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Keetac Tailings Basin Dam Break Analysis Report

Keewatin, Minnesota

Submitted to:
United States Steel Corporation – Keetac
1 Mine Road
Keewatin, Minnesota 55753

Submitted by:
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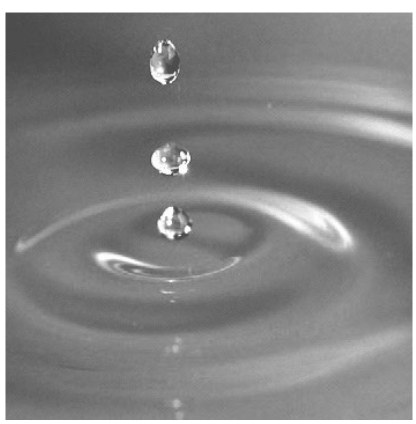
March 27, 2023
Project 2201246



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VIA EMAIL: nrhofland@uss.com

Mr. Nate Hofland, PE
United States Steel Corporation - Keetac
1 Mine Road
P.O. Box 217
Keewatin, Minnesota 55753

Re: Keetac Tailings Basin
Dam Break Analysis Report
Keewatin, Minnesota

Dear Mr. Hofland:

This report outlines the technical analysis for the hypothetical dam breach assessment and provides the inundation maps per State of Minnesota Requirements for the Keetac Tailings Basin. GEI performed the dam breach analysis by modeling a fair weather (sunny day) breach and a probable maximum flood (PMF) breach in accordance with Federal Emergency Management Agency (FEMA) Federal Guidelines for Inundation Mapping of Flood Risks Associated with Dam Incidents and Failures (FEMA P-946), and routed the breach hydrograph downstream with the latest hydraulic numerical program from the US Army Corps of Engineers (USACE) called Hydrologic Engineering Center's River Analysis System (HEC-RAS).

GEI Consultants, Inc. has been pleased to provide our engineering services for the project. If you have any questions, or if we may be of further assistance, please contact us.

Sincerely,

GEI CONSULTANTS, INC.

James P. Bonner, P.E.
Senior Consultant

Michael J. Wheeler, P.E.
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1. Introduction

United States Steel (USS) Minnesota Ore Operations owns and operates the Keetac Mine near Keewatin, Minnesota. Tailings material generated from the mine is stored in a basin with a perimeter dike retention system. Operation of the Original Stage 1 Keetac Tailings Basin began in the 1960's and had an approximate 1,560-acre footprint. In the 1980's the 4,300-acre Stage 2 Tailings Basin was constructed to the south of Stage 1 Tailings Basin. By the early 2000's a 2,500-acre internal basin was constructed within the footprint of the Stage 1 Tailings Basin and Stage 2 Tailings Basin and is referred to as the Stage 2 Interior Tailings Basin. The remaining portion of the original Stage 2 Tailings Basin which is outside the Stage 2 Interior Tailings Basin footprint is now referred to as the Stage 2 Exterior Tailings Basin. **Figure 1** shows the location of the Keetac mine and the footprint of the various tailings basins described above.

To address limited storage within the remaining Stage 2 Interior Tailings Basin (Stage 2 Interior) and reduce risk, a phased horizontal expansion is underway. Permitting for Phase 1 construction of the Stage 2 Exterior Tailings Basin (Stage 2 Exterior) began in Q4 2021. Phase 1 construction and Phase 2 design and permitting is currently in progress. A dam safety permit from the State of Minnesota will be required to vertically expand the Stage 2 Exterior Tailings Basin perimeter dam above the current permitted crest elevation. A dam safety permit requires that a complete set of design drawings and a design documentation report with results of engineering analyses, a hydrologic study, and a dam breach assessment be completed.

This report will outline the technical analysis for the hypothetical dam breach assessment and provide the inundation maps per State of Minnesota Requirements. GEI performed the dam breach analysis by modeling a fair weather (sunny day) breach and a probable maximum flood (PMF) breach in accordance with Federal Emergency Management Agency (FEMA) Federal Guidelines for Inundation Mapping of Flood Risks Associated with Dam Incidents and Failures (FEMA P-946), and routed the breach hydrograph downstream with the latest hydraulic numerical software program from the US Army Corps of Engineers (USACE) called Hydrologic Engineering Center's River Analysis System (HEC-RAS). The Canadian Dam Association's (CDA) guidance on tailing dam breaches is utilized to account for the high solids concentration in a hypothetical tailing breach scenario.

Figure 1 – Historic Dam Footprints

2. Project Description

2.1 Dam and Reservoir

Keetac owns and operates the Keetac Mine near Keewatin, Minnesota. Tailings material generated from the mine is stored in a basin with a perimeter dike retention system. The existing active tailings basin (Stage 2 Interior Tailings Basin) is constructed inside the perimeter of the Stage 2 basin footprint (Stage 2 Exterior Tailings Basin). The original Stage 1 Keetac Tailings Basin had an area of approximately 1,560 acres and was operated as the primary tailings storage facility from the mid-1960s to the early 1980s. The Stage 2 Exterior Tailings Basin dike system had an approximate area of 4,300 acres was generally constructed in the 1970s. The basin provided tailings storage from the early 1980s to the mid-1990s. The Stage 2 Interior Tailings Basin was established in the mid-1990s inside the footprint of the Stage 2 Exterior Tailings Basin with an area of approximately 2,500 acres and has been operated as the primary tailings storage facility from the mid-1990s to present. The construction of the Stage 2 Interior Tailings Basin reduced the size of the remaining Stage 2 Exterior Basin to approximately 1,800 acres.

Currently, the Stage 2 Interior Tailings Basin has an approximate low dam crest elevation of 1,556 ft-NAVD88 but this is constantly changing due to hydraulic deposition of tailings to construct the dam shell. The Stage 2 Exterior Tailings Basin has a low dam crest elevation of 1,460 ft-NAVD88. Keetac is currently in the permitting process to be add material such that the Stage 2 Interior Tailings Basins first reaches the final crest elevation of 1,585 ft-NAVD88 prior to discharging tailings into the Stage 2 Exterior Tailings Basin. The State of Minnesota has requested an interim dam configuration where the Stage 2 Interior Tailings Basin dam crest elevation has been vertically expanded to 1,585 ft-NAVD88 elevation and the Stage 2 Exterior Tailings Basin has only been raised to elevation 1,500 ft-NAVD88. This dam configuration is the approximate temporal midpoint between the existing condition and ultimate elevation condition.

Table 1 provides a summary of the dam data and **Figure 2** provides a cross section of both tailings basins for each dam configuration.

Table 1 – Lowest Dam Crest Elevation

Dam Configuration	Tailings Basin	Area (Acres)	Lowest Dam Crest Elevation (Ft-NAVD88)
Existing	Interior	2,500	1,556
	Exterior	1,800	1,460
Interim	Interior	(No Change from Existing Condition)	1,585
	Exterior		1,500
Final Buildout	Interior		1,585
	Exterior		1,580

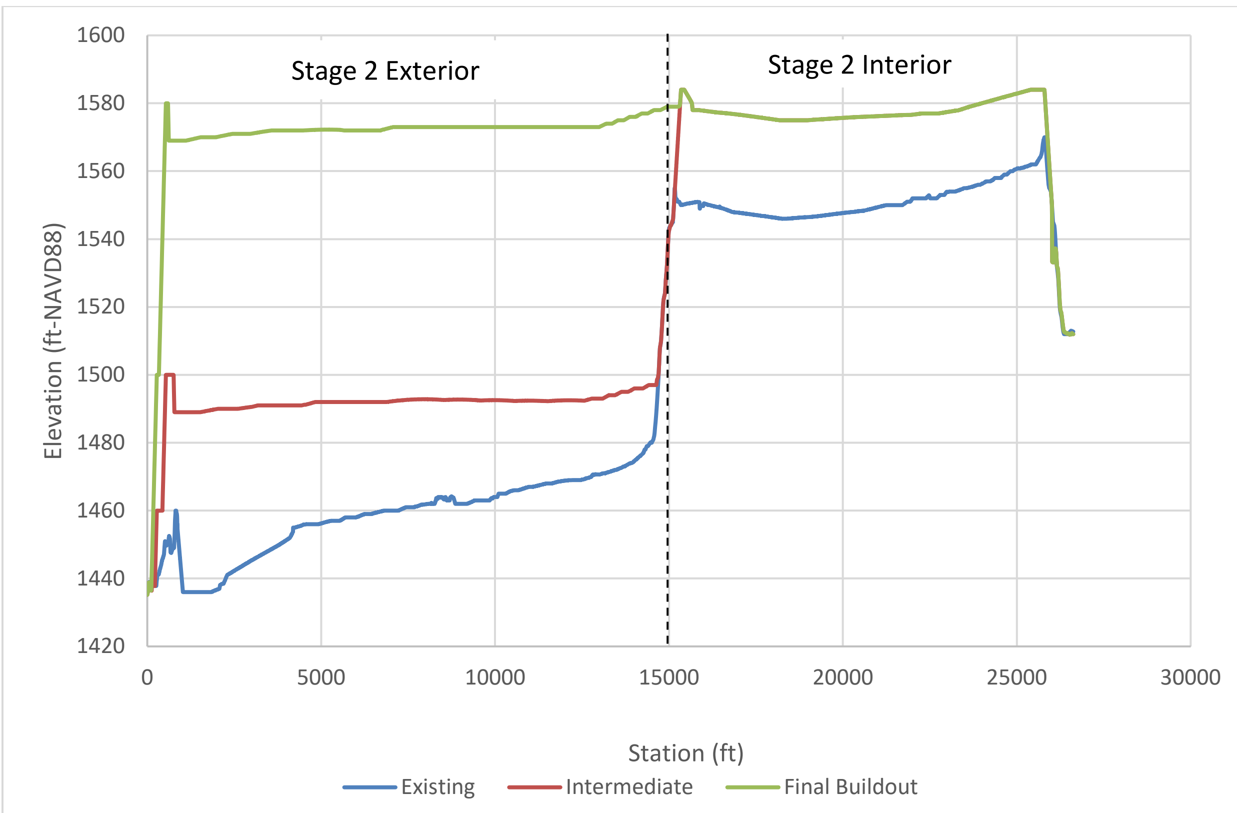


Figure 2 – Profile of Basin

Volume elevation curves are computed for each tailings basin and dam configuration based on topographic data and proposed design data discussed in Section 2.2. **Figure 3** and **Figure 4** show the volume elevation curves for each dam configuration for the interior and exterior tailing basins, respectively.

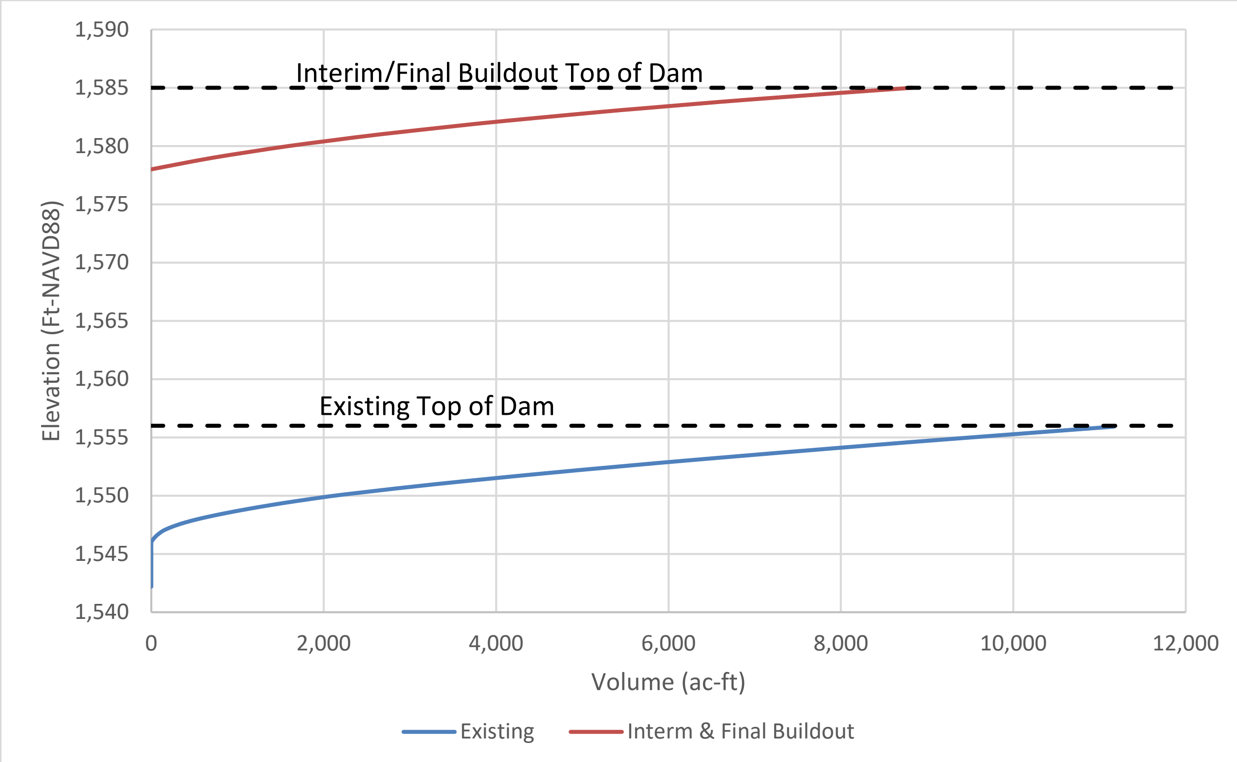


Figure 3 – Interior Reservoir Volume-Elevation Curves

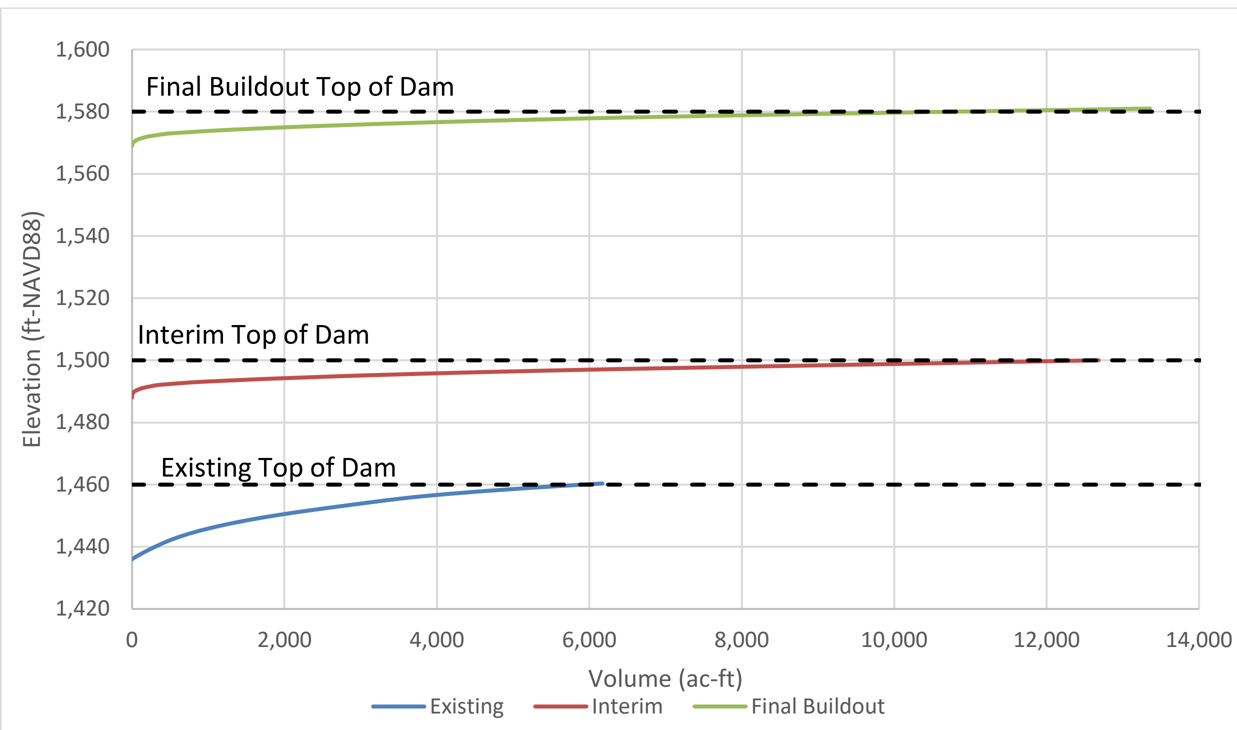


Figure 4 – Exterior Reservoir Volume-Elevation Curves

2.2 Topographic Data and Field Survey

Three sources of topographic data were used for this study. For the existing condition topography, USS flew LiDAR in 2019 and developed a digital elevation model (DEM) with 0.5-meter resolution. Where water was present in the basins, estimated bathymetric data was added into the existing basin DEM. For the interim and final buildout basin, AutoCAD Civil3D designs for the basin were exported as DEMs. For all scenarios, a DEM for areas downstream of the basin was obtained from the State of Minnesota. This DEM was based on LiDAR flown in 2011 and provided at 3-meter resolution. All DEMs were provided in a raster format such as Georeferenced Tagged Image File Format (GeoTIFF), an open file format and de facto standard based on the TIFF format is used as an interchange formation for georeferenced raster images.

2.3 Design Hydrology

The hydrologic analysis of the basin was performed by GEI in 2022 (GEI 2022) for the purpose of designing the final buildout of the tailings basin and the process to meet that final design. The hydrologic analysis analyzed several rainfall events including 100-year, 500-year, 6-hour Probable Maximum Precipitation (PMP), the 24-hour PMP, and the Snow Water Equivalent (SWE) plus storm scenarios. In addition, the analysis exercise also considered the impact that climate change will have on the hydrologic response of the basin.

When determining the PMP depth, GEI considered the potential effects of climate change. The correlation between climate change and rainfall events is not clear at this point. An atomsphere that is subject to warmer weather may be more susceptible to an increase in atomspheric moisture; however, the relationship between a warming climate and the dynamics of a storm is not known. An increase in temperature may affect the frequency or intensity of a storm, but the evidence that has been gathered does not show a significant trend in data in regards to PMP depth. Climate change should not be considered when estimating the rainfall depths for PMP events (WMO 2009, Section 1.1.1). Similar climate change conclusions were recently discussed in the report *"Site-Specific Probable Maximum Precipitation Study For Tittabawasse River Basin, Michigan Final Report"* by Applied Weather Associates (AWA). This analysis exercise selected the runoff from the 24-hour PMP event, known as the PMF, as the design of the basin. **Table 2** provides the volume and peak runoff for each of the basins and dam configuration considered for this analysis.

Table 2 – Summary of Hydrologic Analysis Results

Dam Configuration	Tailings Basin	PMF Volume (Ac-ft)	Peak Flow (cfs)
Existing	Interior	5,327	43,854
	Exterior	5,825	16,145
Interim	Interior	5,165	35,314
	Exterior	6,005	36,418
Final Buildout	Interior	5,165	35,315
	Exterior	5,825	31,296

3. Hydraulic Model Development

Hydraulic models were developed to evaluate the hypothetical dam failures and flood wave routing for the sunny day and PMF conditions using HEC-RAS, version 6.3. This version of HEC-RAS can perform two-dimensional (2D) modeling using the Saint Venant equation for both Newtonian and Non-Newtonian fluids. Models were developed for both assuming sunny-day and PMF hydrologic conditions for the three dam configurations discussed in the previous section. Models include:

- Existing: The existing Stage 2 Interior dam at elevation 1,556 ft-NAVD88 and Exterior dam elevation of 1,460 ft-NAVD88
- Interim: A future dam configuration where Stage 2 Interior dam elevation is 1,585 ft-NAVD88 and Stage 2 Exterior dam elevation is 1,500 ft-NAVD88
- Final Buildout: The designed final buildout dam configuration where Stage 2 Interior dam elevation is 1,585 ft-NAVD88 and Stage 2 Exterior dam elevation is 1,580 ft-NAVD88

Each model extends from Stage 2 Interior Dam to 10 miles downstream consisting of two watersheds to both the Southeast and Southwest. Each model extents consist of the following:

- Stage 2 Interior reservoir as a Storage Area (SA)
- Stage 2 Exterior Dam and the region downstream as a 2D Area
- Stage 2 Interior & Exterior Dams modeled a SA/2D Area Connection or breaklines within the 2D Mesh

The Stage 2 Interior basin was modeled as a 1D storage area based on estimated existing and the designed proposed capacity curve shown in **Figure 3**. The storage area was connected to the downstream 2D Area using SA/2D Connections representing each of the structures where breach locations were chosen. The SA/2D Connection elevations were set to the dam crest elevation provided in Section 2.1 and assigned a weir coefficient of 3.0.

The 2D Area covers the region downstream of the Stage 2 Interior dam including the Stage 2 Exterior dam. A mesh was developed within the 2D Area using 100-foot cells. This cell size was chosen to be of high enough resolution to properly model the breach flows downstream of the dam. To assure the model would accurately capture the reservoir capacity, breaklines were added along the dam crest and SA/2D Connections were added at locations where breaches would occur. Cell sizes along the breaklines were set to 50 feet while cells adjacent to the SA/2D Connection ranged from 200 to 500 feet. This larger grid size was chosen to capture low points and allow for the breaches to form to adequate size. Finally, breaklines were added downstream of the Stage 2 Exterior dam where roads, canals, dams, and other physical barriers would block flow.

The tailing basin is located on the divide between the Lake Superior and Mississippi River watersheds. This creates a scenario where the breach location results in distinctly different water paths. Water that flows out of the east side of the basin flows to the southeast along West Swan River through Silica, Minnesota. West Swan River flows into the St. Louis River which terminates at Lake Superior in Duluth, Minnesota. Water that flows out of the west or south sides of the basin flows into Swan Lake through Lake O'Brien or one of many small creeks. Swan Lake outflows into Swan River which flows into the Mississippi River. This unique situation creates a scenario where two outflow locations are required. To the east, a point approximately 0.5 mile downstream of Silica, Minnesota, was chosen and to the west a point approximately 2.5 miles downstream of Swan Lake was chosen. In both cases the downstream boundary condition was set to a Normal Depth condition with a water surface gradient of 0.001. **Figures 5** show an overview of each model.

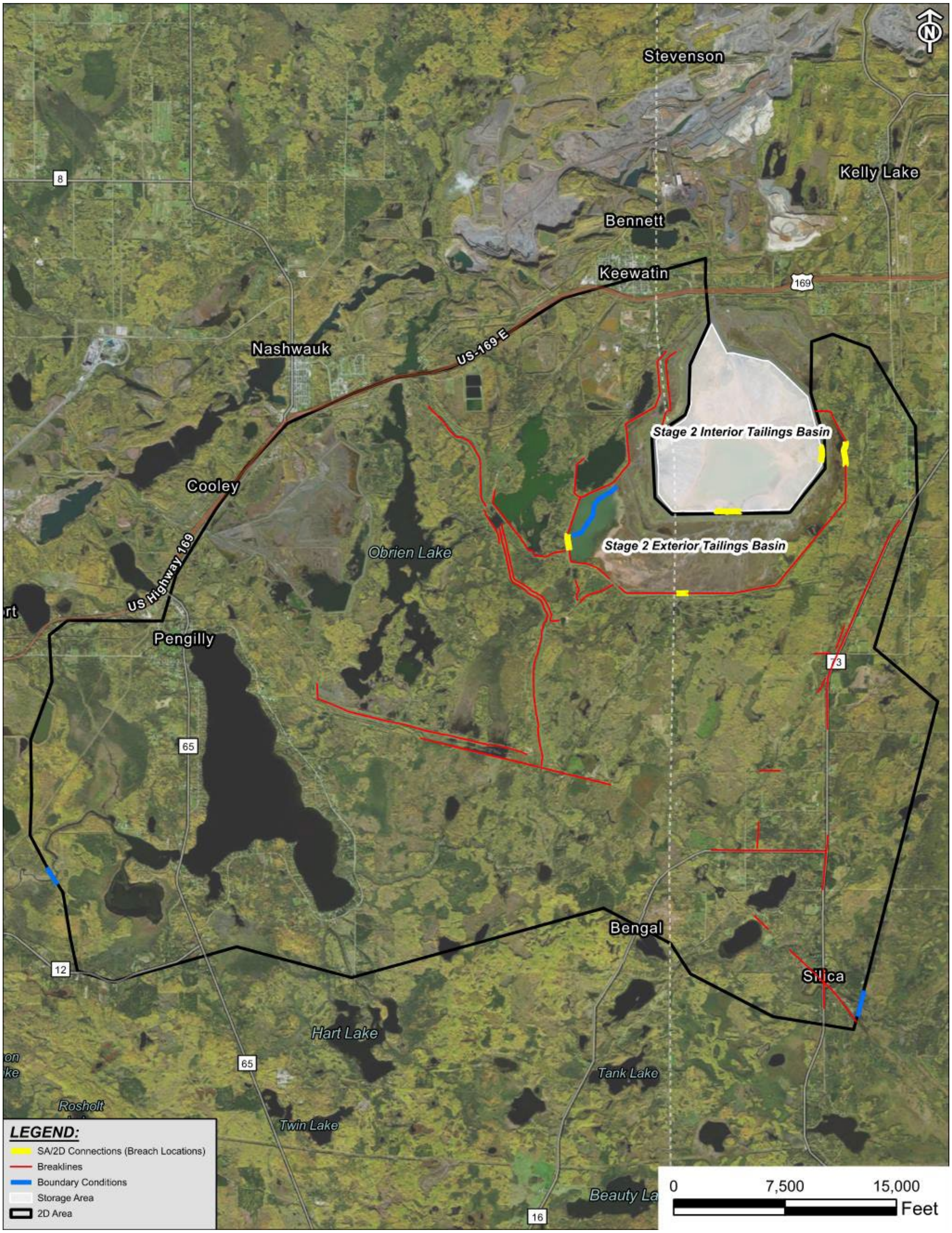


Figure 5 – Model Geometry

3.1 Sensitivity Analyses

3.1.1 Manning's n

Manning's n values were assigned based on land cover data obtained from USGS National Land Cover Database (NLCD) of 2019. Manning's n values were assigned to the land cover database based on values reported for the Natural Resources Conservation Service's (NRCS). This document outlines recommended Manning's n values for different land use types based on best available data. Within the area surrounding the tailings basin, the land cover in primarily Barren with Manning's n value of 0.025. Downstream of the tailings basin, the landcover is predominately deciduous forest (n=0.16) and woody wetlands (n=0.12). **Figure 6** shows the NLCD land use data used for each scenario.

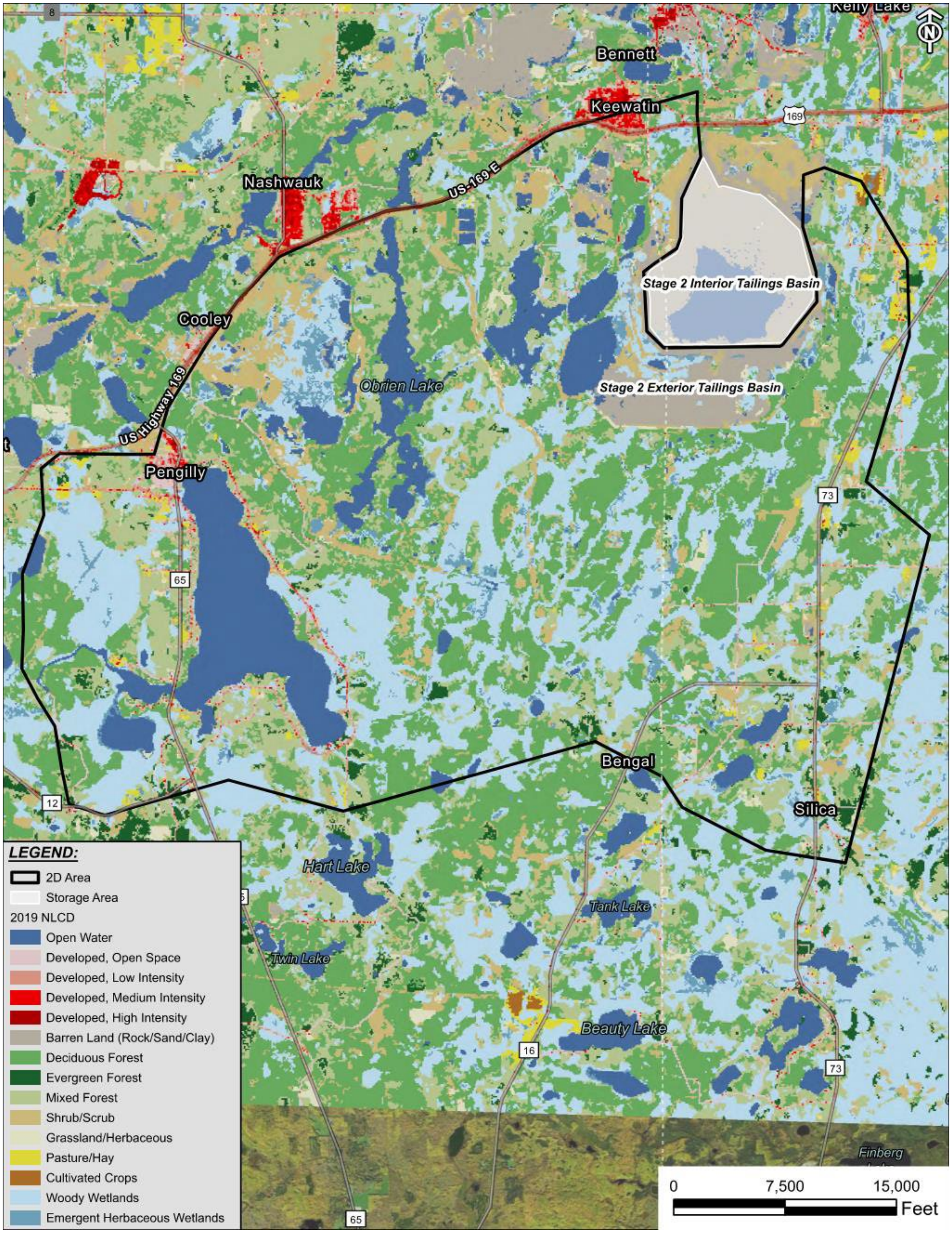


Figure 6 – National Land Cover Database

Table 3 – Manning's n Value

USGS ID	Description	Base n value	Increased n value
11	Open Water	0.025	0.030
21	Developed, Open Space	0.040	0.048
22	Developed, Low Intensity	0.080	0.096
23	Developed, Medium Intensity	0.100	0.120
24	Developed, High Intensity	0.150	0.180
31	Barren Land (Rock/Sand/Clay)	0.025	0.030
41	Deciduous Forest	0.160	0.192
42	Evergreen Forest	0.160	0.192
43	Mixed Forest	0.160	0.192
52	Shrub/Scrub	0.100	0.120
71	Grassland/Herbaceous	0.035	0.042
81	Pasture/Hay	0.030	0.036
82	Cultivated Crops	0.035	0.042
90	Woody Wetlands	0.120	0.144
95	Emergent Herbaceous Wetlands	0.070	0.084

A sensitivity analysis was conducted to determine the impact that the Manning's n values would have on floodplain results. **Table 3** includes the list of land cover type and the assigned base Manning's n value in the hydraulic model and the increased Manning's n value. To determine this, the base Manning's n values were increased by 20%. Both the base and increased Manning's n value model geometries were run with the existing east breach sunny day failure (Discussed in **Section 4.2**). **Table 4** shows the results of the Manning's n sensitivity analysis.

Both the base and increased Manning's n values model runs have similar peak breach flows and timing for the inner breach location. Due to the increase in Manning's n value inside the Stage 2 Exterior reservoir, there is a difference in peak flow and timing of the outer dam breach. The increased Manning's n value results in a greater upstream hydraulic head and a higher peak outflow. Even with this increased outflow, the peak flow attenuates to similar flows at Highway 73 north of Silica, Minnesota. The increased Manning's n value slows the flood wave and causes more attenuation during the travel time which slows the peak of the flood wave by 1.5 hours at Highway 73 north of Silica, Minnesota. The increased Manning's n value also increases the average flood depth of the floodplain by 0.1 foot and the inundation area by 36 acres. Overall, the increased Manning's n value causes an insignificant increase in the flow and water surface elevation while slowing the flood wave arrival time. Therefore, the base Manning's n value was used for this study.

Table 4 – Manning's n Sensitivity Analysis Results

Location	Parameter	Base n	20% Increased n	Difference
Inner Dam	**Peak Flow (cfs)**	2,310.0	2,308.0	-2.0
	Time to Peak (Hours)	1.0	1.0	0.0
Outer Dam	**Peak Flow (cfs)**	570.0	630.0	+59.7
	Time to Peak (Hours)	2.4	2.3	-0.1
Highway 73 North of Silica	**Peak Flow (cfs)**	207.0	214.0	7.0
	Time to Peak (Hours)	24.0	25.5	1.5
	Peak Water Surface Elevation (ft-NAVD88)	1345.8	1,346.0	0.2
	Average Depth (ft)	1.18	1.28	0.10
	Inundation Area (Acres)	689.8	725.7	35.9

3.1.2 Time Step

To improve model speed while maintaining model accuracy, a time step sensitivity analysis was conducted. Through trial and error, it was determined that a 2-second time step was sufficient to model all breach scenarios with low error. Unfortunately, this time step resulted in much longer model run times. To improve this run time, an adaptive time step methodology was used. The adaptive time step in HEC RAS uses the Courant Number to adjust time steps within a user-defined set of parameters. It uses a maximum and minimum threshold to either double or half the time step until the Courant Number is within the acceptable range. The Courant Number, C, is defined below:

$$C = \frac{v\Delta T}{\Delta X}$$

Where v is the flood wave velocity, ΔT is the time step, and ΔX is the cell size. In a perfect scenario, the Courant Number would always be less than 1. If the value is greater than 1, the flood wave would travel more than one cell length in distance which results in higher modeling error. Since the model mesh has several hundred thousand cells, modeling error in a single cell would likely have an insignificant impact on the results. Thus, a higher Courant Number threshold could be used to decrease run times and maintain model accuracy. Three scenarios were analyzed to determine the impact of the time step on the model results and determine the optimal time step scenario:

- Scenario 1: Time step of 2 seconds for the entire scenario
- Scenario 2: Adaptive Time step ranging from 0.125 second to 32 seconds with a maximum Courant Number of 1

- Scenario 3: Adaptive Time step ranging from 0.125 second to 32 seconds with a maximum Courant Number of 3

Table 5 shows the results for the time step sensitivity analysis. The analysis shows that for all scenarios the peak flow at the inner breach differs by only 3 cfs. While the peaks flow at the outer breach, and Highway 73 north of Silica, Minnesota, are identical. All scenarios produce very low modeling error under 0.1%. Scenario 1 has the longest run time at 33 minutes while Scenarios 2 and 3 are much lower at 19.2 minutes and 19 minutes, respectively. Scenario 2 was chosen based on the low volumetric error and comparable run time.

Table 5 – Time Step Sensitivity Analysis Results

	Scenario 1	Scenario 2	Scenario 3
Base Time Step	2-Sec	2-Sec	2-Sec
Max Courant Number	N/A	1	3
Run Time (mins)	33	19.2	19
Volumetric Error	0.03%	0.01%	0.04%
Inner Breach Peak Flow (cfs)	2,308	2,310	2,311
Outer Breach Pack Flow (cfs)	570	570	570
Flow at Highway 73 North of Silica (CFS)	207	207	207

3.1.3 Downstream Boundary

A sensitivity analysis was conducted for the location of the downstream boundary condition on the East outflow location near Silica, Minnesota. This sensitivity analysis was not conducted for the West outflow location because Swan Lake acts as the downstream boundary condition by storing the outflow volumes. The drainage path to the east is channelized resulting in less attenuation of flow. The east downstream boundary condition was chosen to be 0.5 mile downstream of Silica, Minnesota, for two reasons:

- Silica, Minnesota, has several structures near the flow path and could possibly be inundated
- In the highest flow events, the bridges in Silica, Minnesota, are able to pass the flow without overtopping and the water remains in the channel banks

Regardless, it was important to determine the impact of the boundary condition on this location to verify that the inundation area has been properly delineated. If the boundary condition is too close to the town, then it could have an impact on the modeling results at this location. A boundary condition sensitivity analysis was performed by expanding the model 8.5 miles downstream. The flow results for the existing conditions PMF scenario were compared to determine the impact of the boundary condition location has on the model results. **Table 6** shows these results of the boundary condition sensitivity analysis.

The results show that the downstream boundary condition location has an insignificant impact on the model results. There is no impact on water surface elevation at either the Highway 73 location or location or north of Silica, Minnesota. Additionally, there is only a small difference in the flow at these locations. Since the flow is contained within the channel at the location 0.5 miles downstream of Silica, Minnesota, and it does not impact the results, this location was chosen to for the downstream boundary.

Table 6 – Downstream Boundary Condition Sensitivity Analysis Results

Location	Parameter	Scenario 1	Scenario 2	Difference
		0.5 Miles Downstream Silica, MN	8.5 Miles Downstream Silica, MN	-
Flow at Highway 73 North of Silica	**Flow (cfs)**	2,609.0	2,608.0	0.04%
	Max Water Surface Elevation (ft-NAVD88)	1,350.5	1,350.5	0%
Flow at Highway 73 at Silica	**Flow (cfs)**	884.6	885.5	0.1%
	Max Water Surface Elevation (ft-NAVD88)	1,332.0	1,332.0	0

3.2 Initial Conditions

The initial storage elevations of the reservoirs were set based on dam configuration and hydrologic scenarios. For the sunny day scenarios, the design water surface elevation of 7 feet of freeboard was chosen for the initial water surface elevation for every reservoir and scenario except the existing Stage 2 Exterior basin. For the existing Stage 2 Exterior basin, the freeboard of 4 feet was chosen based on normal water conditions in the basin.

To determine the initial storage volume for the PMF scenarios, a volumetric analysis was conducted. The analysis assumed that at the onset of the PMF the water surface elevation in the basin was at the minimum required freeboard elevation. This is the most conservative scenario based on the basin design. The PMF volume was then added to the reservoir to determine the total initial volume at the start of the model. In all cases, except for the Stage 2 Exterior basin under the existing conditions, the reservoir could hold the water volume without overtopping.

Table 7 shows the results of the reservoir capacity analysis.

Table 7 – PMF Reservoir Capacity Analysis

Dam Configuration	Reservoir	Dam Crest Elevation (ft-NAVD88)	PMF Inflow Volume (ac-ft)	Initial		Final	
				Water Surface Elevation (ft-NAVD88)	Volume (Ac-ft)	Water Surface Elevation (ft-NAVD88)	Volume (ac-ft)
Existing	Interior	1,556.0	5,165	1,549.0	1,234	1,553.1	6,399
	Exterior	1,460.0	6,005	1,456.0	3,702	1,466.5	9,707
Interim	Interior	1,585.0	5,165	1,578.0	1,061	1,582.7	6,226
	Exterior	1,500.0	6,005	1,493.0	846	1,497.4	6,851
Final Buildout	Interior	1,585.0	5,165	1,578.0	1,061	1,582.7	6,226
	Exterior	1,580.0	6,005	1,573.0	498	1,578.1	6,503

For the existing conditions Stage 2 Exterior basin the initial conditions were set to the dam crest elevation of 1,460 ft-NAVD88. This occurs 12 hours and 6 minutes into the 24-hour PMF event when the flow is 14,572 cfs. The remaining portion of the PMF hydrograph was input in the reservoir as an internal boundary condition hydrograph. **Figure 7** shows the hydrograph used for this scenario. **Table 8** shows the initial conditions for each of the scenarios.

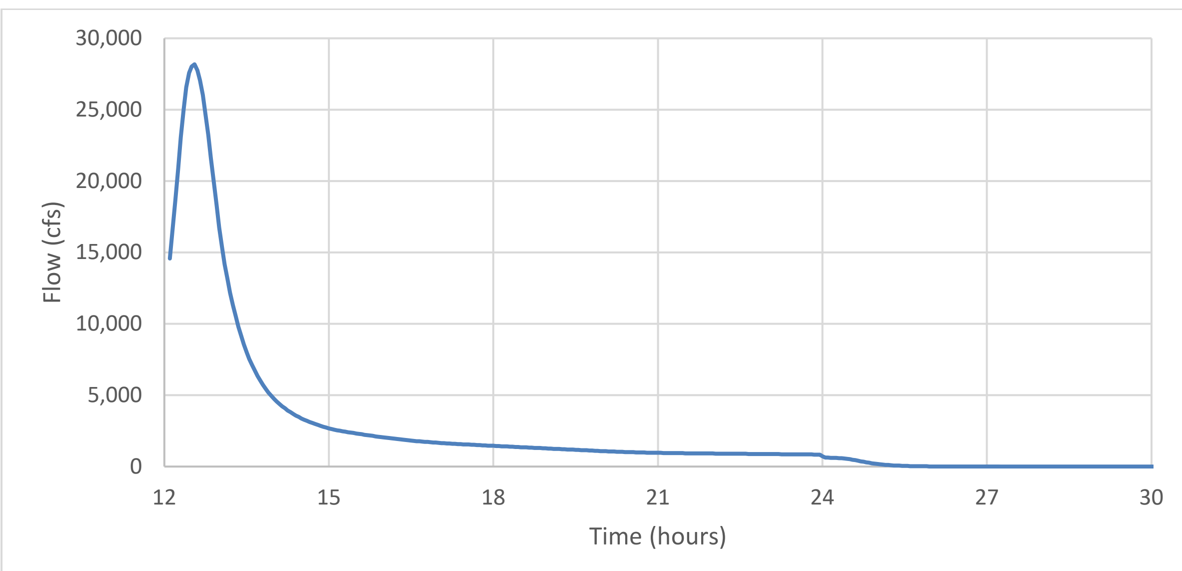


Figure 7 – Inflow Hydrograph for Existing Exterior Dam PMF Scenario

Table 8 – Freeboard and Initial Water Surface Elevation by Scenario

Dam Configuration	Hydrology	Reservoir	Freeboard (ft)	Initial Water Surface Elevation (Ft-NAVD88)
Existing	Sunny Day	Interior	7.0	1,549.0
		Exterior	4.0	1,456.0
	PMF	Interior	2.9	1,553.1
		Exterior	0.0	1,460.0
Interim	Sunny Day	Interior	7.0	1,578.0
		Exterior	7.0	1,493.0
	PMF	Interior	2.3	1,582.7
		Exterior	2.6	1,497.4
Final Buildout	Sunny Day	Interior	7.0	1,578.0
		Exterior	7.0	1,573.0
	PMF	Interior	2.3	1,582.7
		Exterior	1.9	1,578.1

4. Methodology

4.1 Mobilized Tailings

When tailing dams breach the resulting outflow can have high concentrations of tailings solids suspended in the water. These solids concentrations have an impact on how the water behaves, especially at high enough concentrations. Clean water acts as a Newtonian fluid where the water has no yield stress and has constant viscosity. This means that the water will flow free of resisting forces that would cause it to maintain a shape and will have a constant (low) viscosity regardless of the outside forces. As solids concentration increase, the water begins to act like a non-Newtonian fluid. Non-Newtonian fluids have a yield stress and have a variable (and higher) viscosity. This means that the fluid can still flow like water but will have a yield stress to overcome and the viscosity of the fluid will increase slowing down motion. Non-Newtonian fluids can hold a shape and usually flow much slower when they do begin to flow. This change in fluid dynamics will result in substantially different floodplain depths and extents.

O'Brien (1986) developed a taxonomy of fluid flows based on solid concentration by volume (C_V). He classified flows into four categories based on solids concentration shown in **Figure 8**.

- Water Flood ($C_V < 20\%$): These floods act as normal Newtonian flows.
- Mud Flood ($20\% < C_V < 45\%$): These floods have higher concentrations of solids which causes bulking in the water and the water to begin to act like a non-Newtonian fluid.
- Mud Flow ($45\% < C_V < 55\%$): These floods act like non-Newtonian fluid with higher yield stress and viscosity.
- Landslide ($C_V > 55\%$): No longer acts as a fluid

These concentrations are not specific static values; rather the taxonomy is designed to be a spectrum that transitions from one type to another over a range of concentrations. To model impacts of solid concentration on the fluid flow it is necessary to know the concentration of solids in the water and how those solids will impact the rheologic properties of the fluid.

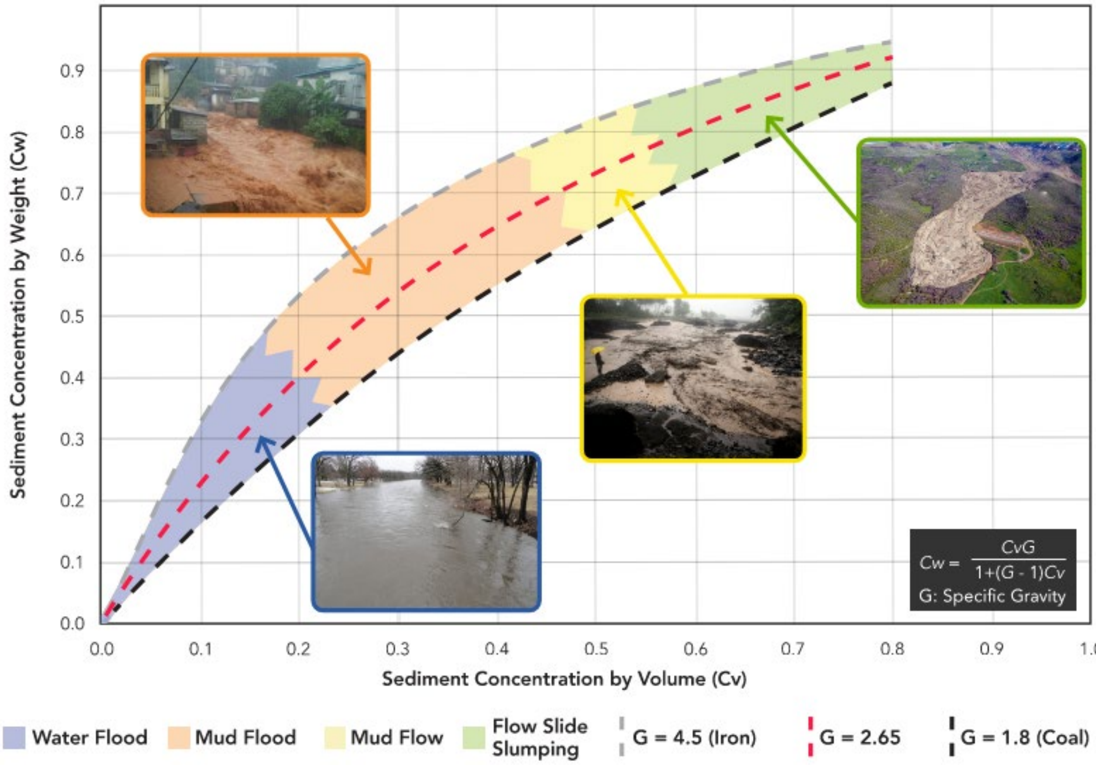


Figure 8 – Taxonomy of Flows by Sediment Concentration (CDA, 2021)

4.1.1 Solids Concentration

The CDA has compiled research literature on tailings dam breaches. As part of this technical bulletin, the CDA classifies failure scenarios and how to estimate the solids concentration of each. The CDA technical bulletin identifies four failure scenarios as follows:

- Case 1A - Supernatant pond present and the tailings liquify
- Case 1B - Supernatant pond present and the tailings do not liquify
- Case 2A - Supernatant pond is not present and the tailings liquify
- Case 2B - Supernatant pond is not present and the tailings do not liquify

For the purposes of this study, Case 1A was chosen for all scenarios because in all scenarios a pond is present and the tailings have a high enough saturation to be susceptible to liquefaction. While Case 2A is possible in some scenarios, the downstream impact of this case will be smaller than in Case 1A, therefore, creating a more conservative case to account for unforeseen conditions.

For Case 1A, CDA estimated total solids outflow volume will occur due to two main processes:

- Process I - Tailings present in the water and mobilized in the reservoir during the failure event
- Process II - Tailings mobilized through liquefication.

Process I accounts for the tailings that are present in the supernatant pond at the time of the failure and the tailings that are mobilized during the initial flood wave. Process II accounts for the tailings that are liquified and mobilized as the initial breach backscarp progresses upstream. CDA recommends that the C_V for Process I range from 20-30% based on engineering judgement. For Process II, CDA recommends computing the volume of tailings from the bottom of the breach location out in a conical pattern until it reaches the surface. This cone would propagate out at an angle between 1% to 9%, based on engineering judgement. The void ratio is then used to compute the in-situ water and dry solids amount in this volume. These volumes are added to the Process I volumes to compute a total C_V value for the analysis.

To determine the impact the angle has on the results, a sensitivity analysis was conducted. The south breach (discussed in Section 5.2) on the existing Stage 2 Interior dam was used to calculate the volumes of sediment at 1%, 3%, 5%, and 9%. The resulting C_V value was calculated for each scenario assuming both 20% and 30% for Process I for both the Sunny Day and PMF scenarios. **Table 9** shows the Sunny Day results. **Table 10** shows the PMF results. The analysis uses a void ratio of 0.89 based on samples collected at the site and assumes a 100% saturation level.

Table 9 – Solids Concentration Sensitivity Analysis (Sunny Day Failure)

Sensitivity Analysis- Existing Inner South Breach (Sunny Day)								
Process I -Mobilized Tailings								
Assumed $C_{v\text{-}MOB}$	30%	30%	30%	30%	20%	20%	20%	20%
Hydrograph Volume (ac-ft)	1,234	1,234	1,234	1,234	1,234	1,234	1,234	1,234
Solids (ac-ft)	370.2	370.2	370.2	370.2	246.8	246.8	246.8	246.8
Process II- Liquefaction								
Void Ratio	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Angle	1%	3%	5%	9%	1%	3%	5%	9%
in Situ Water (ac-ft)	9,591	995	272	18	9,591	995	272	18
Solids (ac-ft)	10,776	1,118	306	21	10,776	1,118	306	21
Total Liquified (ac-ft)	20,367	2,112	578	39	20,367	2,112	578	39
Solids Concentration, C_V	**52%**	**44%**	**37%**	**31%**	**51%**	**41%**	**30%**	**21%**

Table 10 – Solids Concentration Sensitivity Analysis (PMF Failure)

Sensitivity Analysis- Existing Inner South Breach (PMF)								
Process I -Mobilized Tailings								
Assumed $C_{V\text{-}MOB}$	30%	30%	30%	30%	20%	20%	20%	20%
Hydrograph Volume (ac-ft)	6,399	6,399	6,399	6,399	6,399	6,399	6,399	6,399
Solids (ac-ft)	1,920	1,920	1,920	1,920	1,280	1,280	1,280	1,280
Process II- Liquefaction								
Void Ratio	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Angle	1%	3%	5%	9%	1%	3%	5%	9%
in Situ Water (ac-ft)	9,591	995	272	18	9,591	995	272	18
Solids (ac-ft)	10,776	1,118	306	21	10,776	1,118	306	21
Total Liquified (ac-ft)	20,367	2,112	578	39	20,367	2,112	578	39
Solids Concentration, C_V	**47%**	**36%**	**32%**	**30%**	**45%**	**28%**	**23%**	**20%**

These results show that the solids concentration range from 21% to 52% for the sunny day figure and 20% to 47% for the PMF scenario. The results also show that the steeper the angle the closer the solids concentration is to the assumed mobilized concentration. As the angle becomes shallower, the solids concentration approaches 53%. This limit value is a function of the void ratio. The higher the void ratio, the higher the in-situ water content and the lower the solids concentration.

In addition to computing the solids concentration using the CDA method, several empirical equations have been developed to estimate the total amount of tailings that would be released in case of a breach. These equations are based on data gathered from a range of tailing dam failures across the world. Most are based on only the volume of tailings V_T while one equation relies on the height of the dam, h, as well. The equations are as follows:

Rico et al. (2008)

$$V_R = 0.354 \cdot V_T^{1.01}$$

Larraui and Lall (2018)

$$V_R = 0.322 \cdot V_T^{0.95}$$

Quelopana (2019)

$$V_R = 0.0612 \cdot V_T^{0.809} \cdot h^{0.544}$$

Since these equations are independent of the presence of the pond, the type of breach, or any other factor, the tailings volume released would be the same in every scenario. **Table 11** shows the calculations for the total tailing volume for each equation. The results show that for each scenario, there is a large difference in total tailings volume released between the equations. This is due to the equations being power functions. Small changes in the exponent in the power function results in large changes of released volume at high values of released tailings volumes. Although the range of released tailings volume is large, the solids concentrations are predominantly between 40% and 50%. These values are similar to the higher range of the CDA method values.

Table 11 – Solids Concentration Empirical Calculations

	Interior		Exterior		
	Existing	**Interim/Final**	**Existing**	**Interim**	**Final**
Sunny Day Volume (ac-ft)	1,234	1,061	3,702	846	498
PMF Volume (ac-ft)	6,399	6,226	9,707	6,851	6,503
Rico et al. (2008)					
In Situ Water (ac-ft)	22,180	36,473	13,081	30,783	66,468
Solids (ac-ft)	24,921	40,981	14,698	34,588	74,683
Total Released (ac-ft)	47,101	77,454	27,780	65,371	141,152
C_V Sunny Day	**52%**	**52%**	**47%**	**52%**	**53%**
C_V PMF	**47%**	**49%**	**39%**	**48%**	**51%**
Larrauri and Lall, (2018)					
In Situ Water (ac-ft)	14,901	23,790	9,069	20,282	41,837
Solids (ac-ft)	16,743	26,731	10,189	22,789	47,008
Total Released (ac-ft)	31,644	50,521	19,258	43,071	88,844
C_V Sunny Day	**51%**	**52%**	**44%**	**52%**	**53%**
C_V PMF	**44%**	**47%**	**35%**	**46%**	**49%**
Quelopana (2019)					
In Situ Water (ac-ft)	6,441	12,540	3,034	9,548	26,777
Solids (ac-ft)	7,237	14,090	3,409	10,728	30,087
Total Released (ac-ft)	13,677	26,630	6,444	20,277	56,864
C_V Sunny Day	**49%**	**51%**	**34%**	**51%**	**52%**
C_V PMF	**36%**	**43%**	**21%**	**40%**	**47%**

The empirical method results indicate that in the worst-case scenario the failure of these dams would result in a mud flow (C_V between approximately 45% and 55%). For this analysis a solids concentration of 55% was used for all scenarios because it corresponds to the high end of a mud flow and is approximately equal to the high end of each calculation of 53%. The solids concentration of 55% will likely produce conservative results and act as a bookend to the clean water scenarios that will also be modeled.

4.1.2 Rheology

To model the impacts of solid concentrations on flows, HEC-RAS 6.3 incorporates both bulking factor (BF) and non-Newtonian fluid equations. The bulking factor is a function of the solids concentration by volume as shown below.

$$BF = \frac{1}{1 - C_V}$$

This bulking factor increases the volume of the water based on the solids concentrations which impacts the fluid density.

HEC-RAS 6.3 has several methods available to account for non-Newtonian flow. For this study, the O'Brien (quadratic) method was used. This method combines the stresses due to cohesion, internal friction between sediment and fluid, turbulence, and initial impacts between particles. This is also the same method the is used in FLO2D. This equation requires a yield stress, viscosity, and a representative grain size.

The representative grain size is based on the material of tailings. The material consists of layers of predominantly fine-grained sediments. Field samples have shown that the average grain size of the material (d50) is 0.0224 mm with 85 to 99% of the material passing through the 0.075 mm sieve. Based on this analysis, the d50 grain size of 0.0224 mm was chosen as the representative grain size.

Both the yield stress and viscosity are functions of the sediment concentration in the water and the type of sediment present. O'Brien provided an exponential function to compute both as shown below. α and β are experimentally derived parameters that are different for each equation.

$$\tau_y = \alpha_1 e^{\beta_1 Cv}$$

$$\mu = \alpha_2 e^{\beta_2 Cv}$$

O'Brien collected several samples in the Colorado region and computed α and β for both the Yield Stress and Viscosity. Additionally, an analysis performed on an iron ore tailing dam in southeast Brazil by Chacara and Filho (2021) provided data that allowed for the computation of the α and β parameters. **Table 12** provides the parameters for each sample with the corresponding yield stress and viscosity at the chosen solids concentration of 55%.

Table 12 – Rheological Parameters

C_V=55%	Yield Stress			Viscosity		
Source	**α_1 (Pa)**	**β_1**	**τ (Pa)**	**α_2 (Pa-s)**	**β_2**	**μ (Pa-s)**
O'Brien (2020)						
Aspen Pit 1	0.0181	25.7	24,913	0.0036	22.1	684.0
Aspen Pit 2	0.272	10.4	83	0.00538	14.5	16.0
Aspen natural Soil	0.0152	18.7	445	0.000136	28.4	826.0
Aspen Mine Fill	0.00473	21.1	519	0.0128	12.0	9.0
Aspen Watershed	0.0383	19.6	1,840	0.0000495	27.1	147.0
Aspen Mine Source Area	0.0291	14.3	76	0.0000201	33.1	1,620.0
Glenwood 1	0.00345	20.1	218	0.000283	23.0	88.0
Glenwood 2	0.00765	16.9	83	0.00648	6.2	0.2
Glenwood 3	7.07E-05	29.8	928	0.000632	19.9	36.0
Glenwood 4	0.000172	29.5	1,914	0.0000602	33.1	4,852
Chacara and Filho (2021)						
Brazil Iron Mine	0.030725	13.6	54	0.1552852	14.5	449

The results show a wide range of yield stresses and viscosities based on these samples. For reference, water at 20 degrees Celsius has a yield stress of 0 Pa and a viscosity of .001 Pa-s. To determine the most appropriate set of values to use, a sensitivity analysis was performed. The analysis considered four possible conditions:

- High viscosity and high yield stress
- High viscosity and low yield stress
- Low viscosity and high yield stress
- Low viscosity and low yield stress

Of these four scenarios, only two were considered applicable. Low yield stress and low viscosity would function as water and be redundant for this analysis. Low viscosity and high yield stress is also a generally unlikely scenario (O'Brien, 2020). Therefore, the sensitivity analysis considered only high viscosity scenarios with a range of yield stresses.

The existing East sunny day breach cascade failure was modeled with yield stresses and viscosity associated with the Aspen Mine Source Area, Glenwood 4, and the Brazilian Iron Mine samples. **Table 13** shows the result of the sensitivity analysis. **Figure 9** shows the inundation areas for the three scenarios.

Table 13 – Rheological Sensitivity Analysis

		Scenario 1	Scenario 2	Scenario 3
Source Material		**Brazilian Iron Mine**	**Aspen Mine Source Area**	**Glenwood 4**
Yield Stress (Pa)		**54**	**76**	**1,914**
Viscosity (Pa-s)		**449**	**1,620**	**4,852**
Inner Dam	**Peak Flow (cfs)**	2,310	2,310	2,308
	Time to Peak (Hours)	1.0	1	1
Outer Dam	**Peak Flow (cfs)**	506.0	358	258
	Time to Peak (Hours)	2.8	2.9	4.9
Average Depth (ft)		3.6	4.4	11.2
Average Flood wave Velocity (fps)		0.07	0.04	0.02
Inundation Area (Acres)		363.5	298.2	105.1

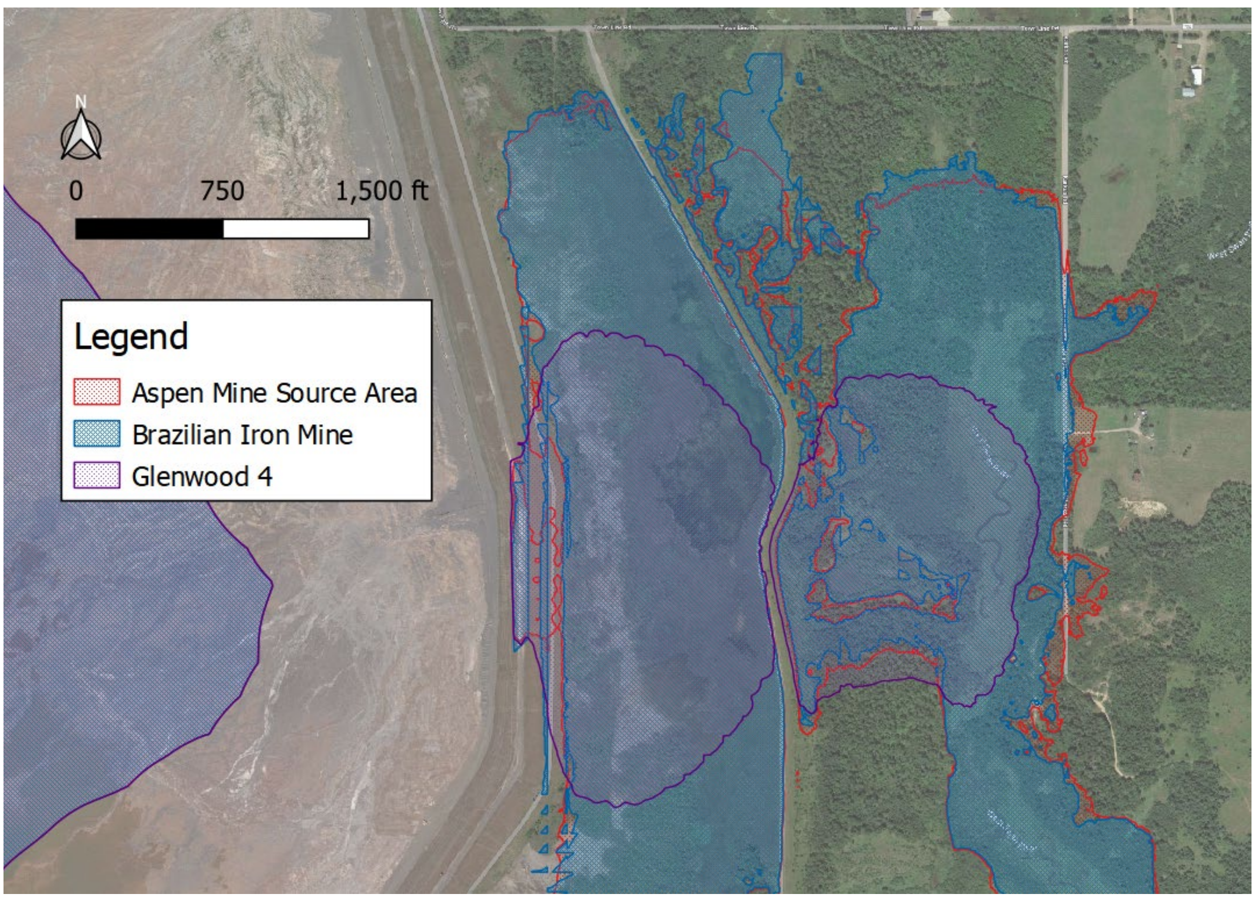


Figure 9 – Inundation area of the Rheology Sensitivity Analysis

The results of the sensitivity analysis show that Scenario 1 has the greatest peak outflow from the outer dam and the largest inundation area. This is due to the relatively lower viscosity and yield stress which allows the water to flow more freely. Scenario 2 has a lower outflow and smaller inundation area but creates a larger floodplain near the breach location. Due to the low yield stress, the fluid does not stop but the high viscosity results in a very slowly moving flow. Scenario 3 has the lowest breach outflow and results in the highest average depth. This is because the high yield stress causes the fluid to stop more easily. In all cases, the flood wave velocity is very low.

The sensitivity analysis indicates that the modeling results are highly dependent on yield stress and viscosity. The Brazilian Iron Mine sample parameters were chosen for this analysis because the source material most closely simulates the tailings that are stored within the basins and is the most conservative scenario.

4.2 Breach Locations & Parameters

4.2.1 Breach Locations

The relatively flat topography and ring dam geometry results in many possible breach locations. The breach locations were chosen based on the downstream flow path, likelihood of failure, and the locations where largest breach would occur. Because the dam is located on the divide between two major watersheds (Lake Superior on the east, and Mississippi River on the west) this dividing line is the driving factor of the downstream flow path. As such, the breach locations were chosen to represent both watersheds with the Lake Superior watershed breaches being on the east side and the Mississippi River watershed breaches being on the south and west sides.

To determine the potential breach locations, the existing and planned future dam geometry was analyzed. For the existing conditions, the Stage 2 Interior dam is lower and narrower on the southeast section of the dam. This is because the north side of the dam is a preferred location to deposit material which provides added protection from a breach that could impact Keewatin, Minnesota, and the Highway 169. The future design plans maintain this scenario by building up a taller and wider crowned dam on the north side. Because of this, two breach locations were chosen for the Interior dam for all scenarios: One on the south side and one on the east side. The hypothetical breach locations sit on opposite sides of the watershed divide.

The hypothetical location of the Stage 2 Interior dam breaches will have a direct impact on the likelihood of failure of the Stage 2 Exterior dam. For the clean water run, the additional water that flows into the Exterior reservoir can cause overtopping. For the mud flow scenarios, the location of the breach will be impacted by an increase in water depth due to mobilized tailings during the Interior breach. To account for all these factors, three Exterior dam breaches were chosen located on the east, south, and west sides as discussed in Section 5.3 below.

Figure 10 shows the dam breach locations considered for this analysis.

Figure 10 – Hypothetical Breach Location Figure

4.2.2 Breach Parameters

Breach parameters for the dams were developed based on published guidance documents, the foundation profile, previous inundation studies, and dam composition. The dam failure parameters were selected from the FEMA P-946 guidelines. The selection of the parameters of the dam failure were based on best available data collected during this study and may not reflect real-time conditions (e.g., weather conditions, vegetation and land cover, location of potential dam failure, reservoir conditions, etc.).

FEMA P-946 references the Federal Energy Regulatory Commission (FERC) engineering guideline which outlines breach parameters for concrete arch, concrete gravity, and earth-fill dams. **Table 14** provides a summary of the range of estimates for breach characteristics for each dam type.

Table 14 – FERC Suggested Breach Parameters

Concrete Arch Dam	
Average Breach Width	Crest Length of Dam
Side Slopes of Breach	0H:1V to Slope of Valley Walls
Breach Formation Time	Less than 0.1 Hour
Concrete Gravity Dams	
Average Breach Width	<0.5 Length of Dam
Side Slopes of Breach	0H:1V
Breach Formation Time	0.1 hour to 0.3 hours
Earth-Fill Dams	
Average Breach Width	0.5 to 5 Times Dam Height
Side Slopes of Breach	0H:1V to 1H:1V
Breach Formation Time	0.1 hour to 1 hours

Earth-fill dam FERC parameters were used as a guideline for the Stage 2 Interior and Stage 2 Exterior dams. An additional sensitivity analysis was conducted to determine the effect of breach parameters on the resulting floodplain. A breach location on the east side of the Stage 2 Interior dam under the sunny day scenario was chosen for the sensitivity analysis. In total, four sensitivity scenarios were conducted at this location.

