

**Appendix A.9:
Tiller Visual Assessment**

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E11.1 Revised Photo Visual Impact Analysis

E11.1.1 Introduction

The current visual conditions of the proposed Project and adjacent properties were photographed and recorded using a global positioning system (GPS) during leaf-on and leaf-off conditions to develop a visual impact baseline for traveling motorists, a local bike trail, neighboring residences in Minnesota and Wisconsin and from the St. Croix River (Figure 1). The analysis also helps determine sensitive observation areas that may have the potential to be impacted by the proposed Project so that mitigation measures can be developed as may be necessary. Activities which may be visible include Site Preparation work, excavation, loading, hauling, grading and removal of stockpiles. These activities will only occur for a limited period of time during any given year of operation.

The existing site is primarily an un-reclaimed gravel mine that is characterized by irregular landforms and several remaining stockpiles. Neighboring properties are characterized by agricultural and residential land uses. Land cover consists of fields, open space and wooded areas. Past mining has left the land at a reduced elevation compared to the adjacent properties which currently limits visibility into the proposed Project area. The proposed Project will result in further lowering of the interior elevation by approximately 15 feet and reconfiguration of the topography. Other than the proposed access entrance and proposed screening berms the current elevations within the proposed Project limits reflect the greatest elevations the site will experience throughout the life of the Project.

E11.1.2 Methods

Leaf-off conditions were photographed April 2009, November 2010, January 2011 and April 2011. Leaf-on conditions were photographed in August and September 2009. The range in photograph dates is a result of accessibility to photograph locations, feedback from the public and comments from the City and its consultant. The GPS locations of the photographs were recorded using Trimble® SCS900 Site Controller Software. In locations where the Trimble® software was not applicable, a combination of topography data and aerial photography was used to identify photograph locations; this technique was utilized for leaf-off photographs in Wisconsin and leaf-off photographs on the Bike Trail.

The photographs were taken at locations surrounding the proposed Project that were most likely to offer a view of the interior of the Project. The locations were determined based on topography, tree coverage and location. A wide range of photograph locations were selected to ensure thorough coverage of the proposed Project for the Photo Visual Impact Analysis (Figure 1). The majority of photograph locations have a corresponding leaf-on and leaf-off photograph. The exact photograph locations were difficult to recreate on the St. Croix River due to the river current, but the locations are as close as practical. In Wisconsin, the leaf-on locations were chosen due to the open viewing corridor over the agricultural fields; no potential for distant visibility is offered in the forested areas. During leaf-off conditions the photograph locations in Wisconsin were selected due east of the proposed Project to determine potential visual impacts to the forested areas that offer no visibility during leaf-on conditions. Photographs taken from the bike trail that travels along Highway 95 were only taken during leaf-off in order to determine the greatest potential for visual impacts.



E11.1.3 Results

Photographs were taken at selected locations to provide a comparison of the view during leaf-off and leaf-on conditions of the proposed Project (Figure 1).

Location 1 – Highway 97 (Photographs 1 and 2)

Photographs 1 and 2 were taken on Highway 97, approximately 0.8 miles west of the proposed Project. For both the leaf-on and leaf-off conditions, the proposed Project will be blocked by trees and rolling topography.

Location 2 – Highway 97 (Photographs 3 and 4)

Photographs 3 and 4 were taken on Highway 97, approximately 0.5 miles west of the proposed Project. For the leaf-on conditions, the visibility of the proposed Project will be blocked by trees and vegetation. During leaf-off conditions tree screening at the perimeter of the property and the reduced elevation of the interior of the proposed Project area prevent any substantial views into the proposed Project area.

Construction of the proposed Project access entrance has the potential to be viewed from this location. The current access is skewed slightly to the north of Highway 97. The new access will be realigned so it is directly in line with Highway 97. The new access will be within the line of sight for motorists traveling eastbound on Highway 97. This activity will be short term (3-4 weeks) during Site Preparation work. The construction of the new access will require the removal of a minor amount of trees within the eastbound Highway 97 viewshed, which will result in the potential to view activity during construction. This will be a temporary viewshed impact not unlike any other road construction project in the area. The new Project access has been designed to accommodate mitigation measures to screen the entrance area. Upon completion of the construction of the new access road alignment, the new access road will turn sharply upon entering the Project area and a screening berm and landscaping will screen the view into the Project area from motorists eastbound on Highway 97. The top of the berm will reach an elevation of 923 feet above mean sea level (MSL). The elevation on the back side of the berm will rapidly drop off to the base of the proposed Project which will vary between 840 feet and 864 feet above MSL throughout the life of the mining operation. The berm will therefore effectively screen the active phases of the Project as motorists eastbound on Highway 97 approach the site. The bluffs on the Wisconsin side of the river will be visible in the horizon beyond the new screening berm.

Location 3 – Highway 97 (Photograph 5)

Photograph 5 was taken during leaf-off conditions on Highway 97, approximately 0.25 miles west of the proposed Project. The trees screen most of the proposed Project area. At this location, the white pines on the east side of the Project Limit Area are visible, but the ground surface is not visible due to the elevation change of 70 feet. The interior of the proposed Project is at a reduced elevation due to past mining activity. The screening berm that remains from previous mining activity is also visible along the right hand side of the photograph across from Highway 95.

Construction of the proposed Project access entrance has the potential to be viewed from this location. The new access will be realigned so it is directly in line with Highway 97. The new access will be within the line of sight for motorists traveling eastbound on Highway 97. This activity will be short term (3-4 weeks) during Site Preparation work, not unlike any other road construction project in the area.



Location 4 – 220th St N (Photographs 6 and 7)

Photographs 6 and 7 were taken on 220th Street North, located north of the proposed Project approximately 0.6 miles. The proposed Project is not visible from this location due to rolling topography and screening from trees, located both along the northern perimeter of the property boundary and midway between 220th Street North and the property boundary.

Location 5 – Quarry Ave N (Photographs 8 and 9)

Photographs 8 and 9 were taken on Quarry Avenue North, located approximately 0.4 miles north of the proposed Project. The proposed Project is not visible from Quarry Ave. North during leaf-on conditions due to rolling topography and screening from trees and vegetation. During leaf-off conditions most of the proposed Project will be screened by trees and rolling topography. Some activity may be visible on the very northern limits of the property, which includes Phase 1 Mining and Phase 2 Reclamation (C1-C2), but visibility will be limited due to screening from trees and further lowering of interior elevation.

