4.0 ENVIRONMENTAL EFFECTS

In this Draft EIS, the Build Alternatives are presented and analyzed by segment. For evaluation purposes the segments are then combined into the respective Build Alternative for reporting potential impacts. The alternatives and associated segments are depicted in Chapter 2 in Figure 2.3-9 and summarized here in Table 4.1-1.

Table 4.1-1. Build Alternatives and Segments

Build Alternatives	Segments
LRT 1A	Segment 1, Segment 4, Segment FR, Segment A
LRT 3A (LPA)	Segment 3, Segment 4, Segment FR, Segment A
LRT 3C-1 (Nicollet Mall)	Segment 3, Segment 4, Segment FR, Segment C-1 (Nicollet Mall)
LRT 3C-2 (11th/12th Street)	Segment 3, Segment 4, Segment FR, Segment C-2 (11th/12th Streets via Nicollet Avenue Tunnel)
	Segment 3, Segment 4, Segment FR, Segment C-2A (11th/12th Streets via Blaisdell Avenue Tunnel)
	Segment 3, Segment 4, Segment FR, Segment C-2B (11th/12th Streets via 1st Avenue Tunnel)
LRT 3A-1 (Co-location alternative)[1]	Segment 3, Segment 4, Segment A

Source: HDR, Engineering, 2012

4.1 Geology and Groundwater Resources

This section provides an inventory of existing geology and groundwater resources within one-half mile on either side of the Build Alternatives and the Freight Rail Relocation Segment, along with potential long-term and short-term construction impacts to those resources identified, and presents potential mitigation options for those resources that may experience adverse impacts due to the implementation of the Build Alternatives.

In addition, a number of issues related to the geologic and geotechnical conditions are evaluated. These issues are:

- Soil or bedrock conditions that would propagate (transmit or spread) ground-borne vibrations (GBV) (see Table 4.8-1, below)
- Near-surface bedrock that would require removal during construction
- Shallow groundwater that would require a permanent water removal system (dewatering)during construction (see Appendix H for additional details)
- Shallow groundwater near proposed deep excavations (cuts) or tunnels that would require a permanent water removal system (see Appendix H for additional details)
- The suitability of soils in tunnel areas for cut-and-cover construction methods, including estimated side slopes

[1] Please see Section 2.1.2.1 of this Draft EIS for why LRT 3A-1 (co-location alternative) is included in this Draft EIS.

- Soil conditions that may require extra shoring
- Soil conditions that may create uneven soil settling, requiring over-excavation, filling, and re-compaction during construction

Of these issues, GBV and a permanent water removal system potentially have long-term implications. Short-term impacts are primarily related to construction activities that require a temporary water removal system, cause soil disturbance, or create potential groundwater contamination because of accidental spills. Best management practices (BMPs) would be used to minimize potential short-term impacts.

4.1.1 Legal and Regulatory Overview

Geologic resources are generally not regulated. In Minnesota, a permit is required to appropriate groundwater if the amount to be used is more than 1.0 million gallons per year or more than 100,000 gallons in any day. A permanent or temporary water removal (dewatering) is considered a groundwater appropriation. The appropriation permit is obtained from the Minnesota Department of Natural Resources (DNR).

Discharge of groundwater from water removal systems also may be regulated. Water removal during construction would be included under the National Pollutant Discharge Elimination System (NPDES) permit required for construction activities. Discharge of uncontaminated water from a permanent water removal system is not regulated. If the water being removed is contaminated, the discharge would be managed either through an individual NPDES permit obtained from the Minnesota Pollution Control Agency (MPCA) or through a permitted discharge to the sanitary sewer administered by Metropolitan Council Environmental Services.

Soils, bedrock, and groundwater are not isolated media and may affect or be affected (generally through construction activities) by other resources, such as wetlands, streams, or lakes, which are subject to regulation. These interactions are managed under regulatory programs discussed in Section 4.2 of this Draft EIS.

4.1.2 Methodology

Surficial geology, bedrock geology, and groundwater resources within one-half mile either side of the Build Alternatives were identified using the Geologic Atlas of Hennepin County (Minnesota Geological Survey 1989). For the Freight Rail Relocation Segment, data on project area soils was obtained primarily from the Natural Resources Conservation Service (NRCS).

4.1.2.1 Potential for Differential Settlement

Differential settlement is the uneven settling of soils due to differences in soil type or soil density. The primary cause for differential settlement would be the presence of organic soils (e.g., peat) or fat clay (Unified Soil Classification code 'CH'). The Hennepin County Soil Survey and the logs of wells in the Minnesota Geological Survey County Well Index (CWI) were used to identify if these soil types existed within one-half mile of the Build Alternatives. A search of the Hennepin County Soil Survey did not indicate the existence of any fat clay soils, therefore the analysis focused on

peat and fat clay soils identified in the CWI well logs, and peat soils identified in the county soil survey.

4.1.2.2 Near-Surface Bedrock

Near-surface bedrock was evaluated by studying well logs from the CWI within the study area for the occurrence of bedrock within 10 feet of the surface.

4.1.3 Existing Conditions

4.1.3.1 Surficial Geology

Along the Build Alternatives, the sediments of the Twin Cities Formation consist of outwash, ice-contact layered deposits, loamy till, sandy till, and mixed till. A map of the surficial geologic materials (materials that are near the surface of the ground) is shown in Figure 4.1-1, Surficial Geology. (Meyer 1989) Post-glacial sediments consist of middle and upper terrace deposits, organic deposits, and lake deposits. The following list summarizes the composition of each deposit type in general order of appearance from southwest to northeast along the Build Alternative:

- **Sandy Till:** Unsorted sediment ranging from clay to boulders, chiefly made up of **loam** to sandy loam.
- **Loamy Till:** Unsorted sediment ranging from clay to boulders, although chiefly made up of loam.
- **Mixed Till:** Complexly intermixed yellowish-brown to gray and reddish-brown to reddish-gray loam to sandy loam.
- **Organic Deposits:** Peat and organic-rich sediment, in some places removed and backfilled.
- **Outwash:** Sand, loamy sand, and gravel, overlain by less than 4 feet of windblown silt (loess).
- **Ice-Contact Stratified Deposits:** Sand, loamy sand, and gravel; cobbles and boulders are common.
- **Lake Deposits:** Thick clay overlain by areas of thick artificial fill over peat.
- **Middle and Upper Terrace Deposits:** Sand, gravelly sand, and loamy sand overlain by thin deposits of silt, loam, or organic sediment.

"Loam" is soil that consists of a relatively equal mixture of sand, clay, silt, and organic matter.

Surficial geologic materials range in thickness from 10 to 400 feet, although the majority of the study area is in areas where sediments are less than 250 feet thick. The thickest sediments (250–400 feet) are found in relatively narrow buried bedrock valleys near the Minneapolis Chain of Lakes and near the intersection of Segment 1 of the LRT 1A Build Alternative and Interstate 494 in Minnetonka. Shallow bedrock (within 10 feet of the ground surface) exists northwest of the northern end of Segment C-1 of the LRT 3C-1 (Nicollet Mall) Build Alternative in downtown Minneapolis.

