HAZARD POTENTIAL CLASSIFICATION ASSESSMENT REPORT
ASH PONDS 1N AND 1S
WILL COUNTY STATION
SEPTEMBER 2021

This initial Hazard Potential Classification Assessment Report has been prepared pursuant to the coal combustion residuals (CCR) rule codified in Title 35 of the Illinois Administrative Code, Section 845.440(a) effective as of April 21, 2021 for Ash Ponds 1N and 1S at Will County Station in Romeoville, Illinois (Station). The purpose of this project is to perform the hazard potential classification assessment by a licensed professional engineer to document the hazard potential classification as either a Class 1 or a Class 2 surface impoundment including the basis for the determination. The site is a coal-fired power station owned and operated by Midwest Generation, LLC (Midwest Generation).

1.0 SUMMARY

The following sections provide a description of physical and operational features followed by an evaluation of the potential failure scenarios of the Ponds 1N and 1S. Based on the results of the analyses provided in this report, Ponds 1N and 1S are classified as a Class 2 CCR surface impoundment because their failure would not result in probable loss of life but could result in potential economic and environmental damages.

2.0 REGULATION REQUIREMENTS

According to Section 845.120 of the CCR regulations:

> "Hazard potential classification" means the possible adverse incremental consequences that result from the release of water or stored contents due to failure of the diked CCR surface impoundment or mis-operation of the diked CCR surface impoundment or its appurtenances. The hazardous potential classifications include Class 1 and Class 2, defined as follows:
>
> Class 1 CCR surface impoundment means a diked surface impoundment where failure or mis-operation will probably cause loss of human life.
>
> Class 2 CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.

3.0 SITE PLAN

Due to geographic constraints, the watershed area for the site is limited. Ponds 1N and 1S can be identified as well as important building and other surface impoundments on the site plan attached as Figure 1. The ponds are located along the eastern banks of the Des Plaines River and west of an electrical substation area.

The information for the ponds was obtained through available construction documents. From these documents, it was determined the ponds were constructed with elevated embankments surrounding the ponds, so run-on into the ponds is limited to the embankment's crests. Light detection and ranging (LiDAR) information for the impoundment breach modeling was obtained through Will County GIS Data Services. The capacity and embankment height of the ponds are shown in Table 1 below.

Table 1: Estimated Capacity and Maximum Depth

	Pond 1N	**Pond 1S**
Estimated Capacity	14.06 acre-ft	12.63 acre-ft
Estimated Maximum Depth	8 ft	8 ft

4.0 POND FAILURE IMPACT EVALUATION

To classify the hazard potential of the ponds, impacts of potential failures must be evaluated. Due to the proximity of the ponds to the Des Plaines River on the western side, a failure of the western embankment(s) of the pond(s) could result in potential economic and environmental damages.

The next step is to evaluate the potential loss of life due to failure or mis-operation. Occupied buildings, including the main power block, are located over 800 feet southeast of the ponds; no occupied buildings are located north or south of the ponds. Detailed modeling discussed in Section 5.0 was used to assess the impact on human life of a potential eastern embankment breach on the surrounding eastern buildings.

5.0 EASTERN EMBANKMENT FAILURE MODELING

Pond 1N and 1S were both analyzed for breach scenarios associated with failure of the eastern pond embankments while containing maximum storage with no rainfall event associated. No rainfall event was necessary as the study was to show the effects of a maximum storage breach. The ponds were breached using United States Army Corps of Engineers (USACE) Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS) to generate flows. The resulting

flood was routed in USACE Hydrologic Engineering Center's River Analysis System (HEC-RAS) to show the effects the breach would have on the site.

The hydrologic modeling process selected by Civil & Environmental Consultants, Inc. (CEC) utilizes the USACE HEC-HMS software to perform the breach analyses. HEC-HMS version 4.8 was used to simulate the impoundment breach hydrographs for Ponds 1N and 1S.

The hydraulic analysis follows standard engineering practices and utilizes GeoHECRAS which is an AutoCAD, Micro Station, and ESRI ArcGIS compatible interactive two-dimensional and three-dimensional graphical user interface data wrapper to the USACE HEC-RAS software. GeoHECRAS was developed by Civil Geo, Inc. and performs one-dimensional and two-dimensional hydraulic analyses using the HEC-RAS v5.0.7 engine. Hydrographs were developed in HEC-HMS and were then routed with two-dimensional GeoHECRAS functions.

LiDAR elevation data from Will County GIS Data Services, dated 2014, served as the basis of the terrain model for the entire study area. Two-dimensional surface mesh was created in GeoHECRAS to capture the elevation data in the terrain underneath for the NRG power station located between the Des-Plaines and the shipping canal. A hexagonal mesh of 50-foot grid sizes was selected as the final two-dimensional geometry of the two-dimensional model area.

Manning's 'n' values for the unsteady flow analysis were estimated from a combination of aerial imagery, National Land Cover Database land cover data, and engineering judgment. It was determined for this analysis a general manning's 'n' of 0.06 would be used for the site.

The minimum flow at the upstream ends of the analysis was set at 0 cubic feet per second. Ponds 1N and 1S were set to the normal pool elevation of 590.5 feet as the starting elevation for the simulations.

As a part of a breach evaluation, CEC performed a drawdown calculation to determine if Ponds 1N and 1S acted as a dynamic breach or level pool breach. By performing this calculation, CEC was able to determine what program to recreate the breach in (dynamic routing requires HEC-RAS, level pool can be performed in HEC-HMS). These calculations also gave us the selected breach width (BR) and time to failure (TFH).

A sensitivity analysis was conducted to evaluate the effects of changes in the breach width and full breach formation time on the peak discharge from the dam breach. The breach side slopes were held at a constant value to independently evaluate the effects of the breach width and full breach formation time on the peak discharges. Calibration of the start time of the breach was also performed to calculate the most conservative result with the maximum peak discharge. Table 2 and Table 3 below summarizes the results of the minimum and maximum parameters.