Location 6 – Highway 95 (Photographs 10 and 11)

Photographs 10 and 11 were taken on Highway 95, located approximately 0.25 miles north-northwest of the proposed Project. During leaf-on conditions the proposed Project is not visible due to vegetation. During leaf-off conditions some activity may be visible on the very northern limits of the property, which includes Phase 1 Mining and Phase 2 Reclamation (C1-C2), but visibility will be limited due to screening from trees and further lowering of interior elevation.

Location 7 – Highway 97 and Highway 95 Intersection (Photographs 12 and 13)

Photographs 12 and 13 were taken just east of the intersection of Highway 97 and Highway 95, facing east towards the proposed Project. During leaf-on conditions the proposed Project is not visible due to vegetation and tree coverage. During leaf-off conditions, the top of a remaining stockpile (center of photo) and the canopies of the white pines are visible on the eastern edge of the Project limit area. During leaf-off conditions, activity that involves the removal of the remaining stockpile has the potential to be visible. This activity will be temporary (less than 2 weeks) during Phase 3 Mining (C3). The existing berm that remains from previous mining activity limits visibility into the proposed Project area. Another factor that limits visibility is a difference in elevation of approximately 50 feet between the photograph locations and the interior of the proposed Project area. The interior of the site is at a reduced elevation due to past mining activity and will be further reduced as part of the Project.

Construction of the proposed Project access entrance has the potential to be viewed from this location. The new access will be realigned so it is directly in line with Highway 97. The new access will be within the line of sight for motorists at the intersection of Highway 97 and Highway 95. This activity will be short term (3-4 weeks) during Site Preparation work, not unlike any other road construction project in the area.

Location 8 – Highway 95 (Photographs 14 and 15)

Photographs 14 and 15 were taken on Highway 95, located west of the proposed Project about 0.1 miles. Both leaf-on and leaf-off conditions essentially provide the same viewshed across an agricultural field that has a viewing corridor into the Project area. There is some visibility of a remaining stockpile in the southwestern fringes of the proposed Project area during leaf-off. The trees that are visible in the distance beyond the agricultural field are within Phase 1 and will be removed as part of the proposed Project. This will open up the view of the Project to motorists northbound on Highway 95. A screening berm is proposed to be constructed along the outside perimeter of the proposed Project limits. The screening berm will continue from the existing berm along Highway 95, wrapping around the southwest corner of Phase 1 heading east-west



and then continuing south along the west property line of Phase 2. The potential for viewing activity at the proposed Project will be highest during the construction of the berm and the potential removal of the berm, during Phase 1 Mining and Phase 4 Reclamation respectively. The potential exists that occasional mining activity may be visible during the four mining phases from this location due to a gradual slope in elevation toward the direction of the proposed Project area and minimal coverage from trees and vegetation. The proposed berm will help decrease visual impacts at this location.

Location 9 – Quinnell Ave N (Photographs 16 and 17)

Photographs 16 and 17 were taken on Quinnell Avenue North, located west of the southwest corner of the proposed Project approximately 0.1 miles. The proposed Project is not visible from this location due to screening from trees and vegetation.

Location 10 – St. Croix River (Photographs 18 through 26)

Photographs 18 through 26 were taken on the St. Croix River during leaf-on and leaf-off conditions. The photographs reveal that a combination of the dramatic elevation change and mature tree and vegetation coverage prevent any visibility of the proposed Project from the river.

Location 11 – Wisconsin (Photographs 27 through 31)

Photographs 27 through 31 were taken at various locations along the Wisconsin bluff line approximately 1-1.5 miles from the proposed Project “as the crow flies”. All five of the images demonstrate that the density of tree and vegetation coverage, the elevation changes, topography and the sheer distance from the proposed Project prevent the possibility of viewing the interior of the proposed Project.

Location 12 – Bike Trail (Photographs 32 through 37)

Photographs 32 through 37 were taken during leaf-off at a number of locations along the bike trail located between Highway 95 and the proposed Project. The bike trail extends from the existing Zavoral site entrance at the intersection of Highways 95 and 97 and terminates just south of the Zavoral property at Quinnell Avenue North. The bike trail does not experience high traffic (as indicated in photograph 32), but it does provide useful consideration for the analysis due to the proximity of the Project.

The segment of the bike trail adjacent to the proposed Project is just under 0.5 miles long, and is considered to be part of the Scandia/Marine Neighborhood Loop. The City of Scandia produced a Trails Planning Map that illustrates existing and proposed bike routes within the City limits. The proposed trailhead for the bike route described as the Scandia/Marine Loop is located near the intersection of Highway 95 and Highway 97. The bike route begins by heading south along Highway 95 for approximately four miles into the City of Marine. From the City of Marine, the trail begins to make the return loop west and north on County Road 4, where a number of trails may be taken back to the proposed trailhead.

Although the bike trail adjacent to the Project is considered as part of the Comprehensive Trail Plan in the City of Scandia, the Washington County Bike Trail System does not include the bike trail as part of the countywide bike trail system. The County Bike Trail Administration produced a map that illustrates bike routes in Washington County. The bike route described as Bike Loop 1 begins at Square Lake Park and travels west and north along paved shoulders of County Roads to Highway 97. From Highway 97, the route travels east through Scandia along paved shoulders, then proceeds south on Highway 95 along paved shoulders to the off-road trail through William O’Brian State Park. The route resumes on Highway 95 in Marine on the St.



Croix and ultimately returns to Square Lake Park. Regardless of the status of the adjacent bike trail, it does offer an additional vantage point that further defines the current viewshed.

As indicated, six photographs were taken along the bike trail starting at the intersection of Highway 95 and Highway 97, then south towards Quinnell Avenue North. Photograph 32 illustrates the condition of the bike trail. Photograph 33 is the view facing towards the existing site access. A new site access is proposed that would realign the site access with Highway 97. The construction of the proposed site access will be a temporary activity (3-4 weeks) during Site Preparation. Photographs 34 and 35 are located south of the intersection and facing the existing berm that screens the site. The existing view at the location of photograph 34 offers limited if any visibility into the site, which is not expected to change since the existing berms will remain throughout the life of the proposed Project. The location of photograph 35 may have a greater potential for visual impacts during Phase 1 Mining and Reclamation due to the higher vantage point and the greater proximity to the location for proposed berms. The proposed berms would be constructed during Site Preparations as a 3-4 week activity. The potential to view activity during Phase 1 Mining and Reclamation would likely be limited to the western-most perimeter of the proposed Project and the potential would decrease as mining reduces the elevation internally within the site. Photographs 36 and 37 are located just north of Quinnell Avenue North and provide a view overlooking the agricultural field adjacent to the proposed Project. From this location, Phase 1 and Phase 2 Mining and Reclamation have the potential to impact this particular viewshed when mining and reclamation activities occur on the western fringes of the proposed Project limits. Activities which may be visible include Site Preparation work, excavation, loading, hauling, grading and removal of stockpiles. These activities will only occur for a limited period of time during any given year of operation. The potential for impacts to the viewshed will decrease as mining reduces the elevation internally within the site.



