA) report. Enclosure 2 of the NRC 10 CFR 50.54(f) letter addresses the situation in which an Integrated Assessment should be provided and the information the Integrated Assessment should contain.

An Integrated Assessment report should be developed for plants where the current design basis floods do not bound the reevaluated hazard for all flood causing mechanisms, and the report should include the following:

a. Description of the integrated procedure used to evaluate integrity of the plant for the entire duration of flood conditions at the site

b. Results of the plant evaluations describing the controlling flood mechanisms and its effects, and how the available or planned measures will provide effective protection and mitigation. Discuss whether there is margin beyond the postulated scenarios.

c. Description of any additional protection and/or mitigation features that were installed or are planned, including those installed during the course of reevaluating the hazard. The description should include the specific features and their functions.

d. Identify other actions that have been taken or are planned to address plant-specific vulnerabilities.

The FHRR for Unit 1 reveals the current design basis floods do not bound all reevaluated flood causing mechanisms at the plant site, and, therefore, this report represents the Integrated Assessment (IA) required by the March 12, 2012 10 CFR 50.54(f) NRC letter. The FHRR determined two flood causing mechanisms – 1) Local Intense Precipitation (LIP) determined from present-day Probable Maximum Precipitation (PMP) methods and 2) Dam Breaches and Failures– exceed the current design basis for flooding at the plant site. The LIP analysis generated the bounding flood elevation at the plant site[1].

2.0 Integrated Assessment Procedure

The licensee did not prepare a specific procedure for the development of this Integrated Assessment. The content for this IA report was developed to meet the requirements of NTTF Recommendation 2.1 and follow the guidance set forth by the NRC in the Japan Lessons-Learned Project Directorate (JLD) - Interim Staff Guidance (ISG)-2012-05, "Guidance for Performing the Integrated Assessment for External Flooding," Revision 0 (Reference 9). Section 8 of JLD-ISG-2012-05 was followed in documenting the analyses and results of this IA. Specifically, the methodologies are described to demonstrate the effectiveness of flood protection features and systems at the plant and any modeling performed to evaluate the overall flood protection capability.

3.0 Peer Review

An independent peer review of this IA was performed to provide assurance of the determined scope, employed methodologies, technical adequacy of input parameters, flood protection analyses, and consistency with the guidance of JLD-ISG-2012-05. Attachment 1 to this Integrated Assessment provides the necessary information regarding the peer review, as required by JLD-ISG-2012-05, Appendix B.

Given that the site flood protection features required evaluation as required by JLD-ISG-2012-05, Appendix A, and a manual action was required to install a new removable flood barrier and thus required an evaluation as required by JLD-ISG-2012-05, Appendix C, the peer review was provided by a team of

[1] The LIP analysis used methods for calculating PMP as described in the Units 1- Final Safety Analysis Report (FSAR) (Reference 10). The LIP analysis considers the effects of a precipitation event for a one square mile land area centered on the plant site having the present-day values of 19.2 inches-per-hour rainfall intensity with 6 hour duration.

independent reviewers. The peer review consisted of a Peer Review Lead, providing consultation and input regarding the scope of the IA, methodologies employed, input parameters utilized, plant configurations considered in the IA, and the adherence of the IA to JLD-ISG-2012-05; a qualified reviewer with sufficient expertise in hydrology, structural engineering, and stormwater runoff and flooding protection measures; and a technically qualified reviewer in human actions.

The desired objectives of the peer review process were met by this peer review team.

An in-process review of the IA with the peer review team was performed at different stages of the IA development. Once the development of the Unit 1 IA was finalized, the IA was provided to the peer review team for their final review.

The required information regarding the each peer reviewer's credentials, relevant experience, review methodology, findings/comments, and conclusions from his/her Unit 1 IA peer review are described in Attachment 1 to this report.

4.0 Site Information Related to Flooding

The Site consists of 2,000 acres located on a coastal plain bluff on the southwest side of [x] river. The mouth of the river is approximately 150 river miles from the site. The contributing drainage area of the river at the site is 6,500 square miles, as estimated from digital mapping.

The river basin and its sub-basins, as delineated by the U.S. Geological Survey (USGS) and further subdivided into USGS Hydrologic Unit Code (HUC-12) Watershed Boundary Dataset (Reference 11), are shown in the Plants' Final Safety Analysis Report (FSAR), Figure 2.4.

The plant consists of a pressurized water reactor- that began commercial operation in April 1986. . Two additional reactors, Units 2 & 3, are new nuclear power generating units under construction and are located adjacent to the current Unit operating plant site. Units 2 & 3 will be located west of and adjacent to the existing Unit -as shown in Units 2 & 3 FSAR Figure 1.1. The combined license (COL) under 10 CFR 52 for Units 2 & 3 was issued by the NRC in 2012. The March 12, 2012 10 CFR 50.54(f) letter excludes 10 CFR 52 plants from the information requested by stating, "For combined license (COL) holders under 10 CFR 52, the issues in NTTF Recommendation 2.1 and 2.3 regarding seismic and flooding reevaluations and walkdowns are resolved."

Electric Generating Plant Unit 1 is a plant site not subjected to flooding from the nearby streams and the river (including postulated dam break scenarios). The normal water elevation of the river is approximately 80 feet (NAVD-88).

Since the licensee originally planned to have three operating units at the site, the Units 2 & 3 site area was included in the grading plan during the construction of Units 1. The Units 2 & 3 area was rough-graded to the plan, which included a drainage ditch south- southwest of the Units 2 & 3 area, designed to accommodate the runoff from the 100-year storm. This ditch also functions as the local Probable Maximum Precipitation (PMP) drainage path for the Units 2 & 3 area during storms, up to an including a postulated LIP event.

The site grade elevation for all structures important to safety of all three units is located at Nominal Design Elevation (NDE) 220 feet (NAVD-88).

5.0 Hazard Definition -- Controlling Flood Mechanism

---Preparer's Note---

When defining the bounding hazard and analyzing each specific flooding mechanism, consider developing a table in this section to compare flood scenario parameters for each flooding mechanism and to show the bounding conditions for each parameter (Entries in the table may be "N/A" if a parameter is not applicable). Informative Annex A provides the suggested table format.

Similarly, when discussing the plant configurations for different operational modes during the analyzed flood mechanisms (JLD-ISG 2012-05, Section 1.3) Informative Annex A provides a suggested table.

Section 5 of JLD-ISG-2012-05 was used to define applicable flood mechanisms to Unit 1 and identify the bounding flood parameters. The controlling flood mechanism analyzed in the Unit 1 FHRR that yields the highest flood elevation is the Local Intense Precipitation (LIP) event at the Unit 1 site. For all postulated flood hazard mechanisms, the flood surface elevation is below the main Unit 1 power block floor elevation containing the SSCs important to safety. However, the flood surface elevation for the evaluated LIP event is .1ft higher locally than the ventilation opening in the intake structure building. The ~~i~~Intake ~~s~~Structure ~~b~~Building houses the Nuclear Service Cooling Water (NSCW) pumps and is a structure independent of the main Unit 1 power block.~~ as indicated on Figure~~. The FHRR (reference 2) provides greater detail of the LIP event.

5.1 Local Intense Precipitation

JLD-ISG-2012-05, Section 5.2 describes flood parameters to consider from the results of the FHRR. Local Intense Precipitation (LIP) is the ~~-~~controlling flood mechanism for the Unit 1 site. The reevaluation of certain flood hazards (LIP and dam failure) exceeded the current design basis for the site. This section demonstrates that the controlling reevaluated hazard in the Unit 1 FHRR is the LIP event. In subsequent sections of this evaluation, it is shown that the reevaluated flood hazards do not exceed the grade of the Unit 1 main power block, and no SSCs important to safety located in the main power block are impacted by the reevaluated flood hazard. Sections 7 will evaluate the LIP event on the Intake Structure Building openings.