The breach scenarios were chosen to be a trapezoidal breach shape with 1H:1V side slopes. For simplicity, minimum breach widths were computed using the range provided by FERC. Minimum breach widths ranging from 1 to 5 times the height were analyzed. Unlike other dams, tailings dams could potentially have a large elevation differential between the upstream and downstream toes. To be conservative, the height of the dam was calculated using the downstream toe elevation. However, for modeling purposes the breach bottom elevation was assigned the upstream elevation. This is because HEC-RAS does not allow for breach bottom elevations to be lower than either side of the breach. Finally, breach formation times were analyzed using the FERC guidance ranging from 0.1 to 1 hours. Typically, larger breaches require longer times to form. This assumption was used except for Scenario 4, which modeled a large dam breach that forms extremely quickly.

Earth-fill dams can fail through overtopping or piping. Piping failures can occur through a variety of mechanism but all result in a failure the originates within the center of the dam and propagates out. Overtopping breaching only occurs when water flows over the top of the dam. As the water flows over the top, it cuts into the dam propagating the failure down and out. For this analysis both failure mechanisms were utilized. For breach scenarios where the water does not overtop the dam a piping mechanism is modeled originating at the breach bottom elevation. If the water in the scenario overtops the dam, an overtopping failure is modeled.

Table 15 shows the parameters used for the sensitivity analysis and the resulting peak flows.

Table 15 – Dam Breach Sensitivity Analysis Parameters and Results

	Scenario			
	1	**2**	**3**	**4**
Top of Dam (ft-NAVD88)	1,556			
Downstream Toe (ft-NAVD88)	1,487			
Upstream Toe (ft-NAVD88)	1,547			
Height (ft)	69			
Width (ft)	345.0	69.0	172.5	345.0
Height Multiplier	5.0	1.0	2.5	5.0
Side Slope (XV:1H)	1			
Breach Time (Hours)	1.0	0.1	0.5	0.1
Breach Trigger (ft-NAVD88)	Start of Run			
Failure Type	Piping			
Peak Flow (cfs)	2,308	518	1,248	2,522
Time to Peak (Hours)	1.0	0.1	0.5	0.1

Figure 11 shows the hydrographs for the three scenarios. For all scenarios peak flow leaving the breach was dependent primarily on the width of the breach. While Scenarios 1 and 4 have the same breach width, Scenario 4 did produce a larger flow due to a much fast breach formation time. While the flow was larger, it was not substantially larger than Scenario 1. As such, the breach parameters for Scenario 1 were used for this analysis. All breaches were chosen to be five times the dam height and form in 1 hour.

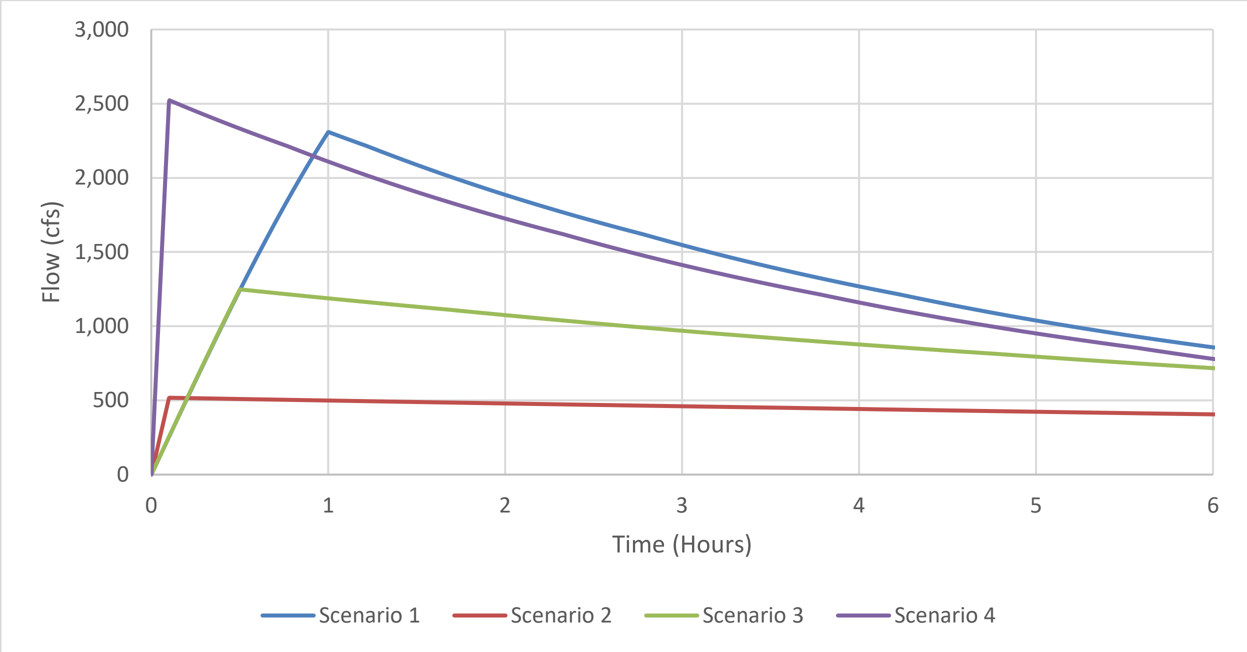


Figure 11 – Breach Sensitivity Analysis Hydrographs

Tables 16 – 18 shows the breach parameters used for each breach location and dam configuration.

Table 16 – Existing Dam Configuration Breach Parameters

	Existing				
	Interior Dam		Exterior Dam		
Breach	**South**	**East**	**South**	**West**	**East**
Top of Dam (ft-NAVD88)	1,556	1,556	1,466	1,459	1,489
Downstream Toe (ft-NAVD88)	1,485	1,487	1,418	1,432	1,462
Upstream Toe (ft-NAVD88)	1,547	1,547	1,459	1,436	1,487
Height (ft)	71	69	48	27	27
Width (ft)	355	345	240	135	135
Height Multiplier	5	5	5	5	5
Side Slope (XV:1H)	1	1	1	1	1
Breach Time (Hours)	1	1	1	1	1
Clean Water					
Sunny Day Breach Trigger (ft-NAVD88)	Start of Run	Start of Run	-	1,457.7	1,488.6
Sunny Day Failure Type	Piping	Piping	-	Piping	Piping
PMF Breach Trigger (ft-NAVD88)	Start of Run	Start of Run	-	1,460.0	1,489.0
PMF Breach Failure Type	Piping	Piping	-	Overtop	Overtop
Mud Flow					
Sunny Day Breach Trigger (ft-NAVD88)	Start of Run	Start of Run	-	1,456.0	1488.6
Sunny Day Failure Type	Piping	Piping	-	Piping	Piping
PMF Breach Trigger (ft-NAVD88)	Start of Run	Start of Run	1,466.0	1,460.0	1,489.0
PMF Breach Failure Type	Piping	Piping	Overtop	Overtop	Overtop

Table 17 – Interim Dam Configuration Breach Parameters

	Interim				
	Interior Dam		Exterior Dam		
Breach	**South**	**East**	**South**	**West**	**East**
Top of Dam (ft-NAVD88)	1,585	1,585	1,500	1,500	1,500
Downstream Toe (ft-NAVD88)	1,497	1,497	1,410	1,431	1,463
Upstream Toe (ft-NAVD88)	1,575	1,575	1,497	1,488	1,497
Height (ft)	88	88	90	69	37
Width (ft)	440	440	450	345	185
Height Multiplier	5	5	5	5	5
Side Slope (XV:1H)	1	1	1	1	1
Breach Time (Hours)	1	1	1	1	1
Clean Water					
Sunny Day Breach Trigger (ft-NAVD88)	Start of Run	Start of Run	-	1,494.1	1,498.9
Sunny Day Failure Type	Piping	Piping	-	Piping	Piping
PMF Breach Trigger (ft-NAVD88)	Start of Run	Start of Run	-	1500	1500
PMF Breach Failure Type	Piping	Piping	-	Overtop	Overtop
Mud Flow					
Sunny Day Breach Trigger (ft-NAVD88)	Start of Run	Start of Run	-	1,493.0	1498.9
Sunny Day Failure Type	Piping	Piping	-	Piping	Piping
PMF Breach Trigger (ft-NAVD88)	Start of Run	Start of Run	1,499.0	1497.4	1,500.0
PMF Breach Failure Type	Piping	Piping	Piping	Piping	Overtop

Table 18 – Final Buildout Dam Configuration Breach Parameters

	Final Buildout				
	Interior Dam		**Exterior Dam**		
Breach	**South**	**East**	**South**	**West**	**East**
Top of Dam (ft-NAVD88)	1,585	1,585	1,580	1,580	1,580
Downstream Toe (ft-NAVD88)	1,578	1,578	1,410	1,431	1,460
Upstream Toe (ft-NAVD88)	1,575	1,575	1,569	1,569	1,579
Height (ft)	7	7	170	149	120
Width (ft)	35	35	850	745	600
Height Multiplier	5	5	5	5	5
Side Slope (XV:1H)	1	1	1	1	1
Breach Time (Hours)	1	1	1	1	1
Clean Water					
Sunny Day Breach Trigger (ft-NAVD88)	No Breach	No Breach	-	1,573.0	No Breach
Sunny Day Failure Type			-	Piping	
PMF Breach Trigger (ft-NAVD88)	Start of Run	Start of Run	-	1,578.8	1,579.2
PMF Breach Failure Type	Piping	Piping	-	Piping	Piping
Mud Flow					
Sunny Day Breach Trigger (ft-NAVD88)	No Breach	No Breach	-	1,573	No Breach
Sunny Day Failure Type			-	Piping	
PMF Breach Trigger (ft-NAVD88)	Start of Run	Start of Run	No Breach	1,578.1	1,579
PMF Breach Failure Type	Piping	Piping		Piping	Piping

4.3 Scenarios

The model scenarios were determined based on the Interior dam breach location and resulting exterior pond inundation area. In total, 22 scenarios were modeled that included dam configuration (existing, intermediate, or final buildout), flow type (clean water or mud flow), hydrology (Sunny Day or PMF), inner breach location, and outer breach location. **Table 19** provides a list of all the dam breach configurations.

For some cases in the Final Buildout scenario, the Stage 2 Interior dam water surface elevation was lower than the downstream toe and were thus excluded from the analysis. Additionally, in some cases, the water does not reach the upstream toe of the exterior dam and were thus not breached.

Table 19 – List of Scenarios

Dam Configuration	Flow Type	Hydrology	Inner Breach	Outer Breach
Existing	Clean Water	Sunny Day	South	West
			East	East
		PMF	South	West
			East	East
	Mud Flow	Sunny Day	South	South
			East	East
		PMF	South	South
				West
			East	East
Interim	Clean Water	Sunny Day	South	West
			East	East
		PMF	South	West
			East	East
	Mud Flow	Sunny Day	South	South
			East	East
		PMF	South	South
				West
			East	East
Final Buildout	Clean Water	Sunny Day	South[1]	West
		PMF	South	West
			East	East
	Mud Flow	Sunny Day	South	[2]
		PMF	South	West
			East	East

[1] Interior Dam does not breach because downstream toe is too high
[2] Exterior Dam does not breach because water does not reach upstream toe

5. Results

The 22 breach scenarios were modeled, and the results were composited based on dam configuration (existing, intermediate, or final buildout), flow type (clean water or mud flow), and hydrology (sunny day or PMF). This resulted in a total of 12 composite scenarios. The peak flow leaving the dam for each scenario is provided in **Table 20.** Peak flow, maximum depth, and arrival time to 1 foot of depth is provided for several points of interest for the existing PMF scenarios in **Table 21.**

For the existing clean water scenarios, the eastern breach flood wave travels down West Swan River and under Highway 73 three times until it reaches Silica, Minnesota. For the PMF scenario, it takes approximately 14.25 hours for the flood wave to arrive and at this point it is contained within the channel. For the west breach the flood wave travels through Reservoir #6 and into O'Brien Lake. The water flows out of O'Brien Lake through two different flow paths that flow into Swan Lake. For the PMF scenario, it takes 11 to 13 hours to arrival at Swan Lake depending on the flow path. At this point, the flood wave is contained within the lake.

For the existing mudflow scenarios, both the eastern and western breaches follow similar flooding paths but moves at a much flow pace and does not travel as far. For the eastern flow path, the mud flow takes 65.75 hours to make it to Silica, Minnesota, where it is fully contained within the channel. The flow along the western path reaches Reservoir #6 in 9 hours and comes to a stop within O'Brien Lake. The southern breach produced flooding along Hay Creek that bypasses the O'Brien Lake. It comes to a stop at a point 2.5 miles upstream of Swan Lake in approximately 43 hours.

For the clean water scenarios, the intermediate and future buildout dam configuration breach extents remain largely unchanged compared to the existing dam configuration. For the west breach the floodplain extents decrease minimally and for the east breach the floodplain increases minimally.

For the mud flow scenarios, the intermediate and future buildout dam configuration breach extents decrease immensely compared to the existing dam configuration. The additional height and volume storage of the Stage 2 Exterior dam combined with the non-Newtonian nature of the fluid makes it more difficult for the mud flow to leave the dam.

Detailed floodplain information is provided in the inundation map books in **Appendix A.**

An inundation map showing structures surrounded by or within the floodplain of the scenarios analyzed, and individual property detail reports are included in **Appendix B.**

Table 20 – Peak Flow Leaving the Dam for Each Scenario

Location	Clean Water (cfs)		Mud Flow (cfs)	
	Sunny Day	PMF	Sunny Day	PMF
Existing				
Inner East Breach	**2,310**	**12,512**	**2,310**	**12,514**
Inner South Breach	**2,364**	**12,832**	**2,370**	**12,831**
Outer East Breach	571	3,707	1,085	8,781
Outer East Overtopping	0	1,927	26	1,143
Outer East Total	**571**	**5,633**	**1,111**	**9,924**
Outer West Breach	28,677	43,932	15,188	42,207
Outer West Overtopping	0	14,582	0	30,683
Outer West Total	**28,677**	**58,514**	**15,188**	**72,891**
Outer South Breach	0	0	0	2,367
Outer South Overtopping	0	2,481	0	157
Outer South Total	**0**	**2,481**	**0**	**2,524**
Intermediate				
Inner East Breach	**5,025**	**21,579**	**5,026**	**21,699**
Inner South Breach	**5,026**	**21,610**	**5,042**	**21,610**
Outer East Breach	964	6,599	2,175	14,139
Outer East Overtopping	1	664	9	1,104
Outer East Total	**965**	**7,262**	**2,184**	**15,243**
Outer West Breach	10,191	33,776	989	4,168
Outer West Overtopping	6	26	0	0
Outer West Total	**10,197**	**33,802**	**989**	**4,168**
Outer South Breach	0	7	0	542
Outer South Overtopping	0	1	0	5
Outer South Total	**0**	**9**	**0**	**547**
Final Buildout				
Inner East Breach	**0**	**1,004**	**0**	**955**
Inner South Breach	**0**	**1,017**	**0**	**981**
Outer East Breach	0	197	0	0
Outer East Overtopping	1,612	0	0	0
Outer East Total	**1,612**	**197**	**0**	**0**
Outer West Breach	6,108	36,088	1,085	5,666
Outer West Overtopping	811	12	0	0
Outer West Total	**6,919**	**36,100**	**1,085**	**5,666**
Outer South Breach	0	0	0	0
Outer South Overtopping	157	0	0	0
Outer South Total	**157**	**0**	**0**	**0**

Table 21 – Results at Select Points of Interest for Existing PMF Scenarios

Cross Section	Location	Clean Water			Mud Flow		
		Flow (cfs)	Depth (ft)	Arrival Time to 1 ft (Hours)	Flow (cfs)	Depth (ft)	Arrival Time to 1 ft (Hours)
E13	Highway 73 at Highway 16	2,614	7.3	9.25	968	10.0	24.75
E16	Highway 73 north of Silica, MN	2,211	9.2	11.25	444	11.0	37.25
E18	Highway 73 at Silica, MN	879	7.2	14.25	8	5.0	65.75
W2a	Reservoir No. 6 Spillway	21,633	6.5	0.75	14,851	9.0	0.75
W5	O'Brien Lake Dam	620	10.5	7.00	0	-	-
W6	O'Brien Creek at Swan Lake	619	2.7	11.00	0	-	-
S5	Hay Creek 2.5 miles upstream of Swan Lake	767	6.0	6.00	45	7.0	43.00
S8	Hay Creek at Swan Lake	1,458	3.5	13.00	0	-	-

6. References

Canadian Dam Association (CDA) *"Technical Bulletin: Tailings Dam Breach Analysis."* 2021

Chacara, Debora and Waldyr Filho. Rheology of Mine Tailings Deposits for Dam Break Analyses. June 2021

Chow (1959) Open channel Hydraulics

Federal Emergency Management Agency (FEMA). 2013. *FEMA 946, Federal Guidelines for Inundation Mapping of Flood Risks Associated with Dam Incidents and Failures.*

FERC. 2020. *Engineering Guidelines for the Evaluation of Hydropower Projects*. Chapter 2, Appendix II-A of FERC's.

Larraui, Paulina and Upmanu Lall *"Tailings Dams Failures: Updated Statistical Model for Discharge Volume and Runout"* February 15, 2018

Natural Resources Conservation Service's (NRCS) *Recommendations and Cautions Manning's n Values for Various Land Covers to Use for Dam Breach Analyses by NRCS in Kansas*

O'Brien, J.S. "Simulating Mudflow Guidelines" October 2020

Rico, M.; Benito, G.; Diez-Herrero, A. Floods from tailings dam failures. J.Hazard. Mater. 2008, 154, 79–87.

Quelopana, Hugo "Released Volume Estimation for Dam Break Analysis." July 2019

US Army Corps of Engineers (USACE). 2014. *Using HEC-RAS for Dam Break Studies*, Davis, CA

US Army Corps of Engineers (USACE). 2016. *HEC-RAS, River Analysis System, 2D Modeling User's Manual, Version 5.0*, Davis, CA.

USGS (1989) Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains

7. Uncertainty and Limitations

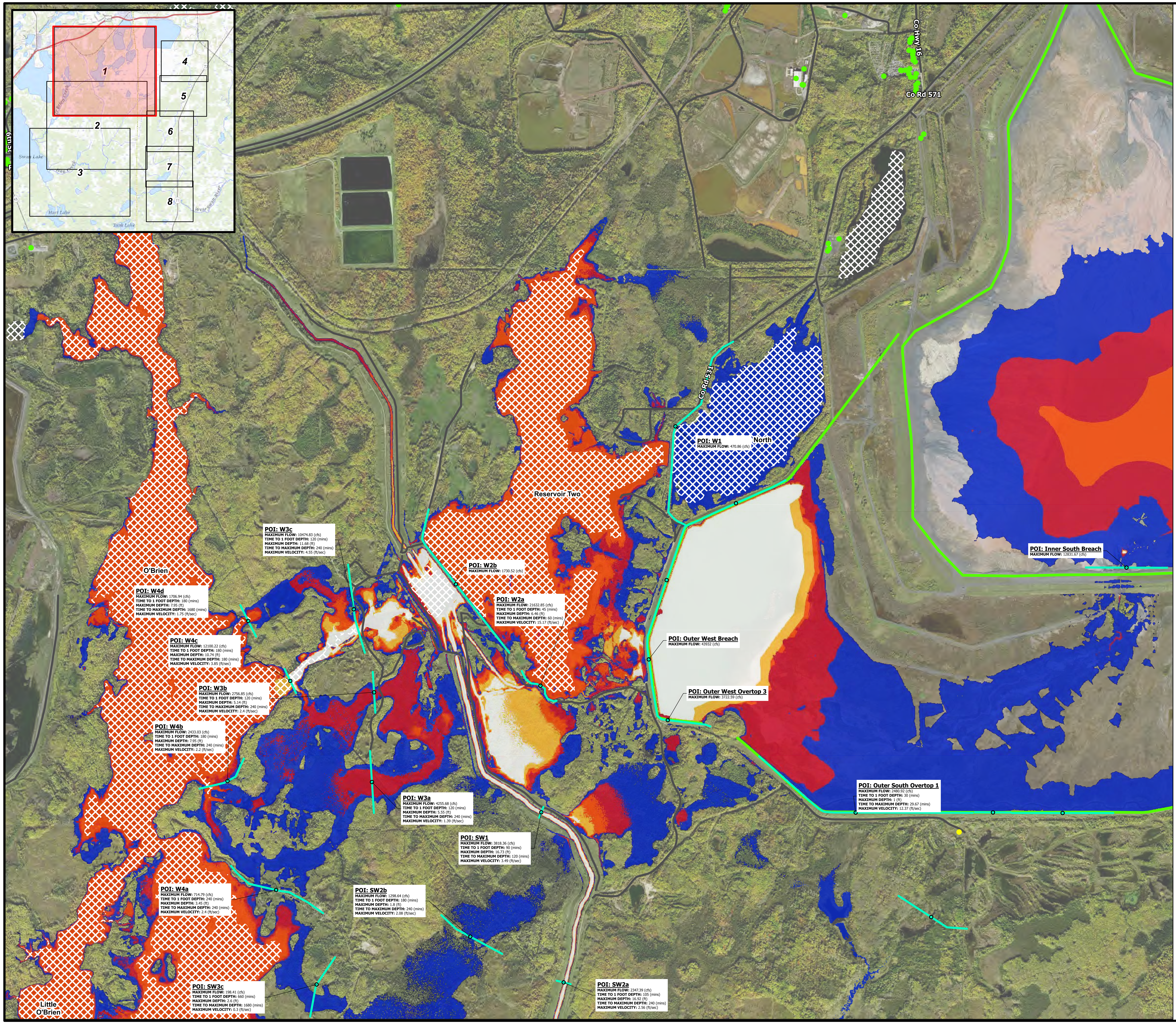
This report presents the results of a hypothetical failure of the Keetac Tailings Basin the subsequent downstream flooding for the sunny day (normal flow), 100-year flood event, and 6-hour PMP conditions. The results are based on our judgment and the suggested breach parameters and hydraulic modeling techniques as recommended in FERC Engineering Guidelines. The results of this analysis should only be used to estimate potential downstream impacts based on the assumed breach conditions for EAP mapping purposes. If any portion of Keetac Stage 2 Interior or Stage 2 Exterior basin were to fail, actual breach conditions, peak flows, and peak water surface elevations will likely vary from those presented in this report.

The hypothetical failure and assumed breach conditions do not indicate or represent the actual integrity, condition, or safety of the Keetac Tailings Basin, but rather the potential effects if a failure should occur. Reuse of this report for any other purposes, in part or in whole, is at the sole risk of the user.

Appendix A

Flood Inundation Map

Downstream Boundary of Mapping Extent
Downstream Boundary of Mapping Extent
Downstream Boundary of Mapping Extent
1
2
3
4
5
6
7
8
Reservoir Two
Reservoir Two North
O'Brien
Little O'Brien
Unnamed (O'Brien Res. #4)
KEEWATIN, MN
SILICA, MN
LEGEND:
Waterbodies with inaccurate data (Due to lack of bathymetry)
Stage 2 Exterior Alignment
Cross-Section Lines
Cross-Section Centerpoint
Existing Building Structures
Completely Within Breach Extent
Within 500ft of Breach Extent
Outside of 500ft of Breach Extent
Max Depth Values (ft)
> 1
1.01 - 4
4.01 - 6
6.01 - 8
8.01 - 10
< 10
0 2,600 5,200 US Feet
Scale: 1 inch = 2,500 feet
DESIGNED: C. FRITSCH
PREPARED: J. HANSEN
REVIEWED: M. WHEELER
APPROVED: -
DATE: FEBRUARY 2023
REVISION: 0
PROJECT NUMBER: 2201246
EXISTING 'PMF' CLEANWATER CASCADE FAILURE - OVERVIEW
KEETAC TAILINGS BASIN
KEEWATIN, MINNESOTA
UNITED STATES STEEL CORPORATION
GEI Consultants



LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Completely Within Breach Extent

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

N

0 1,000 2,000 US Feet

Scale: 1 inch = 1,100 feet

Max Depth Values (ft)

> 1

1.01 - 4

4.01 - 6

6.01 - 8

8.01 - 10

< 10

NOTES:

1. THIS MAP IS PART OF THE EMERGENCY ACTION PLAN FOR KEETAC TAILINGS BASIN.

2. DAM BREACH AND RELATED INUNDATION STUDIES ARE BASED ON HYPOTHETICAL SCENARIOS. A DAM BREACH AND INUNDATION STUDY DOES NOT CONSTITUTE, NOR IMPLY, A DAM SAFETY REVIEW AND SPECIFICALLY DOES NOT IMPLY ANY LIKELIHOOD OF FAILURE. RATHER, IT ASSUMES THAT A BREACH IS INITIATED IRRESPECTIVE OF LIKELIHOOD, ANDASSUMES HYPOTHETICAL CREDIBLE FAILURE MODES BASED ON ASSUMED SITE CONDITIONS AND HISTORIC DAM FAILURES AT OTHER LOCATIONS.

3. INUNDATION LIMITS SHOWN ON THIS MAP REPRESENT THE RESULTS OF A HYPOTHETICAL MODELED DAM FAILURE. ACTUAL INUNDATION LIMITS MAY DIFFER SIGNIFICANTLY FROM THOSE SHOWN ON THIS MAP.

4. INUNDATION FIGURES ARE BASED ON THE AVAILABLE LIDAR INFORMATION AND ARE INTENDED TO GUIDE THE DEVELOPMENT OF OVERALL EMERGENCY RESPONSE PLANS AND THE ASSESSMENT OF THE CONSEQUENCE OF DAM FAILURE; THE ACCURACY OF THE PREDICTED INUNDATION ZONES REFLECTS THIS PURPOSE.

5. UNCERTAINTY IN THE MOBILIZED FLUID VOLUMES AND THEIR RHEOLOGICAL PROPERTIES LEADS TO UNCERTAINTY IN THE DELINEATION OF INUNDATED AREAS ANDFLOW PROPERTIES AT ANY GIVEN LOCATION; GEI HAS FOLLOWED ACCEPTED PRACTICES TO ADDRESS UNCERTAINTY, HOWEVER, RESIDUAL UNCERTAINTY REMAINS.

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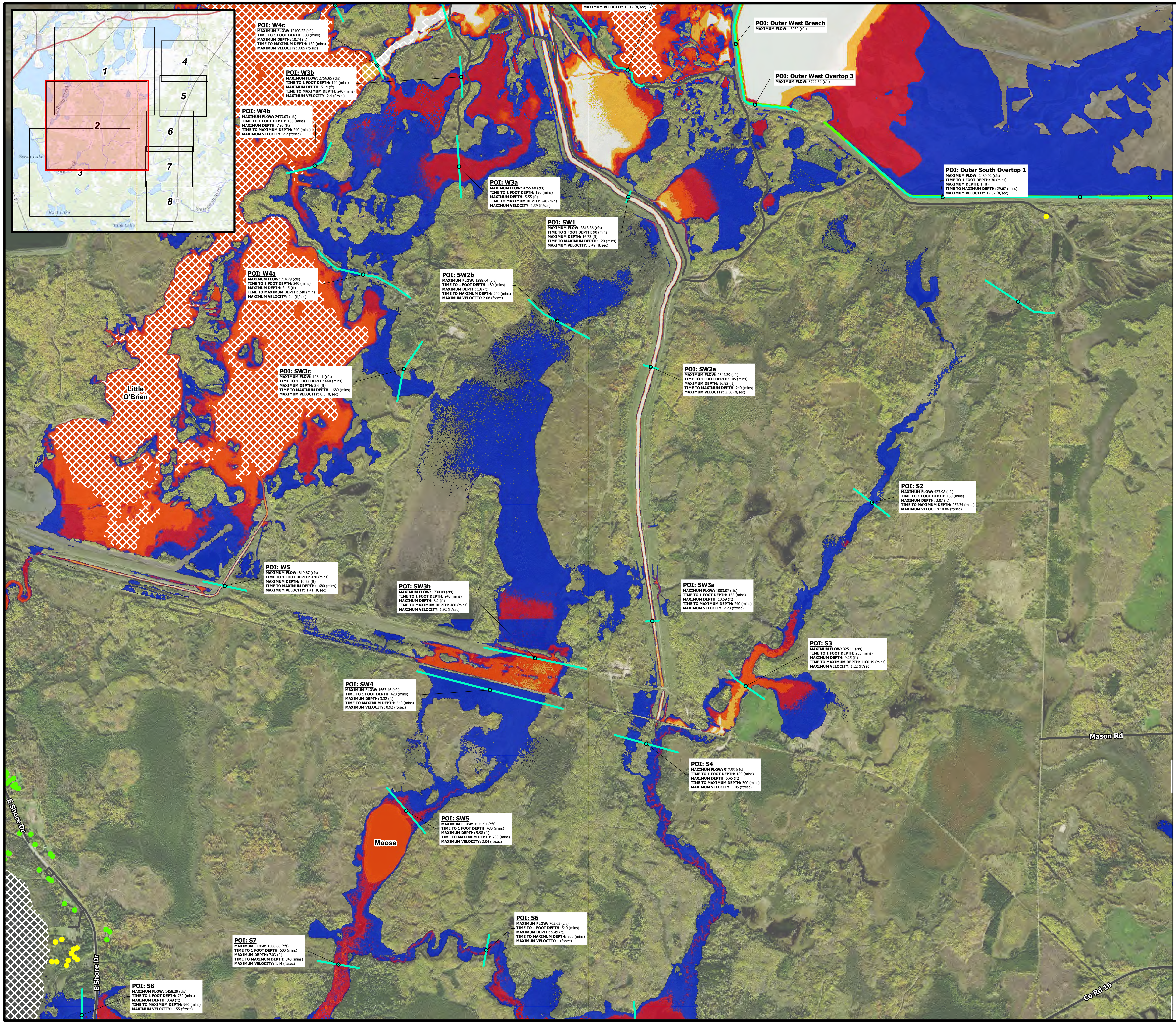
DATUM: NAD 1983 2011
PROJECTION: LAMBERT CONFORMAL CONIC

DESIGNED: C. FRITSCH	**EXISTING 'PMF' CLEANWATER CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 1 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

GEI Consultants



LEGEND:

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Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Completely Within Breach Extent

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

0 1,000 2,000 US Feet

Scale: 1 inch = 1,100 feet

Max Depth Values (ft)

> 1

1.01 - 4

4.01 - 6

6.01 - 8

8.01 - 10

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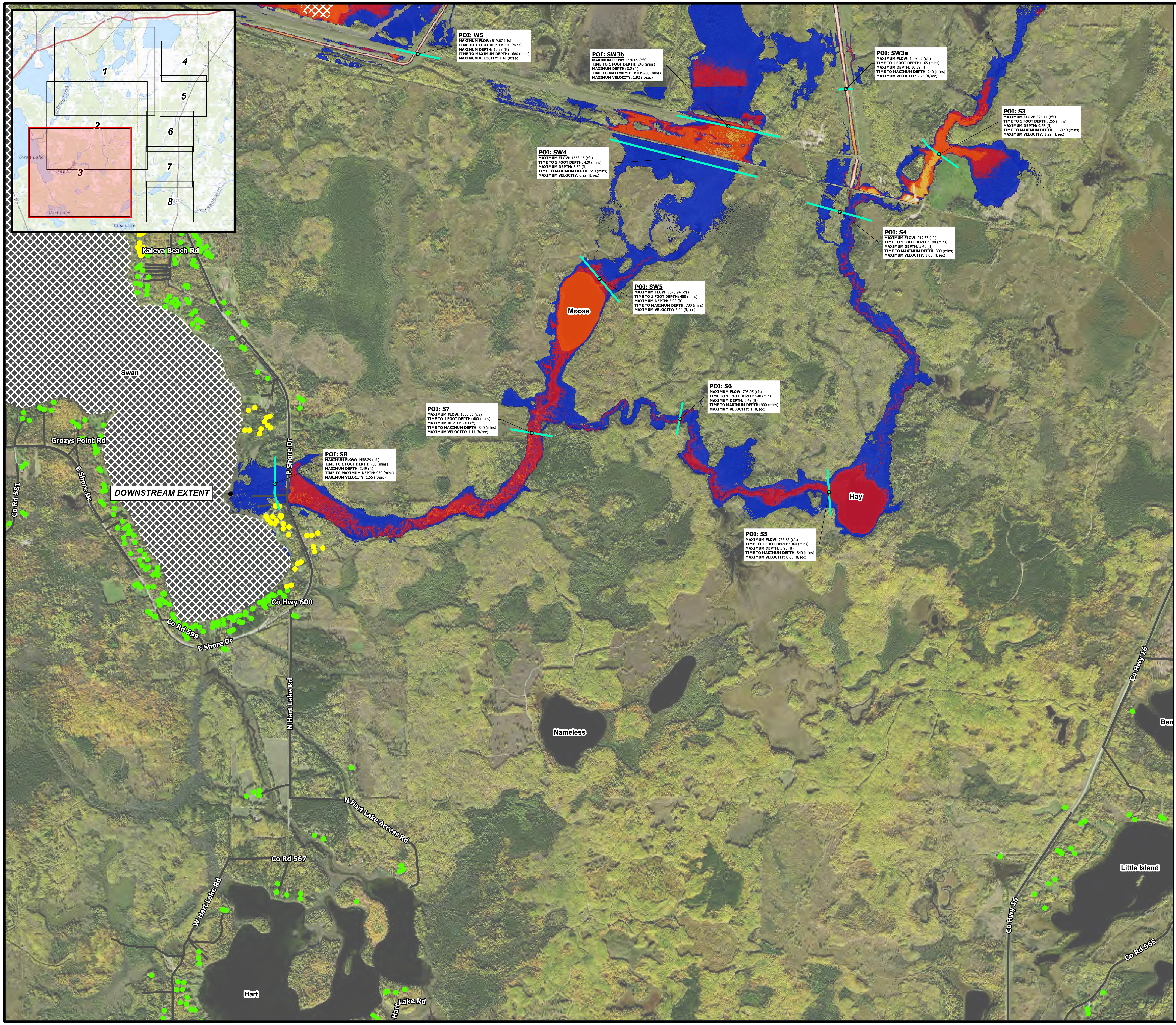

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Outside of 500ft of Breach Extent

0 1,000 2,000 US Feet

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Max Depth Values (ft)

- > 1
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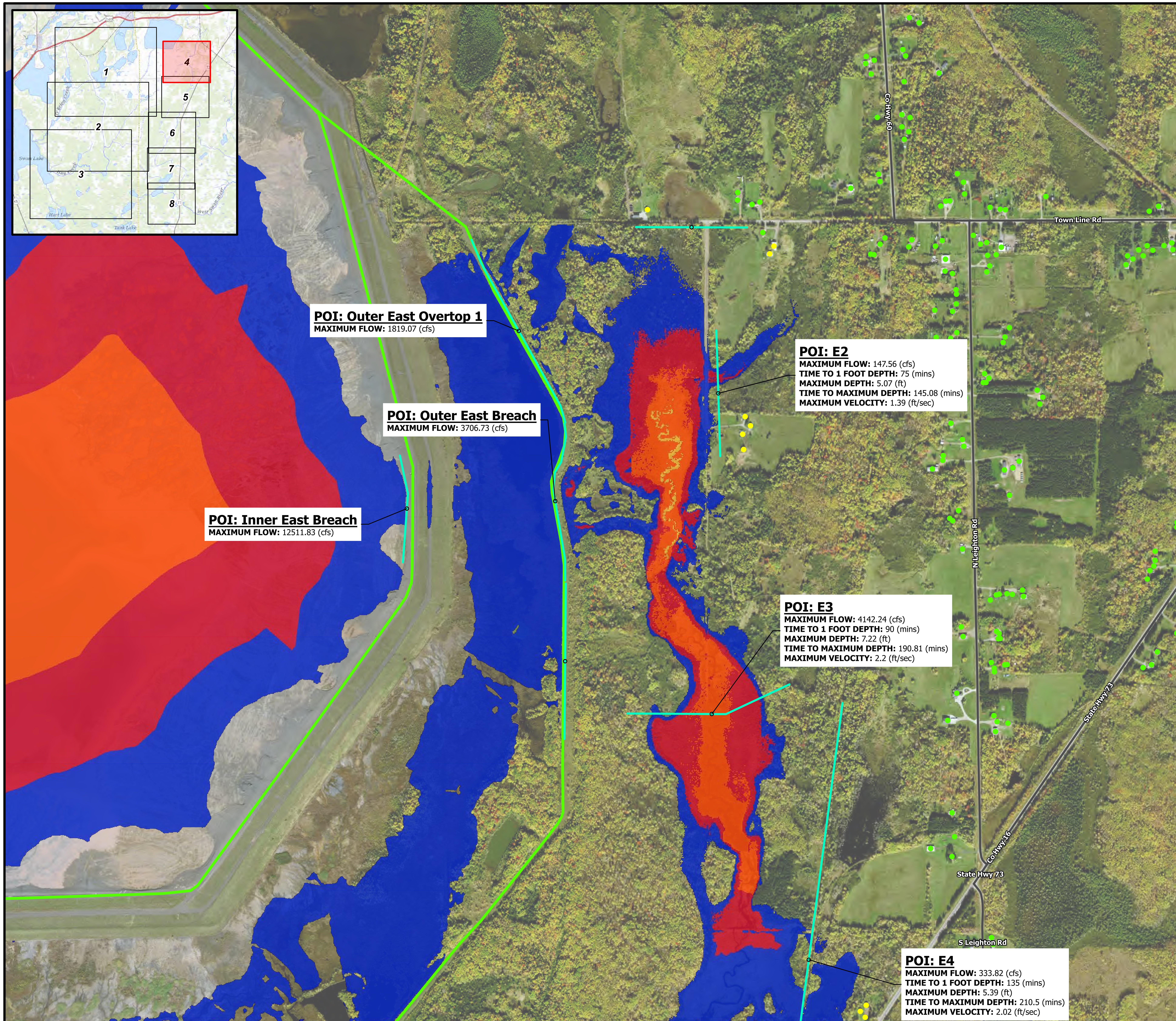

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Cross-Section Centerpoint

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Max Depth Values (ft)

> 1

1.01 - 4

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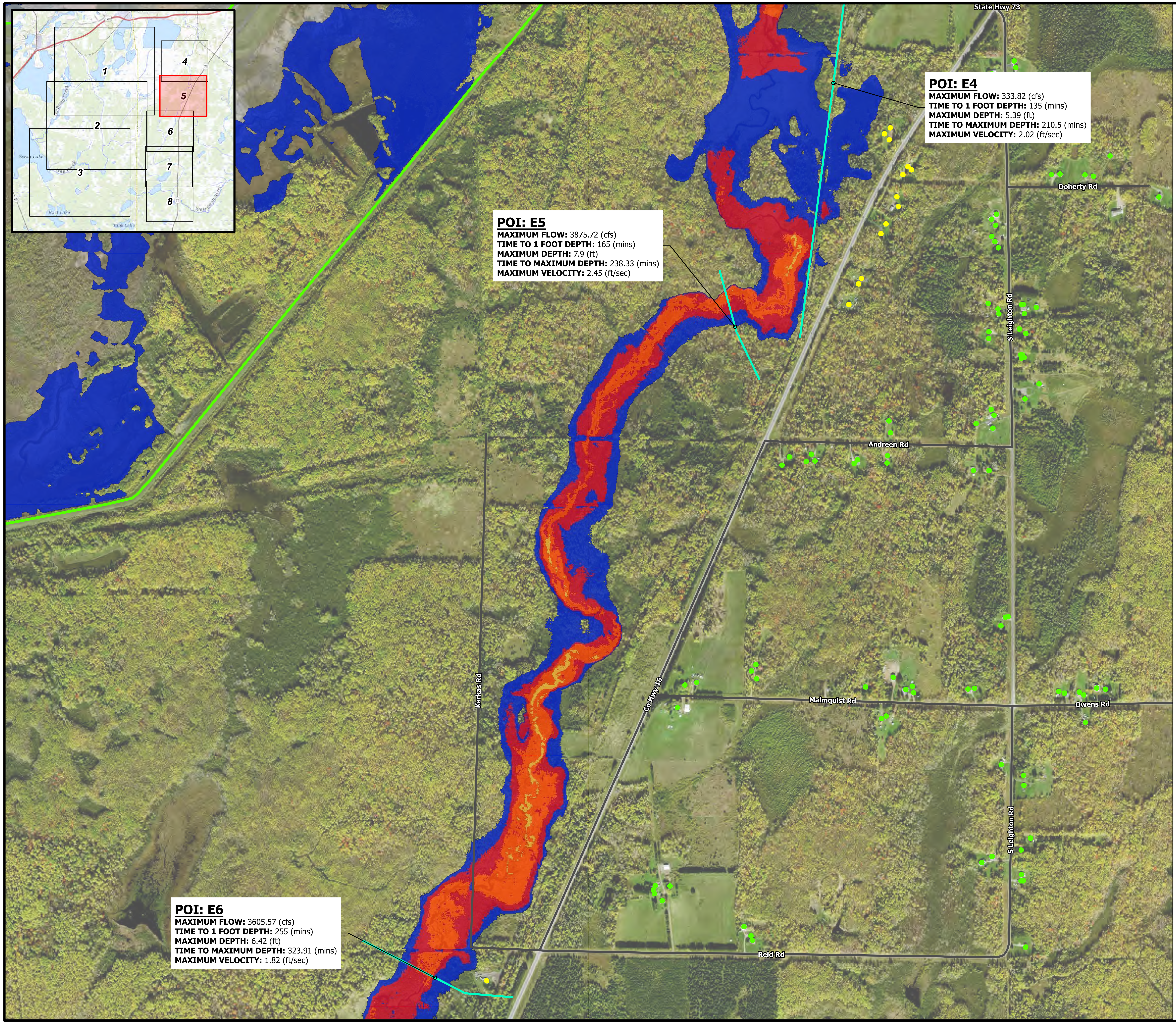

LEGEND:

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Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Completely Within Breach Extent

Within 500ft of Breach Extent

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0 500 1,000 US Feet

Scale: 1 inch = 500 feet

Max Depth Values (ft)

> 1

1.01 - 4

4.01 - 6

6.01 - 8

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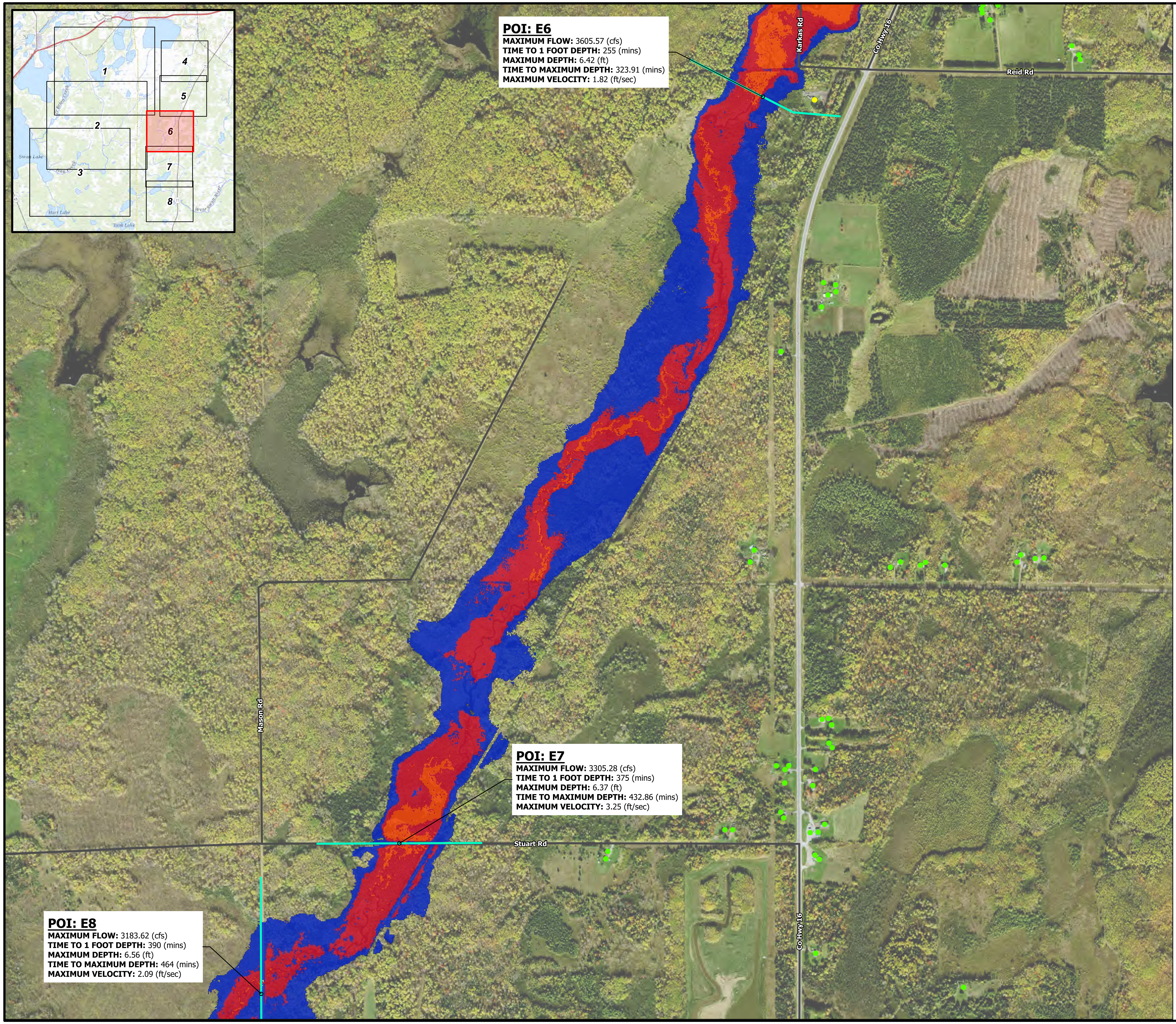

LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Completely Within Breach Extent

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

Max Depth Values (ft)

> 1

1.01 - 4

4.01 - 6

6.01 - 8

8.01 - 10

< 10

0 500 1,000 US Feet

Scale: 1 inch = 500 feet

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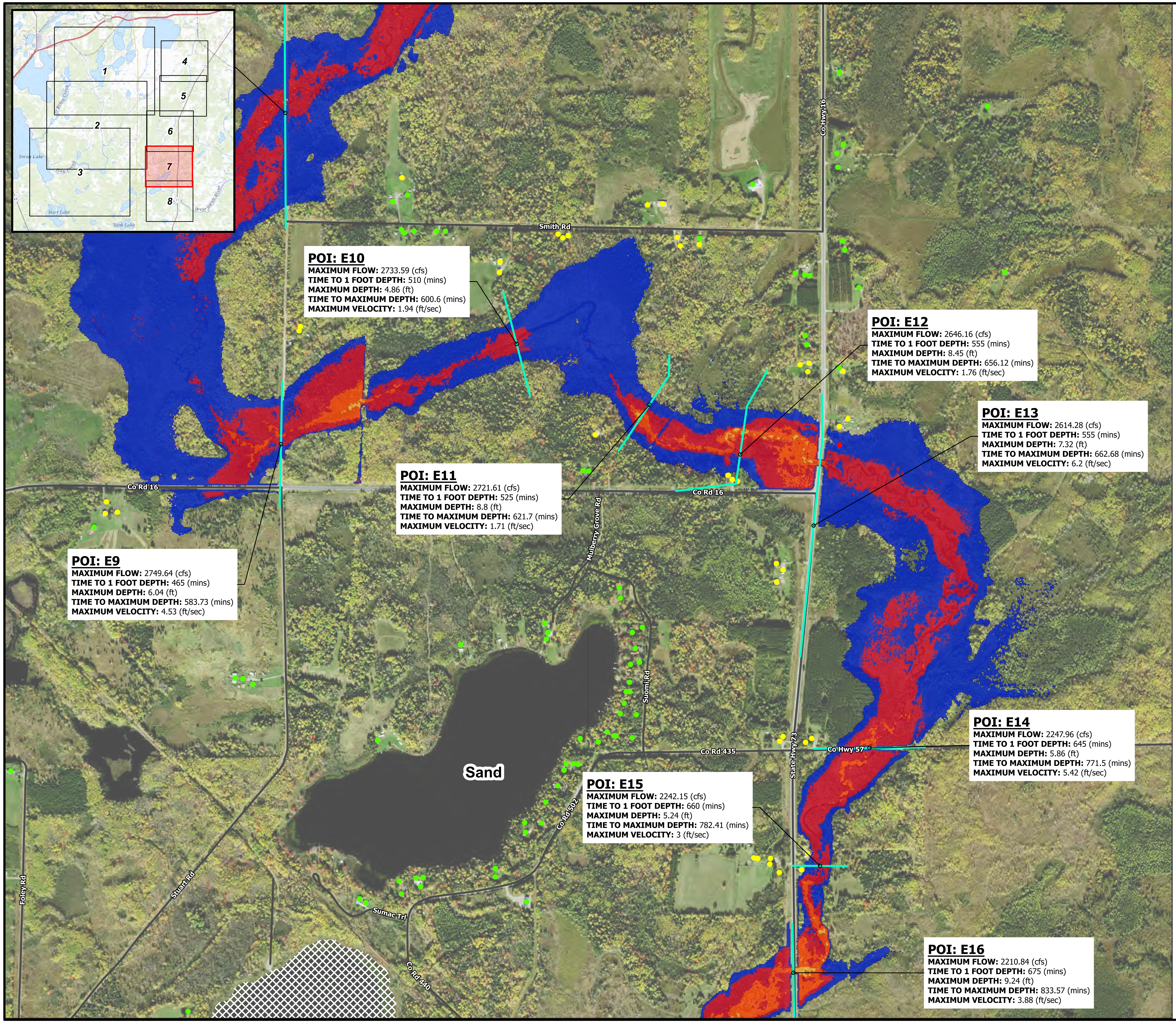
DATUM: NAD 1983 2011
PROJECTION: LAMBERT CONFORMAL CONIC

DESIGNED: C. FRITSCH	EXISTING 'PMF' CLEANWATER CASCADE FAILURE - MAXIMUM FLOOD DEPTH
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 6 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

GEI Consultants



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Waterbodies with inaccurate data (Due to lack of bathymetry)

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Completely Within Breach Extent

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

0 500 1,000 US Feet

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Max Depth Values (ft)

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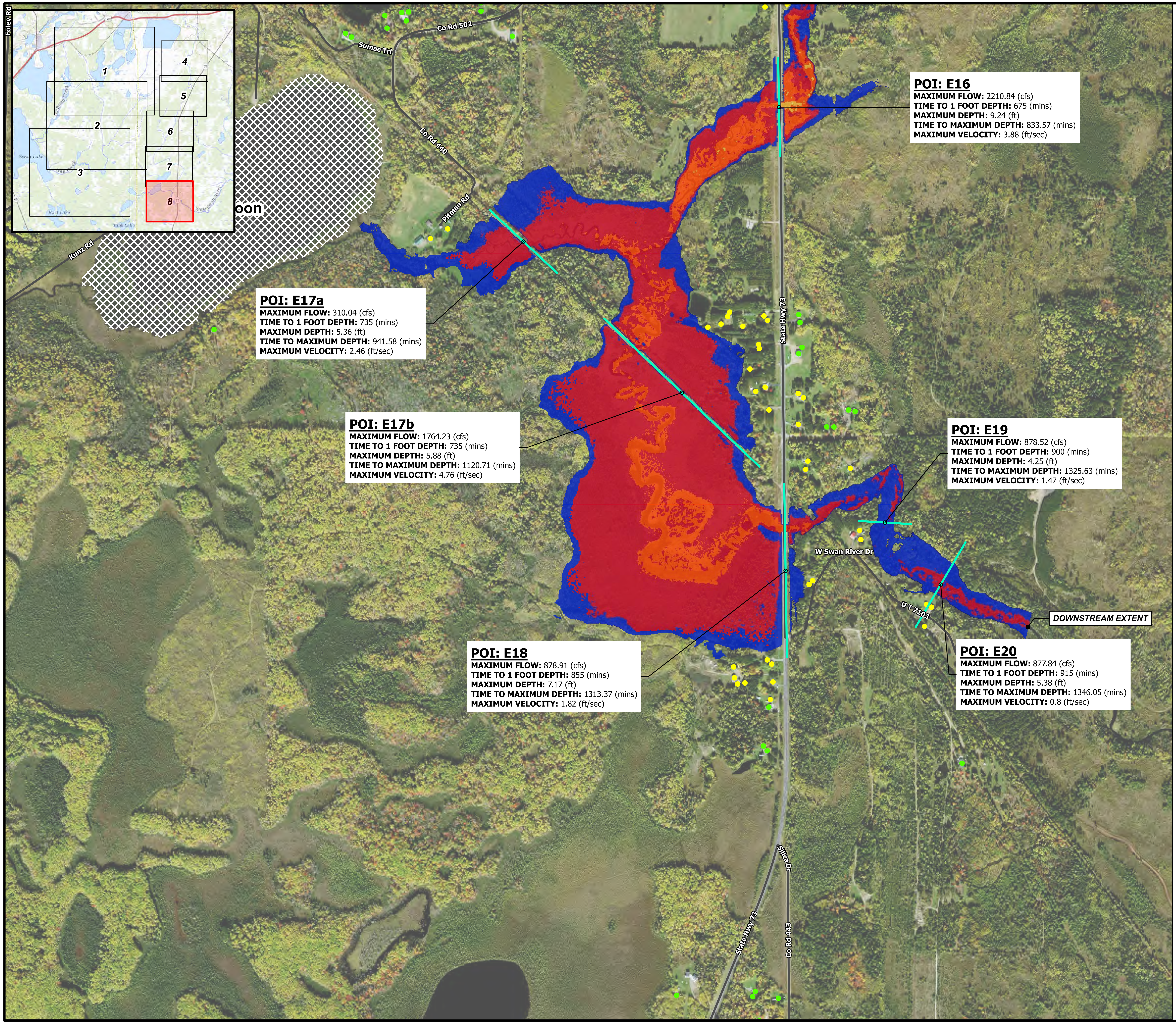
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 7 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	GEI Consultants
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION



LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Completely Within Breach Extent

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

0 500 1,000 US Feet

Scale: 1 inch = 500 feet

Max Depth Values (ft)

> 1

1.01 - 4

4.01 - 6

6.01 - 8

8.01 - 10

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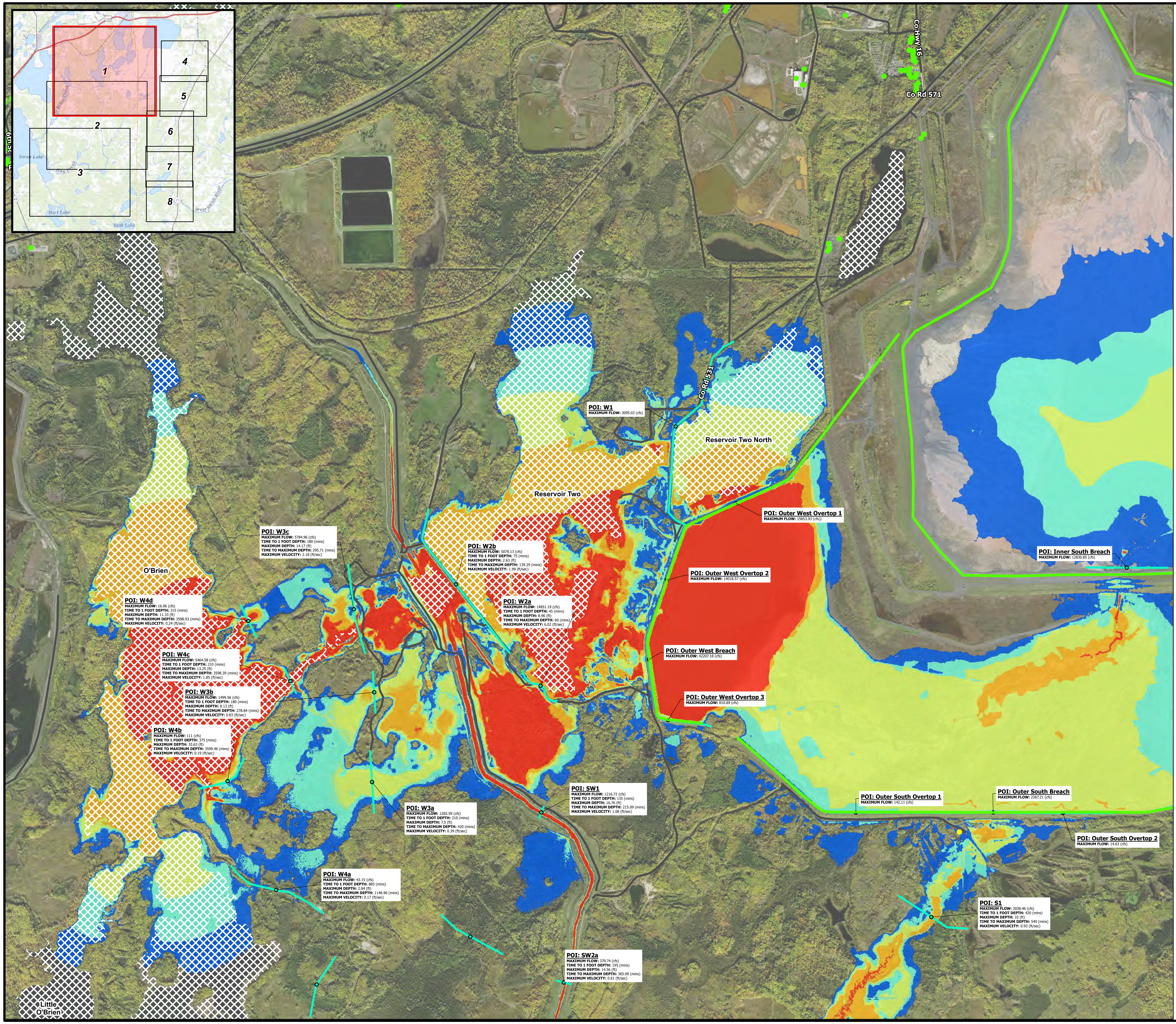
DESIGNED: C. FRITSCH	EXISTING 'PMF' CLEANWATER CASCADE FAILURE - MAXIMUM FLOOD DEPTH
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 8 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

GEI Consultants

LEGEND:
Waterbodies with inaccurate data (Due to lack of bathymetry)
Stage 2 Exterior Alignment
Cross-Section Lines
Cross-Section Centerpoint
Existing Building Structures
Within 500ft of Breach Extent
Outside of 500ft of Breach Extent
Existing Building Structures
Max Depth Values (ft)
> 1
1.01 - 4
4.01 - 6
6.01 - 8
8.01 - 10
< 10
N
0 2,600 5,200 US Feet
Scale: 1 inch = 2,500 feet
DESIGNED: C. FRITSCH
PREPARED: J. HANSEN
REVIEWED: M. WHEELER
APPROVED: -
DATE: FEBRUARY 2023
REVISION: 0
PROJECT NUMBER: 2201246
EXISTING 'PMF' MUDFLOW CASCADE FAILURE - OVERVIEW
KEETAC TAILINGS BASIN
KEEWATIN, MINNESOTA
UNITED STATES STEEL CORPORATION
GEI Consultants
Downstream Boundary of Mapping Extent
Downstream Boundary of Mapping Extent
Downstream Boundary of Mapping Extent
1
2
3
4
5
6
7
8
Reservoir Two
Reservoir Two North
O'Brien
Little O'Brien
Unnamed (O'Brien Res. #4)
KEEWATIN, MN
SILICA, MN
Larue Complex
Little Sucker
Snowball
Ox-Hide
Swan
Moose
Hay
Nameless
Sand
Coon
Bengal
Little Island
Hart
Little Flower
Helen
Harriet
Little Harriet
Lower Panasa
US Hwy 169
Co Rd 611
Co Rd 58
Co Rd 571
Co Rd 531
S Keewatin Rd
Elynwood Rd
Pelto Rd
Jacobson Rd
Salo Rd
S 49th St
Erickson Rd
W Wegener Rd
River Creek Dr
Golf Links Rd
Town Line Rd
Co Hwy 16
Lilliquist Rd
A Matson Rd
Co Hwy 16
Doherty Rd
Andreen Rd
Gust Erickson Rd
Malmquist Rd
Owens Rd
Markus Rd
Reid Rd
Harriet Lake Rd
Thompson Rd
Stuart Rd
Smith Rd
Co Rd 16
Co Rd 435
Co Hwy 57
Pitman Rd
Co Rd 83
Kalmi Rd
Town Hall Rd
Lakeview St
Garland Rd
Badavinac Rd
Kaleva Beach Rd
W Shore Ln
W Bay Dr
Koski Rd
Grozys Point Rd
Maple Knoll Dr
Swan Ln
Co Hwy 600
Co Rd 567
N Hart Lake Rd
St Louis-Itasca Judicial Hwy
Co Rd 565
State Hwy 65
State Hwy 73



LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Completely Within Breach Extent

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

Max Depth Values (ft)

> 1

1.01 - 4

4.01 - 6

6.01 - 8

8.01 - 10

< 10

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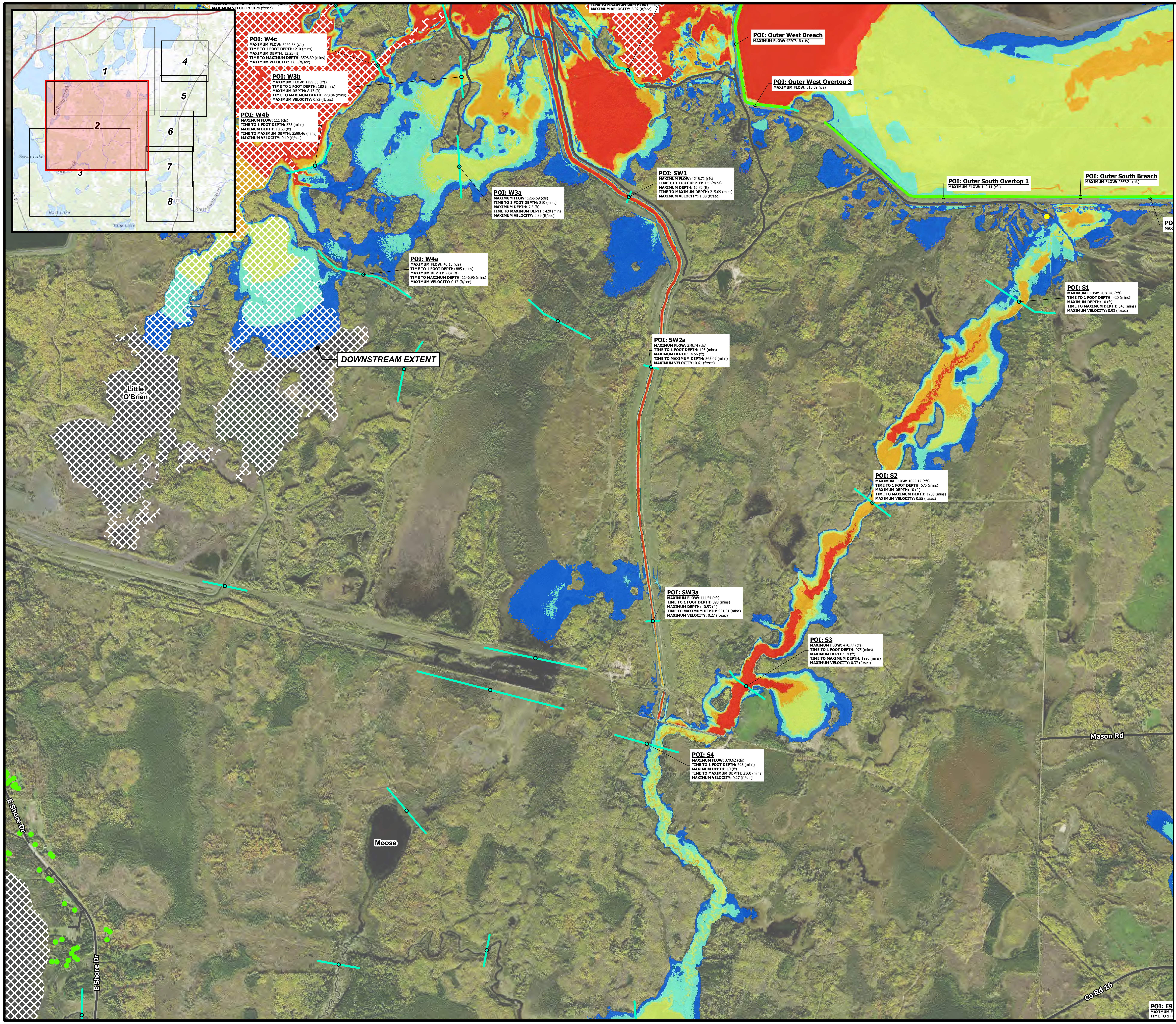
DATUM: NAD 1983 2011
PROJECTION: LAMBERT CONFORMAL CONIC

DESIGNED: C. FRITSCH	**EXISTING 'PMF' MUDFLOW CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 1 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

GEI Consultants



LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Completely Within Breach Extent

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

0 1,000 2,000 US Feet

Scale: 1 inch = 1,100 feet

Max Depth Values (ft)