Photo 1: Leaf-on



Photo 2: Leaf-off

Photo Visual Impact Analysis	Location 1 – Highway 97
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Photo 3: Leaf-on



Photo 4: Leaf-off

Photo Visual Impact Analysis	Location 2 – Highway 97
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Photo 5: Leaf-off

Photo Visual Impact Analysis	Location 3 – Highway 97
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Photo 6: Leaf-on



Photo 7: Leaf-off

Photo Visual Impact Analysis	Location 4 – 220th Street North
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Photo 8: Leaf-on



Photo 9: Leaf-off



Photo 10: Leaf-on



Photo 11: Leaf-off



Photo 12: Leaf-on



Photo 13: Leaf-off

Photo Visual Impact Analysis	Location 7 – East Side of Highway 97 and Highway 95 Intersection
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Photo 14: Leaf-on



Photo 15: Leaf-off

Photo Visual Impact Analysis	Location 8- Highway 95
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Photo 16: Leaf-on



Photo 17: Leaf-off

Photo Visual Impact Analysis	Location 9– Quinnell Avenue North
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Photo 18: Leaf-on



Photo 19: Leaf-off

Photo Visual Impact Analysis	Location 10– St. Croix River
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Photo 20: Leaf-on



Photo 21: Leaf-off

Photo Visual Impact Analysis	Location 10– St. Croix River
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Photo 22: Leaf-on



Photo 23: Leaf-off

Photo Visual Impact Analysis	Location 10– St. Croix River
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Photo 24: Leaf-on



Photo 25: Leaf-off

Photo Visual Impact Analysis	Location 10– St. Croix River
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Photo 26: Leaf-off

Photo Visual Impact Analysis	Location 10– St. Croix River
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Photo 27: Leaf-on



Photo 28: Leaf-on

Photo Visual Impact Analysis	Location 11– Wisconsin
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Photo 29: Leaf-off



Photo 30: Leaf-off

Photo Visual Impact Analysis	Location 11– Wisconsin
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Photo 31: Leaf-off

Photo Visual Impact Analysis	Location 11– Wisconsin
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Photo 32: View of the bike trail facing south.



Photo 33: Leaf-off

Photo Visual Impact Analysis	Location 12– Bike trail
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Photo 34: Leaf-off



Photo 35: Leaf-off

Photo Visual Impact Analysis	Location 12– Bike trail
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Photo 36: Leaf-off



Photo 37: Leaf-off



E11.2 Computer Aided Visual Impact Analysis

E11.2.1 Introduction

A Computer Aided Visual Impact Analysis was conducted to determine the potential for impacts on the local viewshed for motorists, residents, and visitors to the area. The Computer Aided Visual Impact Analysis was developed from a computer model that determines the viewshed, or area that can be seen from a set of observer points. The model is based on the expected visual conditions of the proposed Project area and adjacent and surrounding properties. The analysis helps determine sensitive observation areas that may have the potential to be impacted by the proposed Project so that mitigation measures can be developed as may be necessary.

Activities which may be visible include Site Preparation work, excavation, loading, hauling, grading and removal of stockpiles. These activities will only occur for a limited period of time during any given year of operation.

The existing site is primarily an un-reclaimed gravel mine that is characterized by irregular landforms and several remaining stockpiles. Neighboring properties are agricultural and residential with wooded areas. The past mining has left the land at a reduced elevation compared to the adjacent properties which currently reduces visibility into the proposed Project area. The proposed Project will result in further lowering of the elevation by approximately 15 feet and reconfiguration of the topography. In general, the current elevations within the proposed Project limits reflect the greatest elevations the site will experience throughout the life of the Project.

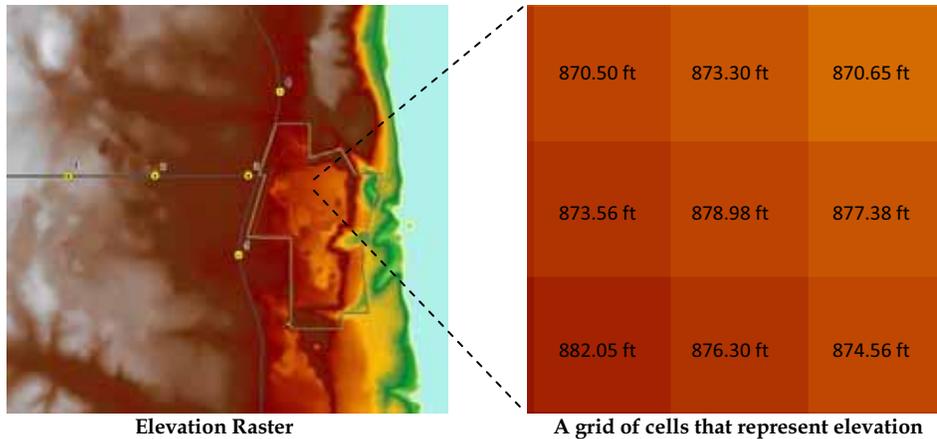
Three viewshed models were developed to determine the degree of visibility into the proposed Project area from sets of selected observer points in Minnesota, the St. Croix River and Wisconsin (Figure 2). The observer points were selected to determine potential visual impacts to each of the following:

- A traveling motorist in Minnesota; observer points were chosen along Highways 95 and 97.
- A recreational user on the St. Croix River; observer points were evenly positioned along the main channel of the St. Croix River near the proposed Project.
- A resident of, or visitor to the Wisconsin bluff line; observer points were chosen at higher elevation points along the bluff where a sight line into the Project area was more likely.

E11.2.2 Methods

All three viewshed models were developed using ArcGIS® 3D Analyst™ 10. To develop the viewshed all necessary data was compiled and processed in order to depict the viewshed accurately.

First, a representation of the topography at the proposed Project and surrounding areas was generated in the form of an elevation raster (illustration below). A raster consists of a matrix of cells (or pixels) organized into rows and columns (or grid) where each cell contains a value representing a measurement at the center of the cell, such as elevation. The elevation raster is a three-dimensional surface that can be processed by the visual analysis tools in 3D Analyst™.