The Unit 1 current design basis calculation determined the LIP flood elevation to be 219.1 feet (NAVD-88). The FHRR for the Unit 1 PMP/LIP was recalculated with a higher 1-hour rainfall intensity to correspond with the assumed 1-hour rainfall intensity utilized in the COL application for Units 2 & 3 (Reference 12). The LIP reevaluation for Unit 1 accounted for an LIP duration of 6 hours and reported an overall increase in flood height of 0.2 feet and 1.2 ft. at the Intake Structure Building. Therefore, the Unit 1 current design basis has an LIP water surface elevation of ~~elEEation~~ 219.1 feet (NAVD-88) and a reevaluated flood height of 219.3 feet (NAVD-88), accounting for beyond design basis rainfall intensity with exception of the Intake Structure Building entrance way. At this location, the reevaluated flood height is 220.3 ft. (NAVD-88)

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This reevaluated LIP flood height with the updated rainfall event provides 0.3 feet of margin between the reevaluated flood height (219.3 feet (NAVD-88)) and the lowest elevation of the openings into the Unit 1 main power block SSCs (219.6 feet (NAVD-88)). However, at the Intake Structure Building the reevaluated flood height of 220.3 ft. (NAVD-88) is .1ft above the ventilation opening and door sill for the building of 220.2 ft. (NAVD-88). See Fig. ~~xxx.~~6.2 & 6.3

The Unit 1 main power block was designed and constructed to have a floor NDE of 220 feet (NAVD-88). During the recent site survey for the FHRR, the lowest main power block including the Intake Structure Building floor elevation was measured to actually be 219.6 feet (NAVD-88), accounting for settlement (discussed below in Section 6.1). From the results of the FHRR, the lowest Available Physical Margin (APM), 0.3 feet, exists between the peak flood height during the LIP event and the lowest SSC floor elevation important to safety. Therefore, SSCs important to safety for the main power block are not in a flooded condition during a LIP event. However, the results of the FHRR also indicated that water in the vicinity of the Intake Structure Building ventilation opening would exceed the opening by .1ft thus allowing water to enter the building. As stated in the interim evaluation portion of the FHRR, an interim action consisting of a sandbag wall was erected around the opening until the plant designed and staged a portable barrier to be installed upon entry of Unit 1 procedure 1234-B Severe Weather Checklist" (Reference 13) described below. This interim action was designed to stay in place until the completion of this IA and implementation of the removable flood barrier design described below.

The LIP for Unit 1 was analyzed for use in the FHRR considering a plant site configuration that would generate the highest flood elevation. The high flood water configuration at Unit 1 would include a double row Vehicle Barrier System (VBS) around the Unit 1 main power block perimeter and would be during the Units 2 & 3 construction phase period.

After the construction phase for Units 2 & 3 was initiated, a second perimeter VBS row was added and security features were implemented at Unit 1 (surrounding the main power block), and the effects of LIP on site drainage were again evaluated. From a LIP analysis standpoint, the construction phase of Units 2 & 3 is more onerous than the operational phase of Units 2 & 3 because permanent site drainage features to be installed at the plant site after construction of Units 2 & 3 are not in existence during the Units 2 & 3 construction phase. Thus, the construction phase of Units 2 & 3 provides the worst-case configuration of the overall plant site that would yield the highest LIP water surface elevation. The configuration of the barrier system was also the cause of the increase in water level to 220.3ft.(NAVD-88) at the Intake Structure Building.

All changes to the Units 2 & 3 construction site drainage design and configuration are controlled appropriately under the Unit 1 operational impact program requiring full evaluations of the proposed changes to the protection and operability of Unit 1.

Unit 1 is subject to tropical storms, heavy rains, and hurricanes. Unit 1 procedure 1234-B, "Severe Weather Checklist," (Reference 13) provides instructions for preparing the plant. This procedure ensures windows to buildings are closed, ensures vents on sewage treatment facilities are closed, ensures certain outside equipment is braced and tied down in an anticipated heavy wind event, ensures personnel are indoors, and ensures necessary storm duty vehicles are accessible within the protected area to withstand the effects of a severe weather event. No manual actions with respect to flood protection and mitigation are relied upon for plant preparation as a component of this checklist for the main power block. This procedure also directs implementation of Unit 1 procedure 1234-C, "Installation of Flood Protection at the Intake Structure Building" (Reference

~~14~~15) which directs personnel to ensure the Intake Structure Building door is closed shut and to install a removable flood barrier over the Intake Structure Building ventilation opening as illustrated in Fig. 6.2 and 6.3. Entry into this checklist is performed for the following conditions:

- A tornado warning issued by the National Weather Service (NWS) for the local geographical region encompassing the plant site,
- Weather anticipated that will result in a Notification of Unusual Event (i.e., NWS issuance of a high wind event, severe thunderstorm, or tornado watch or warning) in accordance with the Plant Emergency Plan,
- Or as deemed necessary by the Shift Manager

Preparation in advance of adverse weather conditions is governed by site procedures, which require plant shutdown as a precaution when appropriate. No in-room water detection systems are relied upon for external flooding in the Unit 1 licensing basis, and no such systems are required due to SSCs important to safety being located at an elevation above all postulated flood heights within the main power block.

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Access to the Ultimate Heat Sink, the Nuclear Service Cooling Water (NSCW) system, is maintained throughout the duration of the LIP flood event. All pumps and electrical components within the Intake Building supporting the NSCW system are located at elevation 222.5 feet. However, since there is a 4 foot square ventilation opening located as illustrated in Fig. 6-3, water may enter the Intake Structure Building.

Access roads to the all structures will be flooded during the LIP event, as they are located at 218.5 feet (NAVD-88) (0.8 feet below LIP flood water elevation). However, the main power block structures are not flooded from the LIP event due to an available 0.3 feet margin between the main power block floor elevation and the LIP flood water elevation. Given the above-average ground clearance and radial tire size of the plant site's storm duty vehicles, the access roads never reach an impassable state during the LIP event. Thus, if additional personnel need to access the Unit 1 power block buildings during a local intense PMP, transport along the roads via regularly-used vehicles is achievable.

5.2 Dam Failures

The Unit 1 FHRR revealed that, in addition to LIP, the dam failure reevaluation yielded a flood elevation higher than the current design basis. Dam breach flooding resulting from dam failure with coincident wave run-up yielded a maximum flood elevation at the site of 178.1 feet (NAVD-88). The current design basis provides a flood elevation resulting from dam failure of 168 feet (NAVD-88). See Table 6-3 for the reevaluated flood elevations related to each flood causing mechanism.

Despite the reevaluated flood height of 178.1 feet (NAVD-88) from dam failures including coincident wave run-up, the floor elevation of 219.6 feet (NAVD-88) of important to safety structures and openings at the site provides 41.5 feet of available margin above the resultant flood water and wind-driven wave run-up from the reevaluated dam failure flood causing mechanism.

The current design basis being exceeded for the flood elevation from the reevaluated dam failure flooding mechanism at the Unit 1 site provides a basis for performing this IA in accordance with the March 12, 2012 10 CFR 50.54(f) letter. However, the parameters generated from the dam failure flood causing mechanism do not present the enveloping case for external flood evaluation at the Unit 1 site. The flood scenario demonstrated by the reevaluated PMP at Unit 1 remains the controlling flood parameters to evaluate at this site. The PMP flood elevation exceeds the dam failure flood elevation by 41.2 vertical feet, which causes the PMP flooding parameters to bound all flood water increases and coincident effects generated by the dam failure scenario. Therefore, the PMP event at Unit 1 will be used to evaluate the protection capability of flood protection features in this IA.

Unit 1 can remain in all operational modes during a worst-case dam failure scenario with all SSCs important to safety being protected from flooding. In the most vulnerable of plant mode configurations, no flood water or associated effects challenge the SSCs important to safety, as all entry ways into power block buildings and access roads remain at least 40.4 feet above flood water.

6.0 Critical Plant Elevations and Equipment Protection

---Preparer's Note---

When describing the plant's critical elevations of SSCs important to safety, consider tabulating the information described in JLD-ISG 2012-05, Section 5.3. Informative Annex A provides a suggested table for use.

6.1 Settlement of Unit 1 Power Block Structures

Section 2.5.4 of the Unit 1 FSAR addresses the predicted heave and settlement of the Unit 1 power block area during the initial excavation through the construction of the facility. A heave-and-settlement monitoring program existed during the entire construction and has been maintained during the operational period as described in Section 2.5.4.1 of the Unit 1 FSAR. Currently, the settlement monitoring program data are collected and reported to the NRC at a reduced frequency (annually) because settlement of the structures has essentially ceased. During the excavation period, the heave at selected depths below the excavation resulting from the removal of the overburden was recorded. From the available measured heave data, corrected for depth and loading effects, an average heave of approximately 1.8 inches was determined for the excavation floor in the power block area.

Measured settlements attributed to backfilling of the excavations are not reported in the FSAR. Unit 1 FSAR Figure 2.5.4-1 presents estimated settlements for power block structures with a maximum settlement of 4.2 inches (0.35 feet). The maximum measured total settlement at the power block structures reported in the Plant Report on Settlement, August 1986 (Reference 14), was 3.6 inches (0.3 feet). These values, along with the calculated differential settlements, are within the allowable limits.

The soil column between the bedrock and the Blue Bluff Marl (BBM) clay, the competent foundation layer, is approximately 1,000 feet deep. The power block excavation extends down, about 90 feet, to the BBM. The BBM is typically from 60 feet to 70 feet thick. Some of the power block structures are founded on and in the BBM, and some are founded in the backfill. Depending on the foundation loading and other factors, the measured settlements vary within the expected range.

