

October 15, 2021

Via Email

Mr. Nicholas M. Reidenbach, P.E.
Civil/Structural Principal Specialist Engineer
DTE Energy
One Energy Plaza
Detroit, MI 48226

**Subject: Five-Year Regulatory Compliance Reporting: Hazard Potential Assessment
Monroe Power Plant Fly Ash Basin Facility
Monroe, MI**

Dear Mr. Reidenbach:

This letter presents Geosyntec Consultants of Michigan, Inc.'s (Geosyntec's) five-year periodic hazard potential assessment for DTE Energy's (DTE's) Monroe Power Plant Fly Ash Basin (FAB).

BACKGROUND

A hazard potential classification of the FAB is required under the United States Environmental Protection Agency (USEPA) Coal Combustion Residual Rule (CCR Rule) published on 17 April 2015 40 CFR 257.73(a)(2). Under the CCR Rule, the FAB is an "existing surface impoundment" and its hazard potential must be assessed at five-year intervals and certified by a Qualified Professional Engineer.

The CCR Rule requires an owner to document the hazard potential of each CCR unit as one of the following:

- *High Hazard Potential—Dams assigned the high hazard potential classification are those where failure or mis-operation will probably cause loss of human life.*
- *Significant Hazard Potential—Dams assigned the significant hazard potential classification are those dams where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification*

dams are often located in predominantly rural or agricultural areas, but could be located in areas with population and significant infrastructure.

- *Low Hazard Potential—Dams assigned the low hazard potential classification are those where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.*

The FEMA guidance document¹ that was used by USEPA further states the following:

- *“...The classification assigned should be based on the worst-case probable scenario of failure or mis-operation of the dam, i.e., the assigned classification should be based on failure consequences that will result in the assignment of the highest hazard potential classification of all probable failure and mis-operation scenarios...”*

The FAB has significant hazard potential. This letter provides the rationale behind the classification.

SITE CHARACTERISTICS

The FAB is about 331 acres in plan area and is located in Section 16, Township 7 South, Range 9 East, of Monroe Township, Michigan shown on Figure 1. The containment embankment was constructed by excavation of native clay subsoils and placing the clay in controlled lifts and compacted to a standard specification. The native subsoils are consistent clay soils extending down 30 to 50 ft below ground surface. The embankment is 14 to 46 ft high with a consistent crest elevation of approximately 615 ft (National Vertical Geodetic Datum/NGVD, 1929). The outer slopes range from approximately 2 horizontal to 1 vertical (2H:1V) to 3H:1V. The inner slopes are approximately 2H:1V. In addition, there is a submerged center dike, approximately in the middle of the FAB (see Figure 1), which has a crest elevation of approximately 592.4 ft.

The surface impoundment (FAB), is licensed under Michigan Part 115, Solid Waste Management, of the Natural Resources and Environmental Protection Act, 1994 License No. 9579. CCRs are placed in the FAB by use of a “wet” (sluiced) disposal method. As the ash settles, the remaining sluice water is ultimately discharged under a National Pollutant Discharge Elimination System (NPDES) permit issued by the EGLE (Permit No. MI0001848).

¹ FEMA (2004). “Federal Guidelines for Dam Safety – Hazard Potential Classification System for Dams”, FEMA-333, Federal Emergency Management Agency (FEMA).

There are residents along the northern side of the facility and I-75 is located to the west as shown on Figure 1. To the south lies farm fields and Waters Edge Road, a paved road leading to a boat launch facility. To the south of Waters Edge Road is the Knabusch Mathematics & Science Center. To the east of the facility lies Lake Erie; there are no habitable structures and no public roads to the east and southeast.

FAILURE MECHANISM ASSESSMENT

DTE conducted a Potential Failure Mode Analysis (PFMA) in 2010 and 2011 to identify potential failure modes. Subsequently, mitigation of the potential failure modes was completed over the subsequent five years and the stability and operation of the embankment have been improved, further reducing the risk of failure.

The “worst-case probable scenario of failure or mis-operation of the dam...”² was identified and a dam breach analysis was conducted to evaluate the hazard potential.

It is important to note that the hazard potential classification does not necessarily imply that the unit has inadequate structural integrity, or the potential for actual dam failure. The hazard potential assessment is performed to qualitatively classify the consequences of a dam failure, not the probability of that dam actually failing. No matter how failure resistant the dam is to misoperation or failure, the hazard potential assessment assumes that it will somehow fail.

The three potential failure modes that were considered are those caused either by “piping” (seepage through the embankment that causes internal erosion leading to collapse), slope stability failure of the embankment, and overtopping.