- > 1
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PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 2 of 8
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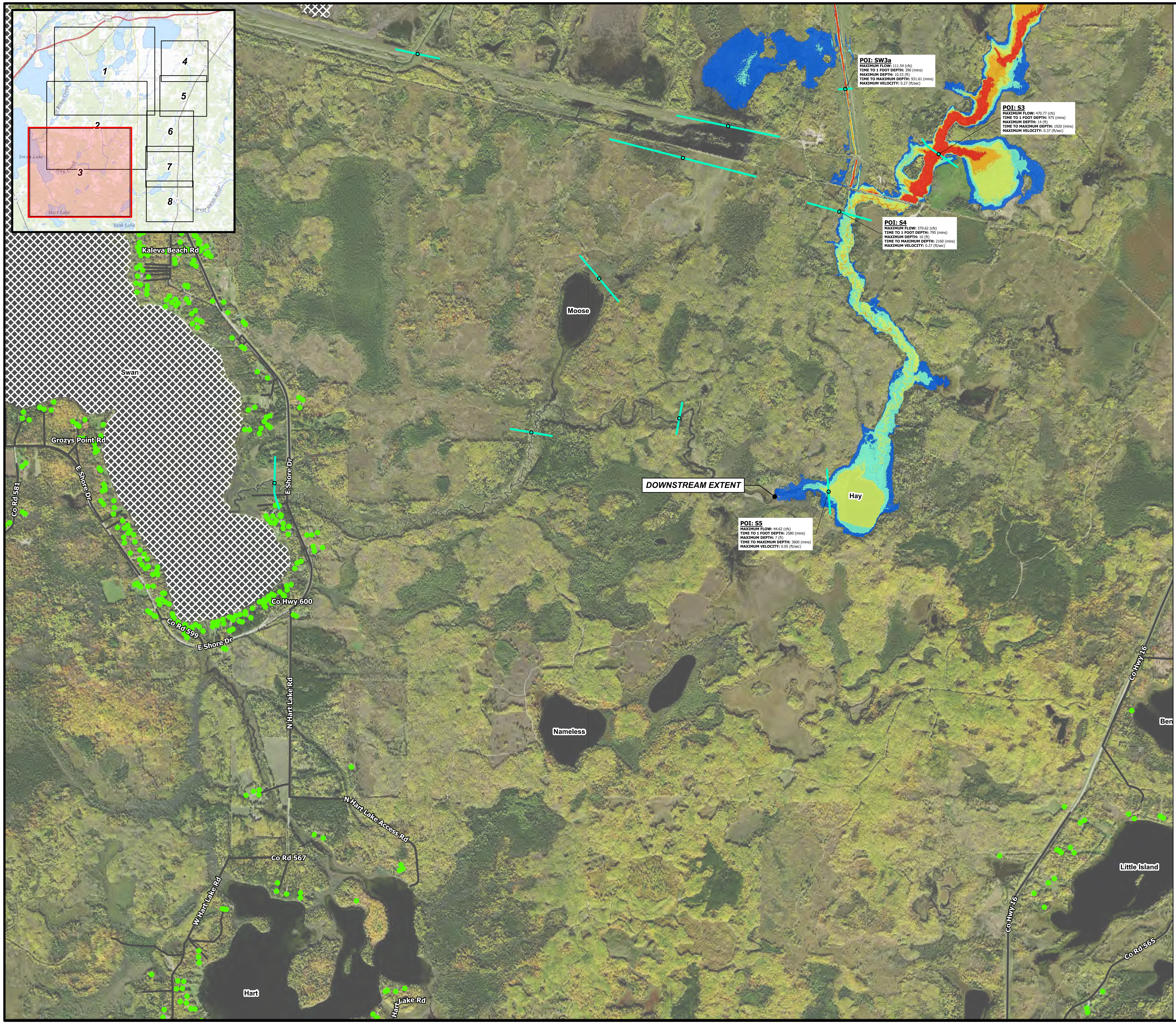

LEGEND:

- Waterbodies with inaccurate data (Due to lack of bathymetry)
- Cross-Section Lines
- Cross-Section Centerpoint

Existing Building Structures

- Completely Within Breach Extent
- Within 500ft of Breach Extent
- Outside of 500ft of Breach Extent

N

0 1,000 2,000 US Feet

Scale: 1 inch = 1,100 feet

Max Depth Values (ft)

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PREPARED: J. HANSEN	
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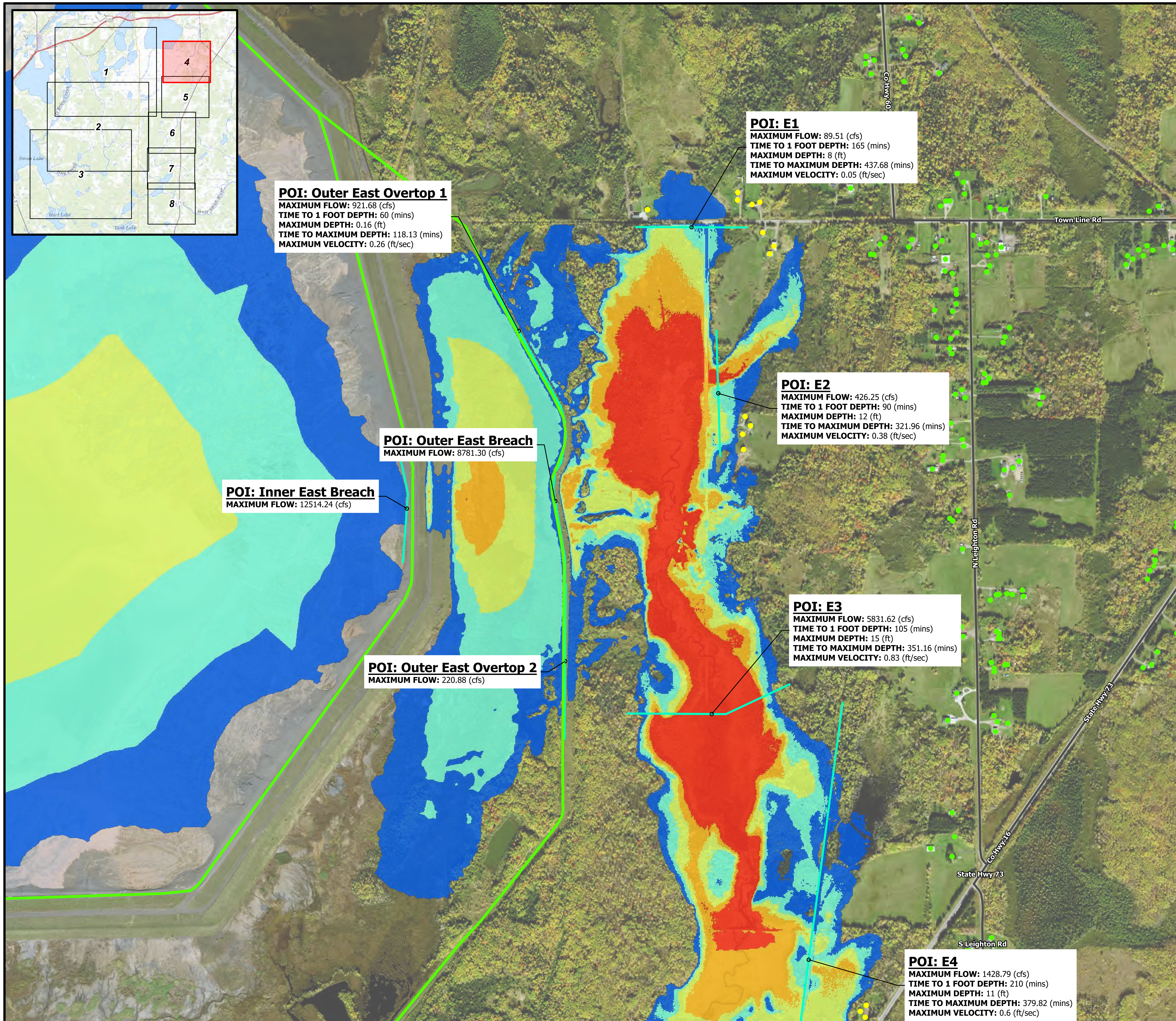

LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Completely Within Breach Extent

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

0 500 1,000 US Feet

Scale: 1 inch = 500 feet

Max Depth Values (ft)

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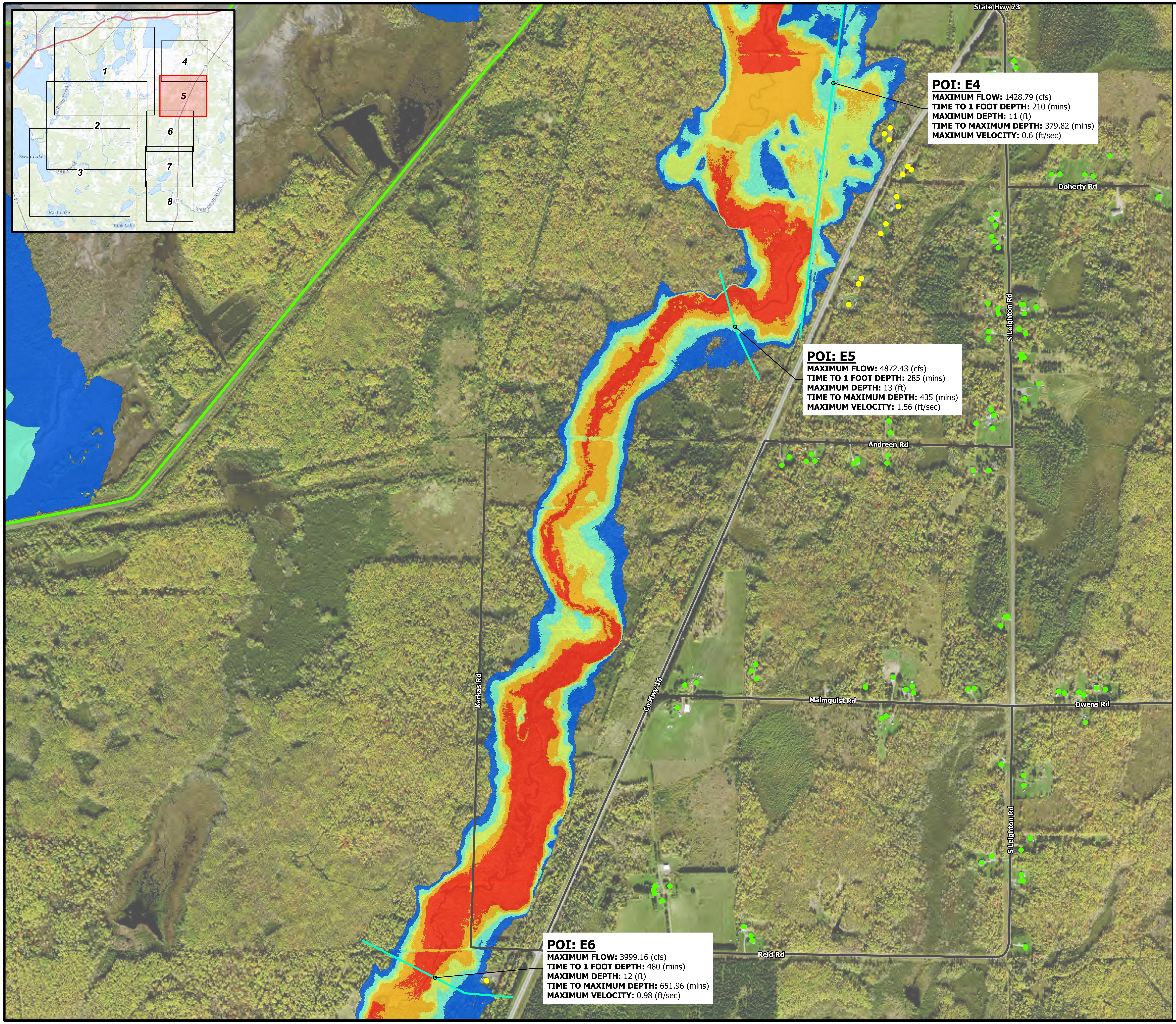
DATUM: NAD 1983 2011
PROJECTION: LAMBERT CONFORMAL CONIC

DESIGNED: C. FRITSCH	**EXISTING 'PMF' MUDFLOW CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 4 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

GEI Consultants



LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

- Completely Within Breach Extent
- Within 500ft of Breach Extent
- Outside of 500ft of Breach Extent

Max Depth Values (ft)

- > 1
- 1.01 - 4
- 4.01 - 6
- 6.01 - 8
- 8.01 - 10
- < 10

N

0 500 1,000 US Feet

Scale: 1 inch = 500 feet

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DESIGNED: C. FRITSCH	EXISTING 'PMF' MUDFLOW CASCADE FAILURE - MAXIMUM FLOOD DEPTH
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 5 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
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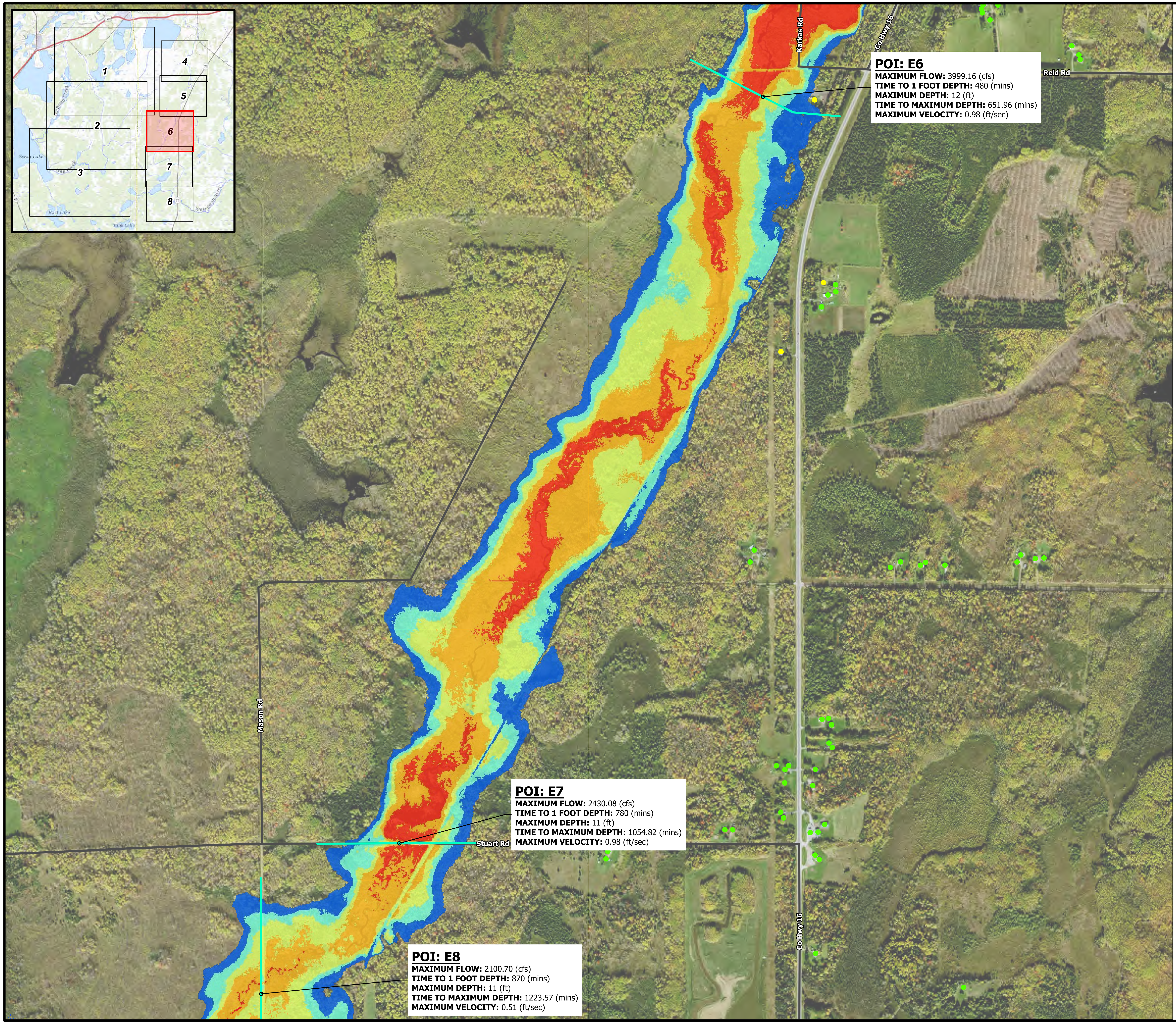

LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Completely Within Breach Extent

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

0 500 1,000 US Feet

Scale: 1 inch = 500 feet

Max Depth Values (ft)

> 1

1.01 - 4

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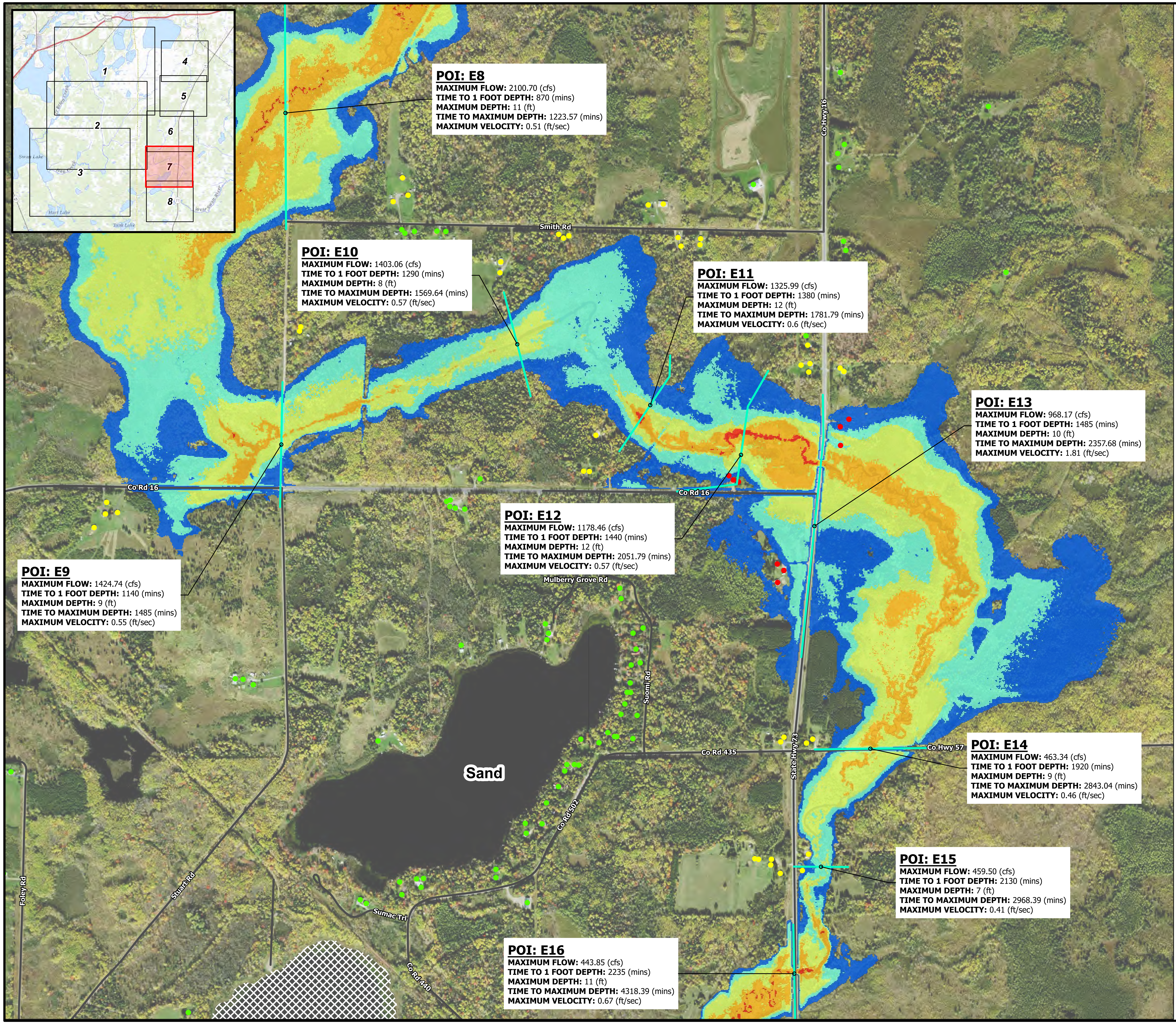
DESIGNED: C. FRITSCH	**EXISTING 'PMF' MUDFLOW CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 6 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

GEI Consultants



LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Completely Within Breach Extent

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

0 500 1,000 US Feet

Scale: 1 inch = 500 feet

Max Depth Values (ft)

> 1

1.01 - 4

4.01 - 6

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DESIGNED: C. FRITSCH	**EXISTING 'PMF' MUDFLOW CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 7 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
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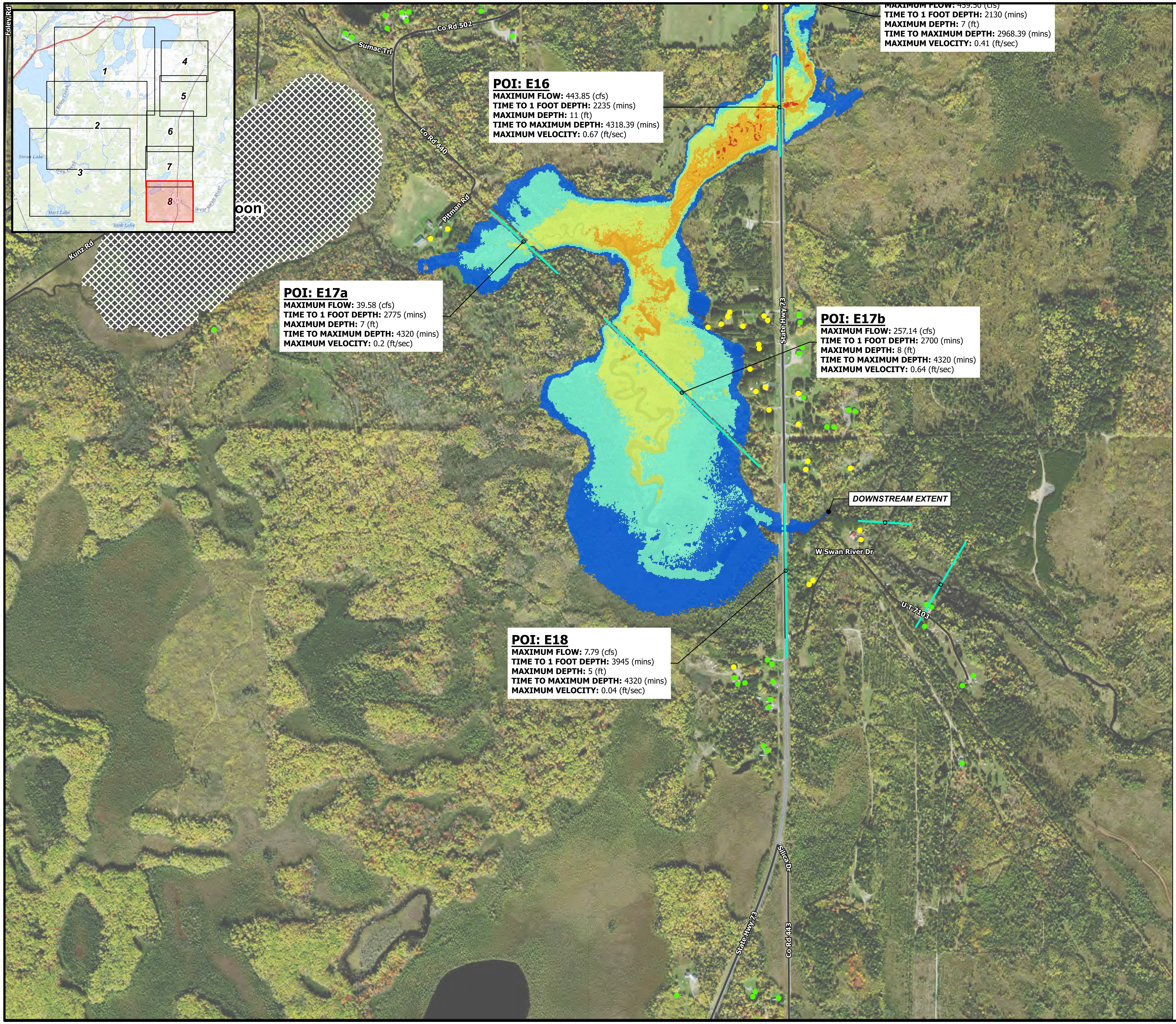

LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

- Completely Within Breach Extent
- Within 500ft of Breach Extent
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Max Depth Values (ft)

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PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 8 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
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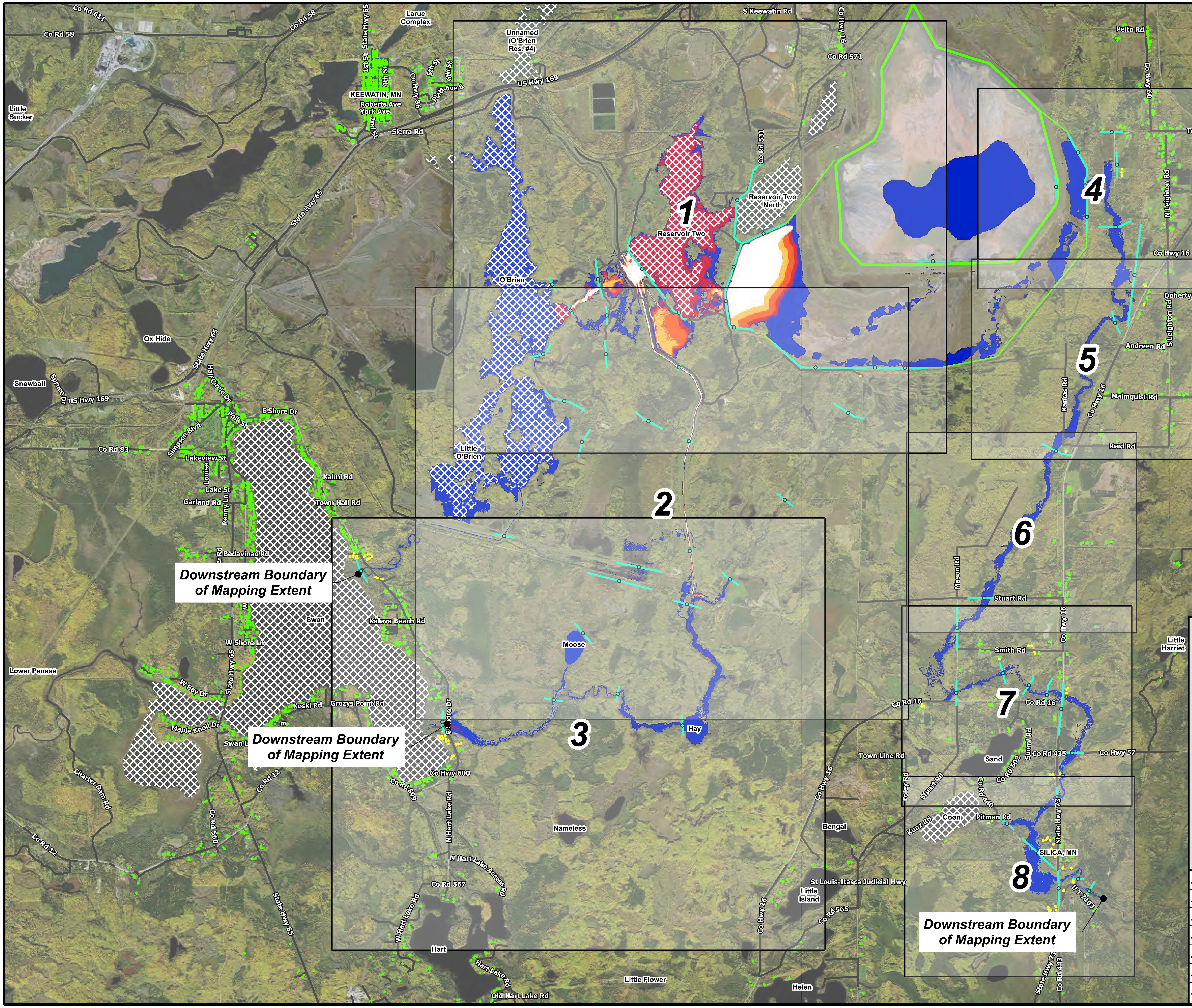

LEGEND:

- Waterbodies with inaccurate data (Due to lack of bathymetry)
- Stage 2 Exterior Alignment
- Cross-Section Lines
- Cross-Section Centerpoint

Existing Building Structures

- Within 500ft of Breach Extent
- Outside of 500ft of Breach Extent

Max Depth Values (ft)

- > 1
- 1.01 - 4
- 4.01 - 6
- 6.01 - 8
- 8.01 - 10
- < 10

0 2,600 5,200 US Feet

Scale: 1 inch = 2,500 feet

DESIGNED: C. FRITSCH	EXISTING 'SD' CLEANWATER CASCADE FAILURE - OVERVIEW
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
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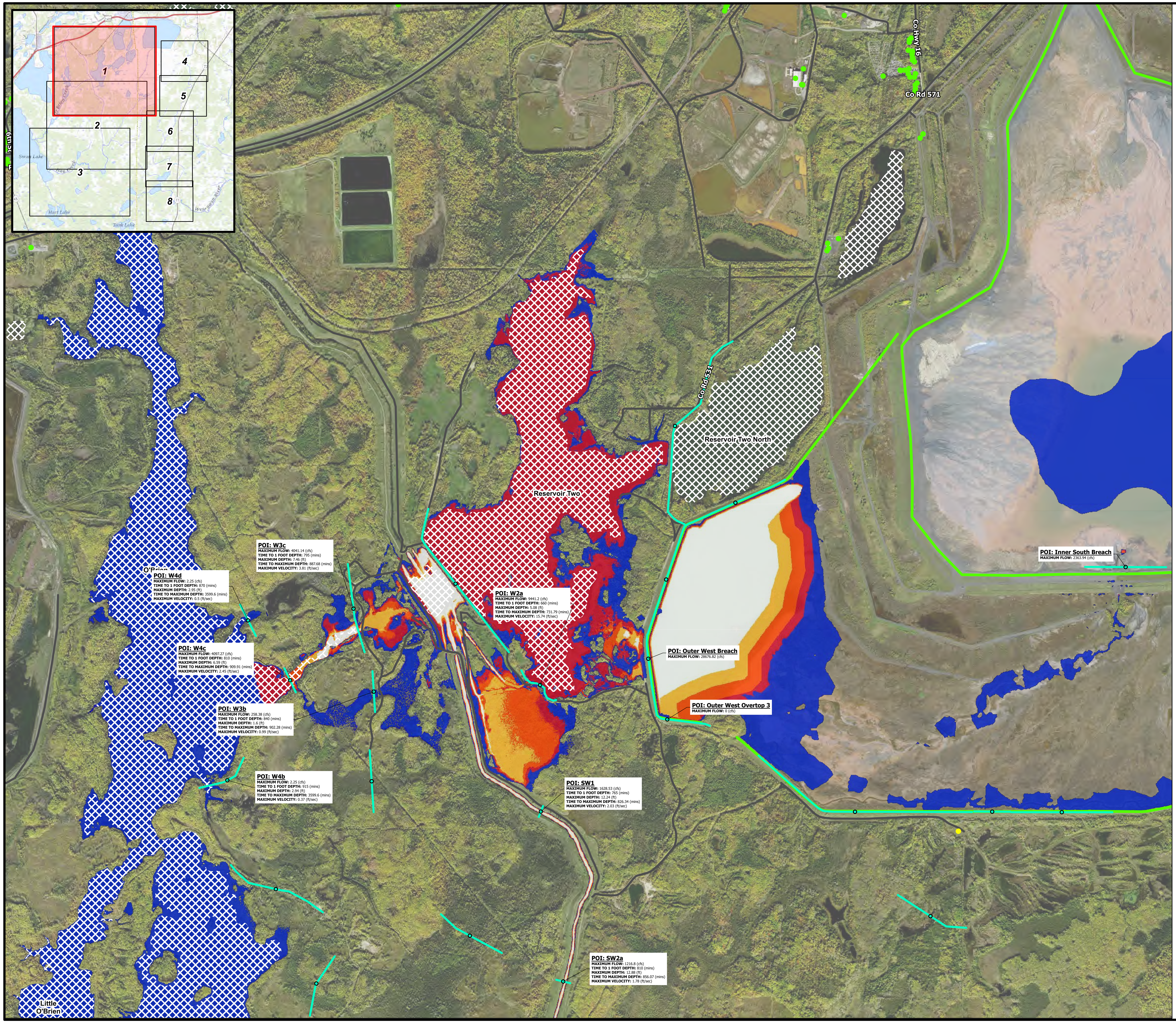

LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

0 1,000 2,000 US Feet

Scale: 1 inch = 1,100 feet

Max Depth Values (ft)

- > 1
- 1.01 - 4
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DESIGNED: C. FRITSCH	**EXISTING 'SD' CLEANWATER CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 1 of 8
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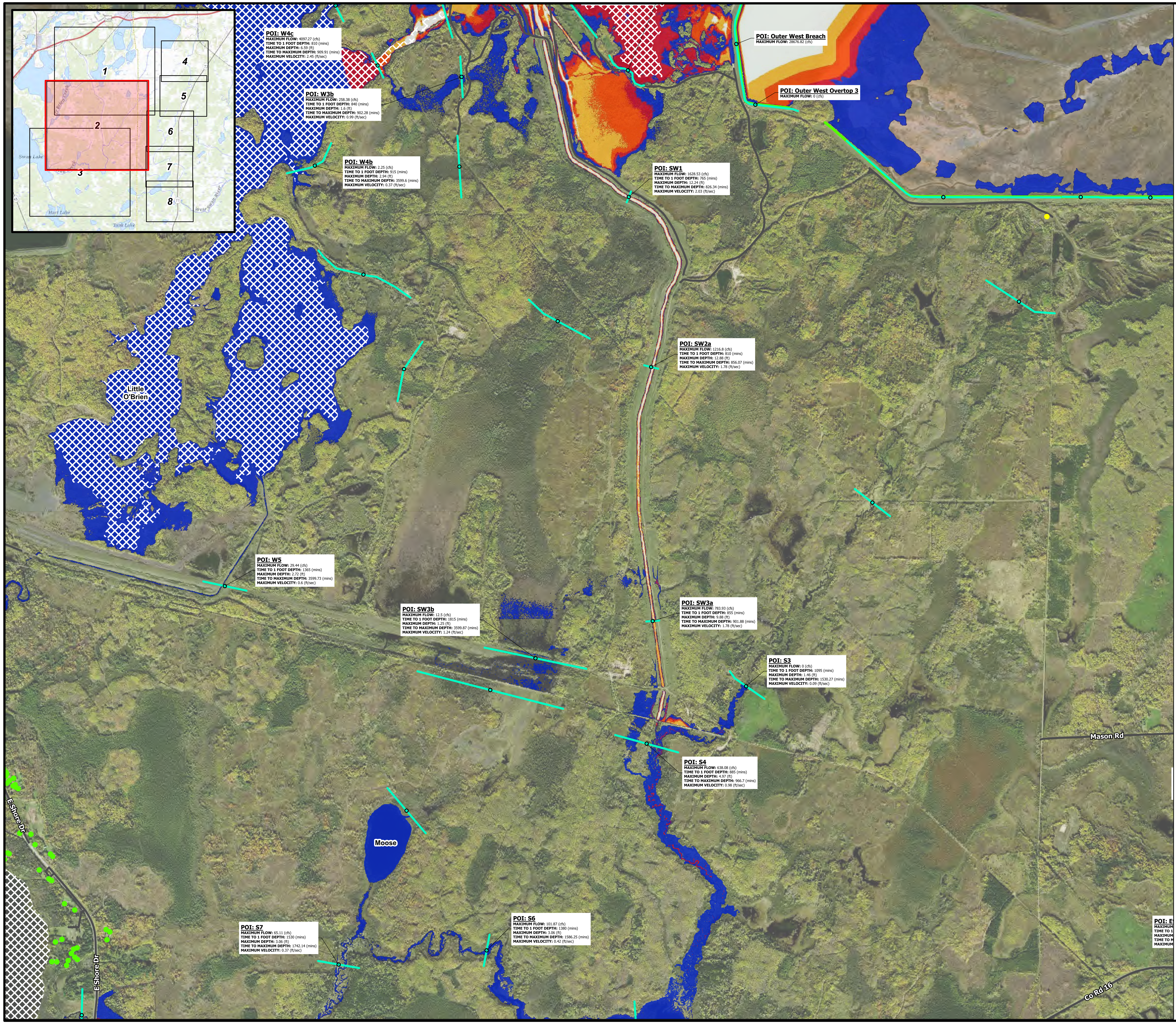

LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

Max Depth Values (ft)

> 1

1.01 - 4

4.01 - 6

6.01 - 8

8.01 - 10

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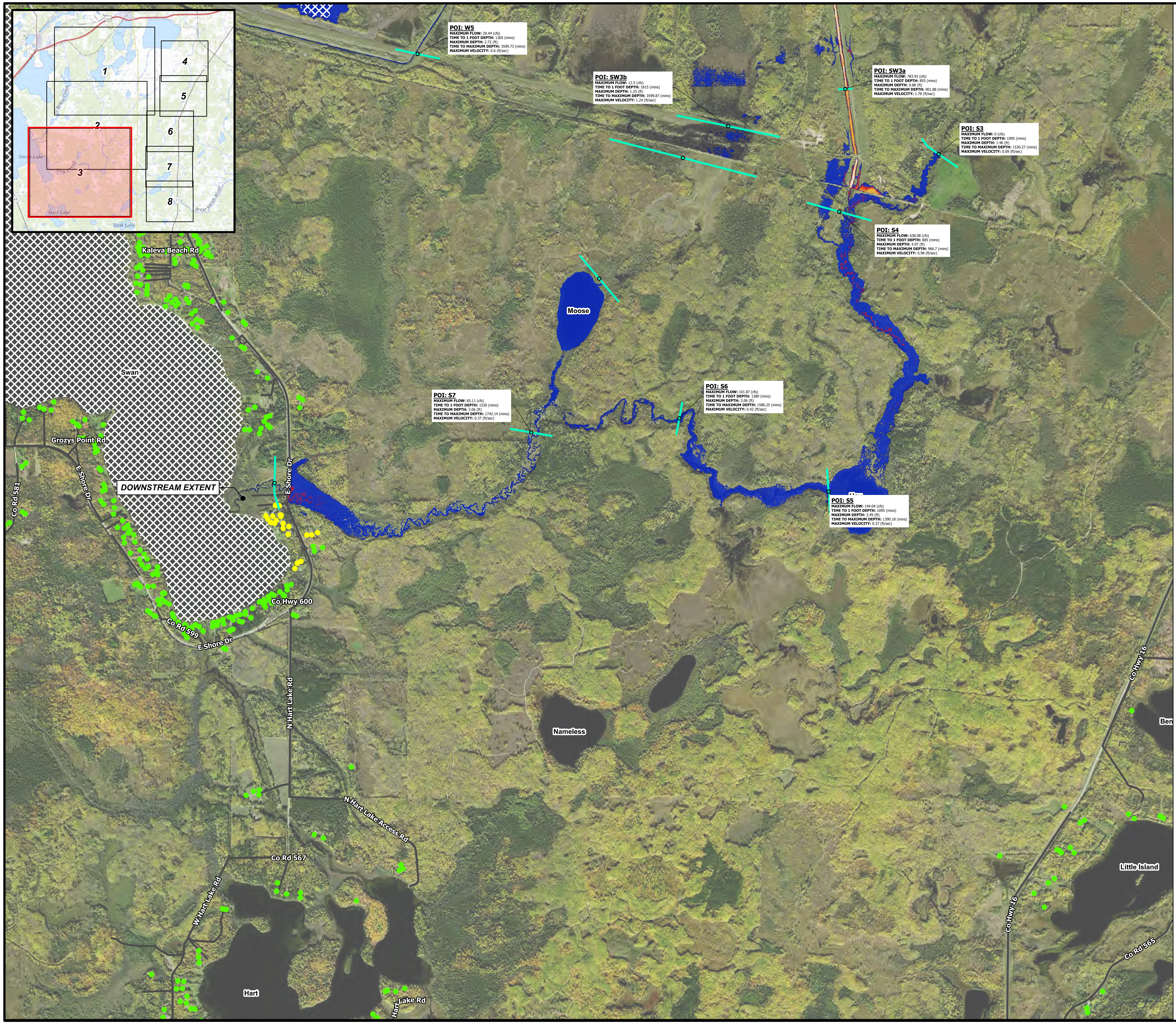
DATUM: NAD 1983 2011
PROJECTION: LAMBERT CONFORMAL CONIC

DESIGNED: C. FRITSCH	EXISTING 'SD' CLEANWATER CASCADE FAILURE - MAXIMUM FLOOD DEPTH	
PREPARED: J. HANSEN		
REVIEWED: M. WHEELER		
APPROVED: -	Page Number: 2 of 8	
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA	GEI Consultants
REVISION: 0		
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION	



LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

Max Depth Values (ft)

> 1

1.01 - 4

4.01 - 6

6.01 - 8

8.01 - 10

< 10

0 1,000 2,000 US Feet

Scale: 1 inch = 1,100 feet

NOTES:

1. THIS MAP IS PART OF THE EMERGENCY ACTION PLAN FOR KEETAC TAILINGS BASIN.

2. DAM BREACH AND RELATED INUNDATION STUDIES ARE BASED ON HYPOTHETICAL SCENARIOS. A DAM BREACH AND INUNDATION STUDY DOES NOT CONSTITUTE, NOR IMPLY, A DAM SAFETY REVIEW AND SPECIFICALLY DOES NOT IMPLY ANY LIKELIHOOD OF FAILURE. RATHER, IT ASSUMES THAT A BREACH IS INITIATED IRRESPECTIVE OF LIKELIHOOD, ANDASSUMES HYPOTHETICAL CREDIBLE FAILURE MODES BASED ON ASSUMED SITE CONDITIONS AND HISTORIC DAM FAILURES AT OTHER LOCATIONS.

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6. FIGURES SHOULD BE READ AND INTERPRETED IN CONJUNCTION WITH THE TAILINGS DAM BREACH ANALYSIS AND INUNDATION STUDY REPORT INCLUDING ASSUMPTIONS AND LIMITATIONS.

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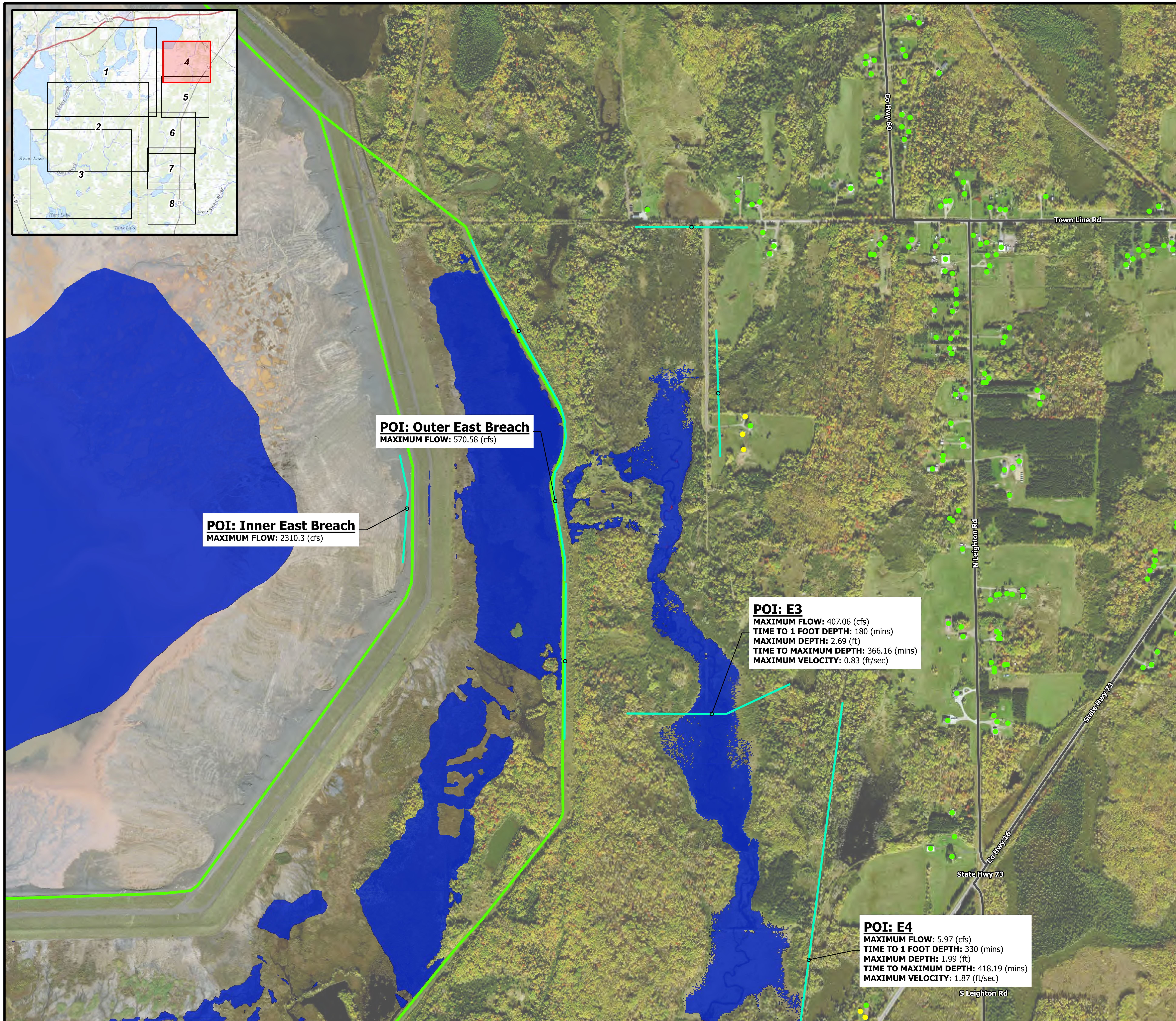

LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

0 500 1,000 US Feet

Scale: 1 inch = 500 feet

Max Depth Values (ft)

> 1

1.01 - 4

4.01 - 6

6.01 - 8

8.01 - 10

< 10

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PREPARED: J. HANSEN	
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APPROVED: -	Page Number: 4 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
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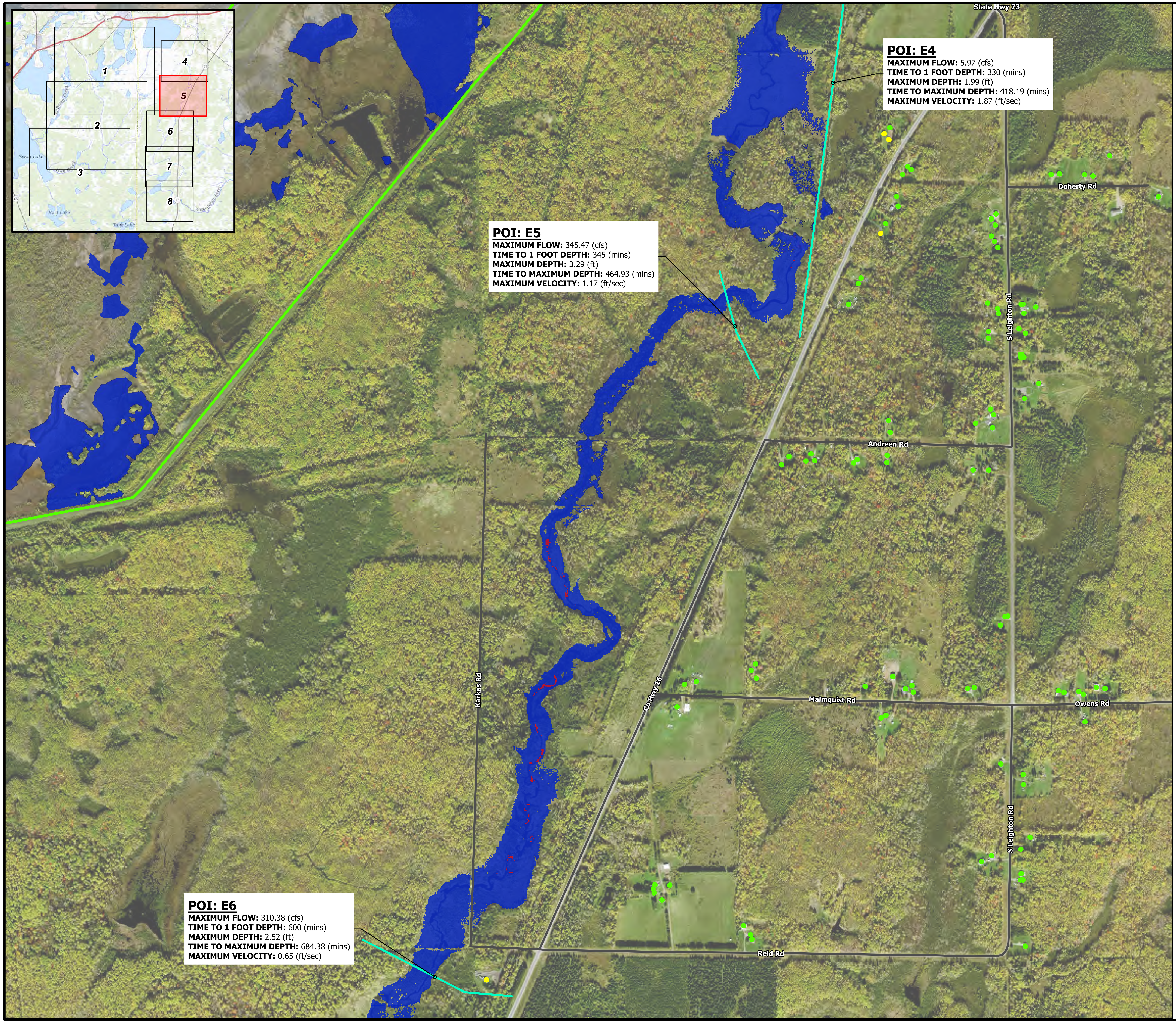

LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

0 500 1,000 US Feet

Scale: 1 inch = 500 feet

Max Depth Values (ft)

> 1

1.01 - 4

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PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 5 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
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PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

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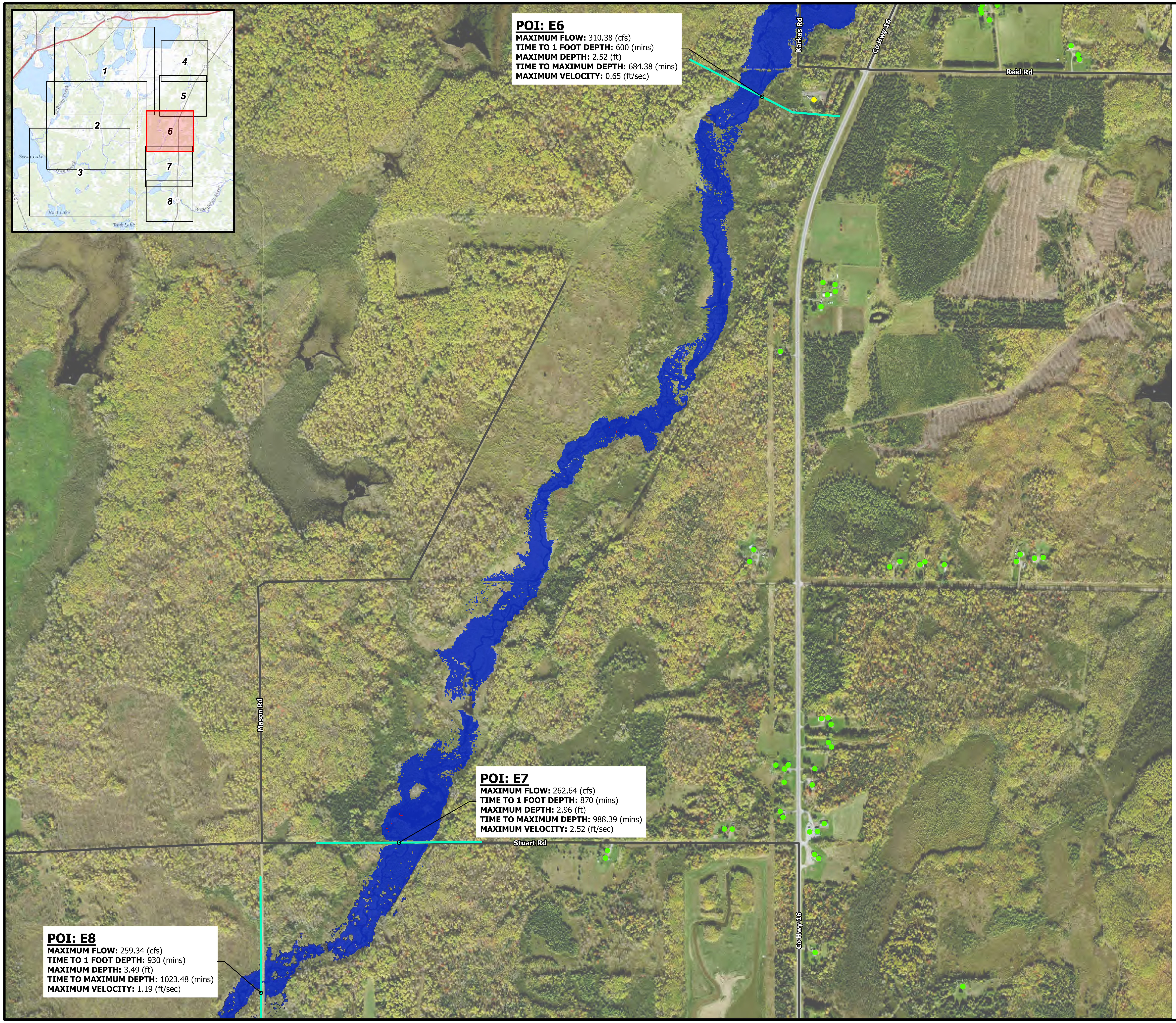

LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

0 500 1,000 US Feet

Scale: 1 inch = 500 feet

Max Depth Values (ft)

> 1

1.01 - 4

4.01 - 6

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PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 6 of 8
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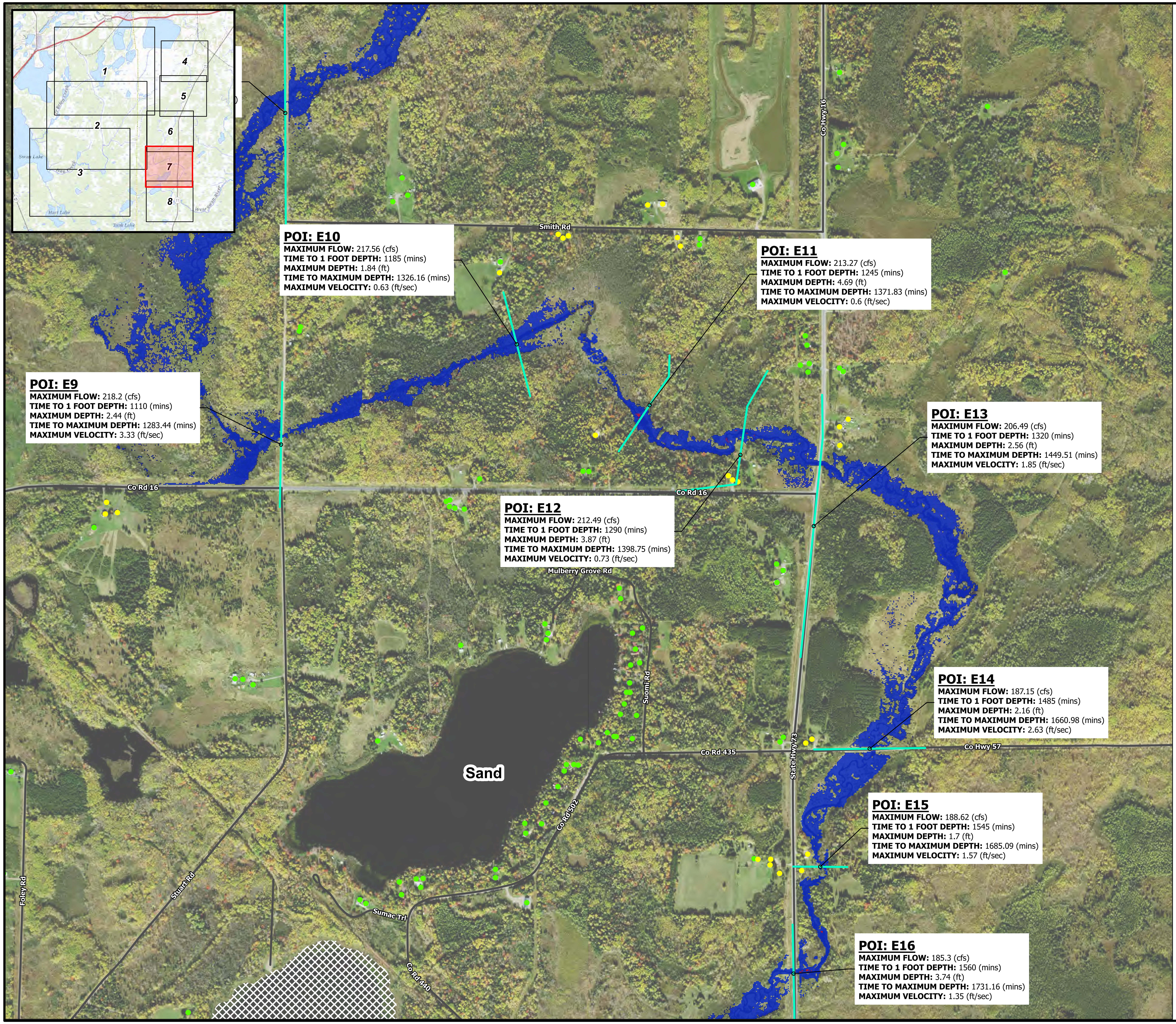

LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

0 500 1,000 US Feet

Scale: 1 inch = 500 feet

Max Depth Values (ft)

> 1

1.01 - 4

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PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 7 of 8
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PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

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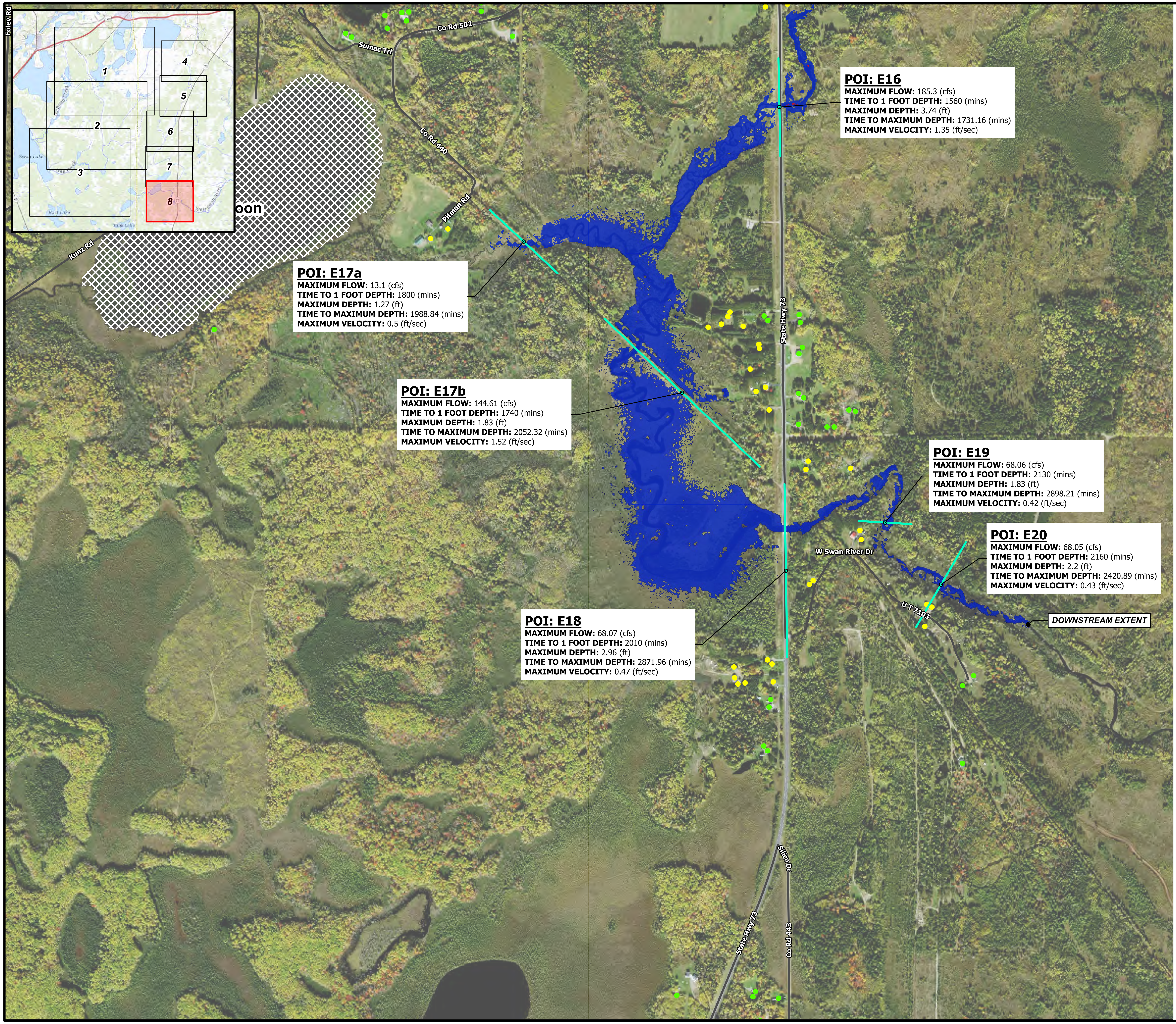

LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

Max Depth Values (ft)

> 1
1.01 - 4
4.01 - 6
6.01 - 8
8.01 - 10
< 10

0 500 1,000 US Feet

Scale: 1 inch = 500 feet

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PREPARED: J. HANSEN	
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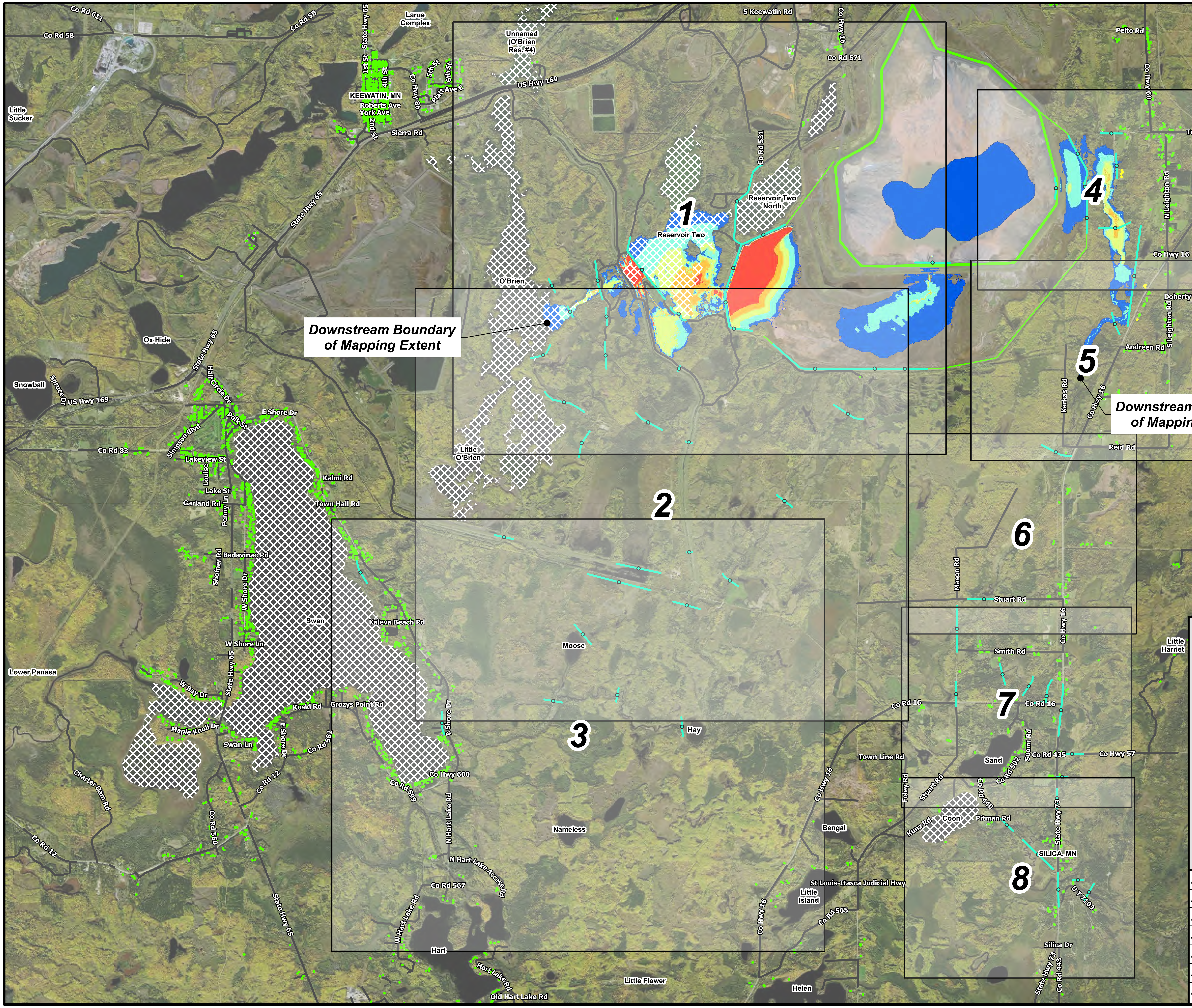

LEGEND:

- Waterbodies with inaccurate data (Due to lack of bathymetry)
- Stage 2 Exterior Alignment
- Cross-Section Lines
- Cross-Section Centerpoint

Existing Building Structures

- Within 500ft of Breach Extent
- Outside of 500ft of Breach Extent

Max Depth Values (ft)

- > 1
- 1.01 - 4
- 4.01 - 6
- 6.01 - 8
- 8.01 - 10
- < 10

0 2,600 5,200 US Feet

Scale: 1 inch = 2,500 feet

DESIGNED: C. FRITSCH	**EXISTING 'SD' MUDFLOW CASCADE FAILURE - OVERVIEW**
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	
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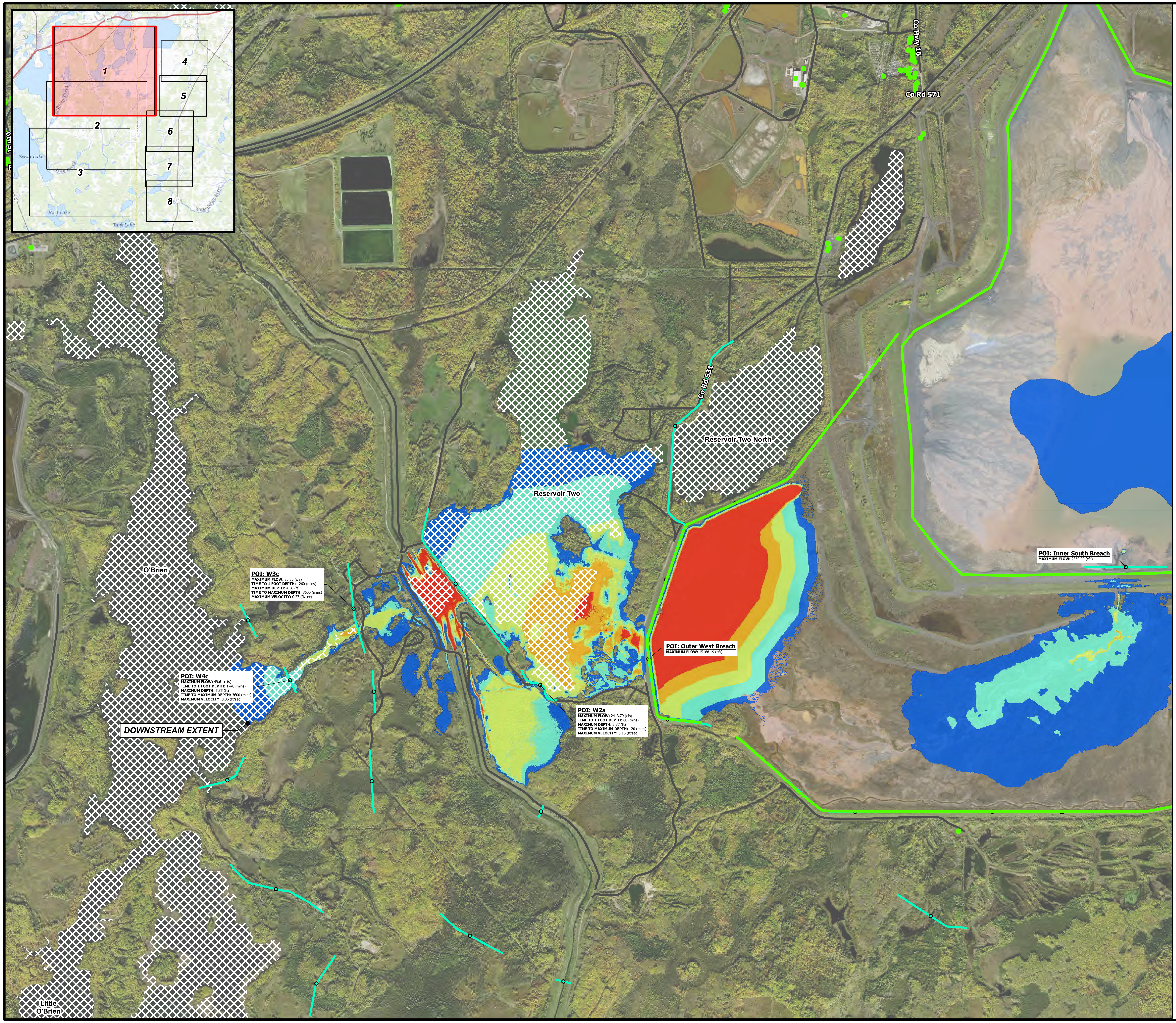