As a result of the settlement, the Nominal Design Elevations (NDE) are not the actual elevations of the structures. As part of the preparation of the Flooding Hazard Reevaluation Report (FHRR), a survey was performed to confirm the actual elevations of floors at NDE 220 feet (NAVD-88). The minimum elevation reported in the recent survey was elevation 219.6 feet (NAVD-88), which is located on the Unit 1 Auxiliary Building floor at the base of the north wall. For the purposes of this IA, the NDE of 220 feet (NAVD-88), the elevation of the grade level structures, is established as elevation 219.6 feet (NAVD-88), which is the lowest of any of the settlements in the FSAR and the results of the recent survey.

JLD-ISG-2012-05, Section 5.3 provides for consideration of certain critical plant elevations and the manner by which plant equipment could be subjected to flooding. The relevant Unit 1 plant nominal design elevations and the assumed, actual power block floor elevation are in Table 6-1 below:

Table 6-1 Critical Plant Design Elevations

Unit 1 Power Block Plant Level	Nominal Design Elevation (feet (NAVD-88))	Measured Elevation (feet (NAVD-88))
Unfinished Plant Grade	219.0	-
Finished Plant Grade	219.5	-
SSCs Finished Floor Main Power Block	220.0	219.6
SSC's Finished Floor Intake Structure Building	222.5	
All Buildings Entry Ways (bottom elevation)	220.1	

The main power block floors are elevated from finished plant grade by horizontal concrete slabs separating the levels of each building. From the field surveys conducted at the plant in preparation of the Unit 1 FHRR, the lowest main power block floor elevation reported was actually 219.6 feet (NAVD-88). All critical elevations of SSCs important to safety and associated equipment is at or above the reevaluated minimum Unit 1 main power block floor elevation of 219.6 feet (NAVD-88), which is above the bounding flood elevation of 219.3 feet (NAVD-88). The main power block finish plant grade is six inches above the unfinished power block grade due to a six-inch layer of concrete. This concrete finished plant grade covers the plant site between all Unit 1 main power block buildings. Additionally, each access way/door into the main power block structures has a bottom elevation six inches above the floor elevation. Accounting for similar settlement as that measured in the main power block floor, the lowest entry way elevation in the plant would be assumed to be 220.1 feet (NAVD-88). Therefore, flood protection features or systems used to protect each piece of equipment, the manner by which the equipment could be subjected to flooding, and potential pathways for ingress of water are non-existent for the Unit 1 main power block buildings. See Figure 6-1 below.

The Intake Structure Building floor is elevated from finished plant grade by a horizontal concrete slab. In addition, once inside the building, two steps are provided to step up from the doorway to the elevation of 222.5 ft. (NAVD-88) where the SSCs important to safety are located. Similar to the main power block buildings, the field surveys conducted at the plant in preparation of the Unit 1 FHRR, the lowest floor elevation reported for the Intake Structure Building was actually 222.5 feet (NAVD-88). All critical elevations of SSCs important to safety and associated equipment is at or above the reevaluated minimum Unit 1 Intake Structure Building floor elevation of 222.5 feet (NAVD-88), which is above the bounding flood elevation of 220.3ft (NAVD-88). See Figure 6-2 and 6.3 below.

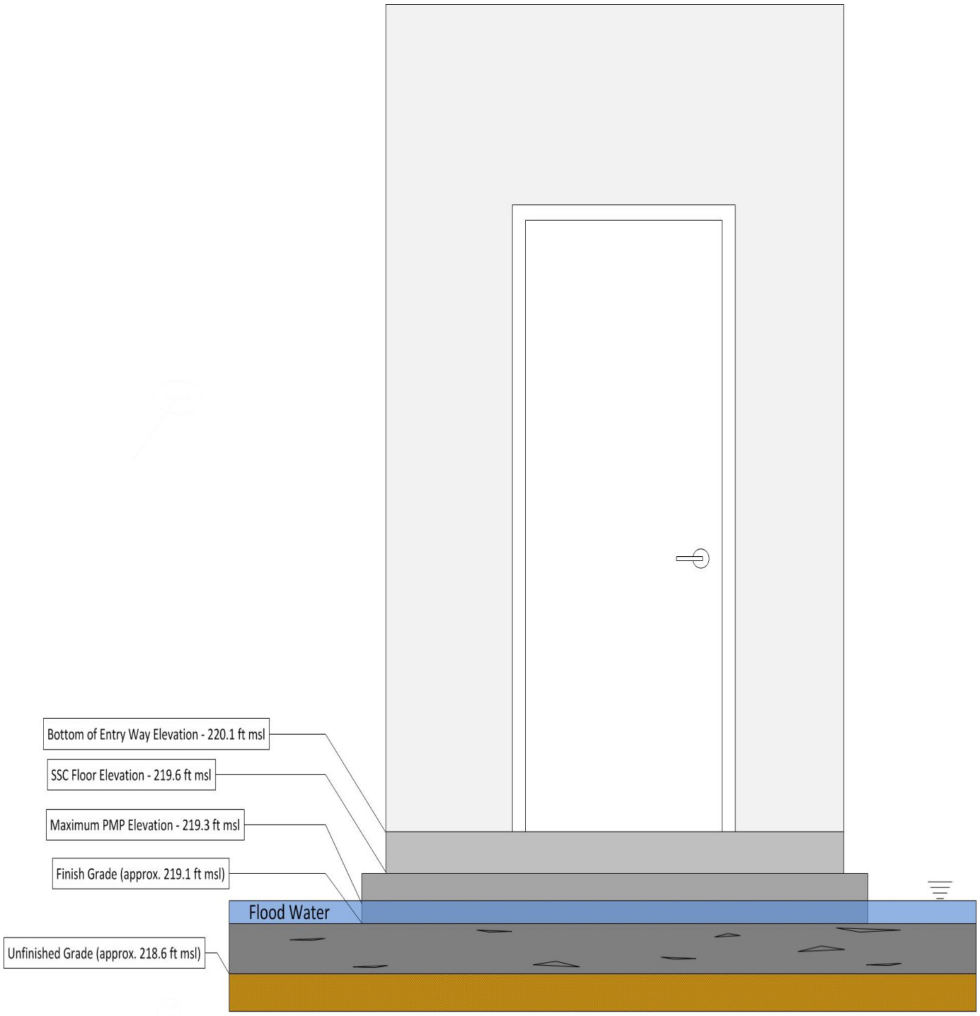

Figure 6-1 Elevation View of Unit 1 Main Power Block Building (Entry-Way Detail) (*Note: Represented elevations assume settlement similar to the 0.4 feet settlement of SSC floor elevation)