Table 2: Pond 1N Sensitivity Analysis Results

WILL COUNTY STATION POND 1N					
Breach Parameter	**Selected**	**Breach Width Sensitivity**		**Time to Failure Sensitivity**	
		Minimum	**Maximum**	**Minimum**	**Maximum**
BR (ft)	29.81	8	40	29.81	29.81
Z (H:V)	1 to 1	1 to 1	1 to 1	1 to 1	1 to 1
TFH (hrs)	0.3	0.3	0.3	0.1	1.0
Breach Scenario	Discharge at Dam (cfs)	Discharge at Dam (cfs)	Discharge at Dam (cfs)	Discharge at Dam (cfs)	Discharge at Dam (cfs)
Sunny Day Breach	646.4	422.5	699.9	1220.8	254.2

Table 3: Pond 1S Sensitivity Analysis Results

WILL COUNTY STATION POND 1S					
Breach Parameter	**Selected**	**Breach Width Sensitivity**		**Time to Failure Sensitivity**	
		Minimum	**Maximum**	**Minimum**	**Maximum**
BR (ft)	28.76	8	40	28.76	28.76
Z (H:V)	1 to 1	1 to 1	1 to 1	1 to 1	1 to 1
TFH (hrs)	0.29	0.3	0.3	0.1	1.0
Breach Scenario	Discharge at Dam (cfs)	Discharge at Dam (cfs)	Discharge at Dam (cfs)	Discharge at Dam (cfs)	Discharge at Dam (cfs)
Sunny Day Breach	609.2	407.8	666.1	1136	254.2

6.0 EASTERN EMBANKMENT FAILURE RESULTS

A summary of the results for the selected breach parameters are listed in Table 4 and Table 5 below.

Table 4: Summary of 1N Impoundment Breach Results

POND 1N	
Scenario	**Sunny Day**
Breach Trigger	Time
	4:00
Pool Elevation at Breach, Initial (ft)	590.5
Time Breach Occurs	4:00
Breach Type	Piping
Starting Pool Elevation (ft)	590.5
Storage Volume at Breach (ac-ft)	14.06
Breach Invert Elevation, Final (ft)	582.5
Discharge at Dam, Peak (cfs)	646.4

Table 5: Summary of 1S Impoundment Breach Results

POND 1S	
Scenario	**Sunny Day**
Breach Trigger	Time
	4:00
Pool Elevation at Breach, Initial (ft)	590.5
Time Breach Occurs	4:00
Breach Type	Piping
Starting Pool Elevation (ft)	590.5
Storage Volume at Breach (ac-ft)	12.63
Breach Invert Elevation, Final (ft)	582.5
Discharge at Dam, Peak (cfs)	609.2

Calculated maximum flow depth and maximum velocity from Ponds 1N and 1S can be found in Figures 2 through 5.

The result of the GeoHECRAS model for Pond 1N shows that the flow through the modeled breach travels from Pond 1N towards the north, south, and east, with the majority traveling to the northeast and releasing into the Shipping Canal. Estimated water depths near the buildings range from 0–1.0 foot with velocities less than 1.0 foot per second

The result of the GeoHECRAS model for Pond 1S shows that the flow through the modeled breach travels from Pond 1S towards the north, south, and east, with the majority traveling to the southeast. Estimated water depths near the buildings range from 0–1.75 feet with velocities less than 1.50 feet per second.

7.0 HAZARD CLASSIFICATION ASSESSMENT

As discussed in Section 1, a CCR surface impoundment is classified as Class 1 if failure or mis-operation will probably cause loss of human life. Guidelines for evaluating potential loss of life during flood conditions are provide in USBR [1998]. Attachment B presents a relationship between flood flow depth and velocity for buildings on foundations that could cause potential loss of human life. Both Pond 1N and 1S' eastern embankment breaches plot in the "low danger zone". This indicates that a breach of either pond will not result in probable loss of human life.

Based on the results of the analysis provided in this report, Ponds 1N and 1S are classified as a Class 2 CCR impoundment because their failure would not result in probable loss of life but could result in impacts to the Des Plaines River creating potential economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.

8.0 LIMITATIONS AND CERTIFICATIONS

The findings and opinions presented are relative to the dates of the referenced and hydraulic data sets and should not be relied on to represent conditions at substantially later dates. The opinions included herein are based on information obtained during the study of CEC's experience. If additional information becomes available that might impact CEC's conclusions, CEC requests the opportunity to review the information, reassess the potential concerns, and modify CEC's opinions, if warranted. If our services included a review or use of documents or data sources prepared by others, CEC has no responsibility for accuracy of information contained therein.

CEC has relied on the accuracy of models and calculations enclosed by the regulatory authorities. Their analyses are in general accordance with industry standards. CEC makes no warrants or representations as to the accuracy or quality of these methods.

This initial Hazard Potential Classification Assessment Report has been prepared pursuant to the CCR rule codified in Title 35 of the Illinois Administrative Code, Section 845.440(a) and was prepared under the direction of Mr. M. Dean Jones, P.E.

By affixing my seal to this, I do hereby certify to the best of my knowledge, information, and belief that the information contained in this report is true and correct. I further certify I am licensed to practice in the State of Illinois and that it is within my professional expertise to verify the

correctness of the information. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment.

Seal:

Signature: _____

Name: M. Dean Jones, P.E.

