South Concord Area Levee Extension Study
Phase 1 Report

February 2014

Prepared for the

City of South St. Paul

Barr Engineering Company with
Bolton & Menk, Inc.

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1 Executive Summary

The City of South St. Paul (City) commissioned the Barr-Bolton & Menk (Barr-BMI) team to evaluate the costs, benefits, and regulatory feasibility of extending the City's flood risk reduction system south of I-494. This study is driven by the inclusion of the South Concord Corridor as a key redevelopment opportunity within the City's Comprehensive Plan. This study is also driven by a $500,000 50/50 cost-share design grant from the Minnesota State Legislature awarded to the City to fund the study and preliminary design of a levee that would remove certain areas south of I-494 within South St. Paul from the FEMA regulatory floodplain.

This report describes the results of Phase 1 of this study. Phase 1 is focused on determining the technical feasibility of an extension by identifying potential project hurdles, fatal flaws, and major impacts. Phase 1 also includes a benefit-cost analysis for several proposed levee alignments; the benefit-cost analysis weighs the cost of levee design, permitting, construction and maintenance against the potential for increased property value from redevelopment of the protected area.

The analysis performed during Phase 1 has identified that a feasible project likely exists. The Phase 1 report identifies levee alignment 3B (see Section 5.1) as having estimated benefits that are greater than the estimated cost under all potential future land use scenarios evaluated; benefit-cost ratios for levee alignment 3B range from 1.0 to 4.4 depending upon the assumed future land use. Some land use combinations evaluated in Phase 1 may require changes to current zoning. The highest benefit-cost ratio for levee alignment 3B occurs if transportation improvements and land use changes similar to those described in the *South Concord Redevelopment Transportation Plan* are realized.

The Barr-BMI team recommends that the City proceed to Phase 2 of this study. Phase 2 may include additional site investigation (e.g., geotechnical borings) and detailed interaction with key stakeholders—primarily those landowners on whose land flood risk reduction works may be constructed. This phase will also include a more detailed review of regulatory issues that may impact the project. Phase 2 will include further refinement of estimates of costs and benefits, and will result in a new benefit-cost ratio determinations to again determine if the project should proceed to Phase 3.

2 Introduction

This report is presented by the Barr-Bolton & Menk (Barr-BMI) team as a record of our Phase 1 evaluation relative to extending the City of South St. Paul's (City) flood risk reduction system to include additional areas currently in the regulatory 100-year floodplain. The Phase I report is a feasibility study including preliminary estimates of costs and benefits for several levee alignment options. The Phase 1 report builds on the preliminary Phase 1 report included in the previously-submitted project proposal.

2.1 Project Scope

The City has been studying redevelopment options for portions of the community that are south of I-494 and below the bluff. The area has been identified in the City's Comprehensive Plan and other studies as an area where opportunities exist for revitalization and renewal. One of the major obstacles to redevelopment in this area is the fact that a significant portion of the area is in the floodplain of the Mississippi River. The City's current flood risk reduction system includes the following elements:

- Areas near the Mississippi River from just south of I-494 to just north of Wentworth Avenue are protected by a series of permanent levees or flood walls constructed as part of a U.S. Army Corps of Engineers (USACE) project in the late 1960's with an average elevation of 710 feet. The City's recent FEMA Recertification effort will ensure that the land protected by the levee is NOT in the regulatory FEMA 100-year floodplain.
- Areas near the Mississippi River but south of the permanent USACE project are protected by a temporary levee with a top elevation of 705. This area is within the regulatory FEMA floodplain.
- Areas near the Mississippi River and north of Wentworth Avenue are protected by a temporary levee with a top elevation of 708. Much of the low lying ground is also within the regulatory floodplain.

The area of interest to this study is the one identified in the second bullet with only a temporary levee constructed to an elevation of 705. The City recently received a 50/50 matching grant from the Minnesota State Legislature to study the feasibility of constructing a permanent flood risk reduction system for this area. This report is Phase 1 of that effort and is intended to provide a preliminary technical analysis of the feasibility of constructing such a system.

The primary objective of the Phase 1 effort summarized in this report is to determine if a technically feasibility, cost-effective project alignment likely exists. If such an alignment likely exists, Phase 2 will further develop the alignment and refine cost and benefit estimates. If the alignment developed in Phase 2 has a favorable benefit-to-cost ratio, can be permitted by the various regulatory authorities, and is supported by project stakeholders, then preliminary design would begin in Phase 3.

2.2 Phase 1 Report

The purpose of this document is to identify if any fatal flaws exist that would preclude the construction of a flood risk reduction project. Potential levee alignments were selected based on qualitative assessments of how such a project would impact local infrastructure and the environment. Analysis of the proposed levee alignments included:

- Qualitative assessment of whether potential impacts to infrastructure could be mitigated,
- Preliminary quantitative analysis of costs associated with levee construction, and
- Preliminary quantitative analysis of financial benefit resulting from levee construction

Project benefits were calculated as increased property values over a baseline condition (see Section 5.4). Project benefits in terms of reduced flood damages are not considered in Phase 1. Note that Phase 1 includes some analysis that is qualitative and general in nature. Phase 2 analyses will add detail and improve the accuracy of both costs and benefits.

A factor in project benefits that is not fully captured in Phase 1 but that will be reviewed in Phase 2 is the impacts of the recently-enacted Biggert Waters Reform Act of 2012. This act will substantially increase flood insurance rates for certain affected properties. Properties whose flood insurance rates will increase may see a decrease in property value. For properties where flood insurance rates would increase, the benefit of a project is actually higher than would be estimated considering current property values, as current property values may not capture the impact of this new act. Phase 2 will include a more detailed review of what, if any, properties in the project area are impacted by this new law. If there are affected properties within the project area, the benefit to cost ratio may increase relative to values estimated in Phase 1 analysis.

The work performed in Phase 1 is based primarily on readily available information already prepared for the project area. The analysis is limited to the identification of a technically feasible, cost-effective levee extension option. Further refinement of feasible levee alignments will require additional analysis (e.g., site-specific hydraulic modeling) to be included as part of the Phase 2 scope of work. This remainder of this report includes the following sections:

- Discussion of project location and general conditions
- Review of related plans, polices, and studies
- Phase 1 environmental site assessment
- Review of available utility data
- Regulatory and permitting review
- Review of stormwater and floodplain conditions
- Preliminary review of geotechnical issues
- Identification of preliminary levee alignments and associated costs
- Preliminary property value review (based on South Concord Transportation Plan)
- Calculation of benefit-cost ratios for feasible alignments
- Summary of preliminary findings

Based on the results presented in Section 5.5, **our team has identified that a feasible project likely exists and that Phase 2 should be undertaken.** The Phase 1 analysis identifies several alignment/land use scenarios with benefits that are greater than costs. Alignment 3B is the most favorable alignment. The benefits and costs calculated in Phase 1 are based on high level analysis. Phase 2 will seek to refine estimates of both costs and benefits.

Ultimately, this document should serve as a guide for Phase 2 work should the City elect to proceed with the project. This report is intended to provide information that can be brought to regulators and stakeholders to facilitate the development of alternative project alignments.

3 Location and Existing Conditions

The project area is bounded on the north by I-494, on the west by Concord Street and the bluff, on the east by the Mississippi River, and on the south by the city limits (see Figure 1). The project area is generally industrial and commercial, but includes some residential use, trails and open space as well.

There are numerous small parcels of primarily commercial land along the western edge of the project area. There are also several large tracts of land in the project area along the river. The major large tracts are identified as Danner Construction to the north, the Dakota Bulk Terminal owned and operated by Kinder Morgan, and the Gun Club to the south:

- The Danner site is a construction yard with significant amounts of fill and construction storage.
- The Dakota Bulk Terminal is an industrial site that includes a barge terminal where bulk products are loaded onto or off from barges and distributed via rail and trucks to other locations around the metropolitan area.
- The Gun Club is a mostly undeveloped open space south of the Dakota Bulk Terminal.

Gun Club property is excluded from the project area on the basis that the Gun Club is constructing its own levee system to an elevation of 710 feet. It is our current understanding that the Gun Club levee will not be a certified levee, meaning that even after it is completed the land protected by it will remain in the flood plain. Any levee extension project undertaken by the City that would include that levee as a portion of its flood protection would require additional action by the City, possibly significant and very costly, in order to ensure that it is certified. This area was excluded from all proposed levee alignments during Phase 1 work. If additional information becomes available that suggests the Gun Club levee will be certified or that it could be easily incorporated into a City extension, then modified levee alignments that include this area may be considered as part of Phase 2.

The Mississippi River Trail Bikeway (MRT) is on the south and east property line of the Danner Property and is managed by Dakota County Parks. The Minnesota Department of Natural Resources' (DNR's) boat landing is located adjacent to I-494, north of the Danner Property (i.e., within the bounds of the existing levee system). The existing levee/flood wall is on the north property line of the Danner Property.

According to historical topographic maps and aerial photographs, the area drains to the east towards the Mississippi River. According to the DNR's Recreation Compass website, there is no state or regional park in the immediate vicinity. The Mississippi River is a State Water Trail. The area between the bluff and the river is a significant transportation corridor including Concord Street and rail lines oriented north/south parallel to the river.

3.1 Related Plans, Policies, and Studies

This section is intended to guide the technical feasibility analysis by identifying the major goals and objectives of past studies and ensuring that a levee project does not conflict with those goals but rather fits within the plans prepared for the area.

The South Concord area is part of a designated redevelopment area; its future is clearly defined in the City's Comprehensive Plan. The *South St. Paul Comprehensive Plan* vision states that …"creating a new image…" and "connection to the riverfront" as a small town with a proud history will enable the City to create opportunities for new development, housing, the natural environment, and city services. The I-494 Corridor is identified in the Comprehensive Plan as an important gateway to the community. The City has defined the image as seen from I-494 as vital to future redevelopment efforts. The City's vision is to have this corridor showcase high-quality redevelopment for the areas north and south of the I-494/Concord interchange. The Plan highlights the fact that a large portion of the area south of the corridor is not protected with existing floodwalls/levees. The Plan also focuses on the Danner site ("…a temporary location for rock crushing"). According to the Plan, "the [Danner] site offers an excellent opportunity for a higher finish office/industrial development…." The Plan goes on to state that the Danner site is seen as the potential cornerstone in achieving the improved image for the I-494 Corridor. Any flood risk reduction project is in accordance with this plan.

The South Concord area, also identified as the South End Redevelopment HRA Investment District, is primarily zoned general business and industrial. The City believes that the area should have some form of mixed-use. The future land use map for the City indicates the desire for commercial, mixed-use commercial, medium density residential, light industrial and industrial land uses in this location. The City also completed the *South Concord Corridor Plan* in 2012 that described a complete mixed-use development with new road alignments/extensions for Hardman Avenue and Richmond Street. Though this plan has not been formally adopted, it clearly demonstrates the City's desire to build long-term value for this area. Most, if not all, of this development would not likely happen without a flood risk reduction project to remove this area from the regulatory floodplain. Again, the project is consistent with this plan.

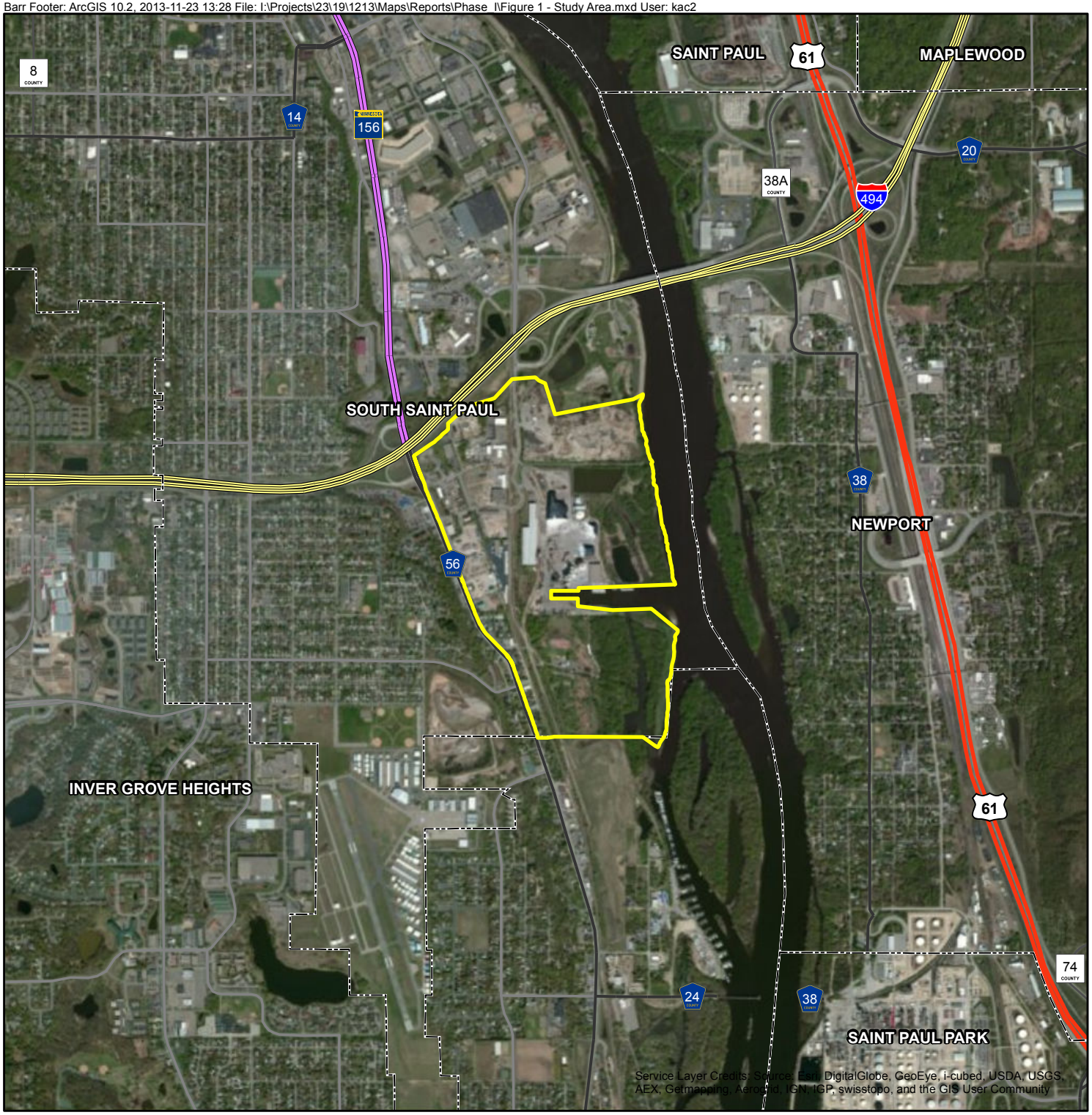
The most recent relevant study, the *South Concord Redevelopment Transportation Plan* (May 2013), looked at possible transportation options (and two alignment alternatives) for serving this area and, in particular, how to overcome the existing challenges and barriers to future redevelopment. The Plan states*:*

> *"Redevelopment of existing properties is always a challenge; however the greatest challenge for this area is providing access to the property east of the Union Pacific main track and power transmission line which parallels Union Pacific……The Danner, Inc. property is the property which will likely attract the highest land use and market values dependent on access."*

This study includes potential layouts for road improvements to enhance access to properties along the riverfront in the study area. It will be beneficial for the City to select which of the alignments it prefers prior to completing any detailed levee siting to assure that no conflicts are created. None of

the proposed road alignments appear to pose a significant hurdle to the likely location of any levee systems with the possible exception of a levee alignment that excludes all of the riverfront properties. Such an alignment would likely run along the east side of Hardman Avenue and would have to be coordinated with any road modifications proposed in the transportation study. One of the transportation alternatives includes a bridge and both include grade changes in an area that would likely also include a levee IF excluding the riverfront properties is the desired approach.

Barr Footer: ArcGIS 10.2, 2013-11-23 13:28 File: I:\Projects\23\19\1213\Maps\Reports\Phase_I\Figure 1 - Study Area.mxd User: kac2



Study Area

Municipal Boundary

N

0 3,000 6,000

Feet

Figure 1

STUDY AREA
City of South St. Paul, MN

<back of Figure 1>

3.1.1 Land Use

The land use plan for the project area, taken from the City's Comprehensive Plan, is shown in Figure 2. The Comprehensive Plan guides the land fronting Concord as mixed-use commercial (dark purple) with general commercial south of the interchange. The majority of the remaining parcels located in the project area are guided for light industrial and industrial uses. Residential use on the east side of Concord is for an existing mobile home development. Open space and natural areas are located along river's edge.

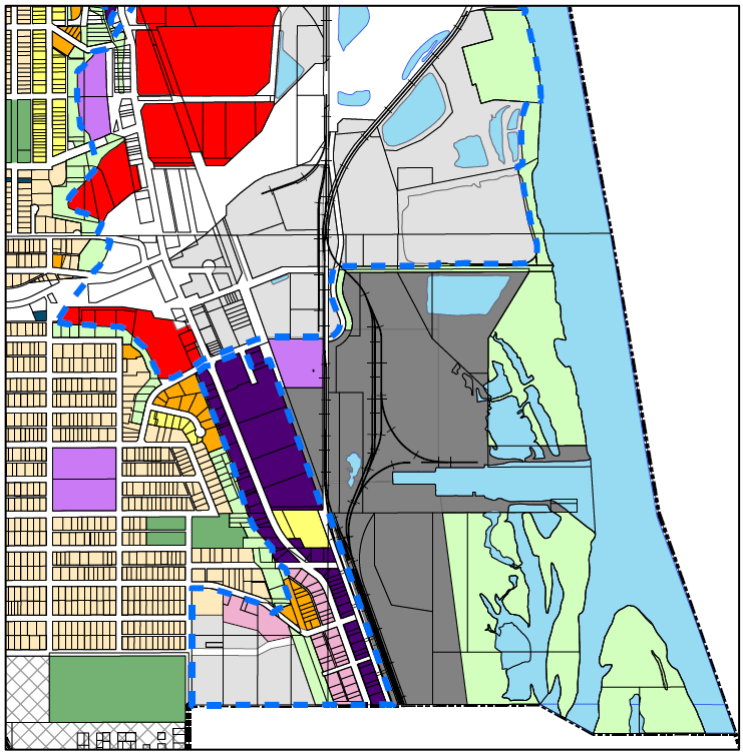


Figure 2. Land Use Plan (from Comprehensive Plan)

3.1.2 Zoning

The City's zoning map (see Figure 3) reinforces, for the most part, the land use plan with commercial (general business) along the Concord corridor. Industrial zoning guides most of the remaining parcels of the project area. One additional development regulation to note is that the project area is also subject to the South St. Paul airport safety zone C which mainly is concerned with the operation of radio/electronic uses and lighting. The project area is also located within the Mississippi National River and Recreation Area (MNRRA).