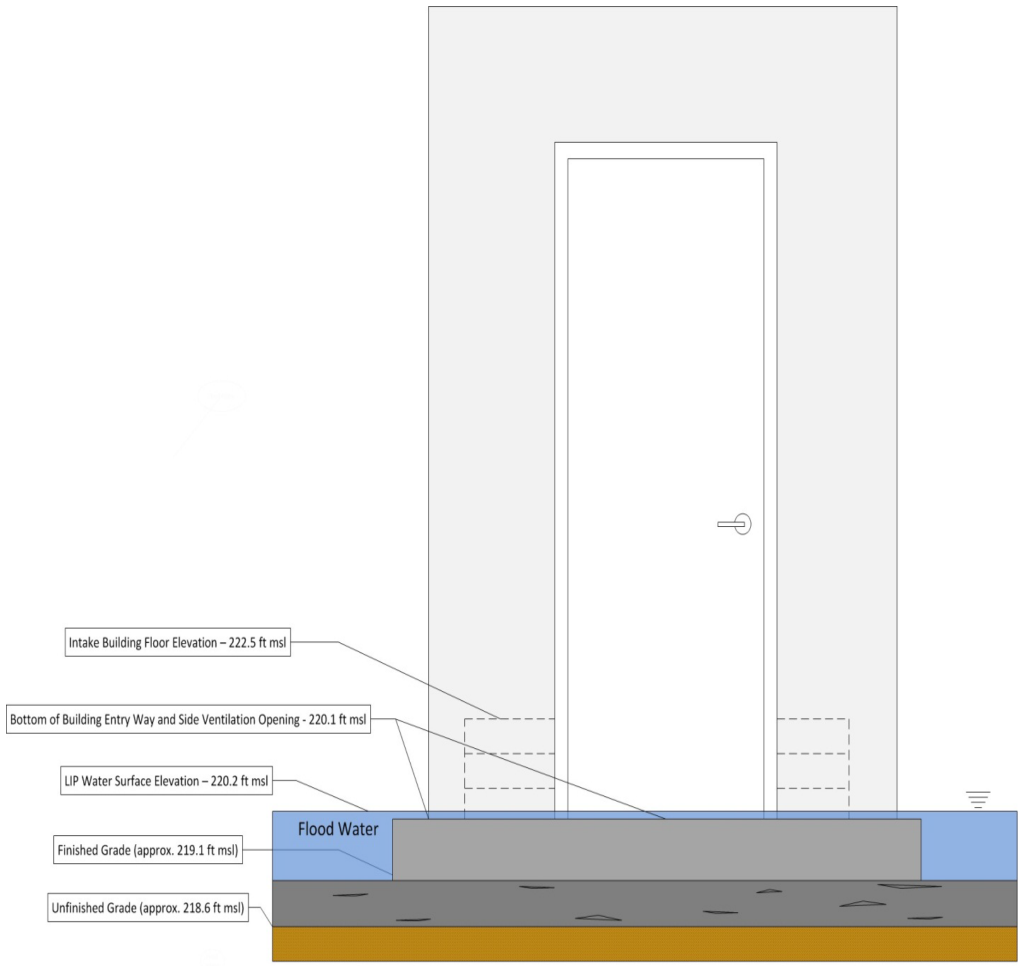

Figure 6-2 Elevation View of Unit Intake Structure Building (Entry-Way Detail) (*Note: Represented elevations assume settlement similar to the 0.4 feet settlement of SSC floor elevation)

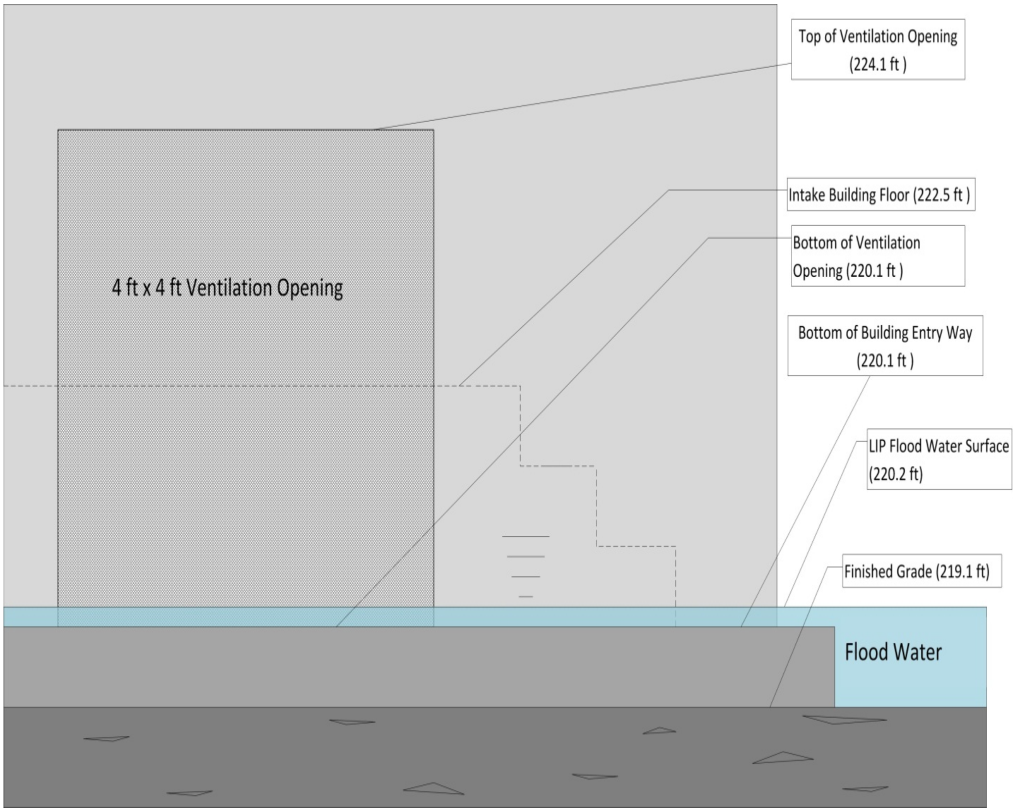

Figure 6-3 Elevation View of Unit Intake Structure Building (Building Side View)
(*Note: Represented elevations assume settlement similar to the 0.4 feet settlement of SSC floor elevation)

6.2 Current Design Basis Flood Elevations

The current design basis flood elevations from various flood causing mechanisms (except the LIP flooding) are listed in Table 6-2 below and are taken from Section 2.4 of the Unit 1 FSAR. For Flooding in Streams and Rivers and Dam Failure analyses, the Unit 1 current licensing basis considers all pertinent associated effects such as wind speeds and wave run-up with the Probable Maximum Flood (PMF). The FHRR reevaluated dam breach flooding with coincident wave run-up, which yielded a maximum flood elevation of 178.1 feet (NAVD-88) – 41.5 feet below the lowest SSC floor elevation of 219.6 feet (NAVD-88) Additionally, the groundwater level at the site has historically been measured to be less than 162.0 feet (NAVD-88), and the maximum potential groundwater level is estimated to be 165.0 feet (NAVD-88) – 54.6 feet below the floor elevation of important to safety structures at the site. A comparison of elevation values between the Unit 1 current design basis flood mechanisms and the reevaluated flood elevations from the Units 1~~&2~~ FHRR are shown in Table 6-3 below.

Table 6-2 Current Design Basis Flood Elevations

Flood Causing Mechanism	Flood Elevation (NAVD-88)((NAVD-88))(NAVD-88)	Flood Elevation coincident with Wind Wave (NAVD-88)((NAVD-88))(NAVD-88)	Source
Local Intense Precipitation (PMP)	(1)	N/A	(1)
Flooding in Streams and Rivers	138 feet	165 feet	Unit 1 FSAR Sections 2.4.3.4 and 2.4.3.6
Upstream Dam Failures	141 feet	168 feet	Unit 1 FSAR Sections 2.4.4.2 and 2.4.4.3
Storm Surge and Seiche	N/A	N/A	Unit 1 FSAR Section 2.4.5
Tsunami	N/A	N/A	Unit 1 FSAR Section 2.4.6
Ice Induced Flooding	N/A	N/A	Unit 1 FSAR Section 2.4.7
Channel Diversion	N/A	N/A	Unit 1 FSAR Section 2.4.9

(1) The Unit 1 FSAR provides the simplified methodology for determining the PMP flood height but it does not report the value. Section 1.2.1 of the Unit 1 FHRR provides the current PMP analysis methodology and results.

Table 6-3 Current Design Basis and Reevaluation Flood Elevations

Flood Causing Mechanism	Current Design Basis Flood Elevation (NAVD-88)	Reevaluation Flood Elevation (NAVD-88)	Reevaluation Flood Delta From Design Basis	Reevaluation Flood Delta from SSC (219.6 ft. (NAVD-88))
Local Intense Precipitation (LIP)	219.1 ft.	219.3 ft.* 220.2 ft.**.	+0.2 ft.* +1.1 ft.**.	-0.3 ft.* -2.3 ft.**
Flooding in Streams and Rivers	165 ft.	151 ft.	-14 ft.	-68.6 ft.
Dam Failures	168 ft.	178.1 ft.	+10.1 ft.	-41.5 ft.
Storm Surge and Seiche	N/A	N/A	N/A	N/A
Tsunami	N/A	N/A	N/A	N/A
Ice Induced Flooding	N/A	N/A	N/A	N/A
Channel Diversion	N/A	N/A	N/A	N/A

*Main Power Block
** Intake Structure Building

7.0 Evaluation of Flood Protection Features

This section describes the flood protection features credited at the Unit 1 plant site. This section is further sub-divided by flood protection feature type: site topography and site grading (section 7.1); site drainage (section 7.2); and incorporated flood protection (section 7.3). Associated with each flood protection feature type are three subsections:

- Performance Criteria: This subsection describes both qualitative and quantitative criteria of the feature to protect against water ingress into a SSC important to safety. Aspects such as the load-bearing ratings, material and size of the feature, and the feature's condition from inspection are considered in this subsection. These aspects are not considered when the flood protection feature is not challenged by the flood water.
- Flood Protection Evaluation: This subsection describes the feature's ability to protect against the bounding flood parameters at the site. Overall, the soundness of the flood protection features are demonstrated by confirming the features are in satisfactory condition, higher than the reevaluated flood height, and structurally adequate based on quantitative engineering evaluations. Other aspects of JLD-ISG 2012-05, Section 6.2 and Appendix A are considered in this subsection.
- Flood Protection Performance Justification: This subsection describes the reasoning as to why the credited flood protection features are capable of withstanding the flood height and associated

effects for the bounding set of flood scenario parameters. Additionally, the section identifies the limiting margin associated with the individual flood protection features.