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Cross-Section Centerpoint

Existing Building Structures

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

Max Depth Values (ft)

> 1

1.01 - 4

4.01 - 6

6.01 - 8

8.01 - 10

< 10

N

0 1,000 2,000 US Feet

Scale: 1 inch = 1,100 feet

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PROJECTION: LAMBERT CONFORMAL CONIC

DESIGNED: C. FRITSCH	EXISTING 'SD' MUDFLOW CASCADE FAILURE - MAXIMUM FLOOD DEPTH
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 1 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

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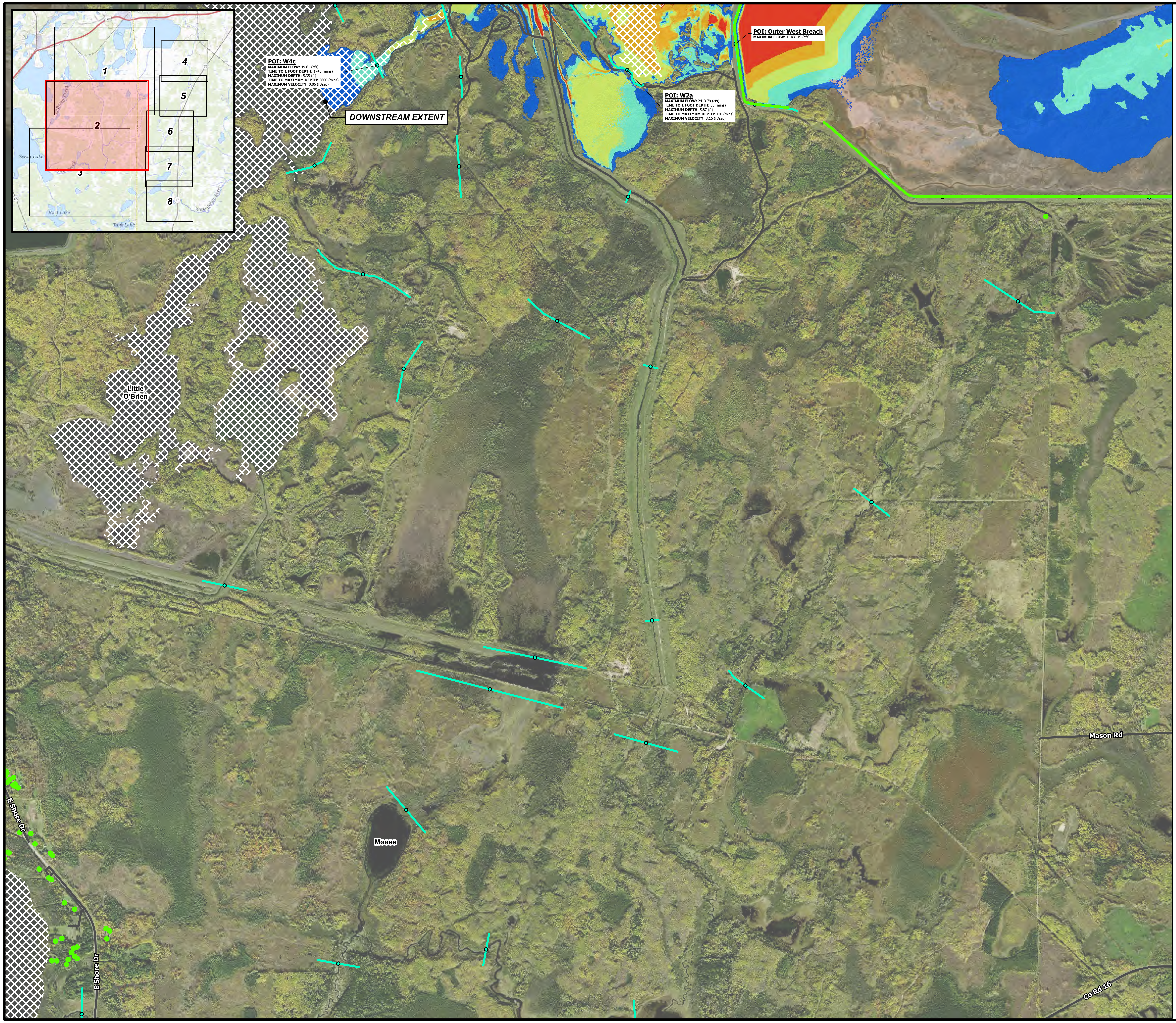

LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

0 1,000 2,000 US Feet

Scale: 1 inch = 1,100 feet

Max Depth Values (ft)

> 1

1.01 - 4

4.01 - 6

6.01 - 8

8.01 - 10

< 10

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PREPARED: J. HANSEN	
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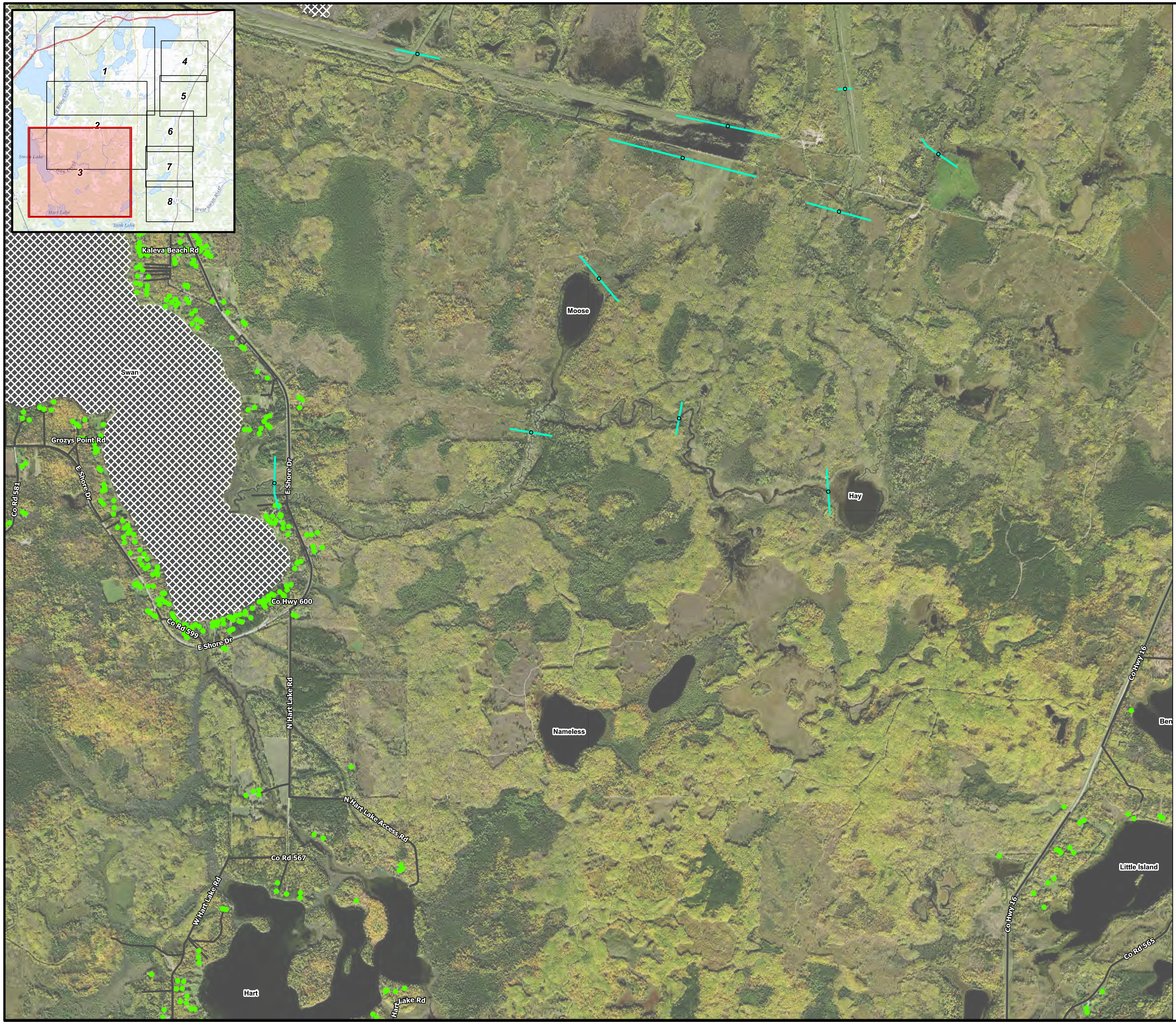

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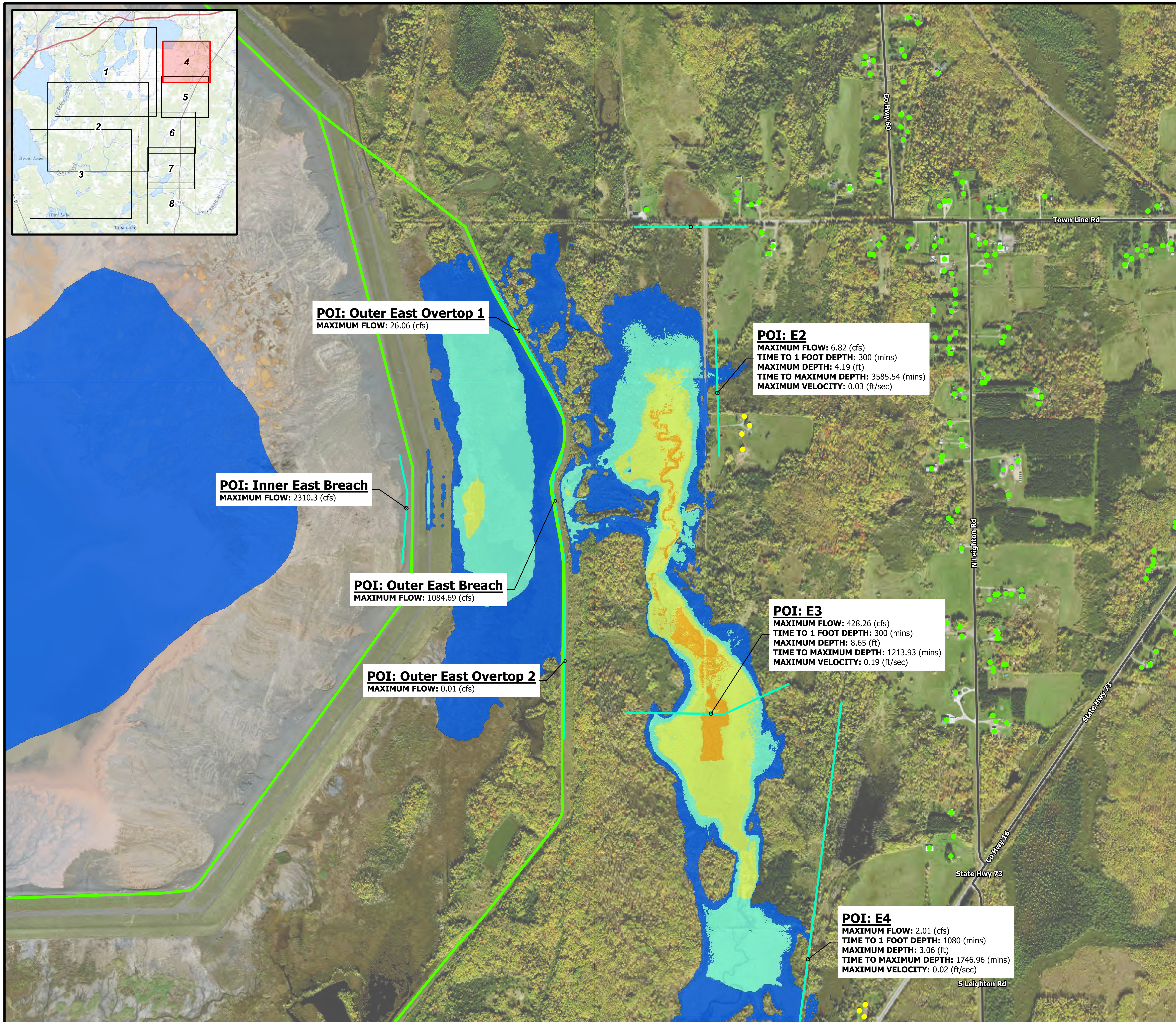

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Cross-Section Lines

Cross-Section Centerpoint

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Outside of 500ft of Breach Extent

0 500 1,000 US Feet

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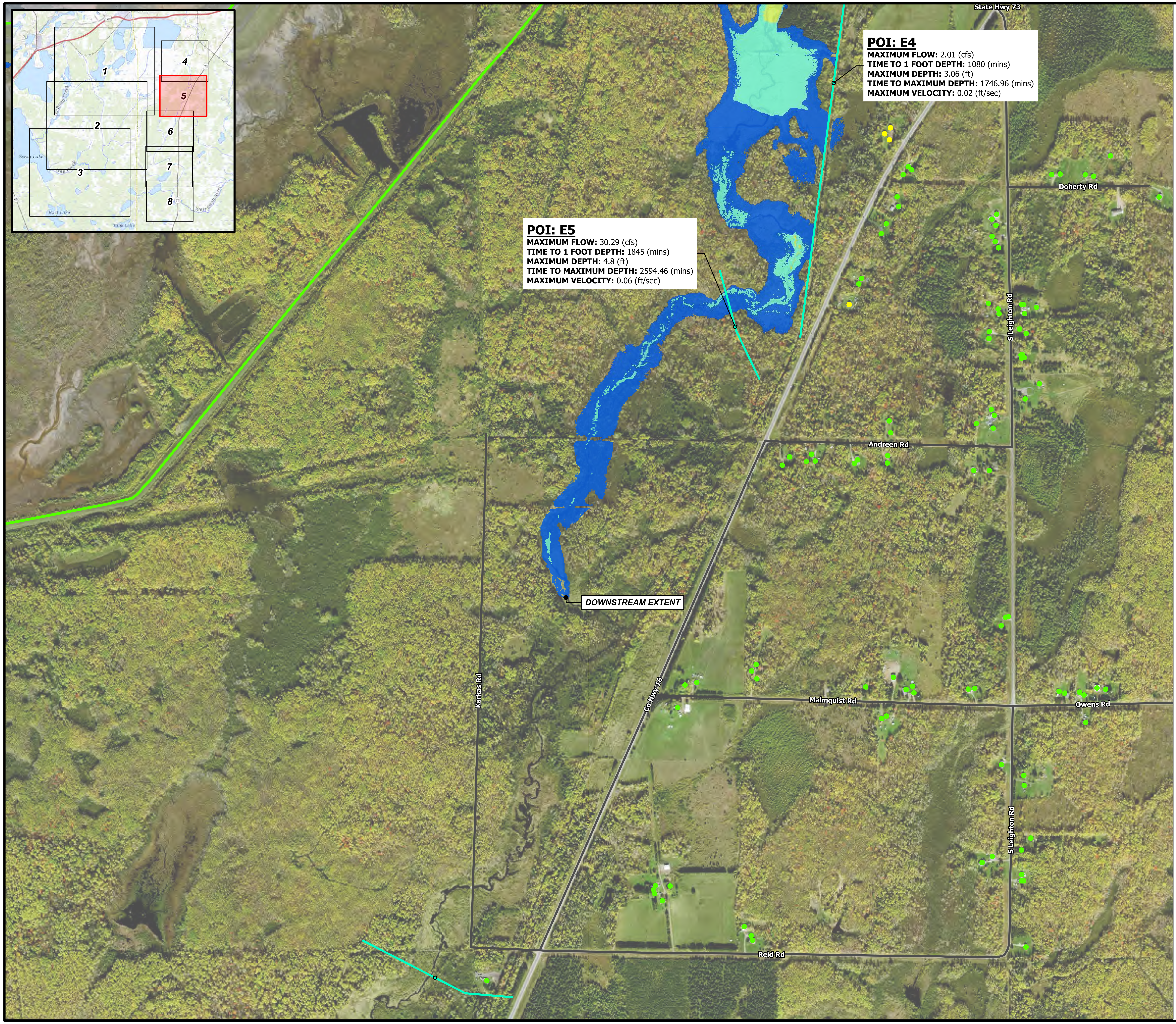

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Within 500ft of Breach Extent

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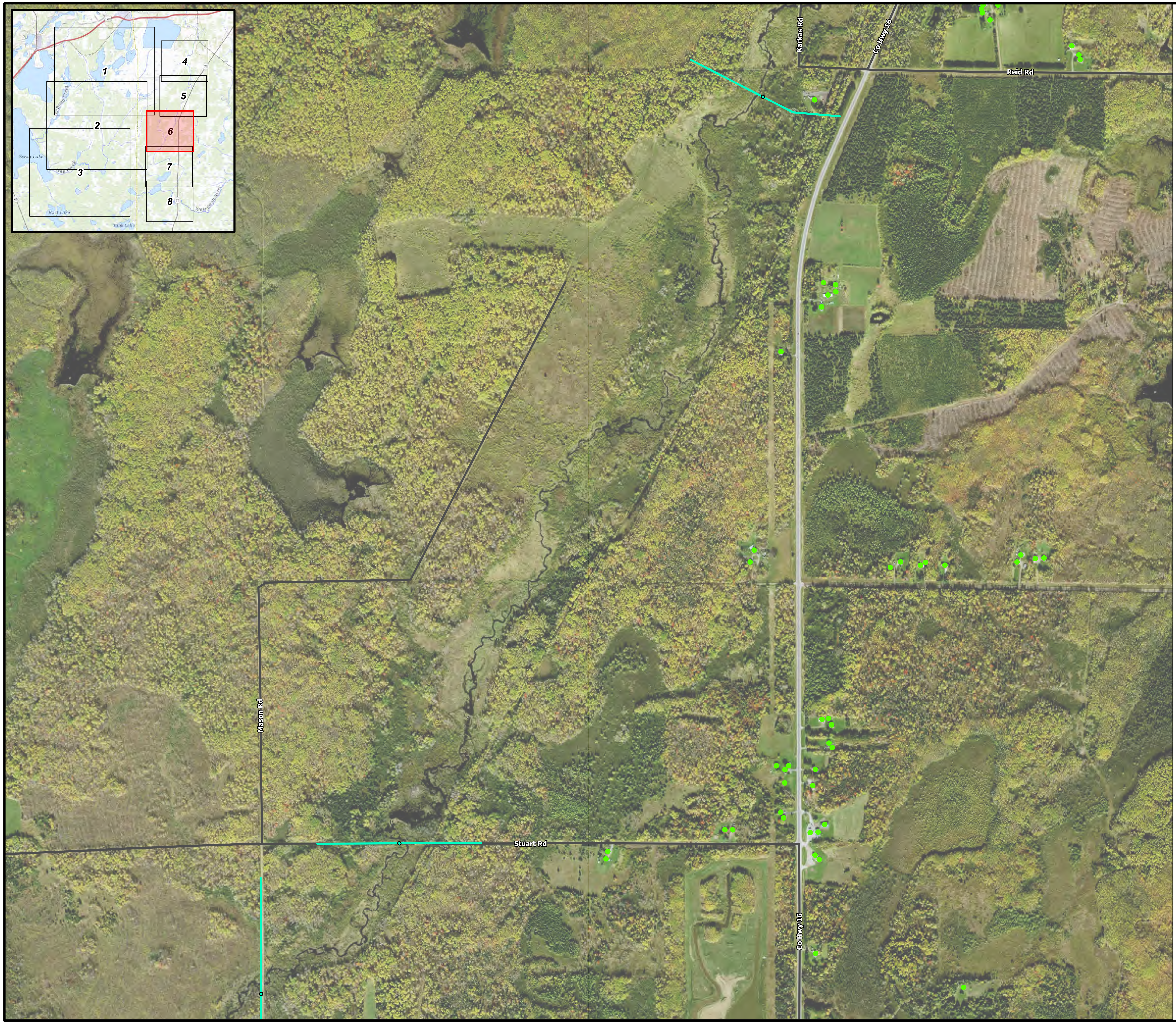

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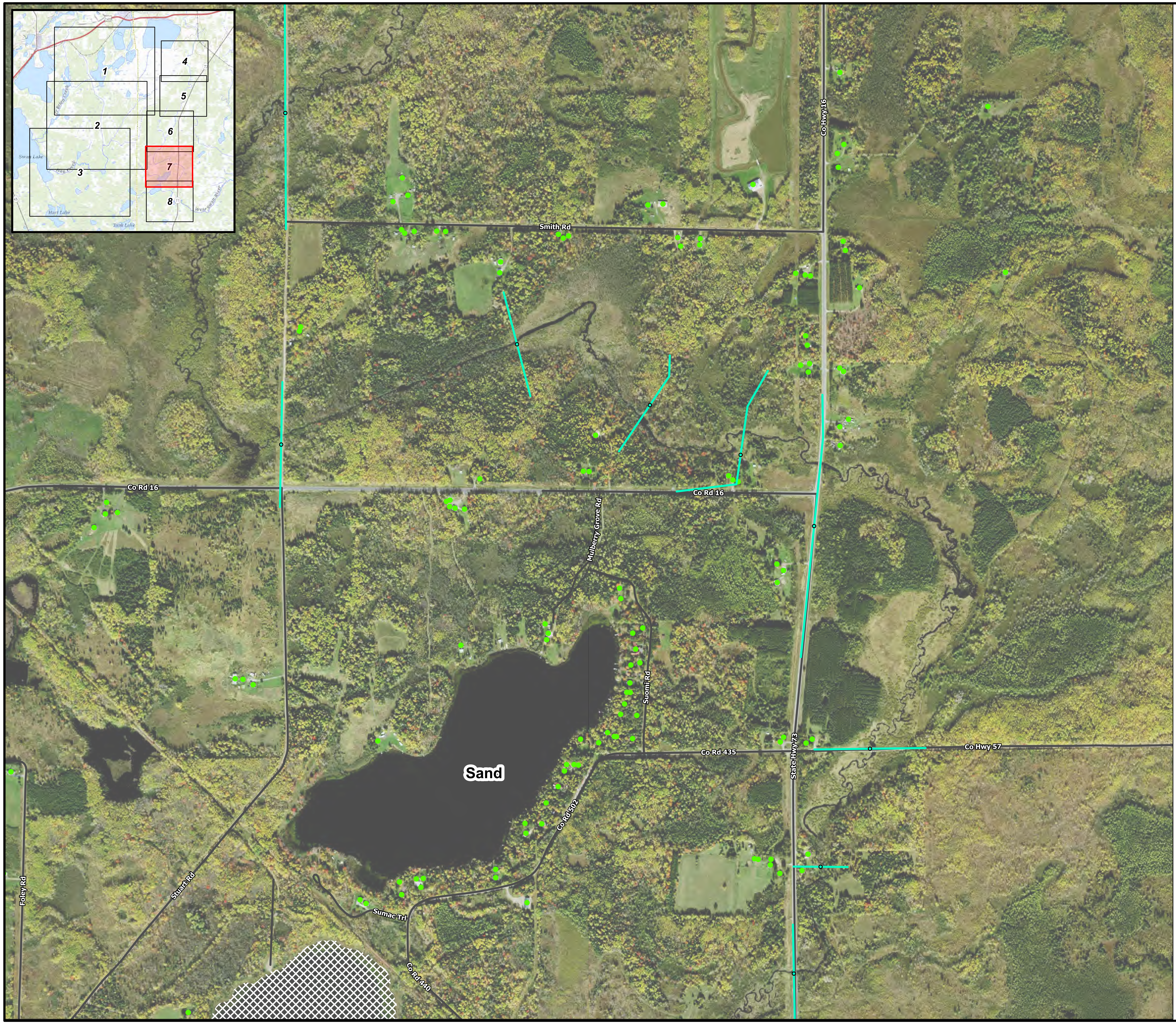

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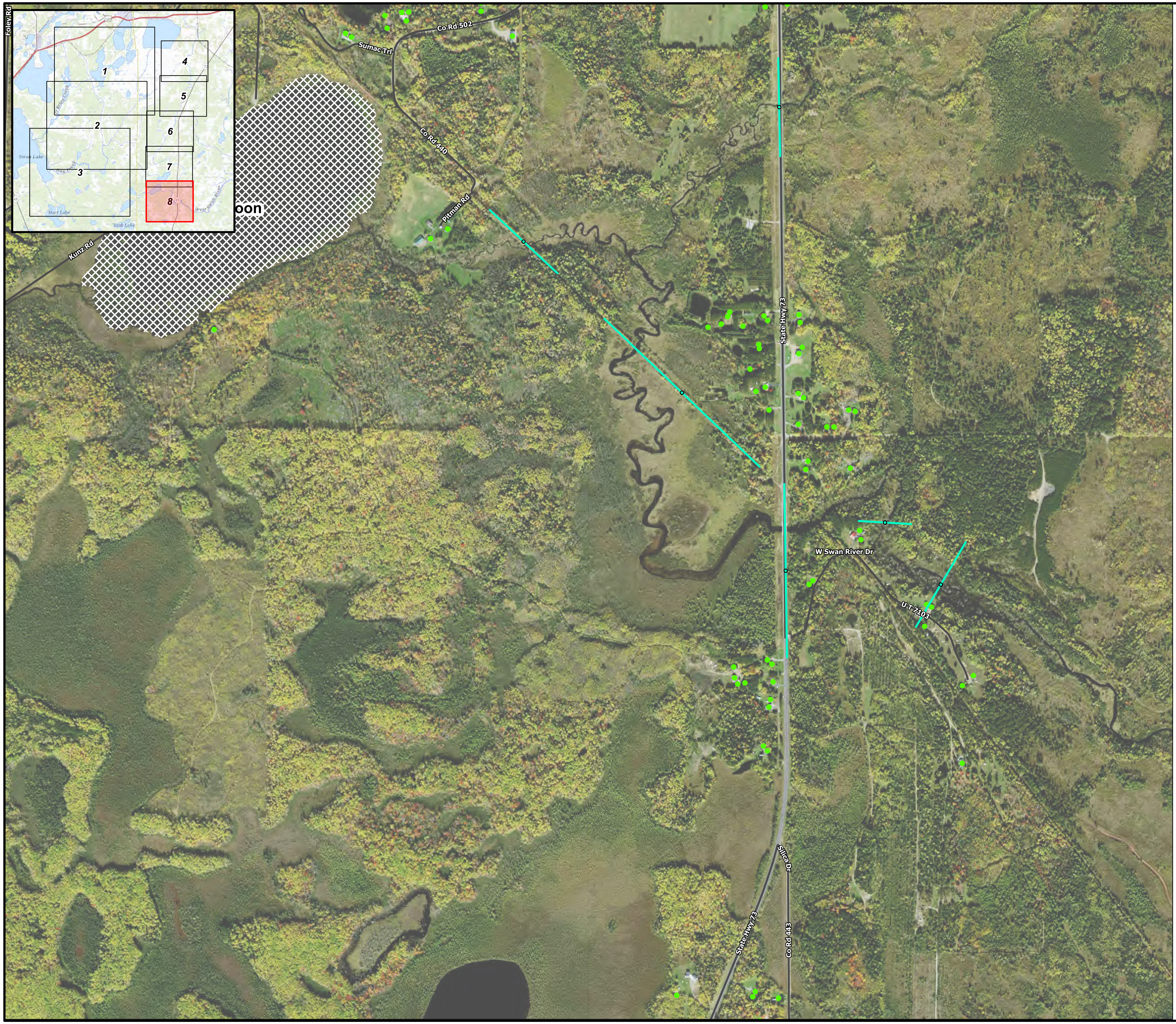

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Max Depth Values (ft)

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4. MAP SPATIAL REFERENCE:
COORDINATE SYSTEM: NAD 1983 2011 STATEPLANE MINNESOTA NORTH FIPS 2201 FT US
DATUM: NAD 1983 2011
PROJECTION: LAMBERT CONFORMAL CONIC

DESIGNED: C. FRITSCH	**EXISTING 'SD' MUDFLOW CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 8 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

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LEGEND:

- Waterbodies with inaccurate data (Due to lack of bathymetry)
- Stage 2 Exterior Alignment
- Cross-Section Lines
- Cross-Section Centerpoint

Existing Building Structures

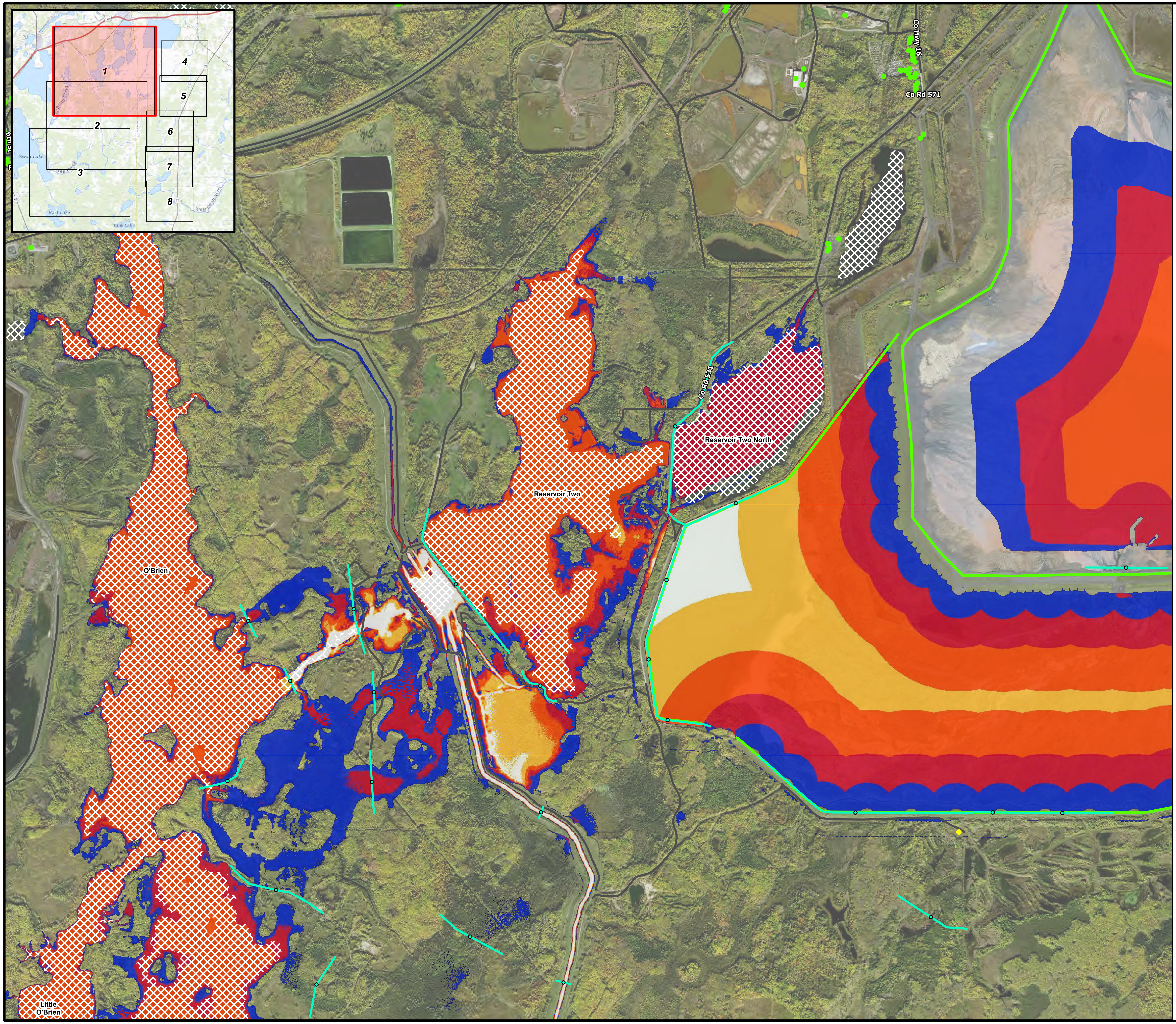
- Completely Within Breach Extent
- Within 500ft of Breach Extent
- Outside of 500ft of Breach Extent

Max Depth Values (ft)

- > 1
- 1.01 - 4
- 4.01 - 6
- 6.01 - 8
- 8.01 - 10
- < 10

DESIGNED: C. FRITSCH	INTERMEDIATE 'PMF' CLEANWATER CASCADE FAILURE - OVERVIEW
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

GEI Consultants



LEGEND:

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- Cross-Section Centerpoint

Existing Building Structures

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- Within 500ft of Breach Extent
- Outside of 500ft of Breach Extent

0 1,000 2,000 US Feet

Scale: 1 inch = 1,100 feet

Max Depth Values (ft)

- > 1
- 1.01 - 4
- 4.01 - 6
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- 8.01 - 10
- < 10

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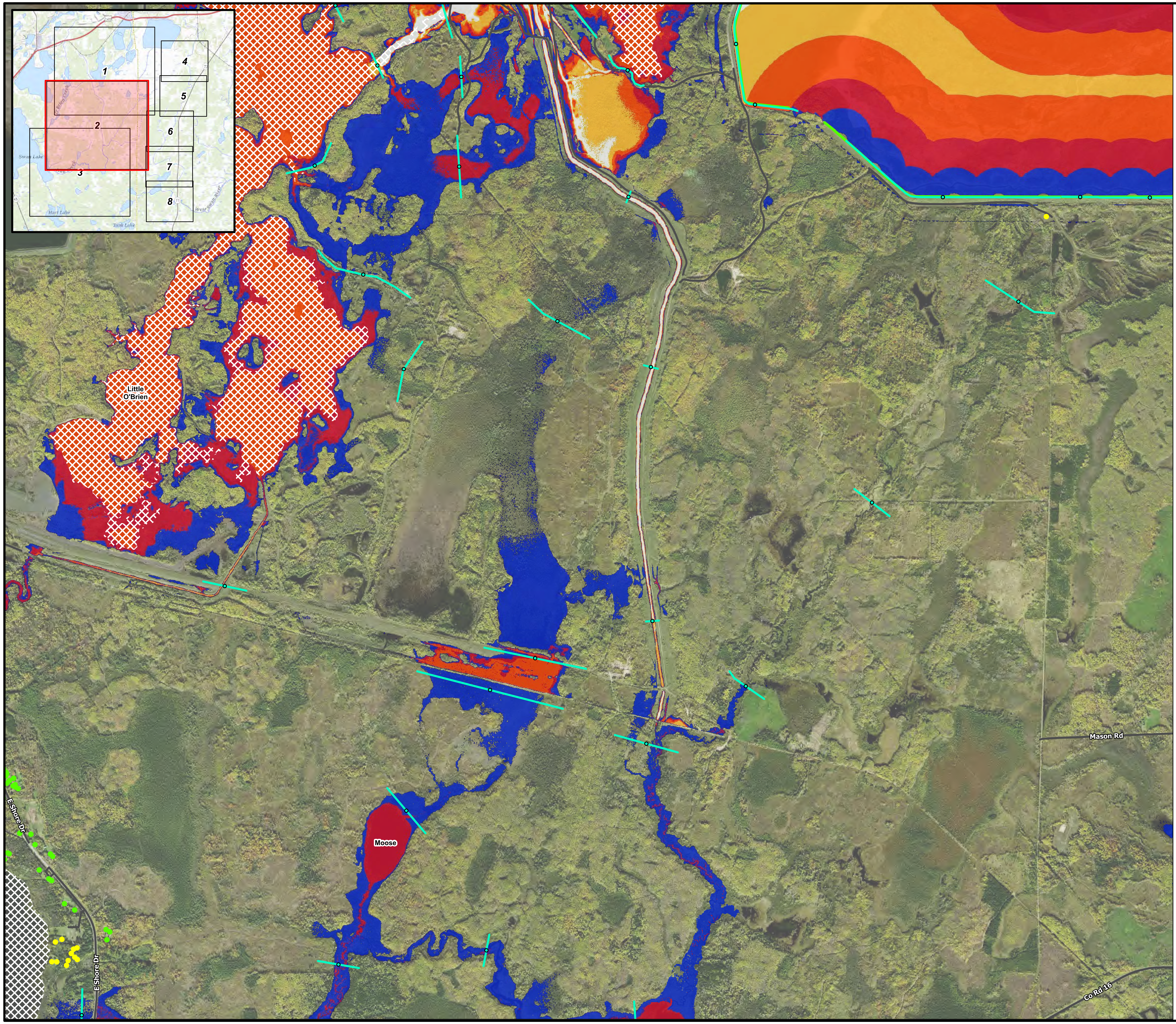
   DATUM: NAD 1983 2011
   PROJECTION: LAMBERT CONFORMAL CONIC

DESIGNED: C. FRITSCH	**INTERMEDIATE 'PMF' CLEANWATER CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 1 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

GEI Consultants



LEGEND:

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- Stage 2 Exterior Alignment
- Cross-Section Lines
- Cross-Section Centerpoint

Existing Building Structures

- Completely Within Breach Extent
- Within 500ft of Breach Extent
- Outside of 500ft of Breach Extent

Max Depth Values (ft)

- > 1
- 1.01 - 4
- 4.01 - 6
- 6.01 - 8
- 8.01 - 10
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0 1,000 2,000 US Feet

Scale: 1 inch = 1,100 feet

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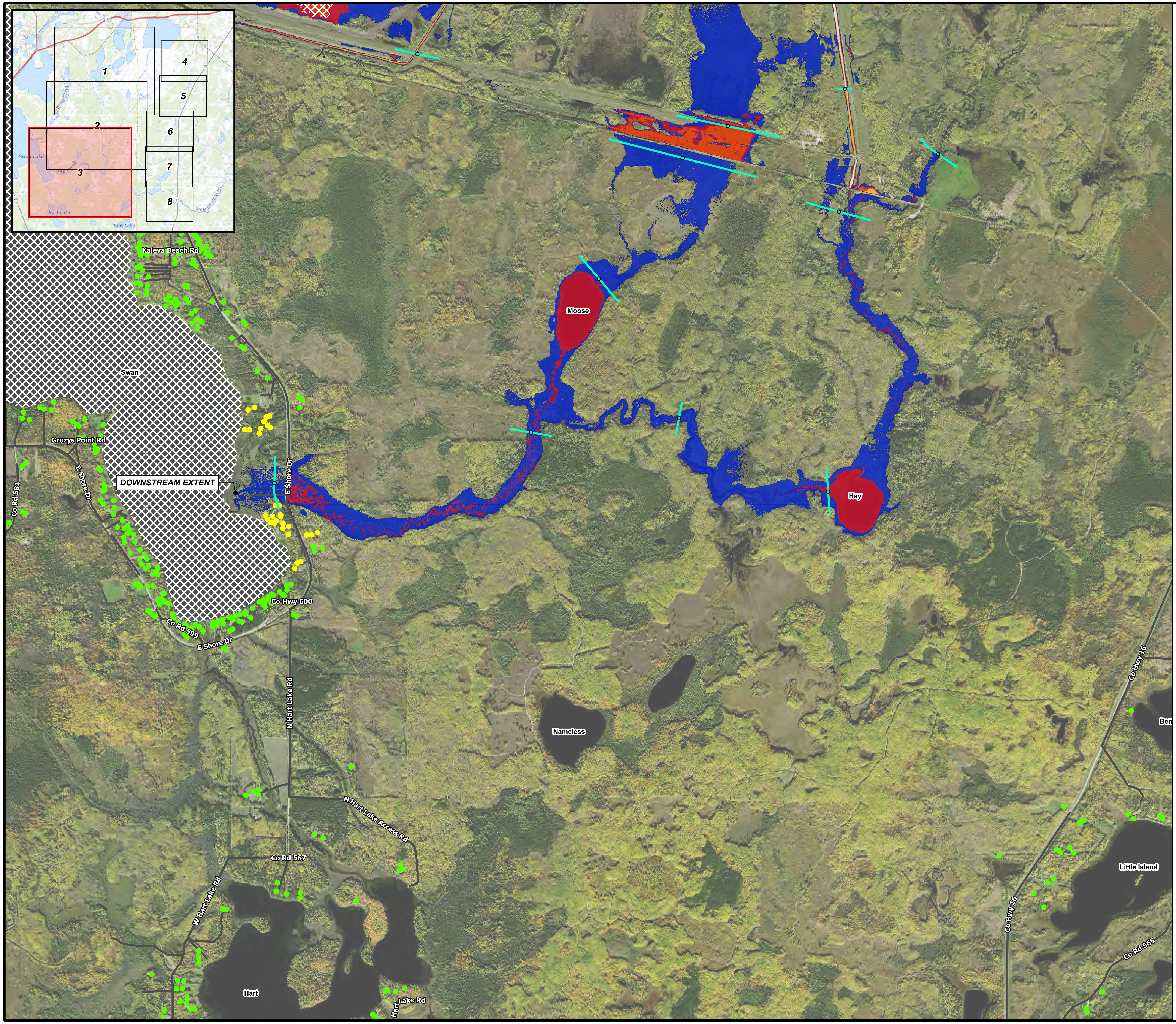
DESIGNED: C. FRITSCH	**INTERMEDIATE 'PMF' CLEANWATER CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 2 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	GEI Consultants
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION



LEGEND:

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- Stage 2 Exterior Alignment
- Cross-Section Lines
- Cross-Section Centerpoint

Existing Building Structures

- Completely Within Breach Extent
- Within 500ft of Breach Extent
- Outside of 500ft of Breach Extent

Max Depth Values (ft)

- > 1
- 1.01 - 4
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- 8.01 - 10
- < 10

N

0 1,000 2,000 US Feet

Scale: 1 inch = 1,100 feet

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DESIGNED: C. FRITSCH	**INTERMEDIATE 'PMF' CLEANWATER CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	Page Number: 3 of 8
REVIEWED: M. WHEELER	
APPROVED: -	
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
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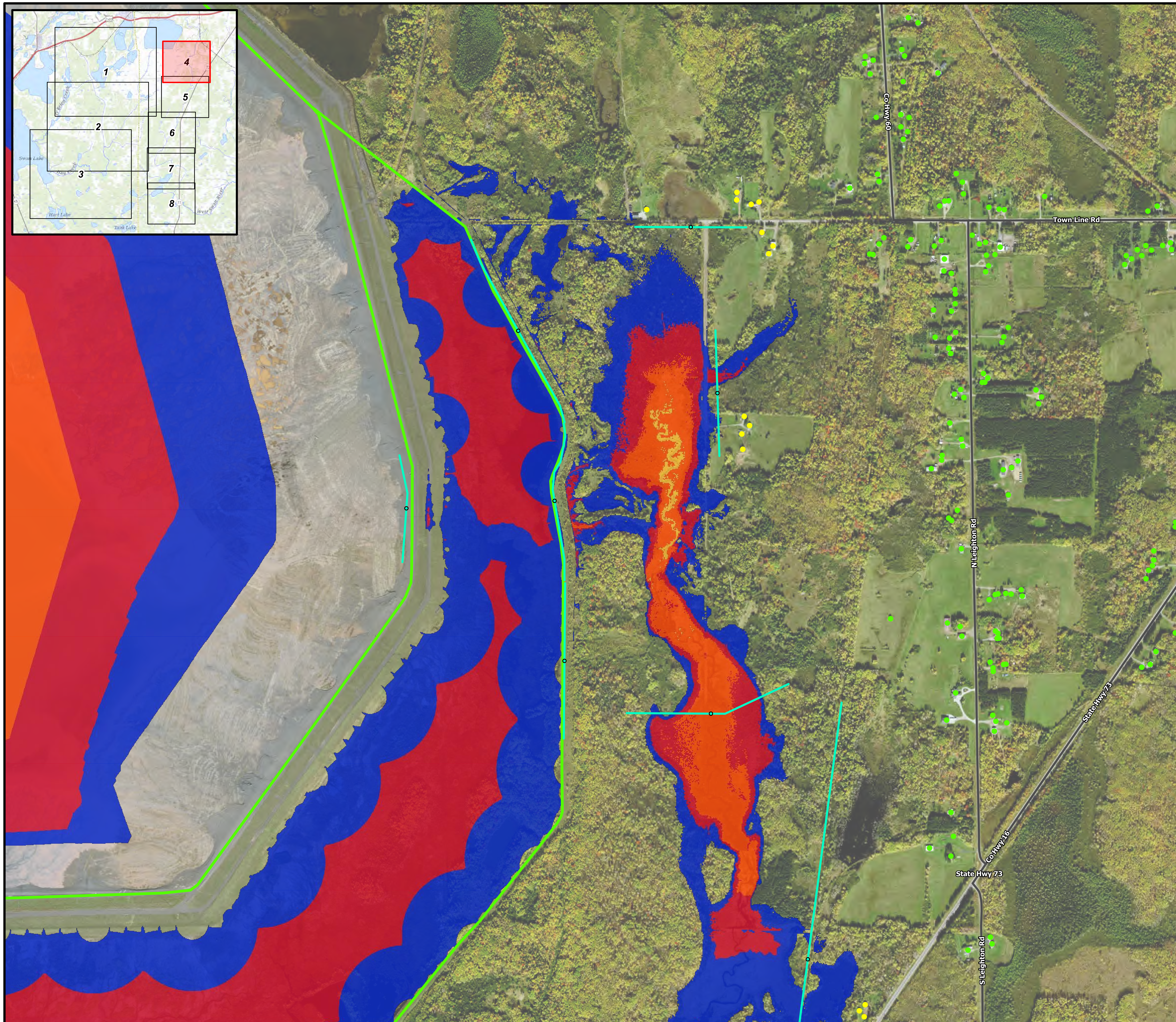

LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Stage 2 Exterior Alignment

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Completely Within Breach Extent

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DESIGNED: C. FRITSCH	**INTERMEDIATE 'PMF' CLEANWATER CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	Page Number: 4 of 8
REVIEWED: M. WHEELER	
APPROVED: -	
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
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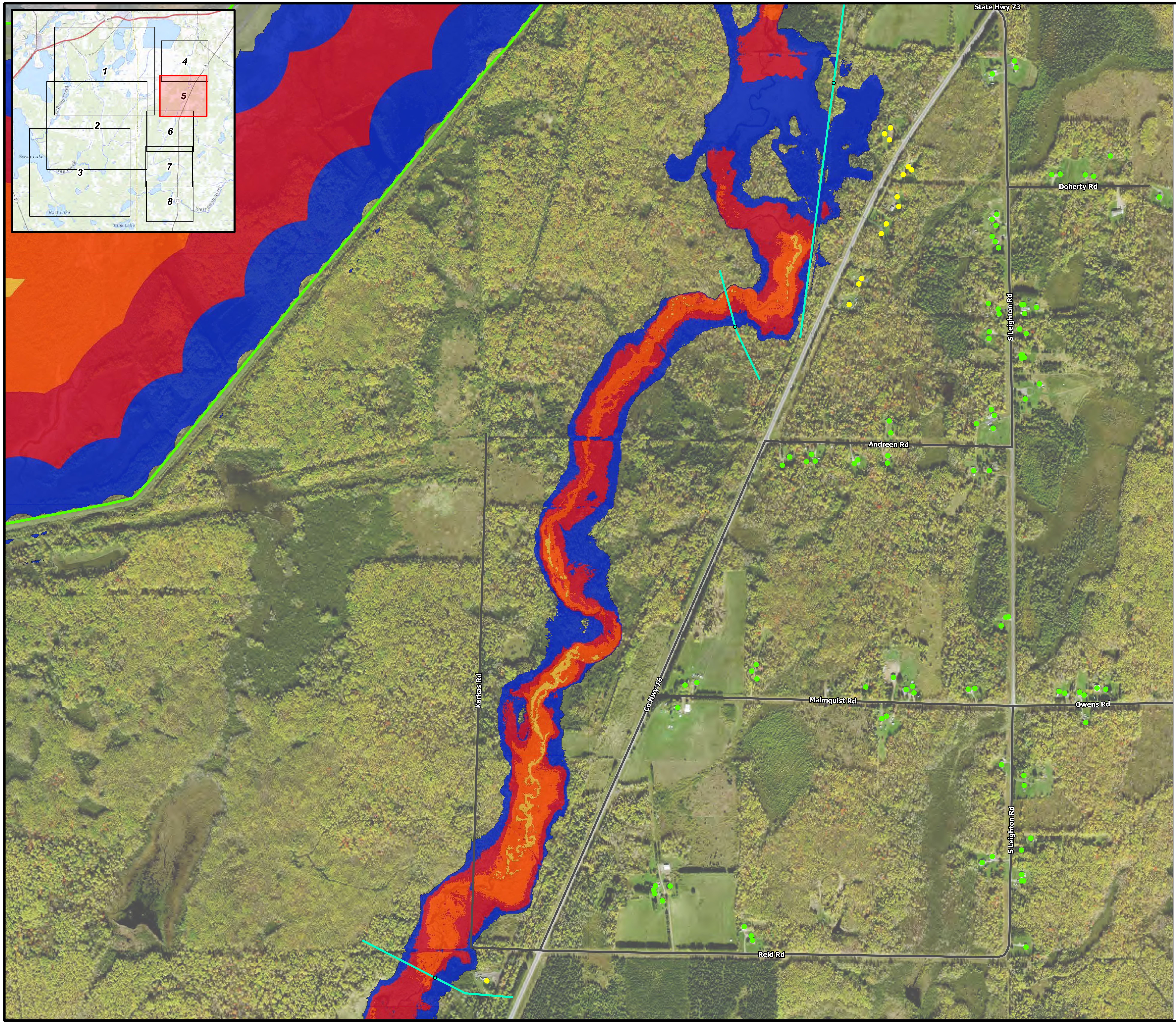
GEI Consultants



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Waterbodies with inaccurate data (Due to lack of bathymetry)

Stage 2 Exterior Alignment

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Cross-Section Centerpoint

Existing Building Structures

Completely Within Breach Extent

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PROJECTION: LAMBERT CONFORMAL CONIC

DESIGNED: C. FRITSCH	**INTERMEDIATE 'PMF' CLEANWATER CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	Page Number: 5 of 8
REVIEWED: M. WHEELER	
APPROVED: -	
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
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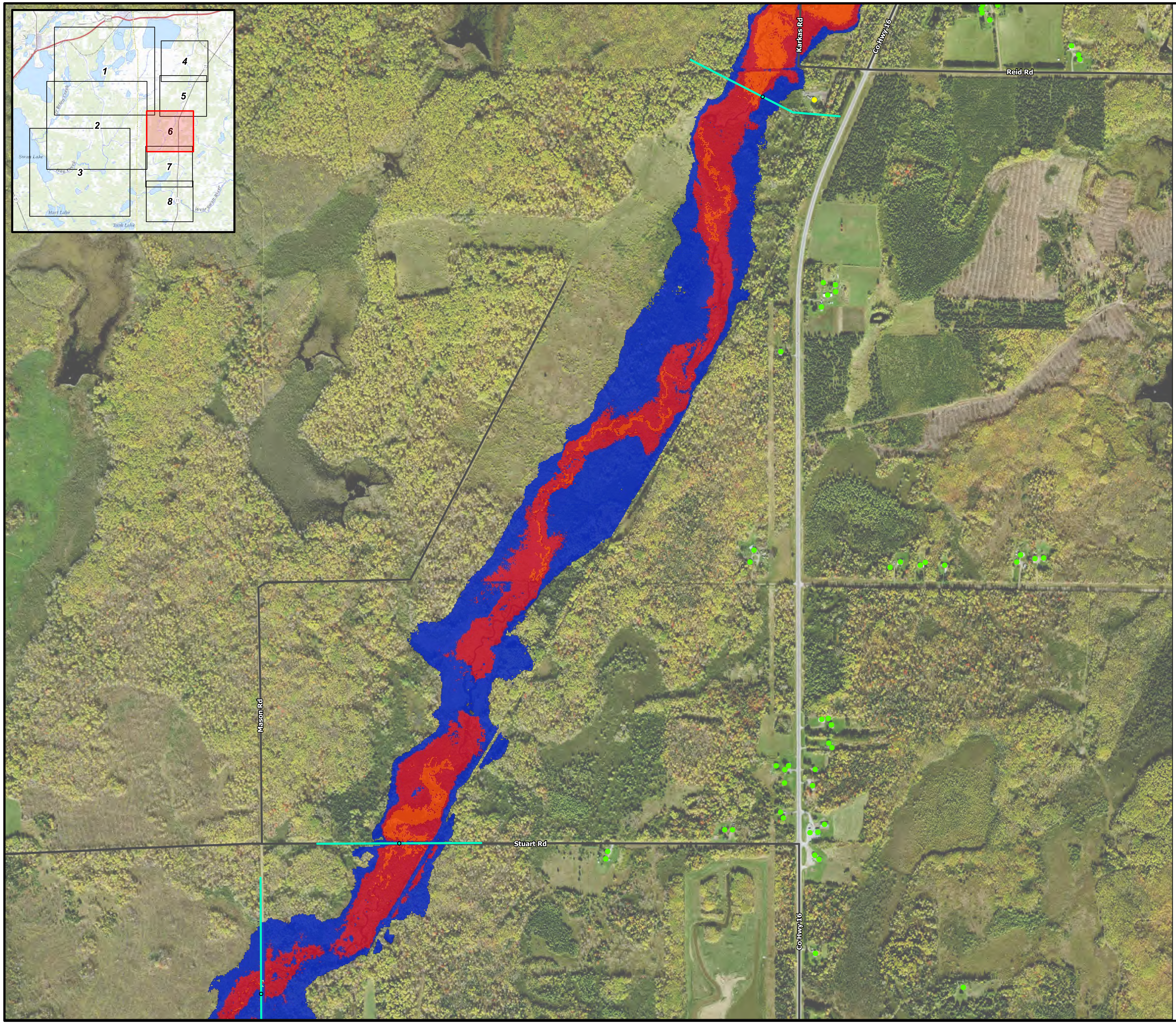

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Existing Building Structures

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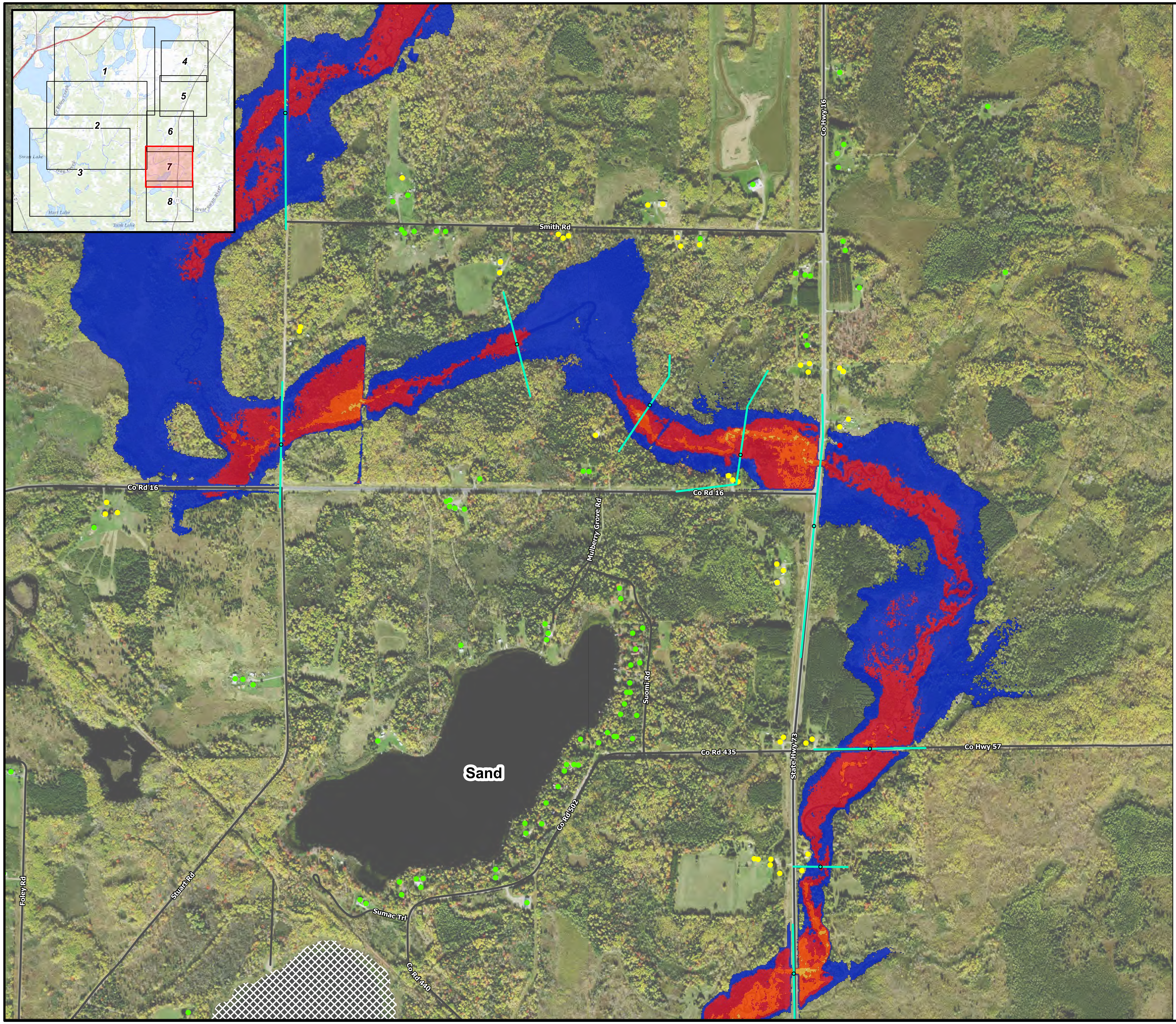
PROJECTION: LAMBERT CONFORMAL CONIC

DESIGNED: C. FRITSCH	**INTERMEDIATE 'PMF' CLEANWATER CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	Page Number: 6 of 8
REVIEWED: M. WHEELER	
APPROVED: -	
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	GEI Consultants
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION



LEGEND:

- Waterbodies with inaccurate data (Due to lack of bathymetry)
- Stage 2 Exterior Alignment
- Cross-Section Lines
- Cross-Section Centerpoint

Existing Building Structures

- Completely Within Breach Extent
- Within 500ft of Breach Extent
- Outside of 500ft of Breach Extent

0 500 1,000 US Feet

Scale: 1 inch = 500 feet

Max Depth Values (ft)

- > 1
- 1.01 - 4
- 4.01 - 6
- 6.01 - 8
- 8.01 - 10
- < 10

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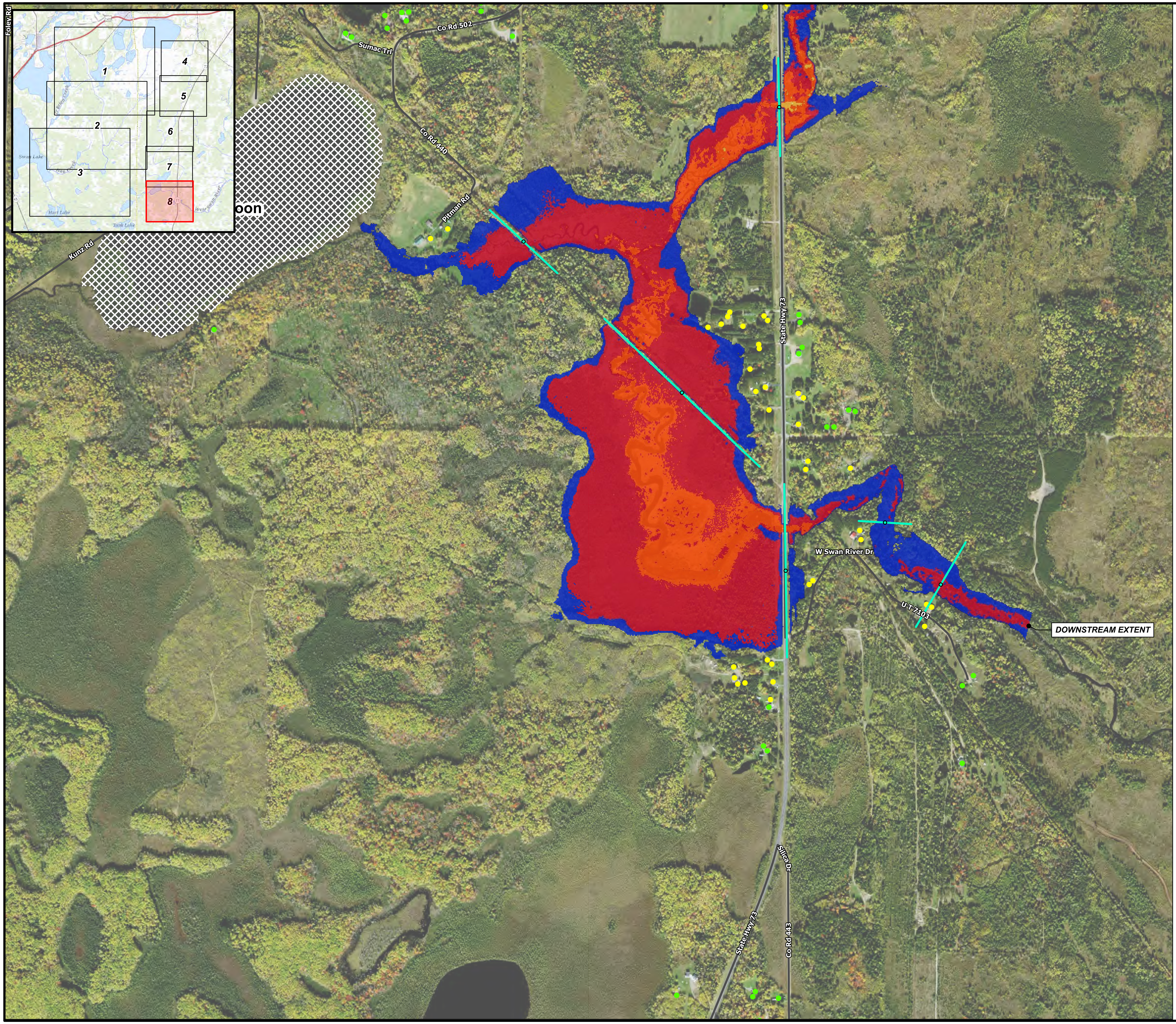

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REVISION: 0	GEI Consultants
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

DESIGNED: C. FRITSCH	INTERMEDIATE 'PMF' MUDFLOW CASCADE FAILURE - OVERVIEW
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
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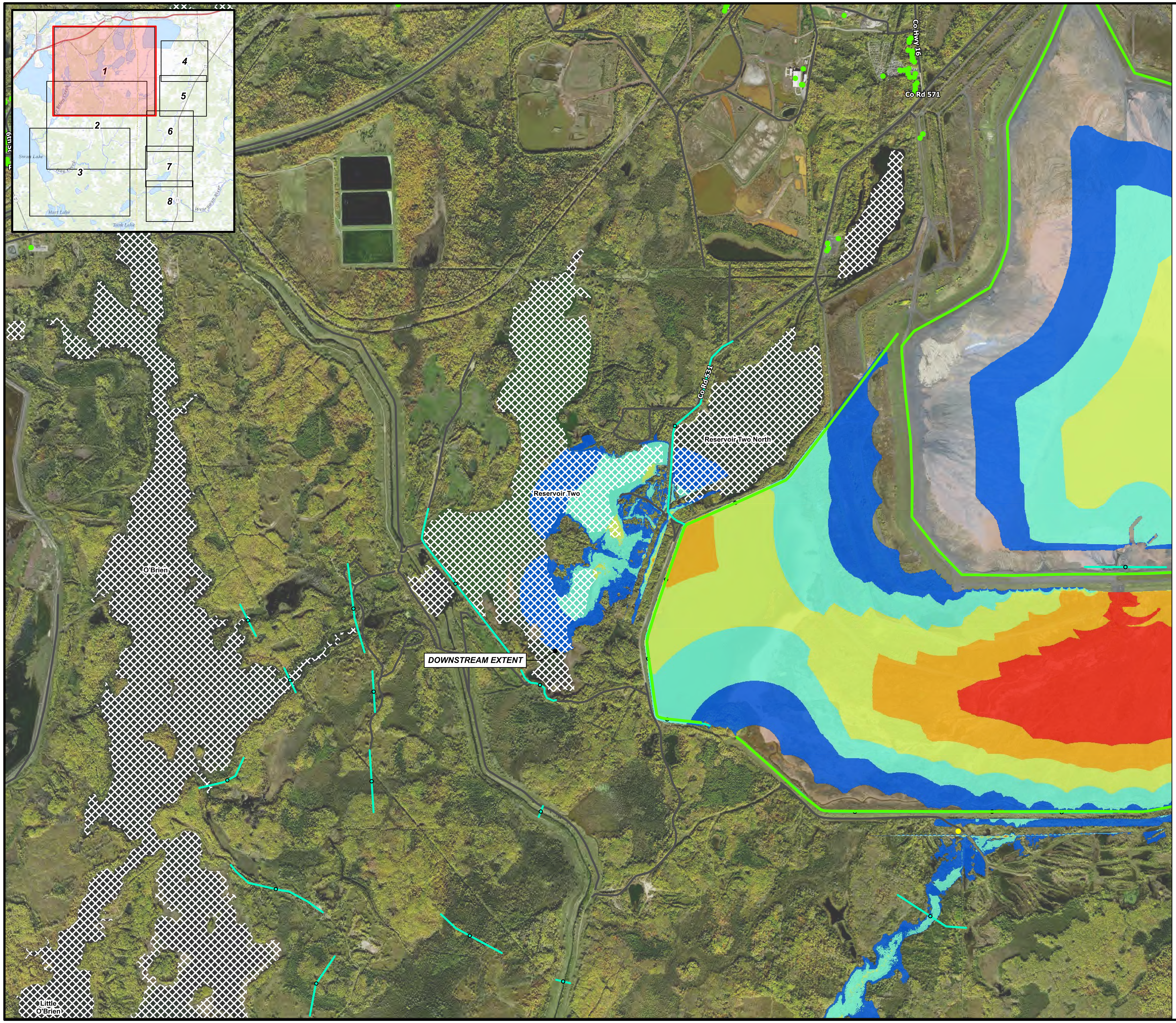