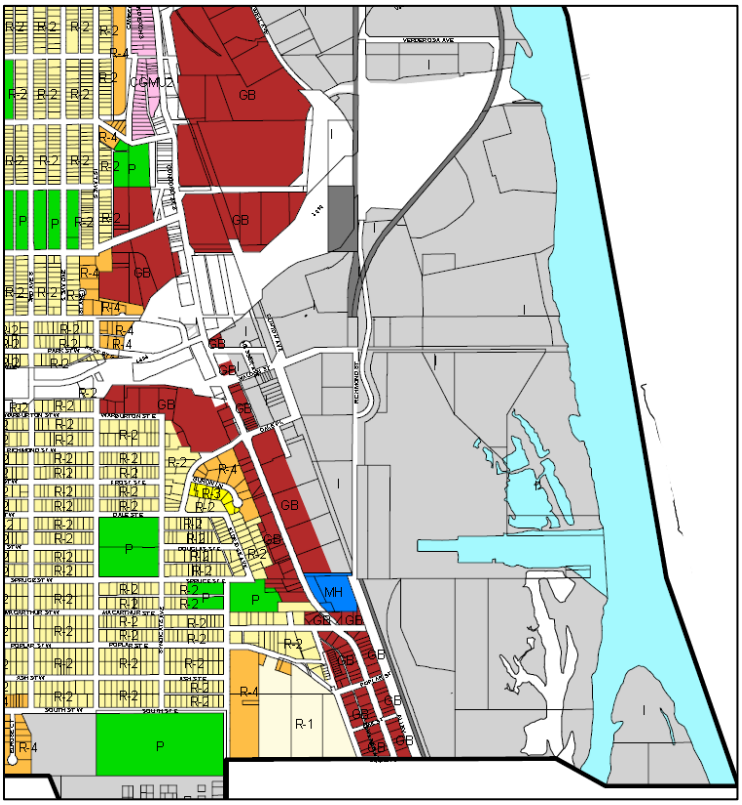


Figure 3. Zoning Map (from Comprehensive Plan)

Flood risk reduction projects can coexist with all of these proposed land uses and zoning; however, it is important to note that certified levee systems have an undevelopable project footprint that include clear zones along both sides of the levee along the toe. Land committed to such a project would not be available for conventional development. The land can be part of certain approved recreation uses such as trails, parks, and open space. When laying out project alignments, it will be important to recognize that this land comes off the tax rolls and future land use is limited but may include some recreational uses. This is not a fatal flaw, but must be considered in estimates of project costs and benefits (e.g., land value). An example of this consideration is that the land (or a permanent easement) for a levee running across the Dakota Bulk Terminal would need to be purchased. Once built, the levee footprint could not be used for some of the current uses on the site. This may be a barrier to obtaining stakeholder acceptance should the project proceed to Phase 2.

4 Assessment of Feasibility

While flood protection of properties is a primary consideration for the potential levee extension, other factors could potentially impact the final alignment. Phase 1 of this project includes a preliminary analysis of several items that will need further consideration during Phase 2 of the project. This section presents the results of this analysis, along with the next steps. Topics assessed for fatal flaws include:

- Preliminary Environmental Site Assessment, including:
  - Potential contamination
  - Threatened and endangered species
  - Historical and cultural resources
- Utility considerations
- Regulatory and permitting considerations
- Stormwater and floodplain considerations
- Potential geotechnical issues

Initial assessment of these areas identified no fatal flaws. Potential issues identified as part of the Phase 1 study, however, require additional consideration in Phase 2.

4.1 Phase 1 Environmental Site Assessment

The purpose of performing a Phase 1 Environmental Site Assessment (P1 ESA) is to assess a property or properties as to the range of contaminants and petroleum products which may be present on or nearby the site (Note that "Phase 1" used as a descriptor of the ESA refers to the type of ESA, and not Phase 1 of this project). The process includes database searches, interviews with property owners and local public officials, and site investigations of the subject properties. For our proposal, we performed the database searches and prepared a base Phase 1 ESA document. To complete the review, the remaining tasks noted above will still need to be completed.

Our initial assessment revealed evidence of conditions indicative of releases or threatened releases of hazardous substances on, at, in, or next to the site, consistent with the historic industrial nature of the area. The assessment also revealed evidence of recognized problem environmental conditions in connection with this site.

4.1.1 Preliminary findings based on database search

The property is south of I-494 and the Union Pacific railroad track, east of Hardman Avenue, west of the Mississippi River, and in the vicinity of residential and industrial/commercial developments. Metropolitan Council Environmental Services (MCES) owns property north of the Danner property and Dakota Bulk Terminal owns property to the south. The Mississippi River Trail Bikeway (MRT) is on the south and east property line of the Danner property. The Mississippi River is a State Water Trail. The DNR boat landing is located adjacent to I-494 north of the Danner property within the current flood control system. The existing levee/flood wall is on the north property line of the Danner property.

According to Historical Information Gatherers (HIG) Water Well Report, there are 18 USGS National Water Information System (NWIS) wells and 109 Minnesota County Well Index wells within one mile of the area. None of these wells were actually on the area where the levee will most likely be constructed. The Water Well Report states that there are four monitoring wells and four NWIS wells that are just west of the Danner property. These are not mapped on the County Well Index's map, possibly because they do not have a GPS location on file with the Minnesota Department of Health (MDH). Well locations may not be included on the County Well Index map for several reasons; for example, the map does not show locations of municipal wells for public safety reasons.

According to the MDH's County Well Index, the closest well to the area is the Standard Building Materials' well. The next nearest well is the Farmers Union Terminal's well. The County Well Index shows that the area is not within the South St. Paul Drinking Water Supply Management Area (DWSMA), but is very close. Based on the location of the river, it is assumed that the groundwater flows towards the river, which would mean the groundwater flow direction for the area would be easterly. Taking the assumed general groundwater flow direction in relation to the area and the nearby river's location in relation to the area, it appears that any contamination at the area would impact the river, but not surrounding wells; and if there were contamination at the sites to the west of the area, it is possible it would flow under the area.

4.1.2 Potential contamination in the area

Historical Information Gatherers, Inc. (HIG) was contracted to perform an environmental records search. The search distances for each database are listed in the Database Findings Summary in the Radius Report. The review searches U.S. Environmental Protection Agency (EPA) and Minnesota Pollution Control Agency (MPCA) lists, among many other lists, to identify any hazardous waste substances and/or petroleum products storage or spill locations on or near the exact location of a property. The review also identifies any solid waste sites in the described location. The search was performed using a 1 mile radius centered around the Danner property. Mapped potential hazards are shown in Figure 4.

The Radius Report lists sites in the vicinity that are listed in the regulatory databases. There are 73 locatable listings and one un-locatable listing for federal databases (within one mile of the property boundaries), 106 locatable listings and seven un-locatable listings for state databases (within one mile of the property boundaries), and no listings for tribal databases. Inclusion of a property on one of these lists does not necessarily mean that it is contaminated, only that it has the potential to be contaminated and is therefore being tracked.

The Radius Report results were verified using the Minnesota Department of Agriculture's and the MPCA's "What's in My Neighborhood" websites.

- The closest site listed, Map ID 1, is the subject property – Danner, Inc. This site has 13 listings, including an air quality permit, hazardous waste generator permit, a voluntary investigation (started in 1998, now inactive). The HIG report lists permits for concentrated animal feeding operations, but these do not show up in either the MPCA's or the MDA's What's in My Neighborhood maps.

- The next closest site listed, Map ID 3, is 0.05 miles west from the subject property, and it is Twin City Hide. This site has four listings and is listed as a hazardous waste cleanup site (started in 1998, closed in 2000).
- The next closest site listed, Map ID 4, is 0.05 miles north from the subject property, and it is the South St. Paul Wastewater Treatment Plant. This site has two listings and has a listing as an unpermitted dump.
- The next closest site listed, Map ID 5, is 0.090 miles west from the subject property, and it is Twin City Tanning. This site has 11 listings in the HIG report and is listed as a voluntary cleanup investigation (started in 1997, ended in 2000), an unpermitted dump, a leaky tank (contaminant is Fuel Oil 1 & 2, closed in 1995), and a hazardous waste cleanup site (site closed in 2004). The unpermitted dump does not show up as Twin City Tanning in either the MPCA's or the MDA's "What's in My Neighborhood" maps, but it does show up as South St. Paul Dump on the MPCA map (no dates listed for this site).
- The next closest site listed, Map ID 2, 0.120 miles southwest from the subject property, and it is Cherokee Mfg. This site has two listings, related to being a hazardous waste generator.
- Further to the west is the Farmers Union Oil Coop, which had a leaking tank of Fuel Oil 1&2. The site was closed in 2004.
- If the groundwater flow direction is to the east, and the Twin City Hide/Twin City Tanning sites, the Farmers Union Oil Coop site, the unpermitted dump, and any other sites to the west have remaining groundwater contamination components, it is possible for those sites to affect the area where a levee may be constructed.

Contamination is likely present within the project site. Potential groundwater contaminants would be chemicals related to tanning hides, as well as petroleum contamination. The City confirmed that approximately 22 acres of the Danner site was excavated to bedrock and replaced with clean fill. The southwest portion of the Danner property was a former City dump; this area may have contamination, and is potentially located adjacent to one or more proposed levee alignments. The Thompson Motors site between Concord Street and Schumacher Road and other businesses along Concord Street are likely to have contamination, but are not located adjacent to proposed levee alignments.

The presence of contamination does not necessarily represent a fatal flow or even a conflict with a potential flood risk reduction project. However, contamination must be taken into consideration during the development of any project alignment. Wastes may or may not have to be cleaned up prior to construction of a levee project depending upon the nature of the waste and how it might impact the performance of a levee or flood risk reduction feature. For example, groundwater contamination will not likely be sited as a reason a levee system would not function as intended. However, construction of buried facilities—such as drainage pipes, toe drains, closure structures, or pump stations in areas of known groundwater contamination—needs to take into account the exposure of workers and the constructed feature to the known waste product.

Another concern for this area is the presence of buried debris. Buried chunks of concrete and other construction waste often contain significant voids that can provide pathways for flood water to migrate under levee systems causing piping and levee failure. This is of particular concern in the southwest portion of the Danner property, where a City dump was formerly located. Other areas

of the Danner property have been raised using clean fill, especially near the river; the presence of buried debris is not a significant concern in those areas. Inspection trenches will be part of any levee construction and will identify the presence of such debris.

4.1.3 Threatened and endangered (T & E) species review

The area was reviewed for T & E species at both the state and federal levels. The U.S. Fish and Wildlife Service provides a listing of Federally Threatened, Endangered, Proposed and Candidate Species by County for Minnesota. In Dakota County, there are currently two listings:

- **Higgins Eye Pearlymussel.** There is the potential for this species to be present in the Mississippi River in the vicinity of the proposed levee extension. Typically, the implementation of appropriate erosion control features during construction will mitigate impacts to the mussels.
- **Prairie Bush Clover.** These are native plants typically encountered on well-drained soils in areas where there have been minimal impacts. Because this area has been developed and redeveloped, there is a low chance of encountering the plants unless the levee is located closer to the river in the undeveloped parts of the Bulk Terminal site.

While the bald eagle is no longer protected under the Federal Species Act, their nests are still protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. The National Park Service does an eagle nest survey in the Mississippi National River and Recreation Area. Bald eagles and nests may be encountered through the course of the project; project staff will need to respond accordingly. The Minnesota DNR's Nongame Wildlife Program staff is available for consultation and the U.S. Fish and Wildlife Service have National Bald Eagle Management Guidelines that will be followed. The following are typical measures taken during construction activities:

- Maintain a buffer of at least 660 feet (200 meters) between project activities and the nest (including active and alternate nests). If a similar activity is closer than 660 feet, then maintain a distance buffer as close to the nest as the existing tolerated activity.
- If activities are closer than 660 feet due to a similar activity existing closer than 660 feet, then restrict all clearing, external construction, and landscaping activities within 660 feet of the nest to **outside the nesting season** (i.e., outside the nesting season is from August through mid-January in the Midwest).
- Maintain established landscape buffers that screen the activity from the nest.

For a state list of T & E species, the DNR's Natural Heritage Database is typically queried to retrieve all the known records of state threatened and endangered species in the vicinity. The response time is generally lengthy, however, and so was not completed as a portion of this preliminary analysis.

No fatal flaws for a levee or flood risk reduction system were identified in this search.

Barr Footer: ArcGIS 10.2, 2013-11-25 09:24 File: I:\Projects\23\19\1213\Maps\Reports\Phase_I\Figure 2 - Environmental Hazards.mxd User: kac2

Leaking Underground Storage Tank (LUST) Locations

Master Entity System (MES) Locations

- UNPERMDUMP
- SW_PERM
- VIC

What's in my Neighborhood (MPCA)

- Air Permit

- Hazardous Waste
- Investigation and Cleanup
- Tanks and Leaks
- Water Quality
- Multiple Activities
- Existing Levee Alignment
- Levee Alignment 1: Protect Maximum Area
- Levee Alignment 2: Follow Floodway
- Levee Alignment 3: Most Permitable
- Levee Alignment 4: Exclude Riverfront Properties
- Levee Alignment 5: Minimize Pump Station

N

Feet

0 500 1,000

Figure 4

ENVIRONMENTAL HAZARDS
City of South St. Paul, MN

<back of Figure>

4.1.4 Historical and cultural resources review

As a portion of Bolton & Menk's ongoing work at Fleming Field, the Barr- Bolton & Menk team queried the State Historic Preservation Office (SHPO) database of archeological sites and standing structures of potential historical significance in this area. No known archaeological sites or structures are inventoried within the project area. During subsequent phases of the project, the SHPO database will need to be queried again to determine if additional surveys have been performed.

The area where the levee is likely to be sited is federally designated as a Mississippi National River and Recreation Area Urban Diversified District. The lands and waters within this district can be used and developed to maintain the present diversity of commercial, industrial, residential, and public uses of the lands, including the existing transportation use of the river; to protect historical sites and areas, natural scenic and environmental resources; and to expand public access to and enjoyment of the river. New commercial, industrial, residential, and other uses may be permitted if they are compatible with these goals. Based on these guidelines, the levee will be an allowed improvement in the area.

The Mississippi River Critical Area (CA) program was established in 1976 by the State of Minnesota and is currently administered by the DNR. Based on our review, this area is not classified as a wild, scenic, or recreational region of the Mississippi River.

It is possible that in the permitting process, the USACE may require a cultural resources survey of the project area. It is recommended that a complete Phase 1 ESA review be performed as part of Phase 2, followed by a more detailed analysis during the Environmental Assessment Worksheet process if that is deemed necessary by the permitting agencies.

No fatal flaws for a flood risk reduction project were identified.

4.2 Utility Considerations

Phase 1 included a review of existing utilities within and around the project site. Existing water lines, sanitary sewer lines, and storm sewer lines are shown on Figure 5. Sanitary sewer runs north from the approximate City limits at the south end of the project area along Concord Street. The sanitary line travels east before reaching the Metropolitan Council Environmental Services (MCES) pump station. Storm water lines located within the project area are described in greater detail in Section 4.4.1. The critical stormwater feature within the study area is an existing 120" storm sewer that runs from Hardman Avenue to the river (between the Danner and Dakota Bulk Terminal sites).

Public utilities also include a water main and service lines to the Dakota Bulk Terminal Property. These lines, however, are positioned such that access points are located above the proposed protected elevation.

Private utilities that are assumed to be in the vicinity of the area, based on the *South Concord Redevelopment Transportation Plan*, include a power transmission line. The transmission towers and power lines follow the Mississippi River to the north from Inver Grove Heights to the south line of the Dakota Bulk Terminal property (see Figure 2). The lines then follow the south line of the Dakota Bulk Terminal property and parallel the railroad tracks to the north, ultimately crossing I-494.Other private utilities may be present, but exact locations have not been determined at this time. Based on preliminary conversations with City staff, it is unlikely that any additional utilities in the area will impact potential levee alignments.

None of the utilities discussed above are considered fatal flaws relative to the construction of a flood risk reduction system; however, all will need to be documented. Closures may be needed on buried pipes, and if a levee is constructed, it will need to avoid the poles supporting the power lines.

Linetype

- Water
- Sanitary Sewer
- Storm Sewer
- Power
- Existing Levee Alignment
- Levee Alignment 1: Protect Maximum Area
- Levee Alignment 2: Follow Floodway
- Levee Alignment 3: Most Permitable
- Levee Alignment 4: Exclude Riverfront Properties
- Levee Alignment 5: Minimize Pump Station

N

Feet
0 500 1,000

Figure 5

UTILITY DELINEATION
City of South St. Paul, MN

<back of Figure>

4.3 Regulatory and Permitting Review

Aside from FEMA regulatory issues associated with placing fill in the floodplain, there are several additional permitting challenges. Barr and the City consulted the USACE and MDNR to evaluate review, permitting, and certification challenges for possible levee construction south of the existing USACE levee.

USACE: Levee Modifications, Section 408.

If the new levee ties into the existing City levee (which is a USACE levee), some level of USACE permitting will be required. If the City desires, the new levee could be incorporated into the USACE levee safety program via the major modification process. Alternatively, the new levee may be incorporated in the non-federal levee system via a minor modification (per discussion with the USACE on 11/14/13). These permitting processes are described in greater detail below:

1. **Major modification:** The City may request to have the new levee brought into the federal levee program through a major modification to the existing levee certification. This would require a lengthy permitting and review process (approximately two years). The primary benefit of this option is that the section of existing levee which includes Gatewell R and Closures No. 2 and 3 (Hardman Avenue Closure) would be decommissioned (as they would be located within the protected area). This would reduce inspection and certification effort for the existing levee and allow Hardman Avenue to remain open during periods of river flooding. As part of the federal system, rehabilitation or repair of levee damage following a flood event would be covered the Flood Control and Coastal Emergency Act (PL 84-99) at no cost to the City.

2. **Minor modification:** The City may request to have the proposed levee tie into the existing levee and be brought into the non-federal levee system. Tying into the existing levee without incorporation into the federal level program would likely require only a minor modification to the existing levee certification (and thus a shorter review period, approximately one year in duration). In this scenario, the section of existing levee west of the tie-in would remain active. This option reduces the duration and complexity of permitting (relative to a major modification), but would not prevent possible closure of Hardman Avenue during periods of river flooding. As part of the non-federal system, rehabilitation or repair of levee damage following a flood event would be covered under PL 84-99 with a 20% cost to the City, provided it is part of the Rehabilitation and Inspection Program (RIP).

PL 84-99 is independent from the Hazard Mitigation Grant Program (HMGP) administered by the Federal Emergency Management Agency (FEMA) and Minnesota Department of Natural Resources (MDNR). Both federal and non-federal levees are eligible for HMGP funding.

If the proposed levee is constructed to an elevation of 710 feet, it will tie into the existing levee and require some level of USACE review through either the major modification or minor modification process. If the proposed levee is built to an elevation of 708 feet, the City may still choose to request incorporation of a new levee into the federal or non-federal levee safety program (see Section 4.4.3).

If the proposed levee is built to an elevation of 708 feet, however, the City may choose not to request to tie into the existing USACE, bypassing the major modification or minor modification process. In this case, the new levee would not require USACE review or certification (bypassing the major or minor modification process). The existing USACE levee would exist and operate as it currently does. The primary benefit of this option is the reduced cost and complexity of permitting. Note that unless a major modification and decommissioning of redundant portions of the existing USACE levee is pursued, Hardman Avenue and the rail line may be subject to closure during periods of river flooding.

FEMA: Levee Certification and Letter of Map Revision (LOMR)
Regardless of incorporation into the federal or non-federal levee safety program, a new levee can be FEMA-certified, and a letter of map revision (LOMR) can be applied for to remove the protected areas from the mapped floodplain. In order to remove the land protected by a flood control system from FEMA's floodplain, the levee must be constructed to FEMA standards that would allow certification of the levee by a registered engineer (much like the City's existing levee system is currently undergoing certification). Several design criteria would have to be considered, including freeboard requirement (three to four feet of protection above the regulatory 100-year elevation), interior drainage considerations, and underseepage and geotechnical analyses. Achieving a certified levee allows the protected land to be removed from the 100-year floodplain and removes the requirement for expensive flood insurance that can discourage development. Note that the City's current levee (elevation 710 feet) has more freeboard than would be required by FEMA. A 710 elevation for the top of levee is not required for certification to remove the area from the floodplain (see Section 4.4.3).