4.1.3.2 Peat Soils

Peat soils are compressible and have the potential to cause uneven settling below structures. Areas of compressible soils are shown by segment in Figure 4.1-2 through Figure 4.1-6, and are summarized here:

- Segment 1 (Figure 4.1-2): Wells containing peat or muck were found near each end of the segment. In addition, peat soils are present at the crossing of Purgatory Creek, at both crossings of the main and tributary stems of South Branch of Nine Mile Creek, and near Glen Lake.
- Segment 3 (Figure 4.1-3): The segment has three general areas where compressible peat soils might be encountered: near the Purgatory Creek Crossing and west of Eden Prairie Town Center station, near the crossing of South Branch of Nine Mile Creek, and near the wetlands between the Opus and Shady Oak stations. Wells completed in these areas appear to confirm the presence of peat soils.
- Segment 4 (Figure 4.1-3): Soils mapping does not document extensive areas of peat, although small extents are mapped near both ends of the segment. However, peat is noted in several wells in the area of Louisiana Avenue, just east of the Minnehaha Creek crossing.
- Segment A (Figure 4.1-5): Peat is documented only along the shoreline in the northeast corner of Cedar Lake.
- Segment C-1 (Figure 4.1-6): Peat is documented only near the southwest corner of Lake of the Isles.
- Freight Rail Relocation Segment: Peat soils are mapped in two locations in proximity to this segment: on the north side of the Iron Triangle (associated with a public water wetland), and in the southeastern corner of the TH 100 crossing (Figure 4.1-4 and Figure 4.1-5).