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- Cross-Section Centerpoint
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Existing Building Structures

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N

0 1,000 2,000 US Feet

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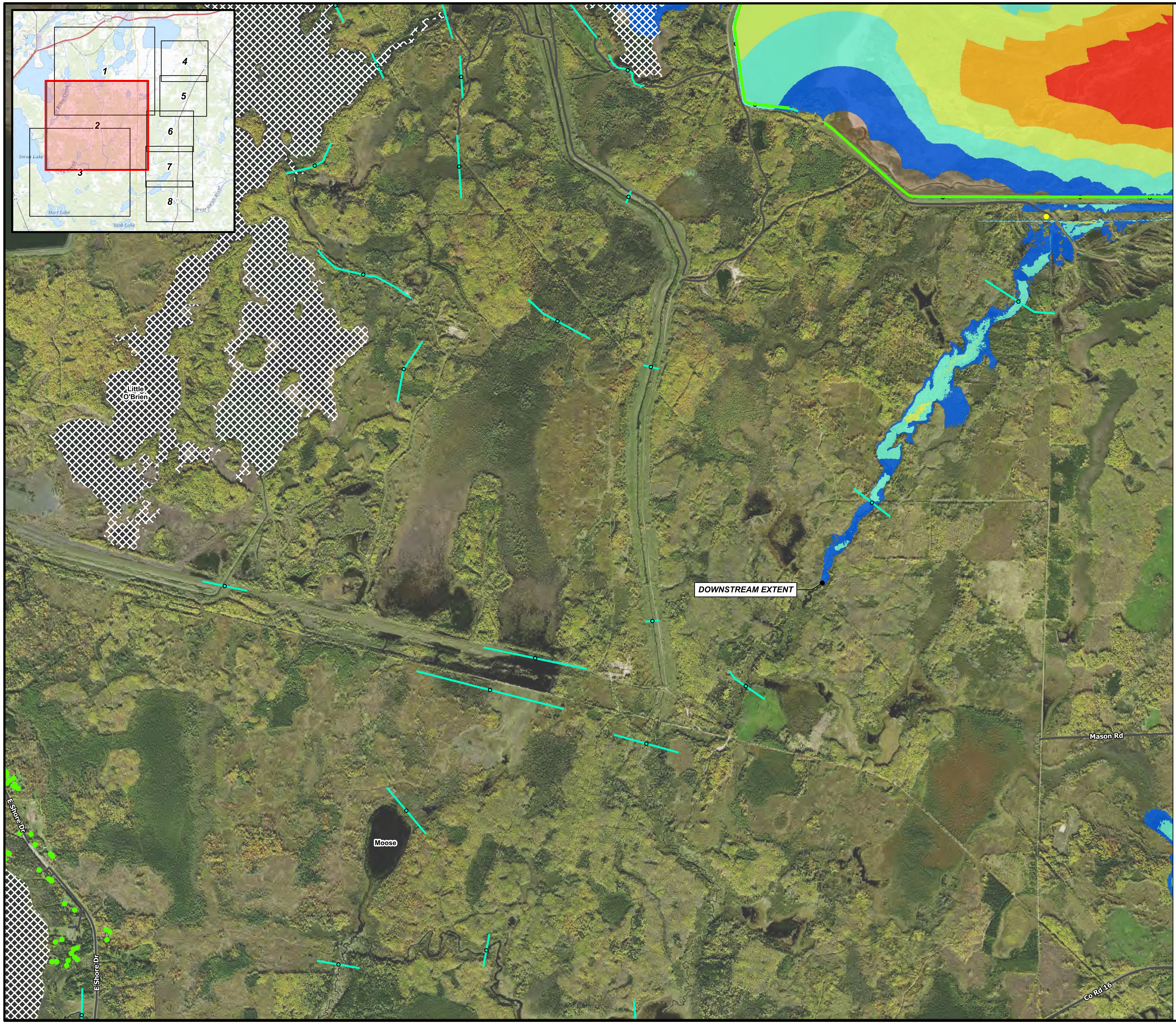

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Stage 2 Exterior Alignment

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Existing Building Structures

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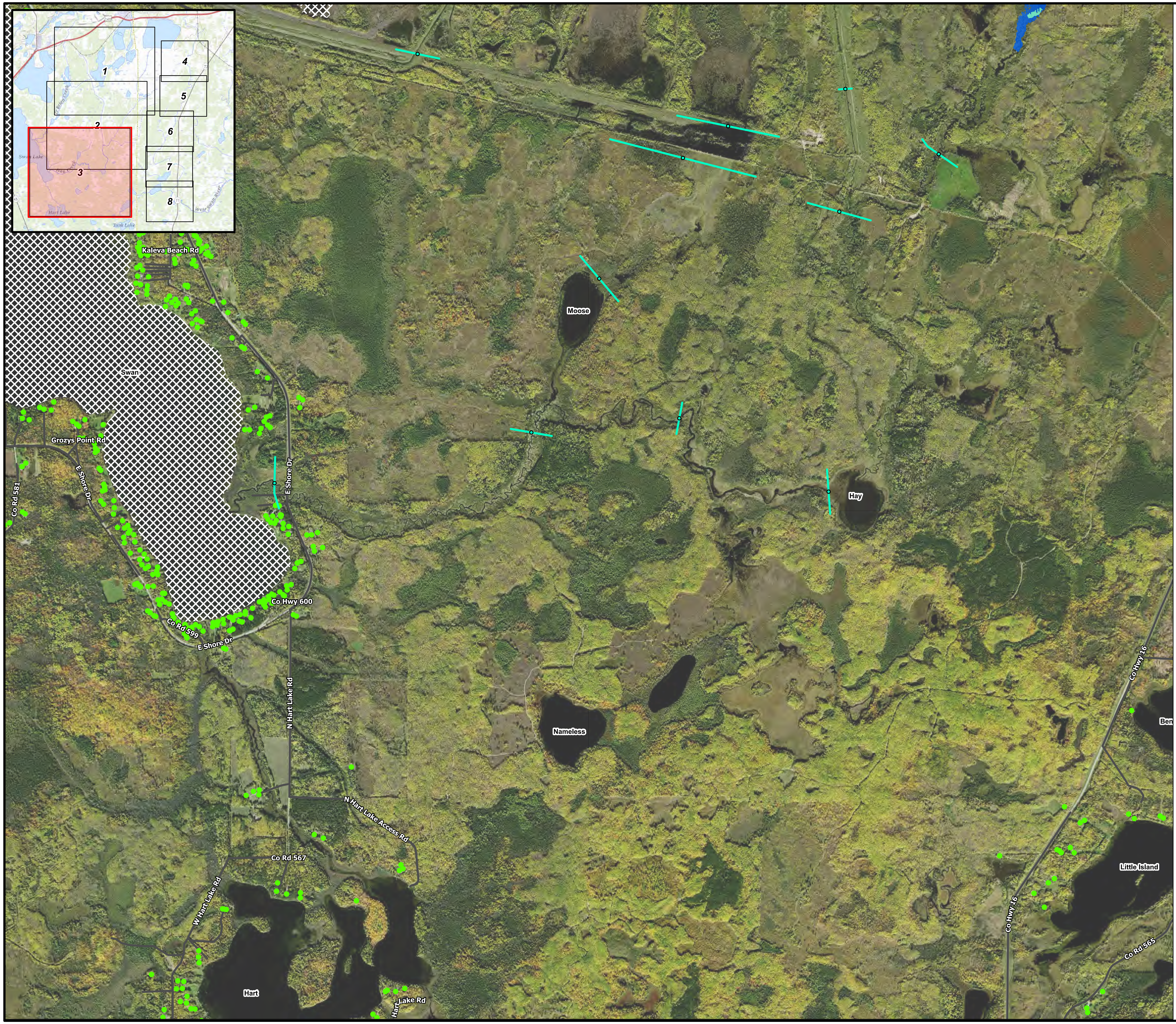

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Stage 2 Exterior Alignment

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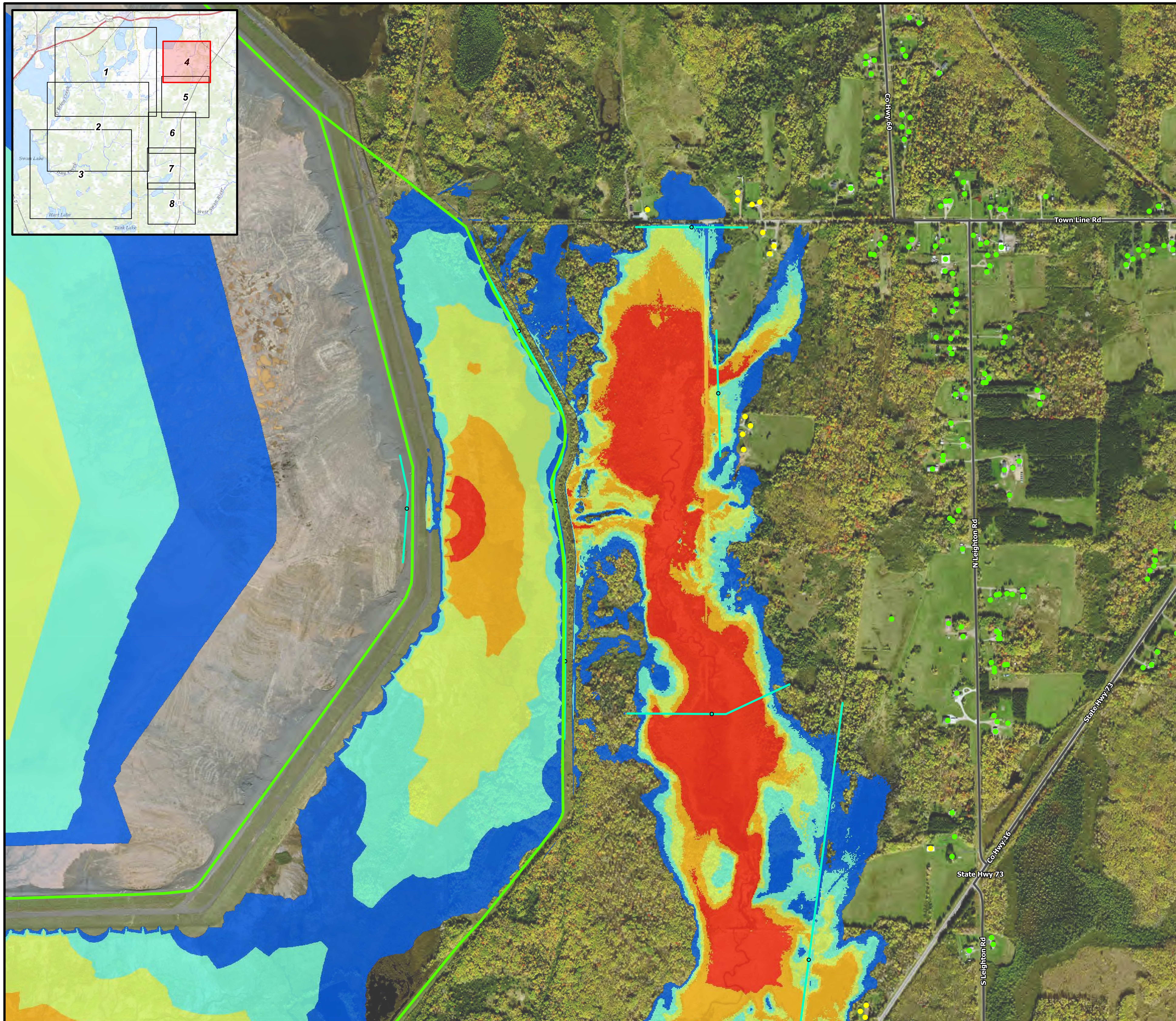

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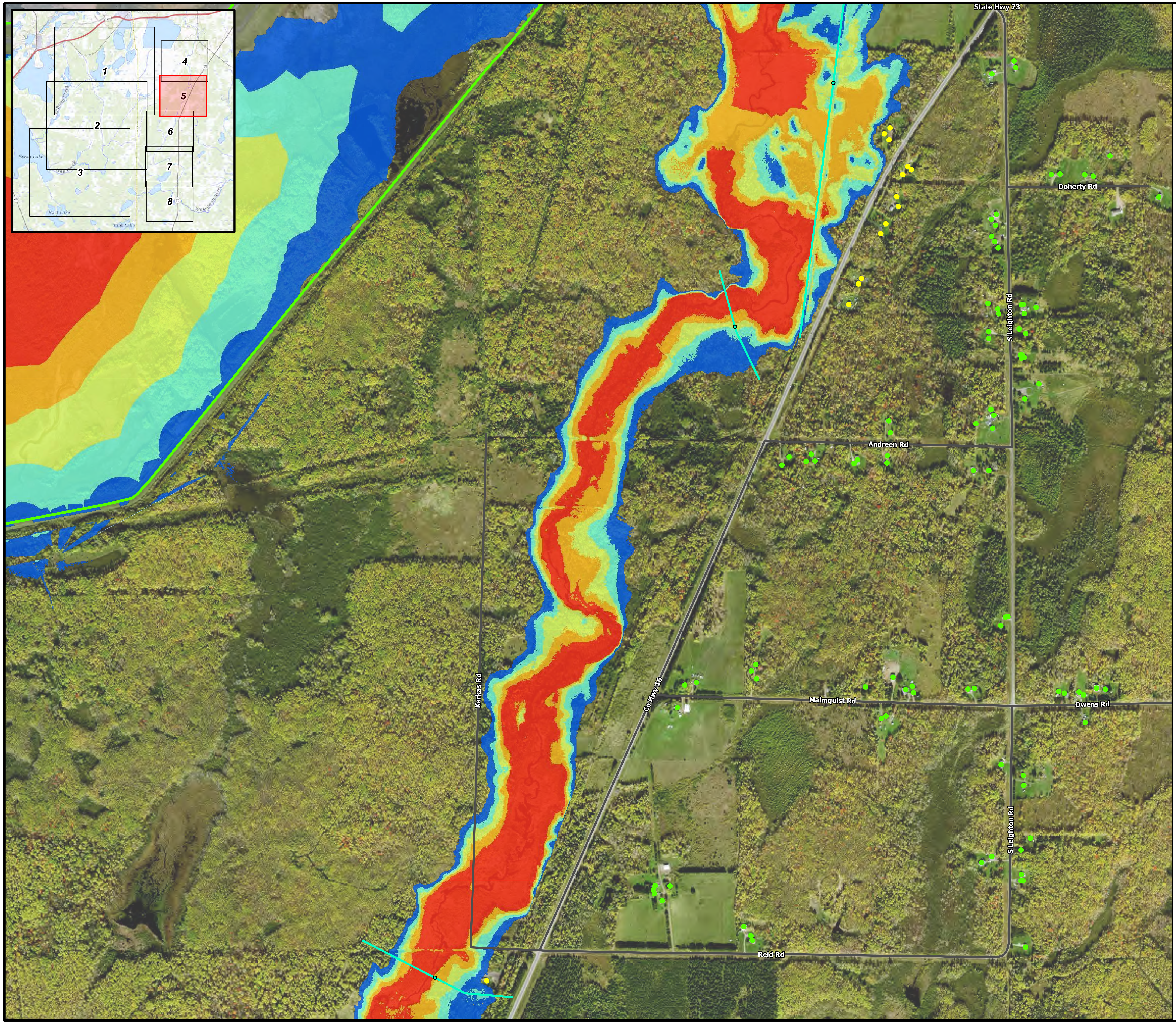

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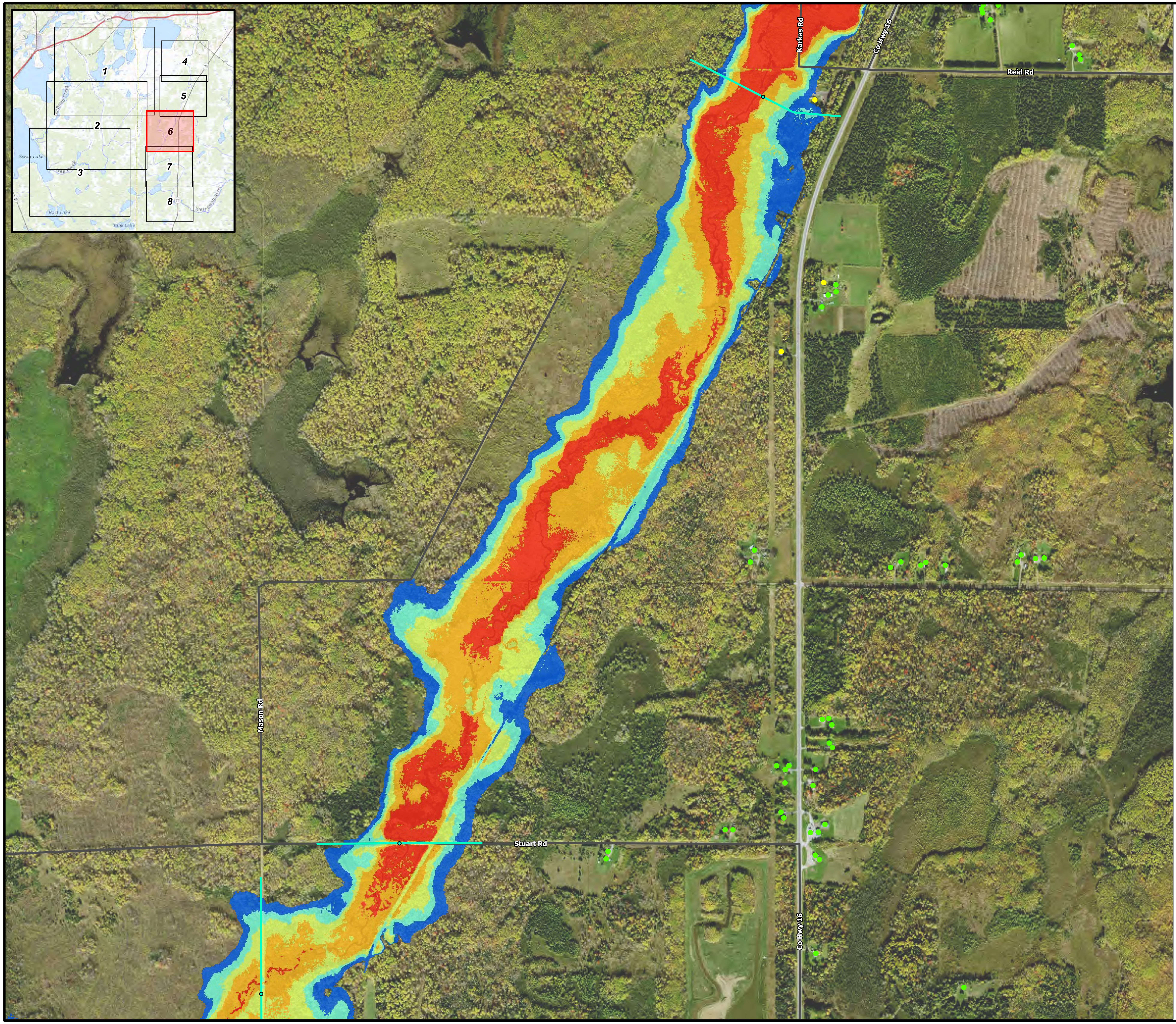
DATUM: NAD 1983 2011
PROJECTION: LAMBERT CONFORMAL CONIC

DESIGNED: C. FRITSCH	**INTERMEDIATE 'PMF' MUDFLOW CASCADE FAILURE - MAXIMUM FLOOD DEPTH**	
PREPARED: J. HANSEN		
REVIEWED: M. WHEELER		
APPROVED: -	Page Number: 5 of 8	
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA	GEI Consultants
REVISION: 0		
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION	



LEGEND:

- Waterbodies with inaccurate data (Due to lack of bathymetry)
- Stage 2 Exterior Alignment
- Cross-Section Centerpoint
- Cross-Section Lines

Existing Building Structures

- Completely Within Breach Extent
- Within 500ft of Breach Extent
- Outside of 500ft of Breach Extent

0 500 1,000 US Feet

Scale: 1 inch = 500 feet

Max Depth Values (ft)

- > 1
- 1.01 - 4
- 4.01 - 6
- 6.01 - 8
- 8.01 - 10
- < 10

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PREPARED: J. HANSEN		
REVIEWED: M. WHEELER		
APPROVED: -	Page Number: 6 of 8	
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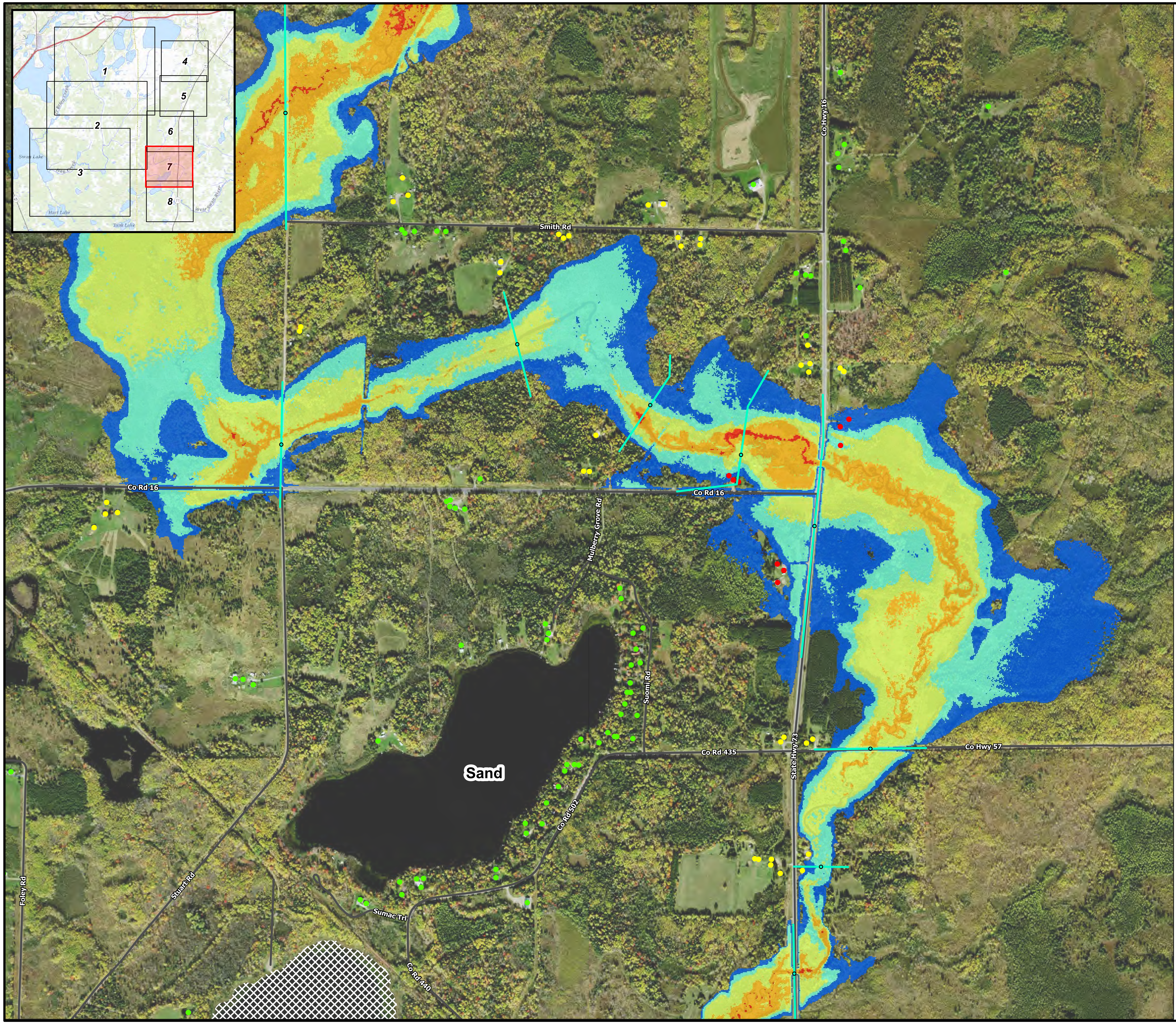

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PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 7 of 8
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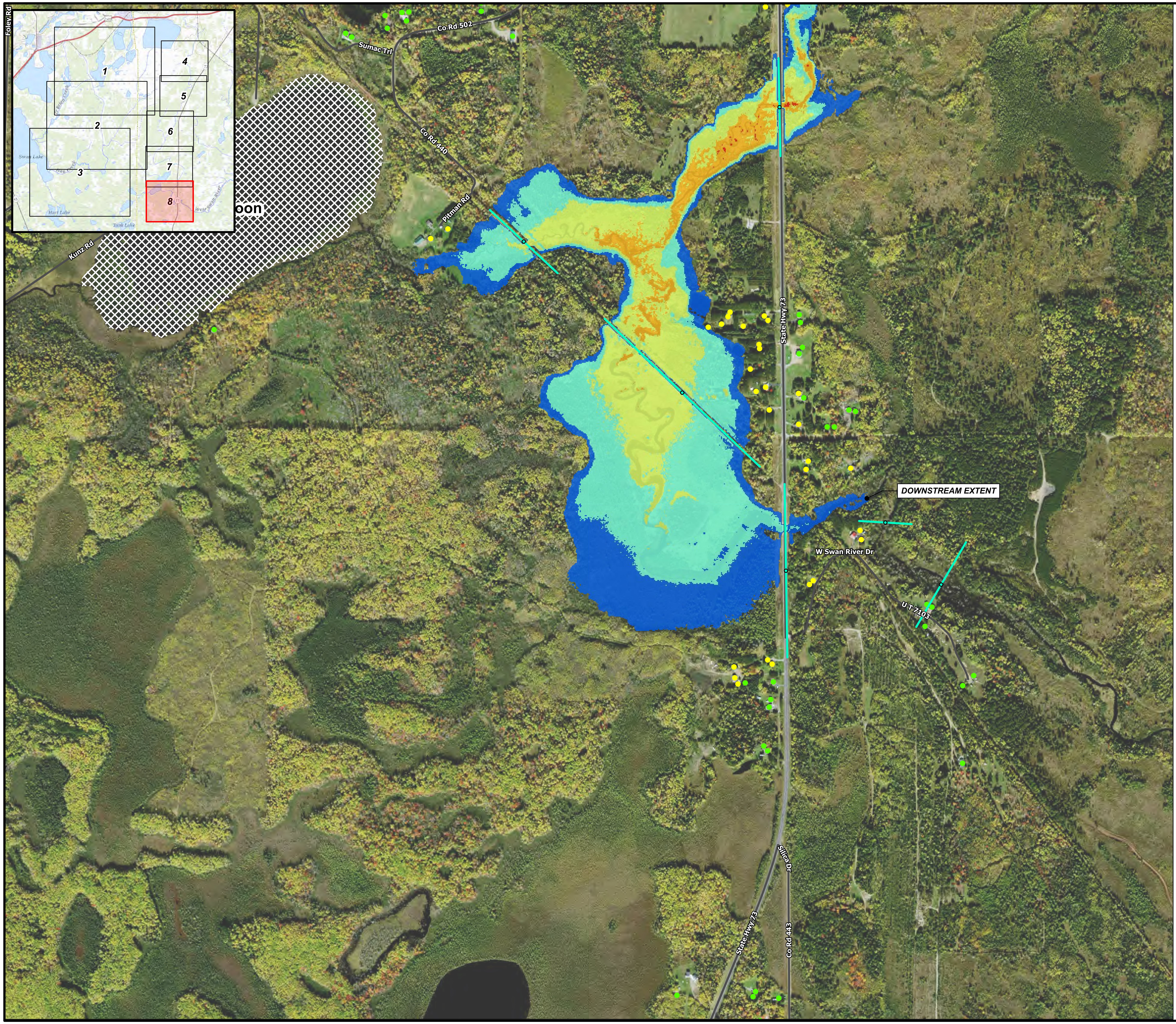
REVISION: 0	
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

GEI Consultants



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- Cross-Section Lines

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PREPARED: J. HANSEN	
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DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
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GEI Consultants


Downstream Boundary of Mapping Extent
Downstream Boundary of Mapping Extent
1
2
3
4
5
6
7
8
Reservoir Two
Reservoir Two North
Unnamed (O'Brien Res. #4)
KEEWATIN, MN
SILICA, MN
O'Brien
Little O'Brien
Swan
Moose
Hay
Nameless
Hart
Sand
Coon
Bengal
Little Island
Helen
Little Flower
Ox Hide
Snowball
Harriet
Lower Panasa
Little Sucker
Larue Complex
US Hwy 169
State Hwy 65
State Hwy 73
Co Hwy 16
Town Line Rd
Stuart Rd
Smith Rd
Pitman Rd
Co Rd 435
Co Hwy 57
Silica Dr
LEGEND:
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Stage 2 Exterior Alignment
Cross-Section Lines
Cross-Section Centerpoint
Existing Building Structures
Within 500ft of Breach Extent
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Max Depth Values (ft)
> 1
1.01 - 4
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N
0
2,600
5,200
US Feet
Scale: 1 inch = 2,500 feet
DESIGNED: C. FRITSCH
PREPARED: J. HANSEN
REVIEWED: M. WHEELER
APPROVED: -
DATE: FEBRUARY 2023
REVISION: 0
PROJECT NUMBER: 2201246
INTERMEDIATE 'SD' CLEANWATER CASCADE FAILURE - OVERVIEW
KEETAC TAILINGS BASIN
KEEWATIN, MINNESOTA
UNITED STATES STEEL CORPORATION
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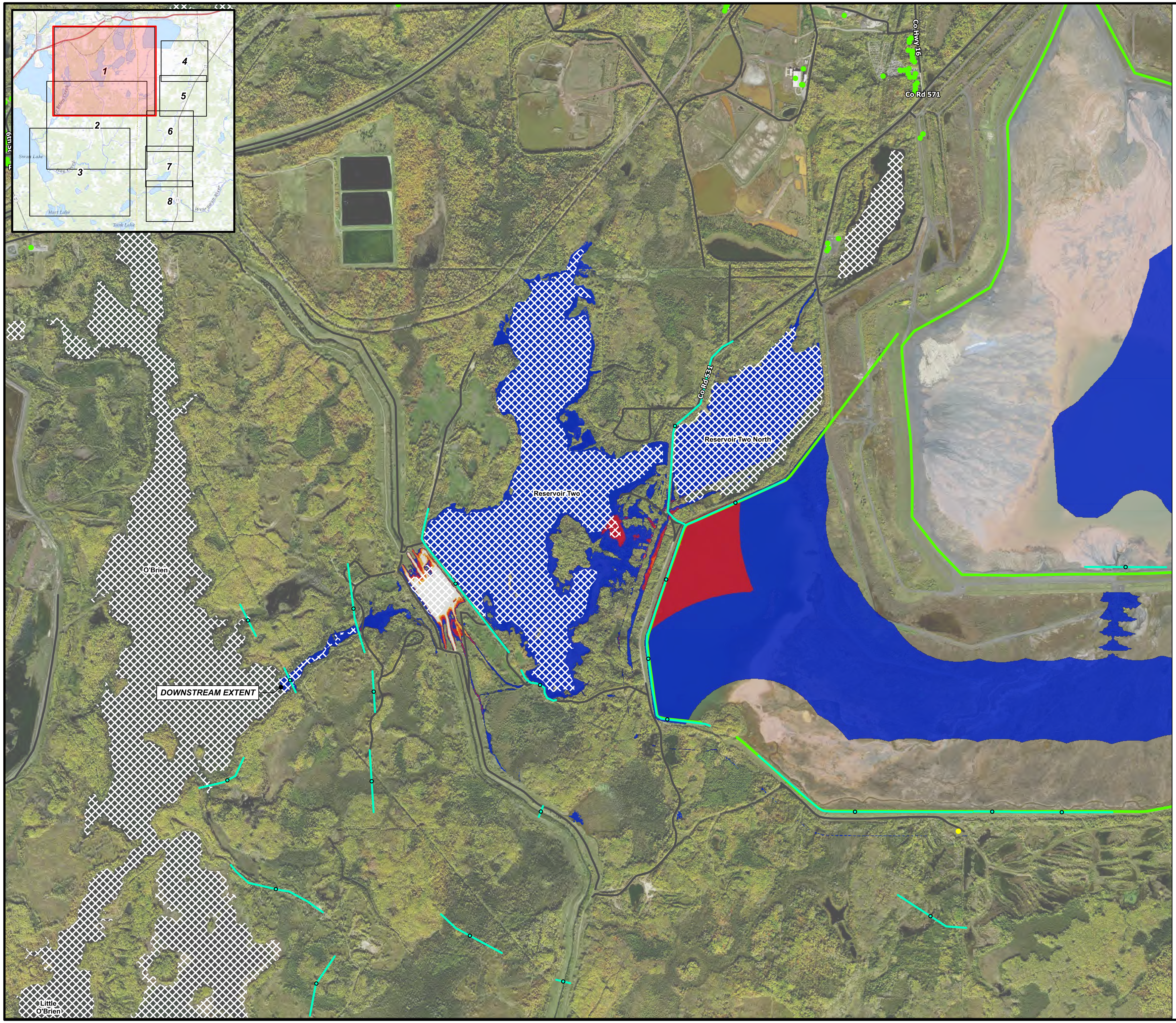

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Stage 2 Exterior Alignment

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PREPARED: J. HANSEN	Page Number: 1 of 8
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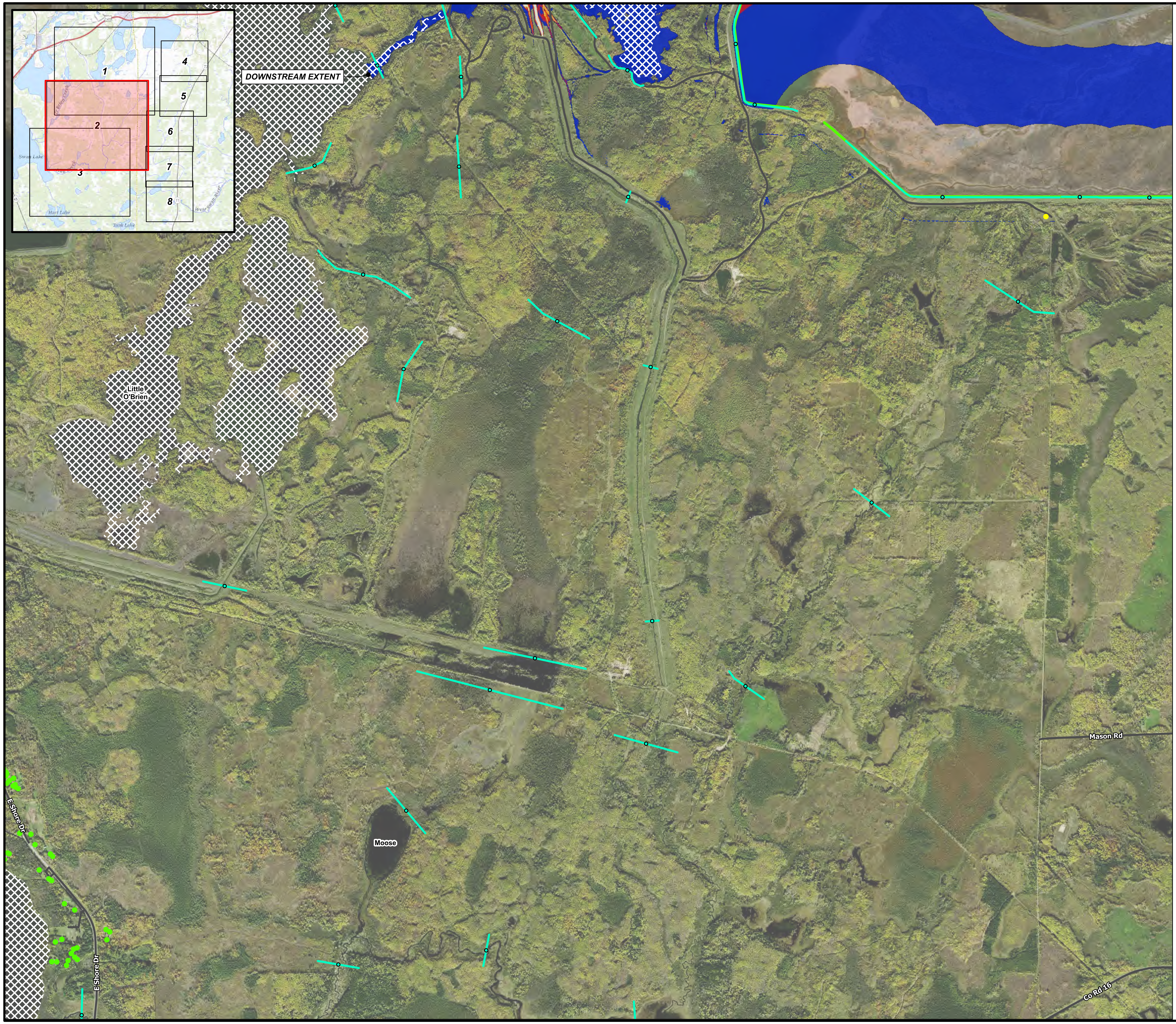

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Cross-Section Centerpoint

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PREPARED: J. HANSEN	Page Number: 2 of 8
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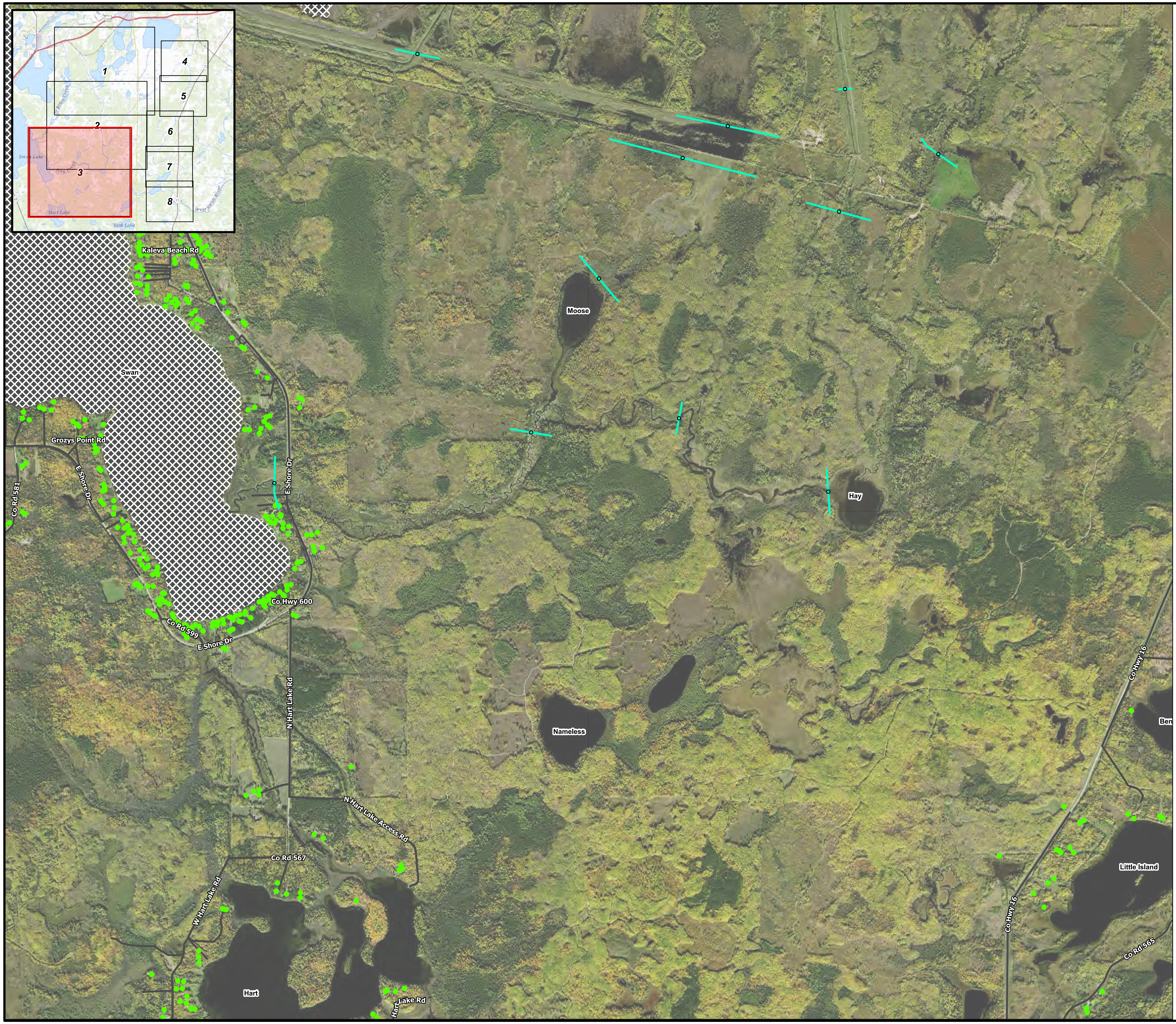

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Stage 2 Exterior Alignment

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

N

0 1,000 2,000 US Feet

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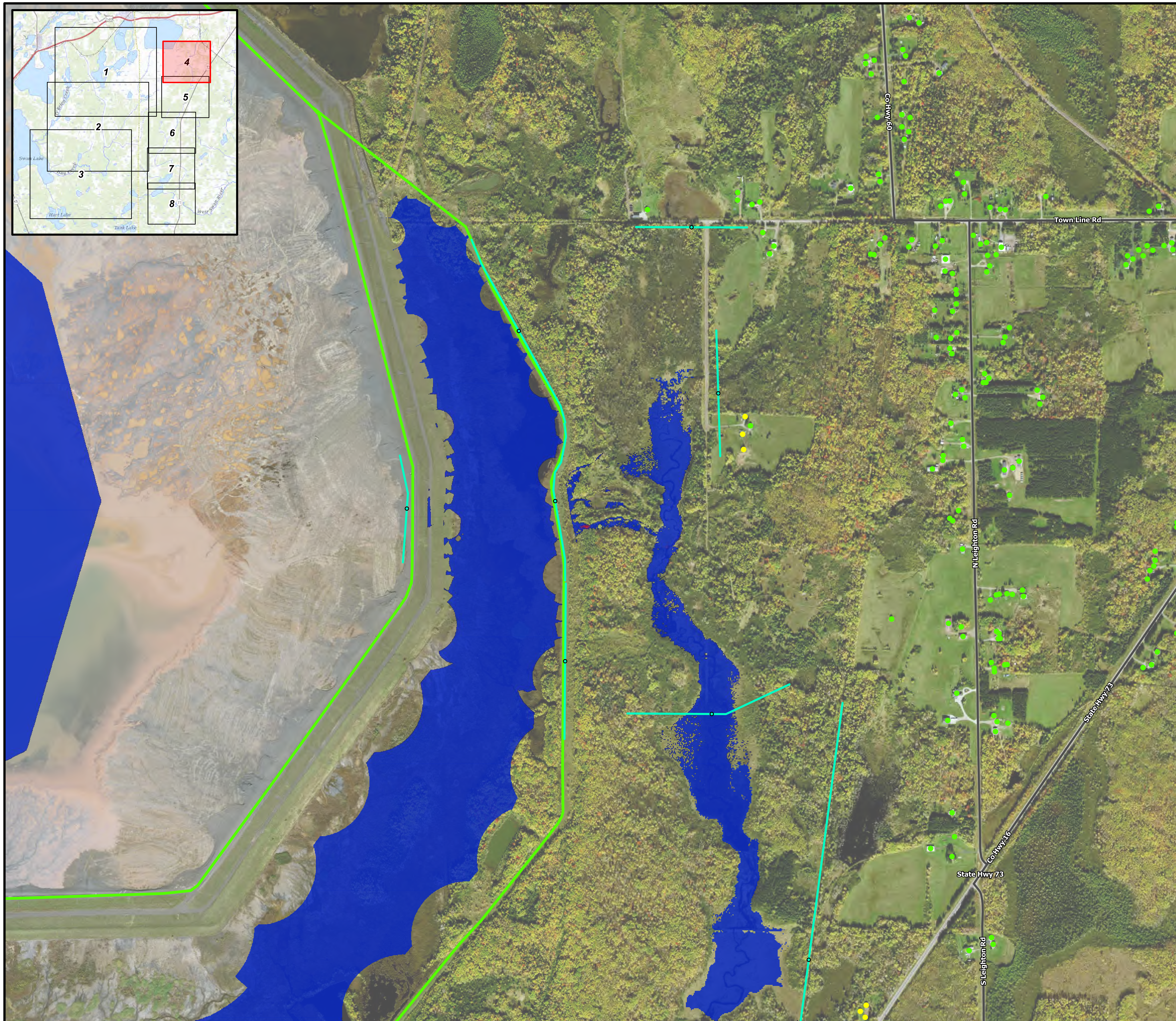

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- Stage 2 Exterior Alignment
- Cross-Section Lines
- Cross-Section Centerpoint

Existing Building Structures

- Within 500ft of Breach Extent
- Outside of 500ft of Breach Extent

Max Depth Values (ft)

- > 1
- 1.01 - 4
- 4.01 - 6
- 6.01 - 8
- 8.01 - 10
- < 10

N

0 500 1,000 US Feet

Scale: 1 inch = 500 feet

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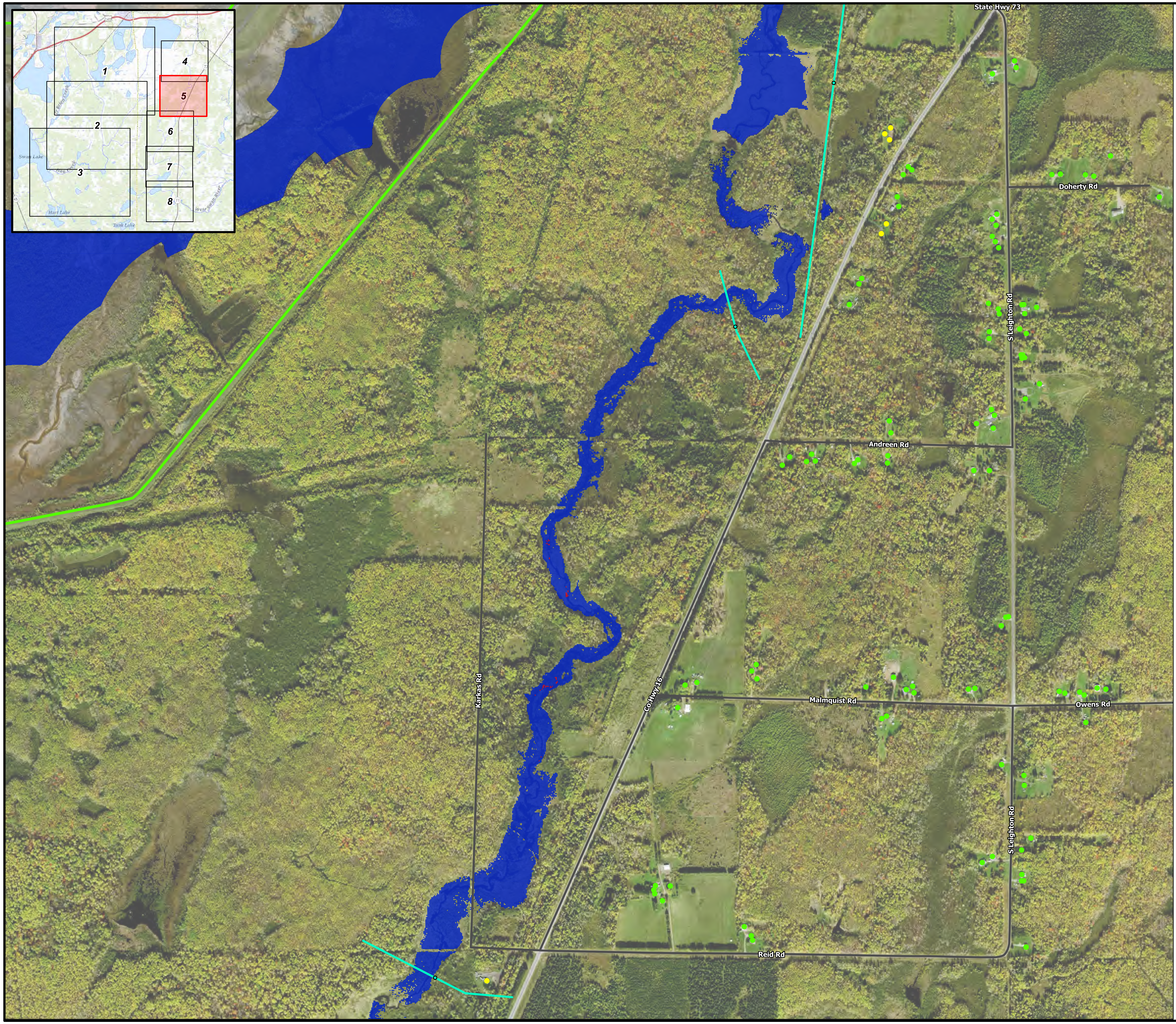
DATUM: NAD 1983 2011
PROJECTION: LAMBERT CONFORMAL CONIC

DESIGNED: C. FRITSCH	**INTERMEDIATE 'SD' CLEANWATER CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	Page Number: 4 of 8
REVIEWED: M. WHEELER	
APPROVED: -	
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

GEI Consultants



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PREPARED: J. HANSEN	Page Number: 5 of 8
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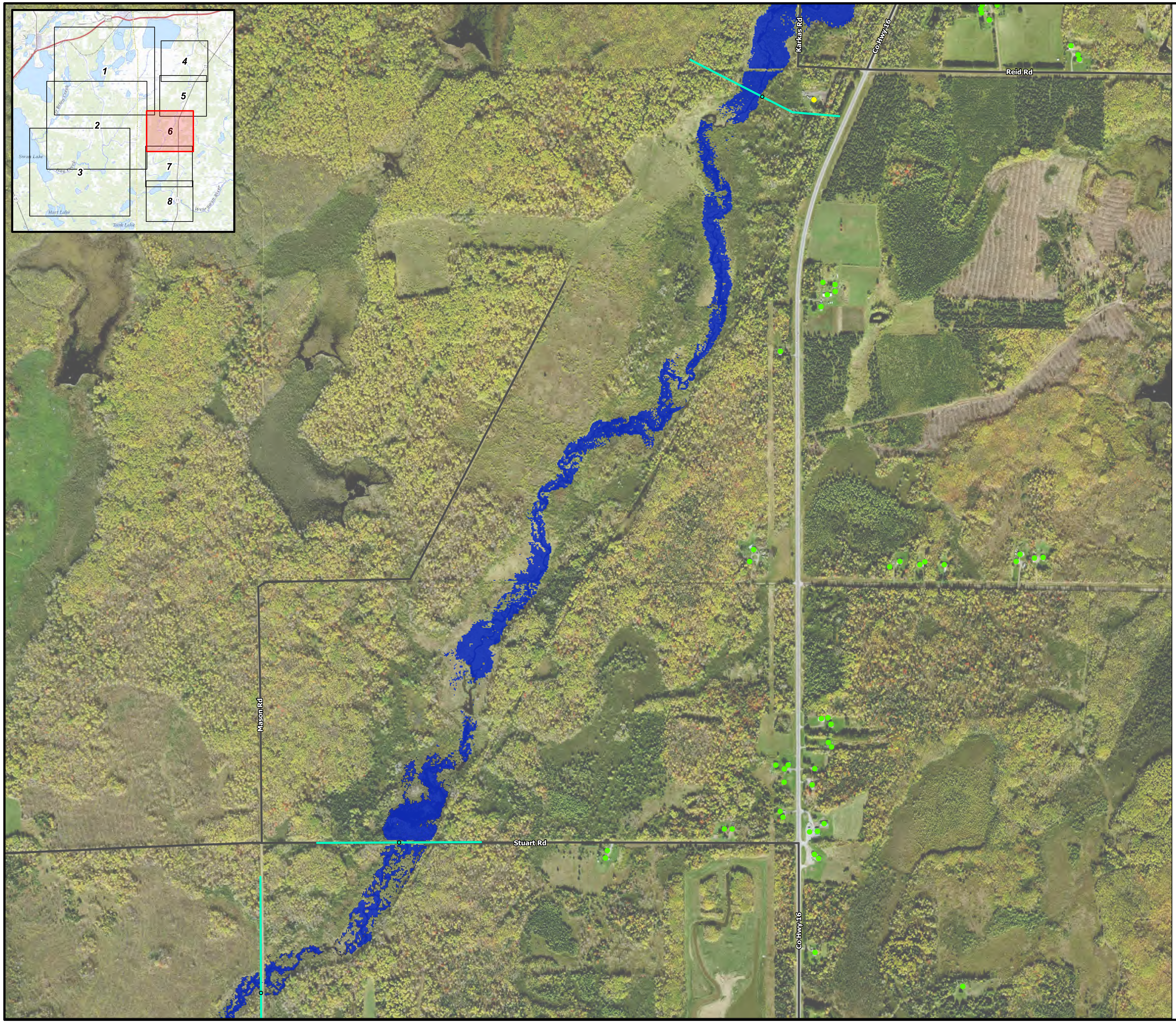

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Stage 2 Exterior Alignment

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

Max Depth Values (ft)

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PREPARED: J. HANSEN	Page Number: 6 of 8
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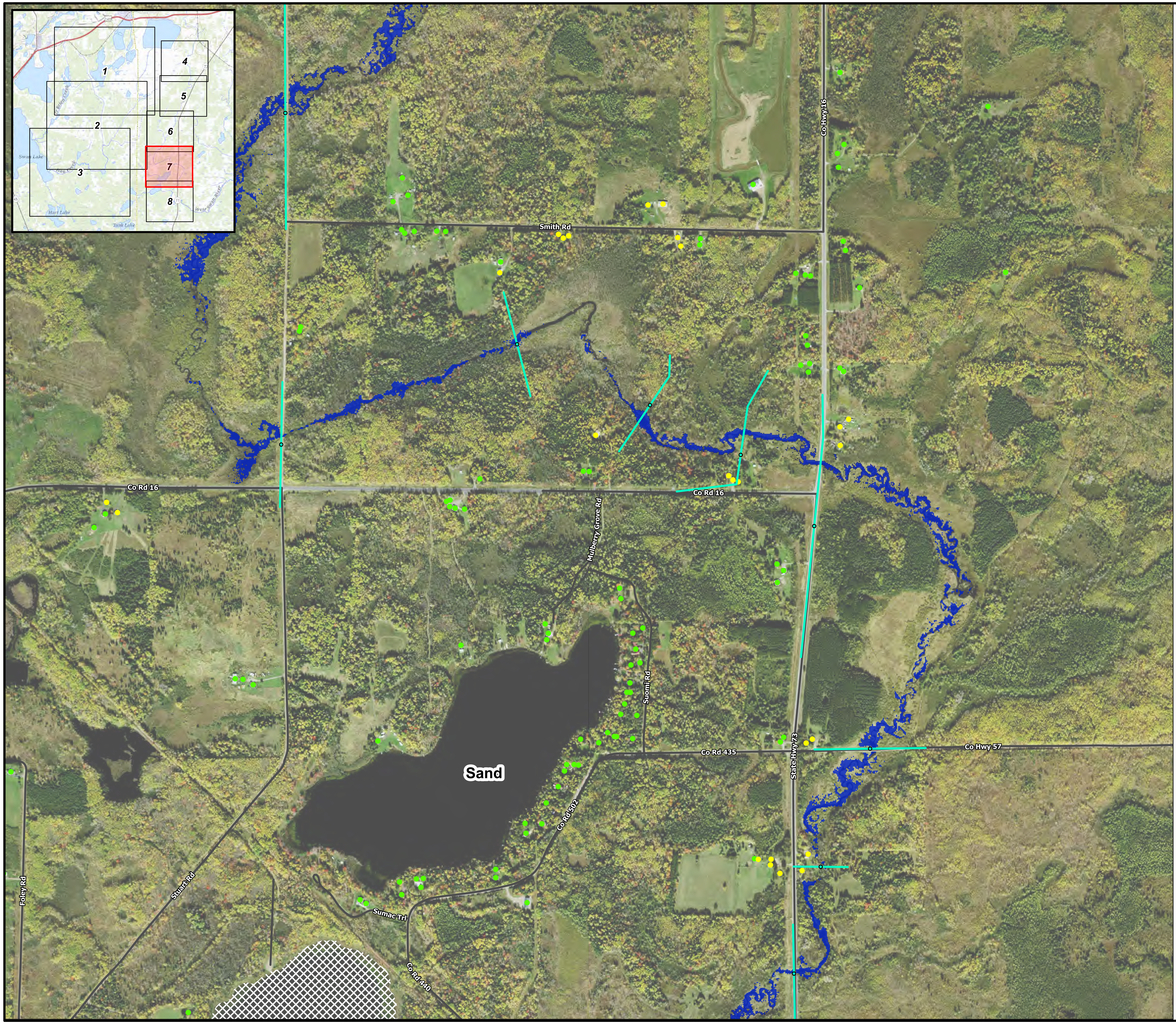
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	GEI Consultants
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION



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Stage 2 Exterior Alignment

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Cross-Section Centerpoint

Existing Building Structures

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

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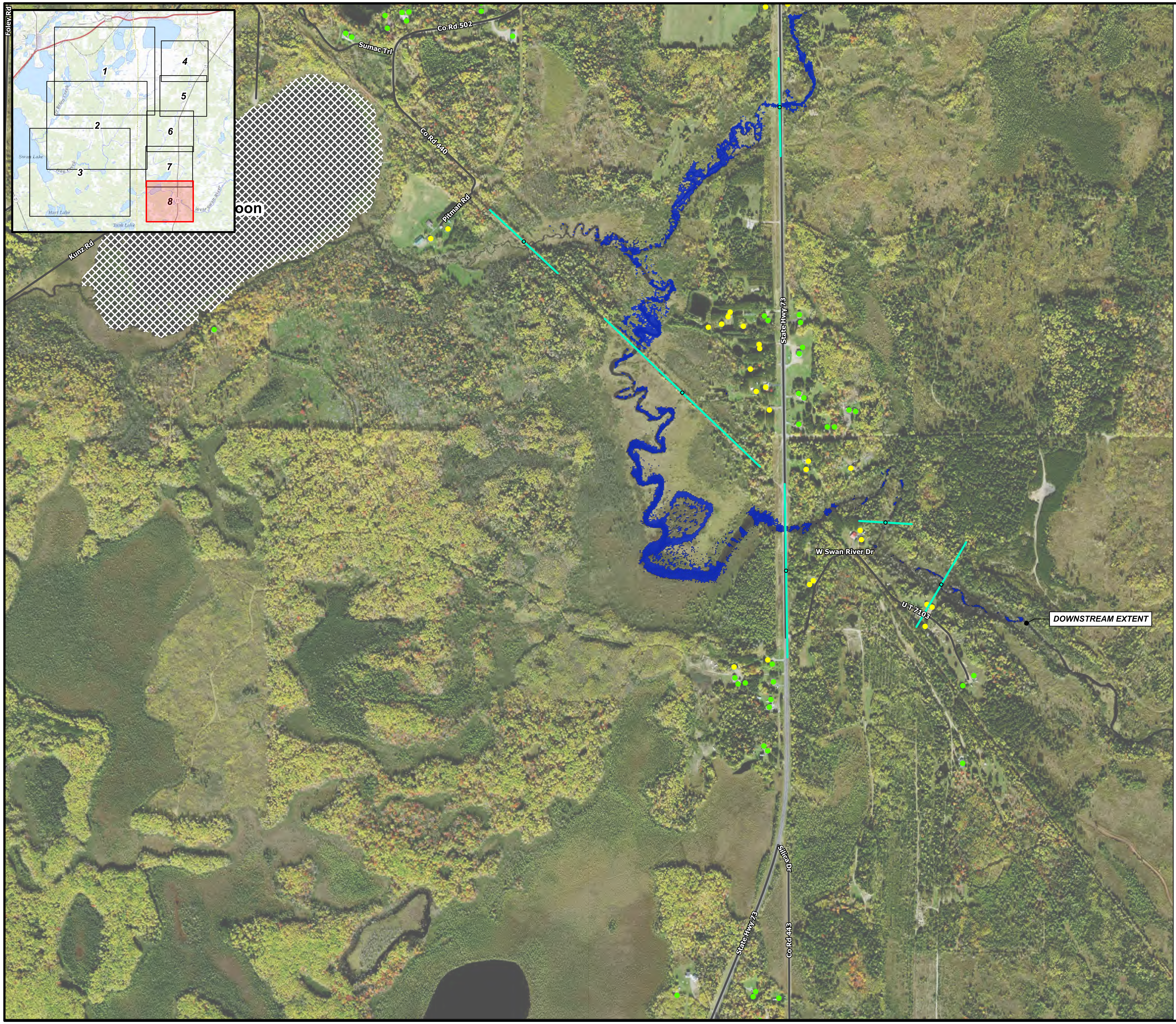
DESIGNED: C. FRITSCH	**INTERMEDIATE 'SD' CLEANWATER CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 7 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	GEI Consultants
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION



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Stage 2 Exterior Alignment

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

Max Depth Values (ft)

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PREPARED: J. HANSEN	Page Number: 8 of 8
REVIEWED: M. WHEELER	
APPROVED: -	
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	GEI Consultants
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

DESIGNED: C. FRITSCH	INTERMEDIATE 'SD' MUDFLOW CASCADE FAILURE - OVERVIEW
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	
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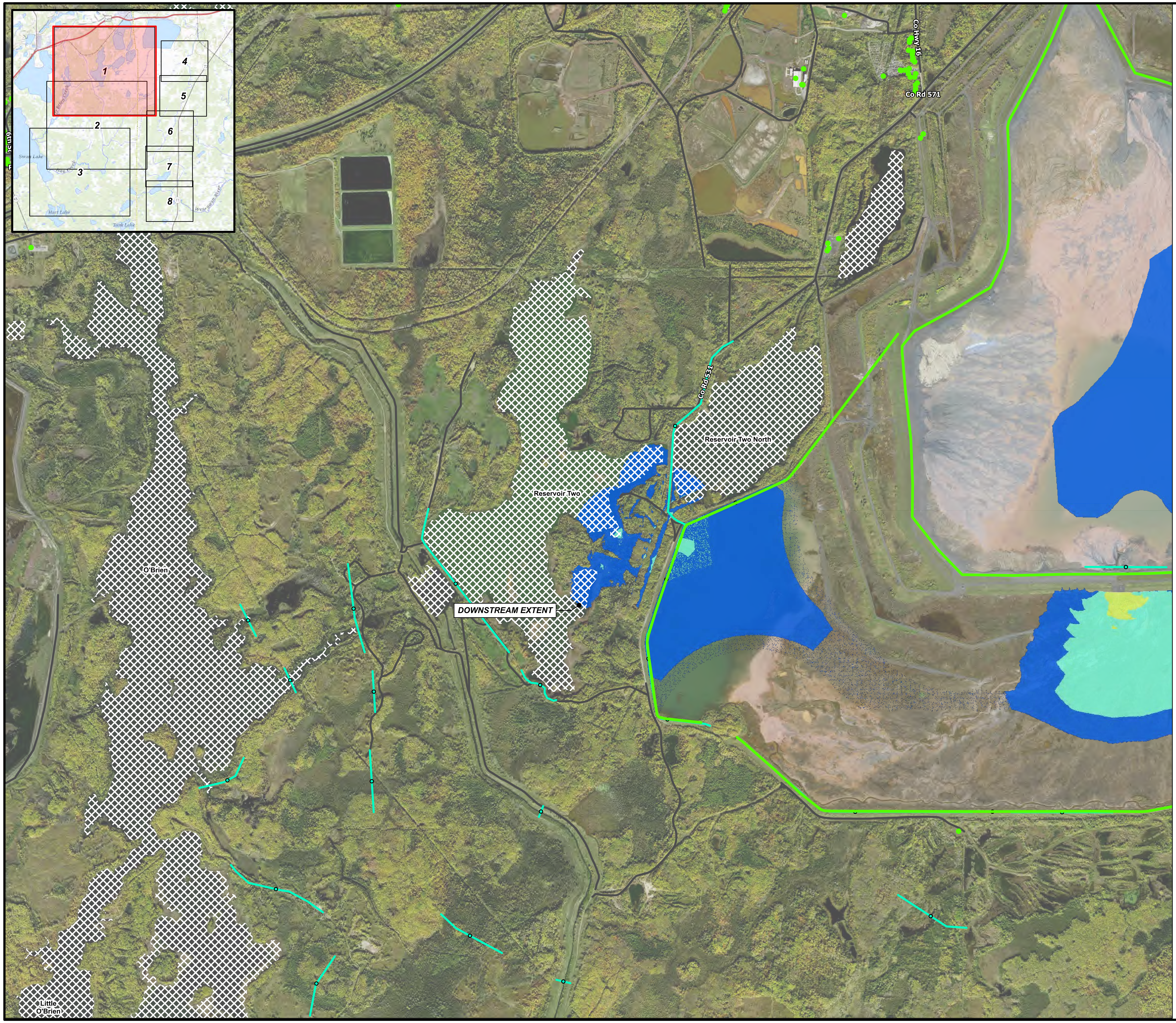