MnDNR/USACE: Public Waters Permit
A joint MnDNR/USACE permit is required for any work that is conducted below the ordinary high water level (OHWL). The Barr-BMI team recently assisted the City in acquiring this permit for the levee improvements project. For the levee alternatives that are not directly along the water's edge, this would likely be a straight-forward permit to acquire, if it is even needed.

Environmental Assessment Worksheet (EAW)
Given the likely scope of a flood risk reduction project, an EAW may be required. Further review is needed to determine this, but at this time it appears likely.

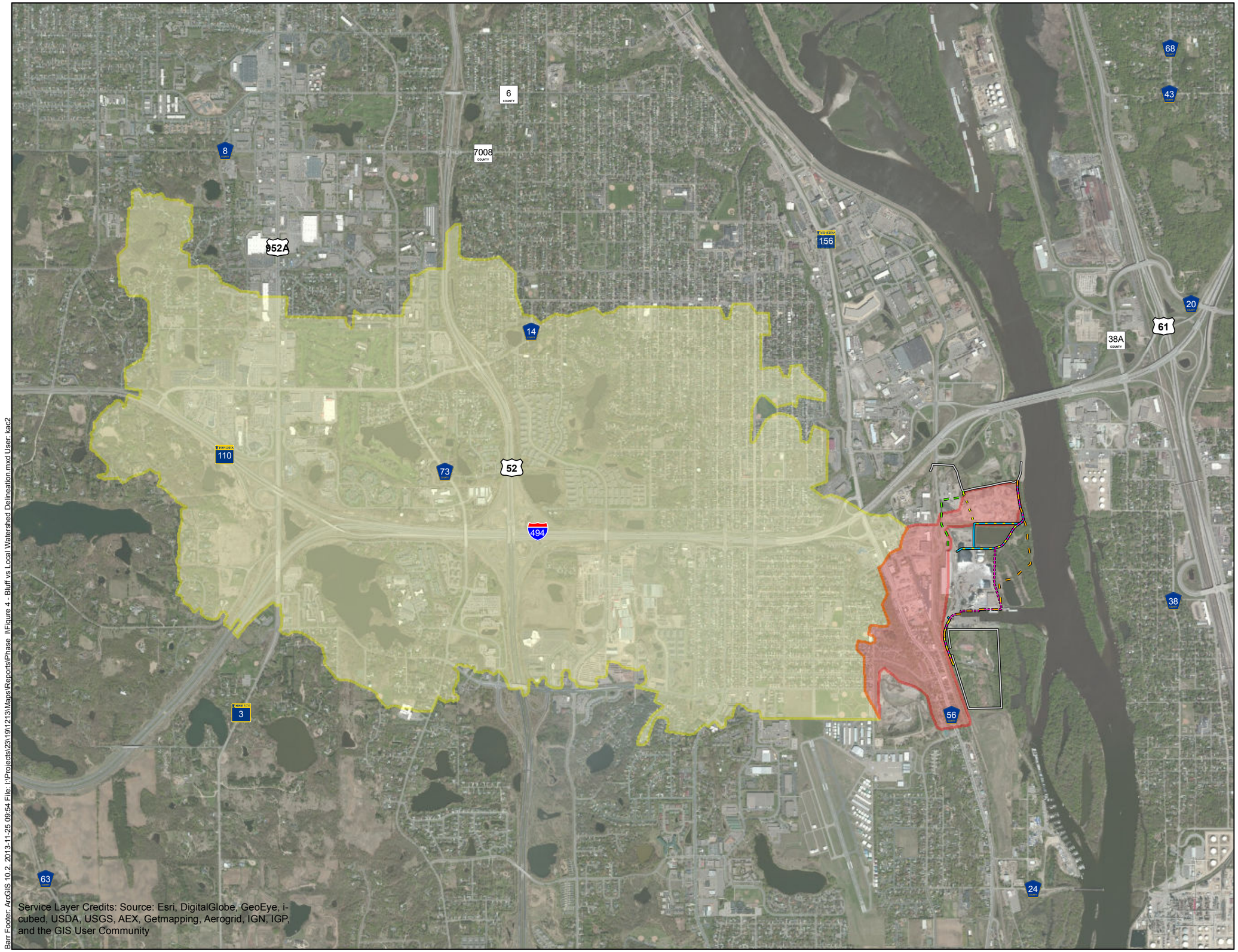
Additional Permits
In addition to these more significant permitting efforts, permits from Dakota County Trails, MPCA (construction), DNR (construction dewatering), and the City (grading) are anticipated for this project.

None of the permits identified are considered fatal flaws. However, obtaining the necessary permits will add complexity, time, and cost to the project. The permits will likely be the critical path of any flood risk reduction project.

4.4 Stormwater and Floodplain Conditions

4.4.1 Stormwater and potential interior flooding review

The dominant stormwater feature in this area is a large 120”diameter storm sewer that extends from Schumacher Road to the Mississippi River. The storm sewer is split into four 72” sections underneath Hardman Avenue. Approximately 5 square miles drains to this pipe, including the southern one-third of the City and a small portion of Inver Grove Heights (see Figure 6). The storm line passes between the Danner property and Dakota Bulk Terminal property and discharges into the Mississippi River under the regional trail present in the area shown in Figure 5.



Existing Levee Alignment

Levee Alignment 1: Protect Maximum Area

Levee Alignment 2: Follow Floodway

Levee Alignment 3: Most Permitable

Levee Alignment 4: Exclude Riverfront Properties

Levee Alignment 5: Minimize Pump Station

Local Watershed (existing)

Bluff watershed

Note: Proposed levee alignments will alter local drainage area

N

Feet

0 2,000 4,000

Figure 6

BLUFF VS LOCAL WATERSHED DELINEATION
City of South St. Paul, MN

Barr Footer: ArcGIS 10.2, 2013-11-25 09:54 File: I:\Projects\23\19\1213\Maps\Reports\Phase_II\Figure 4 - Bluff vs Local Watershed Delineation.mxd User: kac2

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The existing watershed may be subdivided into drainage areas above the bluff, and areas located between the bluff and the Mississippi River (see Figure 6). Drainage from areas above the bluff are conveyed via a 72" pipe draining the north part of the watershed, and a 30" pipe draining the south part of the watershed. Under existing conditions, the area between the bluff and the Mississippi River (described herein as the "local drainage area") either drains directly to the river, north through Gatewell R, or to the 120" pipe via a storm sewer network that runs north from the approximate City limit along Concord Street (see Figure 5). The 30" pipe draining the south part of the bluff drainage area joins the storm sewer network along Concord Street upstream of the 120" line. The 72" pipe from the north continues to the 120" line without additional inlets. The 30" pipe draining the south bluff area connects to the local storm sewer network within the project area before meeting the 120" line.

Every flood protection system needs to consider flooding that could result from internal drainage. Construction of the 120" line is such that the upstream end of the pipe lies below the desired level of protection. The 120" line will require modification or a closure structure to prevent inflow of flood waters from the river. Stormwater conveyed by the 120" pipe must be stored and/or pumped over the proposed levee during flood conditions.

There is no existing hydrologic/hydraulic model that represents the total drainage area to the 120" line. Based on the drainage area, however, it is assumed for the Phase 1 analysis that runoff from this area is significant during storm events, despite the presence of several stormwater retention ponds in the upstream portions of the watershed. Additional hydrologic and hydraulic modeling is proposed for Phase 2 to more accurately estimate peak stormwater runoff rates. Further analysis will facilitate optimizing the necessary storage and pumping requirements to minimize interior flooding.

One of the key features of any proposed levee extension project will need to include how to handle the drainage area associated with the 120" pipe. It is likely that drainage from above the bluff can be handled separately from that below the bluff. It could be separated from the local drainage and routed directly to the river with no need for pumping during a flood event. The local drainage area will then be handled separately and will need to be pumped. The benefit of this is to significantly reduce the size of the pump station. For the purposes of the Phase 1 analysis it is assumed that this separation of flow is feasible. The details of if and how the drainage can be separated will be addressed during Phase 2 of this effort should the City elect to proceed with the additional work. Though addressing the 120" line is the single most costly element of the levee extension it is not viewed as a fatal flaw.

4.4.2 Floodplain review

The project area contains areas that are in the 1-percent-annual-chance floodplain (100-year floodplain), 0.2-percent-annual-chance floodplain (500-year floodplain), and areas that are above the 0.2-percent-annual-chance floodplain (see Figure 9). Within the 1-percent-annual-chance floodplain, there are areas that are within the floodway (area with highest conveyance of flood waters) and flood fringe (100-year floodplain outside of the floodway). Parcels located within the 100-year and 500-year floodplains are shown in Figure 10.

Generally, constructing levees and placing fill in a floodway is quite challenging to permit. Barr conducted a hydraulic analysis using the Mississippi River HEC-RAS model for this reach of the river and determined that even a modest infringing on the floodway will result in flood elevation increases that extend all the way to the Ford Dam (Lock and Dam No. 1) in St. Paul. Permitting this would likely require the creation of additional channel capacity through dredging or other channel modification that would be expensive and difficult to permit. The initial consultation with permitting agencies included the presentation of proposed alignments 1 through 5 (see Section 5.1). The DNR expressed concerns regarding the ability to permit alignment 1, which encroaches into the floodway.

Placing fill in the flood fringe is allowed, although permitting through Minnesota Department of Natural Resources, FEMA, and possibly the USACE is still required. Levee alignments 2, 3A, 3B, and 4 avoid placing fill in the Floodway, and thus are easier to permit than levee alignment 1, as shown on the figures below.

Barr also conducted a hydraulic analysis using the Mississippi River HEC-RAS model for this reach of the river and determined that a levee system in the flood fringe will NOT result in flood elevation impacts. The two outputs from the model runs are shown below. Though very similar in appearance one does show impacts extending far upstream while the other shows no impacts.

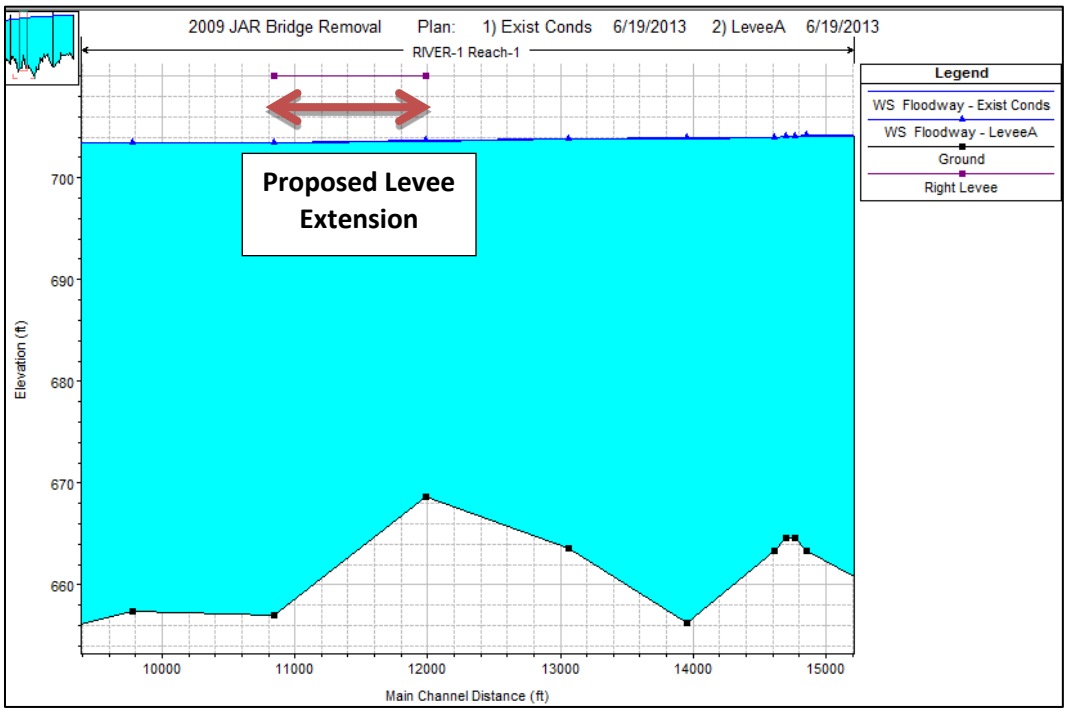


Figure 7. HEC-RAS Hydraulic model output for levee alignment encroaching on floodway (alignment 1): floodway impacts extend to Ford Dam

Based on the above analysis and discussion with the MDNR, Barr considers construction of a levee in the floodway (e.g., alignment 1) to be fatally flawed (see Section 5.2.1). However, alignments that avoid the floodway are not.

An additional project consideration is that properties currently located in the flood plain with designation AE (see Figure 9 and Figure 10) may be subject to significant flood insurance rate increases as a result of the recently passed Biggert Waters Act of 2012. Further consideration of the impacts of this Act will be considered during Phase 2 of this effort should the City elect to move to that stage.

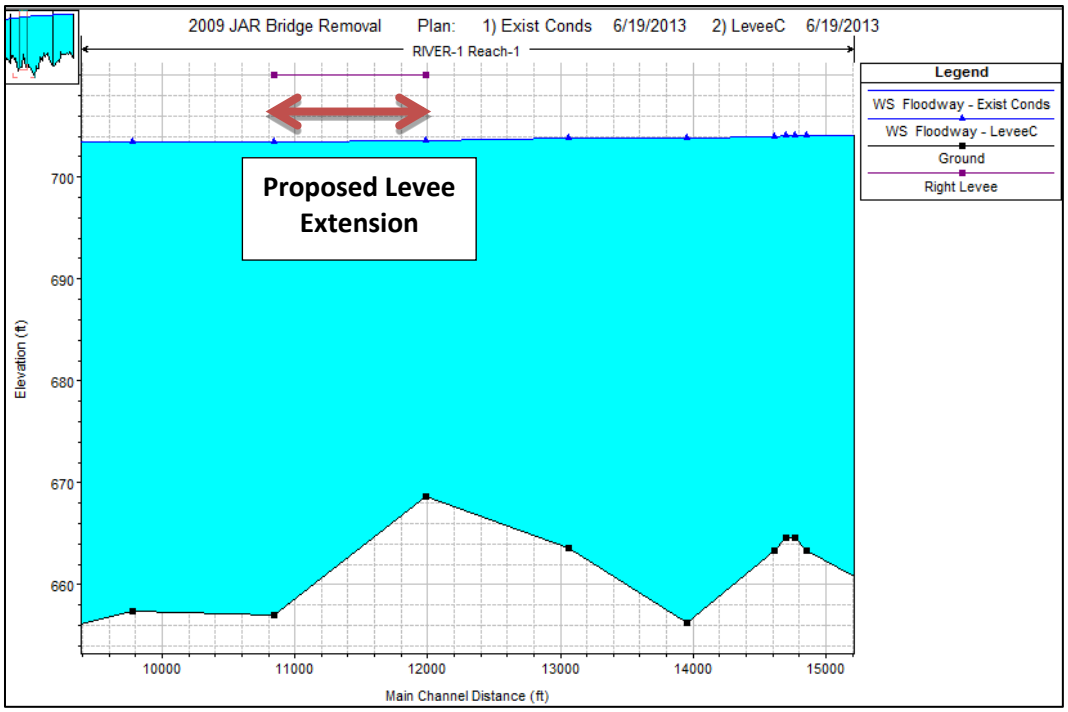


Figure 8. HEC-RAS Hydraulic model output for levee alignments outside of floodway (alignments 2, 3A, 3B, 4, and 5): no floodway impacts

4.4.3 Level of Protection

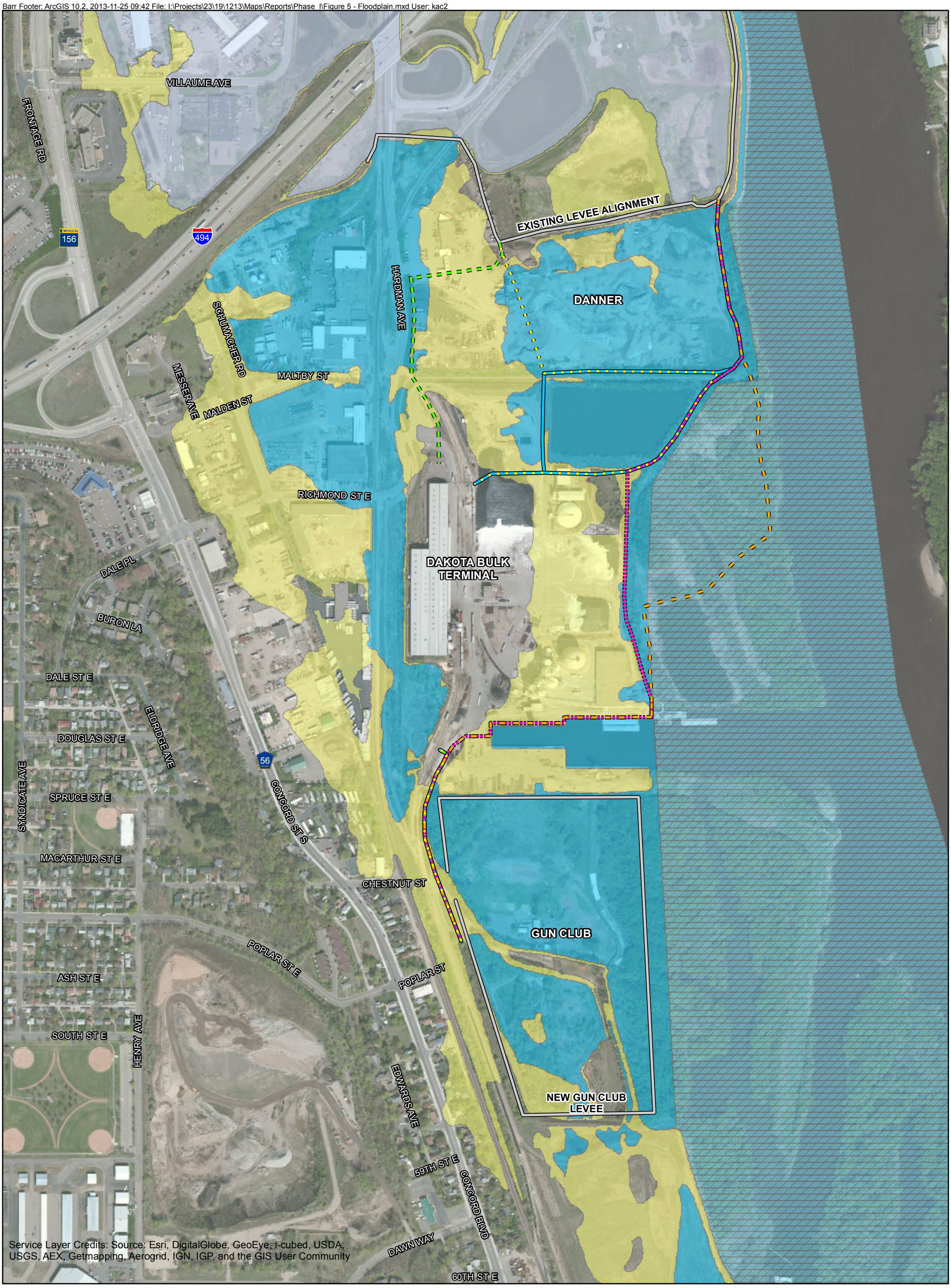
The FEMA-designated 100-year flood elevation for the Mississippi River adjacent to the project area ranges from 704 to 705 feet. FEMA requires 3 feet of freeboard in most cases (i.e., approximately 707 feet) and 4 feet of freeboard around bridges and at the upstream tie-in (i.e., approximately 708 feet) as the minimum level of protection for levees. There are currently no bridge structures located along the proposed levee alignments. Thus, any proposed levee must be constructed to an elevation of at least 707 feet, except at the upstream tie-in, which will need to be at least 708 feet.