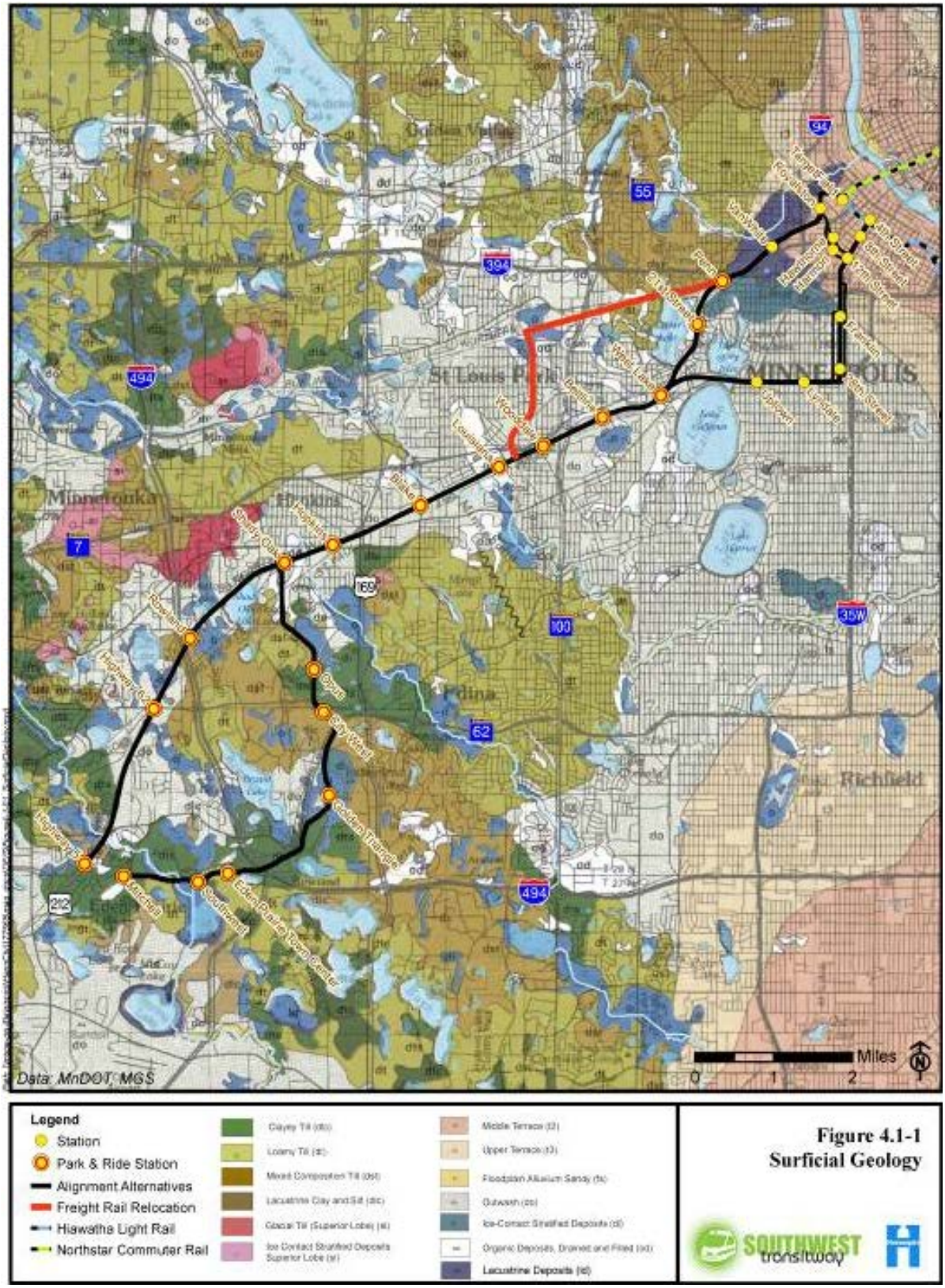


Figure 4.1-1
Surficial Geology

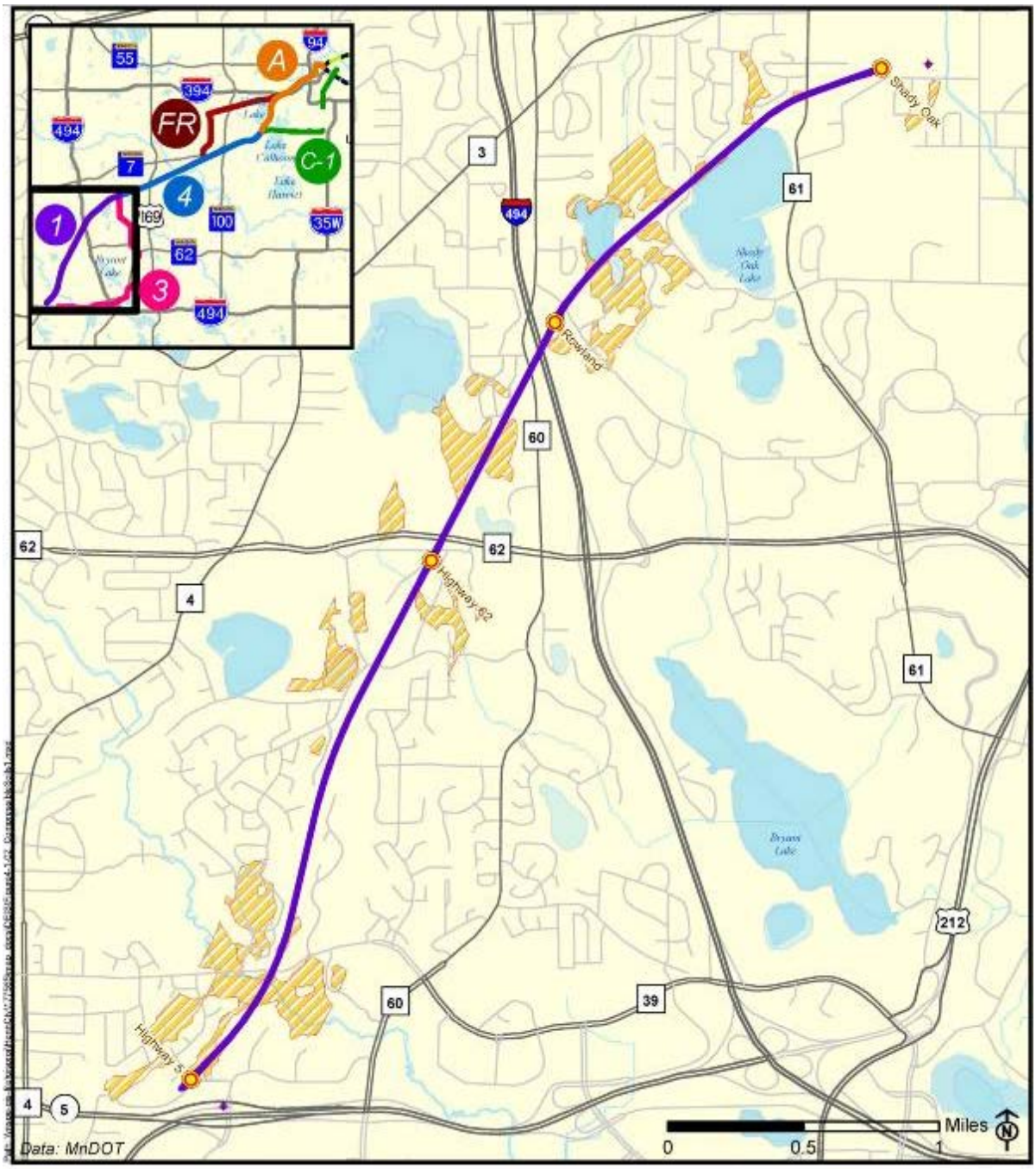


Figure 4.1-2
Areas of Compressible Soils: Segment 1

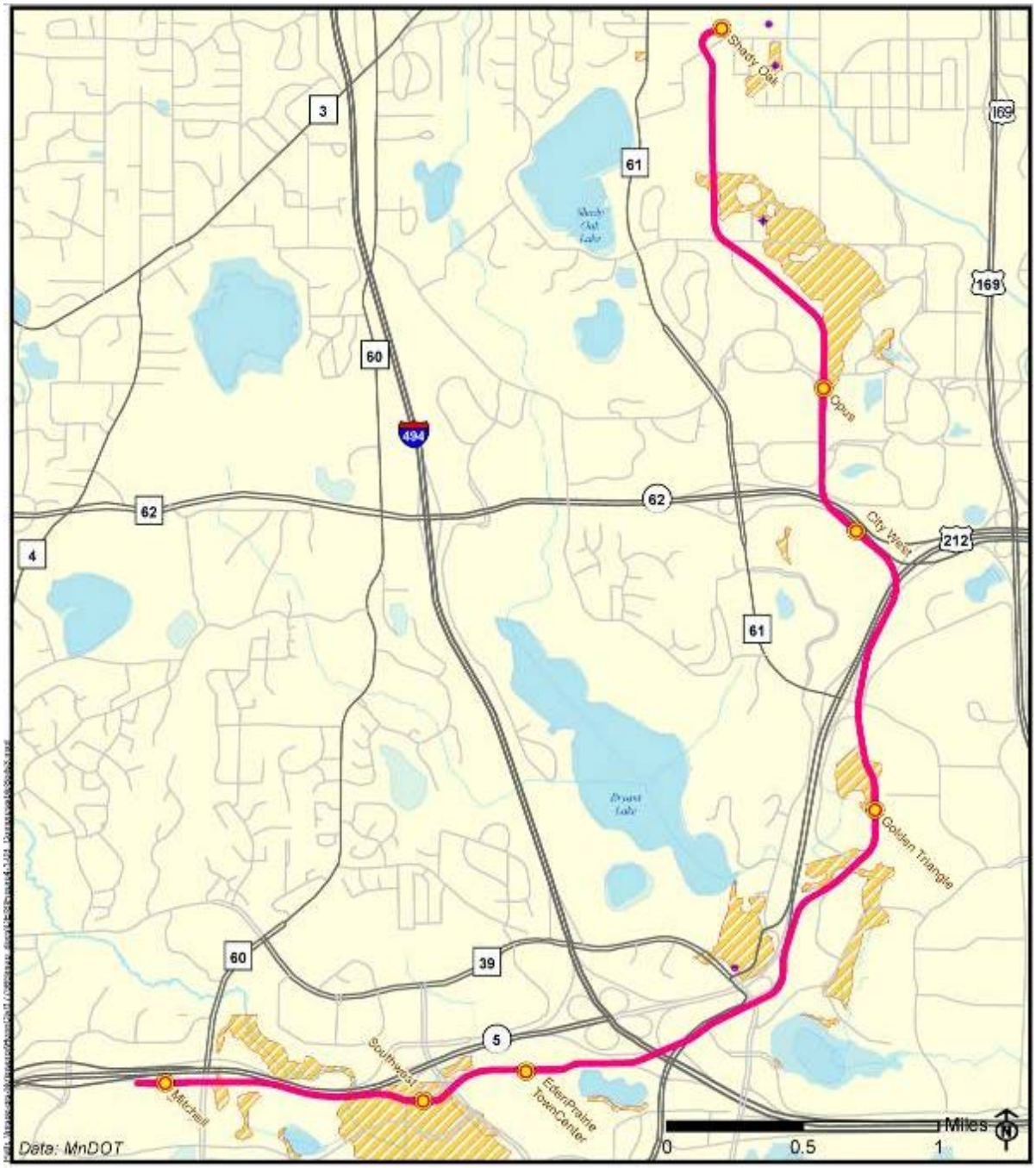
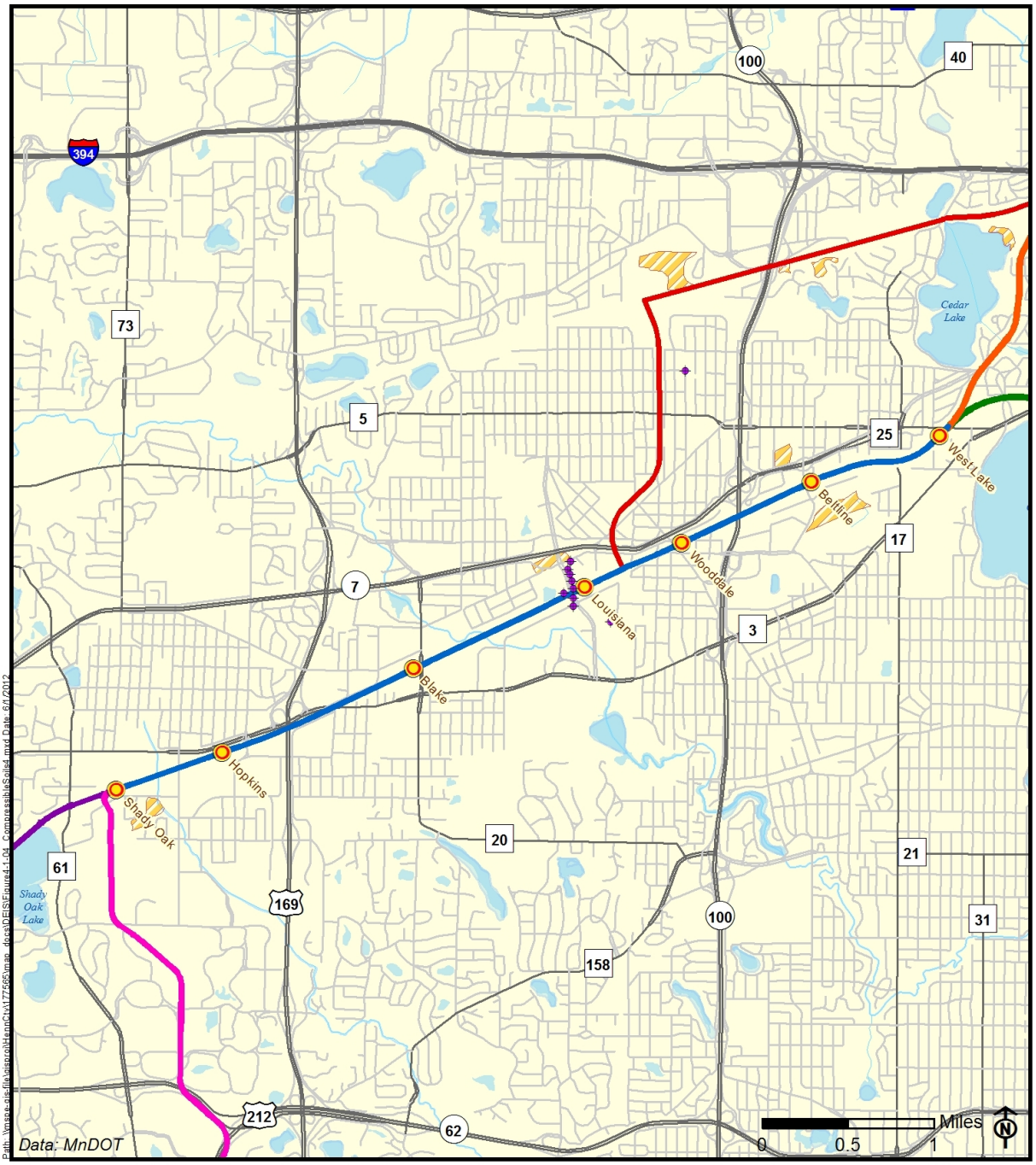