The data that represents the topography at the proposed Project and surrounding areas and used to generate the elevation raster are shown on Figure 2 and include:

- **10 ft Contours** outside the Property Boundary (source: Mapmart).
- **2 ft and 10 ft Washington County Contours** inside the Property Boundary (source: Washington County).
- **60 ft Tree Canopy Height** added to the elevation of the two sets of contours at select locations (source: Mapmart and Washington County modified by Tiller Corporation).
- **Proposed and Existing Berms**, which includes the proposed new access entrance (source: Sunde Engineering, PLLC).

The elevation raster was generated from the topography data using an interpolation technique specifically designed to work with contour inputs. The basic function of interpolation is to determine cell values in a raster based on known values and characteristics of the input data. The interpolation method uses an iterative finite difference technique based on the widely accepted algorithm developed by Michael Hutchinson (1988, 1989)¹.

Second, five points were selected per viewshed to represent observer locations. The points were chosen in locations where a potential viewing corridor would be most likely: at higher elevations, at locations with minimal tree coverage that could obstruct the view and at locations close to the proposed Project (Figure 2).

Third, three viewshed models were generated by ArcGIS 3D Analyst™ 10, using the Observer Points tool. The Observer Points tool uses the elevation raster and the five selected observer points as inputs to generate a new raster that represents the viewshed. The viewshed raster stores information about which observer points are visible from each raster cell, which can be used to identify and symbolize the raster cells that are visible from a specific observer point. For

¹ Hutchinson, M.F. 1988. Calculation of hydrologically sound digital elevation models. Paper presented at Third International Symposium on Spatial Data Handling at Sydney, Australia.

Hutchinson, M.F. 1989. A new procedure for gridding elevation and stream line data with automatic removal of spurious pits. *Journal of Hydrology* 106: 211-232.



example, every raster cell that is visible from Observer 1 is shaded pink (Figure 3). Each observer point is assigned a unique color which is used to show the region that is visible to that particular observer. An additional color is used to indicate areas that can be seen by multiple observers (2+ Observer Points). A raster cell that is not shaded on the map is not visible to any observer point.

The viewshed is modeled based on a calculated visibility for each cell in the raster. The visibility of a cell is determined by comparing the altitude angle to the cell center with the altitude angle to the local horizon. The local horizon is computed by considering the intervening terrain between the observation point and the current cell center. Essentially, where cells of higher elevation value are between the observation point and the current cell, the view is blocked. If the view is blocked then the current cell is determined to not be part of the viewshed. If it is not blocked then it is included in the viewshed.

The viewshed models were created using the following settings:

- No observation constraints.
- Azimuth set to a full 360-degree view.
- No vertical limitations.
- Radius (three-dimensional line of sight) distance set to infinity.
- Output resolution (the dimension of each cell, or area covered on the ground by each cell) set to 20 feet × 20 feet to match the resolution of the elevation raster.
- 4-foot offset was added to the elevation value at each of the observer points.

The 4-foot value is a conservative number to account for the height of a driver's eye. (The Mn/DOT Road Design Manual uses a standard of 3.5 feet.) A driver's eye height is not a concern for most of the observer point locations; however, the 4-foot offset provides a greater vantage point and generates a more conservative model. Without an offset, the observer points would be at ground elevation, which would decrease the size of the viewshed.

E11.2.3 Assumptions

First, tree canopy height was added to the appropriate elevation contours within reasonable proximity to the proposed Project to reflect the existing and expected visual obstacle which trees provide (Figure 2). A 60-foot canopy height was used to simulate the existing type of tree coverage which is dominated by mature white pine and mixed hardwoods. This is a conservative estimate since most of the trees east of the proposed Project are greater than 60 feet in height. The tree canopy height was only added to elevation contours in Minnesota between the proposed Project limit and the St. Croix River, and only to elevation contours that exist in dense tree coverage that reflect the mature part of the forest.

No tree canopy height modifications were made to elevation contours in Wisconsin, elevation contours for the existing and proposed berms, elevation contours west of the property line, or elevation contours within the proposed Project limits (Figure 2). By limiting the extent of tree canopy height modifications, the view from the observer points is modeled as having an open



corridor free of trees and vegetation. This is a conservative approach to the analysis and produces an expanded viewshed that more closely examines the worst-case potential for visual impacts of the proposed Project. This does not reflect the true nature of the current and expected visual conditions. In reality, trees provide a substantial amount of screening at most of the described locations. As mentioned earlier, tree canopy height is only modeled for portions of the forest between the proposed Project limit and the St. Croix River that present significant visual screening (Figure 2).

Second, observer points were placed in areas having the following characteristics:

- Higher elevation than the proposed Project area.

Due to the recessed elevation in the proposed Project area, there is a greater potential for visibility into the proposed Project area from higher elevations.

- Minimal tree coverage.

Although trees were only modeled for the area between the proposed Project limit and the St. Croix River, placement of observer points was based on where a viewing corridor might exist in reality.

- Close proximity to the proposed Project area, including the St. Croix River and neighboring residences.

E11.2.4 Results

The three viewshed models that were generated are illustrated on Figures 3-5. Each figure includes an aerial photograph of the site, the limits of the proposed Project, the location of the five observation points used in the model, and the resulting visible viewshed from the five observation points. The viewshed, or area visible from the observation points, is shaded. Areas that are not shaded are not visible from the observation point in any direction.

Model 1 – Traveling Motorist, MN (Figure 3)

The results of the first model, as shown on Figure 3, indicate that the interior of the proposed Project limit represents a very small fraction of the overall viewshed. The viewshed represented by motorists on Highway 97 does not include the proposed Project as a significant component. For Observers 1, 2 and 3 the visual impact associated with the proposed Project includes: the existing berm that runs parallel to Highway 95, the proposed new access and the tree canopy on the eastern edge of the proposed Project limit. The limited visual impact of the proposed Project is due to undulating topography, reduced elevation within the proposed Project and sufficient screening from the existing berm.

The viewshed model indicates that visibility into the proposed Project area is primarily limited to motorists traveling on Highway 95. Observers 4 and 5 represent the traveling motorist on Highway 95. From these two observer points, a small fraction of the interior of the proposed Project can be seen. From Observer 4, the northern reaches of the proposed Project and several existing stockpiles are indicated to be part of the viewshed. The visible area in the northern reaches of the proposed Project encompasses approximately 3.80 acres. This visible area is included as part of Phase 1 Mining and Phase 2 Reclamation (C1-C2). The existing stockpiles will be removed as part of Phase 3 Mining (C3). From Observer 5, the eastern portion of the agricultural field that occurs within the proposed Project area and several existing stockpiles are indicated to be part of the viewshed. The eastern portion of the agricultural field



will be mined as part of Phase 2 Mining (C2). Screening from the proposed berm and reduced elevation within the proposed Project as mining progresses will reduce visual impacts. The existing stockpiles will be removed as part of Phase 3 Mining (C3).