The existing City levee is constructed to an elevation of 710 feet. The USACE stated that they did not consider a possible two foot elevation difference between the two levee sections to be an issue when tying into the existing levee via a minor modification. Consistency with the existing City levee may be an issue if the City wishes to decommission portions of the existing levee via a major modification.

The difference between the 708 feet and 710 feet levee elevation impacts the location of tie-ins, the levee footprint, amount of fill necessary for construction, and the height of closures (see Section 5.2.2). Designing to an elevation of 710 feet requires a railroad closure west of the barge

terminal for alignments 3A, 3B, 4 and 5. This railroad closure would not be required for a levee constructed to 708 feet (a road access closure would still be required adjacent to this location). Based on initial feedback from the USACE and impacts to levee design, selection of a levee elevation of 708 feet versus 710 feet is not anticipated to significantly affect the feasibility and permittability of the projects (aside from project cost).

Barr Footer: ArcGIS 10.2, 2013-11-25 09:42 File: I:\Projects\23\19\1213\Maps\Reports\Phase_I\Figure 5 - Floodplain.mxd User: kac2



Floodway (Zone AE)

100-year Floodplain (Zone AE)

500-year Floodplain

Area Protected byLevee

Existing Levee Alignment

Levee Alignment 1: Protect Maximum Area

Levee Alignment 2: Follow Floodway

Levee Alignment 3: Most Permitable

Levee Alignment 4: Exclude Riverfront Properties

Levee Alignment 5: Minimize Pump Station

N

Feet

0 500 1,000

Figure 9

FLOODPLAIN
City of South St. Paul, MN

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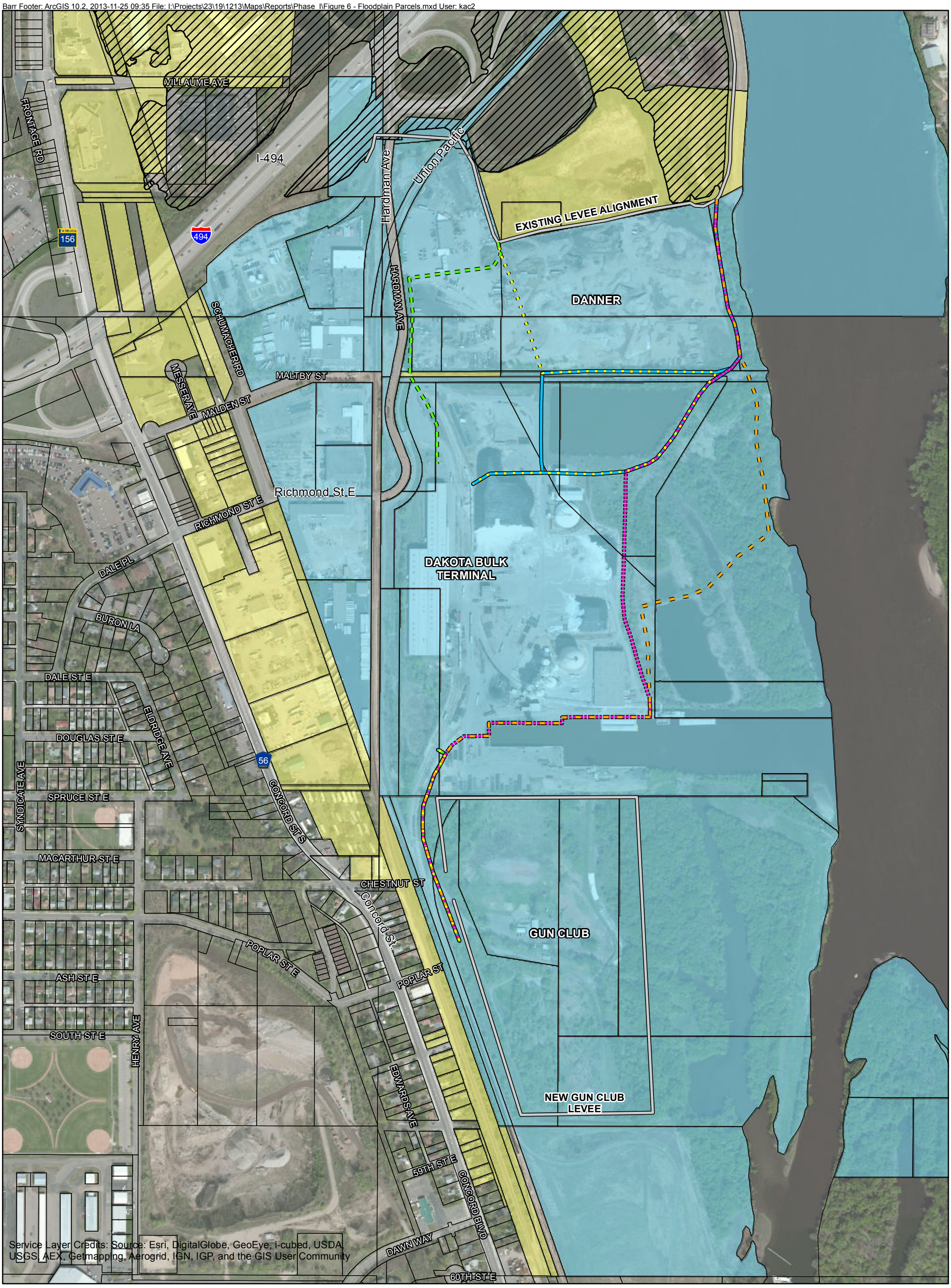


Parcels intersecting floodplain

- 100-yr floodplain (Zone AE)
- 500-yr floodplain
- Area Protected by Levee (Zone X)
- Existing Levee Alignment
- Levee Alignment 1: Protect Maximum Area
- Levee Alignment 2: Follow Floodway
- Levee Alignment 3: Most Permitable
- Levee Alignment 4: Exclude Riverfront Properties
- Levee Alignment 5: Minimize Pump Station

N

Feet
0 500 1,000

Figure 10

FLOODPLAIN PARCELS
City of South St. Paul, MN

<back of figure>

4.5 Potential Geotechnical Issues

A preliminary geotechnical analysis was performed for the project area based on available data. This section includes a summary of the documents reviewed, an overview of soil conditions at the site, the effects of assumed soil conditions on levee construction, and preliminary recommendations based on the findings.

4.5.1 Summary of Reports

Information compiled from the reports includes soil boring logs, laboratory testing results, and associated recommendations. Documents evaluated as part of the geotechnical review are listed below:

1. Northern Technologies, Inc. Geotechnical Exploration and Engineering Review: South St. Paul Public Works Salt Storage Structure. May 20, 2013.
2. Northern Technologies, Inc. Geotechnical Boring Logs. February 21, 2012.
3. Braun Intertec Corporation. A Soil Boring Report: Proposed CSAH 56 Improvements. April 20, 2005.
4. Braun Intertec Corporation. Hazardous Building Materials Inspection Report: Royal Star Enterprises Furniture Store. May 12, 2005.
5. Braun Intertec Corporation. A Geotechnical Evaluation Report: County State Aid Highway 56 Improvement Project. February 7, 2007.

4.5.2 Soil Conditions Observed

Documents 1, 2, 3, and 5 were reviewed for geotechnical purposes. Document 4 did not contain significant geotechnical information to warrant a review. Each document reviewed contained boring logs completed at locations pertinent to this memo. A total of 49 boring logs were available for review and are presented in Figure 11 for the purpose of showing the available boring locations relative to the site. Included on the figure are:

- Three standard penetration borings performed in May 2013 on 400 East Richmond Street between Concord Street and Hardman Avenue to depths of 10 to 15 feet below existing grade [Reference 1].
- Eight standard penetration borings performed in February 2012 on 400 East Richmond Street between Concord Street and Hardman Avenue to depths of 4 to 11 feet below existing grade [Reference 2].
- Nine power-auger borings and two standard penetration borings performed along Concord Boulevard to depths of 10 to 25 feet below existing grade [Reference 3].
- Twenty-seven borings performed along Concord Street to depths of 4 to 17 feet below existing grade [Reference 5]. Standard penetration testing was not performed and no soil samples were collected.

From the available information presented above, borings SPT-5, FA-1, FA-2, and FA-3 [Reference 2] were used to evaluate the soils at the north side of the site along Levee Alignment 3 and 4. Borings SPT-1 through SPT-4 [Reference 2] and SB-1 through SB-3 [Reference 1] were reviewed to represent the middle location of the proposed levees. Borings ST-83 through ST-92 and ST-101 through ST-

104 [Reference 5] were reviewed to represent the southern portion of the proposed levee alignments. A review of the geotechnical reports and boring logs indicated that the soils in the area are relatively consistent, with three soil units identified to be present on the west side of the site. The only discernible difference from the north to south side of the proposed levee alternatives is a slightly shallower bedrock and possibly higher water table to the north. It should be noted that, with the exception of the northern soil borings, no geotechnical data was reviewed in locations along any of the proposed levee alignments. Therefore, the information contained within this memo should be used with caution.

The primary units observed in the boring logs completed near the proposed site area are, from shallowest to deepest: fill, native soil, and bedrock. The fill material was observed in a majority of the borings and its presence is likely due to location of the borings performed on or near roadway surfaces and within industrial sites. The fill ranged from 9 to 12 feet below existing grade [Reference 1] and was classified as loamy sand (SL) [Braun, 2005] and as poorly graded sand with silt (SP-SM) [Reference 1]. Encountered beneath the fill was the native granular soils classified as sandy loam (SL) [Reference 3], sandy clay loam with gravel [Reference 5], and clayey sand (SC) with trace organics [Reference 1]. Standard Penetration Test (SPT) results generally fell within the range of 2 to 76, with a typical value of 8, indicating a low to medium dense relative density. The SPT values observed in the native soil are relatively low, with higher values associated with boulders or the top of bedrock. Laboratory testing of the sandy loam reported moisture content values ranging from 18 to 23% and loamy sand having lower moisture content ranging from 3 to 10% [Reference 3], indicating moist to saturated conditions. The native soil (alluvial) deposits are underlain by bedrock, reported as weathered shale [Reference 1] and Shakopee Formation limestone [Reference 3]. Bedrock was encountered at depths ranging from 22 to 26 feet below existing grade [Reference 3]. Rock Quality Designation (RQD) of the bedrock was reported as ranging from 61 to 90%, considered to be fair to excellent quality.

Groundwater was encountered in three borings from depths of 6 to 10 feet [Reference 1]. The remaining boring logs which presented moisture contents obtained from laboratory testing suggest that there is a moist to wet layer of soil perched on top of the bedrock [Reference 3], however groundwater was not encountered in these borings.

Recommendations for the geotechnical reports all agreed that the soils and bedrock in the region are suitable for proposed widening of roadway alignment, drilled shaft foundations, cast-in-place concrete retaining walls, and modular block retaining walls. Soil bearing pressures were reported to be between 2,500 and 4,000 psf, which are moderately high values with respect to soil strength. It was also recommended that topsoil and vegetation be removed prior to construction or placement new fill.

Barr Footer: ArcGIS 10.2, 2013-11-25 10:00 File: I:\Projects\23\19\1213\Maps\Reports\Phase_I\Figure 10 - Reviewed Boring Locations.mxd User: kac2

Borings Reported by Braun, 2005

Borings Reported by Braun, 2007

Borings Reported by NTI, 2012

Borings Reported by NTI, 2013

Existing Levee Alignment

Levee Alignment 1: Protect Maximum Area

Levee Alignment 2: Follow Floodway

Levee Alignment 3: Most Permitable

Levee Alignment 4: Exclude Riverfront Properties

Levee Alignment 5: Minimize Pump Station

Wetlands (National Wetlands Inventory)

N

Feet

0 700 1,400

Figure 11

REVIEWED BORING LOCATIONS
City of South St. Paul, MN

<back of Figure>

4.5.3 Geotechnical Conditions Affecting Levee Construction

Barr's preliminary Phase 1 report suggested that the levee alignment would be constructed on clayey soils or silty sands. There did not appear to be any indication that poor soils were located near the site such as fat or weak clays or soil with high organic content such as peat. However, the National Wetlands Inventory data indicates that wetlands are present in the area and are in the path of the proposed levee alignments as shown on Figure 11. Wetlands likely contain soils unsuitable for construction. However, the depth and extent of these unsuitable soils is unknown.

All of the geotechnical reports reviewed identified fill material of loamy sand above native soils of sandy loam. Loam is a soil composed of sand, silt, and clay. Sandy and loamy soils generally have good drainage and infiltration properties. The loam at this site was classified as a sandy loam with trace clay. Sandy loam soil is considered a desirable and acceptable soil for a foundation. It generally maintains a steady consistency and size when wet or dry. This eliminates the potential for shrink/swell problems. However, problems identified with sandy loam include slaking, runoff, and erosion.

A map of the Unified Soil Classification System (USCS) designation of the surficial soils, as developed by the USDA, is shown on Figure 12. This map generally indicates the presence of either unknown soils or sand in areas where boring logs were available for review. The unknown soils are likely an indication of either shallow bedrock or fill material, both of which were encountered in the soil borings reviewed. However, Figure 12 also identifies extensive areas of lean clay (CL) along the Mississippi River and within many of the proposed levee alignments. The potential presence of lean clay does not warrant immediate concern as it related to levee construction, provided it is found to exhibit medium stiff to hard consistency. However, there may be concern if the clay is found to be in a very soft to soft consistency and/or if it exhibits a relatively high plasticity index. Both of these factors could be an indication of potentially low strength and high long-term settlement potential.

4.5.4 Conclusions and Recommendations

Based on a review of the available geotechnical reports, there does not appear to be any fatal flaws based on the available information. However, with the exception of the northern soil borings, there was no geotechnical data available in locations that coincided with the proposed levee alignments. There exists a high potential for geotechnical conditions to be different from those observed in the soil borings along many of the proposed levee alignments.

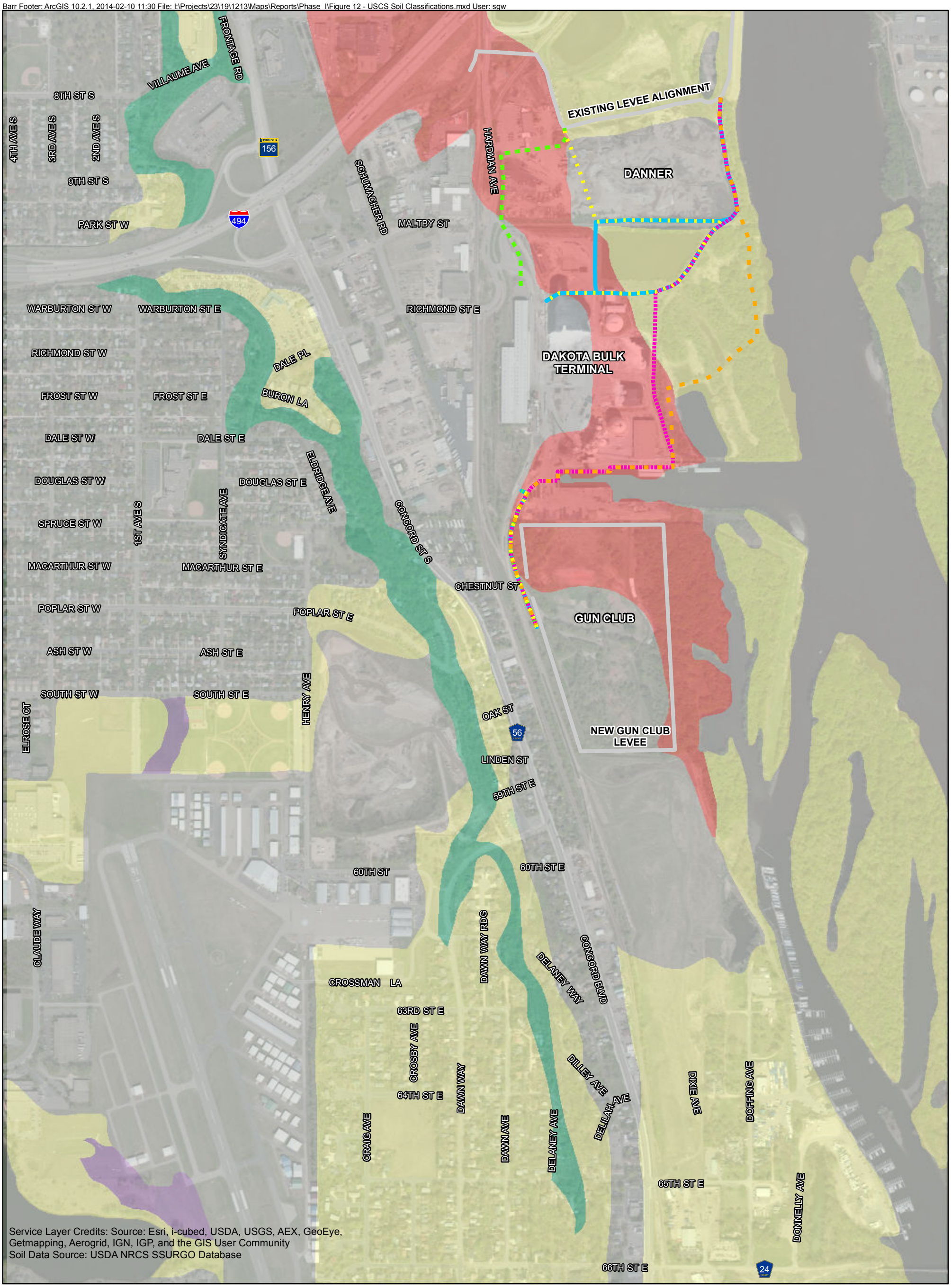
Therefore, while the reviewed documents did not identify any geotechnical concerns, there are uncertainties and unknowns associated with the current data set, including:

- Low blow counts in the native soil.
- Inconsistent amount of clay and organics reported in the reviewed boring logs.
- None of the boring locations coincided with the proposed levee alignments.
- Geotechnical parameters for the lean clay (as identified Figure 12) were not reported in available borings and, therefore, are unknown. These parameters may play a critical role in levee design, depending on the condition of the clay.

- Geotechnical parameters for the soils comprising existing and previous wetlands in the project area are presently unknown. These parameters may also play a critical role in levee design, depending on the condition of the clay.

It is Barr's recommendation that, should the project proceed to Phase 2, a series of geotechnical investigations be performed along the proposed levee alignments to assess geotechnical conditions and develop recommendations for levee construction. This could occur in a phased approach, wherein a preliminary geotechnical investigation is completed at a select number of locations along the proposed levee alignment to better define the geotechnical conditions and then followed by a full geotechnical investigation (should the project move to full design) along the entire levee alignment.

Barr Footer: ArcGIS 10.2.1, 2014-02-10 11:30 File: I:\Projects\23\19\1213\Maps\Reports\Phase_II\Figure 12 - USCS Soil Classifications.mxd User: sgw



Service Layer Credits: Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community
Soil Data Source: USDA NRCS SSURGO Database

Unified Soil Classification (Surface)

- Poorly-graded sand, silty sand
- Silty sand
- Lean clay, silt
- Lean clay
- Not Rated

- Existing Levee Alignment
- Levee Alignment 1: Protect Maximum Area
- Levee Alignment 2: Follow Floodway
- Levee Alignment 3: Most Permitable
- Levee Alignment 4: Exclude Riverfront Properties
- Levee Alignment 5: Minimize Pump Station

N

Feet
0 700 1,400

Figure 12

USCS SOIL CLASSIFICATIONS
City of South St. Paul, MN

<back of Figure>

5 Levee Alignments Options

5.1 Possible Alignments

The following potential levee alignments were originally delineated during the project proposal to bracket a reasonable range of levee placement (see Figure 13). Alignments were modified for this report based on available topographic, utility, and land use data. The alignments are not intended to be final but rather to identify major benefits and limitations of each alignment.