Date of Certification: September 23, 2021

Illinois Professional Engineer No.: 062-051317

Expiration Date: November 30, 2021

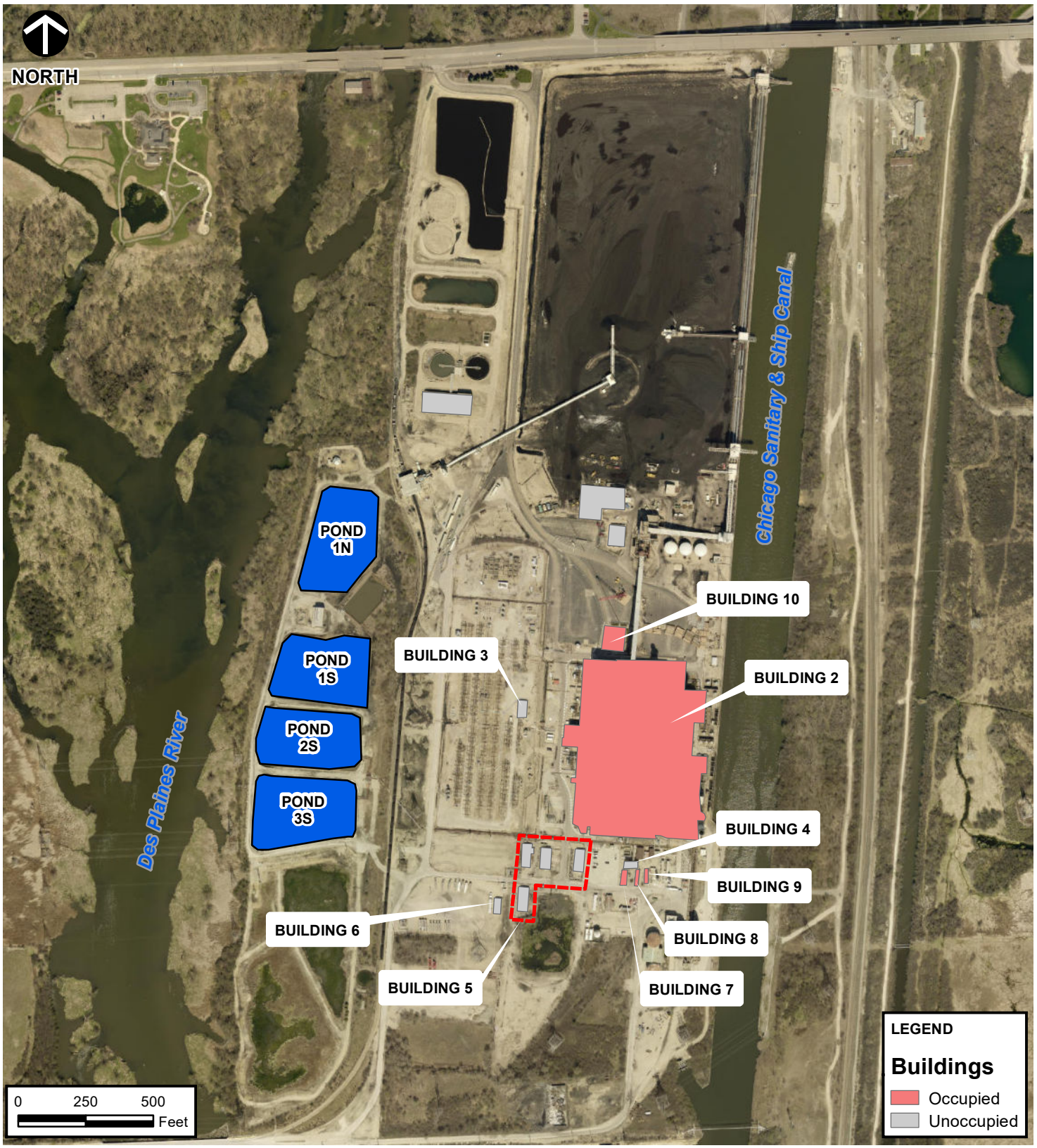
Enclosures: Figures:

- Figure 1 - Site Map
- Figure 2 - Pond 1N Maximum Flow Depth
- Figure 3 - Pond 1N Maximum Velocity
- Figure 4 - Pond 1S Maximum Flow Depth
- Figure 5 - Pond 1S Maximum Velocity

Attachments:

- Attachment A - Storage Tables
- Attachment B - USBR Loss of Life Graph

FIGURES



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MIDWEST GENERATION, LLC
HAZARD POTENTIAL CLASSIFICATION ASSESSMENT
POND 1N AND POND 1S
WILL COUNTY, IL