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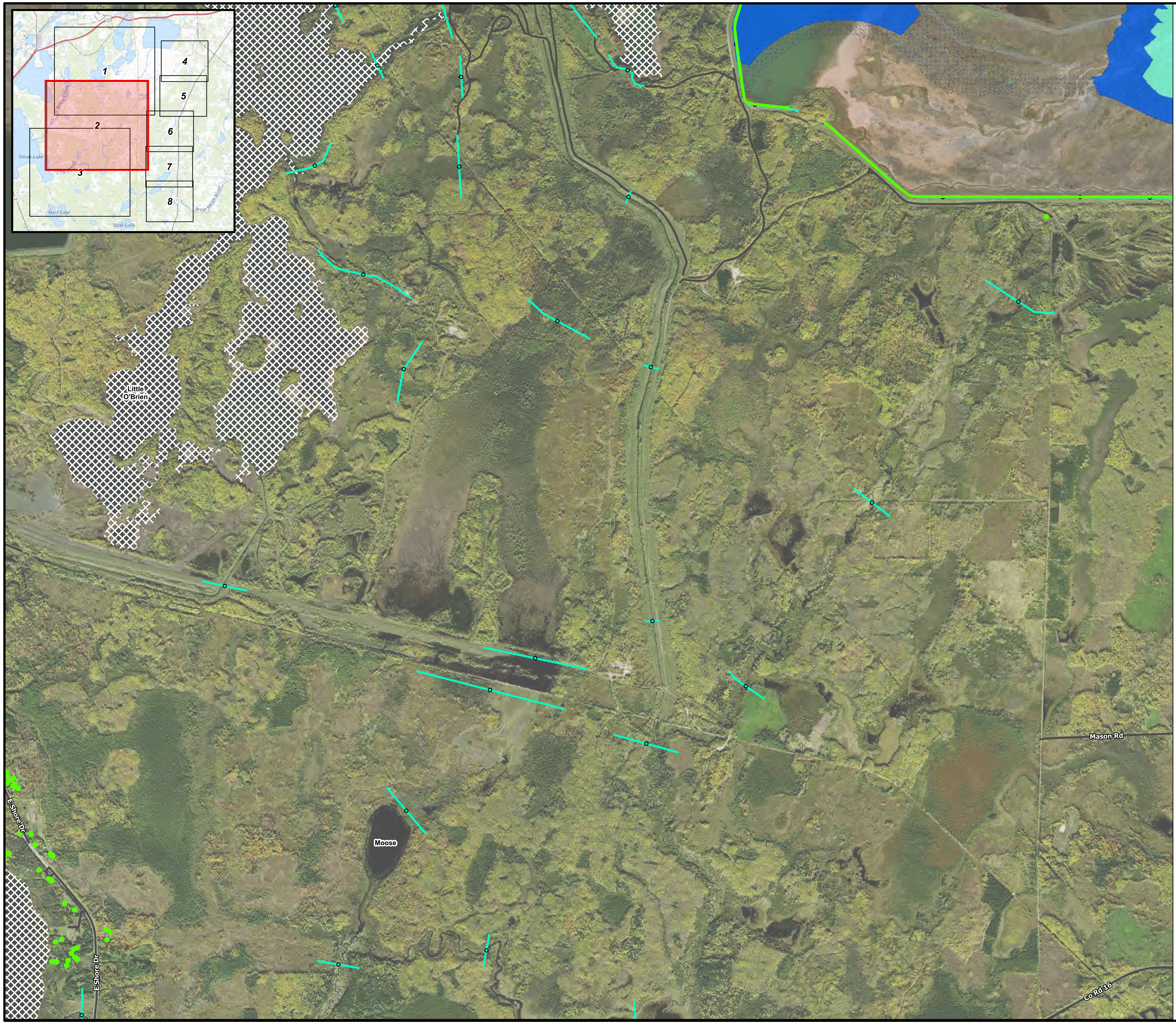

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Cross-Section Lines

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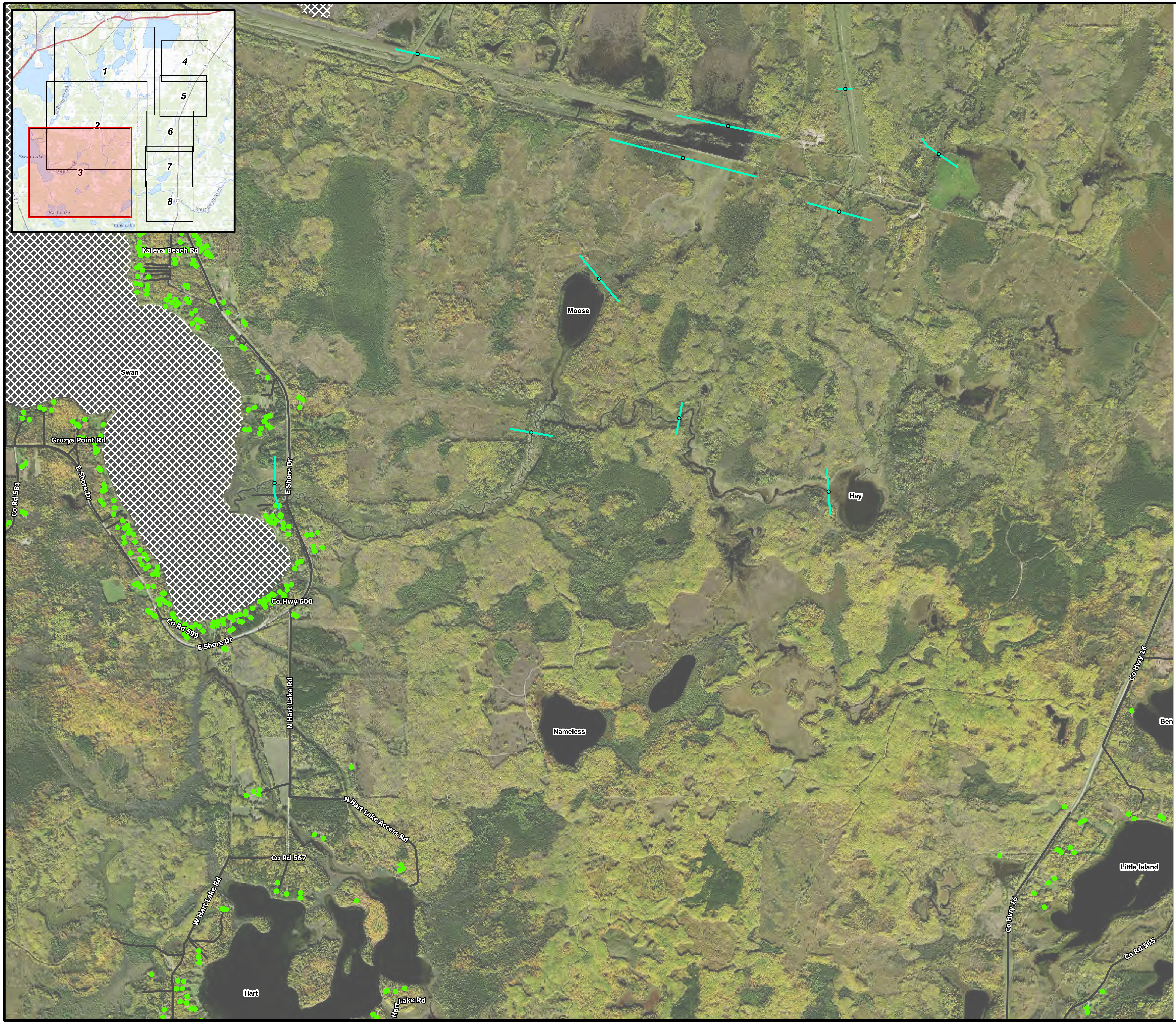
DESIGNED: C. FRITSCH	**INTERMEDIATE 'SD' MUDFLOW CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 2 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

GEI Consultants



LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Stage 2 Exterior Alignment

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

N

0 1,000 2,000 US Feet

Scale: 1 inch = 1,100 feet

Value

> 1

1.01 - 4

4.01 - 6

6.01 - 8

8.01 - 10

< 10

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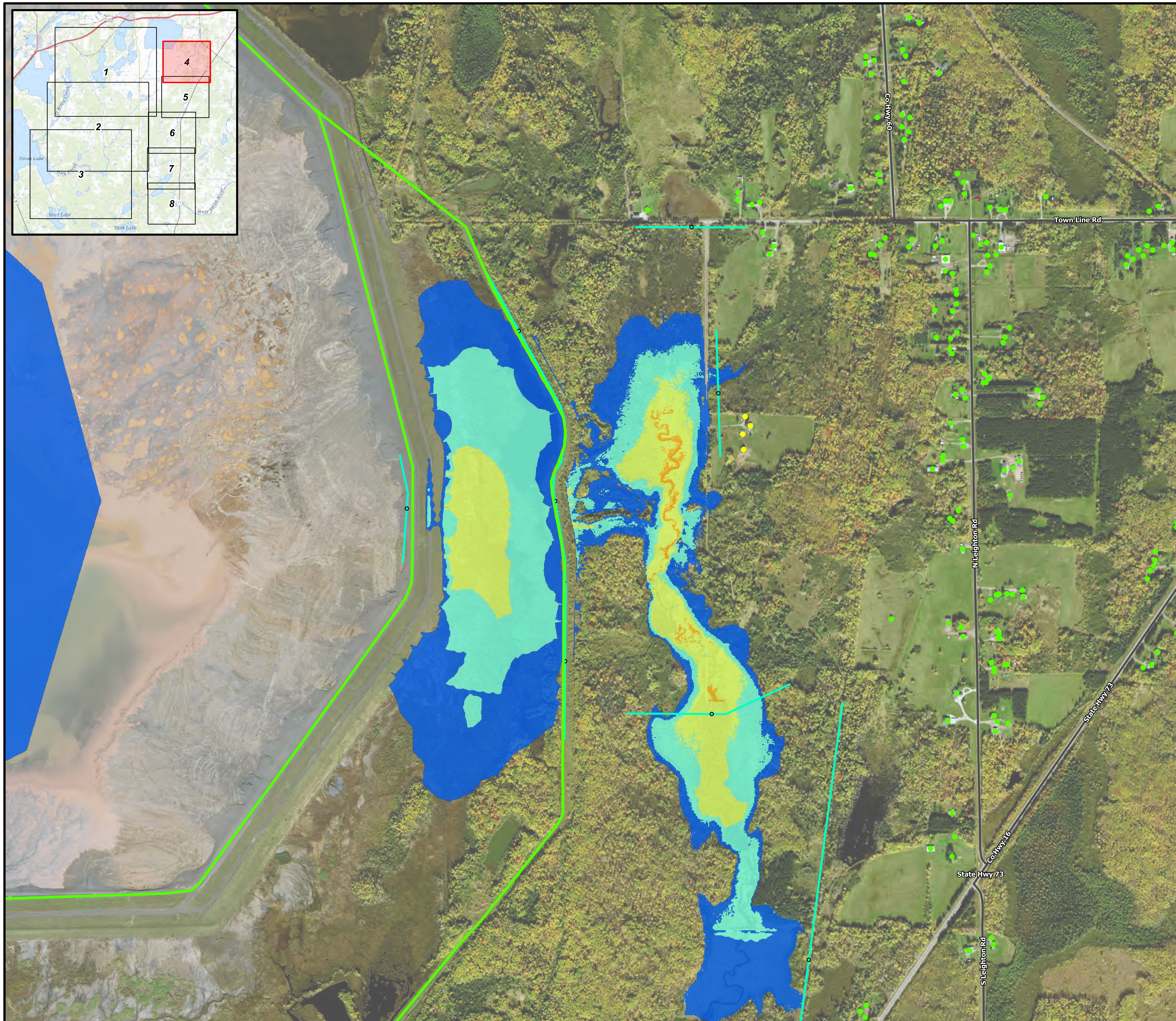

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Stage 2 Exterior Alignment
Cross-Section Lines
Cross-Section Centerpoint

Existing Building Structures
Within 500ft of Breach Extent
Outside of 500ft of Breach Extent

0 500 1,000 US Feet
Scale: 1 inch = 500 feet

Value
> 1
1.01 - 4
4.01 - 6
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8.01 - 10
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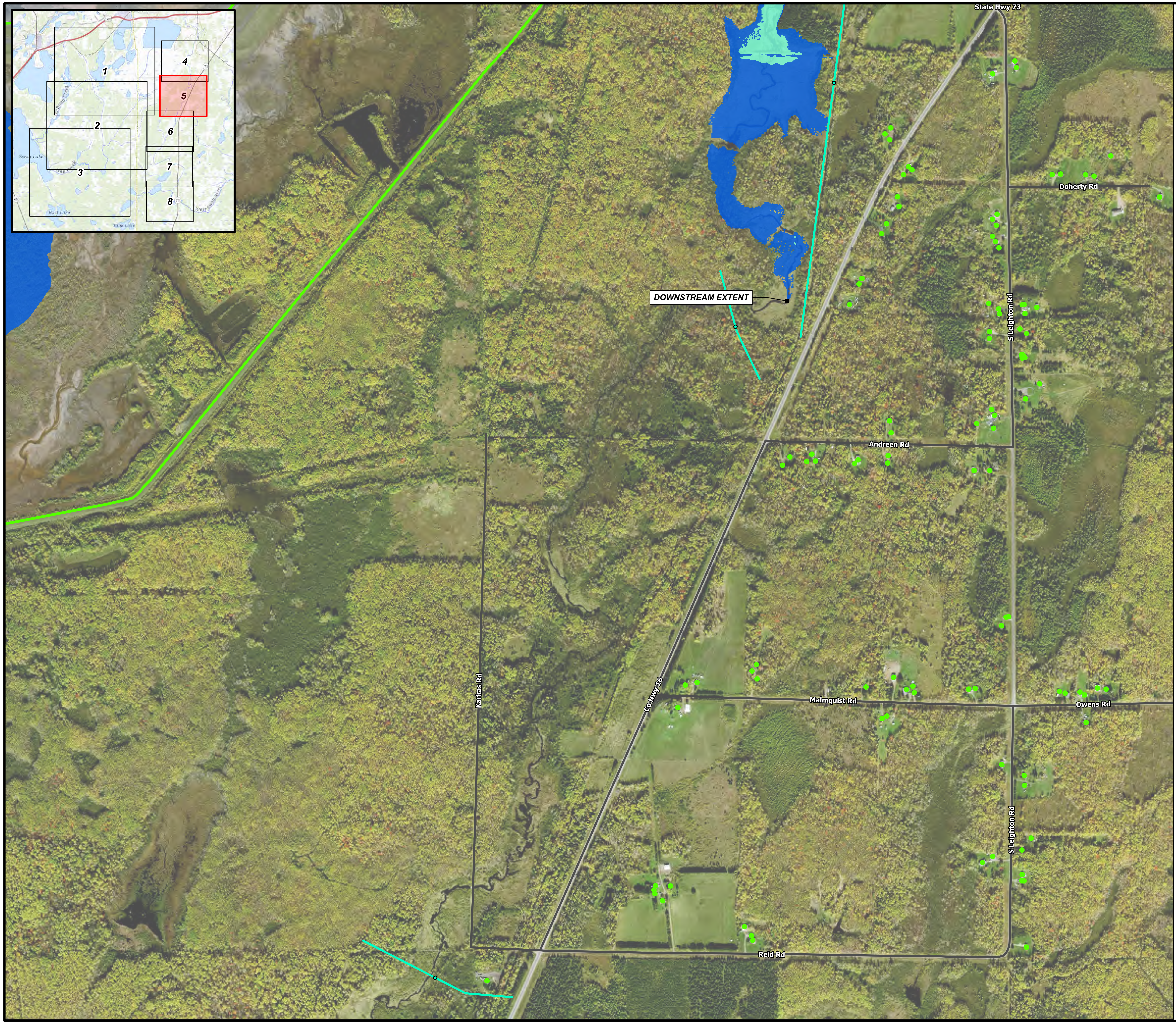

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Existing Building Structures

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> 1
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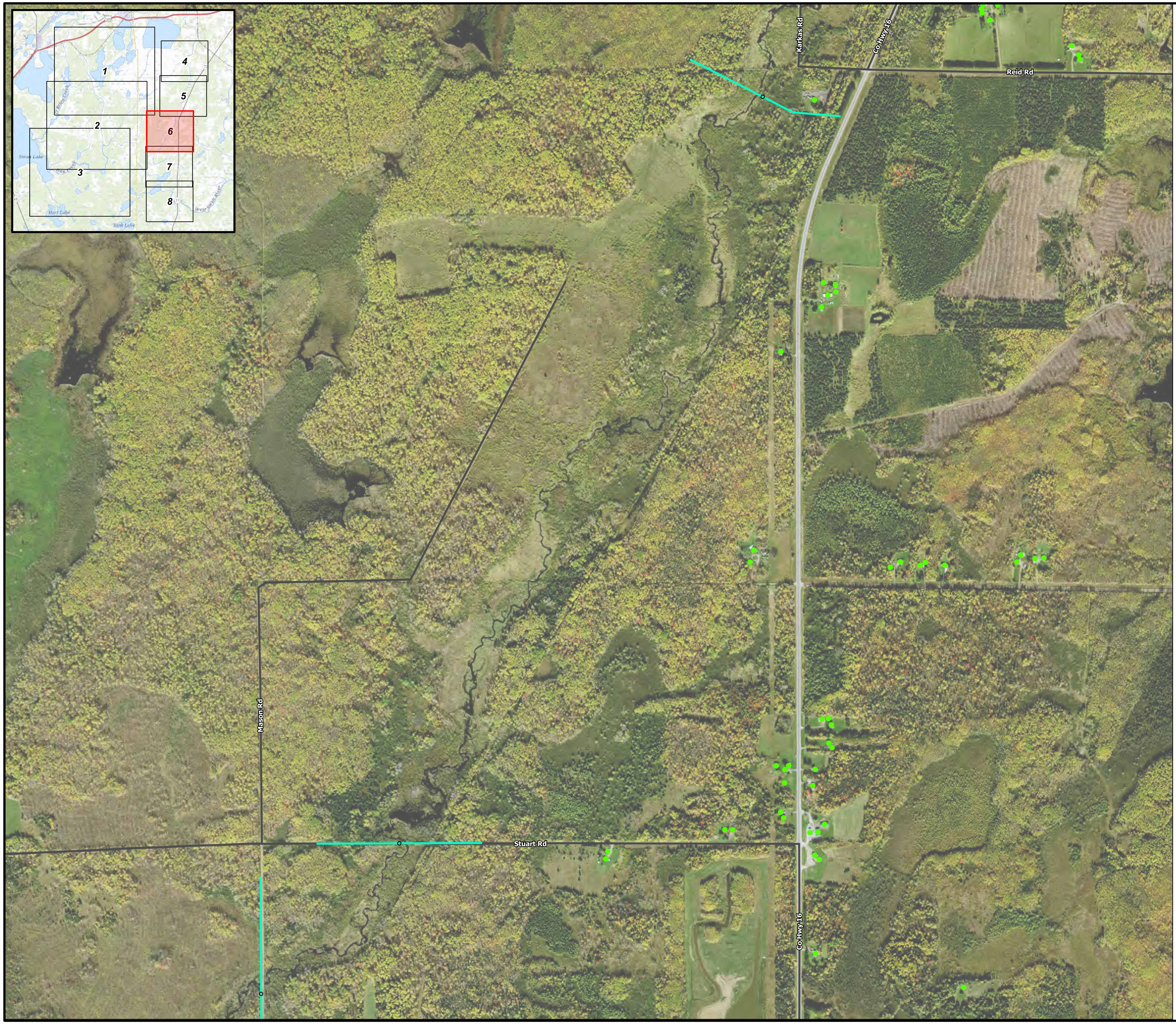

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Existing Building Structures

- Within 500ft of Breach Extent
- Outside of 500ft of Breach Extent

Value
> 1
1.01 - 4
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6.01 - 8
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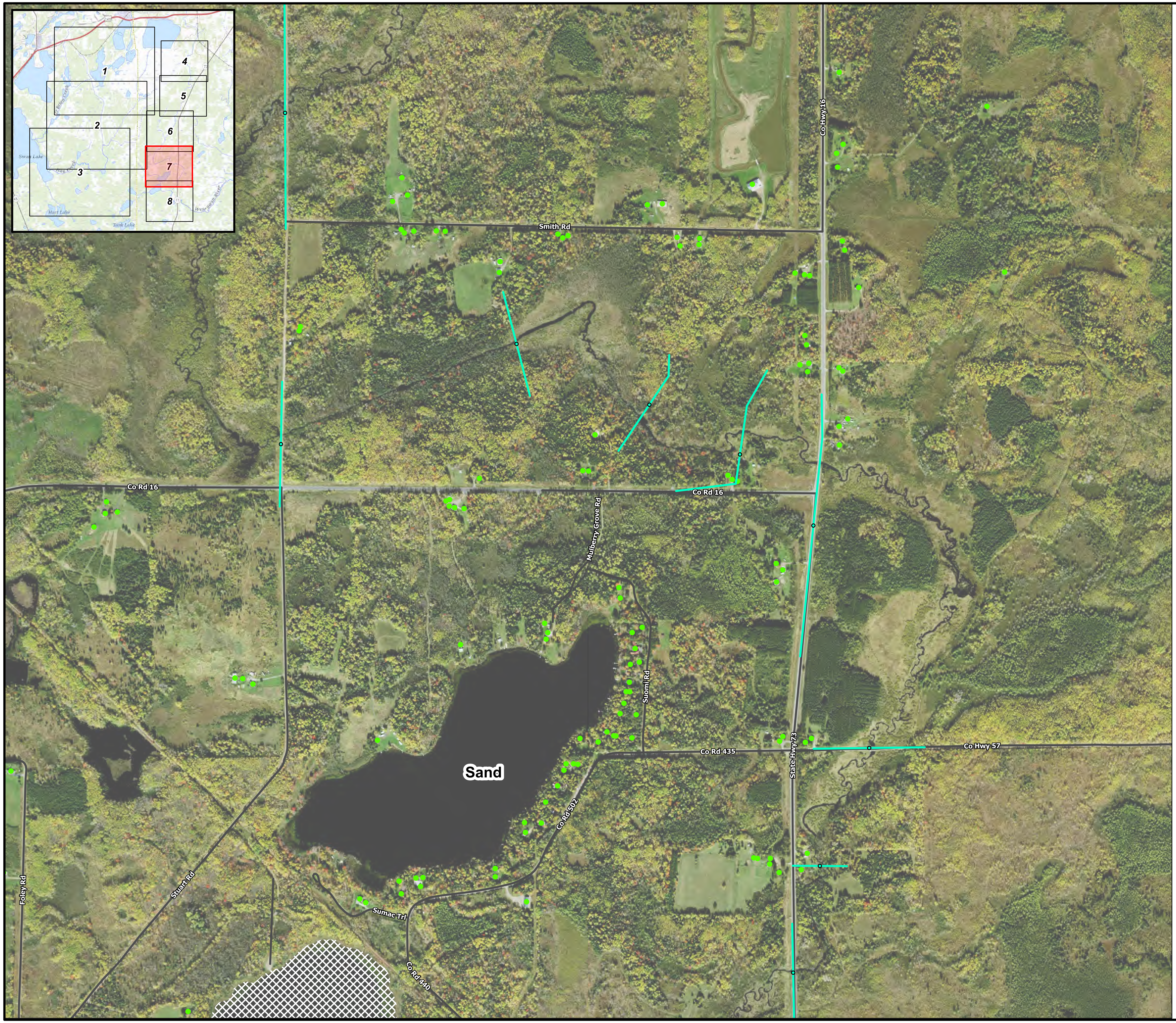

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Stage 2 Exterior Alignment

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

0 500 1,000 US Feet

Scale: 1 inch = 500 feet

Value

> 1

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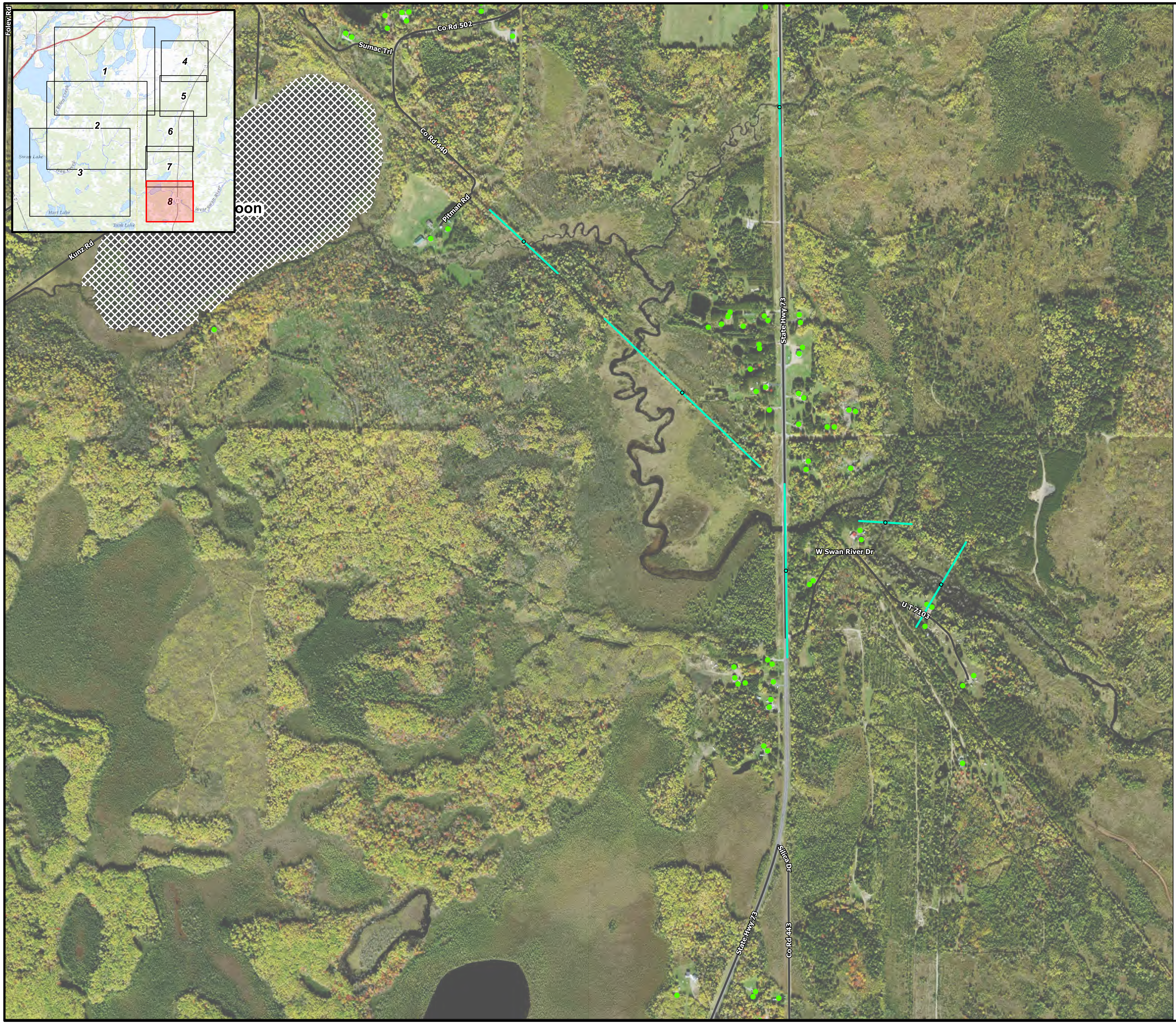

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Existing Building Structures

- Within 500ft of Breach Extent
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1
2
3
4
5
6
7
8
Reservoir Two
Reservoir Two North
O'Brien
Little O'Brien
Unnamed (O'Brien Res. #4)
KEEWATIN, MN
SILICA, MN
Moose
Hay
Swan
Sand
Coon
Nameless
Bengal
Little Island
Hart
Downstream Boundary of Mapping Extent
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REVIEWED: M. WHEELER
APPROVED: -
DATE: FEBRUARY 2023
REVISION: 0
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EXISTING 'PMF' CLEANWATER CASCADE FAILURE - OVERVIEW
KEETAC TAILINGS BASIN
KEEWATIN, MINNESOTA
UNITED STATES STEEL CORPORATION
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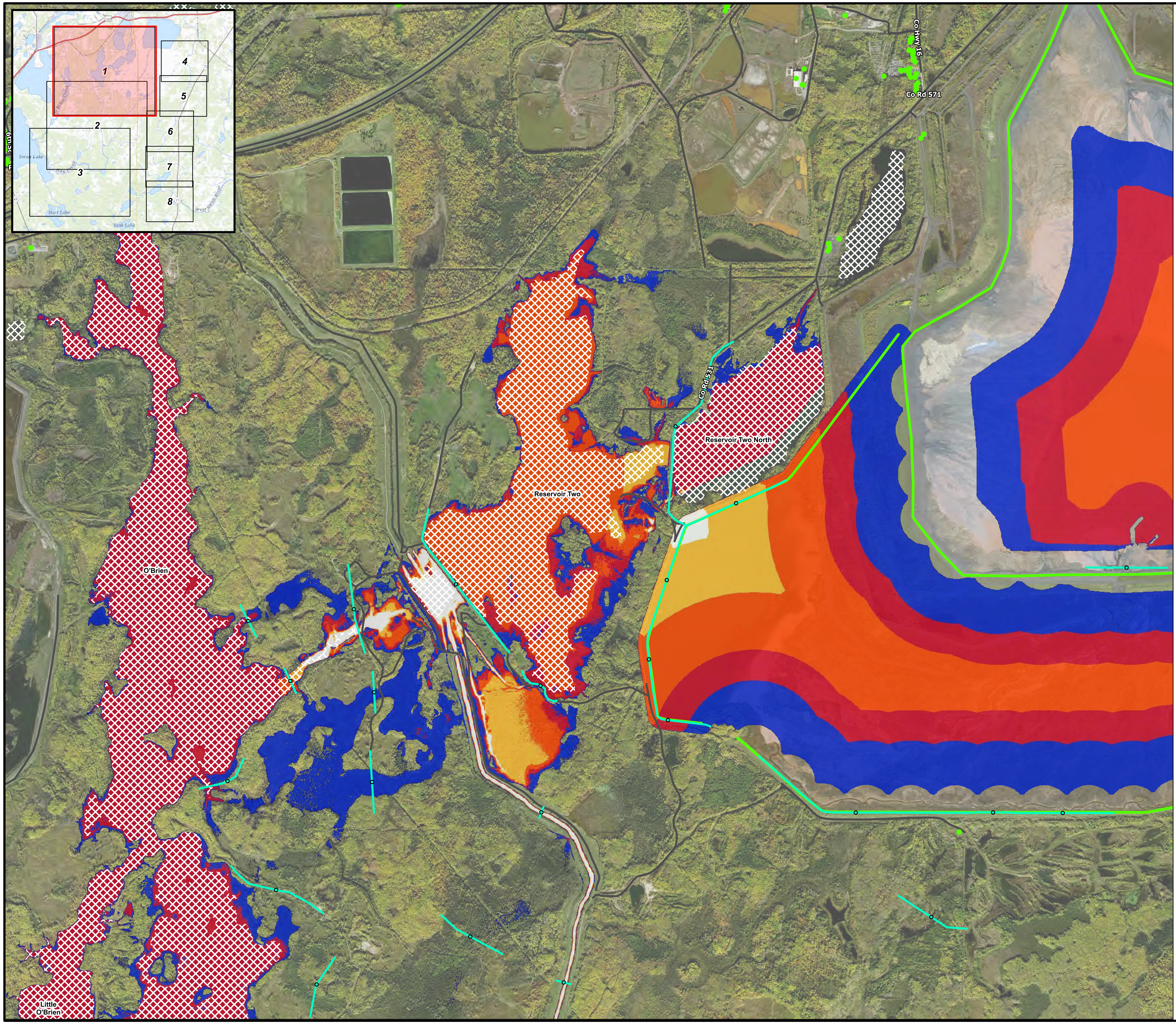

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Stage 2 Exterior Alignment
Cross-Section Centerpoint
Cross-Section Lines

Existing Building Structures

Within 500ft of Breach Extent
Outside of 500ft of Breach Extent

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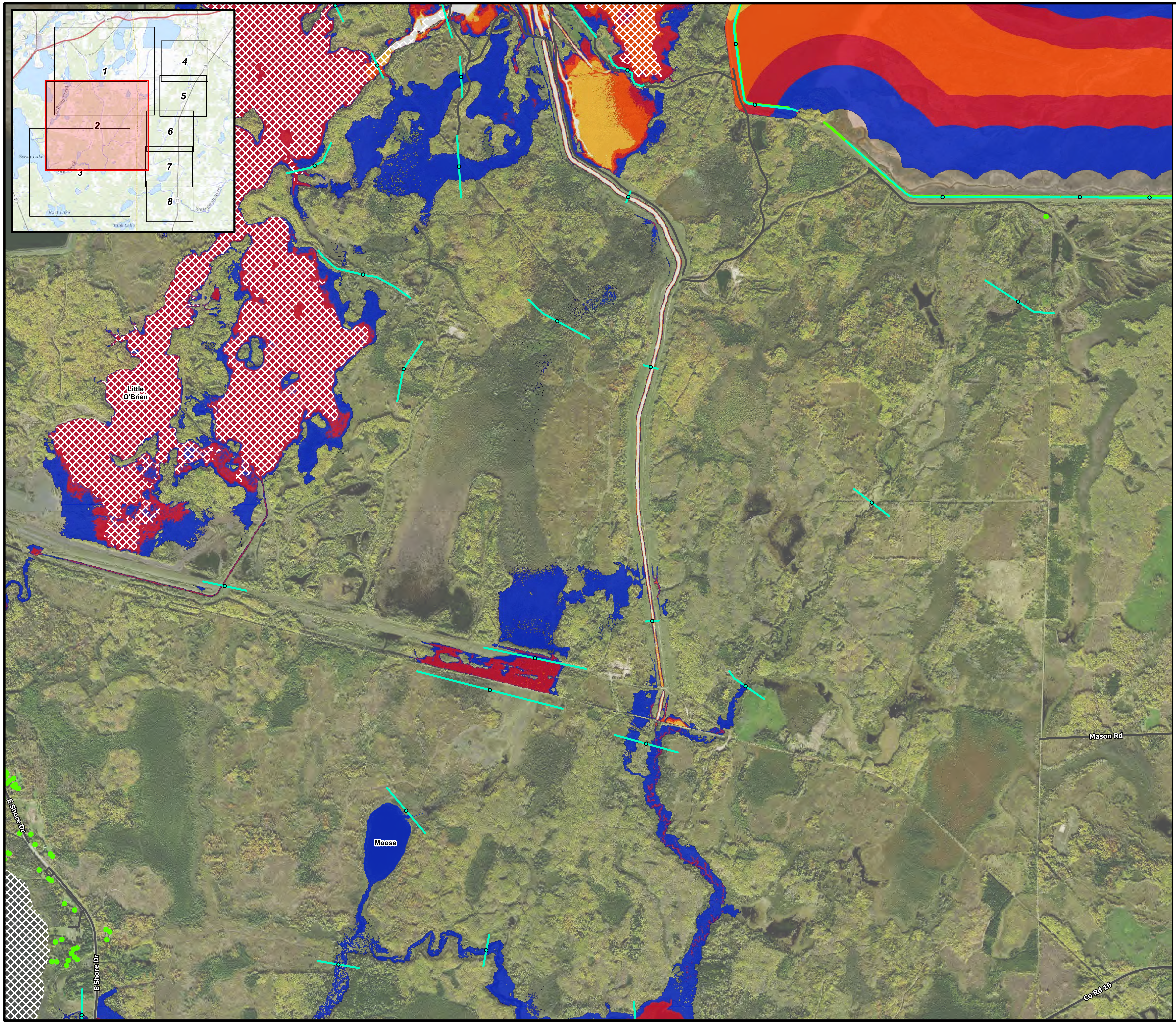
DESIGNED: C. FRITSCH	**FINAL BUILDOUT 'PMF' CLEANWATER CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 1 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

GEI Consultants



LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Stage 2 Exterior Alignment

Cross-Section Centerpoint

Cross-Section Lines

Existing Building Structures

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

Max Depth Values (ft)

> 1

1.01 - 4

4.01 - 6

6.01 - 8

8.01 - 10

< 10

N

0 1,000 2,000 US Feet

Scale: 1 inch = 1,100 feet

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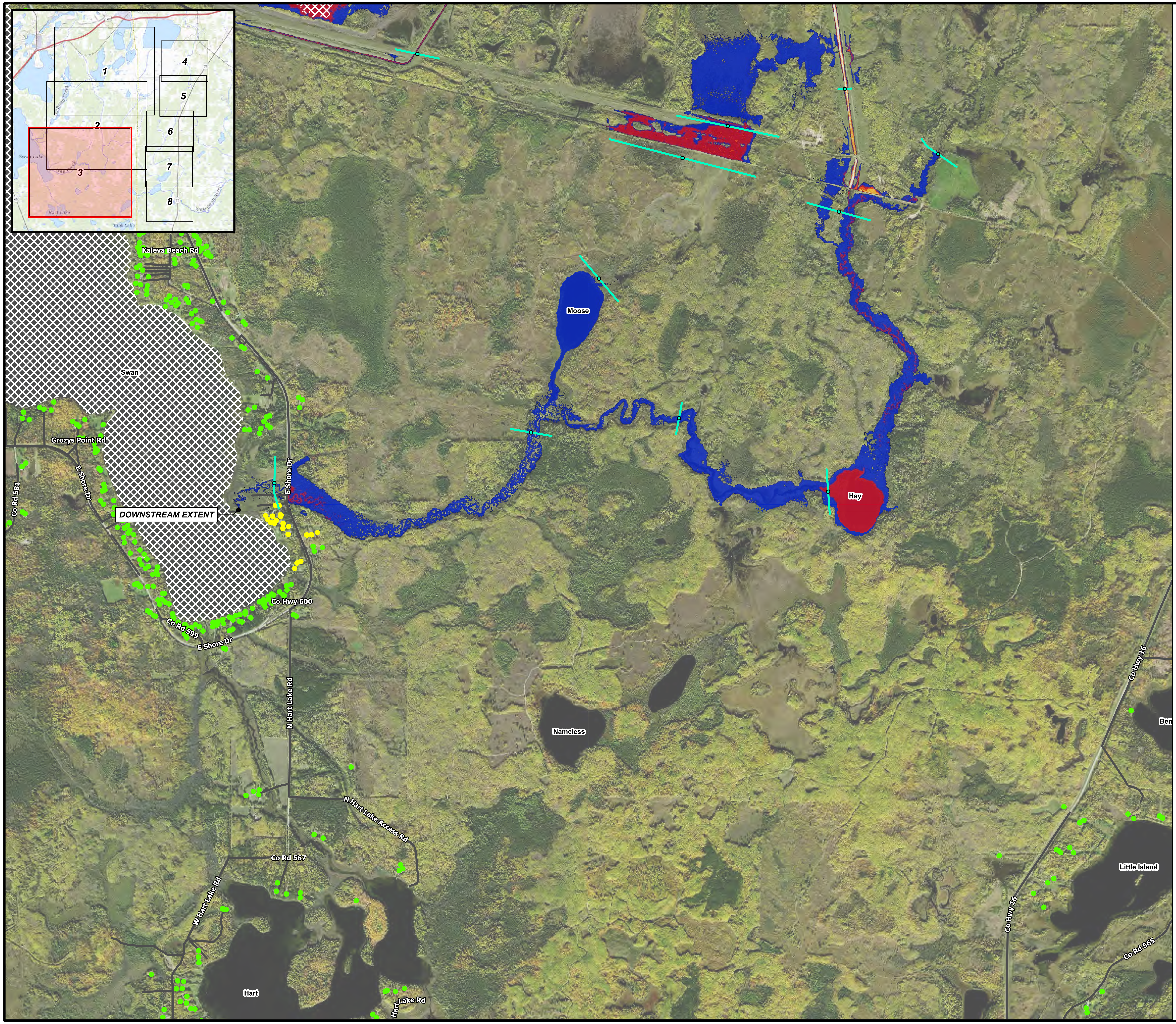

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Cross-Section Centerpoint

Cross-Section Lines

Existing Building Structures

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

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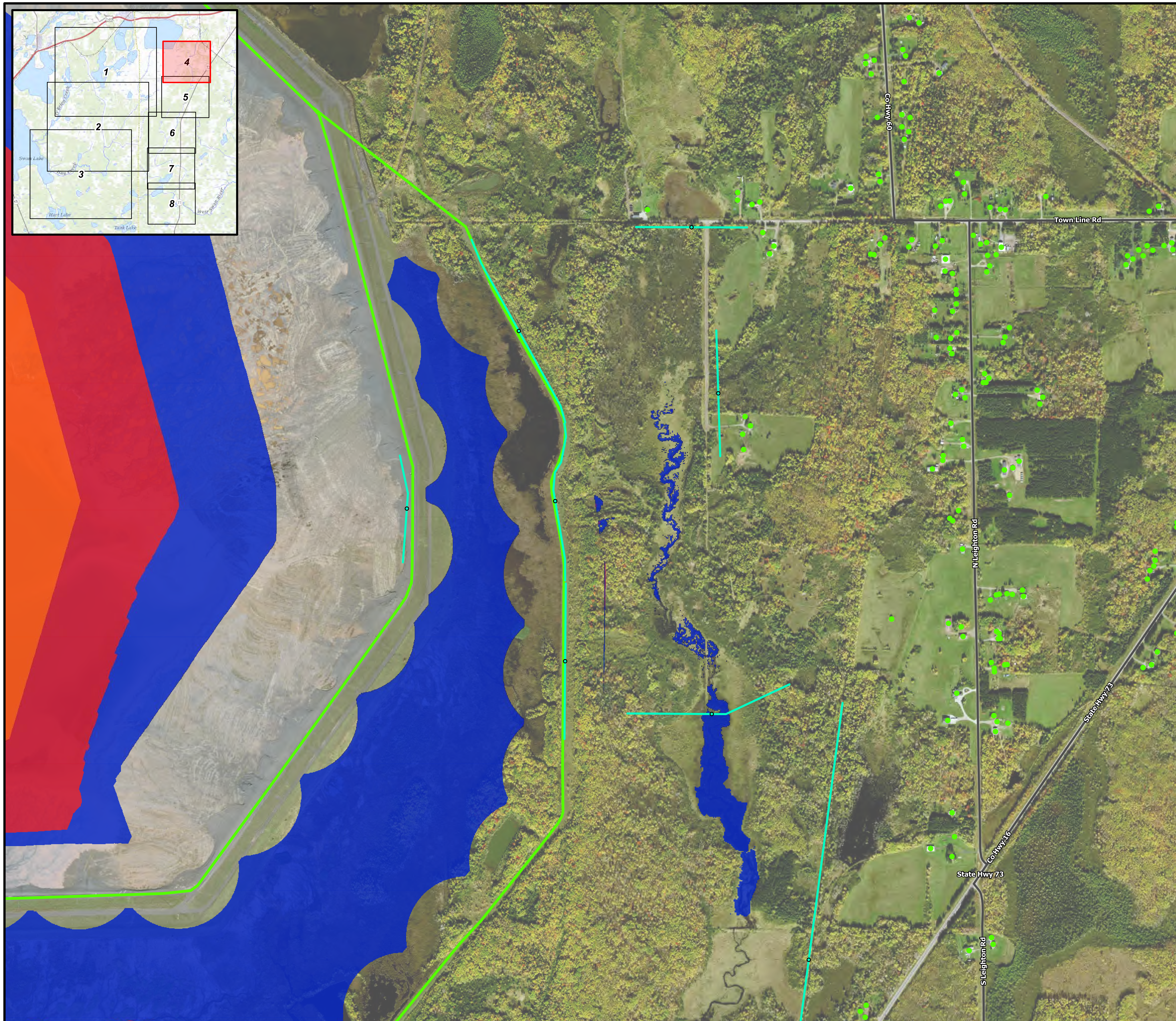

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- Stage 2 Exterior Alignment
- Cross-Section Centerpoint
- Cross-Section Lines

Existing Building Structures

- Within 500ft of Breach Extent
- Outside of 500ft of Breach Extent

Max Depth Values (ft)

- > 1
- 1.01 - 4
- 4.01 - 6
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0 500 1,000 US Feet

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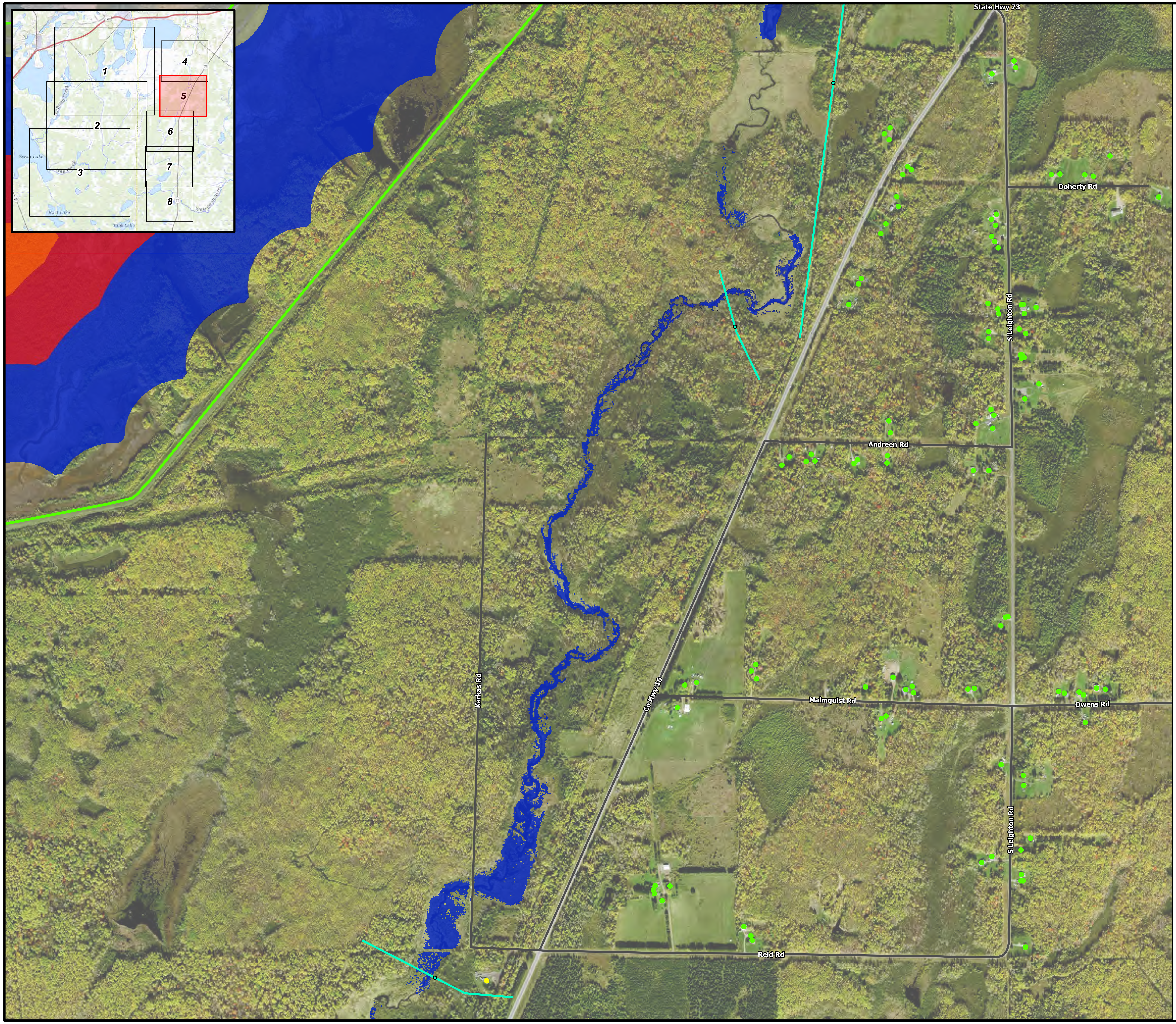

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Waterbodies with inaccurate data (Due to lack of bathymetry)

Stage 2 Exterior Alignment

Cross-Section Centerpoint

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Existing Building Structures

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

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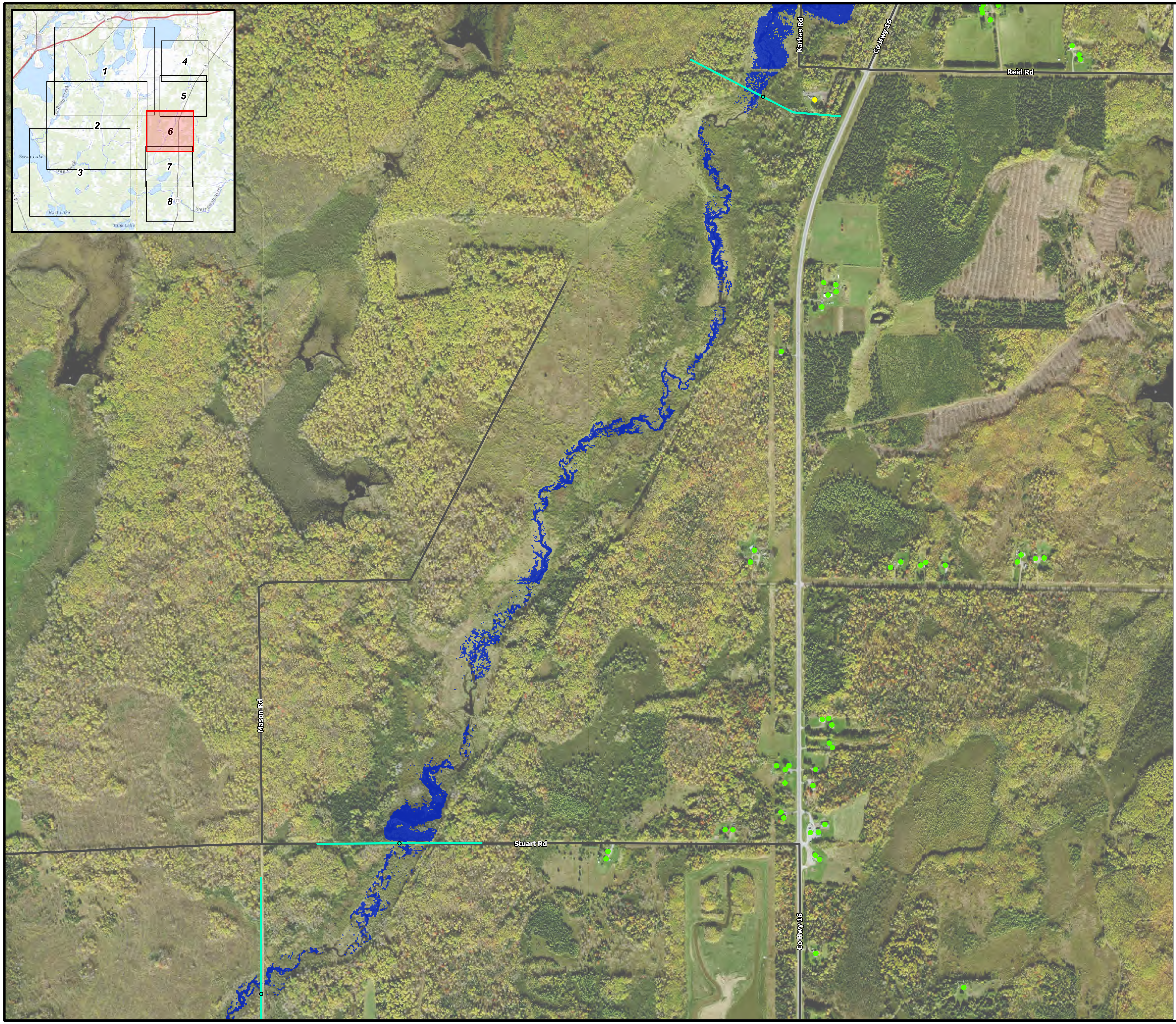

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0 500 1,000 US Feet
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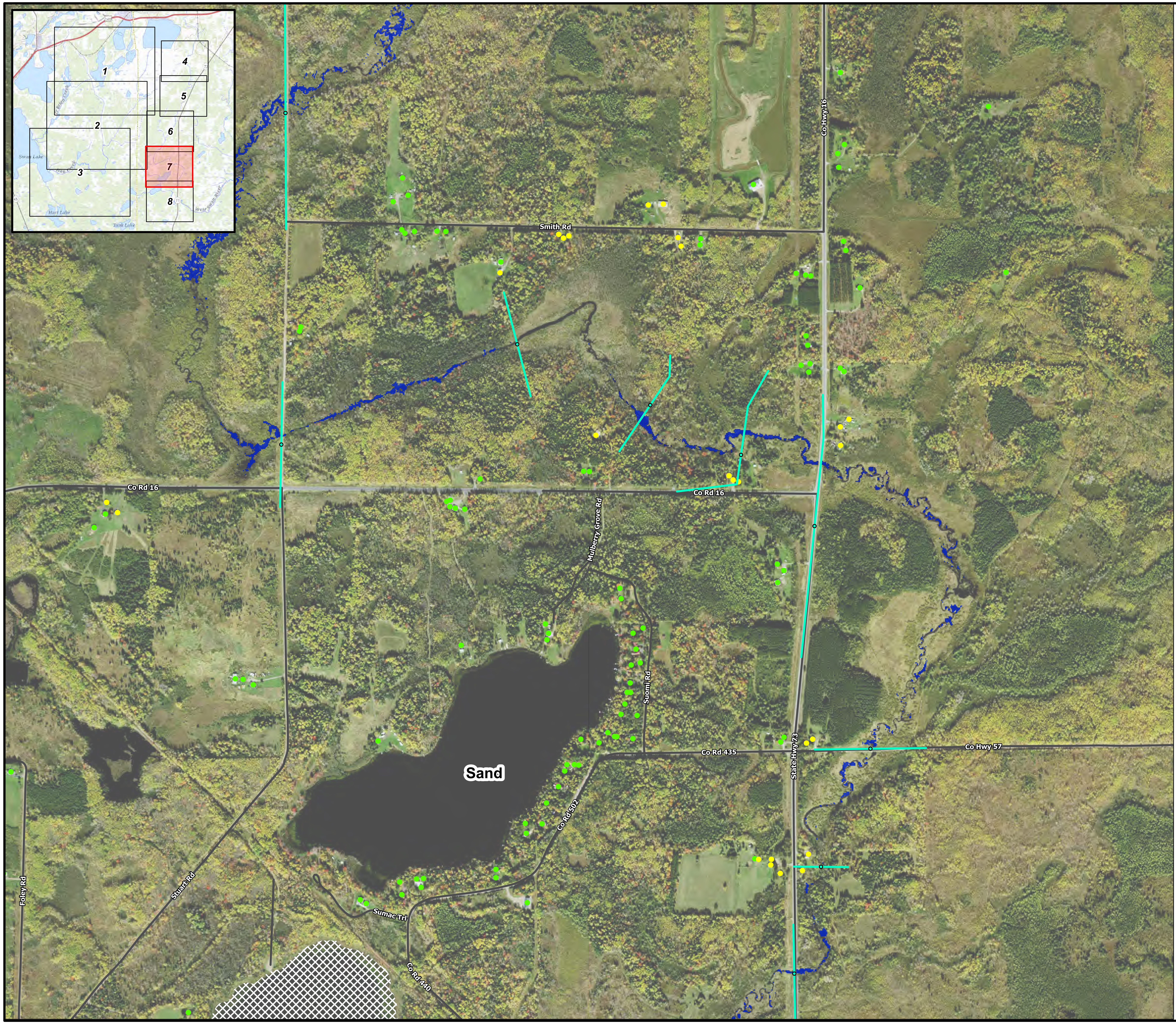

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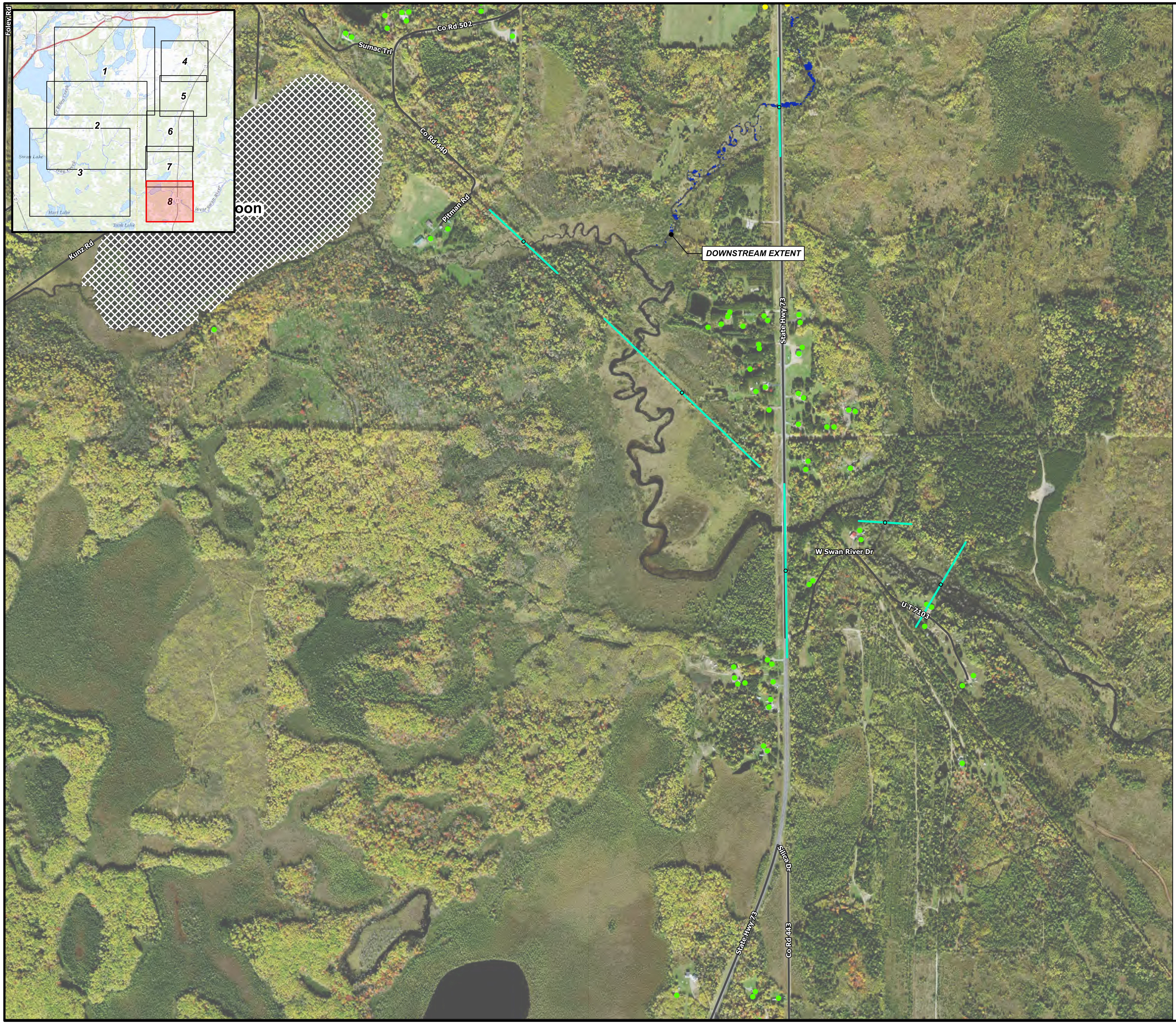

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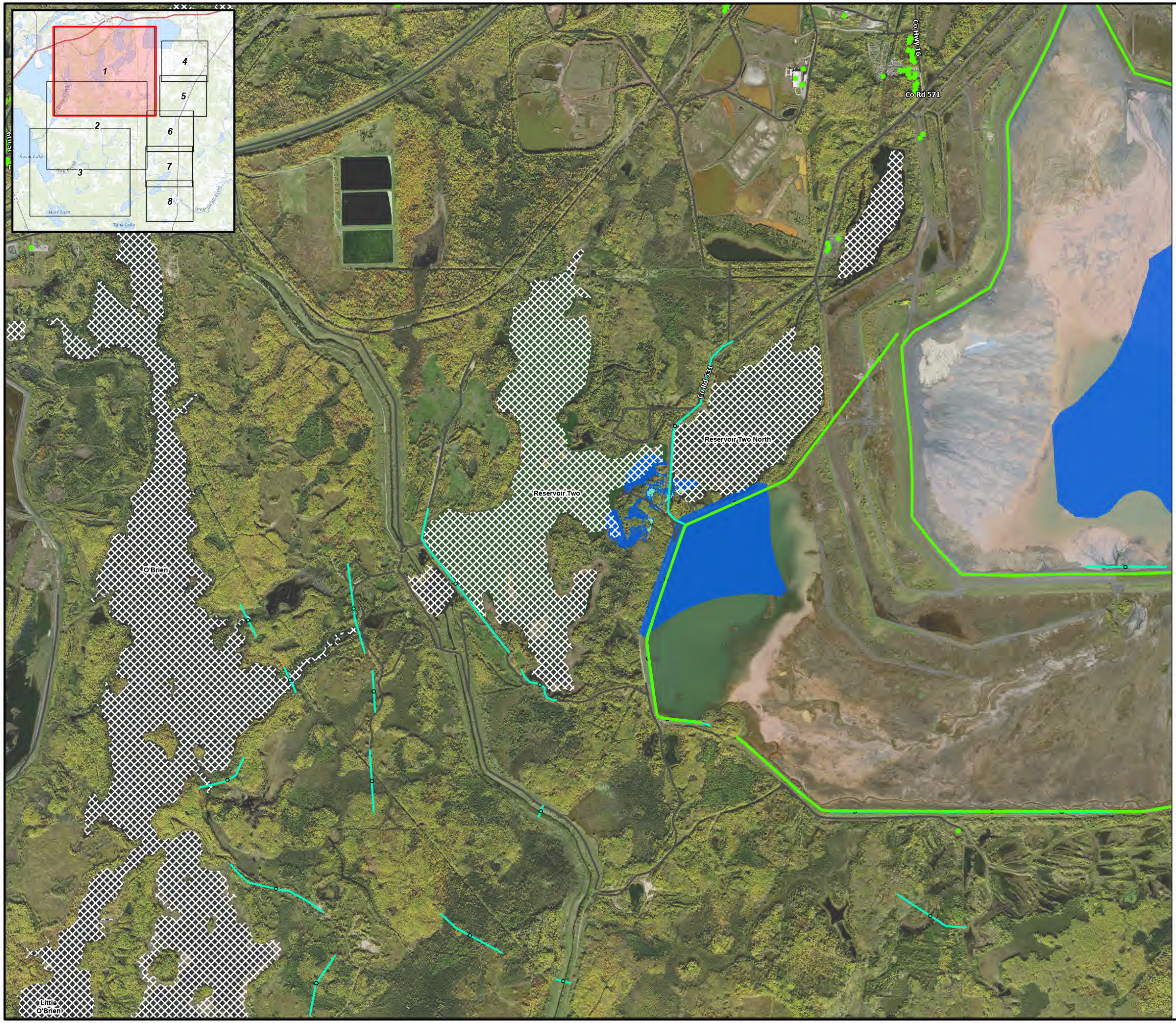
DATUM: NAD 1983 2011
PROJECTION: LAMBERT CONFORMAL CONIC

DESIGNED: C. FRITSCH	**FINAL BUILDOUT 'PMF' CLEANWATER CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	Page Number: 8 of 8
REVIEWED: M. WHEELER	
APPROVED: -	
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

GEI Consultants



LEGEND:

- Waterbodies with inaccurate data (Due to lack of bathymetry)
- Stage 2 Exterior Alignment
- Cross-Section Lines
- Cross-Section Centerpoint

Existing Building Structures

- Within 500ft of Breach Extent

Max Depth Values (ft)

- > 1
- 1.01 - 4
- 4.01 - 6
- 6.01 - 8
- 8.01 - 10
- < 10

N

0 1,000 2,000 US Feet

Scale: 1 inch = 1,100 feet

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PROJECTION: LAMBERT CONFORMAL CONIC

DESIGNED: C. FRITSCH	**FINAL BUILDOUT 'SD' MUDFLOW CASCADE FAILURE - MAXIMUM FLOOD DEPTH**	
PREPARED: J. HANSEN		
REVIEWED: M. WHEELER		
APPROVED: -	Page Number: 1 of 8	
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA	GEI Consultants
REVISION: 0		
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION	

LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Stage 2 Exterior Alignment

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Within 500ft of Breach Extent

Max Depth Values (ft)

- > 1
- 1.01 - 4
- 4.01 - 6
- 6.01 - 8
- 8.01 - 10
- < 10

N

0 1,000 2,000 US Feet

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DESIGNED: C. FRITSCH	**FINAL BUILDOUT 'SD' MUDFLOW CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 2 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
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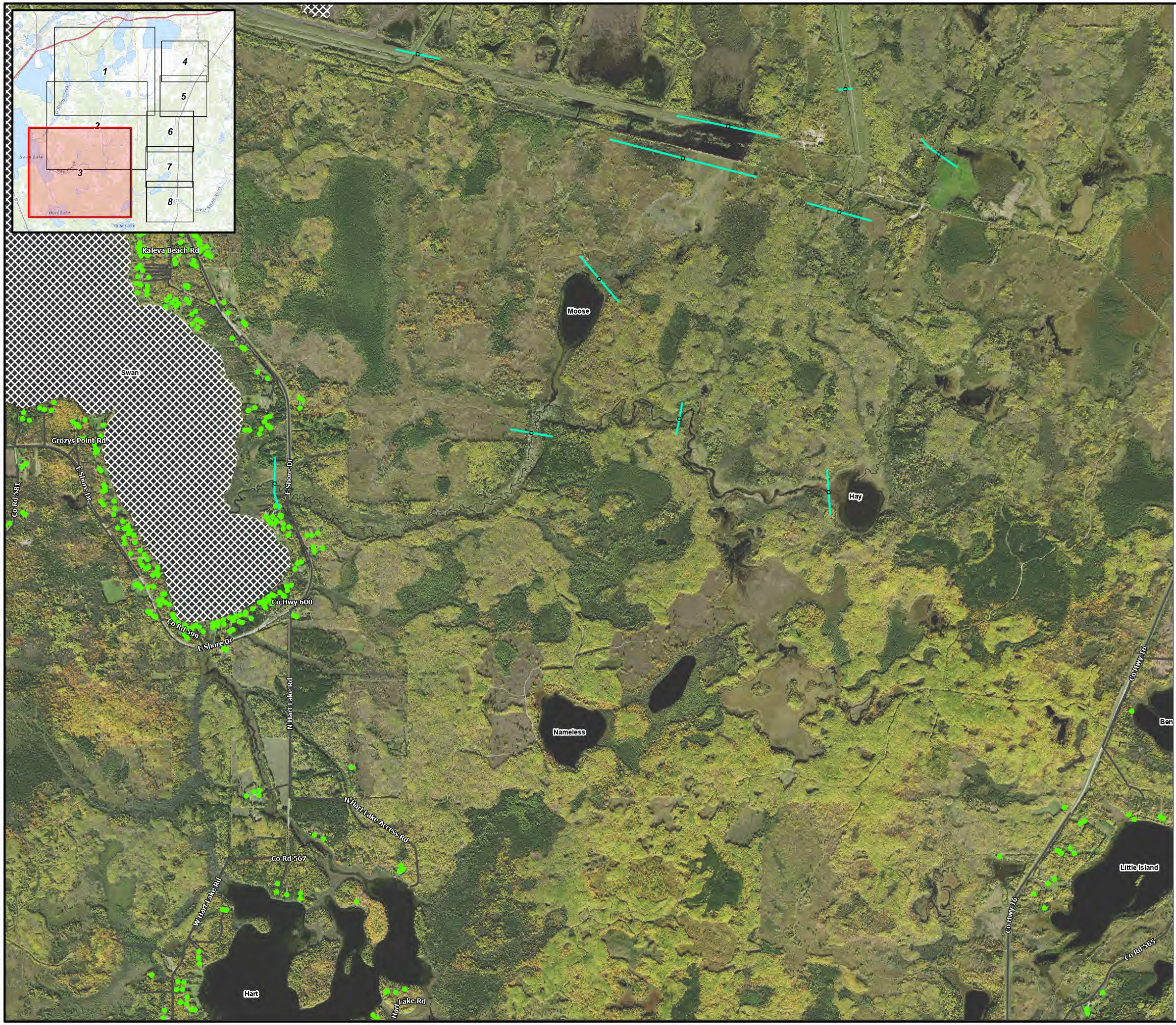