5.1.1 Levee alignment 1: protect as much developable land as possible

This option locates the levee along the west bank of the river in order to protect the largest amount of property in the study area (see Figure 13). This option assumes that the levee would extend south from the City's existing levee north of the Danner property, working its way around the berge terminal, ultimately tying into high ground north of the Gun Club property. While this option protects the most amount of land from flooding, the presence of the levee within the FEMA floodway creates major permitting challenges and impacts to the floodplain upstream to the Ford Dam in St. Paul, as noted in Section 4.4.3.

5.1.2 Levee alignment 2: follow floodway line

This option follows the delineation of the existing floodway (see Figure 13). The levee would extend south from the existing levee, hugging FEMA's floodway delineation, working its way around the barge terminal, ultimately tying into high ground north of the Gun Club property. This option would protect the most amount of land that can be permitted, but results in a long levee alignment, high fill volumes due to lower average ground elevation, and a flood wall along the north side of the barge terminal.

5.1.3 Levee alignments 3A and 3B: connect the high ground

These options "connect the dots," connecting high points to protect the greatest area of land using the shortest levee alignment. These options protect Danner's property, as well as the properties west of Hardman Avenue. The 3A option presents the shortest alignment, while the 3B option adds in protection of the large pond immediately south of Danner's facility; this pond could then be used in conjunction with a pumping station to address interior drainage and flooding concerns. These options provide the fewest restrictions to the Danner and Dakota Bulk Terminal properties.

5.1.4 Levee alignment 4: exclude riverfront properties

This option excludes the riverfront properties in the event that the major property owners (Danner, Dakota Bulk Terminal) do not want to participate in the construction of a levee on their land (or want to minimize their involvement). This option results in an alignment that protects only properties west of Hardman Avenue and requires the least amount of easement acquisition and fill.

This option results in more closures than options 3A and 3B and provides less benefit than the other alignment options.

5.1.5 Levee alignment 5: minimize pump station

This option excludes the majority of the riverfront properties (similar to alignment 4) but incorporates the pond south of the Danner property. Inclusion of the pond allows for some attenuation of local runoff and reduces the cost of a pumping station relative to alignment 4. Similar to alignment 4, this option protects only properties west of Hardman Avenue and requires the least amount of easement acquisition and fill. This option results in more closures than options 3A and 3B and provides less benefit than the other alignment options.

Existing Levee Alignment

Levee Alignment 1: Protect Maximum Area

Levee Alignment 2: Follow Floodway

Levee Alignment 3: Most Permitable

Levee Alignment 4: Exclude Riverfront Properties

Levee Alignment 5: Minimize Pump Station

N

Feet
0 500 1,000

Figure 13

PROPOSED ALIGNMENTS
City of South St. Paul, MN

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5.2 Feasibility Limitations

The proposed levee alignments were initially selected to provide a reasonable range of possible benefits. The feasibility of the proposed levee alignments was qualitatively evaluated with respect to several design factors. This qualitative analysis is presented in Table 1. The table is based on numerical ranking and is color-coded: green indicating a preferred or highest ranked option.

Table 1. Initial qualitative assessment of levee alignment feasibility

Alignment ID	Description	Levee Length	Quantity of Fill	Likely Closures	Easements/Property Required	FEMA Permitability	Overall Permitability	Potential Geotechnical Concerns	Utility Challenges	Transportation Challenges	Protected Property
1	Protect maximum developable area	6	6	1 (tie)	6	6	6	6	1 (tie)	1 (tie)	1
2	Follow the floodway line	5	4 (tie)	1 (tie)	5	4	5	5	1 (tie)	1 (tie)	2
3A	Connect the high ground	2	2	3 (tie)	2 (tie)	3 (tie)	3 (tie)	3	3 (tie)	3 (tie)	3 (tie)
3B	Connect the high ground (with pond)	3	4 (tie)	3 (tie)	4	3 (tie)	3 (tie)	4	3 (tie)	3 (tie)	3 (tie)
4	Exclude riverfront properties	1	1	6	1	1	1 (tie)	1 (tie)	6	6	6
5	Minimize pump station	4	3	5	2 (tie)	2	1 (tie)	1 (tie)	3 (tie)	3 (tie)	5

Notes:

- A rank of 1 is the preferred option; a rank of 6 is the least preferred.
- Transportation challenges were initially identified in the *South Concord Redevelopment Transportation Plan*. A major issue is bridging the Union Pacific main track which would be required of all the alignments in order to provide predictable, safe, and controlled access to the Danner or Dakota Bulk Terminal sites.

Qualitative analysis identifies levee alignments 1, 2, and 4 as potentially infeasible, while levee alignments 3A, 3B and 5 appear to be more feasible. Further analysis was performed to determine the feasibility of each alignment with respect to the ability to permit, need for closures, and need for utility modifications.

5.2.1 Permitting Considerations

Levee alignment 1 extends into the Mississippi River FEMA-mapped floodway. During initial feasibility consultation with the DNR and USACE, the DNR was doubtful that such an alignment could be permitted, based on potential for upstream flooding impacts. In addition, this alignment

would require construction activity in potentially sensitive riparian areas. **For these reasons, alignment 1 was eliminated as a possible alignment and omitted from subsequent analysis.**

5.2.2 Closure Considerations

All of the proposed levee alignments will require closures in one or more locations (see Figure 14). Alignments 1 and 2, however, would require approximately 1,300 feet of floodwall along the north side of the barge terminal. This length of floodwall could significant impact the operations at the Dakota Bulk Terminal. Much of the Dakota Bulk Terminal property is above the floodplain, and it is unlikely that the property owner would support a levee alignment that hinders their operations while not providing a necessary benefit. **For this reason, alignment 1 and alignment 2 were eliminated as possible alignments and are omitted from subsequent analysis.**

Alignments 3A, 3B, 4 and 5 would require a closure at the entrance to the Gun Club property (see Figure 11). The ground surface at this location is approximately 704 feet, requiring a closure of 4 to 6 feet in height (depending on the levee design elevation of 708 or 710 feet). This closure would span a distance of approximately 30 feet.

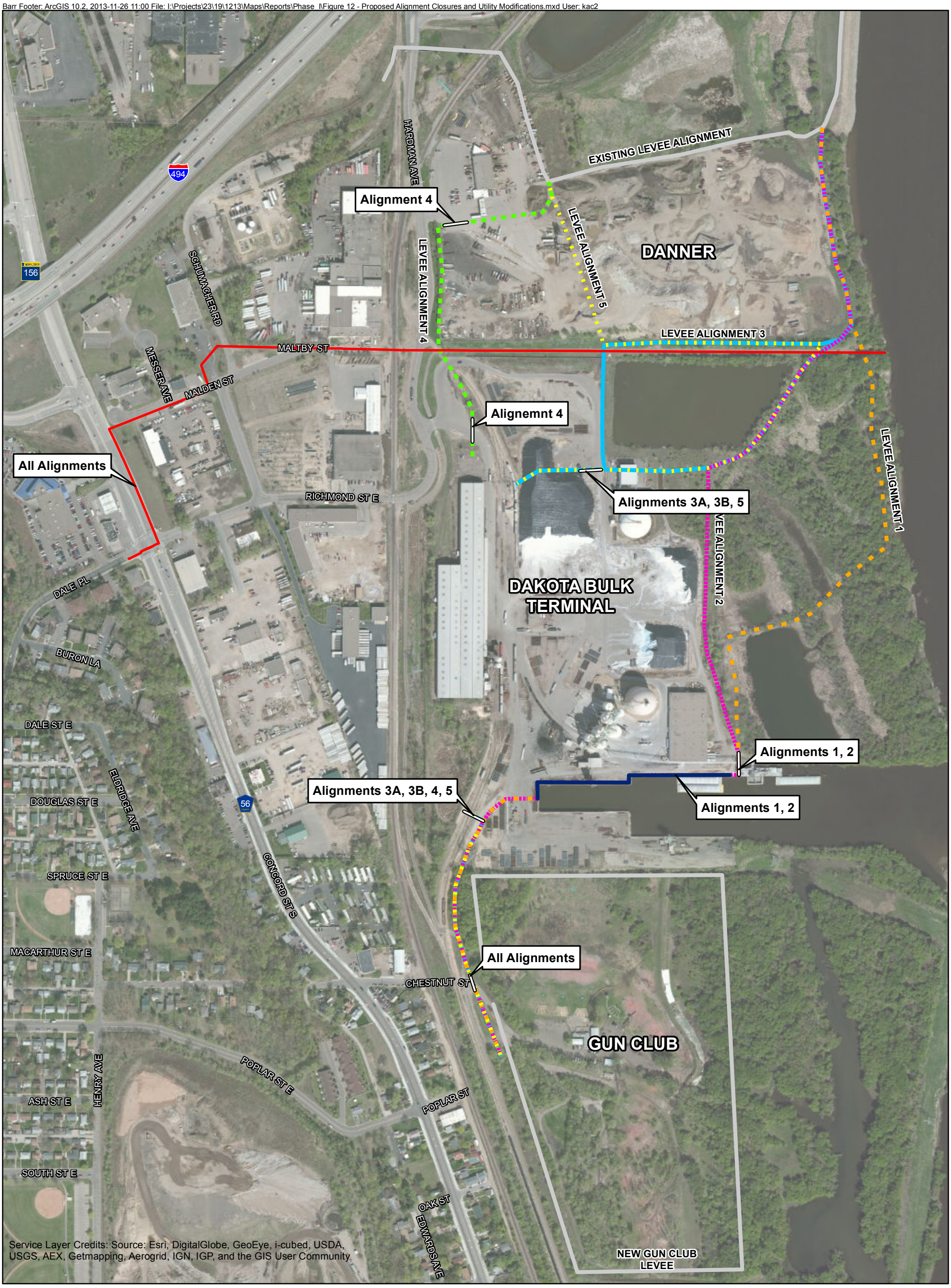
If the proposed levee is constructed to an elevation of 710 feet, Alignments 3A, 3B, 4 and 5 will require a railroad closure at the southwest corner of the Dakota Bulk Terminal (see Figure 14). This closure is not required if the levee is constructed to an elevation of 708 feet. If needed, this closure would have a height of two feet and a width of approximately 60 feet. This closure would impact the operations of the Dakota Bulk Terminal; aerial photographs suggest that trains are often parked on this section of track. This supports a levee elevation of 708 feet versus 710 feet (see Section 4.4.3).

Alignments 3A, 3B, 4 and 5 may also require a road closure or road raise adjacent to the railroad near the southwest corner of the Dakota Bulk Terminal (see Figure 14). The necessity for this closure is dependent on how this site access is used by the property owner. If necessary, this closure would be 4 to 6 feet high (depending on the levee design elevation of 708 or 710 feet) and approximately 30 feet wide. **Note that the cost estimates presented in Section 5.3.5.3 include all possible closures discussed in this section and assume a levee elevation of 710 feet.**

Two additional closures will be required for alignment 4 to allow access across the line of protection at west side of the Danner property and the west side of the Dakota Bulk Terminal (see Figure 14). The ground surface at each location is approximately 704 feet, requiring closures of 4 to 6 feet in height (depending on the levee design elevation of 708 or 710 feet). Each closure would span a distance of approximately 30 feet.

A closure may be necessary to allow access across the line of protection at north side of the Dakota Bulk Terminal adjacent to the pond (see Figure 14) for all feasible alignments. The necessity for this closure is dependent on how this site access is used by the property owner. If necessary, this closure would be 3 to 5 feet high (depending on the levee design elevation of 708 or 710 feet) and approximately 30 feet wide.

Cost estimates presented in Section 5.3.5.3 include all possible closures discussed in this section and assume a levee elevation of 710 feet.



Closure

Floodwall

Reconstructed Storm Sewer

Existing Levee Alignment

Levee Alignment 1: Protect Maximum Area

Levee Alignment 2: Follow Floodway

Levee Alignment 3: Most Permitable

Levee Alignment 4: Exclude Riverfront Properties

Levee Alignment 5: Minimize Pump Station

N

Feet
0 500 1,000

Figure 14

PROPOSED ALIGNMENT CLOSURES AND UTILITY MODIFICATIONS
City of South St. Paul, MN

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5.2.3 Stormwater Considerations

All of the proposed levee alignments intersect the 120" pipe that drains a significant portion of the City. During flood conditions, flow through the 120" pipe must be retained and/or pumped over the levee. Without detailed hydrologic modeling available, flow through the pipe under existing conditions cannot be reasonably estimated. It was therefore assumed the least expensive option is to separate the drainage from the bluff from the local drainage (see 4.4.1). Drainage from the bluff would be carried through the levee through a sealed pipe. Local drainage would drain to the river via the existing 120" pipe. During river flooding, the 120" pipe would be closed and flow would be diverted to a pump station (in alignments 3A and 4) or the pond on the north side of the Dakota Bulk Terminal (in alignments 1, 2, 3B, and 5).

This option would require improvements to the storm sewer system, including:

- Approximately 1,200 feet of new storm sewer pipe (30" diameter and 48" diameter) along Concord Street and Malden Street to convey drainage from the south half of the bluff to the approximate intersection of Schumacher Road and Malden Street.
- Approximately 2,900 feet of sealed storm sewer, beginning at the approximate intersection of Schumacher Road and Malden Street and running parallel to the existing 120" pipe, to convey the bluff drainage to the river. A 72" diameter pipe is assumed based on the combined pipe area of the two pipes carrying drainage from the bluff.
- A pump station located at the approximate intersection of the levee and the 120" pipe.

The proposed improvements are shown in Figure 14. Note that the location of the pump station varies according to the proposed alignment. The length of pipe necessary is similar for all alignments (regardless of levee location) because during non-flood conditions, local drainage, as well as bluff drainage will need to be conveyed to the river. The existing storm sewer carries bluff drainage and local drainage via the 120" pipe. Thus, it may be possible to convey the bluff drainage in a sealed pipe within the 120" pipe, with local drainage conveyed in the annulus around the sealed pipe. More detailed hydrologic modeling is proposed for Phase 2 to more accurately determine runoff rates and storm sewer improvement needs.

5.2.3.1 Modeling of Local Drainage

A simple HydroCAD model was developed to estimate the local runoff draining to the 120" pipe assuming the bluff drainage has been isolated. The approximate local drainage area to the 120" pipe is shown in Figure 6 (note that the drainage area varies by levee alignment). Watershed time of concentration is assumed to be 84 minutes and curve number of 73 (based on the available data from City's XP-SWMM model).

Runoff was estimated using the Atlas 14 100-year 24-hour storm event (7.42 inches) and the NRCS nested storm distribution. Use of the nested distribution may be overly conservative, but is the current recommended approach by the Minnesota Department of Transportation. Estimated peak runoff using the nested distribution and Atlas 14 precipitation is approximately 150% of that estimated using the old TP-40 precipitation values and the old SCS Type II storm distribution.

Alignments 1, 2, 3A and 5 include the pond at the north side of the Dakota Bulk Terminal (see Figure 14). Use of this pond to attenuate runoff from the local drainage area reduces the rate at which local runoff must be pumped outside the levee. The pond is approximately 6 acres in size, with a water surface elevation of approximately 692 feet (based on LiDAR data). In addition to the pond, there is a small amount of local storage west of Hardman Avenue (see Figure 15). GIS was used to estimate storage elevation curves for the existing pond and the local storage (see Table 2).

Table 2. Available local storage and storage in Dakota Bulk Terminal pond

Elevation (feet)	Storage (acre-feet)		
	Local storage	Pond Storage*	Combined Storage*
688	--	--	--
689	--	5.4	5.4
690	--	11.0	11.0
691	--	16.8	16.8
692	--	22.7	22.7
693	0.1	28.7	28.8
694	0.2	34.9	35.1
695	0.5	41.5	42.0
696	0.9	48.5	49.4
697	2.3	55.5	57.8
698	5.2	62.7	67.9

* pond storage is measured above an anticipated base elevation of 688 feet.
Existing water level is approximately 692 feet.

Storage Elevation

- 690 - 691
- 691 - 692
- 692 - 693
- 693 - 694
- 694 - 695
- 695 - 696
- 696 - 697
- 697 - 698

- Existing Levee Alignment
- Levee Alignment 1: Protect Maximum Area
- Levee Alignment 2: Follow Floodway
- Levee Alignment 3: Most Permitable
- Levee Alignment 4: Exclude Riverfront Properties
- Levee Alignment 5: Minimize Pump Station

N

Feet
0 500 1,000

Figure 15

INTERNAL AND POND STORAGE ELEVATION CURVES
City of South St. Paul, MN

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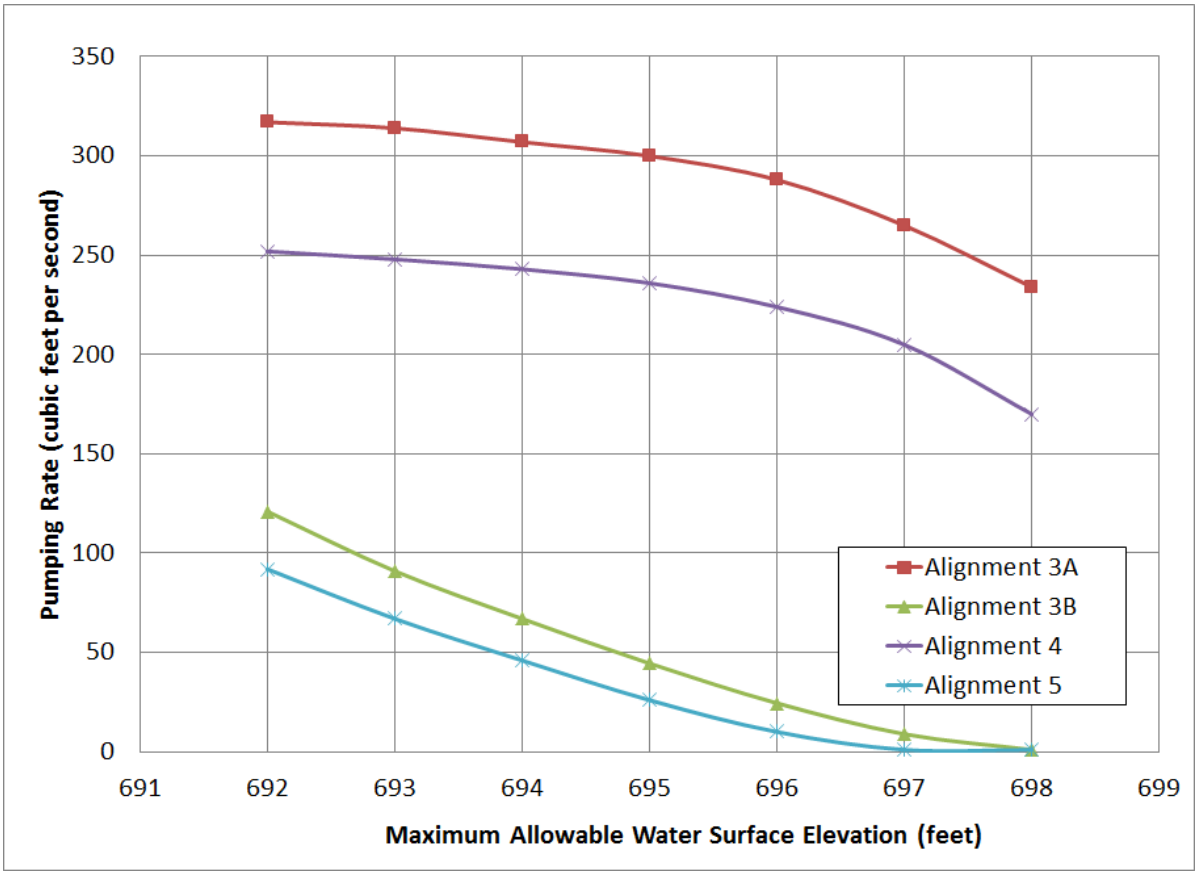


Figure 16. Pump Rate based on Allowable Elevation

The HydroCAD model was used to determine the minimum required pumping rate necessary to keep the interior water level below a given elevation while discharging the local drainage from the 100-year, 24 hour event. The resulting pumping rates are show in Figure 16. Alignments that incorporate the pond require much lower pumping rates to maintain a given water surface elevation. The upstream water surface elevation may reach as high as approximately 698 feet before reaching existing structures. The upstream storage is not significant relative to the storage available in the pond. Therefore, it may be beneficial to fill the upstream storage to allow higher bounce in the pond while preventing standing water upstream of Hardman Avenue. A maximum allowable elevation of 696 feet was assumed for cost estimating purposes, as it prevents flooding upstream of Hardman Avenue and minimizes required earthwork around the existing pond.