SITE MAP

DRAWN BY:	CJG	CHECKED BY:	CJG	APPROVED BY:	MDG*	FIGURE NO:	1
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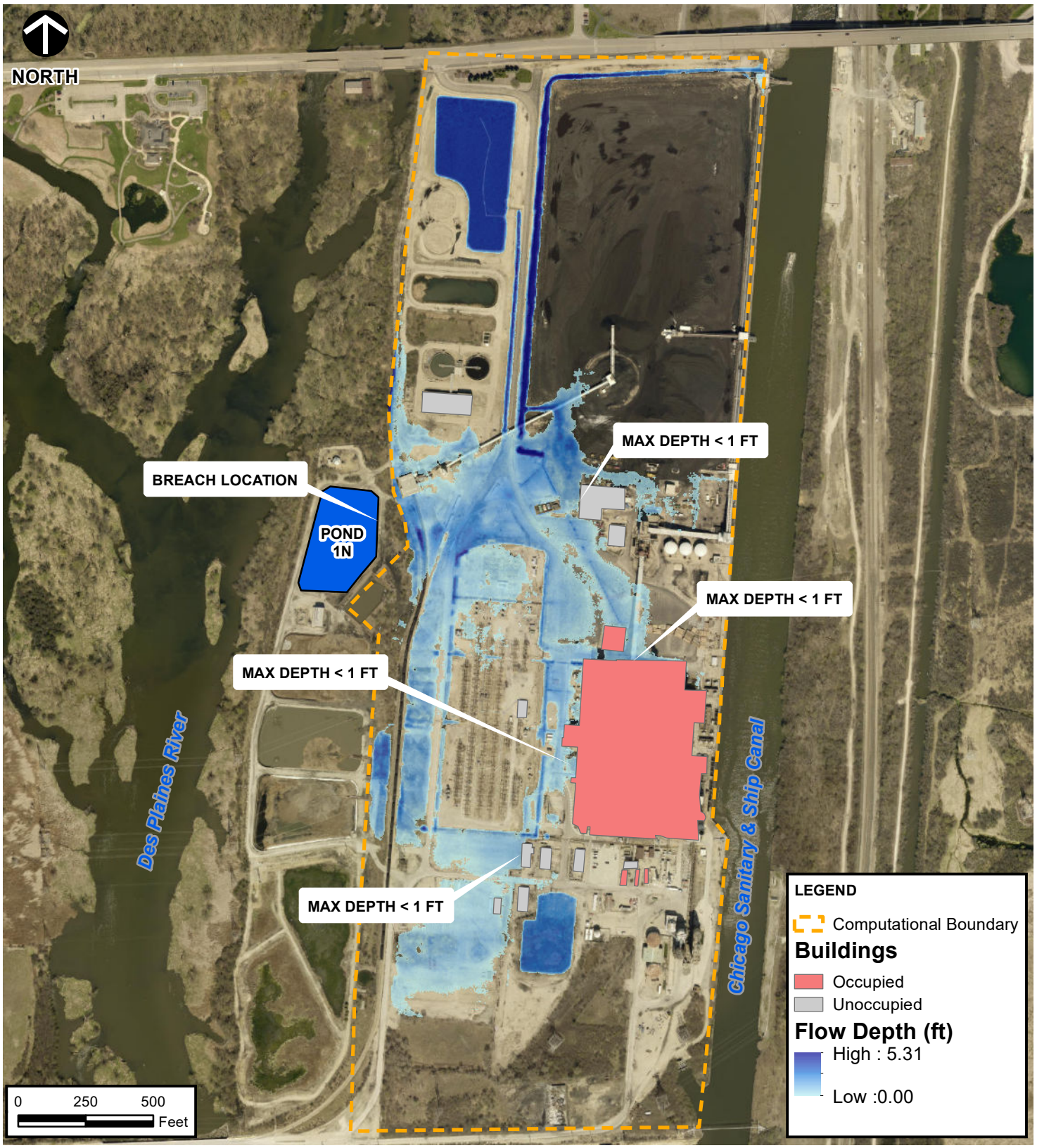

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POND 1N MAXIMUM FLOW DEPTH

DRAWN BY:	CJG	CHECKED BY:	CJG	APPROVED BY:	MDG*	FIGURE NO:	2
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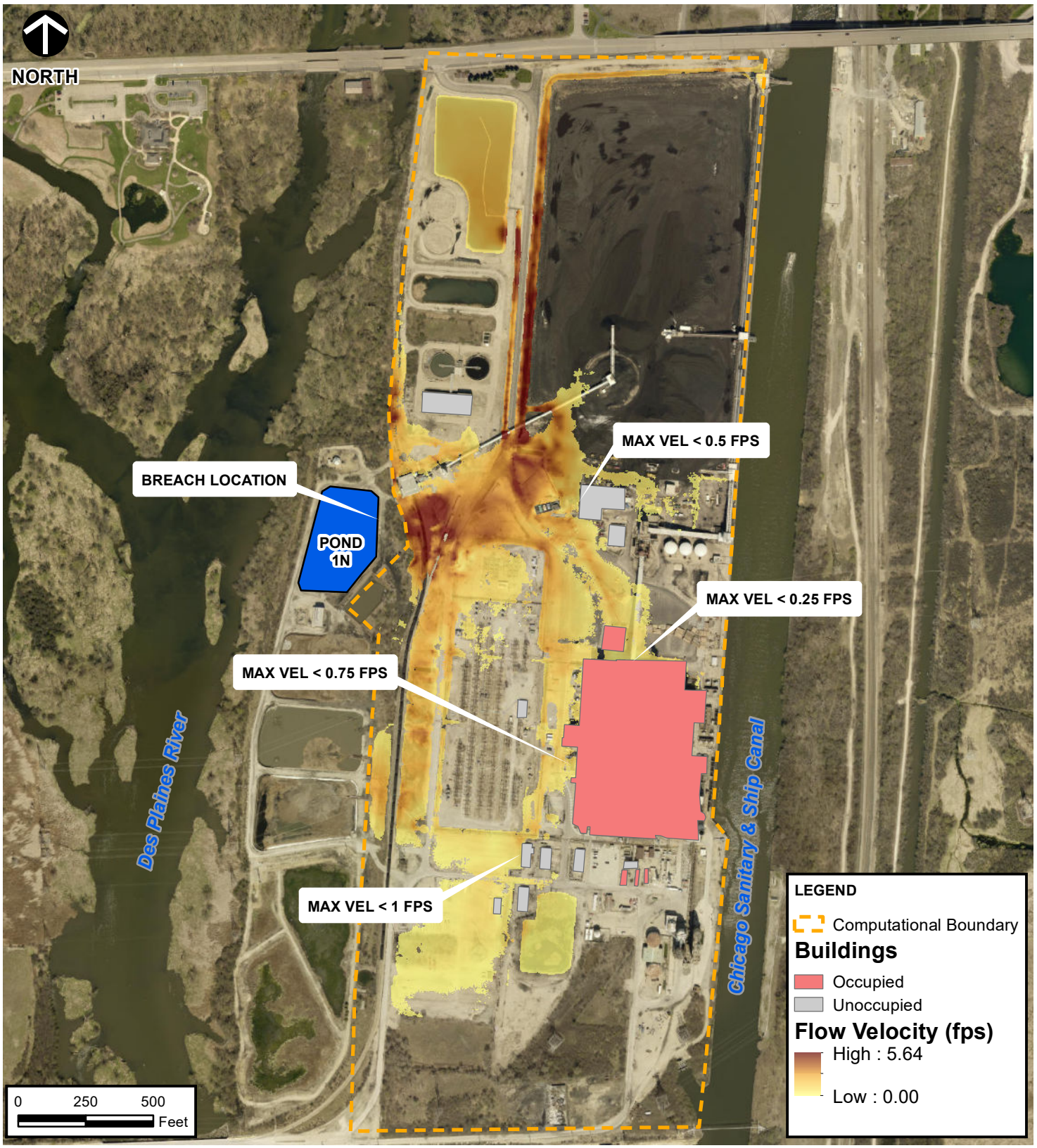