LEGEND:

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Existing Building Structures

- Within 500ft of Breach Extent

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PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
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DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

GEI Consultants

LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Stage 2 Exterior Alignment

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Within 500ft of Breach Extent

0 500 1,000 US Feet

Scale: 1 inch = 500 feet

Max Depth Values (ft)

> 1

1.01 - 4

4.01 - 6

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PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 4 of 8
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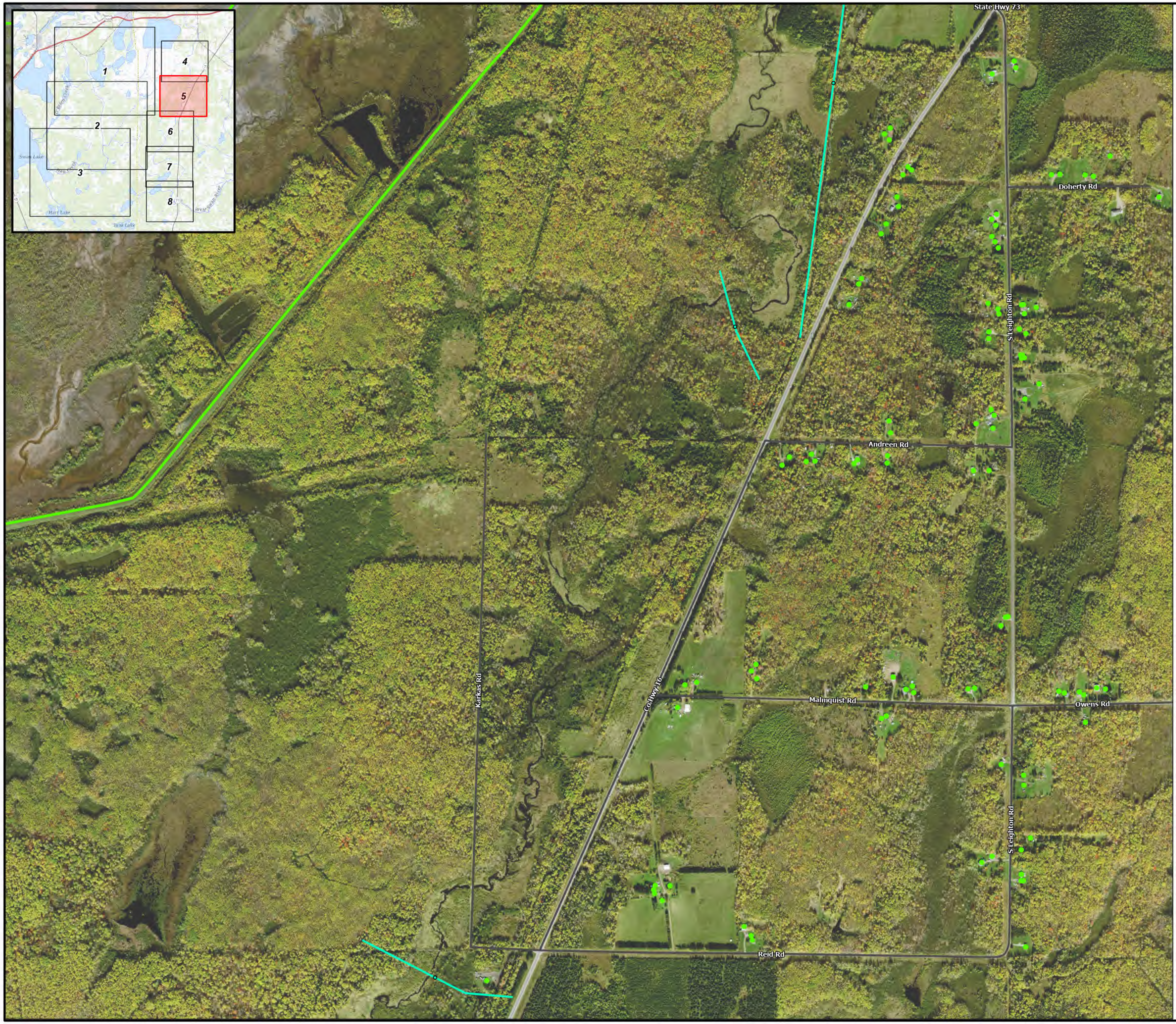

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- Stage 2 Exterior Alignment
- Cross-Section Lines
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Existing Building Structures

- Within 500ft of Breach Extent

Max Depth Values (ft)

- > 1
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0 500 1,000 US Feet

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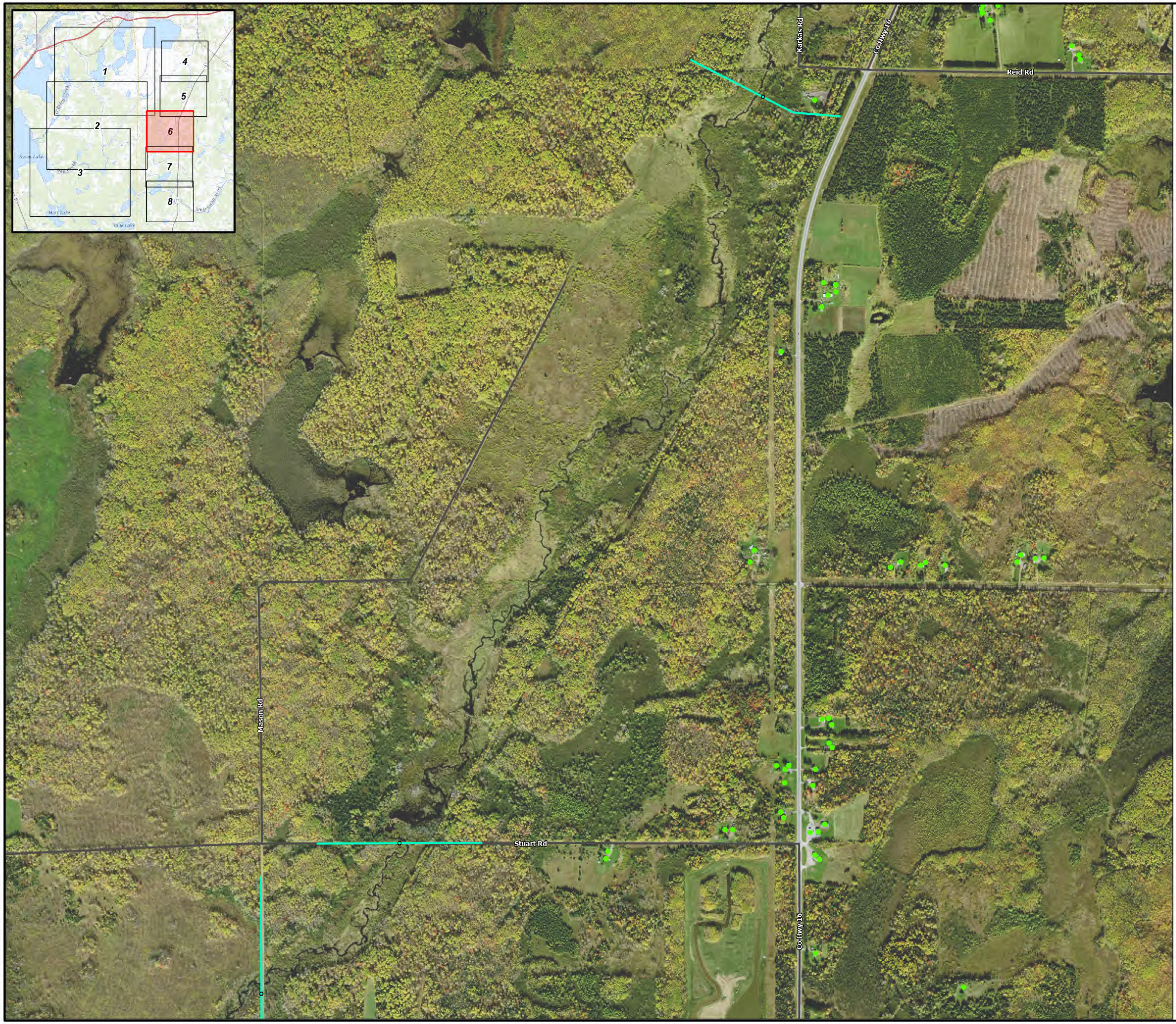

LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Stage 2 Exterior Alignment

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Within 500ft of Breach Extent

Max Depth Values (ft)

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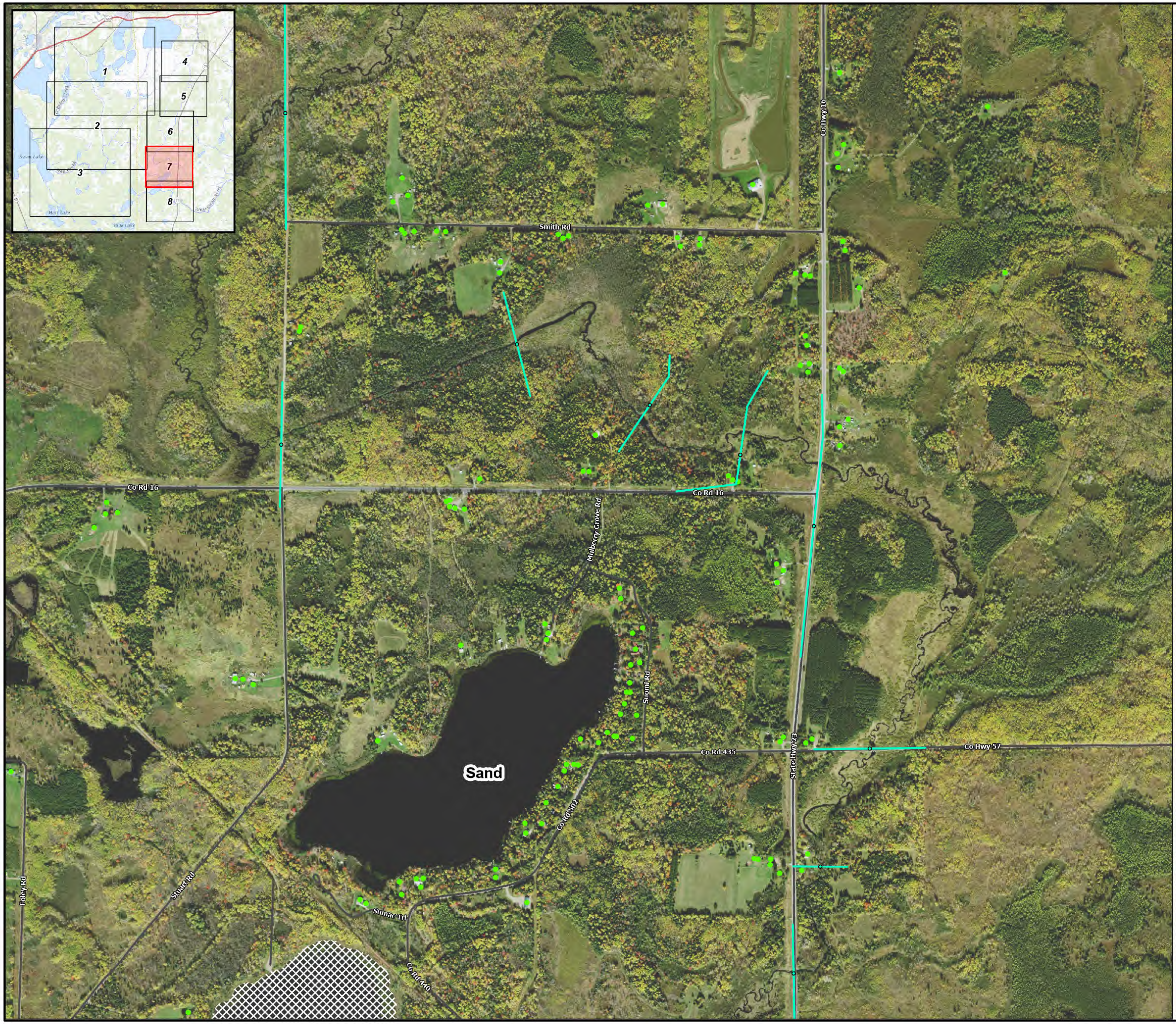

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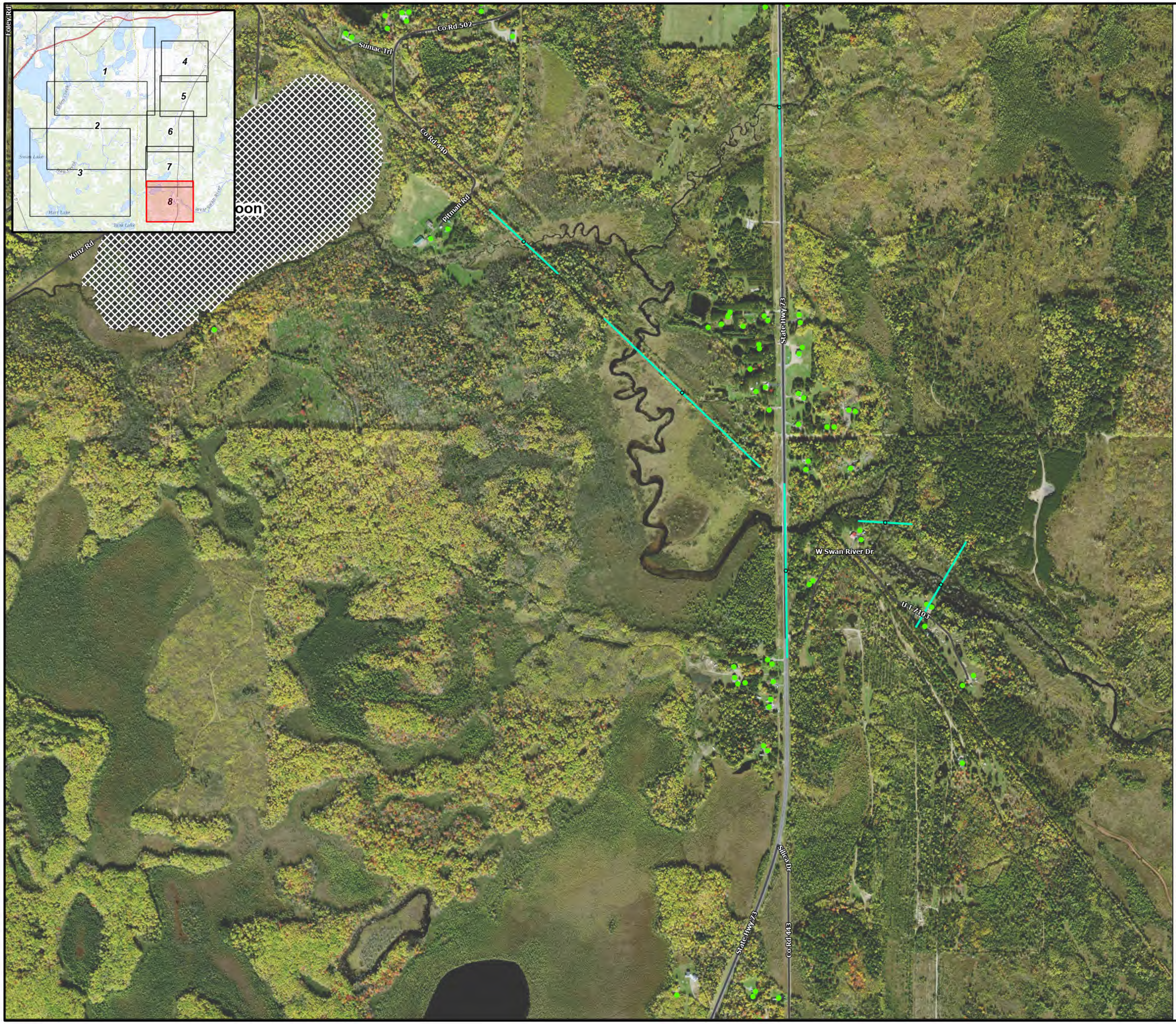
DATUM: NAD 1983 2011
PROJECTION: LAMBERT CONFORMAL CONIC

DESIGNED: C. FRITSCH	**FINAL BUILDOUT 'SD' MUDFLOW CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 7 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

GEI Consultants



LEGEND:

- Waterbodies with inaccurate data (Due to lack of bathymetry)
- Stage 2 Exterior Alignment
- Cross-Section Lines
- Cross-Section Centerpoint

Existing Building Structures

- Within 500ft of Breach Extent

Max Depth Values (ft)
> 1
1.01 - 4
4.01 - 6
6.01 - 8
8.01 - 10
< 10

0 500 1,000 US Feet

Scale: 1 inch = 500 feet

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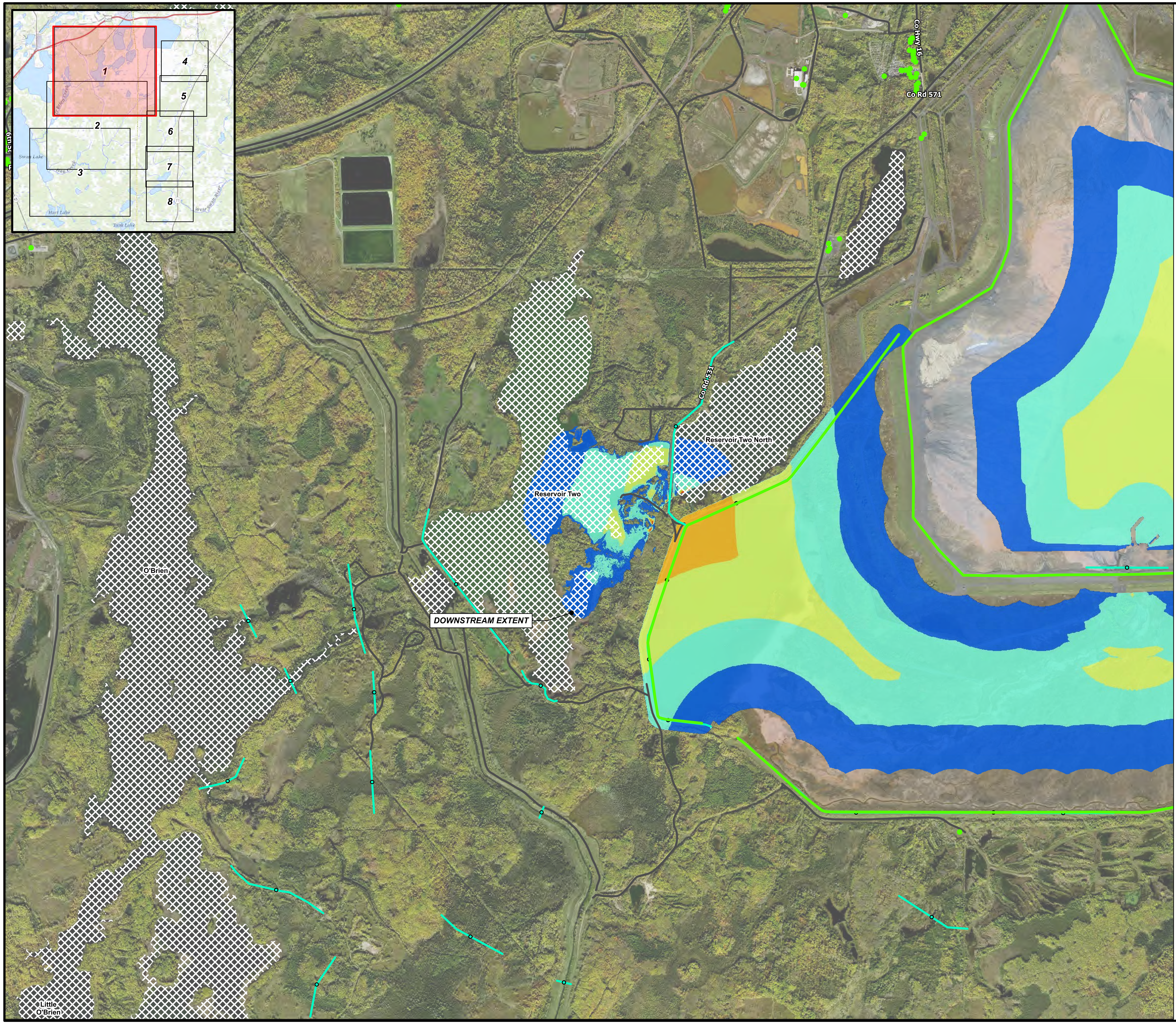
DESIGNED: C. FRITSCH	**FINAL BUILDOUT 'SD' MUDFLOW CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	Page Number: 8 of 8
APPROVED: -	
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

GEI Consultants


LEGEND:
Waterbodies with inaccurate data (Due to lack of bathymetry)
Stage 2 Exterior Alignment
Cross-Section Lines
Cross-Section Centerpoint
Existing Building Structures
Within 500ft of Breach Extent
Outside of 500ft of Breach Extent
Max Depth Values (ft)
> 1
1.01 - 4
4.01 - 6
6.01 - 8
8.01 - 10
< 10
0 2,600 5,200 US Feet
Scale: 1 inch = 2,500 feet
N
Downstream Boundary of Mapping Extent
Downstream Boundary of Mapping Extent
1
2
3
4
5
6
7
8
Reservoir Two
Reservoir Two North
KEEWATIN, MN
SILICA, MN
Unnamed (O'Brien Res. #4)
O'Brien
Little O'Brien
Swan
Moose
Hay
Nameless
Hart
Sand
Coon
Bengal
Little Island
Little Flower
Helen
Harriet
Snowball
Ox Hide
Little Sucker
Lower Panasa
Larue Complex
US Hwy 169
State Hwy 65
State Hwy 73
Co Hwy 16
Co Hwy 57
Co Hwy 600
Town Line Rd
Stuart Rd
Smith Rd
Harriet Lake Rd
Owens Rd
Reid Rd
Malmquist Rd
Andreen Rd
Doherty Rd
Gust Erickson Rd
St Louis-Itasca Judicial Hwy
DESIGNED: C. FRITSCH
PREPARED: J. HANSEN
REVIEWED: M. WHEELER
APPROVED: -
DATE: FEBRUARY 2023
REVISION: 0
PROJECT NUMBER: 2201246
FINAL BUILDOUT 'PMF' MUDFLOW CASCADE FAILURE - OVERVIEW
KEETAC TAILINGS BASIN
KEEWATIN, MINNESOTA
UNITED STATES STEEL CORPORATION
GEI Consultants



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- Stage 2 Exterior Alignment
- Cross-Section Lines
- Cross-Section Centerpoint

Existing Building Structures

- Within 500ft of Breach Extent
- Outside of 500ft of Breach Extent

0 1,000 2,000 US Feet

Scale: 1 inch = 1,100 feet

Max Depth Values (ft)

- > 1
- 1.01 - 4
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DESIGNED: C. FRITSCH	**FINAL BUILDOUT 'PMF' MUDFLOW CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	Page Number: 1 of 8
APPROVED: -	
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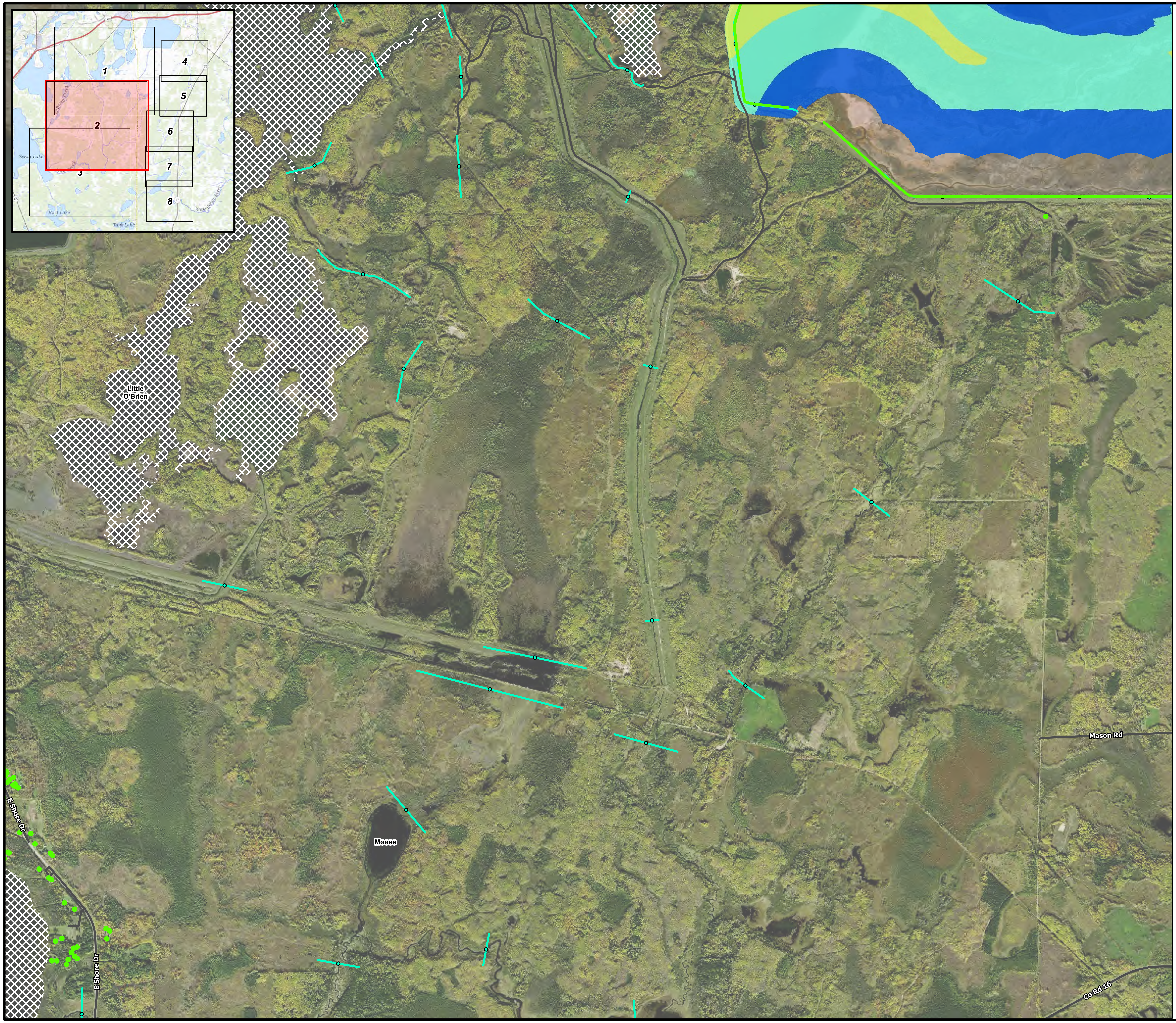
GEI Consultants



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0 1,000 2,000 US Feet

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PREPARED: J. HANSEN	
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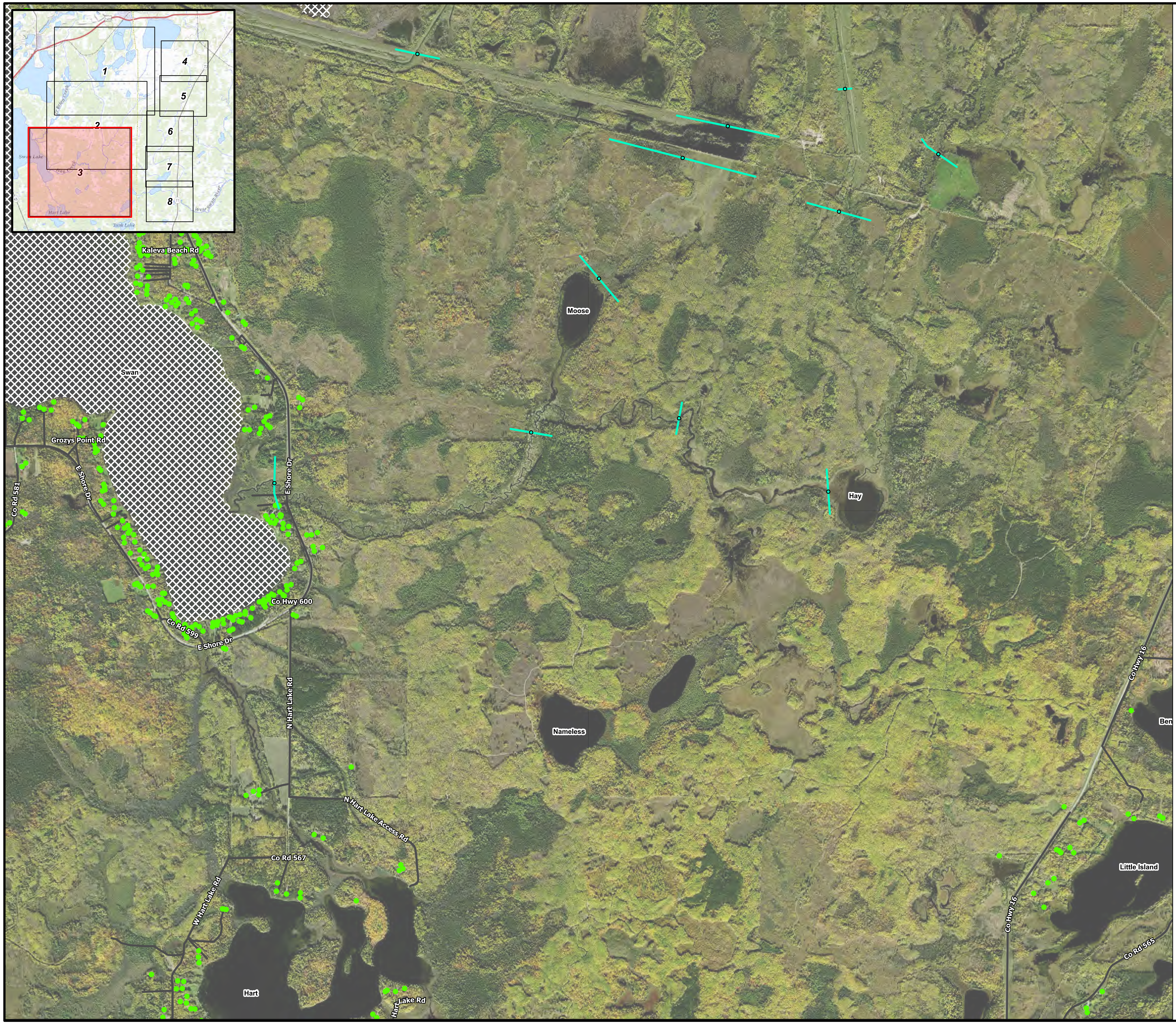

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Existing Building Structures

- Within 500ft of Breach Extent
- Outside of 500ft of Breach Extent

0 1,000 2,000 US Feet

Scale: 1 inch = 1,100 feet

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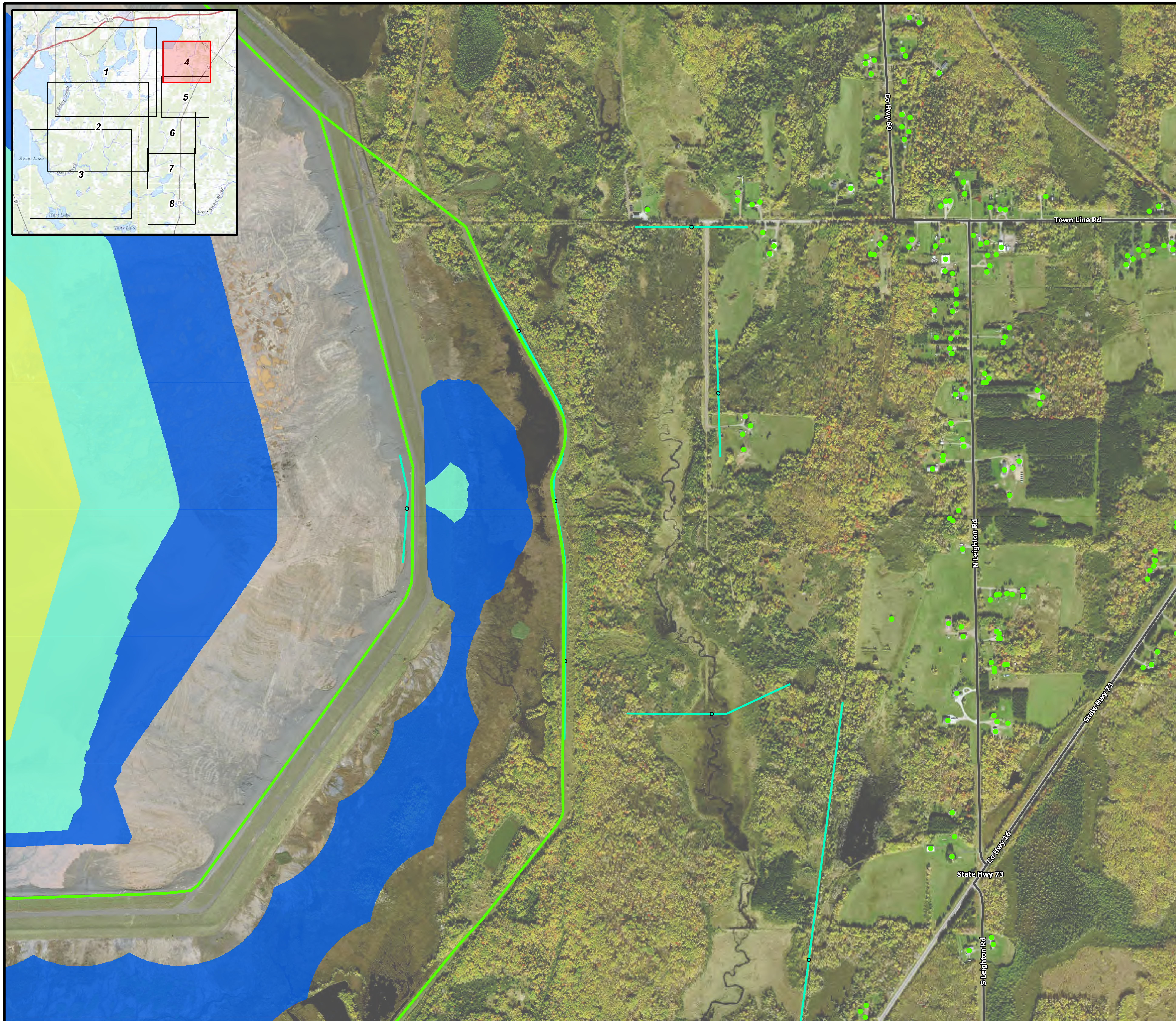

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- Cross-Section Centerpoint

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- Outside of 500ft of Breach Extent

0 500 1,000 US Feet

Scale: 1 inch = 500 feet

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PREPARED: J. HANSEN	
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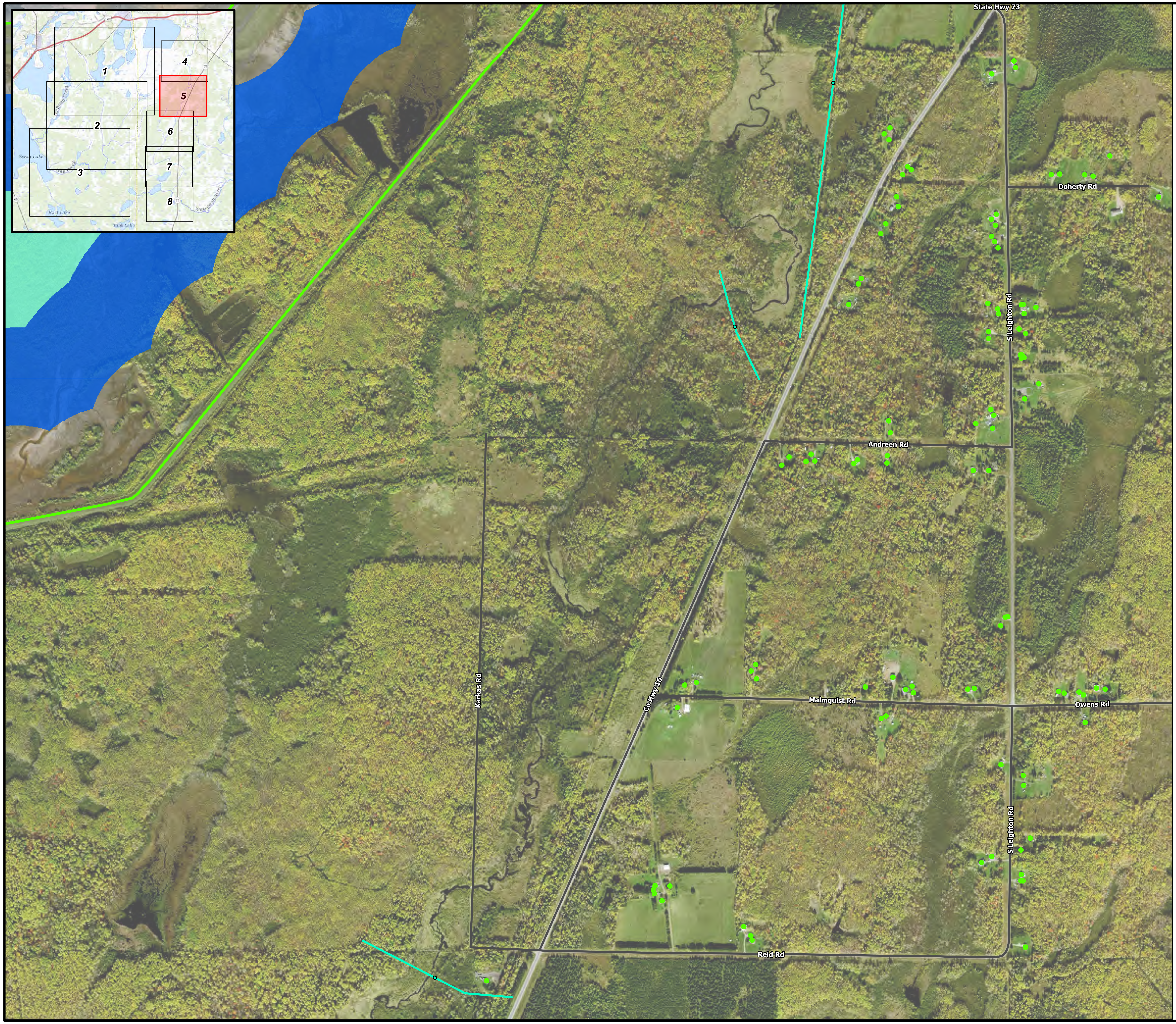

LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Stage 2 Exterior Alignment

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Within 500ft of Breach Extent

Outside of 500ft of Breach Extent

0 500 1,000 US Feet

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Max Depth Values (ft)

> 1

1.01 - 4

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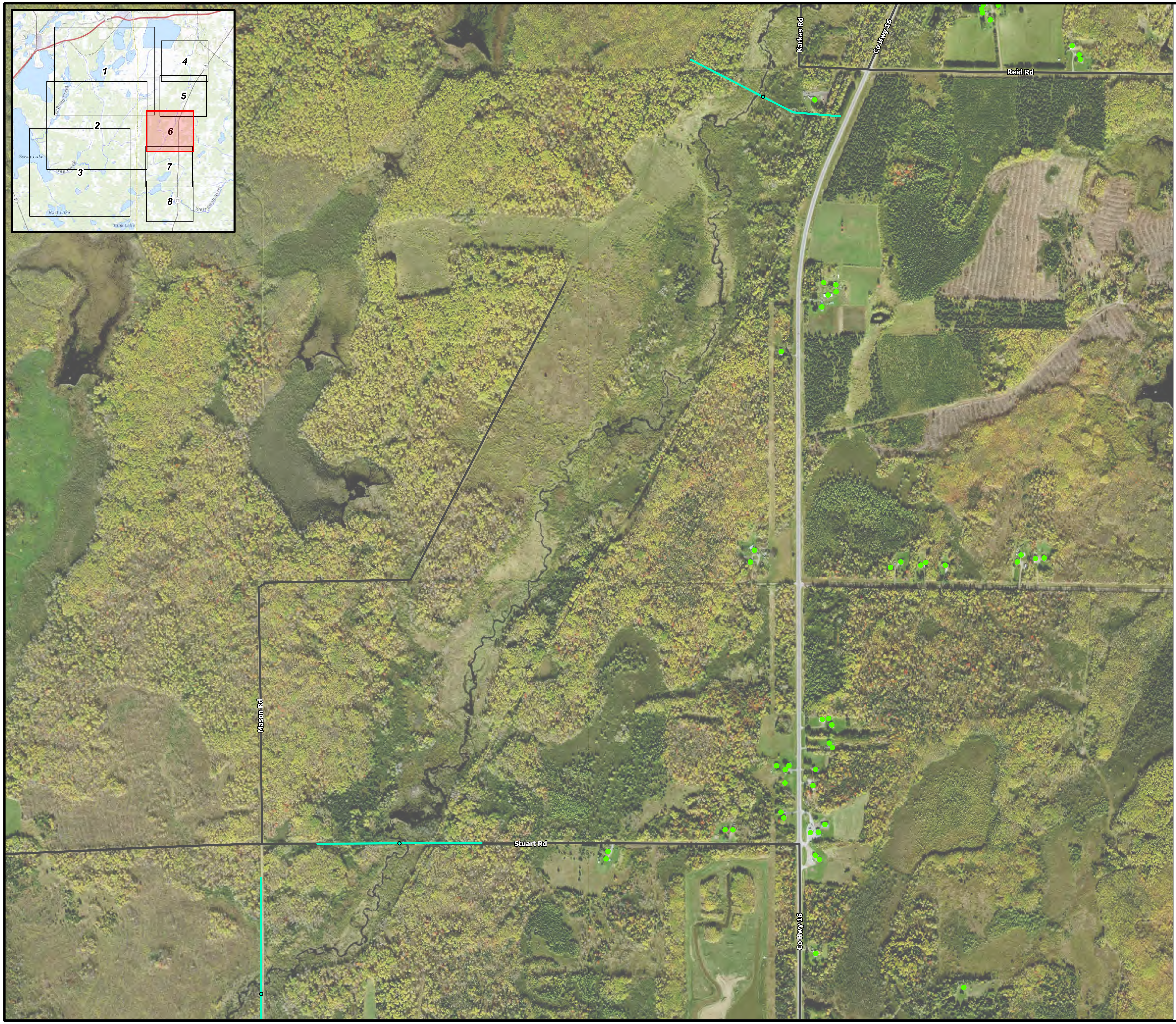
DESIGNED: C. FRITSCH	**FINAL BUILDOUT 'PMF' MUDFLOW CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 5 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	GEI Consultants
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION



LEGEND:

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- Stage 2 Exterior Alignment
- Cross-Section Lines
- Cross-Section Centerpoint

Existing Building Structures

- Within 500ft of Breach Extent
- Outside of 500ft of Breach Extent

0 500 1,000 US Feet

Scale: 1 inch = 500 feet

Max Depth Values (ft)

- > 1
- 1.01 - 4
- 4.01 - 6
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- < 10

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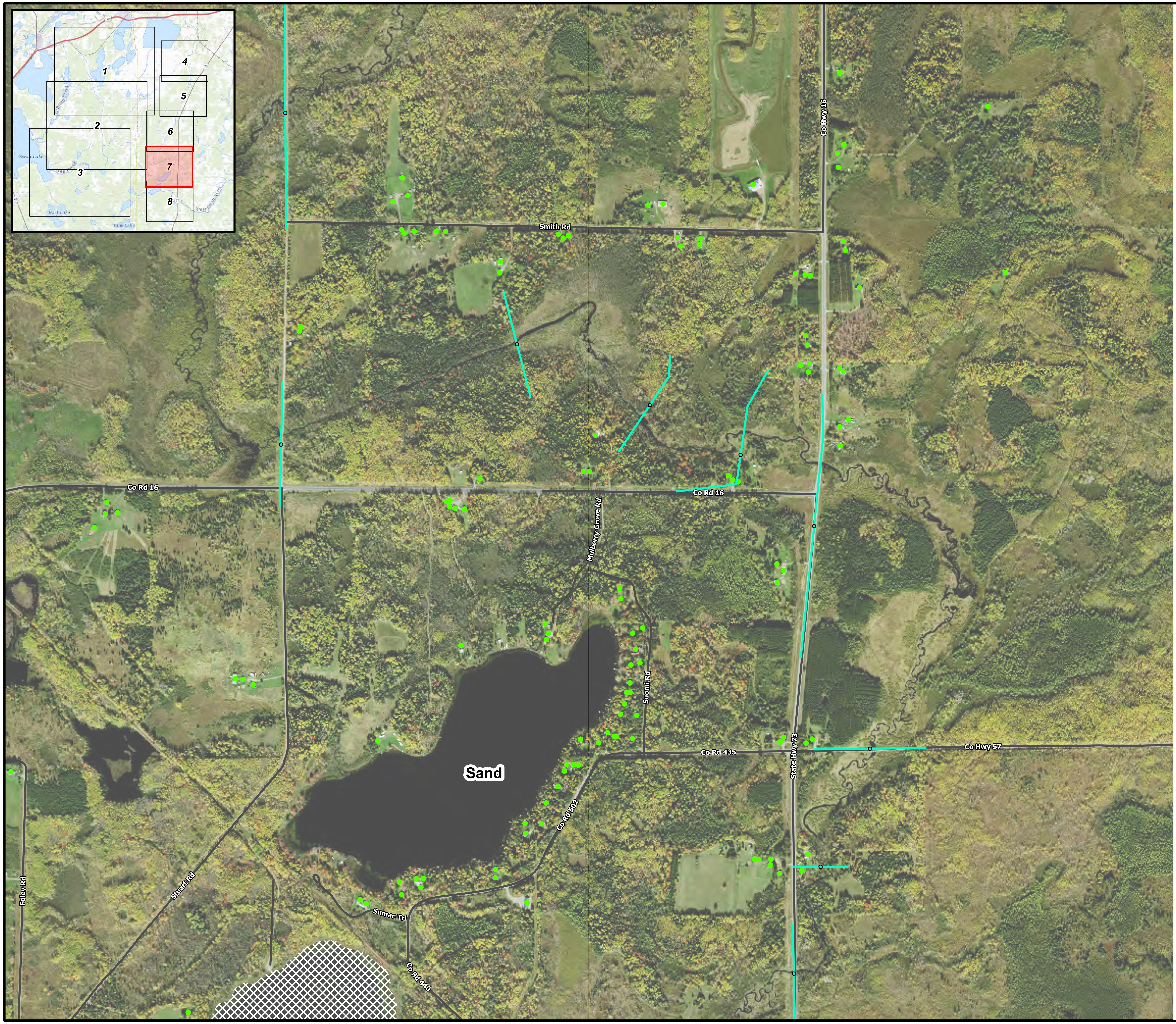

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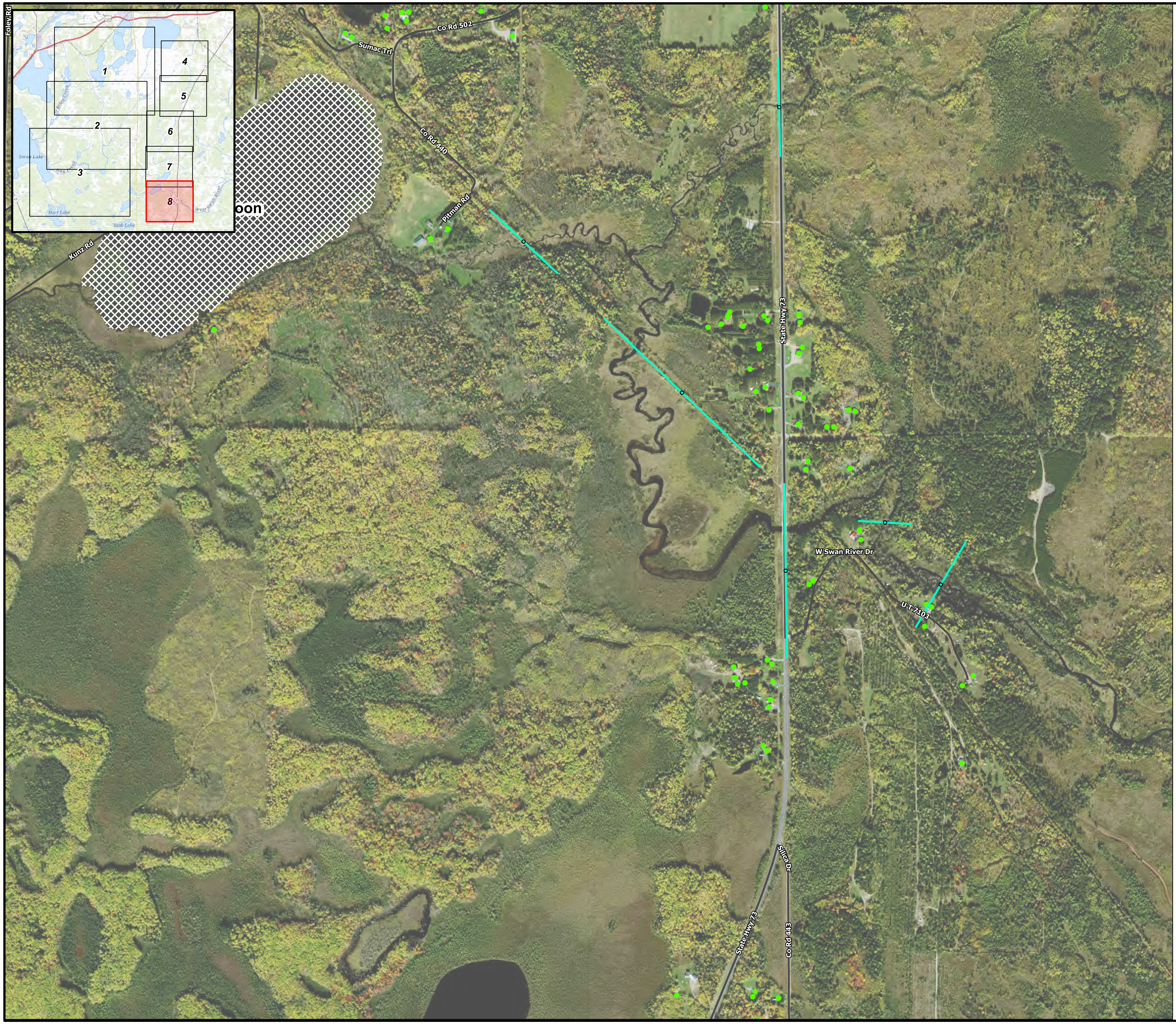

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FINAL BUILDOUT 'SD' CLEANWATER CASCADE FAILURE - OVERVIEW

KEETAC TAILINGS BASIN
KEEWATIN, MINNESOTA

UNITED STATES STEEL CORPORATION

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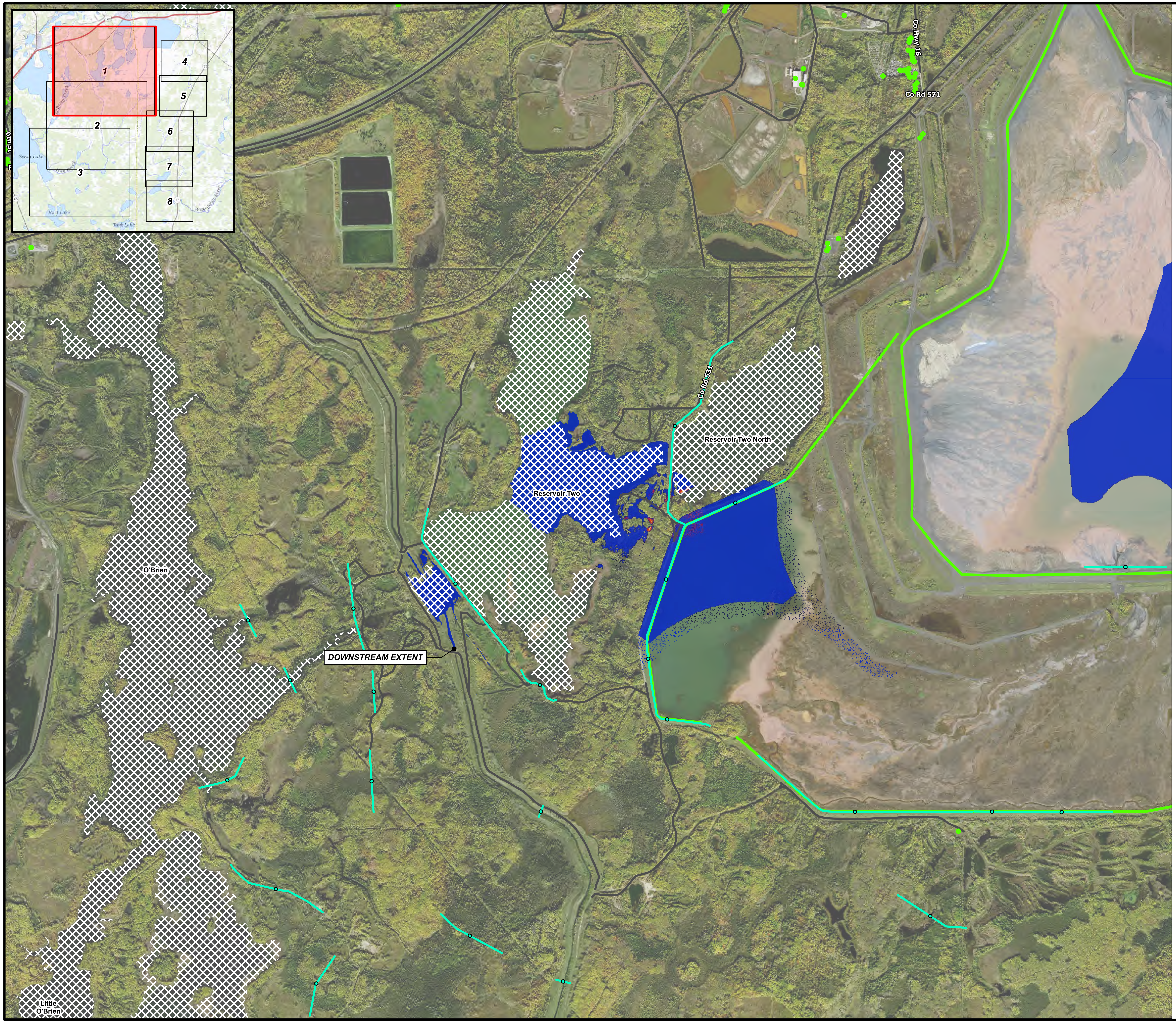

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0 1,000 2,000 US Feet

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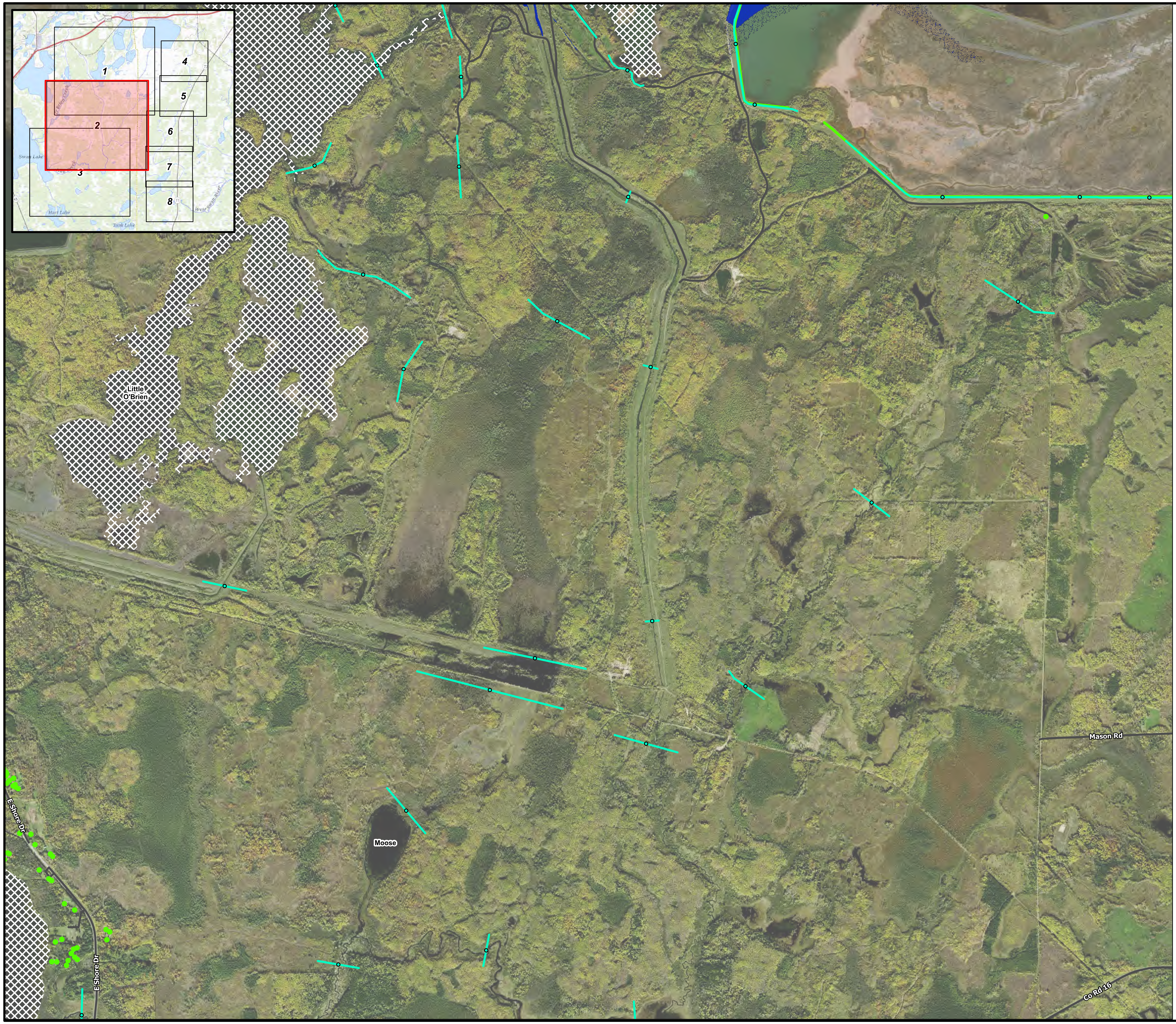

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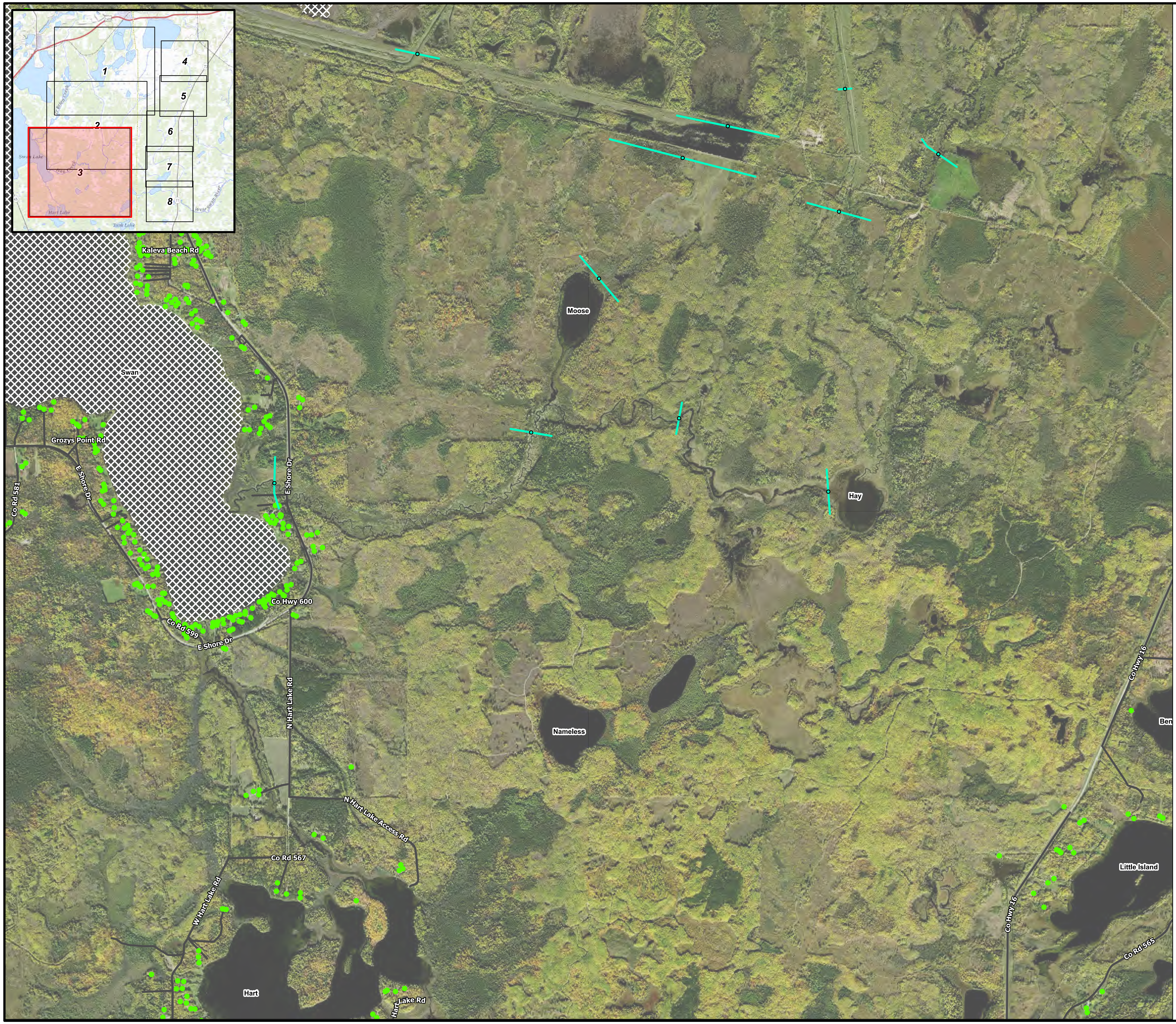

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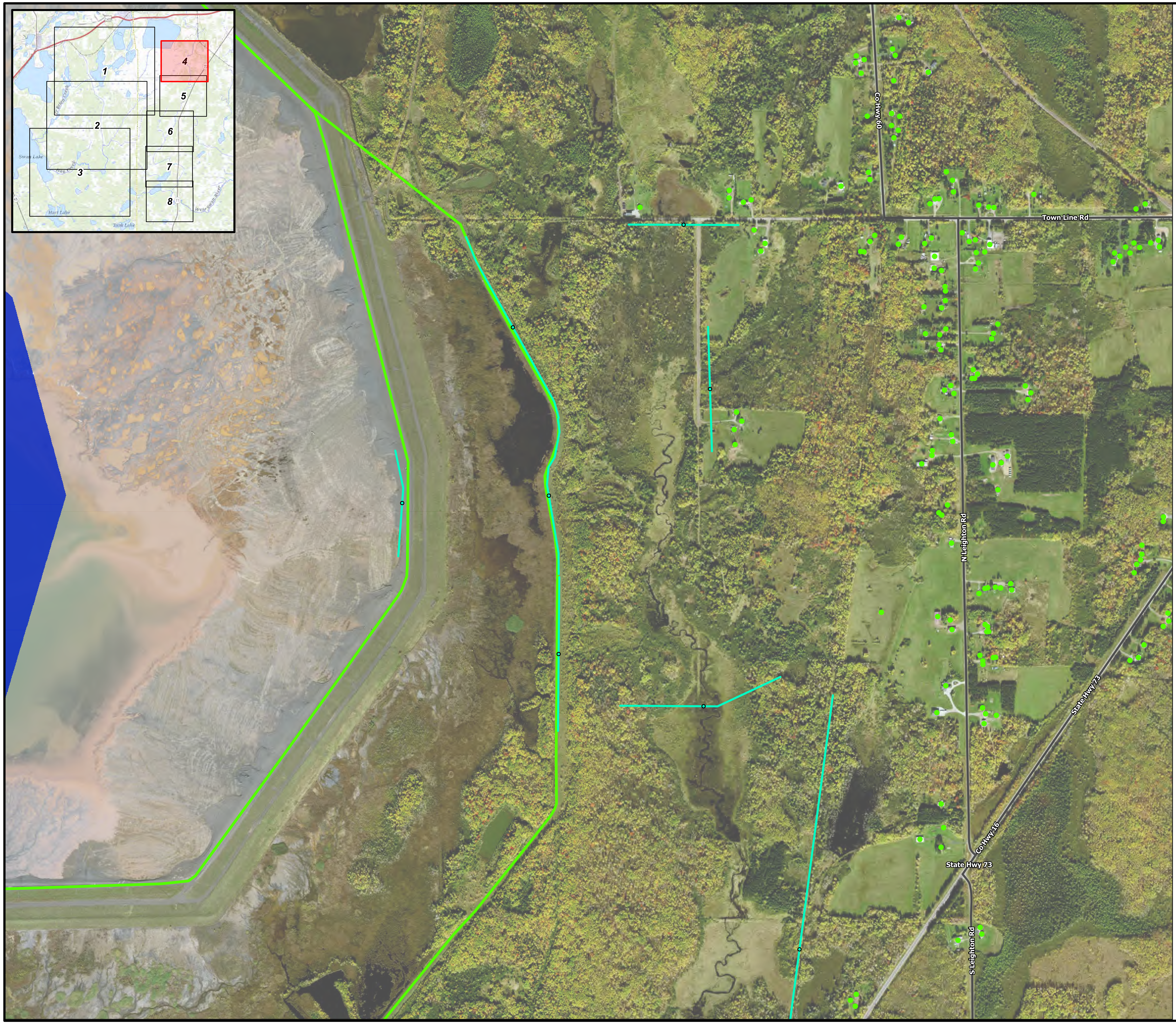