Tree canopy height was not added to elevation contours west of the project limit area, therefore vegetation and tree screening do not present any visual limitations in this model. Refer back to Figure 2 for the extent of tree canopy modifications to elevation contour lines.

Model 2 – St. Croix River (Figure 4)

The results of the second model, as shown on Figure 4, indicate that the proposed Project is not visible from the St. Croix River. A combination of the dramatic elevation change and mature forest prevent the possibility of viewing the proposed Project from the St. Croix River.

Model 3 – Wisconsin (Figure 5)

The results of the third model, as shown on Figure 5, indicate that there is very limited potential for visibility into the Project limit area. Most of the viewshed near the Project limit area is reflective of visible tree canopy. The west central portion of the proposed Project is visible to Observer 3 and visible at places to 2+ Observer Points (Observers 1, 2, 3, and/or 5). This area contains the proposed and existing berms and a portion of the field adjacent to the berms. Throughout the life of the project, elevations within the Project limit area will decrease, further reducing visual impacts to residents and visitors on the Wisconsin bluff line.

Tree canopy height was not added to elevation contours in Wisconsin. Therefore the visual limitations caused by vegetation and tree screening have been reduced, which results in an expanded viewshed. Refer back to Figure 2 for the extent of tree canopy modifications to elevation contour lines.

Summary

The proposed Project is well screened; a very limited number of potential viewing corridors exist. This conclusion is supported by both the Photo and Computer Aided Visual Impact Analyses.

Reasons for limited visibility into the proposed Project area include:

- Local topography.
- Mature forest surrounding much of the proposed Project area.
- Proposed and existing berms.
- Decreased elevation within the proposed Project area due to past mining activities.

With the exception of the new entrance alignment, tree coverage and vegetation that exist outside of the proposed mining limits are expected to remain for screening and therefore no new viewing corridors to the site are anticipated to open. It is not expected that the current viewing corridors will change much throughout the life of the Project. Mining activities within the proposed Project will further reduce elevation which will also decrease the potential for visibility into the proposed Project area.



The greatest potential for visual impact is to the traveling motorist in Minnesota. This conclusion is supported by both the Photo and Computer Aided Visual Impact Analyses (Figure 3). Mining activities that have the greatest potential for visual impact include the construction of the proposed Project access entrance (which will occur for a 3-4 week period during Site Preparation) and construction of proposed screening berms (which will occur during Phase 1 Mining as a temporary activity). Mining and reclamation activities that occur at or near the western perimeter of the proposed Project limits have the potential to be visible for motorists traveling within close proximity of the proposed Project. Results from both analyses suggest that the visual impact will be minimal based on the small fraction of the viewshed modeled within the proposed Project limit area and the degree of tree screening in both leaf-on and leaf-off conditions illustrated in photo locations 1-9.

According to both analyses, the proposed Project will not be visible from the St. Croix River. A combination of the dramatic elevation change and mature forest prevent the possibility of viewing the proposed Project from the St. Croix River.

In addition, both analyses support the conclusion that the proposed Project will not be visible from Wisconsin. The Photo Visual Impact Analysis clearly demonstrates that high tree density from tall canopy trees prevents an open viewing corridor to the proposed Project area. The Computer Aided Visual Impact Analysis suggests that the west central portion of the proposed Project is visible to Observer 3 and visible at places to 2+ Observer Points (Observers 1, 2 3 and/or 5). The visible area within the Project contains the proposed and existing berms and a portion of the field adjacent to the berms. Since the model does not include tree canopy height near the observer points, the viewshed is expanded to resemble worst-case. The Photo Visual Impact Analysis supports the conclusion that visibility into the proposed Project area from Wisconsin is unlikely.

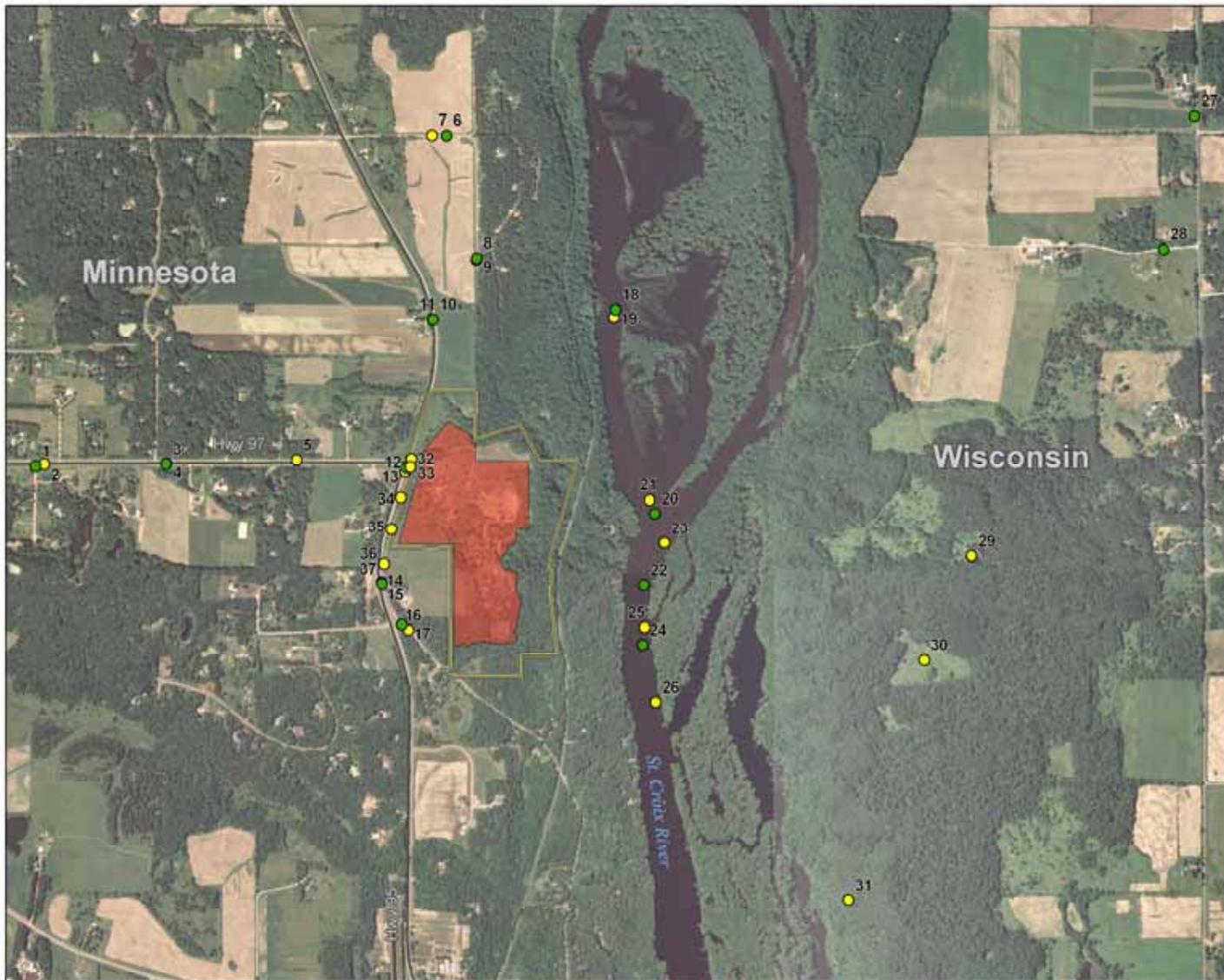
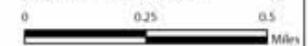