The Unit 1 plant site is protected from external flooding by site topography and site grading. While a site drainage system is in place at the site, it is not credited as a flood protection feature, and an evaluation of it was not performed in this IA. Incorporated barriers at the site are located below grade and are credited for protection from groundwater infiltration. Because surface water is not estimated to infiltrate beyond a depth of 9.6 feet into the site subsurface, these features are not expected to be challenged by surface water and are, thus, not evaluated as part of this IA. Additional details associated with each flood protection feature type as well as any associated evaluations performed (or justification for evaluations not performed) are provided in the subsections below. See also Figure 7-1 for a sub-surface depiction between two of the power block buildings at Unit 1.

7.1 Site Topography and Site Grading

The Unit 1 power block area is on a high plateau and is not in the path of any adjacent watershed. By definition, the power block area is contained in one or more watersheds. There are no gaps between watersheds, and the watersheds are separated by watershed divides. The topography and site grading is such that the runoff is directed away from the power block by a combined system of culverts and open ditches to natural drainage channels. The system has been evaluated to ensure that flooding of important to safety equipment would not occur as a result of the flood controlling parameters at the site. The highest flood level from the flood controlling parameters is 219.3 feet (NAVD-88), which is 0.3 feet below the lowest floor elevation in the Unit 1 power block area.

7.1.1 Performance Criteria

The performance criteria listed in Section 6.2 and evaluation information in Section 8.2.2 of JLD-ISG-2012-05 as well as related methodology of Appendix A are not applicable for a site topography evaluation as the natural elements composing site elevation protect SSCs important to safety at the site grade elevation when APM exists above the controlling site flood elevation. No failure modes exist for site topography at the plant site. Heave and settlement monitoring of Unit 1 will continue for the life of the plant.

7.1.2 Flood Protection Evaluation

The lowest measured important to safety structure floor elevation at Unit 1 is located at 219.6 feet (NAVD-88). All external entry ways into structures/buildings important to safety are 0.5 feet above the structure's floor elevation – assumed to be a minimum elevation of 220.1 feet (NAVD-88) for purposes of this evaluation. These potential external water ingress points remain 0.8 feet above the controlling flood water elevation, which provides inherent protection to the SSCs important to safety from external flooding.

7.1.3 Flood Protection Performance Justification

Unit 1 site topography, as a flood protection feature, provides a minimum important to safety SSC floor elevation of 219.6 feet (NAVD-88), which yields 0.3 feet reliable, available margin above the bounding water elevation of 219.3 feet (NAVD-88). JLD-ISG-2012-05, Section 6.3 provides required information that is not applicable to evaluating the site topography of Units1 & 2.

7.2 Site Drainage Features

While the site yard drainage system is designed and constructed to effectively divert surface water away from the Unit 1 power block, the site drainage features of the Unit 1 site were assumed to be 100 percent blocked in the Unit 1 FHRR. Blocking the site drainage features to prevent their functionality helps generate the maximum flood elevation of 219.3 feet (NAVD-88) at the plant site. Therefore, an evaluation of the site yard drainage system as a flood protection feature is not required.

7.2.1 Performance Criteria

Because the site yard drainage system is not intended to be credited as a reliable flood protection system, the criteria of JLD-ISG-2012-05, Section 6.2 and related methodology of Appendix A are not applicable.

7.2.2 Flood Protection Evaluation

This section is not applicable as the site drainage system is not credited to drain water away from the Unit 1 power block SSCs during an event with the bounding flooding parameters at the plant site. Given the site drainage system is credited for being 100% blocked during a bounding flood event, the evaluation for that feature is not applicable for purposes of this IA.

7.2.3 Flood Protection Performance Justification

Because the Unit 1 site drainage system is not credited as a reliable flood protection feature, justification of its performance is not applicable in this IA. JLD-ISG-2012-05, Section 6.3 requires evaluation information that is not applicable to a flood protection feature not credited to function in a flood scenario.

7.3 Incorporated Flood Protection Features

Although there are no SSCs important to safety located below grade, the plant contains incorporated flood protection features such as permanent, passive barriers, flood protection seals, and waterstops. These flood protection features were credited in the Unit 1 original licensing basis to protect against groundwater seepage into the buildings. Although credited as flood protection features in the original licensing basis, these barriers do not protect any SSC important to safety.

Underground, safety-related tunnels connecting rooms in separated safety-related structures exist as a conduit for cabling and system piping. None of these connecting rooms contain SSCs important to safety, but they are a conveyance for cables or piping for SSCs important to safety located above-grade and above the flood level. The tunnels are covered by compacted, load-bearing competent site soil, and no interim entry points into the tunnel system exist between buildings. The entry points into those tunnels exist within safety-related structures at or above the floor elevation of, at least, 219.6 feet (NAVD-88) – which is protected from the controlling flood elevation with available margin. There are no other entry points or penetrations outside of the structures into safety-related tunneling at the site. See Figure 7-1.

7.3.1 Concrete Walls

Certain exterior concrete walls were credited in the Unit 1 FWR as a flood protection feature. Every wall inspected as a flood protection feature is located in a main power block building room located at a sub-grade elevation at or below historical groundwater elevations (162.0 feet (NAVD-88)) at the site. No exterior concrete walls are challenged by external flooding from the bounding flood water elevation. All credited concrete walls are, at least, 39.6 feet below the floor elevation of SSCs important to safety.

7.3.1.1 Performance Criteria

Because there are no above-grade concrete walls credited for the protection of SSCs important to safety against external flooding, the criteria of JLD-ISG-2012-05, Section 6.2 and related methodology of Appendix A are not applicable.

The below-grade concrete walls credited as flood protection features within the Unit 1 FWR are located at elevations a minimum of 39.1 feet below the finished plant grade. However, the maximum estimated groundwater table elevation of 165.0 feet (NAVD-88) would challenge a portion of sub-surface concrete walls with hydrostatic loading.

All exterior, sub-surface concrete walls for the Unit 1 power block structures are a minimum of 24 inches thick and are applied with waterproofing media up to plant grade elevation. Either a waterproofing membrane or a chemical waterproofing treatment was applied to the exterior of the concrete walls.

The six-inch concrete slab that creates the finished plant grade between main power block buildings has a 0.95 water runoff coefficient, which translates to 5% of all flood water standing on top of finished plant grade will infiltrate into the soil adjacent to sub-grade walls of the main power block buildings – minimizing any hydrostatic loading that may occur from a rise in elevation of the groundwater table. With a maximum 0.2 feet (equal to 2.4 inches) of standing water above finished plant grade from the controlling flood event at Unit 1, the rate of sub-surface infiltration of flood water adjacent to exterior concrete walls would be too minimal to affect the amount of groundwater hydrostatic loading against any portion of the exterior, sub-surface concrete walls.

7.3.1.2 Flood Protection Evaluation

Evaluation of the below-grade concrete walls is not applicable due to those walls being subjected to minimal, additional hydrostatic loading during the bounding flood event. The groundwater table elevation would be negligibly affected by the potential infiltration of external flood water at Unit 1.

7.3.1.3 Flood Protection Performance Justification

No concrete walls located at or above site grade are credited to protect SSCs important to safety at Unit 1 from external flooding. As a result, performance justification for these non-credited features, as described in JLD-ISG-2012-05, Section 6.3, is not applicable.

Additionally, the below-ground concrete walls in direct contact with the groundwater table would not realize additional hydrostatic loading from the infiltration of flood water due to the height of flood water above finished plant grade being minimal, the 6 hour duration of the bounding flood event, and the vertical distance the water would need to travel to reach the static groundwater table (at least 54.1 feet).

7.3.2 Penetration Seals

Certain sub-grade wall penetration seals were credited in the Unit 1 FWR as flood protection features. Every wall penetration seal inspected as a flood protection feature is located in a main power block building room located on a sub-grade floor at or below historical groundwater elevations at the site (162.0 feet (NAVD-88)). No penetration seals are challenged by external flooding from the bounding flood water elevation at the site. Additionally, there are no penetrations through exterior walls or building foundational base mats into the soil below the historical high groundwater level.

7.3.2.1 Performance Criteria

Because there are no above-grade penetration seals credited for the protection of SSCs important to safety against external flooding, the criteria of JLD-ISG-2012-05, Section 6.2 and related methodology of Appendix A are not applicable to those seals.