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POND 1N MAXIMUM VELOCITY

DRAWN BY:	CJG	CHECKED BY:	CJG	APPROVED BY:	MDG*	FIGURE NO:	3
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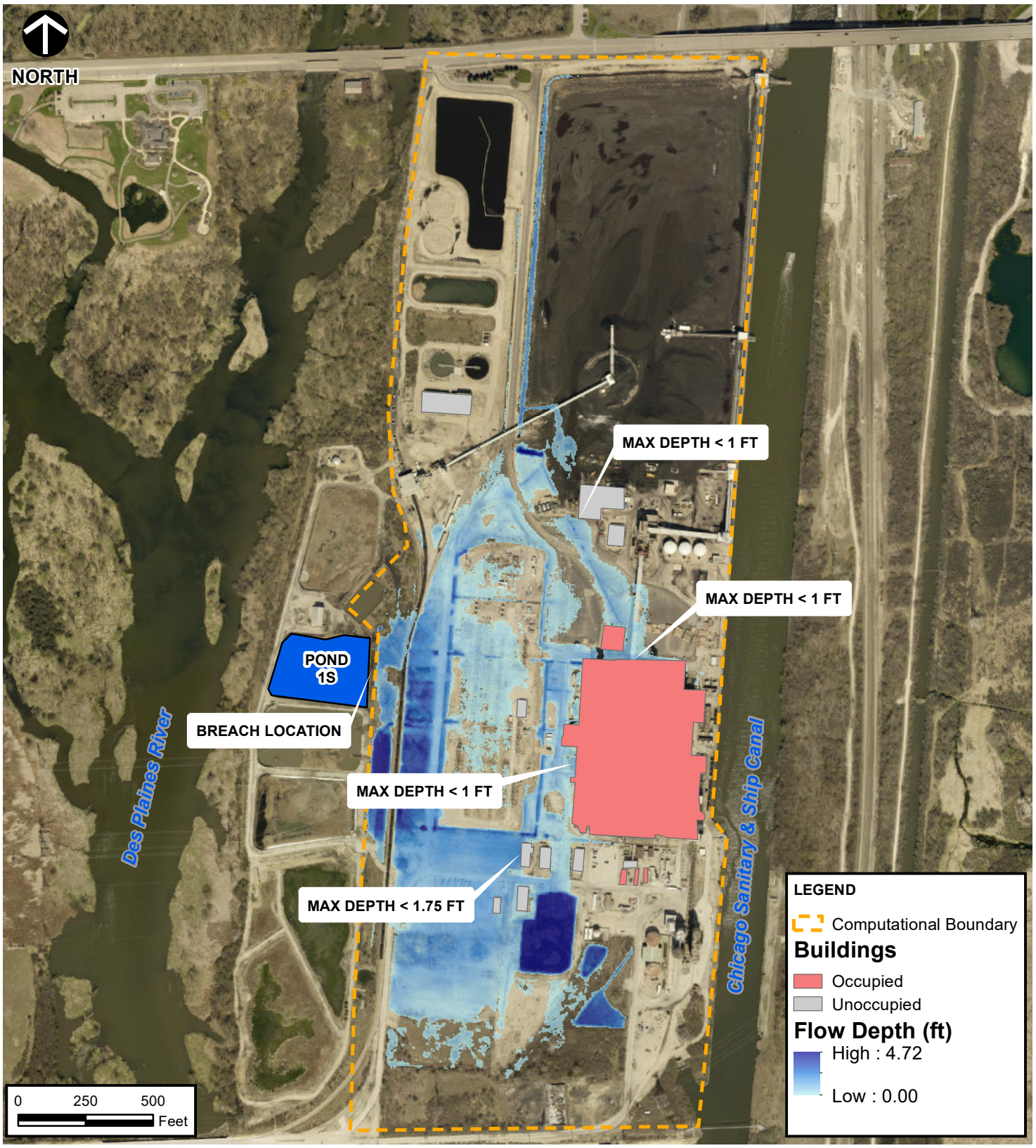