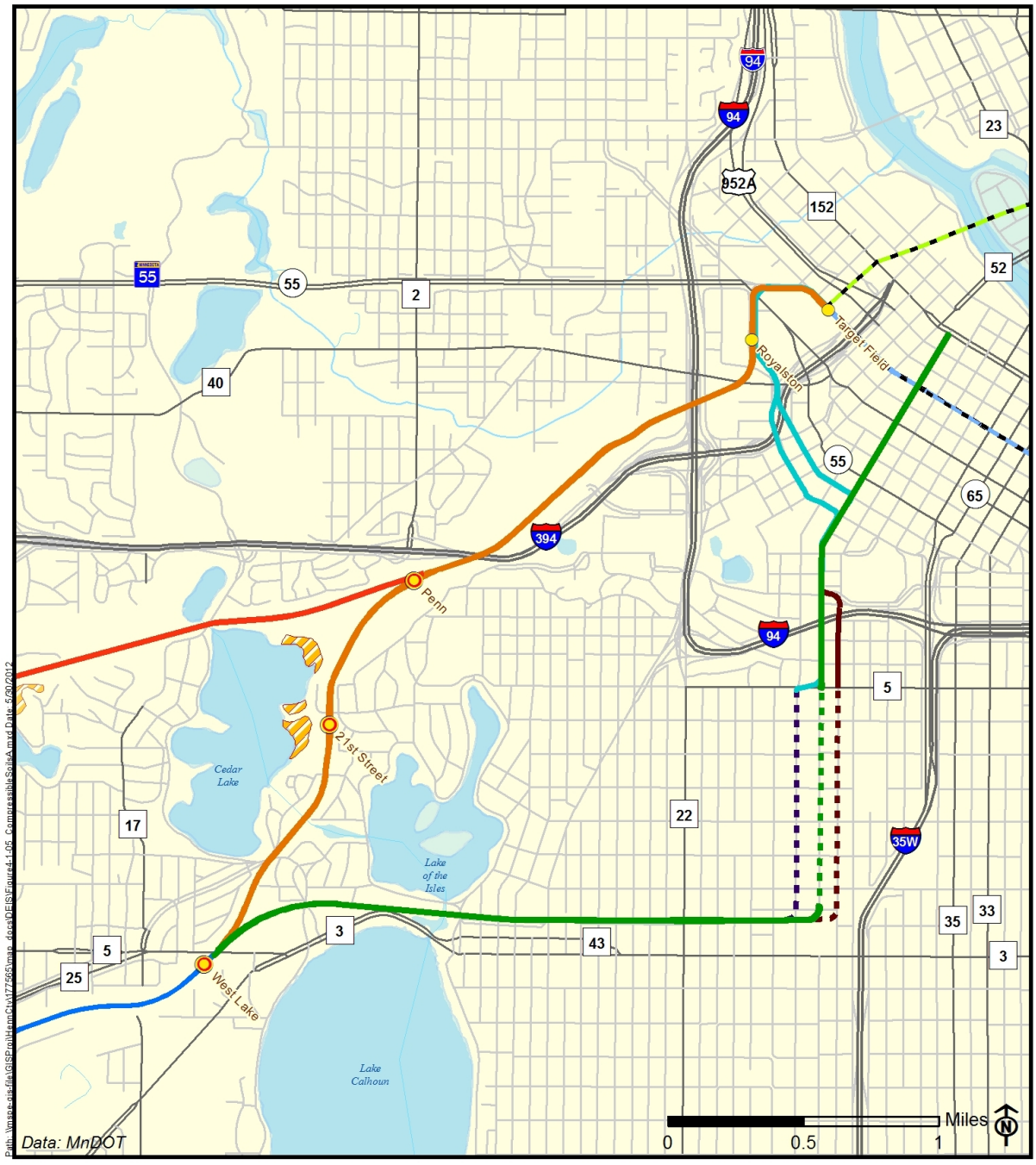
Figure 4.1-3
Areas with Compressible Soils: Segment 3



Legend

- Segment 4
- Segment FR
- Segment A
- Segment C
- Segment 1
- Segment 3
- Peat
- Wells Encountering Peat or Muck
- Station
- Park & Ride Station
- Lake
- Streams

Figure 4.1-4
Areas with Compressible Soils: Segment 4



Legend

- Station
- Park & Ride Station
- Segment A
- Segment C-1
- Segment_4
- Segment FR
- Northstar Commuter Rail
- Hiawatha Light Rail
- Wells Encountering Peat or Muck
- Peat
- Lake
- Streams