For the below-grade penetration seals, the Unit 1 FWR credits those seals as groundwater flooding protection features. However, for those seals to be challenged by the groundwater table, the groundwater elevation would have to rise beyond the maximum assumed groundwater level at the plant site (assumed to be 165.0 feet (NAVD-88) based on actual historical recorded values).

With respect to below-grade penetration seals into exterior concrete walls being challenged by surface flood water infiltration into the sub-surface, the realized maximum surface water level above finished plant grade to propagate through the soil would be 0.2 feet. Given the duration of the bounding flood parameters to be 6 hours, the 0.2 feet of standing flood water above grade to infiltrate the soils below, and the minimum assumed distance (54.1 feet) for the surface water at finish grade to travel to reach the high groundwater elevation, the effects of water percolating through the soils and adjacent to main power block structure penetration seals are negligible. Those same effects would not add hydrostatic pressure to the seals due to the seals existing above the maximum assumed groundwater level (which is 3 feet above the actual recorded maximum groundwater elevation).

7.3.2.2 Flood Protection Evaluation

Evaluation of the below-grade penetration seals is not applicable due to those seals being subjected to minimal, additional hydrostatic loading during the bounding flood event. The groundwater table elevation would be negligibly affected by the potential infiltration of external flood water at Unit 1.

7.3.2.3 Flood Protection Performance Justification

No penetration seals located within buildings at or above site grade are credited to protect SSCs important to safety at Unit 1 from external flooding. As a result, performance justification for these non-credited features, as described in JLD-ISG-2012-05, Section 6.3, is not applicable.

Additionally, the below-grade penetration seals through main power block exterior walls are located at elevations above the maximum assumed groundwater table elevation. The seals are only subjected to surficial flood water that does not drain on the surface, but rather infiltrates the sub-surface while traveling to the groundwater table located at an elevation beneath the seal(s).

7.3.3 Waterstops

Waterstops embedded in exterior wall or floor construction joints of the Unit 1 main power block buildings, or in seismic gaps below the groundwater table elevation, are credited flood protection features in the Unit 1 licensing basis. The FWR considered the waterstops in inspections of the incorporated concrete wall barriers.

The waterstops are in place below 219.6 feet (NAVD-88) to protect against groundwater seepage into sub-grade SSCs. One waterstop is provided at each construction joint below 170 feet (NAVD-88), except in the nuclear service cooling water towers where two waterstops are provided at each construction joint below 220 feet (NAVD-88). Two waterstops are provided at each seismic separation gap below 170 feet (NAVD-88), and one waterstop is provided at each seismic gap located between 170 feet (NAVD-88) and 220 feet (NAVD-88). No waterstops are challenged by external flooding from the bounding flood water elevation at the site.

7.3.3.1 Performance Criteria

Because there are no above-grade waterstops credited for the protection of SSCs important to safety against external flooding through seismic gaps or construction joints, the criteria of JLD-ISG-2012-05, Section 6.2 and related methodology of Appendix A are not applicable to those waterstops.

For the below-grade waterstops, the Unit 1 FWR credits those waterstops as groundwater flooding protection features. However, the maximum estimated groundwater table elevation of 165.0 feet (NAVD-88) would challenge those waterstops located in seismic separations joints beneath that elevation with hydrostatic loading.

There are two waterstops located in the Unit 1 main power block seismic separation joints below 170.0 feet (NAVD-88), which provide a protection redundancy against groundwater hydrostatic pressure against those seismic joints. The likelihood of groundwater infiltration through the seismic joints and past two waterstops is minimal as the waterstops each have 65 pounds per square inch (psi) of tensile strength (approximately 150 feet of flood water column).

7.3.3.2 Flood Protection Evaluation

The sub-surface waterstops located in the main power block structure seismic separation joints provide demonstrated protection from in-seepage of groundwater into the joints (as inspected and documented in the Unit 1 FWR). Additionally, there is a maximum 0.2 feet (equal to 2.4 inches) of standing water above finished plant grade from the controlling flood event at Unit 1. The rate of sub-surface infiltration of flood water adjacent to sub-surface waterstops would be too minimal to affect the amount of groundwater hydrostatic loading against any portion of the waterstops in the seismic separation joints. Furthermore, the maximum additional hydrostatic pressure added to the groundwater table from the surficial water infiltration during a bounding flood event would be negligible.

7.3.3.3 Flood Protection Performance Justification

There are no waterstops embedded within seismic gaps or construction joints at or above site grade. There is varying margin between each waterstop and site grade, but no external flooding challenges the waterstops because they are below-ground. However, the below-grade waterstops in direct contact with the groundwater table would not realize additional hydrostatic loading from the infiltration of flood water due to the height of flood water above finished plant grade being minimal (maximum 0.2 feet), the 6 hour duration of the bounding flood event, and the vertical distance the water would need to travel to reach the static groundwater table (at least 54.1 feet).

7.3.4 Flood Doors and Barriers

As previously stated in section 5 of this IA, the FHRR results in an increase of flood water at the Intake Structure Building to elevation 220.3 feet (NASD-88). This new elevation is 0.1 ft. over the door sill for the building entrance doorway and 0.1 ft. above the minimum elevation of a 4x4 ft. ventilation opening for the building. To protect against water entering the intake building through the ventilation opening, a removable flood barrier has been staged in the building to be installed over the opening. The flood barrier is designed to be installed from the building interior and is capable of blocking water completely from entering the building. To protect against water from seeping underneath the door sill the exterior door is designed to be watertight to external flood elevations in excess of 2 feet above the top of the sill and is procedurally required to be secured prior to the onset of extreme weather challenges. Therefore, both the entrance door and the portable flood barrier are considered active features and will be evaluated in accordance with Section 6.2 and Appendix A.1.1.2 of JLD-ISG-2012-05.

7.3.4.1 Performance Criteria

Both the Intake Structure Building entry door and the removable flood barrier are fabricated of high grade 6063 T6 alloy extruded aluminum frames and angles and 3003-H16 alloy aluminum sheet skin. The Intake Structure Building entry door is a hinged door, with rubber water sealant gaskets for the full perimeter of the door. The removable flood barrier has a rubber gasket around the perimeter, is designed for CSI Section 08316(Reference 16) openings and is mounted on an aluminum frame that surrounds the perimeter of the opening. Both the door and the removable flood barrier are designed to meet lateral forces from a hydrostatic pressure of 124.8 pounds per square foot in accordance with FEMA Technical Bulletin 3-93 (Reference 17~~.~~). In addition, both the door and removable flood barrier are designed for a hydrodynamic force resulting from water velocity of 20 feet per second and in accordance with FEMA Technical Bulletin 3-93. Also, in accordance to FEMA Technical Bulletin 3-93, the door and the removable flood barrier is designed for 500 pounds debris impact force assuming one (1) second duration of impact.

7.3.4.2 Flood Protection Evaluation

Unit 1 procedure 1234-B "Severe Weather Checklist" invokes implementation of Unit 1 procedure 1234-C, "Installation of Flood Protection at the Intake Structure Building" which requires the closing of the entrance door into the Intake Structure Building if open and provides the steps necessary for installation of the removable flood barrier. Engineering Evaluation EE 1234 "-Engineering Evaluation and Analysis of Intake Structure Building Flood Barriers" (~~r~~reference 18..) provides the analysis that demonstrates the functionality of the door and barrier under the flood mechanisms and conditions identified in the FHRR. The analysis conclusions are summarized in table 7.1 below.

Table 7-1 Performance Comparison for the Intake Door and Removable Flood Barrier

ATTRIBUTE	DESIGN (FEMA TB 3-93 METHOD)	ACTUAL CALCULATED VALUE (EE-1234)	MARGIN
Hydrostatic Pressure Resistance	124.8 lbs./Square Foot	62.4 lbs./Square Foot	62.4 lbs./Square Foot
Hydrodynamic Force Resistance	100 lbs.	20 lbs.	80 lbs.
Debris Impact Force	500 lbs. (1 Second Duration)	No Debris generated per FHRR	NA

As can be seen from the table above and as supported by the Engineering Evaluation EE 1234, there is sufficient hydrostatic and hydrodynamic margin in the Intake Structure Building door and the removable flood barrier. The FHRR for Unit 1 did not generate any debris from an LIP event and thus debris was not analyzed in the EE other than to document the attribute and the design of the door and barrier.

The required tools and hardware for the installation of the removable flood barrier are located immediately to the right of the entrance doorway to the Intake Structure Building in a locked cabinet. The removable flood barrier is staged and stored in a protective locked cabinet designed by the barrier manufacturer to ensure protection of the door and the gasket material.