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POND 1S MAXIMUM FLOW DEPTH

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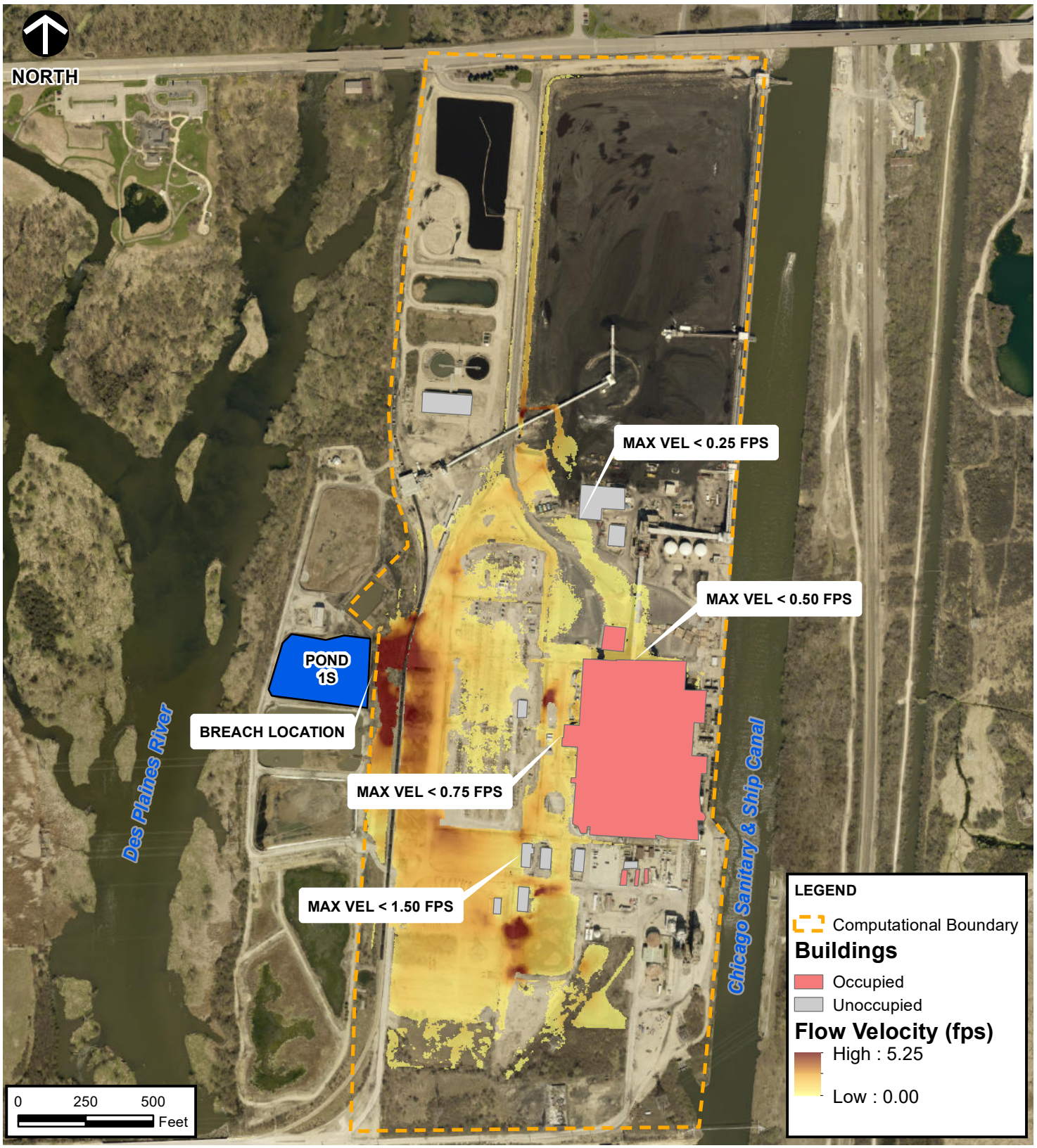

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POND 1S MAXIMUM VELOCITY

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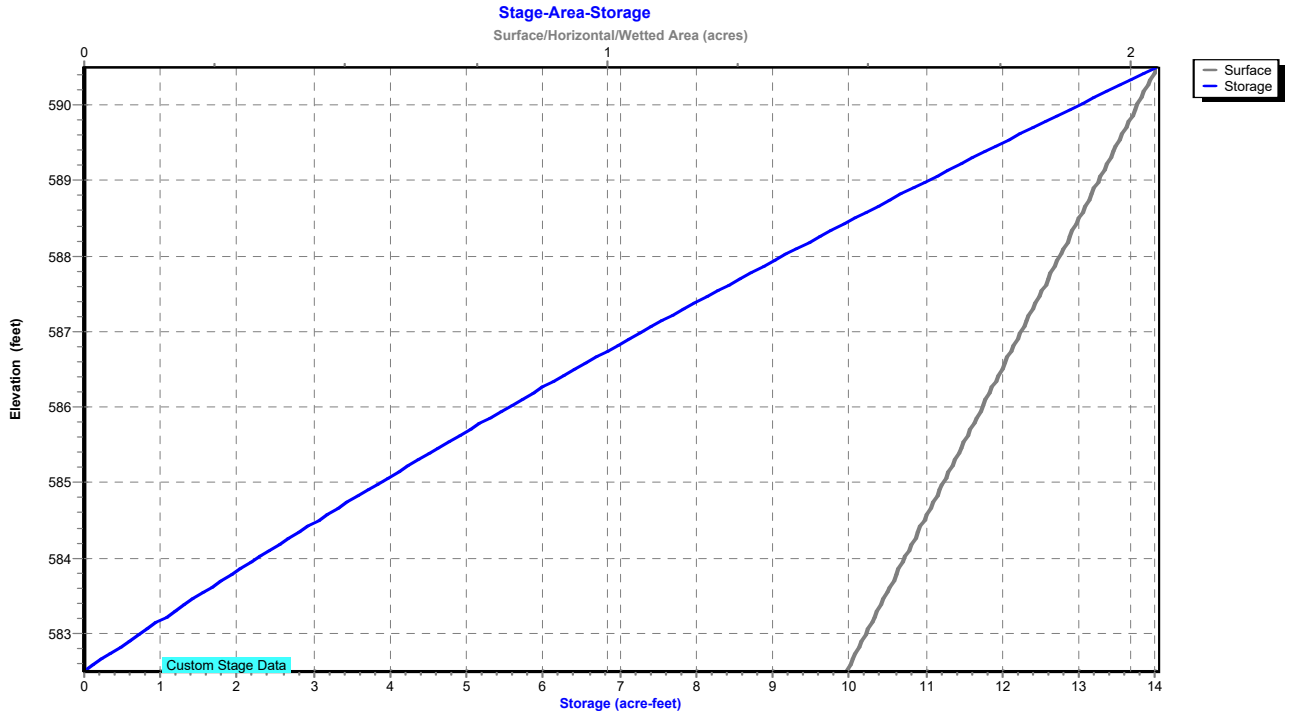
ATTACHMENT A