Figure 4.1-5
Areas with Compressible Soils: Segment A

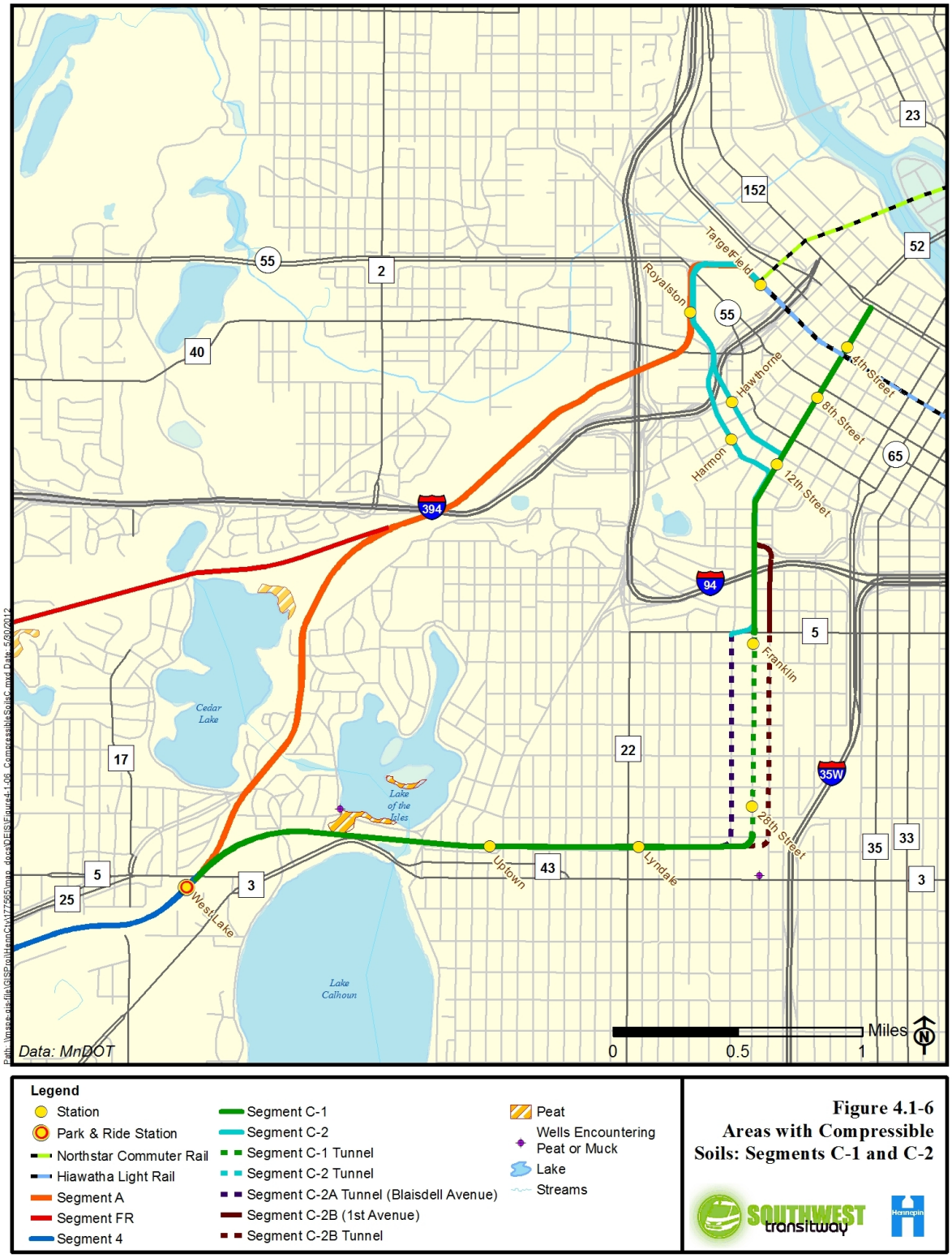


Figure 4.1-6
Areas with Compressible Soils: Segments C-1 and C-2

4.1.3.3 Bedrock Geology

The uppermost bedrock along the Build Alternative consists of (from youngest to oldest) the Platteville (limestone) and Glenwood Formations (shale), St. Peter Sandstone (sandstone), and Prairie du Chien Group (dolostone). A map of the uppermost bedrock units is shown in Figure 4.1-7, Bedrock Geology. (Olsen 1989)

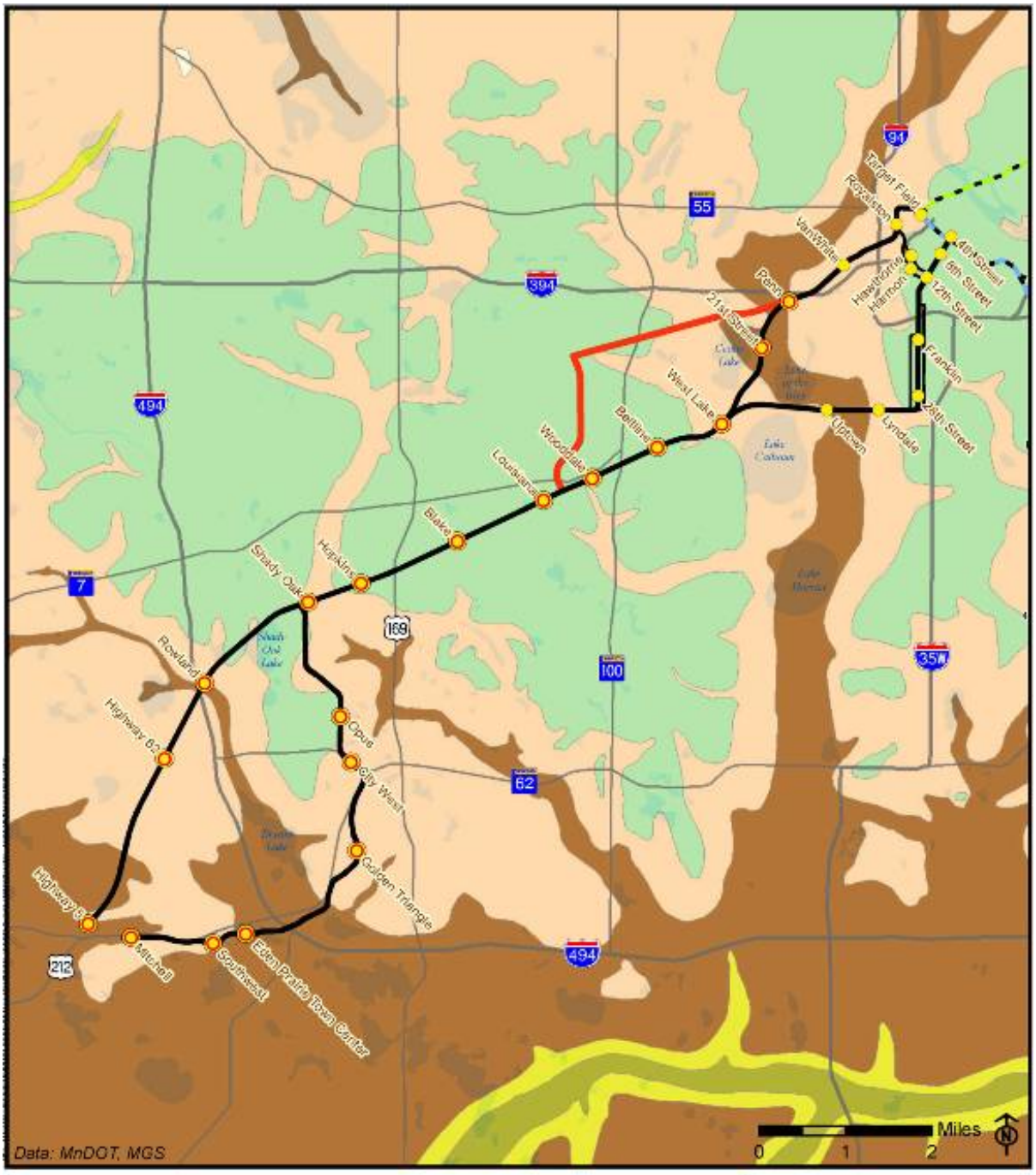
The following list summarizes the composition of each formation:

- **The Platteville and Glenwood Formations:** Limestone of the Platteville Formation (30 feet thick) underlain by thin, green, sandy shale of the Glenwood Formation (5 feet thick). These formations generally form aquitards (layers that slow the flow of groundwater), which provide the lower aquifers some protection from contamination.
- **St. Peter Sandstone:** Fine- to medium-grained quartz sandstone, underlain by multicolored beds of mudstone, siltstone, and shale with lying between beds of very coarse sandstone. Approximately 160 feet thick where present. The lower portion of the St. Peter is considered an aquitard.
- **The Prairie du Chien Group:** Karsted dolostone that varies in thickness but averages 120 feet. In the eastern portion of Hennepin County, the Prairie du Chien Group is sandier and the upper third to half contains minor amounts of shale. The lower portion is less sandy except at the base where it forms a transition zone with the Jordan Sandstone. The Prairie du Chien Group forms a major aquifer.

The Platteville, Glenwood, and St. Peter Sandstone share the majority of the uppermost bedrock coverage. The Prairie du Chien Group is the uppermost bedrock unit in relatively isolated portions of the study area.

4.1.3.4 Groundwater Resources

The water table is the boundary between geologic materials completely saturated with groundwater and the unsaturated zone above. The depth to the water table depends on a variety of factors, including the elevation of nearby surface water features, the permeability of the geologic materials (a quality that allows fluids to flow through it), and surface topography. The depth of the water table varies across the study area from less than 10 feet to more than 70 feet below grade. The regional shallow groundwater flow direction in the study area varies with location, with the flow direction shifting from south-southeasterly in Eden Prairie and Edina, to easterly near Lake Calhoun in south Minneapolis. The groundwater in the shallow (water table) system flows toward and discharges into the Minnesota and Mississippi rivers.