The Intake Structure Building entry door and the removable flood barrier are part of the plant maintenance program. Preventative Maintenance Procedure MST 1234 “Maintenance of Flood Protection Doors and Barriers” (reference 19~~.~~) requires that the Intake Structure Building entrance door, the removable flood barrier, hardware and gasket material be inspected during each site scheduled refueling outage. In addition, the MST ensures that all parts and tools are staged correctly and in good working order. The MST consists of the manufacturer’s instructions, industry Operating Experience (OE) and any special requirements as outlined by the procedure. To facilitate installation holes have been pre-drilled in the barrier and the wall. Elastomeric gasket material is inspected quarterly and replaced once every two years or more often as necessary. The MST also directs the maintenance personal to install the removable flood barrier and to conduct a hose test to observe any leaks or failure or the removable flood barrier. This test is also performed on the Intake Structure Building entry door. Both the entry door and the removable flood barrier are FEMA flood proof certified. Any calibrated tools are part of the site calibration program. Any deviation from the MST is documented in the site corrective action program.

7.3.4.3 **Flood Protection Performance Justification**

Unit 1 procedure 1234-C “Installation of Flood Protection at the Intake Structure Building” directs maintenance personal to obtain the keys to the cabinets from the Main Control Room, traverse to the Intake Structure Building, install the removable flood barrier and secure the Intake Structure Building entry door. This procedure is performed once each plant refueling outage and from the entry condition to the procedure to the final installation of the removable flood barrier and securing of the Intake Structure Building door it has been demonstrated to take fifteen minutes. This implementation time is well within the timeframe required to prepare the plant for the conditions identified in Unit 1 procedure 1234-B. The weight of the removable flood barrier, 25 lbs., can be handled by a single maintenance technician however it takes two technicians to completely install the barrier.

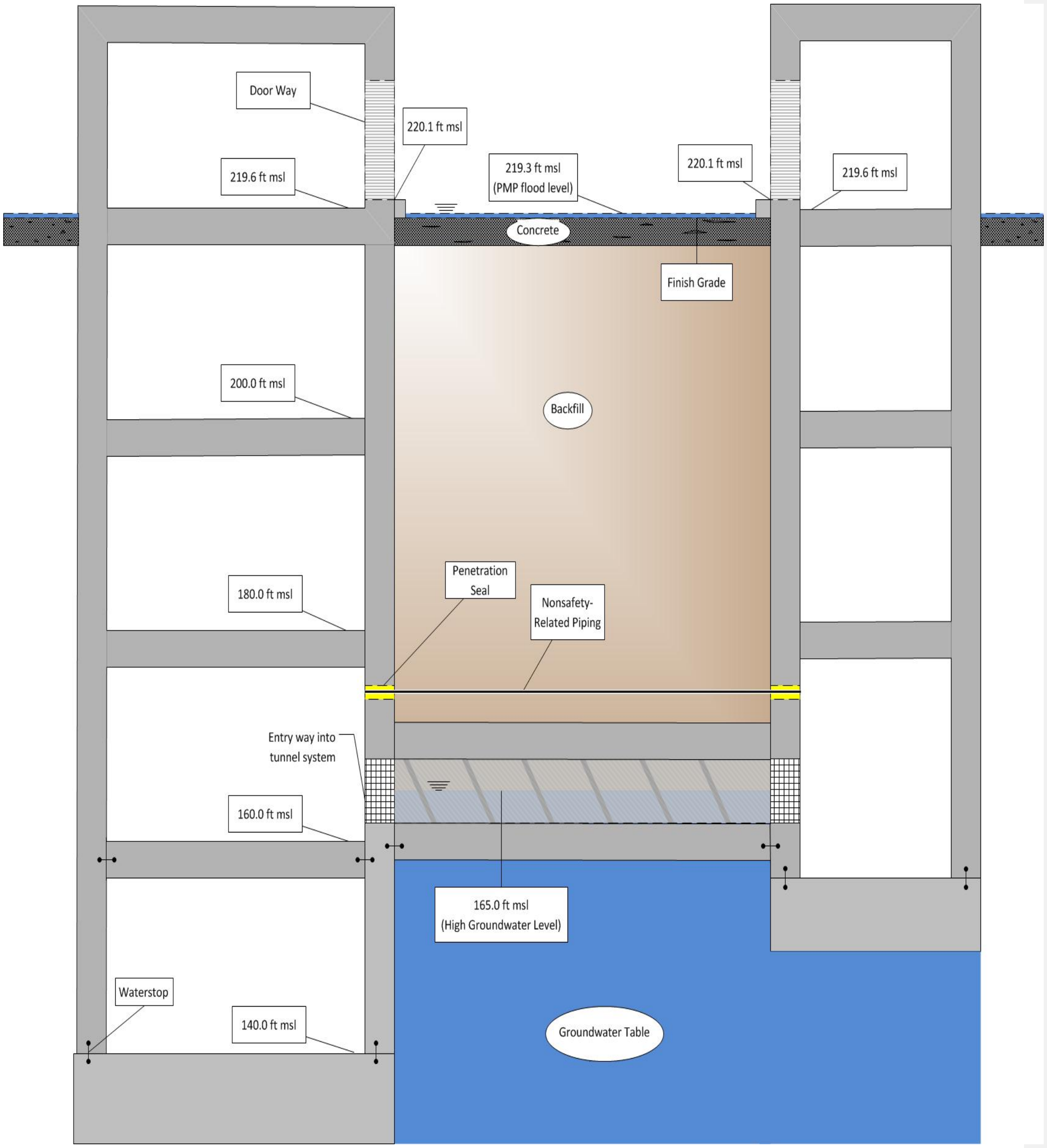

Figure 7-1 Elevation View of Unit 1 Subsurface at Power Block

7.4 Evaluation of Manual Actions to Install Passive Flood Barriers

An LIP flooding event has been reevaluated and now challenges equipment in the Intake Building Structure. As described in the previous section, the site must take manual actions to close the door to the Intake Structure Building and install a temporary, passive flood ~~gate~~barrier. The progression of the scenario is very straight forward~~, and~~ the required actions are simpl~~e~~ and ~~,~~ follow an event specific site procedure. ~~well proceduralized and S~~scenario simulations and past experience have demonstrated these actions to be highly reliable.

The scenario begins with a warning issued by the NWS when more than X" of rainfall is predicted in the next 4 hours. This will be broadcast by the NWS emergency alert system which is monitored by the MCR throughout the day. Once that alert is received, the site will initiate ~~AOP-1234-A, "Extreme Weather" procedure. This directs a severe weather team to be formed and the~~ Unit 1 procedure 1234-B, "Severe Weather Checklist" ~~will be performed~~ which directs a severe weather team to be formed and implement the checklist required by this procedure including the direction to implement Unit 1 Procedure 1234-C.. It can be conservatively assumed that the formation of this team will take 20 minutes following the declaration of a severe weather event. Operators are directed to obtain keys from the MCR and send a crew of at least 2 operators to the Intake Building Structure. These actions can be conservatively assumed to take 10 mins.

Once inside the Intake Building ~~structure~~Structure, the operators will locate the temporary flood barrier and implement Unit 1 Procedure 1234-C "Installation of Flood Protection at the In~~na~~take Structure Building". The barrier is located immediately adjacent to the correct opening with the ~~label~~label, "Flooding Barrier – Do Not Remove" and the associated hardware, tools and instruction required are attached to the barrier in a bag. The operators will then place the flood barrier in its correct location over the opening, lining up the pre-drilled holes in the barrier flange with those in the wall. Bolts and washers can be retrieved from the hardware bag, and then installed in the designed locations. All the bolts and holes are identical. The operator will then use the supplied torque wrench to tighten all the bolts to the specified value of 16 ft-lb. This ensures that the bolts are securely fastened and the rubber gasket is depressed to form a water tight seal. After the flood barrier is installed, the operators will ensure that the barrier is flood tight by using a hose to observe if any water leakage occurs. The last action is to ensure entrance door to the Intake Building Structure is securely closed by challenging the door and confirming that the rubber gasket is properly installed. The installation of the flood barrier and closure of the intake door can conservatively be estimated to take 30 mins.

The procedures ~~AOP-1234-A,~~ 1234-B and 1234-C are routinely trained every outage cycle. The operators are given the NWS warning and the procedure is carried out. Bounding time estimates were used above as the training drill has never taken more than 45 ~~mins~~ minutes to complete. With a window to complete the procedure of at least 4 hours, the time margin available for untimely forecasts, slow procedure initiation and difficulty installing the barrier is more than adequate, especially for actions that are routinely trained. The PM procedure MST 1234 ensures that all the proper materials and equipment are in place, available and will perform its intended function when an LIP event is eminent.

Actions discussed above will be taken in advance of the adverse environment associated with the LIP event. A review of potential environmental conditions and other performance shaping factors that may occur during this time frame will not significantly impact completion of the required actions.