5.2.3.2 Pump Station and Gatewell Design

A pump station will be required for all alignments, although the required pumping capacity varies according to alignment and allowable water level within the protected area (see Figure 16). Barr proposes integrating the pump station and gatewell designs into a single structure located adjacent to the 120" pipe at the location of levee crossing. The 120" pipe would run into the gatewell, where a closure structure would be used to shut the pipe and divert local drainage to a small basin for pumping (for alignments 3A and 4) or into the pond (for alignments 3B and 5).

If the pipe conveying drainage from the bluff is carried within the 120" pipe (see Section 5.2.3), it will be separated from the 120" pipe within the gatewell structure and passed through to the

unprotected side of the levee. If the bluff drainage is conveyed via a new pipe running parallel to the 120" pipe, it will bypass the gatewell and pump station altogether.

5.3 Alignment Cost Estimation

Initial evaluation of alignment feasibility (see Section 5.2) identified alignments 3A, 3B, 4, and 5 as possible options for levee extension, and eliminated alignments 1 and 2. Cost estimates were generated for each of the feasible alignments. Concept level costs for some project elements are based on unit costs from recent levee projects or MnDOT unit costs; other costs are based on totals for similar tasks/elements from previous projects (e.g., City of Olso, City of Rushford) or best professional judgment. More detailed cost estimating is proposed in Phase 2 for any alignment(s) carried forward. Costs are summarized by alignment in Table 3. Costs for several elements of the proposed levees vary according to whether the levee is constructed to an elevation of 708 feet or 710 feet (e.g., earthwork, closures). **A design elevation of 710 feet has been assumed for cost estimation purposes, as it results in a higher (more conservative) total construction cost.**

Costs estimated for the proposed alignment include:

- Geotechnical Investigation
- Engineering and Design
- Permitting and Certification
- Land Acquisition
- Construction
- Maintenance

5.3.1 Geotechnical Investigation

This report includes a preliminary geotechnical investigation based on available data. Prior to alignment design, however, a more detailed investigation must be conducted. This investigation will include collection of data along the proposed alignment. The cost for this activity is estimated at $65,000 for each of the proposed alignments. This cost is based on geotechnical investigations for recent Minnesota levee projects (Oslo, Rushford).

5.3.2 Engineering and Design

Engineering and design is assumed to be ten percent of the construction cost (which varies by alignment). This percentage is based on the scale of the project. This includes development of plans and specifications, and oversight during the construction process. Use of a constant percentage for all alignments is reasonable based on the similarity of design needs and scope between alignments (e.g., stormwater design, geotechnical design, etc.).

5.3.3 Permitting and Certification

Permitting will include coordination with the DNR and USACE. A cost of $100,000 is estimated for permitting of alignments 3A, 3B, and 5. A cost of $50,000 is assumed for alignment 4; alignment 4 avoids the riparian areas along the Mississippi River and will likely avoid permitting needs associated with public waters. Certification of the levee with FEMA and the USACE is estimated to cost $50,000 regardless of the proposed alignment.

5.3.4 Land Acquisition

Much of the land which underlays the proposed levee footprints is privately held. This analysis assumes that this land will be purchased by the City. The cost of the land was estimated based on the footprint of the levee (plus a 15 foot clear buffer on either side) multiplied by the per acre property value of the associated parcel. Each levee alignment includes land currently owned by Danner, the Dakota Bulk Terminal, and the Gun Club. A 50 percent contingency is assumed for this cost. Including contingency, land acquisition costs are similar between alignments, ranging from a minimum of approximately $220,000 (alignment 3A) to a maximum of approximately $310,000 (alignment 5). The land value of the pond was not included in this analysis, based on the assumption that the Dakota Bulk Terminal will request the City to take ownership and manage the pond.

5.3.5 Construction

Construction of the levee and associated infrastructure represents the largest project cost. Construction costs may be subdivided into:

- General Costs (e.g., traffic control, mobilization)
- Earthwork
- Closures and Ramps
- Utility Improvements and
- Pump Station and Gatewell

5.3.5.1 General Costs

General costs include traffic control, mobilization/demobilization, and temporary erosion control. Mobilization/demobilization costs are assumed to be five percent of the construction costs for each alignment (this percentage is based on the scale of the project). Traffic control is estimated at $25,000 based on MnDOT average bid prices. Temporary erosion control is assumed to be $50,000 for each alignment based on similar costs for recent levee projects.

5.3.5.2 Earthwork

Earthwork includes site preparation, inspection trenches, filling, grading, and planting of the levee. Costs for each alignment are based on bid unit costs, where possible, from previous levee projects (e.g., Oslo, Rushford). Costs vary according to the length, area, and volume of fill necessary for each alignment. Fill volumes used to calculate the costs presented in Table 3 are based on a levee elevation of 710 feet, as this provides a conservative estimate with respect to costs. Figures showing proposed grading for levee alignments constructed to an elevation of 710 feet are included in Appendix B.

5.3.5.3 Closures and Ramps

Costs for road closures are estimated at $1,000 per linear foot based on a recent project estimate (Oslo). The referenced costs are for taller closure structures, but are assumed applicable for this case. Costs for ramp construction are include fill, gravel, and resurfacing and are based on recent MnDOT unit prices. Cost estimates include all possible closures discussed in Section 5.2.2 and assume a levee elevation of 710 feet.

5.3.5.4 Utility Improvements

Each of the alignments will require modifications to the storm sewer layout (see Section 5.2.3). The cost estimate includes construction of new storm sewer and associated road reconstruction to gain access. The majority of cost is related to the new sealed pipe necessary to convey the bluff drainage to the river. Costs for the utility improvements and associated road reconstruction are based on MnDOT unit costs.

5.3.5.5 Pump Station and Gatewell

Pump station and gatewell costs include estimated costs of $500,000 for gatewell and closure construction and $50,000 for the diversion to the pond (for alignments 3B and 5). Pump station costs are related to design peak pumping rate, and assume a rate that restricts bounce to an elevation of 696 feet (see Figure 16; note that required pumping rates, and therefore cost, decrease if additional pond bounce is acceptable).

Pump station costs for alignments 3B and 5 are based on the average bid price of the 4,500 gpm pump station currently under construction, linearly extrapolated to design pumping rates of 11,000 gpm and 4,500 gpm for alignments 3B and 5, respectively. For these alignments, a linear extrapolation is considered appropriate based on design rates of similar order of magnitude. Alignments 3A and 4 require significantly higher pumping rates, limiting the accuracy of extrapolation. For these alignments, estimated costs are based on values published in Pumping Station Design (Sanks et al., 1998). Costs are based on the lower end of the range for lake and river intakes, and are adjusted for present day using engineering cost indices. Pump station costs range from approximately $1-2M for alignments 3B and 5 to approximately $16-20M for alignments 3A and 4.

5.3.5.6 Maintenance

Regular maintenance will include mowing and inspections, and periodic dredging for alignments including a pond (alignments 3B and 5). Major maintenance of the levee and pump station will be required at varying intervals over the life of the project. An annual cost of regular maintenance of $25,000 per year is assumed for all alignments. An additional future cost of $100,000 every 10 years is assumed for dredging of ponds in alignments 3B and 5. An additional $5,000,000 every 50 years is assumed for major maintenance for all alignments. When converted to present value using a 5 percent time value of money, the maintenance costs are approximately $900,000 for alignments 3A and 4 and approximately $1,050,000 for alignments 3B and 5. Maintenance of infrastructure improvements associated with levee construction (e.g., stormsewer, road improvements) is not considered in this cost estimate.

5.3.6 Long-term Transportation Improvement Costs

The long-term redevelopment plans for the study area include potential transportation improvements, as described in the South Concord Redevelopment Transportation Plan. Long-term transportation improvement costs are considered separately from levee construction costs, as each levee alignment may be constructed with or without these improvements. The additional cost of transportation improvements is considered in the benefit-cost analysis (see 5.5).

Detailed cost estimates for possible transportation improvements are beyond the scope of Phase 1. As an approximation, a cost of $3,000,000 is assumed for transportation improvements within the

study associated with the frontage road scenario. This total is based on $800,000 for road improvement (based on the City's 2012 CIP for road reconstruction of similar scope) and a cost of $2,200,000 is assumed for bridge construction (based on the MnDOT 2012 bridge construction summary, an assumed span of 300 feet and an assumed width of 50 feet). Land acquisition for transportation improvements is not considered in the Phase 1 study.

5.3.7 Combined Costs and Contingency

Summarized costs for each alignment are presented in Table 3. A 20 percent contingency was applied to all costs except land acquisition costs, which include a 50 percent contingency (see Section 5.3.4). The total estimated costs for alignments 3B and 5 are significantly less than alignments 3A and 4, owing to the difference in pump station costs. Total costs were summed with and without an additional $3,000,000 in transportation improvement costs. The additional transportation improvements are associated with select future land use scenarios, as described in Section 5.3.6.

Table 3. Summary of levee alignment costs

Cost by Category	Cost of feasible alignments			
	Alignment 3A	Alignment 3B	Alignment 4	Alignment 5
Geotechnical Investigation	$ 65,000	$ 65,000	$ 65,000	$ 65,000
Engineering and Design	$ 2,405,000	$ 590,000	$ 1,970,000	$ 440,000
Permitting and Certification	$ 150,000	$ 150,000	$ 100,000	$ 150,000
Land Acquisition*	$ 217,000	$ 268,000	$ 235,000	$ 315,000
Construction	$ 24,055,000	$ 5,896,000	$ 19,701,000	$ 4,402,000
Maintenance	$ 895,000	$ 1,041,000	$ 895,000	$ 1,041,000
Contingency*	$ 5,514,000	$ 1,548,000	$ 4,546,000	$ 1,220,000
Total	**$ 33,301,000**	**$ 9,558,000**	**$ 27,512,000**	**$ 7,633,000**
Total with Frontage Road**	**$ 36,301,000**	**$ 12,558,000**	**$ 30,512,000**	**$ 10,633,000**

* Land acquisition costs include a 50% contingency. The 20% overall contingency excludes land acquisition costs.

** Includes cost of transportation improvements associated with select future land use scenarios (see Section 5.3.6)

5.4 Benefits (Land Value Assessment)

The benefit-cost analysis for flood improvement projects often measures "benefit" in terms of the avoided flood damage costs, which are weighted by the frequency of the expected damages (i.e., money saved over time). This method of analysis is used by the US Army Corps of Engineers and is necessary to obtain federal funding for flood improvement projects. The Phase 1 study does not quantify the project benefit using the US Army Corps of Engineers' method; this analysis is omitted because estimated flood damages in the project area are not significant relative to the expected project cost, and such frequency-scaled benefits are expected to be minimal.

Alternatively, this Phase 1 study considers changes in estimated land value (i.e., potential for redevelopment) to quantify the benefits of feasible levee extensions in the Phase 1 study. Note that although the benefits of avoided flood damages are estimated to be small in comparison to the benefits of redevelopment, consideration of avoided flood damage and/or eligibility for federal funding would *increase* the benefit-cost ratios from those presented in Section 5.5. Additional analysis in future project phases is necessary to estimate project benefits by US Army Corps of Engineers standards and eligibility for federal funding.

5.4.1 Land Use Scenarios

Existing land use is described in Section 3.1.1. Property value for existing properties within the 100-year floodplain is based on Dakota County data. The City evaluated future land use options within the study area as part of the *South Concord Transportation Redevelopment Plan.* The Plan identifies new access road alignment and improvements that are intended to support redevelopment and new investment. The Plan goes on to say that the biggest challenge for the area is "…providing access to the property (Danner, Kinder Morgan [Dakota Bulk Terminal] and SSP Gun Club) east of the Union Pacific main track and power transmission line…" The Plan identifies the Danner property as most "…likely to attract the highest land use and market uses dependent on access."

5.4.1.1 South Concord Transportation Redevelopment Plan

The South Concord Transportation Redevelopment Plan considered future land use scenarios based on two potential road alignments: the Schumacher Road scenario and the Frontage Road scenario. For each potential road alignment, three land use scenarios were analyzed relative to overall impacts, assessed value estimates (based on similar comparable values on a per acre increment), and employment.

The **Schumacher Road Scenario** is based on a new access road that aligns with the I-494 ingress/egress ramp at Concord to provide better access to existing parcels west of the Union Pacific (UP) line (Figure G of the South Concord Transportation Redevelopment Plan). Within this scenario, new investment is assumed to include mid-value industrial, highway retail, and low-values industrial, with no redevelopment of the existing Dakota Bulk Terminal and Gun Club properties. The increased values of the land created by each of the Schumacher Road scenarios are:

Schumacher Scenario 1	$29.1 million
Schumacher Scenario 2	$37.0 million
Schumacher Scenario 3	$49.0 million

The **Frontage Road Scenario** is based on a frontage road alignment that connects the Concord/494 interchange with the Hardman/494 interchange with at-grade road and a bridge over the UP main track to provide access to the Danner and Dakota Bulk Terminal sites (see Figure 17, Figure G of the South Concord Transportation Redevelopment Plan). Due to greater exposure of multiple parcels, redundant access, and an un-interrupted connection over the busy UP line, higher value land uses were considered, including highway retail, mixed-use, multi-family, high-value employment, office, and high-value industrial land uses. Like the Schumacher scenarios, the Dakota Bulk Terminal and Gun Club sites remain unchanged. The increased values of the land created by each of the scenarios are:

Frontage Scenario 1	$112.8 million
Frontage Scenario 2	$196.7 million
Frontage Scenario 3	$121.0 million

The land use scenarios presented in the *South Concord Redevelopment Transportation Plan* demonstrate a very positive range for potential improved land use and land values. The Frontage Road scenario presents significantly higher land values, but also requires a greater amount of infrastructure improvements and may require changes to existing zoning. Possible obstacles related to future property development potential may include site assembly (multiple property owners, hold-outs, litigation, etc.), extension of infrastructure, property visibility/exposure and/or ingress/egress related to marketability for preferred land use(s), market timing, and current real estate economics. The presence or lack of flood protection will also impact redevelopment. Only with protection from the 100-year flood will it be possible to anticipate redevelopment on the scale as shown with the Frontage Road scenarios.

5.4.2 Impact of Flood Protection on Redevelopment

Future land use values presented in the *South Concord Redevelopment Transportation Plan* provide a reference for potential benefits, but are not directly applicable to this benefit-cost analysis. This is because those estimates include areas outside of the 100-year regulatory floodplain. Redevelopment outside of the regulatory floodplain may occur with or without the additional protection afforded by the proposed levee extension. Therefore, the estimated benefits of flood protection presented in this report are limited to parcels within the regulatory 100-year floodplain.

Combinations of land use and transportation improvements (similar to those explored in the *South Concord Redevelopment Transportation Plan*) were considered to assess benefits within the existing 100-year floodplain if additional flood protection is provided. These land use combinations include a baseline condition and four future land use conditions. Future land use conditions are based on two fundamentally different scenarios: Low value and High value. Zoning changes may be required to allow the land uses assumed for the high value scenarios.

Baseline Scenario – this scenario assumes no additional flood protection. In this scenario, redevelopment within the regulatory 100-year floodplain will be limited to low value industrial uses. This condition is assumed as the baseline land use scenario beyond which the benefits of flood protection will be quantified. This scenario assumes that the Dakota Bulk Terminal and South St. Paul Public Works properties are not redeveloped.

Low Value Scenarios – the two low value scenarios are based on a 10- to 20-year timeline and assume there are no significant transportation improvements within the study area. The low value scenarios are similar to the Schumacher Road Scenario 1 presented in the *South Concord Redevelopment Transportation Plan*. In the low value scenarios, the following assumptions apply:

- Redevelopment within the regulatory floodplain is limited to low value industrial land uses
- Redevelopment in protected areas is limited to low or mid value industrial land uses
- The developable area is reduced according to the proposed levee footprints
- The Dakota Bulk Terminal is not redeveloped

- The South St. Paul Public Works is not redeveloped

High Value Scenario – the two high value scenarios are based on a 15- to 30-year timeline and assume that transportation improvements are made as part of a coordinate redevelopment effort. The high value scenarios are similar to Frontage Road Scenario 1 presented in the *South Concord Redevelopment Transportation Plan*. In the high value scenarios, the following assumptions apply:

- Redevelopment within the regulatory floodplain is limited to low value industrial land uses
- Redevelopment in protected areas may include commercial, mixed use, and high value employment land uses
- The developable area is reduced according to the proposed levee footprints
- The developable area is reduced by approximately 5 acres for transportation improvements
- The Dakota Bulk Terminal is not redeveloped

Within the low value and high value scenarios, two future land use combinations were considered. For simplicity, future land use was applied to the existing parcel boundaries. The future land use scenarios evaluated are summarized in Table 4 and illustrated in Figure 17. The total property value for the baseline and future land use scenarios summarized were calculated using the land use values presented in the *South Concord Redevelopment Transportation Plan*.