STORAGE TABLES

Stage-Area-Storage for Pond 1P: 1N CCR Basin

Elevation (feet)	Surface (acres)	Storage (acre-feet)
582.50	1.456	0.000
582.60	1.463	0.146
582.70	1.471	0.293
582.80	1.478	0.440
582.90	1.486	0.588
583.00	1.493	0.737
583.10	1.500	0.887
583.20	1.508	1.037
583.30	1.515	1.188
583.40	1.523	1.340
583.50	1.530	1.493
583.60	1.537	1.646
583.70	1.545	1.800
583.80	1.552	1.955
583.90	1.560	2.111
584.00	1.567	2.267
584.10	1.574	2.424
584.20	1.582	2.582
584.30	1.589	2.741
584.40	1.597	2.900
584.50	1.604	3.060
584.60	1.611	3.221
584.70	1.619	3.382
584.80	1.626	3.545
584.90	1.634	3.708
585.00	1.641	3.871
585.10	1.648	4.036
585.20	1.656	4.201
585.30	1.663	4.367
585.40	1.671	4.534
585.50	1.678	4.701
585.60	1.685	4.869
585.70	1.693	5.038
585.80	1.700	5.208
585.90	1.708	5.378
586.00	1.715	5.549
586.10	1.722	5.721
586.20	1.730	5.894
586.30	1.737	6.067
586.40	1.745	6.241
586.50	1.752	6.416
586.60	1.759	6.592
586.70	1.767	6.768
586.80	1.774	6.945
586.90	1.782	7.123
587.00	1.789	7.301
587.10	1.796	7.481
587.20	1.804	7.661
587.30	1.811	7.841
587.40	1.819	8.023
587.50	1.826	8.205
587.60	1.833	8.388
587.70	1.841	8.572
587.80	1.848	8.756
587.90	1.856	8.941
588.00	1.863	9.127
588.10	1.870	9.314
588.20	1.878	9.501
588.30	1.885	9.689
588.40	1.893	9.878
588.50	1.900	10.068
588.60	1.907	10.258
588.70	1.915	10.449
588.80	1.922	10.641
588.90	1.930	10.834
589.00	1.937	11.027
589.10	1.944	11.221
589.20	1.952	11.416
589.30	1.959	11.612
589.40	1.967	11.808
589.50	1.974	12.005
589.60	1.981	12.203
589.70	1.989	12.401
589.80	1.996	12.601
589.90	2.004	12.801
590.00	2.011	13.001
590.10	2.018	13.203
590.20	2.026	13.405
590.30	2.033	13.608
590.40	2.041	13.812
590.50	**2.048**	**14.016**