Zavoral Mining and Reclamation Project Figure 1

Zavoral Viewshed Analysis

- Leaf On Photo Points
- Leaf Off Photo Points
- Project Limit Area
- Property Boundary
- State Highways

2005 NAIP Aerial Photo



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Zavoral Mining and Reclamation Project

Figure 2

Zavoral Viewshed Analysis

-  Observer Point Locations
 -  Project Limit Area
 -  Property Boundary
 -  State Highways
- Topography
-  2 ft and 10 ft Contours
 -  Contours+60ft Tree Canopy Height
 -  Proposed and Existing Berms

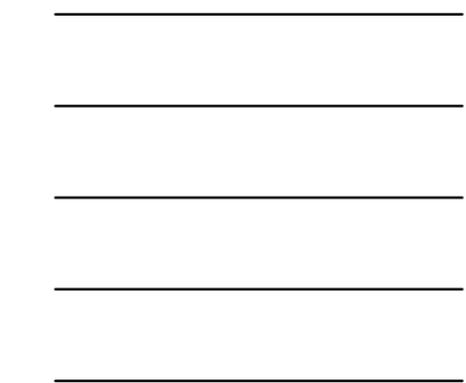
2005 NAIP Aerial Photo

0 0.15 0.3 Miles



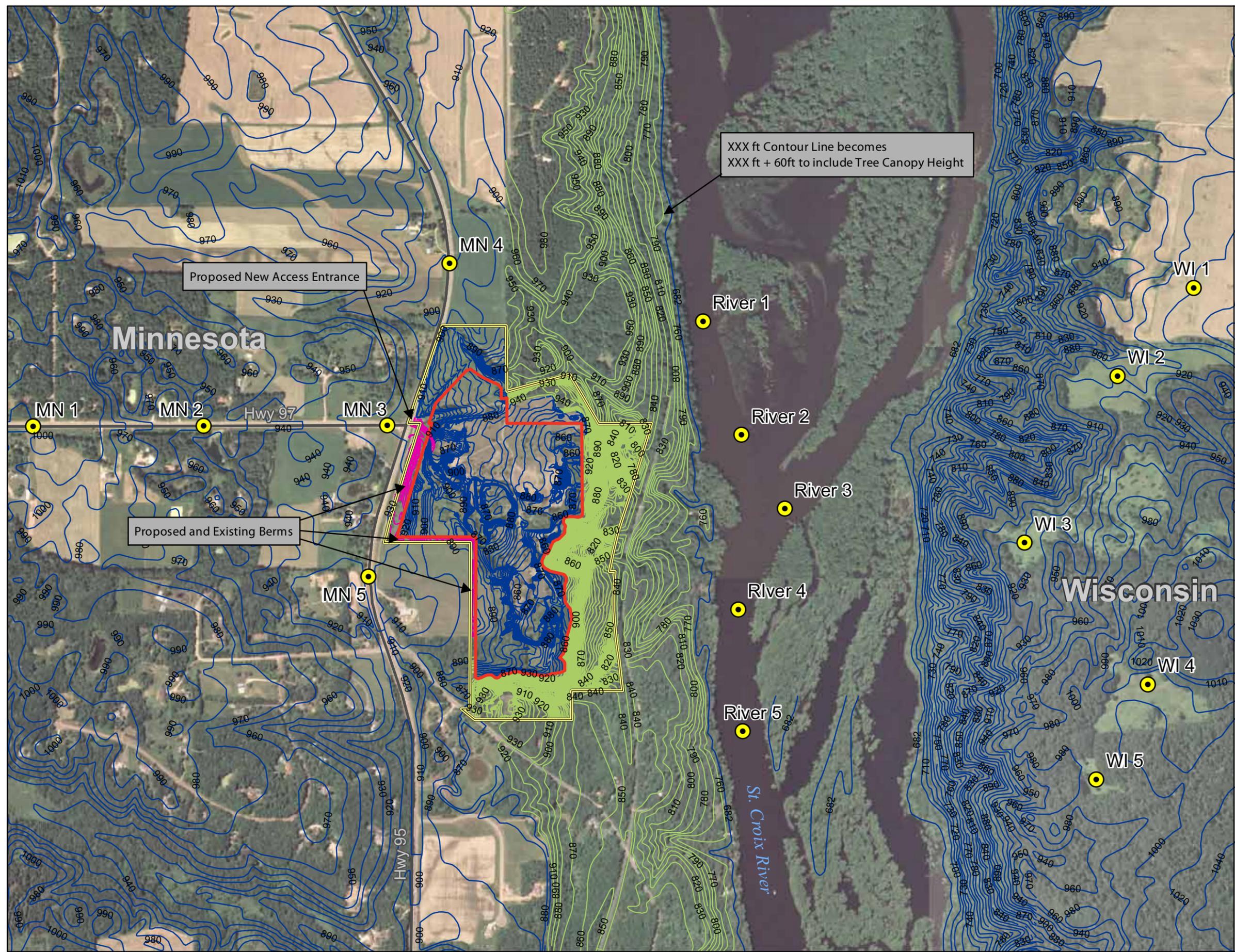
Topography within the property boundary includes 2ft and 10ft contours (Washington County). Topography outside the property boundary includes 10ft contours (Mapmart).