Table 4. Future land use combinations within the current 100-year floodplain

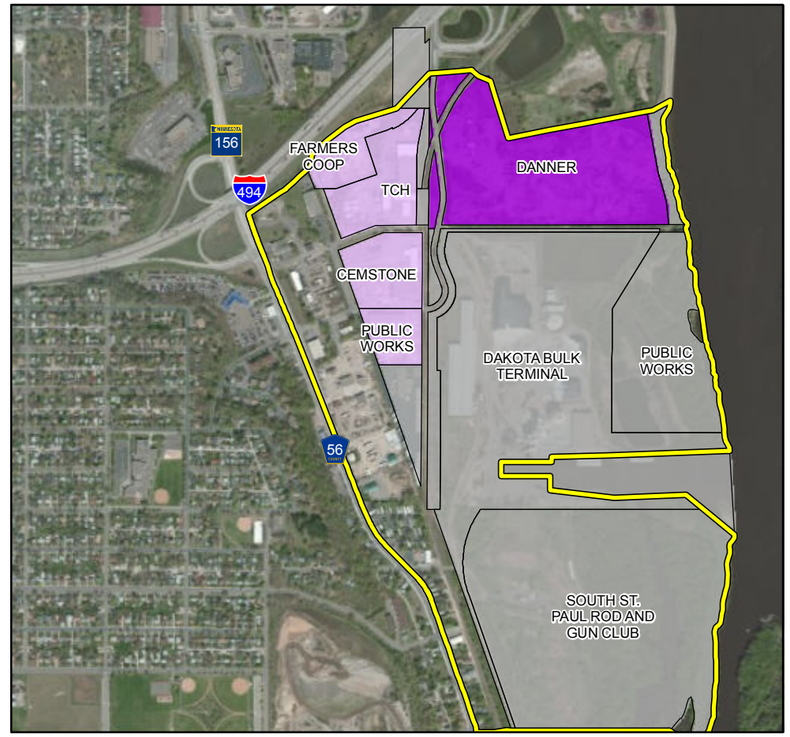
Existing Property Owner	Land Use Category				
	Baseline	Low Value Scenario 1	Low Value Scenario 2	High Value Scenario 1*	High Value Scenario 2*
Danner	Low Industrial	Mid Industrial	Mid Industrial	High Industrial	High Ind./Office
Farmers Coop	Low Industrial	Low Industrial	Mid Industrial	Commercial	Commercial
TCH	Low Industrial	Low Industrial	Mid Industrial	Commercial	Commercial
Cemstone	Low Industrial	Low Industrial	Mid Industrial	Commercial	Commercial
Public Works	Low Industrial	Low Industrial	Mid Industrial	Multi-family	Mixed Use
Dakota Bulk Terminal	Existing	Existing	Existing	Existing	Existing

* High value scenarios 1 and 2 are similar to Frontage Road Scenarios 1 and 2 from the *South Concord Redevelopment Transportation Plan,* respectively. Zoning changes may be necessary to allow land uses assumed in these scenarios.

Table 5 presents the total property value for each land use combination identified in Table 4, in combination with each of the proposed levee alignments. Note that the property values presented in Table 5 vary according to levee alignment because levee location limits the area available for redevelopment. Property value benefits over the baseline condition are realized under all evaluated land uses scenarios. Levee alignments 4 and 5 result in the lowest increase in property values, as those alignments significantly reduce the redevelopment potential for the Danner property. Increases in property values are less than those presented in the *South Concord Redevelopment Transportation Plan*, owing to the smaller number of parcels considered (i.e., only those within the regulatory floodplain). Scenarios including transportation improvements result in the greatest increase over baseline conditions, reflecting the assumptions of the *South Concord Redevelopment Transportation Plan*. Phase 2 of this project will include more detailed assessment of current and estimated future property values.

BASELINE SCENARIO

LOW VALUE SCENARIO 1



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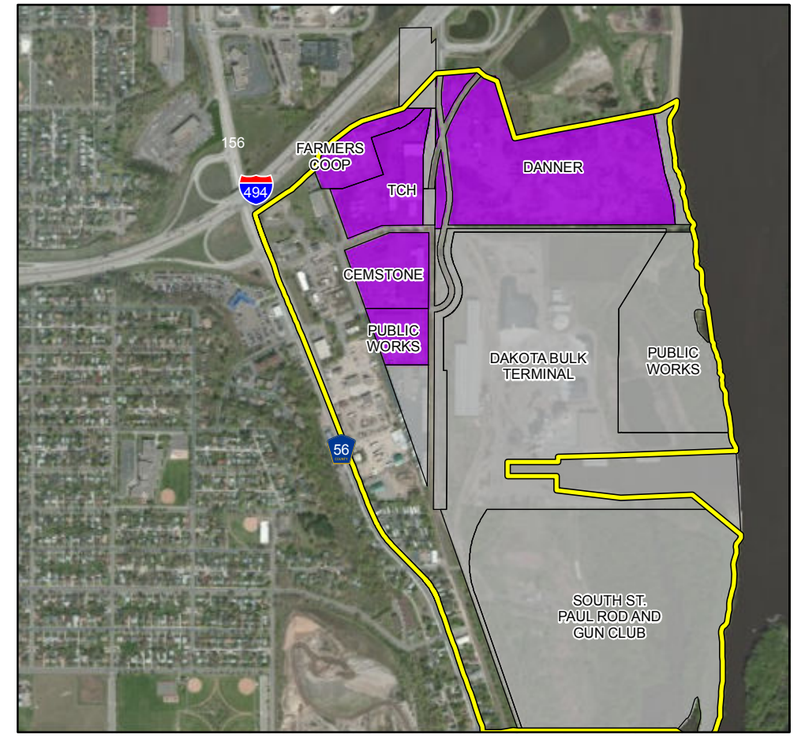
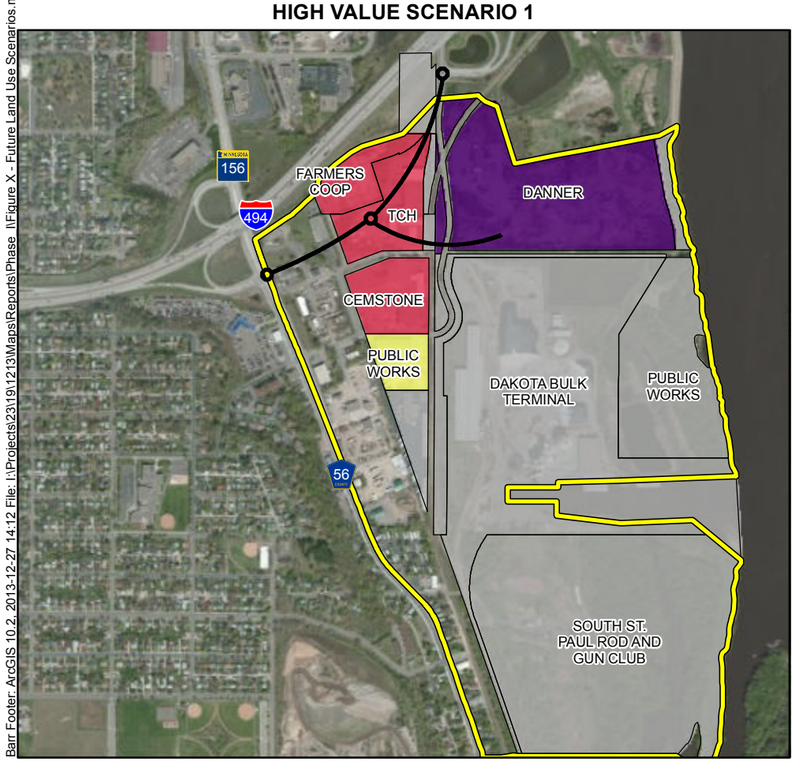


HIGH VALUE SCENARIO 1



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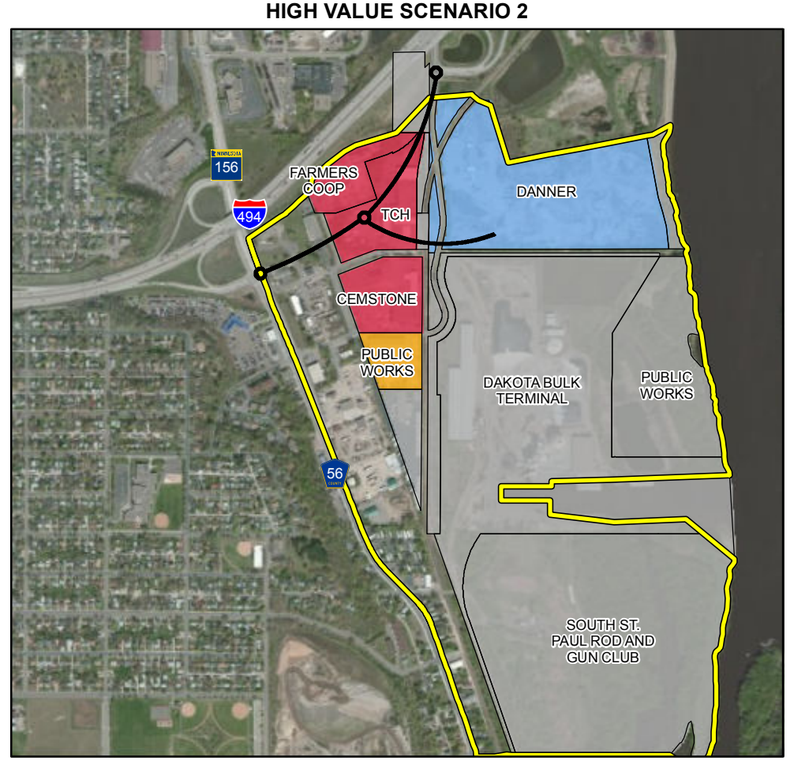

Study Area

Land Use Category

- Commercial
- Low Industrial
- Mid Industrial
- High Industrial
- High Industrial / Office
- Mixed Use
- Multi-Family
- Existing
- Proposed Transportation Improvements

N

Feet

0 1,500 3,000

Figure 17

BASELINE AND FUTURE LAND USE SCENARIOS
City of South St. Paul, MN

Barr Footer: ArcGIS 10.2, 2013-12-27 14:12 File: I:\Projects\23\19\1213\Maps\Reports\Phase_I\Figure X - Future Land Use Scenarios.mxd User: kac2

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Table 5. Property value of future land use combinations for feasible levee alignments

Land Use Scenario	Total Property Value (in thousands of dollars)			
	Alignment 3A	Alignment 3B	Alignment 4	Alignment 5
Baseline	$ 21,215,000	$ 21,215,000	$ 21,215,000	$ 21,215,000
Low Value 1	$ 30,592,000	$ 31,082,000	$ 23,783,000	$ 25,757,000
Low Value 2	$ 37,116,000	$ 37,606,000	$ 30,307,000	$ 32,281,000
High Value 1	$ 54,988,000	$ 55,852,000	$ 37,856,000	$ 42,635,000
High Value 2	$ 75,515,000	$ 76,585,000	$ 52,705,000	$ 59,027,000
Land Use Scenario	**Change from Baseline Scenario (in thousands of dollars)**			
	Alignment 3A	**Alignment 3B**	**Alignment 4**	**Alignment 5**
Baseline	$ -	$ -	$ -	$ -
Low Value 1	$ 9,377,000	$ 9,867,000	$ 2,568,000	$ 4,542,000
Low Value 2	$ 15,901,000	$ 16,391,000	$ 9,092,000	$ 11,066,000
High Value 1	$ 33,773,000	$ 34,637,000	$ 16,641,000	$ 21,420,000
High Value 2	$ 54,300,000	$ 55,370,000	$ 31,490,000	$ 37,812,000

5.5 Benefit Cost Analysis

Estimated costs associated with four technically feasible levee alignments are described in Section 5.3. Benefits associated with four future land use scenarios are described in Section 5.4. Some land use scenarios include transportation improvements based on the *South Concord Redevelopment Transportation Plan*; additional costs associated with those land use scenarios are described in Section 5.3.6. The benefit to cost ratio was calculated for all combinations of feasible alignments and land use scenarios (see Table 6).

Table 6. Benefit-Cost ratios for feasible levee alignments under selected land-use scenarios

Land Use Scenario	Benefit-Cost Ratio			
	Alignment 3A	Alignment 3B	Alignment 4	Alignment 5
Low Value 1	0.3	1.0	0.1	0.6
Low Value 2	0.5	1.7	0.3	1.4
High Value 1	0.9	2.8	0.5	2.0
High Value 2	1.5	4.4	1.0	3.6

Note: values greater than 1 indicate benefit is greater than cost.

Under all future land use scenarios evaluated, alignment 3B results in a benefit-cost ratio equal to or greater than 1. Alignment 3B benefit-cost ratios are significantly higher if transportation

improvements are realized (i.e., under high value land use scenarios, see Section 5.4.1). Under all future land use scenarios, alignment 3B returns a higher benefit-cost ratio than the other alignments. Alignment 5 also has potential for high benefit-cost ratios if transportation improvements are realized. Alignments 3A and 4 result in benefit cost ratios greater than 1 only when the frontage road improvements discussed in the *South Concord Redevelopment Transportation Plan* are implemented and high value redevelopment occurs (scenario B2).

6 Phase 1 Findings

The Phase 1 Report is provides an initial assessment of the technical and economic feasibility of constructing a levee extension south of the City's existing levee. The analysis performed as part of Phase 1 is based on a variety of information compiled and reviewed by our team, including:

- The data gathering portion of a Phase 1 Environmental Assessment of site conditions
- Understanding of the long-range land use and policy guidance (including recent corridor and transportation plans and studies)
- Assessment of potential fatal flaws related utilities, stormwater, floodplain, regulatory/permitting, and geotechnical issues
- Meeting with the USACE and DNR to identify issues related to levee design and certification
- Identification of several levee options and evaluation of the feasibility of those alignments with respect to technical, operational, and permitting issues, including handling of drainage within the protected area
- Quantification of benefits of redevelopment of the study area, including land use forecasts and related land values documented in the *South Concord Redevelopment Transportation Plan*.
- Estimation of costs related to the design, permitting, construction, and maintenance of potential levee alignments
- Summary of benefit-cost ratios for multiple combinations of levee alignments and possible future land use conditions

The results presented in Section 5.5 identify several alignment/land use scenarios with benefits that are greater than costs. Alignment 3B as the most favorable alignment, resulting benefits greater than costs under all future land use scenarios considered. The estimated cost for alignment 3B is approximately $9.6 million dollars. In combination with alignment 3B, increases in property values range from approximately $9.9 million to $55.4 million according to land use scenario. The greatest benefits are estimated from land use scenarios that assume transportation improvements and possible zoning changes.

The benefits and costs calculated in Phase 1 are based on high level analysis. The capital investments intended to support redevelopment within the study area will also be subject to a variety of other factors including the cyclical nature of the marketplace, willing landowners and area stakeholders, transportation funding, and how (and how long) this area will change from an industrial-based economy to a pattern that will support a mix of uses.

Despite the uncertainty in future land development, **our team has identified that a feasible project likely exists and that Phase 2 should be undertaken.**

Appendices

Appendix A
Land Valuation Tables

Appendix A. Land Value for Existing Conditions, Baseline Conditions, and Redevelopment Scenarios

Table A.1 - Current land value based on existing ownership (parcels in the 100-year floodplain)

Current Property Owner	Area (acres)	Current Property Value	Value/acre
Danner LLC	39.85	$ 2,457,000	$ 61,656
Farmers Coop	6.05	$ 981,700	$ 162,264
TCH	10.37	$ 2,195,100	$ 211,678
Cemstone	8.37	$ 2,584,700	$ 308,805
South Saint Paul Public Works	4.66	$ 1,449,000	$ 310,944
Dakota Bulk Terminal	91.28	$ 4,949,100	$ 54,219
Total	**160.6**	**$ 14,616,600**	**$ 91,023.79**

Table A.2 - Assumed land use values based on *South Concord Transportation Redevelopment Plan*

Land Use	Value/acre
Low-value industrial	$ 227,226
Mid-value industrial	$ 490,380
High-value industrial	$ 864,414
Multi	$ 1,585,698
High-value industrial/Office	$ 1,070,133
Commerical	$ 588,720
Multi-family	$ 1,275,851
Mixed Use	$ 4,054,054

Appendix A. Land Value for Existing Conditions, Baseline Conditions, and Redevelopment Scenarios

Table A.3 - Land use and value corresponding to baseline and future redevelopment scenarios

Current Property Owner	Baseline		Scenario A.1		Scenario A.2		Scenario B.1		Scenario B.2	
	Land Use	Value/acre	Land Use	Value/acre	Land Use	Value/acre	Land Use	Value/acre	Land Use	Value/acre
Danner LLC	low industrial	$ 227,226	mid industrial	$ 490,380	mid industrial	$ 490,380	high industrial	$ 864,414	high ind./office	$ 1,070,133
Farmers Coop	existing	$ 162,264	low industrial	$ 227,226	mid industrial	$ 490,380	commercial	$ 588,720	commercial	$ 588,720
TCH	existing	$ 211,678	low industrial	$ 227,226	mid industrial	$ 490,380	commercial	$ 588,720	commercial	$ 588,720
Cemstone	existing	$ 308,805	low industrial	$ 227,226	mid industrial	$ 490,380	commercial	$ 588,720	commercial	$ 588,720
SSP Public Works	existing	$ 310,944	existing	$ 310,944	existing	$ 310,944	multi-family	$ 1,275,851	mixed use	$ 4,054,054
Dakota Bulk	existing	$ 54,219	existing	$ 54,219	existing	$ 54,219	existing	$ 54,219	existing	$ 54,219

Appendix A. Land Value for Existing Conditions, Baseline Conditions, and Redevelopment Scenarios

Table A.4 - Land area available for redevelopment for land use scenario/levee alignment combinations

Current Property Owner	Levee Alignment	Acre (acres) by Redevelopment Scenario				
		Baseline	Scenario A.1	Scenario A.2	Scenario B.1*	Scenario B.2*
Danner LLC**	Align 3A	39.85	37.85	37.85	36.85	36.85
Danner LLC**	Align 3B	39.85	38.85	38.85	37.85	37.85
Danner LLC**	Align 4	39.85	10.25	10.25	9.25	9.25
Danner LLC**	Align 5	39.85	17.75	17.75	16.75	16.75
Farmers Coop	All Alignments	6.05	6.05	6.05	4.55	4.55
TCH		10.37	10.37	10.37	7.87	7.87
Cemstone		8.37	8.37	8.37	8.37	8.37
SSP Public Works		4.66	4.66	4.66	4.66	4.66
Dakota Bulk***		91.28	NA	NA	NA	NA

* Scneario B assumes 5 ac reduction for road/bridge ROW (1 acre from Danner, 1.5 acres from Coop, 2.5 acres from TCH)