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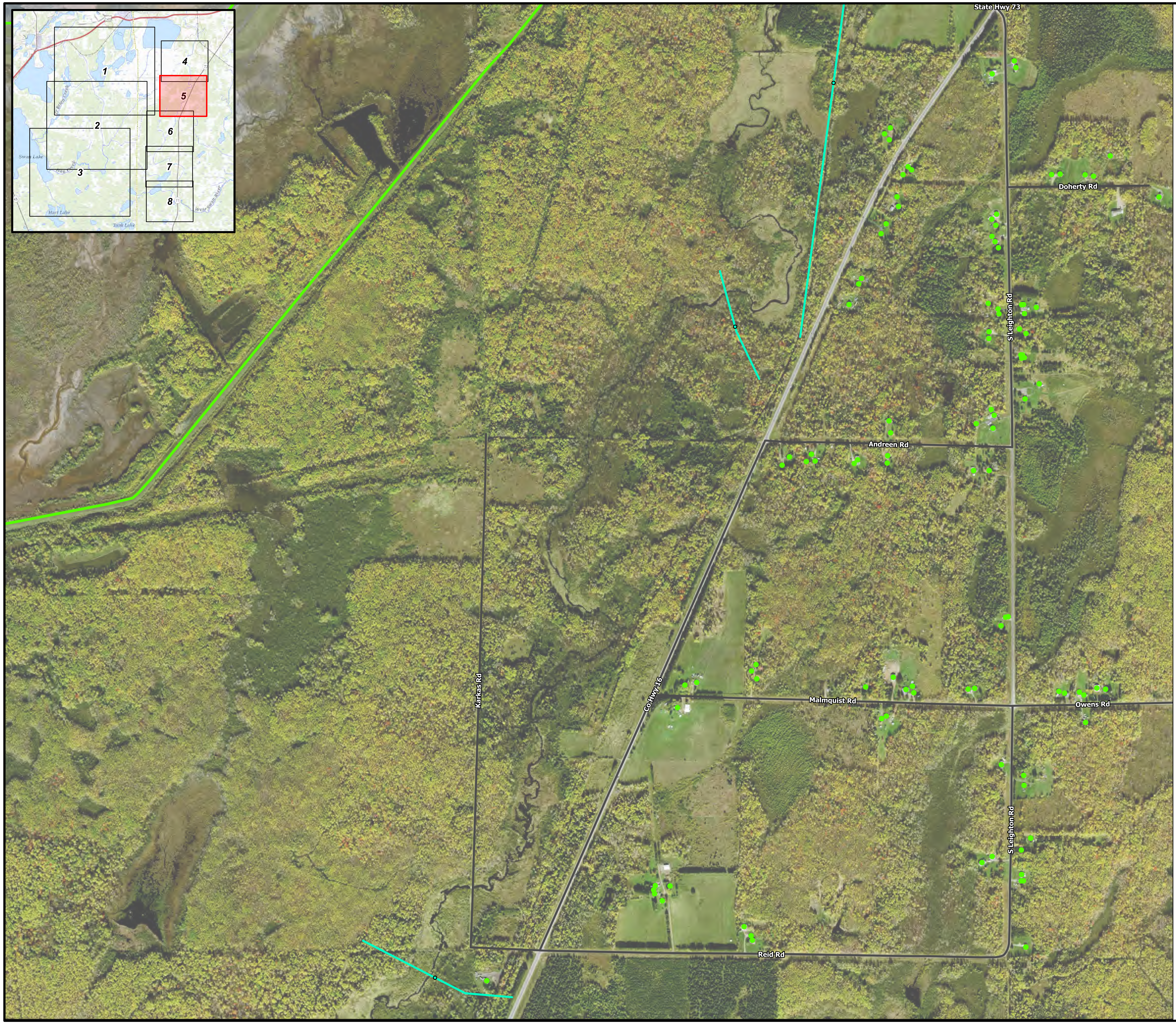
DESIGNED: C. FRITSCH	**FINAL BUILDOUT 'SD' CLEANWATER CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	Page Number: 4 of 8
REVIEWED: M. WHEELER	
APPROVED: -	
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

GEI Consultants



LEGEND:

- Waterbodies with inaccurate data (Due to lack of bathymetry)
- Stage 2 Exterior Alignment
- Cross-Section Lines
- Cross-Section Centerpoint

Existing Building Structures

- Within 500ft of Breach Extent
- Outside of 500ft of Breach Extent

0 500 1,000 US Feet

Scale: 1 inch = 500 feet

Max Depth Values (ft)

- > 1
- 1.01 - 4
- 4.01 - 6
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- < 10

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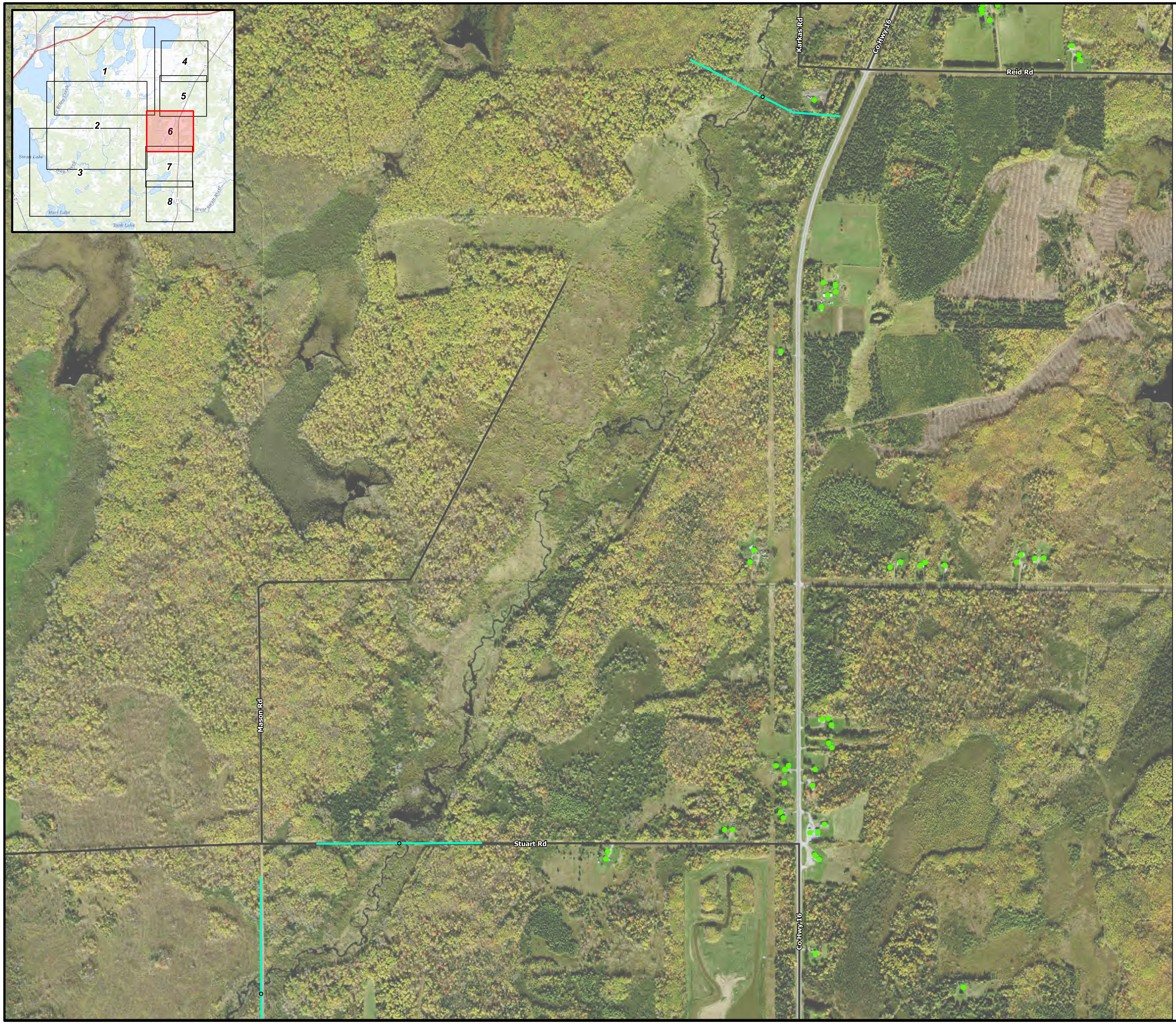

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Cross-Section Centerpoint

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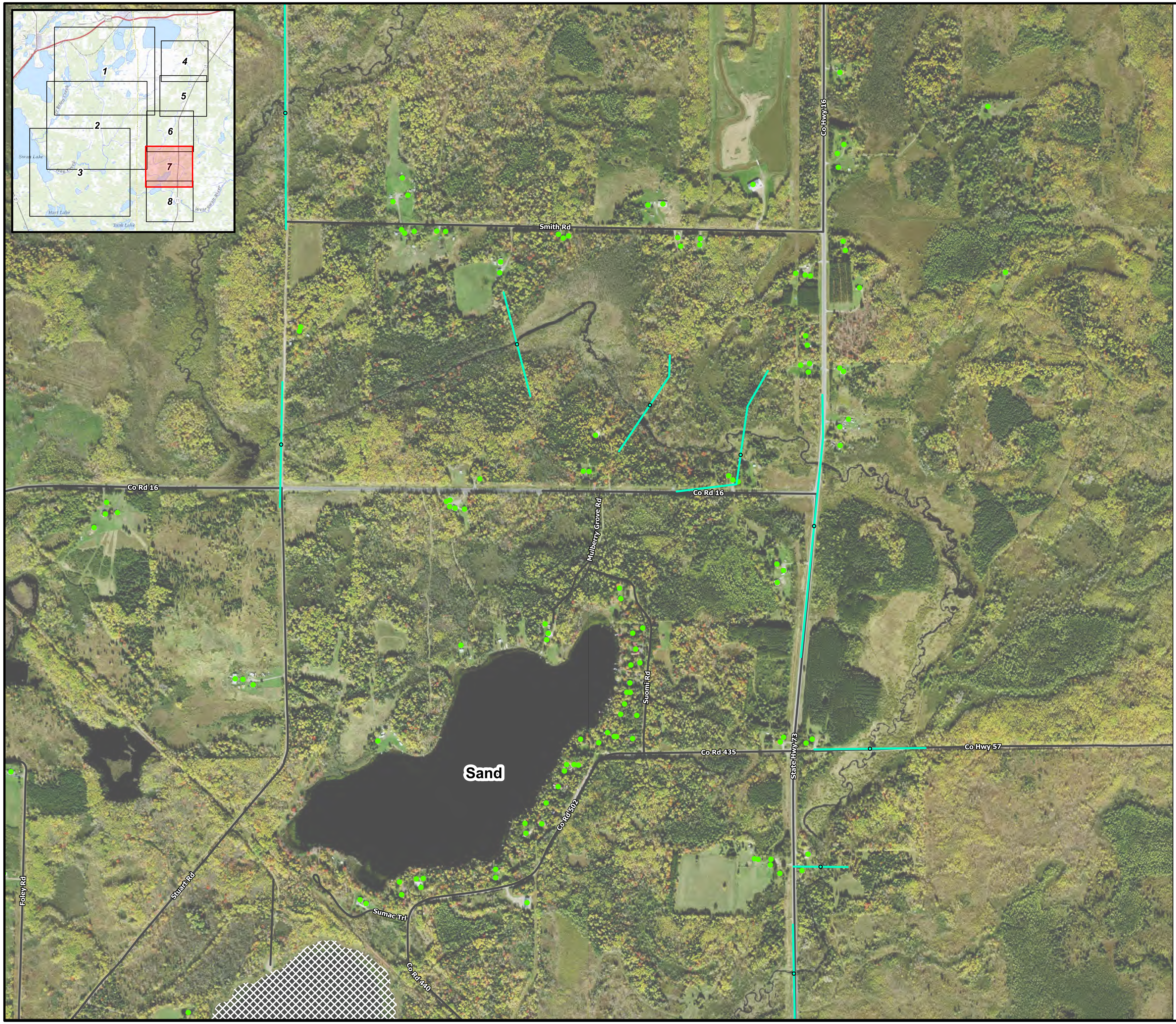

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Cross-Section Centerpoint

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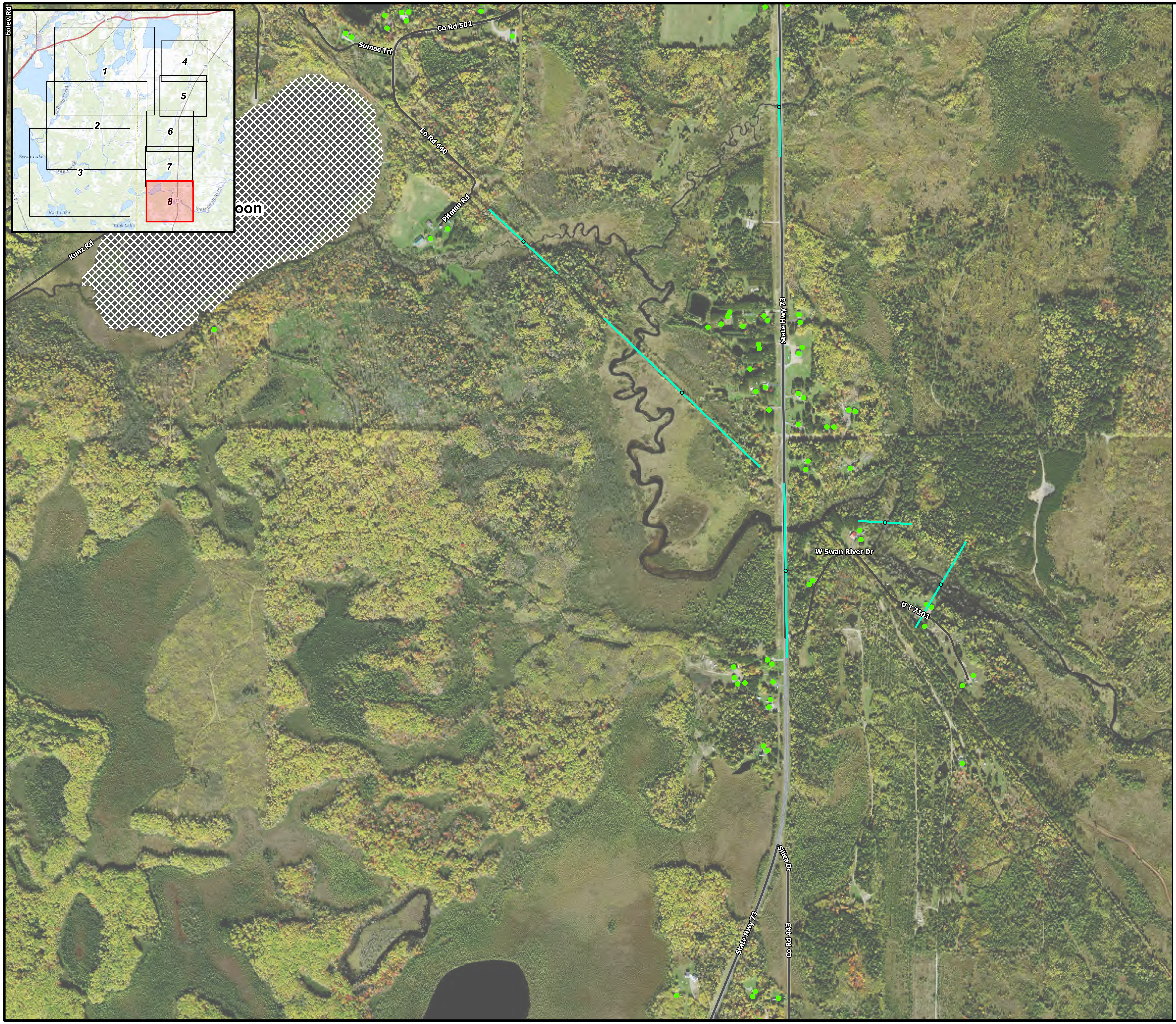

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FINAL BUILDOUT 'SD' MUDFLOW CASCADE FAILURE - OVERVIEW

KEETAC TAILINGS BASIN
KEEWATIN, MINNESOTA

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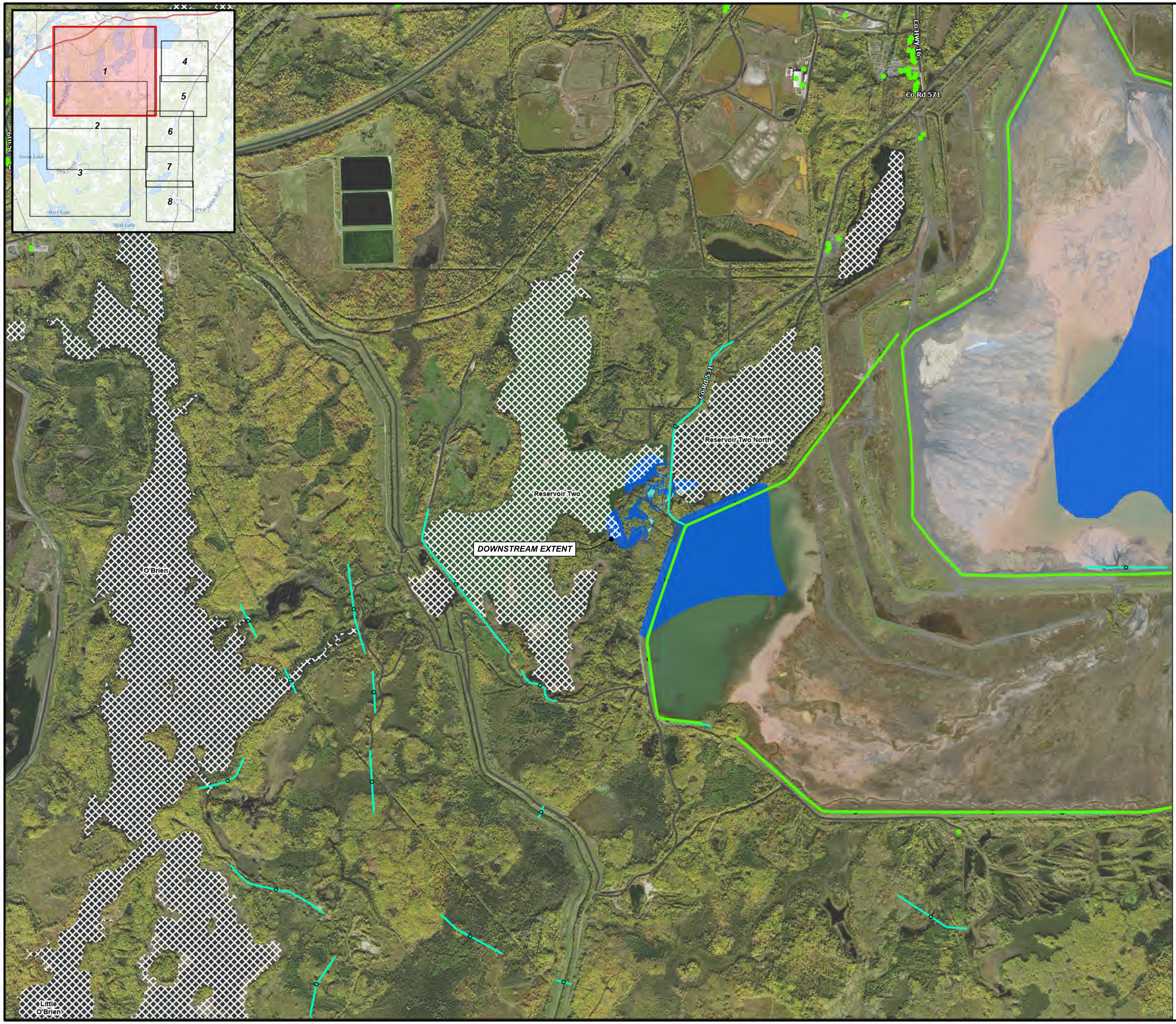

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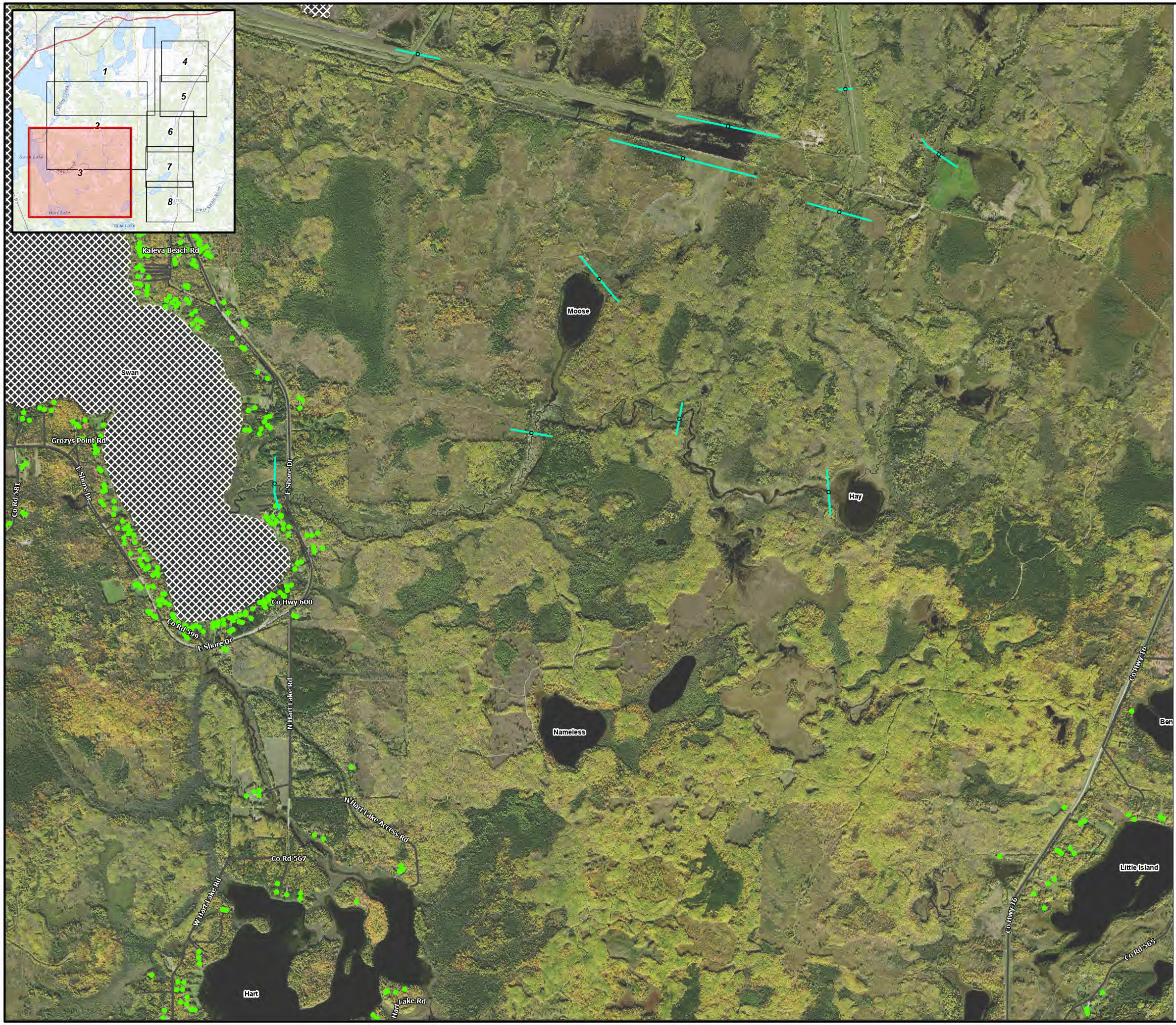

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DATUM: NAD 1983 2011
PROJECTION: LAMBERT CONFORMAL CONIC

DESIGNED: C. FRITSCH	**FINAL BUILDOUT 'SD' MUDFLOW CASCADE FAILURE - MAXIMUM FLOOD DEPTH**
PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
APPROVED: -	Page Number: 3 of 8
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION

GEI Consultants

LEGEND:

Waterbodies with inaccurate data (Due to lack of bathymetry)

Stage 2 Exterior Alignment

Cross-Section Lines

Cross-Section Centerpoint

Existing Building Structures

Within 500ft of Breach Extent

0 500 1,000 US Feet

Scale: 1 inch = 500 feet

Max Depth Values (ft)

> 1

1.01 - 4

4.01 - 6

6.01 - 8

8.01 - 10

< 10

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PREPARED: J. HANSEN	
REVIEWED: M. WHEELER	
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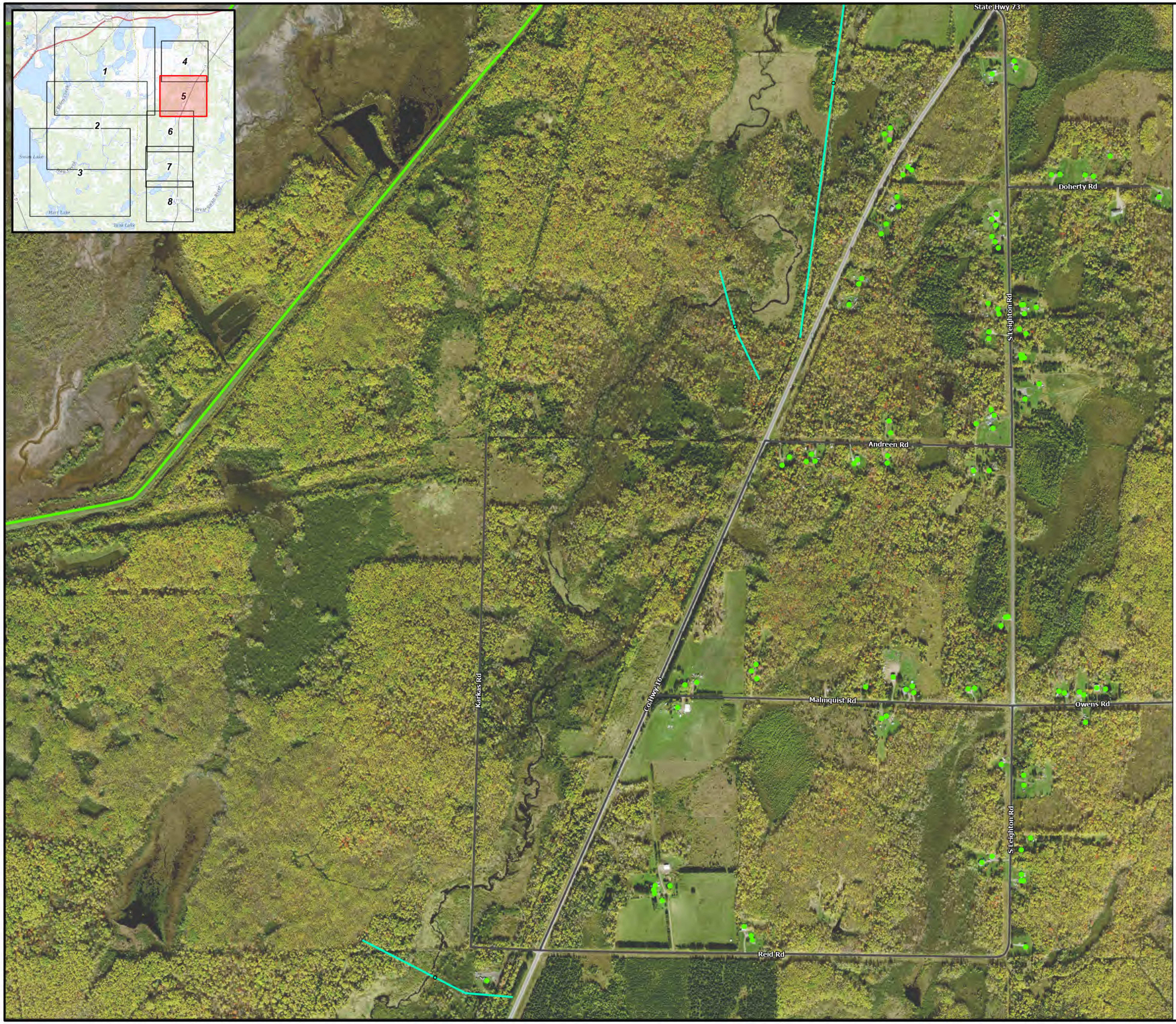
DATE: FEBRUARY 2023	KEETAC TAILINGS BASIN KEEWATIN, MINNESOTA
REVISION: 0	
PROJECT NUMBER: 2201246	UNITED STATES STEEL CORPORATION



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Cross-Section Centerpoint

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Max Depth Values (ft)

- > 1
- 1.01 - 4
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- 6.01 - 8
- 8.01 - 10
- < 10

N

0 500 1,000 US Feet

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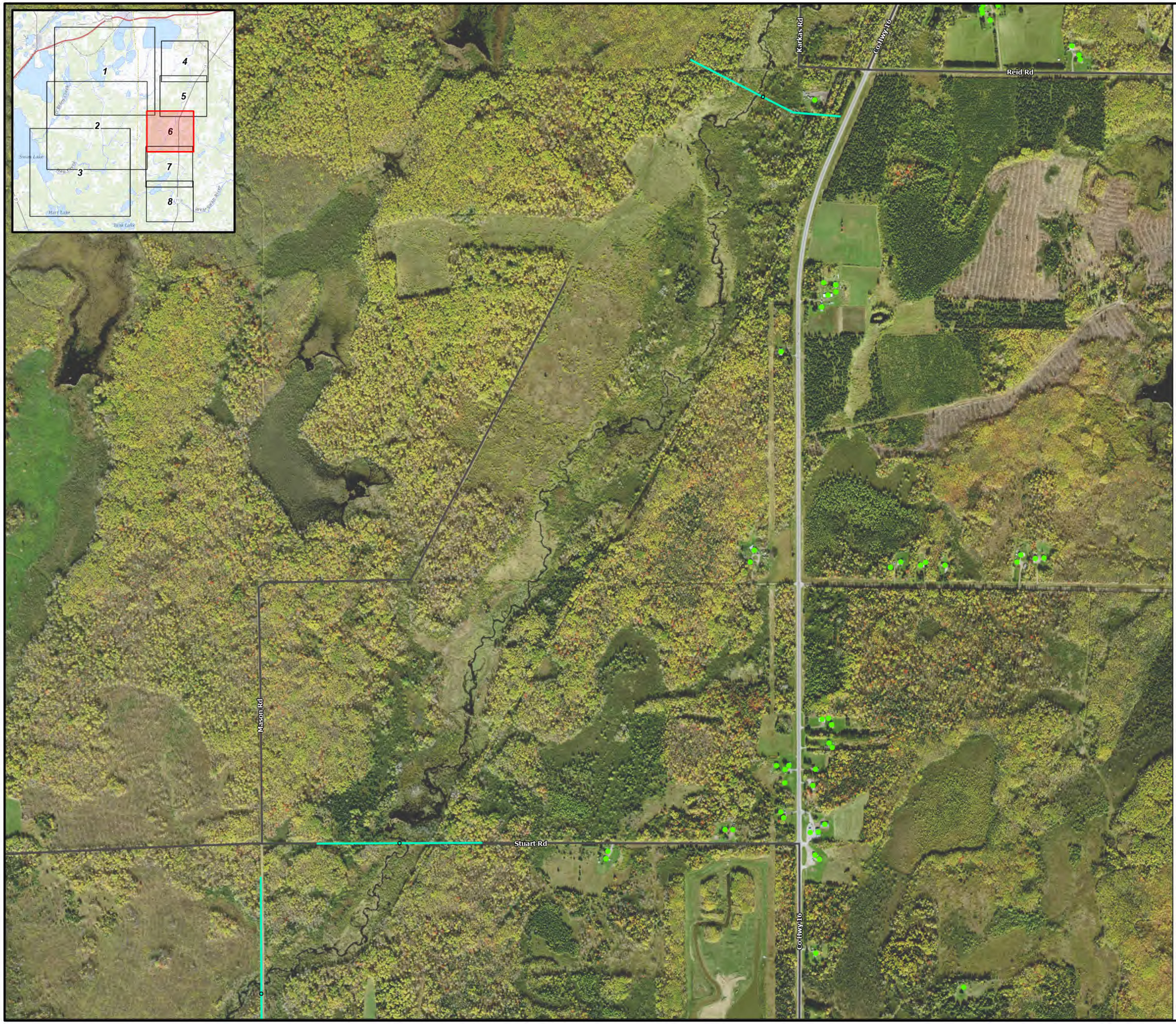

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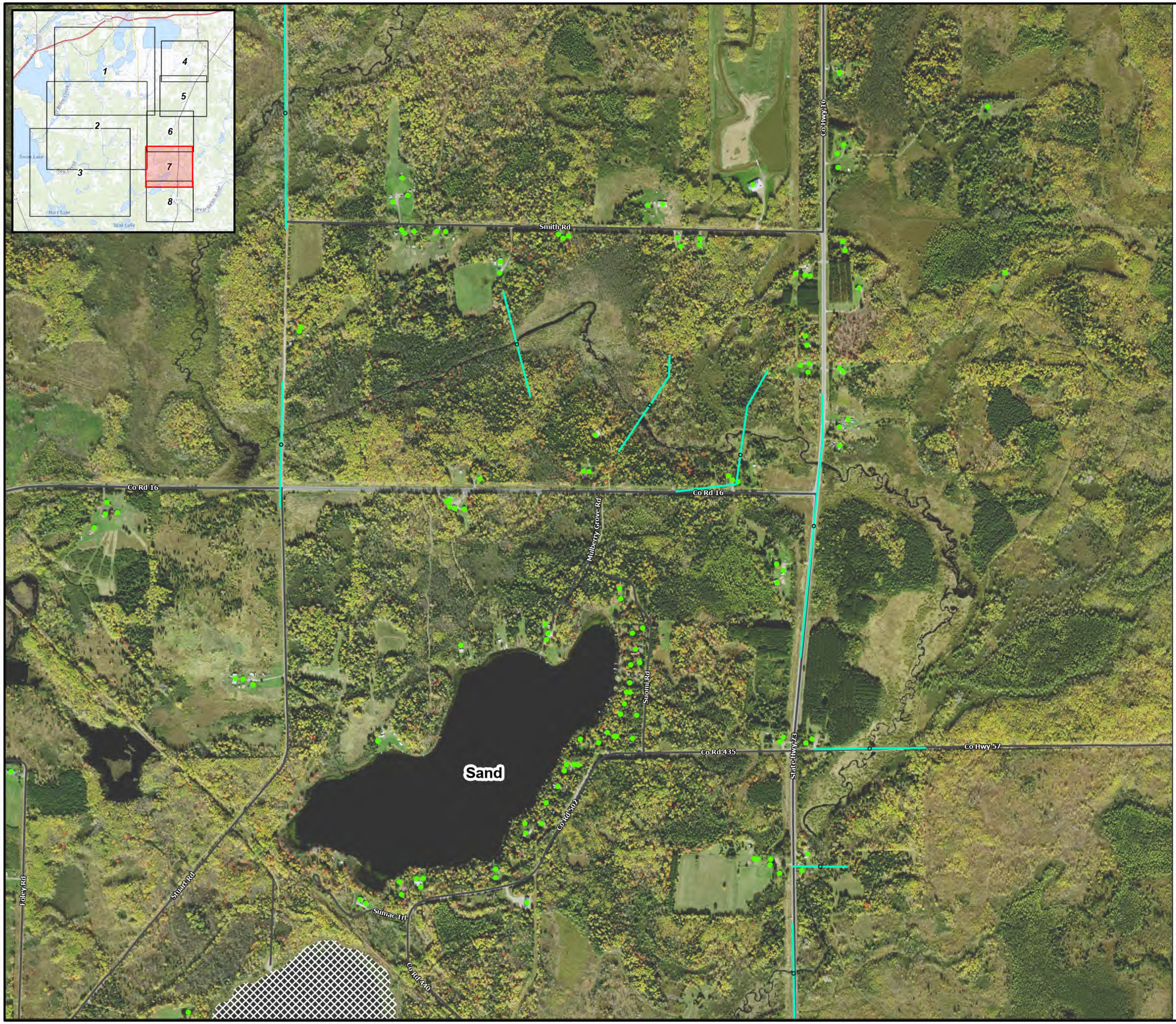

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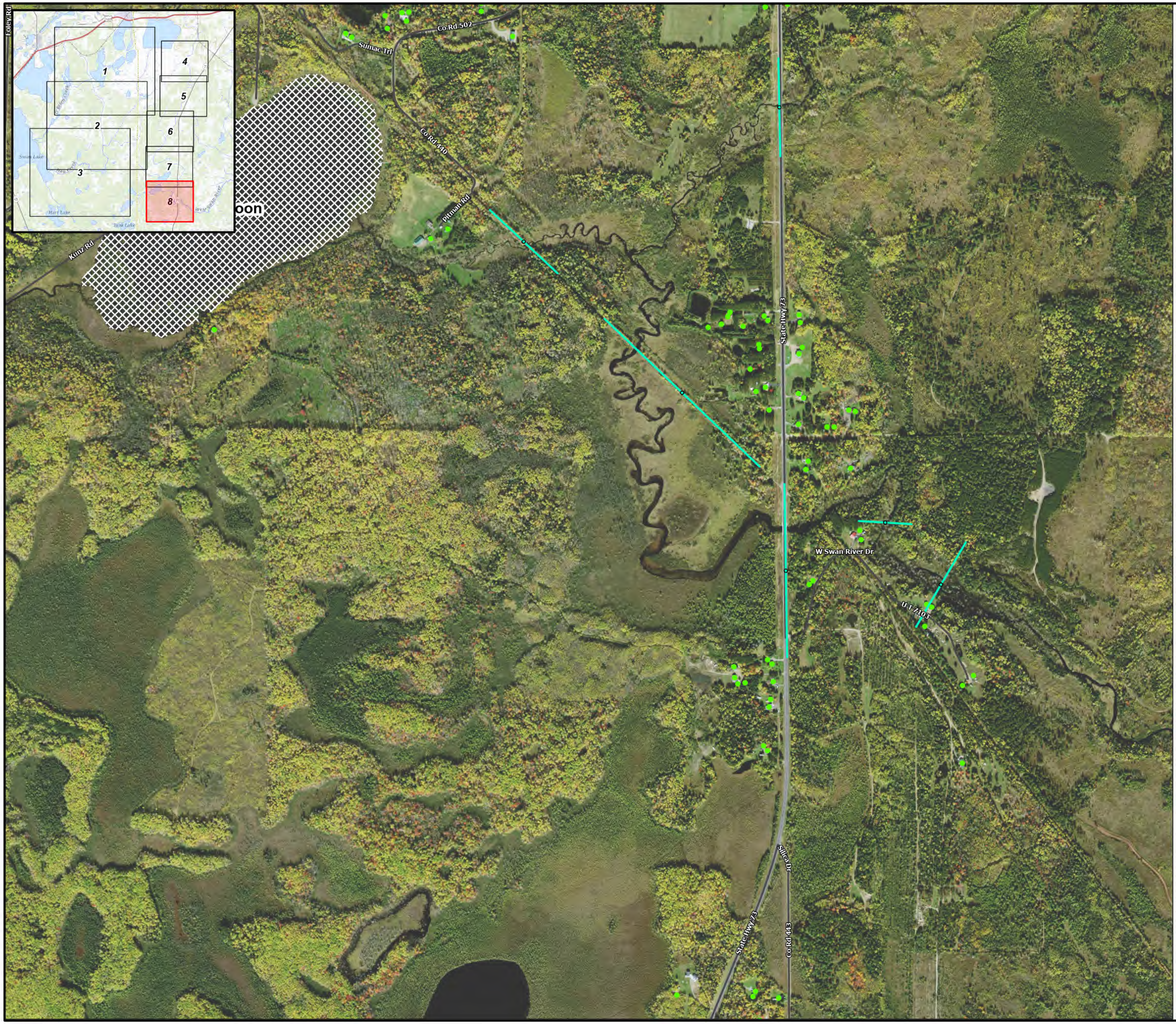

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REVISION: 0	
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GEI Consultants

Appendix B

Inundation Parcels

STRUCTURES TABLE

ID	Scenario	X	Y
6	ex_pmf_mud, int_pmf_mud	498001.94	5237464.27
3	ex_pmf_cw, ex_pmf_mud, int_pmf_cw, int_pmf_mud	498318.99	5237576.98
2	ex_pmf_mud, int_pmf_mud	498318.28	5237635.03
1	ex_pmf_mud, int_pmf_mud	498345.1	5237658.42
9	ex_pmf_mud, int_pmf_mud	498123.08	5237151.4
4	ex_pmf_mud, int_pmf_mud	497972.49	5237483.43
5	ex_pmf_mud, int_pmf_mud	497985.6	5237470.27
8	ex_pmf_mud, int_pmf_mud	498142.57	5237188.84
7	ex_pmf_mud, int_pmf_mud	498122.1	5237208.78

PARCELS TABLE

Parcel #	Acreage	Tax District	Name	Address 1	Address 2	Township	Range	Section	Balance Due	Deeded Acres	Description	Description 2
141-0040-05830	20.431432	CITY OF HIBBING	COLLINS TODD R & MICHELLE L	2420 HWY 73	HIBBING MN 55746	56	21	33	1448.56	19.42	Non-Homestead Qualifying Single Res Unit	Rural Vacant Land
141-0040-05714	11.527085	CITY OF HIBBING	GROSZBACH NICHOLAS & PIA	2373 HWY 73	HIBBING MN 55746	56	21	32	3566	10.03	Residential 1 unit	Unclassified
141-0040-05600	37.122839	CITY OF HIBBING	GARGANO CHARLES A	12731 HWY 16	HIBBING MN 55746	56	21	32	2518	32.2	Non-Homestead Qualifying Single Res Unit	Rural Vacant Land
141-0040-05835	8.259435	CITY OF HIBBING	HERRERA JOANN NASON	2410 HWY 73	HIBBING MN 55746	56	21	33	108	9.11	Residential 1 unit	Unclassified

LEGEND:

- Potentially Inundated Structures

NOTES:

1. Aerial image obtained from USDA NAIP. Image collected June of 2019.
2. Parcel data obtained from St. Louis County MN.

0 200 400 Feet

Keetac Dam Breach Analysis
Keetac Tailings Basin
Keewatin, MN

United States Steel Corporation
Keewatin, MN

GEI Consultants

Project 2201246

INUNDATION STRUCTURES & PARCEL LOCATIONS

March 2023

Fig. 2

Path: C:\Users\jhansen\OneDrive - GEI Consultants, Inc\Documents\GIS_Work\KEETAC\2022\2201246_Keetac Dam Break Analysis and EAP\MAPSERIES\MAPSERIES.aprx

PROPERTY DETAILS REPORT

St. Louis County, Minnesota

Date of Report: 3/6/2023 4:23:55 PM

General Details

Parcel ID:	141-0040-05600
Document Department:	Abstract
Document Number:	01416554
Document Date:	05/18/2021
Plat Name:	HIBBING

Legal Description Details

Plat Name: HIBBING

Section	Township	Range	Lot	Block
32	56	21	-	-

Description: SE 1/4 OF NE 1/4 EX 2 80/100 AC FOR HWY NO 73 AND EX N 10 RODS

Taxpayer Details

Taxpayer Name and Address:
GARGANO CHARLES A
12731 HWY 16
HIBBING MN 55746

Owner Details

Owner Name and Address:
GARGANO BRENDA S
12731 HWY 16
HIBBING MN 55746

Owner Name and Address:
GARGANO CHARLES A
12731 HWY 16
HIBBING MN 55746

Payable 2023 Tax Summary

2023 - Net Tax	$2,518.00
2023 - Special Assessments	$0.00
2023 - Total Tax & Special Assessments	**$2,518.00**

Current Tax Due (as of 3/5/2023)

Due May 15		Due October 16		Total Due	
2023 - 1st Half Tax	$1,259.00	2023 - 2nd Half Tax	$1,259.00	2023 - 1st Half Tax Due	$1,259.00
2023 - 1st Half Tax Paid	$0.00	2023 - 2nd Half Tax Paid	$0.00	2023 - 2nd Half Tax Due	$1,259.00
2023 - 1st Half Due	**$1,259.00**	**2023 - 2nd Half Due**	**$1,259.00**	**2023 - Total Due**	**$2,518.00**

Parcel Details

Property Address:	12731 HWY 16, HIBBING MN
School District:	701
Tax Increment District:	-
Property/Homesteader:	-

PROPERTY DETAILS REPORT

St. Louis County, Minnesota

Date of Report: 3/6/2023 4:23:55 PM

Assessment Details (2022 Payable 2023)

Class Code (Legend)	Homestead Status	Land EMV	Bldg EMV	Total EMV	Def Land EMV	Def Bldg EMV	Net Tax Capacity
204	0 - Non Homestead	$29,300	$99,300	$128,600	$0	$0	-
111	0 - Non Homestead	$12,400	$0	$12,400	$0	$0	-
	Total:	**$41,700**	**$99,300**	**$141,000**	**$0**	**$0**	**1410**

Land Details

Deeded Acres:	32.20
Waterfront:	-
Water Front Feet:	0.00
Water Code & Desc:	W - DRILLED WELL
Gas Code & Desc:	-
Sewer Code & Desc:	S - ON-SITE SANITARY SYSTEM
Lot Width:	0.00
Lot Depth:	0.00

The dimensions shown are not guaranteed to be survey quality. Additional lot information can be found at https://apps.stlouiscountymn.gov/webPlatsIframe/frmPlatStatPopUp.aspx. If there are any questions, please email PropertyTax@stlouiscountymn.gov.

Building 1 Details

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
HOUSE	1926	948	948	AVG Quality / 234 Ft ²	RAM - RAMBL/RNCH

Segment	Story	Width	Length	Area	Foundation
BAS	1	2	6	12	BASEMENT
BAS	1	26	36	936	BASEMENT
CN	1	6	8	48	FLOATING SLAB
DK	1	9	12	108	POST ON GROUND

Bath Count	Bedroom Count	Room Count	Fireplace Count	HVAC
1.0 BATH	2 BEDROOMS	4 ROOMS	1	C&AIR_COND, WOOD

Building 2 Details

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
GARAGE	1964	624	624	-	DETACHED

Segment	Story	Width	Length	Area	Foundation
BAS	1	24	26	624	FLOATING SLAB

Building 3 Details (MORTON)

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
POLE BUILDING	1977	1,500	1,500	-	-

Segment	Story	Width	Length	Area	Foundation
BAS	1	30	50	1,500	PIERS AND FOOTINGS

Building 4 Details (SHED)

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
STORAGE BUILDING	1979	340	340	-	-

Segment	Story	Width	Length	Area	Foundation
BAS	1	17	20	340	POST ON GROUND

Building 5 Details (MISC SHED)

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
LEAN TO	1955	36	36	-	-

Segment	Story	Width	Length	Area	Foundation
BAS	1	6	6	36	POST ON GROUND

Building 6 Details (LNTO STRG)

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
LEAN TO	1982	448	448	-	-

Segment	Story	Width	Length	Area	Foundation
BAS	1	16	28	448	POST ON GROUND

Building 7 Details (SCRN HOUSE)

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
SCREEN HOUSE	1983	179	179	-	-

Segment	Story	Width	Length	Area	Foundation
BAS	1	0	0	179	POST ON GROUND

Sales Reported to the St. Louis County Auditor

Sale Date	Purchase Price	CRV Number
05/2021	$160,000	242930

Assessment History

Year	Class Code (Legend)	Land EMV	Bldg EMV	Total EMV	Def Land EMV	Def Bldg EMV	Net Tax Capacity
2022 Payable 2023	204	$29,300	$99,300	$128,600	$0	$0	-
	111	$12,400	$0	$12,400	$0	$0	-
	Total	**$41,700**	**$99,300**	**$141,000**	**$0**	**$0**	**1,410.00**
2021 Payable 2022	204	$27,200	$84,200	$111,400	$0	$0	-
	111	$10,800	$0	$10,800	$0	$0	-
	Total	**$38,000**	**$84,200**	**$122,200**	**$0**	**$0**	**1,222.00**
2020 Payable 2021	201	$27,200	$80,300	$107,500	$0	$0	-
	111	$10,800	$0	$10,800	$0	$0	-
	Total	**$38,000**	**$80,300**	**$118,300**	**$0**	**$0**	**907.00**
2019 Payable 2020	201	$26,300	$78,600	$104,900	$0	$0	-
	111	$10,100	$0	$10,100	$0	$0	-
	Total	**$36,400**	**$78,600**	**$115,000**	**$0**	**$0**	**872.00**

Tax Detail History

Tax Year	Tax	Special Assessments	Total Tax & Special Assessments	Taxable Land MV	Taxable Building MV	Total Taxable MV
2022	$2,258.00	$0.00	$2,258.00	$38,000	$84,200	$122,200
2021	$1,376.00	$0.00	$1,376.00	$31,025	$59,710	$90,735
2020	$1,246.00	$0.00	$1,246.00	$29,430	$57,771	$87,201

PROPERTY DETAILS REPORT

St. Louis County, Minnesota

Date of Report: 3/6/2023 4:32:28 PM

General Details

Parcel ID:	141-0040-05714
Document Department:	Abstract
Document Number:	01447263
Document Date:	06/30/2022
Plat Name:	HIBBING

Legal Description Details

Plat Name: HIBBING

Section	Township	Range	Lot	Block
32	56	21	-	-

Description: NE1/4 OF SE1/4 EX N 612 FT AND EX S 350 FT EX HWY R/W

Taxpayer Details

Taxpayer Name and Address:
GROSZBACH NICHOLAS & PIA
2373 HWY 73
HIBBING MN 55746

Owner Details

Owner Name and Address:
GROSZBACH NICHOLAS
2373 HWY 73
HIBBING MN 55746

Owner Name and Address:
GROSZBACH PIA
2373 HWY 73
HIBBING MN 55746

Payable 2023 Tax Summary

2023 - Net Tax	$3,566.00
2023 - Special Assessments	$0.00
2023 - Total Tax & Special Assessments	**$3,566.00**

Current Tax Due (as of 3/5/2023)

Due May 15		Due October 16		Total Due	
2023 - 1st Half Tax	$1,783.00	2023 - 2nd Half Tax	$1,783.00	2023 - 1st Half Tax Due	$1,783.00
2023 - 1st Half Tax Paid	$0.00	2023 - 2nd Half Tax Paid	$0.00	2023 - 2nd Half Tax Due	$1,783.00
2023 - 1st Half Due	**$1,783.00**	**2023 - 2nd Half Due**	**$1,783.00**	**2023 - Total Due**	**$3,566.00**

Parcel Details

Property Address:	2373 HWY 73, HIBBING MN
School District:	701
Tax Increment District:	-
Property/Homesteader:	LANTZ, CURRIE & SHARON

Assessment Details (2022 Payable 2023)

Class Code (Legend)	Homestead Status	Land EMV	Bldg EMV	Total EMV	Def Land EMV	Def Bldg EMV	Net Tax Capacity
201	1 - Owner Homestead (100.00% total)	$26,800	$204,500	$231,300	$0	$0	-
	Total:	**$26,800**	**$204,500**	**$231,300**	**$0**	**$0**	**2149**

PROPERTY DETAILS REPORT

St. Louis County, Minnesota

Date of Report: 3/6/2023 4:32:28 PM

Land Details

Deeded Acres:	10.03
Waterfront:	-
Water Front Feet:	0.00
Water Code & Desc:	W - DRILLED WELL
Gas Code & Desc:	-
Sewer Code & Desc:	S - ON-SITE SANITARY SYSTEM
Lot Width:	0.00
Lot Depth:	0.00

The dimensions shown are not guaranteed to be survey quality. Additional lot information can be found at https://apps.stlouiscountymn.gov/webPlatsIframe/frmPlatStatPopUp.aspx. If there are any questions, please email PropertyTax@stlouiscountymn.gov.

Building 1 Details (HOUSE)

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
HOUSE	1991	1,248	1,248	ECO Quality / 624 Ft ²	RAM - RAMBL/RNCH

Segment	Story	Width	Length	Area	Foundation
BAS	1	26	48	1,248	BASEMENT
DK	1	0	0	83	PIERS AND FOOTINGS
DK	1	0	0	260	POST ON GROUND
DK	1	0	0	520	POST ON GROUND

Bath Count	Bedroom Count	Room Count	Fireplace Count	HVAC
2.0 BATHS	3 BEDROOMS	6 ROOMS	0	C&AIR_COND, GAS

Building 2 Details (26X36 DG)

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
GARAGE	1996	936	936	-	DETACHED

Segment	Story	Width	Length	Area	Foundation
BAS	1	26	36	936	FLOATING SLAB

Building 3 Details (SCRN HSE)

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
SCREEN HOUSE	1991	256	256	-	-

Segment	Story	Width	Length	Area	Foundation
BAS	1	16	16	256	POST ON GROUND
DKX	1	4	16	64	POST ON GROUND

Building 4 Details (36X48 PB)

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
POLE BUILDING	2008	1,728	1,728	-	-

Segment	Story	Width	Length	Area	Foundation
BAS	1	36	48	1,728	PIERS AND FOOTINGS
LT	1	8	48	384	PIERS AND FOOTINGS

Sales Reported to the St. Louis County Auditor

Sale Date	Purchase Price	CRV Number
06/2022	$350,000 (This is part of a multi parcel sale.)	249923

Assessment History

Year	Class Code (Legend)	Land EMV	Bldg EMV	Total EMV	Def Land EMV	Def Bldg EMV	Net Tax Capacity
2022 Payable 2023	201	$26,800	$204,500	$231,300	$0	$0	-
	Total	**$26,800**	**$204,500**	**$231,300**	**$0**	**$0**	**2,149.00**
2021 Payable 2022	201	$25,000	$173,500	$198,500	$0	$0	-
	Total	**$25,000**	**$173,500**	**$198,500**	**$0**	**$0**	**1,791.00**
2020 Payable 2021	201	$25,000	$165,300	$190,300	$0	$0	-
	Total	**$25,000**	**$165,300**	**$190,300**	**$0**	**$0**	**1,702.00**
2019 Payable 2020	201	$24,300	$152,700	$177,000	$0	$0	-
	Total	**$24,300**	**$152,700**	**$177,000**	**$0**	**$0**	**1,557.00**

Tax Detail History

Tax Year	Tax	Special Assessments	Total Tax & Special Assessments	Taxable Land MV	Taxable Building MV	Total Taxable MV
2022	$3,038.00	$0.00	$3,038.00	$22,560	$156,565	$179,125
2021	$2,846.00	$0.00	$2,846.00	$22,358	$147,829	$170,187
2020	$2,462.00	$0.00	$2,462.00	$21,374	$134,316	$155,690

PROPERTY DETAILS REPORT

St. Louis County, Minnesota

Date of Report: 3/6/2023 4:29:04 PM

General Details

Parcel ID:	141-0040-05830
Document Department:	Abstract
Document Number:	1018992
Document Date:	05/12/2006
Plat Name:	HIBBING

Legal Description Details

Plat Name: HIBBING

Section	Township	Range	Lot	Block
33	56	21	-	-

Description: SW14 of NW1/4 EXCEPT North 10 acres AND EXCEPT W1/2 of South 600 feet AND EXCEPT that part of the following described tract: SW1/4 of NW1/4 wchich lies westerly of a line run parallel with and distance 75 feet easterly of the following described line: Beginning at a point on the east and west quarter line of Section 32, Township 56, Range 21 distance 40.5 feet wet of the east quarter corner thereof; thence run Northerly at an angle of 94DEG50' with said east and west quarter line for 373 feet; thence deflect to the left on a 0DEG45' curve (delta angle 5 degrees 29') for 731.1 feet; thence on tangent to said curve for 400 feet and there terminating; together with a strip 85 feet in width adjoining and easterly of the above described strip; Beginning oppostie a point on the above described line, distant 208.5 feet northerly of its point of beginning and extending northerly for 100 feet, containing 1.61 acres, more or less, in addition to the existing highway

Taxpayer Details

Taxpayer Name and Address:
COLLINS TODD R & MICHELLE L
2420 HWY 73
HIBBING MN 55746

Owner Details

Owner Name and Address:
PAGET DAWN C
12708 GILBOE RD
HIBBING MN 55746

Owner Name and Address:
PAGET ROBERT J
12708 GILBOE RD
HIBBING MN 55746

Payable 2023 Tax Summary

2023 - Net Tax	$1,448.56
2023 - Special Assessments	$357.44
2023 - Total Tax & Special Assessments	**$1,806.00**

Current Tax Due (as of 3/5/2023)

Due May 15		Due October 16		Total Due	
2023 - 1st Half Tax	$903.00	2023 - 2nd Half Tax	$903.00	2023 - 1st Half Tax Due	$903.00
2023 - 1st Half Tax Paid	$0.00	2023 - 2nd Half Tax Paid	$0.00	2023 - 2nd Half Tax Due	$903.00
2023 - 1st Half Penalty	$0.00	2023 - 2nd Half Penalty	$0.00	Delinquent Tax	$4,268.43
2023 - 1st Half Due	**$903.00**	**2023 - 2nd Half Due**	**$903.00**	**2023 - Total Due**	**$6,074.43**

Delinquent Taxes (as of 3/5/2023)

Tax Year		Net Tax	Penalty	Cst/Fees	Interest	Total Due
2021		$1,269.74	$158.72	$0.00	$130.94	**$1,559.40**
2014		$388.80	$54.43	$0.00	$178.66	**$621.89**
2013		$784.70	$109.86	$0.00	$468.19	**$1,362.75**
2012		$369.06	$51.67	$20.00	$283.66	**$724.39**
	Total:	**$2,812.30**	**$374.68**	**$20.00**	**$1,061.45**	**$4,268.43**

Parcel Details

Property Address: 2420 HWY 73, HIBBING MN
School District: 701
Tax Increment District: -
Property/Homesteader: -

Assessment Details (2022 Payable 2023)

Class Code (Legend)	Homestead Status	Land EMV	Bldg EMV	Total EMV	Def Land EMV	Def Bldg EMV	Net Tax Capacity
204	0 - Non Homestead	$26,800	$48,200	$75,000	$0	$0	-
111	0 - Non Homestead	$6,000	$0	$6,000	$0	$0	-
	Total:	**$32,800**	**$48,200**	**$81,000**	**$0**	**$0**	**810**

Land Details

Deeded Acres: 19.42
Waterfront: -
Water Front Feet: 0.00
Water Code & Desc: W - DRILLED WELL
Gas Code & Desc: -
Sewer Code & Desc: S - ON-SITE SANITARY SYSTEM
Lot Width: 0.00
Lot Depth: 0.00

The dimensions shown are not guaranteed to be survey quality. Additional lot information can be found at https://apps.stlouiscountymn.gov/webPlatsIframe/frmPlatStatPopUp.aspx. If there are any questions, please email PropertyTax@stlouiscountymn.gov.

Building 1 Details (HOUSE)

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
HOUSE	1900	1,056	1,488	-	1S+ - 1+ STORY

Segment	Story	Width	Length	Area	Foundation
BAS	1	24	10	240	PIERS AND FOOTINGS
BAS	1.7	24	24	576	BASEMENT
CN	1	6	6	36	FOUNDATION
DK	1	0	0	210	POST ON GROUND
OP	1	8	8	64	POST ON GROUND

Bath Count	Bedroom Count	Room Count	Fireplace Count	HVAC
1.0 BATH	3 BEDROOMS	5 ROOMS	-	CENTRAL, PROPANE

Building 2 Details (20X28 DG)

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
GARAGE	1930	936	936	-	DETACHED

Segment	Story	Width	Length	Area	Foundation
BAS	1	26	36	936	POST ON GROUND

Building 3 Details (STRG SHED)

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
STORAGE BUILDING	0	276	276	-	-

Segment	Story	Width	Length	Area	Foundation
BAS	1	12	23	276	POST ON GROUND

Building 4 Details (STRG SHED)

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
STORAGE BUILDING	0	80	80	-	-

Segment	Story	Width	Length	Area	Foundation
BAS	1	8	10	80	POST ON GROUND

Building 5 Details (STRG BLDG)

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
STORAGE BUILDING	0	120	120	-	-

Segment	Story	Width	Length	Area	Foundation
BAS	1	10	12	120	POST ON GROUND

Building 6 Details (PLY LNTO)

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
LEAN TO	0	128	128	-	-

Segment	Story	Width	Length	Area	Foundation
BAS	1	8	16	128	POST ON GROUND

Building 7 Details (10X40)

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
MANUFACTURED HOME	1960	400	400	-	SGL - SGL WIDE

Segment	Story	Width	Length	Area	Foundation
BAS	0	10	40	400	POST ON GROUND

Bath Count	Bedroom Count	Room Count	Fireplace Count	HVAC
0 BATH	-	-	-	NONE,

Building 8 Details (PIGPEN/CHK)

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
STORAGE BUILDING	2015	192	192	-	-

Segment	Story	Width	Length	Area	Foundation
BAS	0	12	16	192	POST ON GROUND
LT	0	8	16	128	POST ON GROUND
LT	0	16	16	256	POST ON GROUND

Sales Reported to the St. Louis County Auditor

Sale Date	Purchase Price	CRV Number
06/2012	$49,900	197371
05/2006	$39,900	171509
04/1998	$20,000	121353

Assessment History

Year	Class Code (Legend)	Land EMV	Bldg EMV	Total EMV	Def Land EMV	Def Bldg EMV	Net Tax Capacity
2022 Payable 2023	204	$26,800	$48,200	$75,000	$0	$0	-
	111	$6,000	$0	$6,000	$0	$0	-
	Total	**$32,800**	**$48,200**	**$81,000**	**$0**	**$0**	**810.00**
2021 Payable 2022	204	$24,700	$40,800	$65,500	$0	$0	-
	111	$5,200	$0	$5,200	$0	$0	-
	Total	**$29,900**	**$40,800**	**$70,700**	**$0**	**$0**	**707.00**
2020 Payable 2021	204	$24,700	$38,900	$63,600	$0	$0	-
	111	$5,200	$0	$5,200	$0	$0	-
	Total	**$29,900**	**$38,900**	**$68,800**	**$0**	**$0**	**688.00**
2019 Payable 2020	204	$28,700	$41,800	$70,500	$0	$0	-
	Total	**$28,700**	**$41,800**	**$70,500**	**$0**	**$0**	**705.00**

Tax Detail History

Tax Year	Tax	Special Assessments	Total Tax & Special Assessments	Taxable Land MV	Taxable Building MV	Total Taxable MV
2022	$1,307.26	$330.74	$1,638.00	$29,900	$40,800	$70,700
2021	$1,259.80	$332.20	$1,592.00	$29,900	$38,900	$68,800
2020	$1,244.78	$337.22	$1,582.00	$28,700	$41,800	$70,500

PROPERTY DETAILS REPORT

St. Louis County, Minnesota

Date of Report: 3/6/2023 4:30:55 PM

General Details

Parcel ID:	141-0040-05835
Document Department:	Abstract
Document Number:	01131686
Document Date:	03/17/2010
Plat Name:	HIBBING

Legal Description Details

Plat Name: HIBBING

Section	Township	Range	Lot	Block
33	56	21	-	-

Description: W1/2 OF S 600 FT OF SW1/4 OF NW1/4

Taxpayer Details

Taxpayer Name and Address:
HERRERA JOANN NASON
2410 HWY 73
HIBBING MN 55746

Owner Details

Owner Name and Address:
HERRERA JOANN NASON
PO BOX 55748
HILL CITY MN 55748

Payable 2023 Tax Summary

2023 - Net Tax	$108.00
2023 - Special Assessments	$0.00
2023 - Total Tax & Special Assessments	**$108.00**

Current Tax Due (as of 3/5/2023)

Due May 15		Due October 16		Total Due	
2023 - 1st Half Tax	$54.00	2023 - 2nd Half Tax	$54.00	2023 - 1st Half Tax Due	$54.00
2023 - 1st Half Tax Paid	$0.00	2023 - 2nd Half Tax Paid	$0.00	2023 - 2nd Half Tax Due	$54.00
2023 - 1st Half Due	**$54.00**	**2023 - 2nd Half Due**	**$54.00**	**2023 - Total Due**	**$108.00**

Parcel Details

Property Address:	2410 HWY 73, HIBBING MN
School District:	701
Tax Increment District:	-
Property/Homesteader:	HERRERA, JOANN

Assessment Details (2022 Payable 2023)

Class Code (Legend)	Homestead Status	Land EMV	Bldg EMV	Total EMV	Def Land EMV	Def Bldg EMV	Net Tax Capacity
201	1 - Owner Homestead (100.00% total)	$21,100	$7,400	$28,500	$0	$0	-
	Total:	**$21,100**	**$7,400**	**$28,500**	**$0**	**$0**	**171**

Land Details

Deeded Acres:	9.11
Waterfront:	-
Water Front Feet:	0.00
Water Code & Desc:	W - DRILLED WELL
Gas Code & Desc:	-
Sewer Code & Desc:	S - ON-SITE SANITARY SYSTEM
Lot Width:	0.00
Lot Depth:	0.00

The dimensions shown are not guaranteed to be survey quality. Additional lot information can be found at https://apps.stlouiscountymn.gov/webPlatsIframe/frmPlatStatPopUp.aspx. If there are any questions, please email PropertyTax@stlouiscountymn.gov.

Building 1 Details (ARTCRAFT)

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
MANUFACTURED HOME	1975	924	924	-	SGL - SGL WIDE

Segment	Story	Width	Length	Area	Foundation
BAS	1	14	66	924	POST ON GROUND
CN	1	8	12	96	POST ON GROUND
DK	1	8	8	64	POST ON GROUND

Bath Count	Bedroom Count	Room Count	Fireplace Count	HVAC
1 BATH	2 BEDROOMS	-	-	CENTRAL, GAS

Building 2 Details (WELL HOUSE)

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
LEAN TO	1971	36	36	-	-

Segment	Story	Width	Length	Area	Foundation
BAS	1	6	6	36	POST ON GROUND

Building 3 Details (LOG SHED)

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
STORAGE BUILDING	1977	64	64	-	-

Segment	Story	Width	Length	Area	Foundation
BAS	1	8	8	64	POST ON GROUND

Building 4 Details (CAMPR STRG)

Building Type	Year Built	Main Floor Ft ²	Gross Area Ft ²	Basement Finish	Style Code & Desc.
	1974	160	160	-	-

Segment	Story	Width	Length	Area	Foundation
BAS	0	8	20	160	-

Sales Reported to the St. Louis County Auditor

Sale Date	Purchase Price	CRV Number
03/2010	$6,300	189081
09/2009	$3,000	187189
04/2007	$8,000	176567
03/2003	$7,000	151382
09/1996	$7,000	114170

Assessment History

Year	Class Code (Legend)	Land EMV	Bldg EMV	Total EMV	Def Land EMV	Def Bldg EMV	Net Tax Capacity
2022 Payable 2023	201	$21,100	$7,400	$28,500	$0	$0	-
	Total	**$21,100**	**$7,400**	**$28,500**	**$0**	**$0**	**171.00**
2021 Payable 2022	201	$20,100	$6,300	$26,400	$0	$0	-
	Total	**$20,100**	**$6,300**	**$26,400**	**$0**	**$0**	**158.00**
2020 Payable 2021	201	$20,100	$6,000	$26,100	$0	$0	-
	Total	**$20,100**	**$6,000**	**$26,100**	**$0**	**$0**	**157.00**
2019 Payable 2020	201	$19,600	$6,300	$25,900	$0	$0	-
	Total	**$19,600**	**$6,300**	**$25,900**	**$0**	**$0**	**155.00**

Tax Detail History

Tax Year	Tax	Special Assessments	Total Tax & Special Assessments	Taxable Land MV	Taxable Building MV	Total Taxable MV
2022	$104.00	$0.00	$104.00	$12,060	$3,780	$15,840
2021	$102.00	$0.00	$102.00	$12,060	$3,600	$15,660
2020	$98.00	$0.00	$98.00	$11,760	$3,780	$15,540