Contour elevation labels reflect the modified elevations used in the model to account for tree canopy height.




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Zavoral Mining and Reclamation Project

Figure 3

Zavoral Viewshed Analysis

 Observer Points, MN

Visible Areas From Observer Points

Traveling Motorist, MN

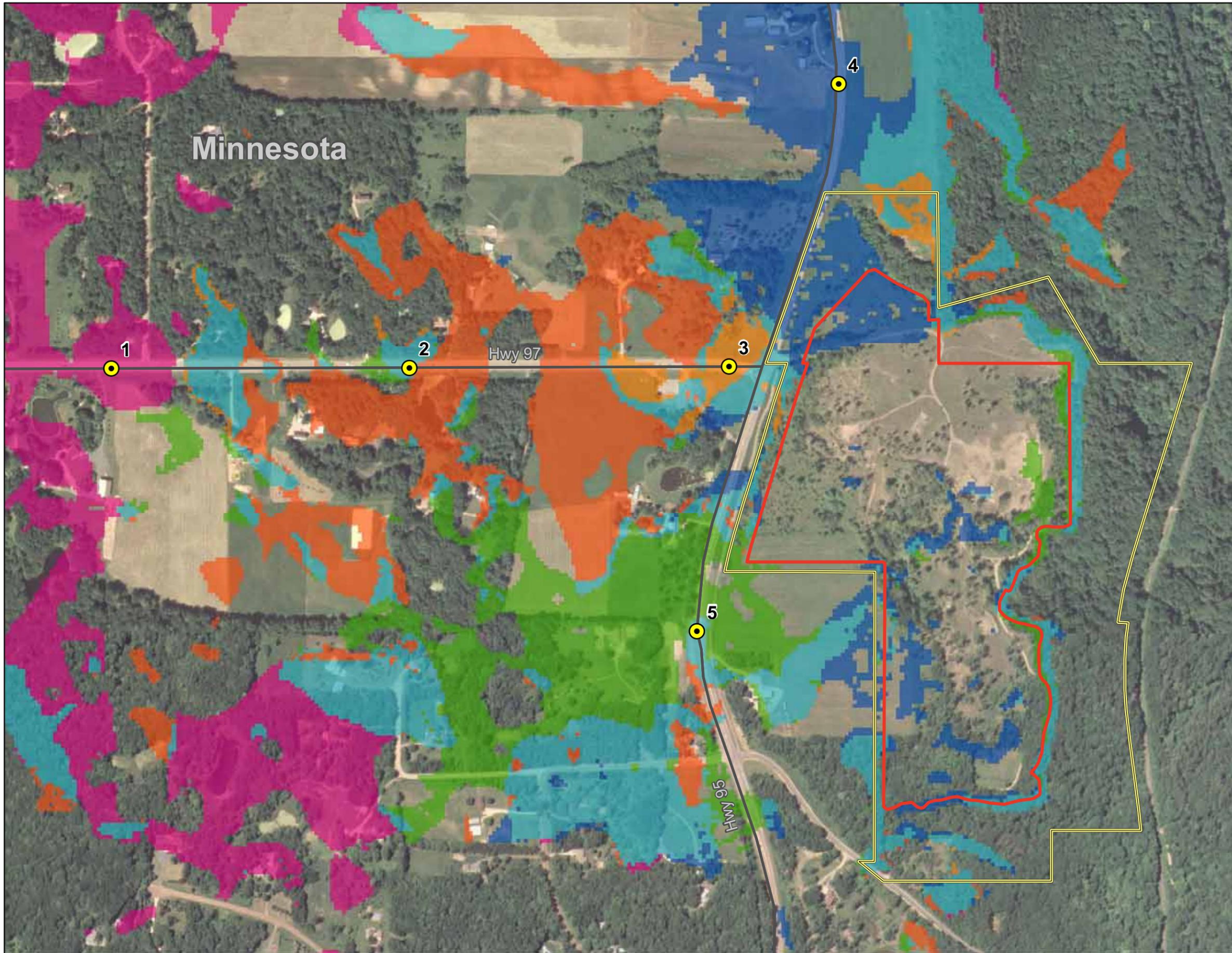
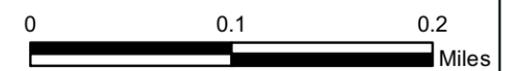
-  1
-  2
-  2+ Observer Points
-  3
-  4
-  5

 Project Limit Area

 Property Boundary

 State Highways

2005 NAIP Aerial Photo



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Zavoral Mining and Reclamation Project Figure 4