During construction that occurred from 2009 through 2013, the face of the embankment was exposed and inspected, and seepage was not detected. During subsequent inspections conducted from 2013 through the September 2020, seepage through the embankment was not detected. Therefore, failure due to seepage is not the “worst-case probable scenario” of failure.

The stability of the embankment has been studied extensively from 2009 through September 2021. The embankment meets all of the factors of safety required by the CCR Rule. Therefore, failure due to slope instability is not the “worst-case probable scenario” of failure.

² FEMA (2004). “Federal Guidelines for Dam Safety – Hazard Potential Classification System for Dams”, FEMA-333, Federal Emergency Management Agency (FEMA).

The potential for overtopping was evaluated. Based on hydraulic analysis conducted to assess the hydraulic capacity of the spillway, it was clear that normal (non-rainfall) operating conditions would not cause overtopping. Therefore, flood flow conditions were assessed.

The probable maximum flood (PMF) is defined as the flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in a particular drainage area, and could possibly cause overtopping. Hydraulic analysis using the PMF was conducted to assess the hydraulic capacity of the spillway. Further, another “worst-case” condition was included where the spillway pipes became blocked and sluice ash flow and stormwater pump operations into the basin continued during the storm.

Therefore, it was concluded that the “worst-case probable scenario” of failure would occur as a result of a blockage of the spillway discharge pipes at the start of the PMF. It is recognized that DTE has modified the spillway structure and operation practices to maintain the maximum water level in the impoundment to alleviate even a complete blockage of the spillway. Therefore, even an overtopping incident would be unlikely.

The location of the overtopping and subsequent breach was assessed. The elevation of the crest of the embankment is relatively consistent around 615 ft with a low elevation of 613.0 ft along the eastern side at approximately Station 165 as shown on Figure 1. That area of the embankment is also one of the tallest embankment areas with a height of 45 ft above the downstream toe. The low point at Station 165 was selected as the point of overtopping.

DAM BREACH ANALYSIS

A Dam Breach Analysis using HEC-RAS 2D (HEC-RAS 6.0.0, 2021) was conducted assuming an impounded water surface elevation of 613.0 ft as a result of the PMF storm and blockage of the spillway discharge pipes. The inundation analysis and mapping conservatively assumes the impounded fly ash will flow equally as the impounded water; as such, the full volume of fly ash and water above the downstream toe of the perimeter embankment will be released within the area east of the center dike, while the fly ash and water west of the center dike will flow until it reaches to the top of center dike. The PMF as defined by FEMA³ was evaluated using HEC-HMS (HEC-HMS 4.8, 2021) to estimate the resulting water surface elevation from the PMF and the blockage of the spillway discharge pipes. Both HEC-RAS 2D and HEC-HMS are programs developed by the U.S. Army Corps of Engineers (USACE) and are accepted models

³ FEMA (2004). “Federal Guidelines for Dam Safety – Hazard Potential Classification System for Dams”, FEMA-333, Federal Emergency Management Agency (FEMA).

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for performing dam breach and inundation studies. The maximum depth of inundation and velocity of water from the embankment breach analysis are presented on Figures 2 and 3.

The areas that are shown to be inundated have no habitable structures and no public roads. The only possibility for the presence of people would be temporary workers at the facility and the occasional fisherman. FEMA does not take into account improbable (transient) loss of life, such as that of a recreational user, passer-by or occasional, non-overnight user of the downstream area (FEMA 2004). Consequently, there would not be probable loss of life due to the embankment breach.

Misoperation or failure at Monroe results in no probable loss of human life, but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns. Consequently, a hazard potential classification of "significant" is appropriate.


QUALIFICATIONS OF LICENSED PROFESSIONAL ENGINEER

John Seymour is a qualified licensed professional engineer with over 40 years of experience in civil and geotechnical engineering associated with earthen embankments and dams.

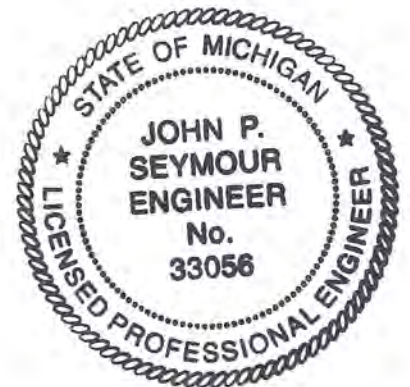
CERTIFICATION

I, John Seymour, am a qualified licensed professional engineer in Michigan have evaluated the FAB and conclude that the FAB has a **significant hazard potential** classification because the worst-case probable failure scenario would probably cause significant environmental impacts but no loss of life. I certify that this hazard potential classification is provided in accordance with the requirements of 40 CFR 257.73(a)(2).