** Area shown is protected area; area outside the levee is assumed to be redeveloped as low value industrial

*** Area reduction to Dakota Bulk Terminal not considered because no revelopment is considered under future scenarios

Table A.5 - Land value of individual properties in the 100-year floodplain

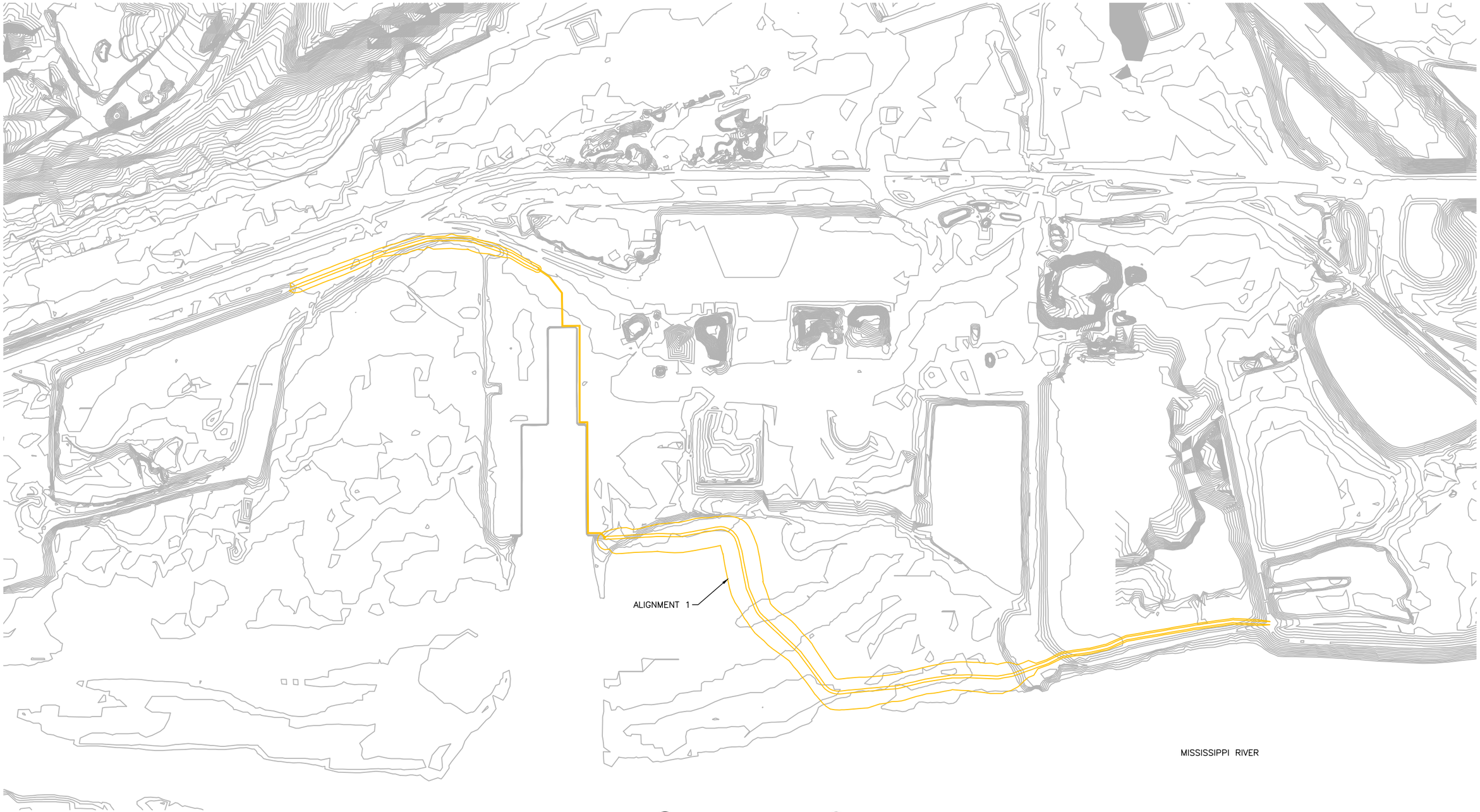
Current Property Owner	Levee Alignment	Acre (acres) by Redevelopment Scenario				
		Baseline	Scenario A.1	Scenario A.2	Scenario B.1*	Scenario B.2*
Danner LLC	Align 3A	$ 9,054,956.10	$ 18,560,883	$ 18,560,883	$ 31,853,656	$ 39,434,401
Danner LLC	Align 3B	$ 9,054,956.10	$ 19,051,263	$ 19,051,263	$ 32,718,070	$ 40,504,534
Danner LLC	Align 4	$ 9,054,956.10	$ 11,525,059	$ 11,525,059	$ 14,721,719	$ 16,624,620
Danner LLC	Align 5	$ 9,054,956.10	$ 13,498,714	$ 13,498,714	$ 19,500,629	$ 22,946,422
Farmers Coop	All Alignments	$ 981,700	$ 1,374,717	$ 2,966,799	$ 2,678,676	$ 2,678,676
TCH		$ 2,195,100	$ 2,356,334	$ 5,085,241	$ 4,633,226	$ 4,633,226
Cemstone		$ 2,584,700	$ 1,901,882	$ 4,104,481	$ 4,927,586	$ 4,927,586
SSP Public Works		$ 1,449,000	$ 1,449,000	$ 1,449,000	$ 5,945,466	$ 18,891,892
Dakota Bulk*		$ 4,949,100	$ 4,949,100	$ 4,949,100	$ 4,949,100	$ 4,949,100

* No redevelopment assumed for Dakota Bulk Terminal; existing property value is assumed

Table A.6 - Total land value of parcels within the 100-year floodplain by levee alignment

Current Property Owner	Levee Alignment	Acre (acres) by Redevelopment Scenario				
		Baseline	Scenario A.1	Scenario A.2	Scenario B.1*	Scenario B.2*
Total Cost	Align 3A	$ 21,214,556	$ 30,591,916	$ 37,115,503	$ 54,987,710	$ 75,514,881
	Align 3B	$ 21,214,556	$ 31,082,296	$ 37,605,883	$ 55,852,124	$ 76,585,014
	Align 4	$ 21,214,556	$ 23,556,091	$ 30,079,679	$ 37,855,774	$ 52,705,100
	Align 5	$ 21,214,556	$ 25,529,746	$ 32,053,334	$ 42,634,684	$ 59,026,903
Increase Value over Baseline	Align 3A	$ -	$ 9,377,359	$ 15,900,947	$ 33,773,154	$ 54,300,325
	Align 3B	$ -	$ 9,867,739	$ 16,391,327	$ 34,637,568	$ 55,370,458
	Align 4	$ -	$ 2,341,535	$ 8,865,123	$ 16,641,217	$ 31,490,544
	Align 5	$ -	$ 4,315,190	$ 10,838,778	$ 21,420,127	$ 37,812,347

Appendix B
Levee Alignment Grading Plans



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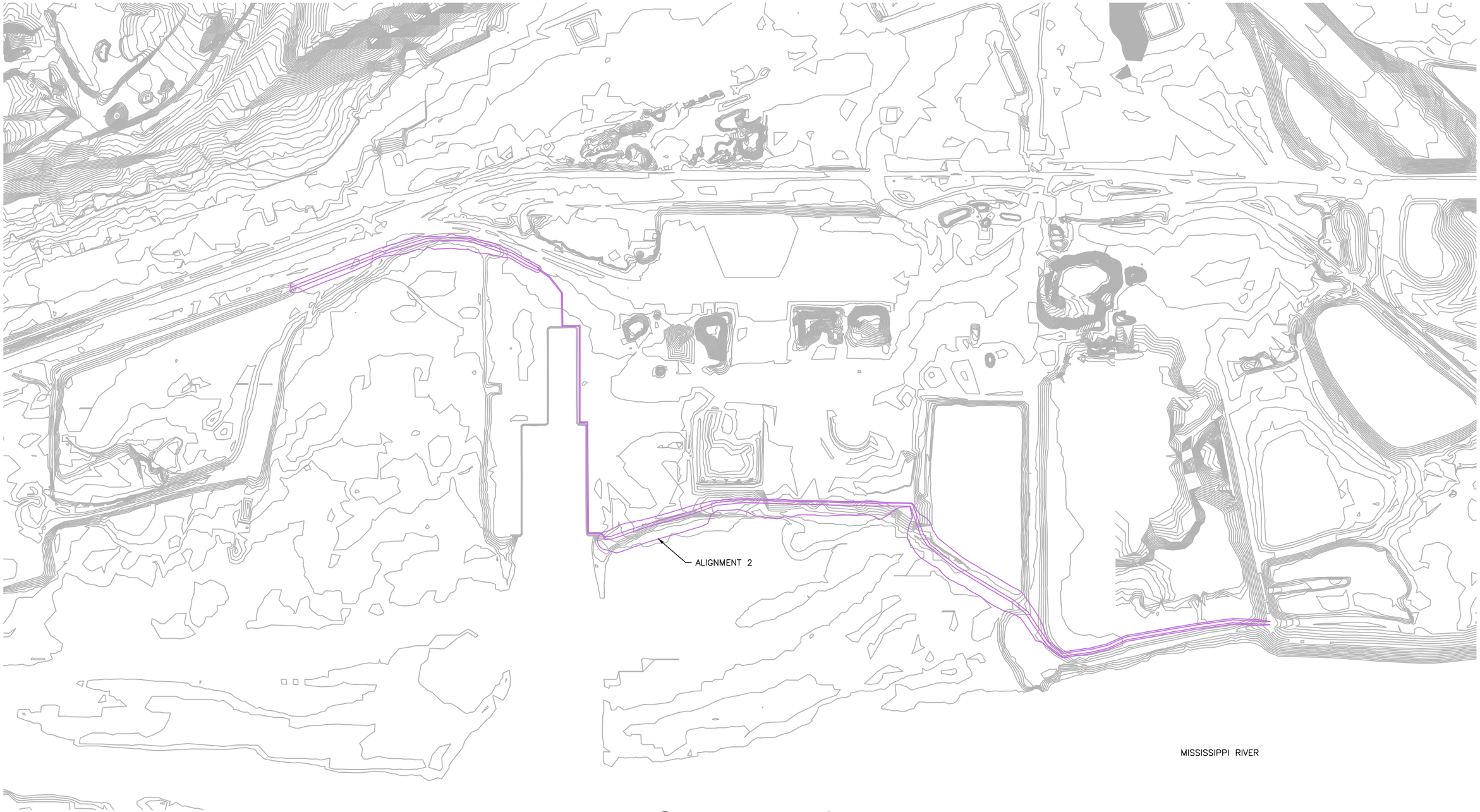

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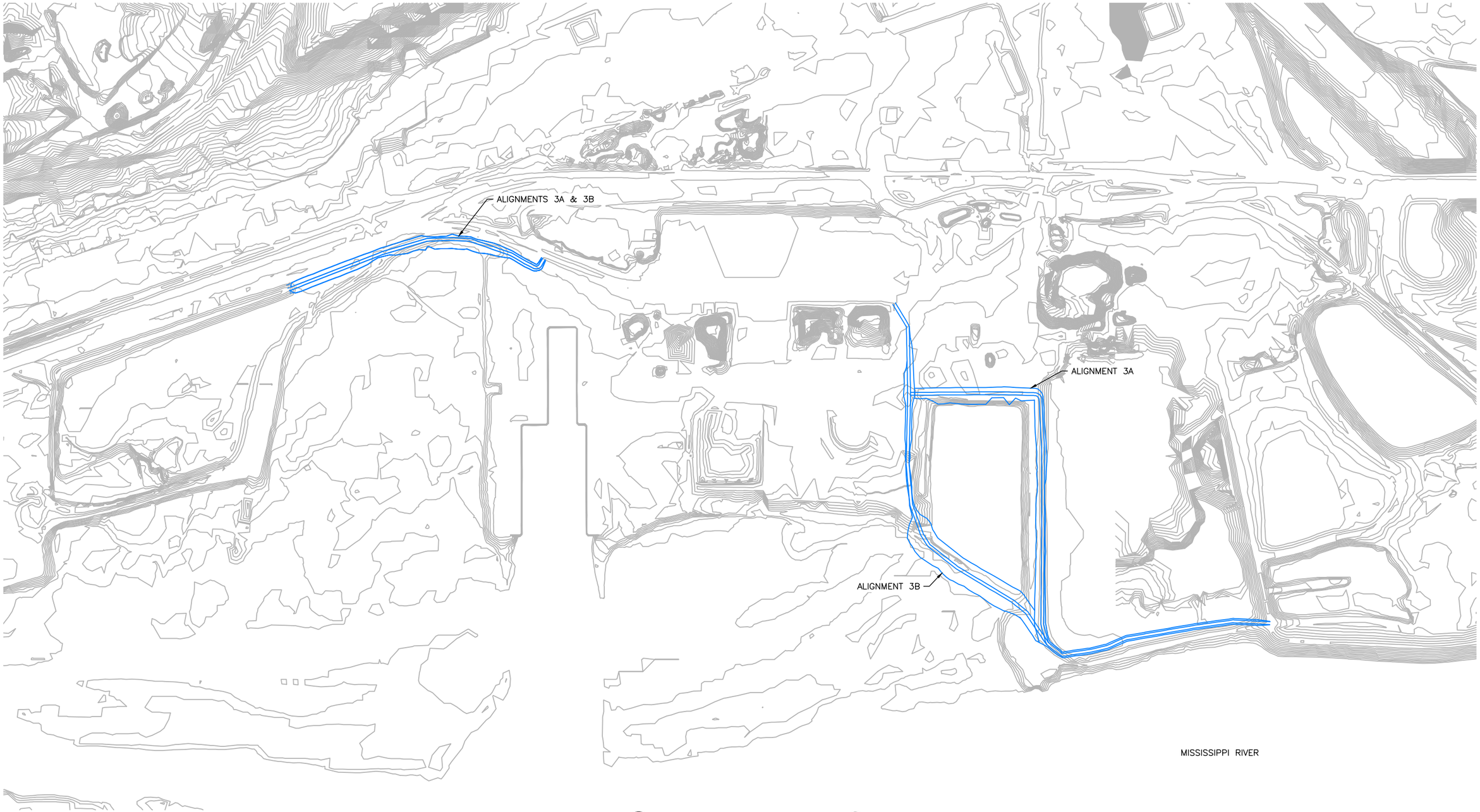

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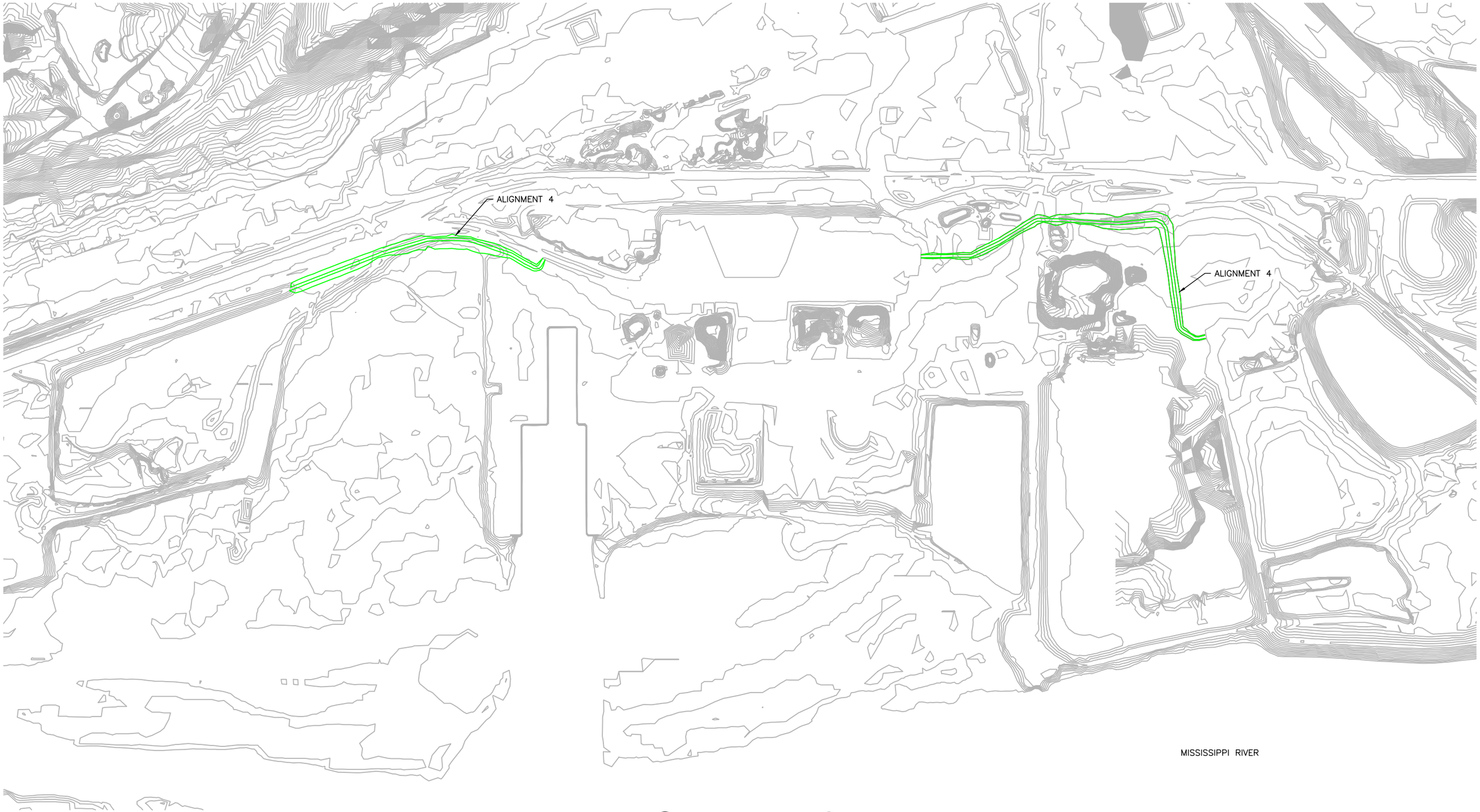

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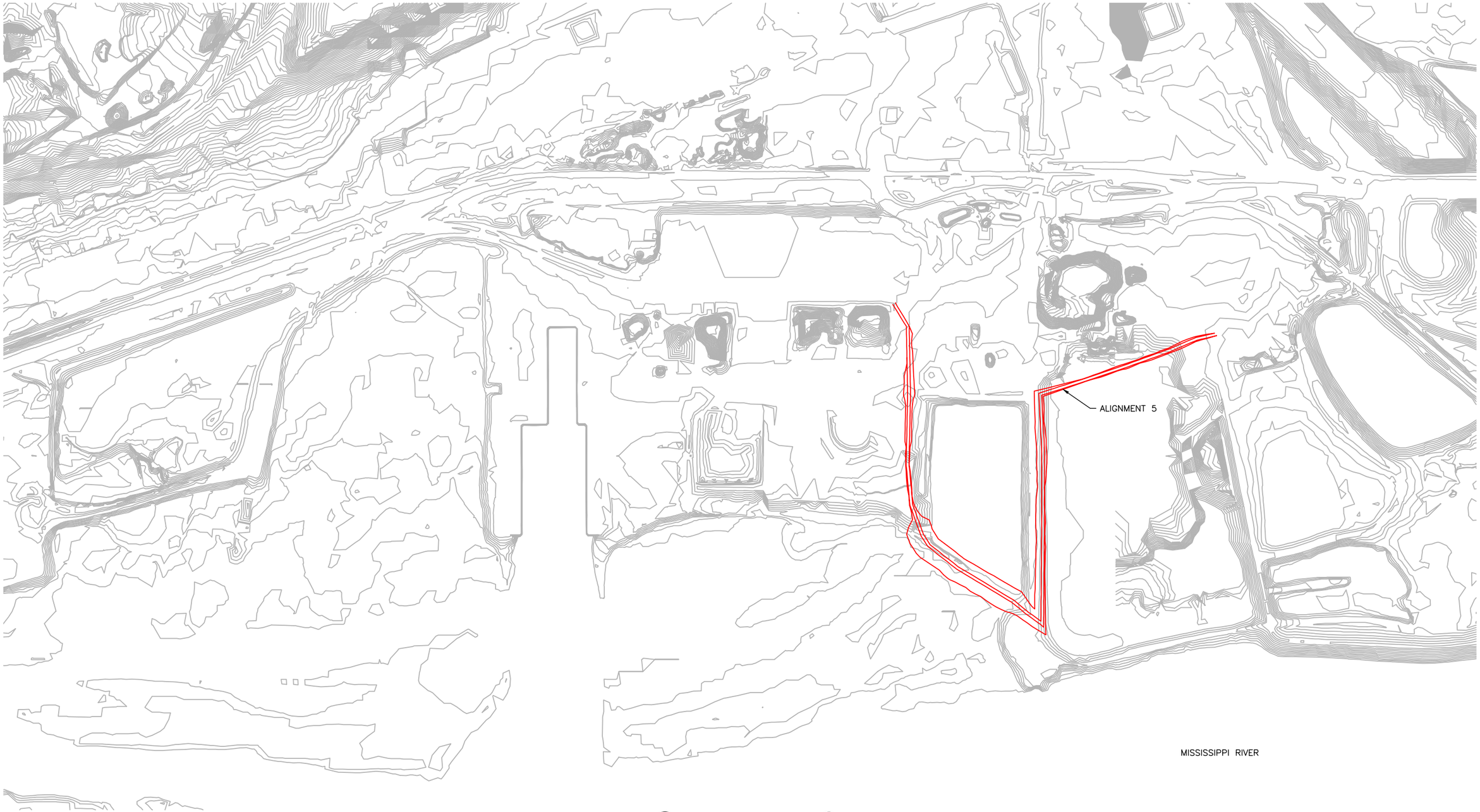

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