Zavoral Viewshed Analysis

 Observer Points, River

Visible Areas From Observer Points

St. Croix River

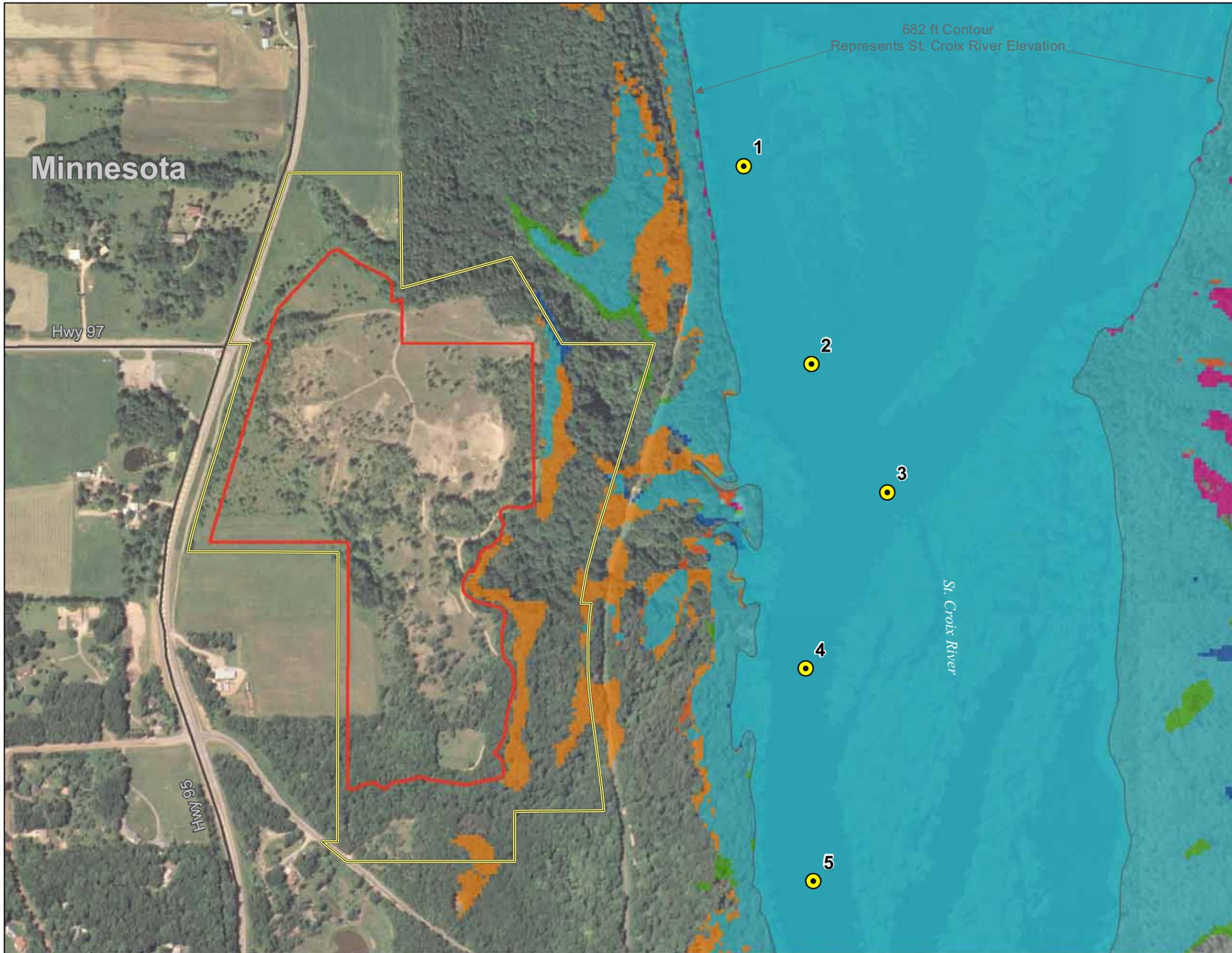
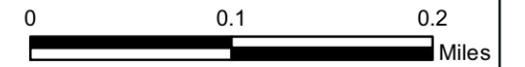
-  1
-  2
-  2+ Observer Points
-  3
-  4
-  5

 Project Limit Area

 Property Boundary

 State Highways

2005 NAIP Aerial Photo



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Zavoral Mining and Reclamation Project

Figure 5

Zavoral Viewshed Analysis

 Observer Points, WI

Visible Areas From Observer Points

Wisconsin

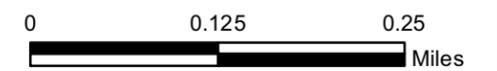
-  1
-  2
-  2+ Observer Points
-  3
-  4
-  5

 Project Limit Area

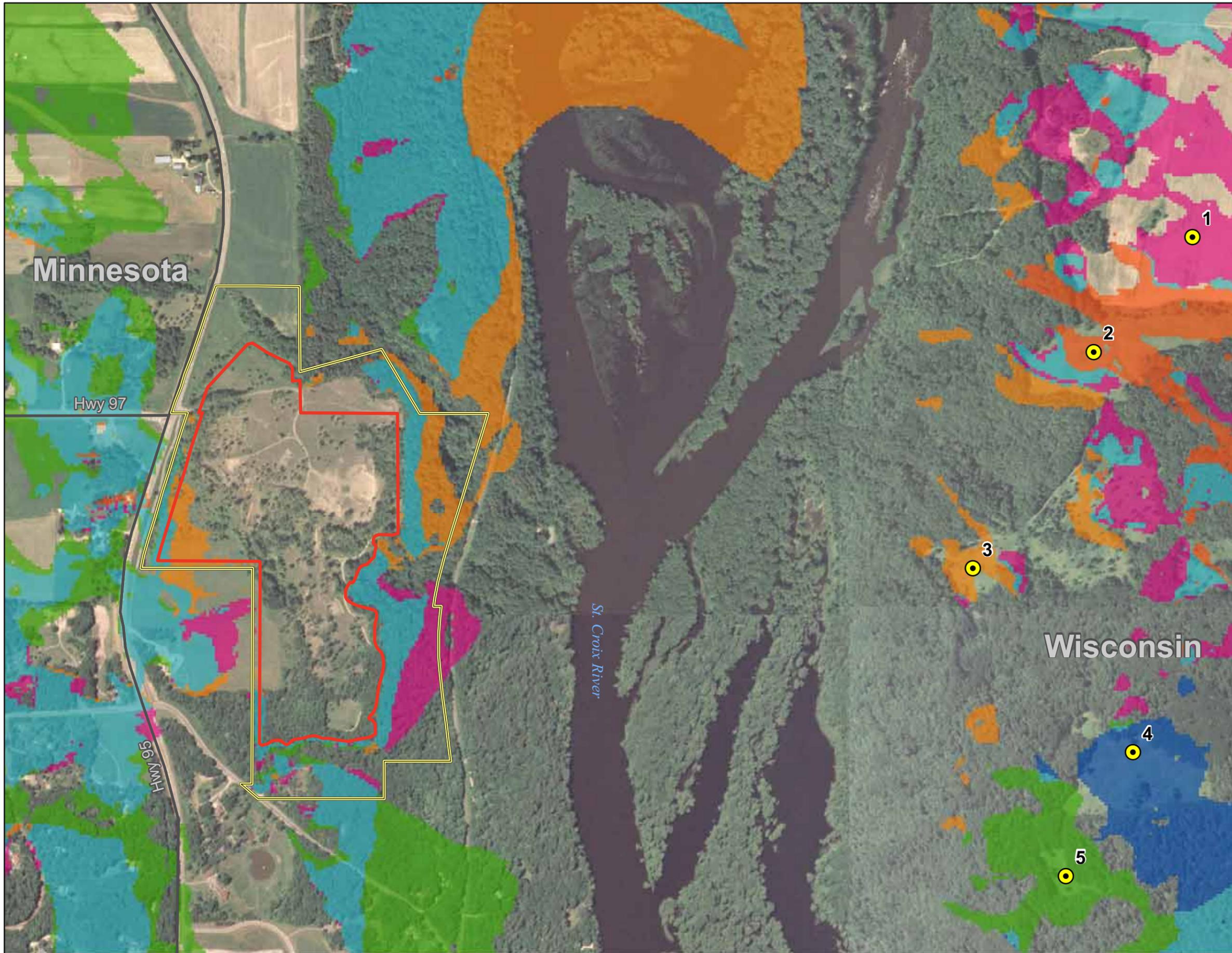
 Property Boundary

 State Highways

2005 NAIP Aerial Photo



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