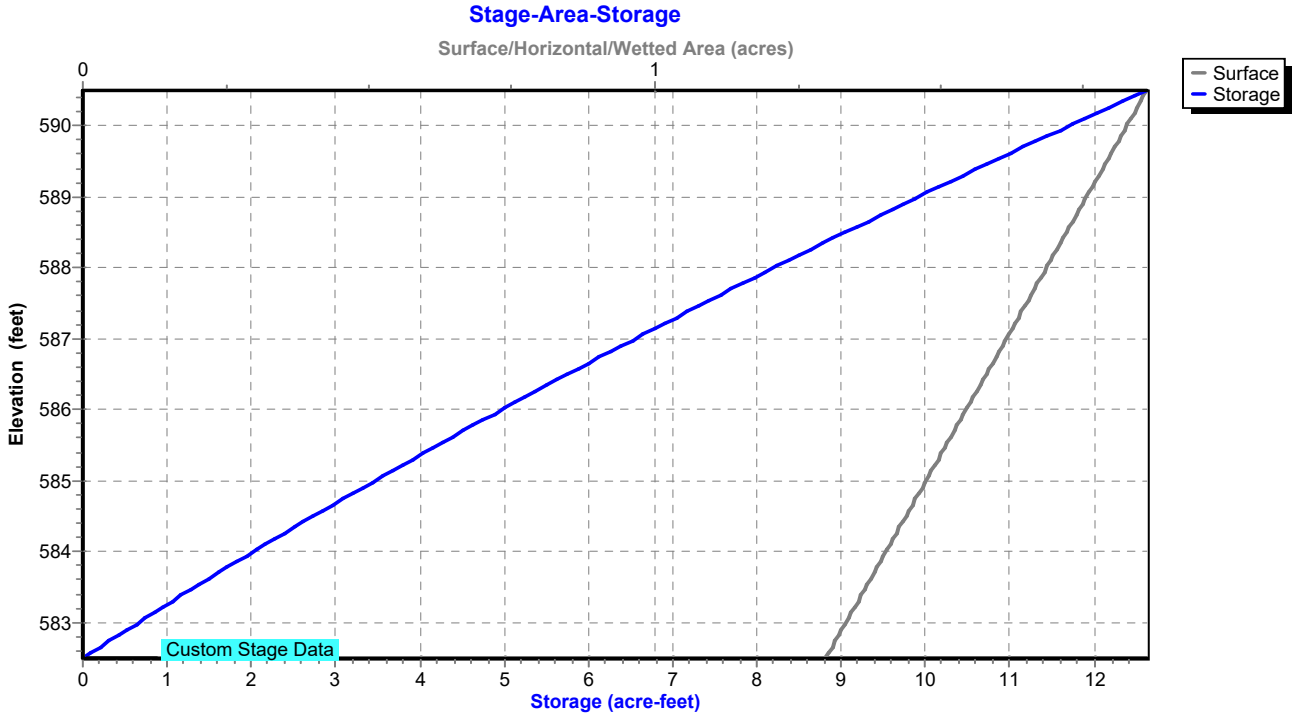
Pond 1P: 1N CCR Basin



Stage-Area-Storage for Pond 2P: 1S CCR Basin

Elevation (feet)	Surface (acres)	Storage (acre-feet)
582.50	1.298	0.000
582.60	1.305	0.130
582.70	1.312	0.261
582.80	1.319	0.393
582.90	1.326	0.525
583.00	1.333	0.658
583.10	1.340	0.791
583.20	1.347	0.926
583.30	1.354	1.061
583.40	1.361	1.197
583.50	1.368	1.333
583.60	1.375	1.470
583.70	1.382	1.608
583.80	1.389	1.747
583.90	1.396	1.886
584.00	1.403	2.026
584.10	1.410	2.167
584.20	1.417	2.308
584.30	1.424	2.450
584.40	1.431	2.593
584.50	1.438	2.736
584.60	1.445	2.880
584.70	1.452	3.025
584.80	1.459	3.171
584.90	1.466	3.317
585.00	1.473	3.464
585.10	1.480	3.612
585.20	1.487	3.760
585.30	1.494	3.909
585.40	1.501	4.059
585.50	1.508	4.210
585.60	1.515	4.361
585.70	1.522	4.513
585.80	1.529	4.665
585.90	1.536	4.819
586.00	1.543	4.973
586.10	1.550	5.127
586.20	1.557	5.283
586.30	1.564	5.439
586.40	1.571	5.596
586.50	1.578	5.753
586.60	1.586	5.911
586.70	1.593	6.070
586.80	1.600	6.230
586.90	1.607	6.390
587.00	1.614	6.551
587.10	1.621	6.713
587.20	1.628	6.875
587.30	1.635	7.038
587.40	1.642	7.202
587.50	1.649	7.367
587.60	1.656	7.532
587.70	1.663	7.698
587.80	1.670	7.864
587.90	1.677	8.032
588.00	1.684	8.200
588.10	1.691	8.368
588.20	1.698	8.538
588.30	1.705	8.708
588.40	1.712	8.879
588.50	1.719	9.050
588.60	1.726	9.222
588.70	1.733	9.395
588.80	1.740	9.569
588.90	1.747	9.743
589.00	1.754	9.918
589.10	1.761	10.094
589.20	1.768	10.271
589.30	1.775	10.448
589.40	1.782	10.626
589.50	1.789	10.804
589.60	1.796	10.983
589.70	1.803	11.163
589.80	1.810	11.344
589.90	1.817	11.525
590.00	1.824	11.707
590.10	1.831	11.890
590.20	1.838	12.073
590.30	1.845	12.258
590.40	1.852	12.442
590.50	**1.859**	**12.628**

Pond 2P: 1S CCR Basin



ATTACHMENT B

USBR LOSS OF LIFE GRAPH

HIGH DANGER ZONE - Occupants of most houses are in danger from floodwater.

JUDGEMENT ZONE - Danger level is based upon engineering judgement.

LOW DANGER ZONE - Occupants of most houses are not seriously in danger from flood water.

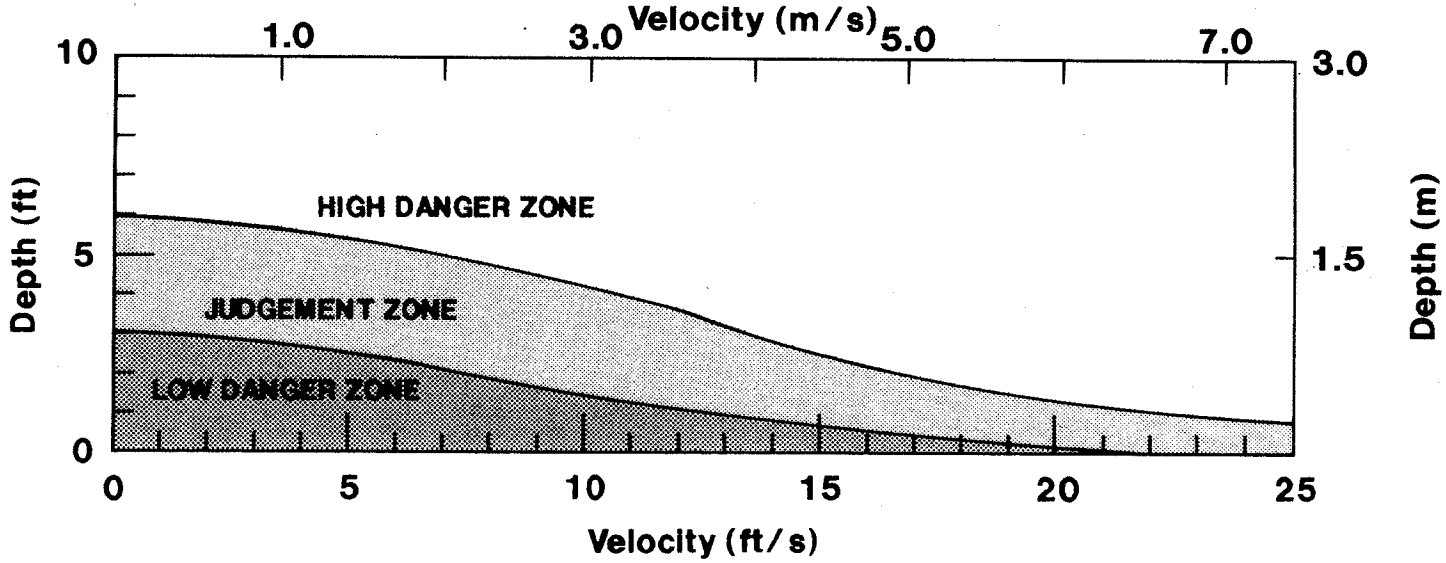


Figure 2. – Depth–velocity flood danger level relationship for houses built on foundations.