The conclusion of this evaluation is that the installation of the temporary flood barrier and ensuring that the Intake Building Structure's door is securely closed are highly reliable actions that support the external flooding protection strategy. The time margin is well in excess of 100% which will allow for a reasonable amount of uncertainty in timing and allow the operators plenty of time to re-perform a portion of the procedure if necessary.

8.0 Unit 1 Evaluation Results

The current Unit 1 design basis high flood water elevation of 219.1 feet (NAVD-88) was exceeded by 0.2 feet in the Unit 1 FHRR bounding external flooding scenario, which prompted the development of this IA as required in NTTF Recommendation 2.1 (Enclosure 2 to the March 12, 2012 10 CFR 50.54(f) letter).

~~As indicated above, the Unit 1 controlling flood scenario parameters derived from the FHRR are generated from the local intense PMP~~ Section 5 of JLD-ISG-2012-05 was used to define applicable flood mechanisms to Unit 1 and identify the bounding flood parameters. The controlling flood mechanism analyzed in the Unit 1 FHRR that yields the highest flood elevation is the Local Intense Precipitation (LIP) event at the Unit 1 site. For all postulated flood hazard mechanisms, the flood surface elevation is below the main Unit 1 power block floor elevation containing the SSCs important to safety. However, the flood surface elevation for the evaluated LIP event is .1ft higher locally than the ventilation opening in the intake structure building. The Intake Structure Building houses the Nuclear Service Cooling Water (NSCW) pumps and is a structure independent of the main Unit 1 power block. As demonstrated above and in the referenced supporting analysis, in the event of an LIP of this magnitude, sufficient and reliable protection and mitigation is provided to ensure safe and reliable operation of Unit 1.
~~with a maximum flood elevation of 219.3 feet (NAVD-88). For these controlling flood parameters at the Unit 1 site, the reevaluated flood height is 0.3 feet below the lowest important to safety SSC floor elevation of 219.6 feet (NAVD-88). Given the FHRR indicates 0.3 feet APM, the Unit 1 site can continue to be classified as a site not susceptible to flooding of SSCs important to safety from any postulated flood hazard mechanism. Therefore, Unit 1 is protected from external flooding by site topography and design, and not reliance upon flood protection features or mitigation measures.~~

~~The site FWR performed in accordance with NTTF Recommendation 2.3 verified the effectiveness of the Unit 1 flood protection features and determined that no additional or enhanced flood protection features are necessary to be implemented at Unit 1. The flood walkdown inspections confirm that the plant is protected from revaluated flood hazard mechanisms.~~

~~Unit 1 is a plant with all SSCs important to safety constructed above the maximum estimated flood stage, and therefore the safety-related SSCs, including rooms important to safety, do not require in-room water detection systems specific for external flooding. Thus, water detection and warning systems are not relied upon in the licensing basis for protection against external floods. The Unit 1 FHRR does not identify any severe weather conditions that would impair support functions necessary to achieve safe shutdown of the units.~~

~~APM exists for all flood hazard mechanisms between the Unit 1 important to safety SSC floor elevations and flood water peak elevations. Unit 1 can operate in all plant modes throughout site flooding durations without SSCs important to safety being challenged, so that changes in operational mode do not affect the plant's ability to remain dry and keep SSCs important to safety protected.~~

9.0 References

1. U.S. Nuclear Regulatory Commission, Request for Information Pursuant to Title 10 of the Code of Federal Regulations (CFR) 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, March 12, 2012, Agencywide Documents Access & Management System (ADAMS) Accession No. ML12053A340.

2. Electric Generating Plant Unit 1 Flooding Hazard Reevaluation Report (FHRR) submitted to the U.S. Nuclear Regulatory Commission, March 12, 2013.

3. U.S. Nuclear Regulatory Commission. Staff Requirements – SECY-11-0093 – Near-Term Report and Recommendations for Agency Actions Following the Events in Japan, August 19, 2011, ADAMS Accession No. ML112310021.

4. U.S. Nuclear Regulatory Commission. Staff Requirements – SECY-11-0124 – Recommended Actions to be Taken Without Delay From the Near-Term Task Force Report, October 18, 2011, ADAMS Accession No. ML112911571.

5. U.S. Nuclear Regulatory Commission. "Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned," SECY-11-0137, October 3, 2011, ADAMS Accession No. ML11272A111.

6. Consolidated Appropriation Act, for 2012 (PUB LAW 112-74), Section 402.

7. 10 CFR 52 – Licenses, Certifications, and Approvals for Nuclear Power Plants.

8. U.S. Nuclear Regulatory Commission. Generic Issue (GI) 204, "Flooding of Nuclear Power Plant Sites Following Upstream Dam Failure."

9. U.S. Nuclear Regulatory Commission. Japan Lessons-Learned Project Directorate (JLD) – Interim Staff Guidance (ISG) -- 2012-05.

10. Electric Generating Plant Unit 1 Final Safety Analysis Report (FSAR).

11. U.S. Geological Survey (USGS) Hydrologic Unit Code (HUC-12) Watershed Boundary Dataset.

12. Electric Generating Plant Units 2 & 3, 10 CFR 52, Combined License (COL) Application.

13. Electric Generating Plant Unit 1 Procedure, "Severe Weather Checklist" procedure 1234-B.

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14. Electric Generating Plant Unit 1, Plant Report on Settlement, August 1986.

15. Electric Generating Plant Unit 1 Procedure 1234-C, "Installation of Flood Protection at the Intake Structure Building"

16 CSI Section 08316

17 FEMA Technical Bulletin 3-93 "Non-Residential Floodproofing – Requirements and Certification"

18 Engineering Evaluation EE 1234 "Analysis and Evaluation of Intake Structure Building Flood Barriers"

19 Unit 1 Generating Plant Unit 1 Procedure MST 1234 "Maintenance of Flood Protection Doors and Barriers

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Electric Generating Plant Unit 1

Attachment A: Integrated Assessment for External Flooding Peer Review

A.1 Peer Review

A.1.1 Peer Review Process

---Preparer's Note---

Pursuant to JLD-ISG-2012-05, "Guidance for Performing the Integrated Assessment for External Flooding," Revision 0, Section 4 and Appendix B.3, "Peer Review Documentation," state how this Peer Review Attachment meets the objectives of a successful peer review by first describing the peer review process utilized to meet the requirements of JLD-ISG-2012-05, Appendix B.

A.1.2 Peer Reviewer/Peer Review Team

---Preparer's Note---

The name and credentials (e.g. training, experience, expertise, capabilities and background information) of the peer reviewer or members of the peer review team would be provided in this section – consistent with the requirements of Appendix B.3 of JLD-ISG-2012-05.

Additionally, describe how the peer review team member(s) met the reviewer attributes and were independent from the preparation, review, and supervision of the IA report development in this section of the Attachment, in accordance with JLD-ISG-2012-05, Appendix B.1 and B.3.

A.1.3 Findings and Comments

---Preparer's Note---

Consistent with JLD-ISG-2012-05, Appendix B.3, provide the key findings, observations, and/or comments made by the peer review team member(s) in this section of the Peer Review Attachment along with the how the comments were dispositioned for inclusion in the final IA report.

A.1.4 Conclusions

---Preparer's Note---

In this section of the Peer Review Attachment, state the peer review team's overall conclusions of its review with regard to the completeness, accuracy of input information and reported results, technical bases, and the alignment of the IA report with the guidance of JLD-ISG-2012-05.

Informative Annex A

The purpose of this Informative Annex is to provide suggested tabular formats to compare data requested from JLD-ISG 2012-05. The preparer is not bound by these formats and may use other more convenient formats which may be better suited for his/her Integrated Assessment. Although these are suggested formats, the content of these tables needs to be presented in accordance with the ISG. It is suggested to use these tables in the applicable section(s) of the Integrated Assessment.

Table to Compare All Parameters from Each Flood Mechanism

Flood Scenario Parameter	Mechanism: LIP	Mechanism: Dam Failure (hydrologic)	Bounding Scenario
Flood Height		]	
Wind Waves and Run-Up			
Sediment Deposition and Erosion			
Adverse Weather Conditions			
Debris.			

Table to Compare Flood Impacts for Each Plant Operational Mode

Mode	Discussion of Flood Impacts	Discussion of Mode-Specific Vulnerabilities	Configuration Controls in Place
- -	- -	- -	- -

Table to List SSCs Important to Safety and Their Flood Protection Features

SSC (Or Group of SSCs)	Critical Elevation	Flood Protection Features or Systems Used to Protect SSCs	Manner by which Equipment could be Subject to Flooding (if applicable)
- - -	- - -	- - -	- - -