Certified by:


Date 10/15/2021

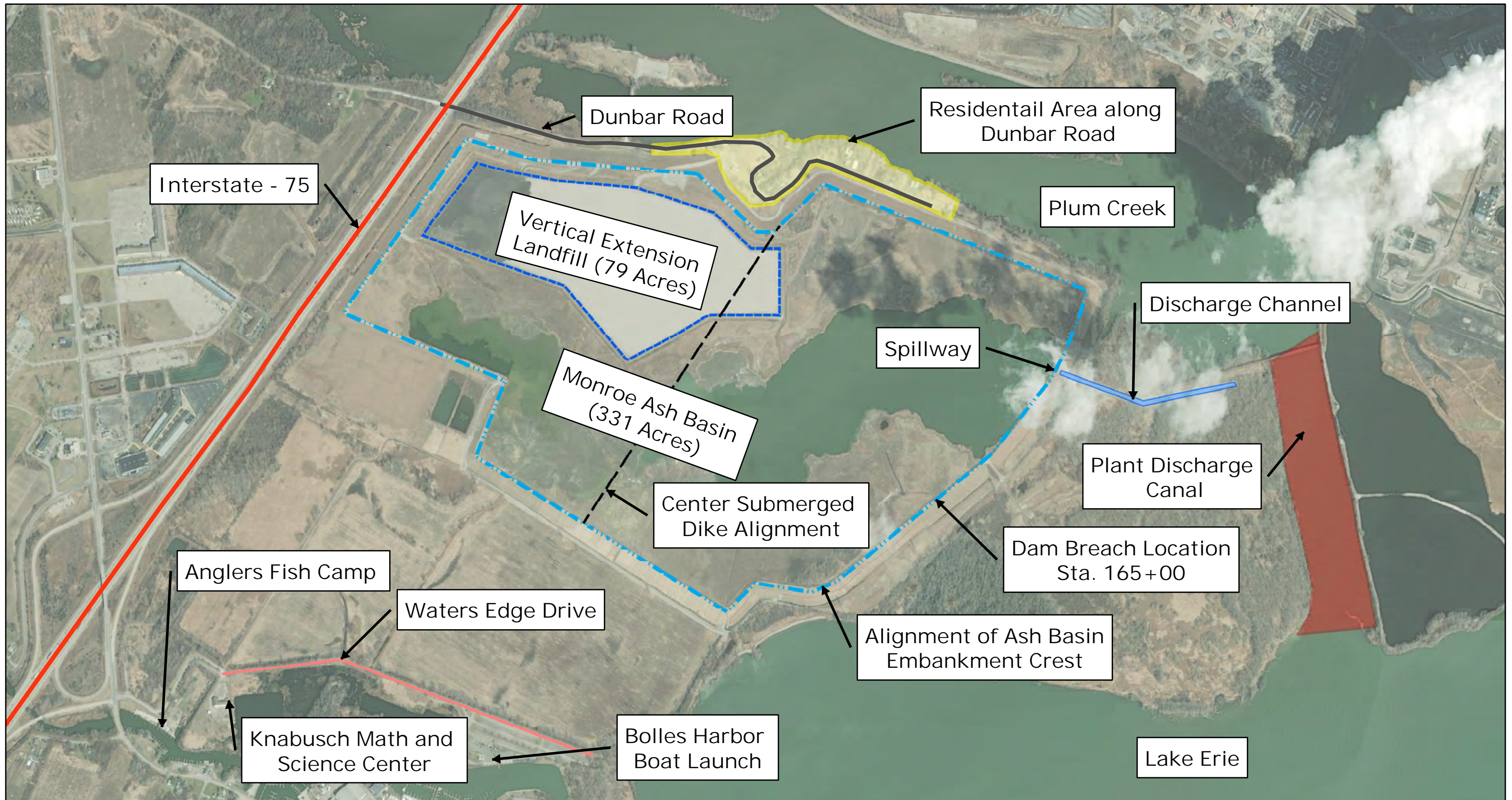
John Seymour, P.E.
Michigan License Number 620103356
Senior Principal






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Attachments: Figure 1 through 3

Copy to: Mark Green (DTE)
Christopher Scieszka (DTE)
Lisa Lockwood (DTE)