Data: MnDOT, MGS
Miles
0
1
2
Legend
Station
Park & Ride Station
Alignment Alternatives
Freight Rail Relocation
Hiawatha Light Rail
Northstar Commuter Rail
Bedrock Geology
Platteville and Glenwood Formations (OPGW)
St. Peter Sandstones (OSTP)
Prairie Du Chien (OPDC)
Jordan Sandstone (CJDN)
St. Lawrence and Franconia Formations (CSLF)
Figure 4.1-7
Bedrock Geology
SOUTHWEST transitway

Wetlands and ponds in the study area are either surface exposures of the water table, or water that is perched above the actual water table by relatively impermeable layers of clay-rich glacial deposits (Kanivetsky 1989). Perched water occurs when the elevation of the surface water feature (a stream, lake, or wetland) is higher than the water table measured in nearby wells. The following areas of shallow groundwater exist along the Build Alternative:

- Segment 1 (Figure 4.1-8): There are five shallow groundwater areas identified, all associated with adjacent surface water features. These are the crossings of Purgatory Creek and the South Branch of Nine Mile Creek (the main branch and a tributary), and wetland areas associated with Glen Lake and Shady Oak Lake.
- Segment 3 (Figure 4.1-9): There are three areas of concern for shallow groundwater. First is the crossing of Purgatory Creek and associated wetland areas between the Mitchell and Southwest stations. Second is the crossing of the South Branch of Nine Mile Creek and neighboring wetlands just southwest of the Golden Triangle station. The final area of concern is between the Opus and Shady Oak stations, where nearly the entire Build Alternative abuts wetland areas or low-lying uplands near the Shady Oak station.
- Segment 4 (Figure 4.1-10): There are three general areas of concern for shallow groundwater. At the west end of the segment, between the Shady Oak Station to about 500 feet east of the Hopkins station is an area of suspected shallow groundwater. There is one well with a confirming measurement in this area, and the area includes the crossing of the North Branch of Nine Mile Creek. The second area of concern is generally centered on the crossing of Minnehaha Creek. This area extends from about 500 feet west of the Blake Station to about 500 feet east of the Louisiana Station. There are at least eight wells in this area with documented water levels at depths less than 10 feet. The final area extends approximately from TH 100 to the east end of the segment. This is an area of low relief topography with some nearby wetlands.
- Segment A (Figure 4.1-11): Concern exists for the areas near Lake Calhoun, the channel between Cedar Lake and Lake of the Isles, and the low areas beginning near the 21st Street station and extending through the areas near the Penn and Van White stations to I-94.
- Segments C-1 and C-2 (Figure 4.1-12): There are areas from the West Lake Station through the isthmus between Lake of the Isles and Lake Calhoun that have the potential for shallow groundwater.
- Freight Rail Relocation Segment (Figure 4.1-10): Areas of concern are associated with Minnehaha Creek. This area extends to about 500 feet east of the proposed Louisiana Station near the western end of this segment. Concern also exists for the areas near the Public Water Inventory (PWI) wetlands in the Iron Triangle area, the area near Brownie and Cedar Lakes and the low areas near the proposed Penn Station.