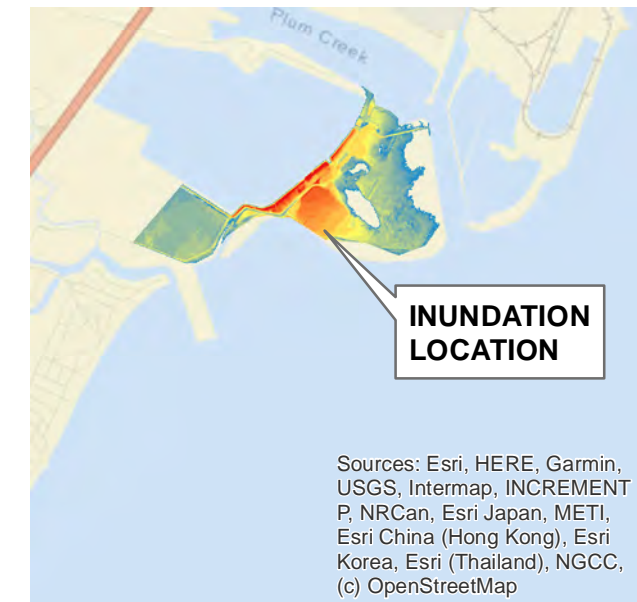




0 335 670 1,340 2,010 Feet

<h2>Monroe Ash Basin and Surrounding Features</h2>		
<h3>Monroe Ash Basin Hazard Impact Classification</h3>		<h1>Figure 1</h1>
CHE8242W	September 2021	

DETROIT EDISON ASH BASIN

INUNDATION MAP - DEPTH OF WATER



LEGEND

Maximum Depth (feet)

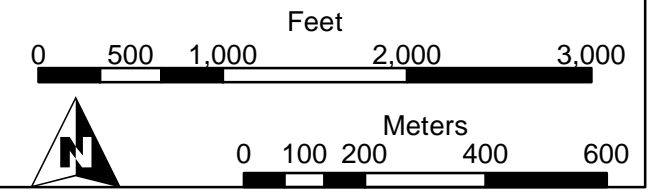
< 0.5	4- 5	12 - 13
0.5 - 1	5 - 6	13 - 14
1- 2	6 - 7	14 - 15
2 - 3	7 - 10	15 - 16
3- 4	10 - 12	> 16

- Ash Basin Embankment
- Limits of Analysis
- Access Roads
- Local Depth Value

The method used to develop inundation zones will depend on actual failure and pre-failure hydrologic conditions and may differ significantly from information shown on maps.



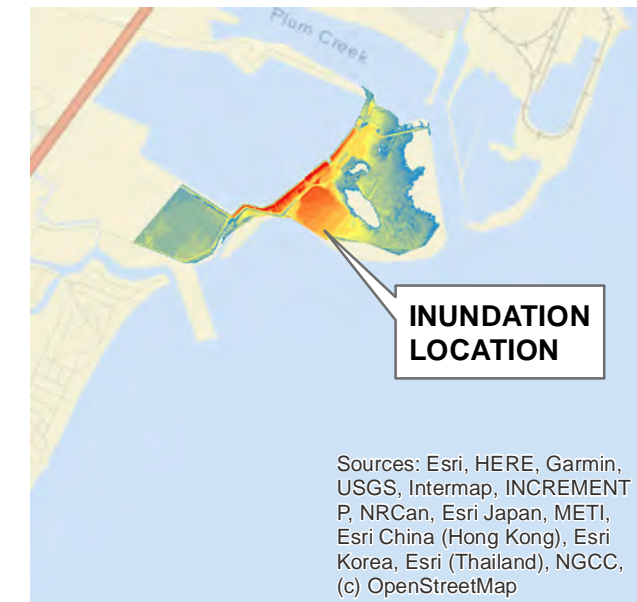
09-Sep-2021



Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

DETROIT EDISON ASH BASIN

INUNDATION MAP - WATER VELOCITY



LEGEND

Maximum Velocity (feet/second)

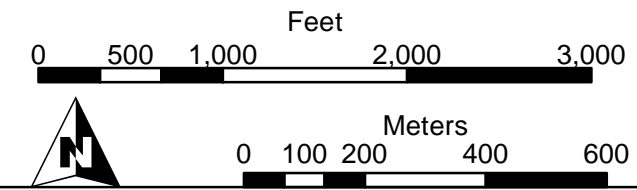
< 0.5	5 - 7	17 - 20
0.5 - 1	7 - 10	20 - 22
1 - 2	10 - 12	22 - 25
2 - 3	12 - 15	25 - 30
3 - 5	15 - 17	> 30

- Ash Basin Embankment
- Limits of Analysis
- Access Roads
- Local Velocity Value

The method used to develop inundation zones will depend on actual failure and pre-failure hydrologic conditions and may differ significantly from information shown on maps.

Geosyntec
consultants

09-Sep-2021



Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community