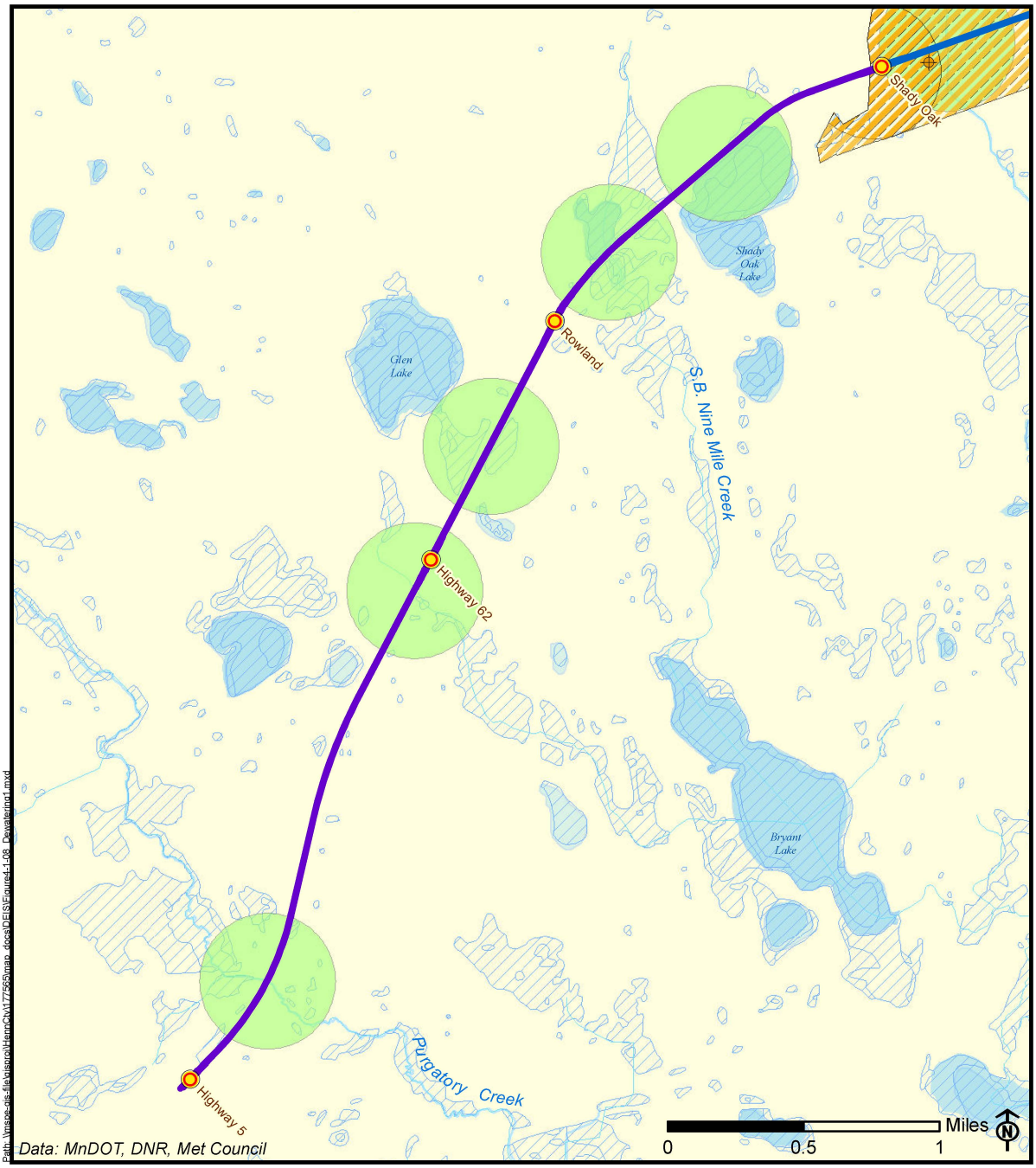


Figure 4.1-8
Areas of Likely Construction Dewatering: Segment 1

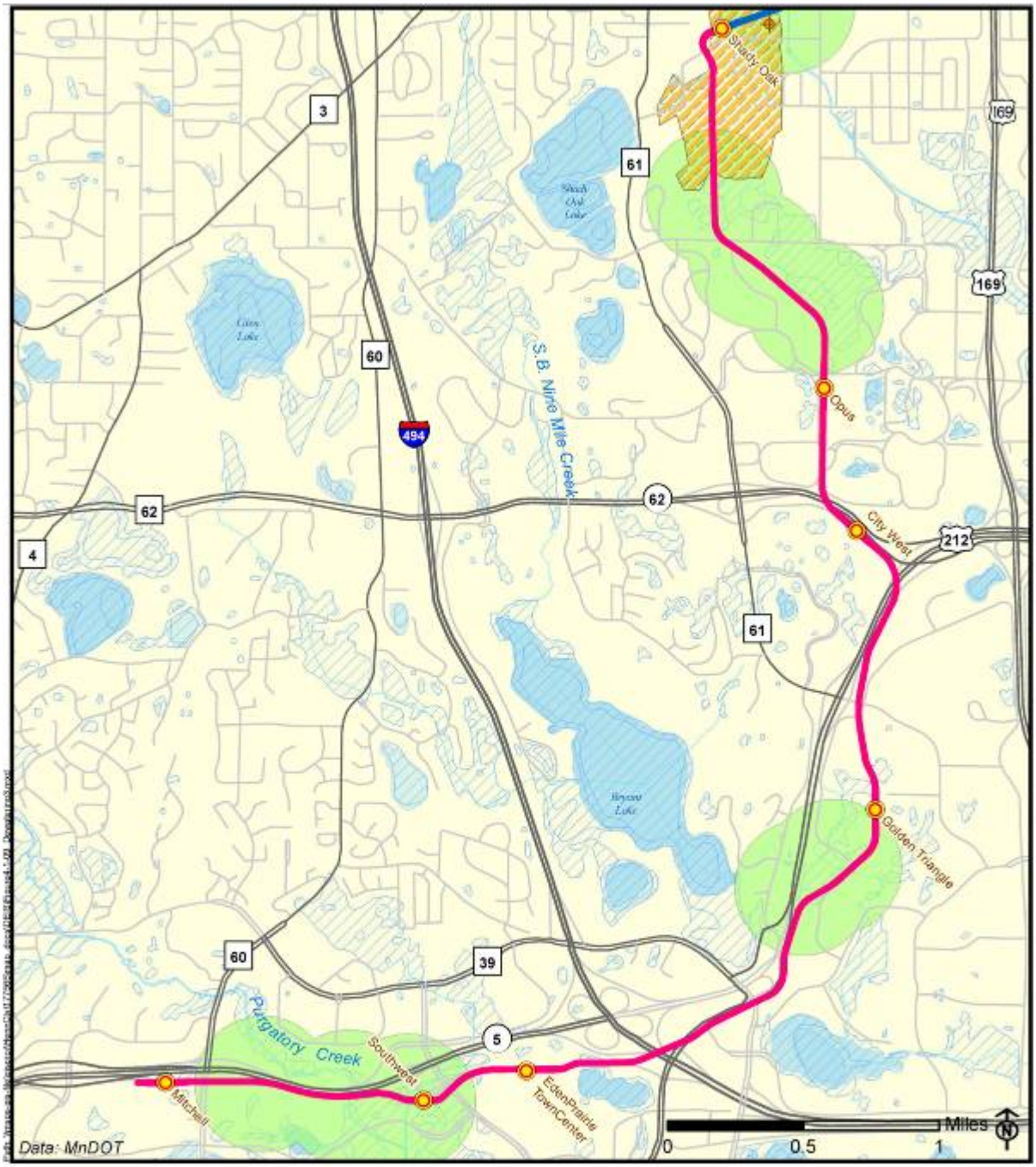


Figure 4.1-9
Areas of Likely Construction Dewatering: Segment 3

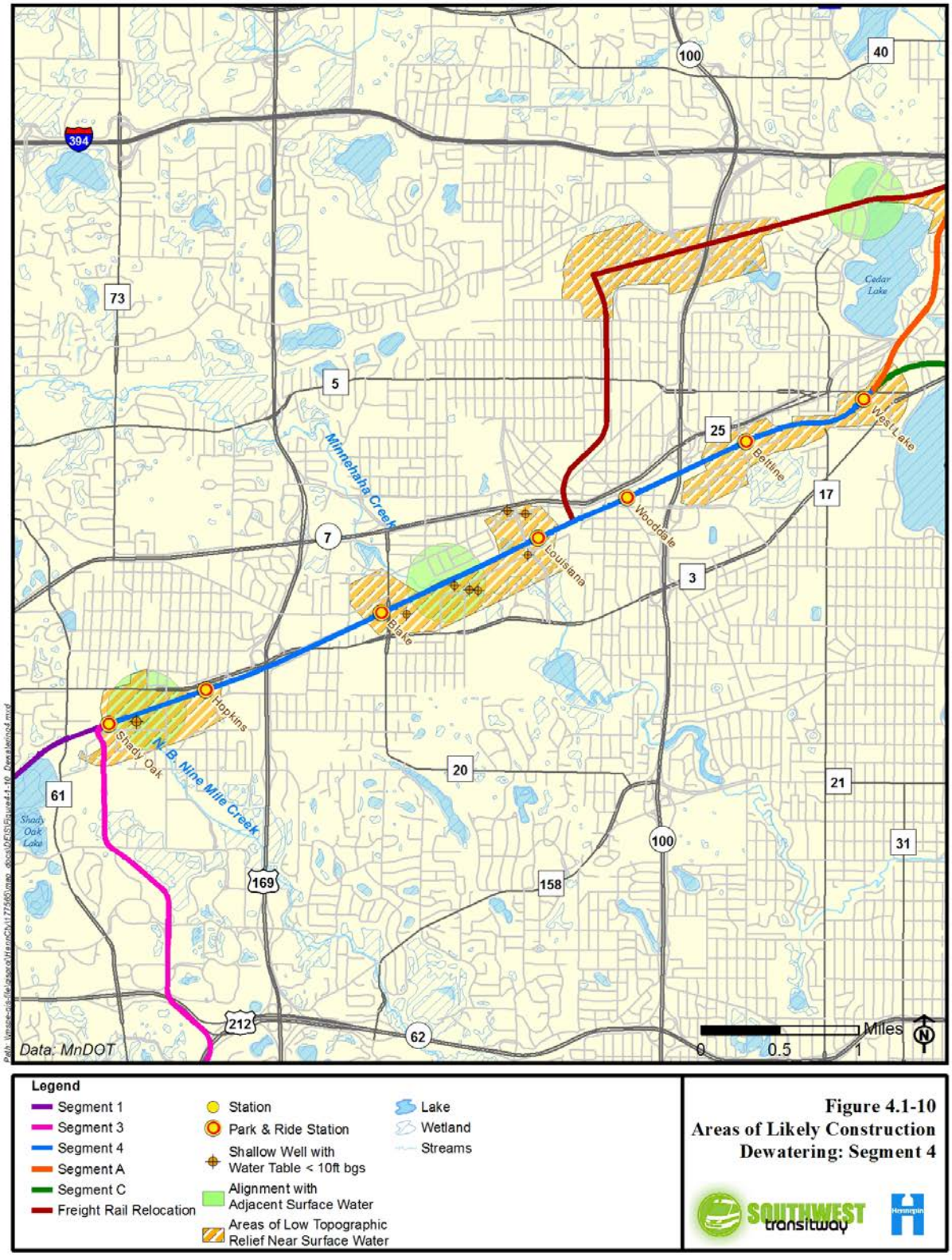


Figure 4.1-10
Areas of Likely Construction Dewatering: Segment 4

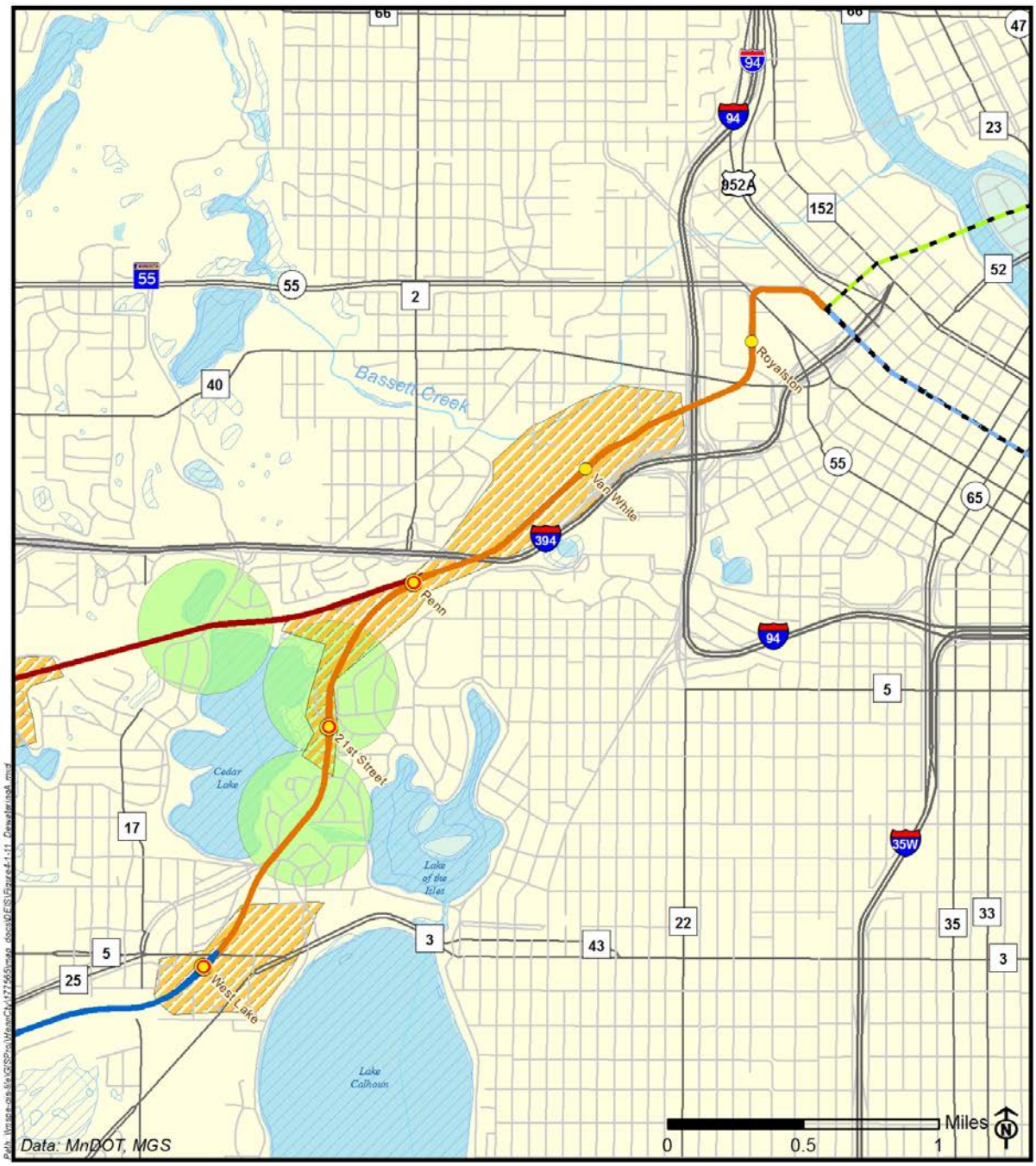


Figure 4.1-11
Areas of Likely Construction Dewatering: Segment A

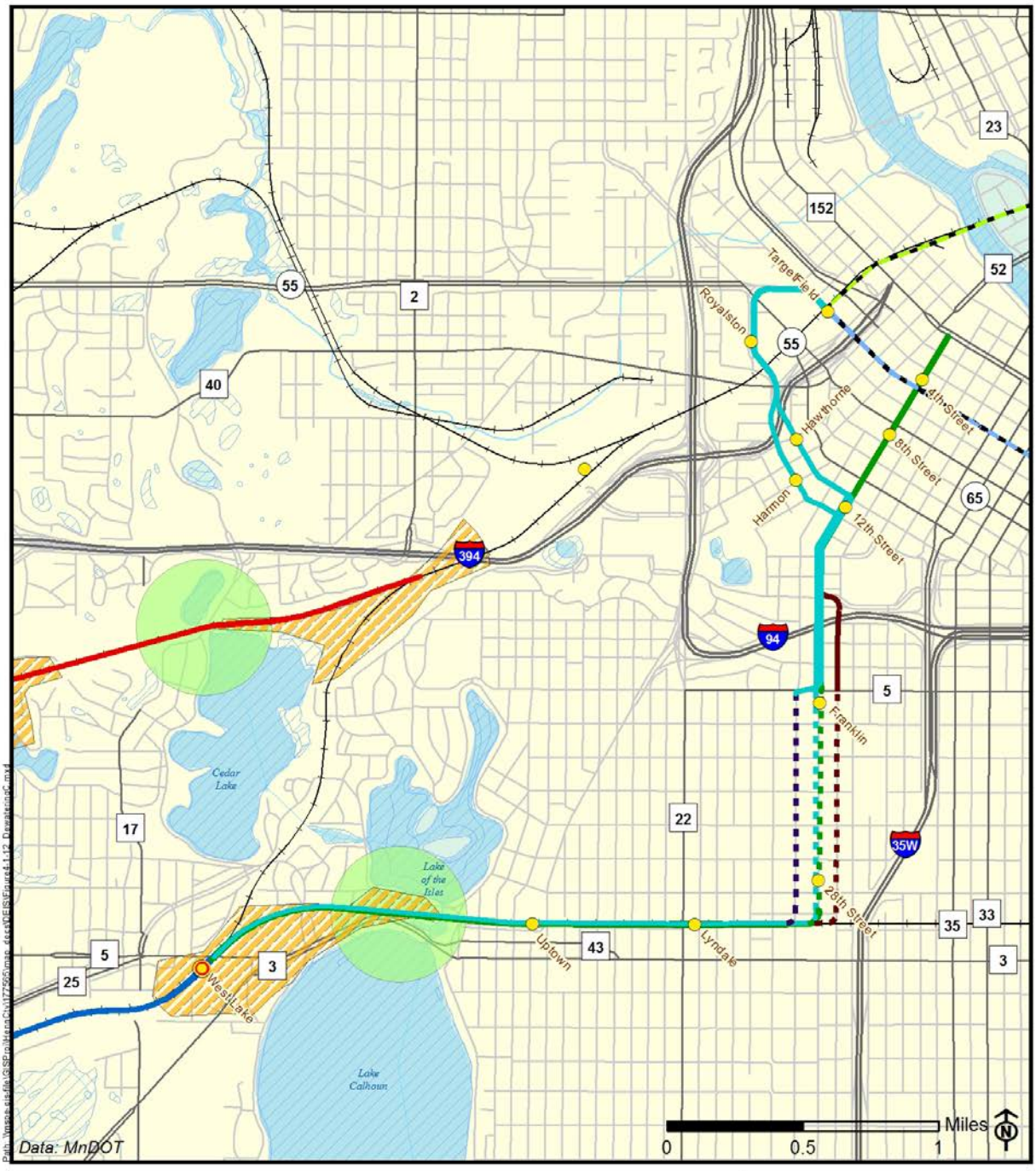


Figure 4.1-12
Areas of Likely Construction Dewatering: Segments C-1 and C-2

4.1.3.5 Potable Water Supply

Shallow groundwater in the unconsolidated geologic materials (loose sediments that are not cemented together to form rock) is not used as a major source of potable groundwater within the study area. Groundwater resources found in the deeper bedrock aquifers beneath the unconsolidated sediments are used as a source of potable water by municipalities and businesses. These aquifers include (from shallower to deeper):

- St. Peter aquifer
- Prairie Du Chien-Jordan aquifer
- Franconia-Ironton-Galesville aquifer
- Mt. Simon-Hinckley aquifer

Nearly all municipal wells in the study area target the Prairie Du-Chien-Jordan and Mt. Simon-Hinckley aquifers, which can yield over 2,000 gallons per minute to wells. Municipal potable water is supplied to consumers in the entire study area, although numerous groundwater wells are used for non-potable purposes.

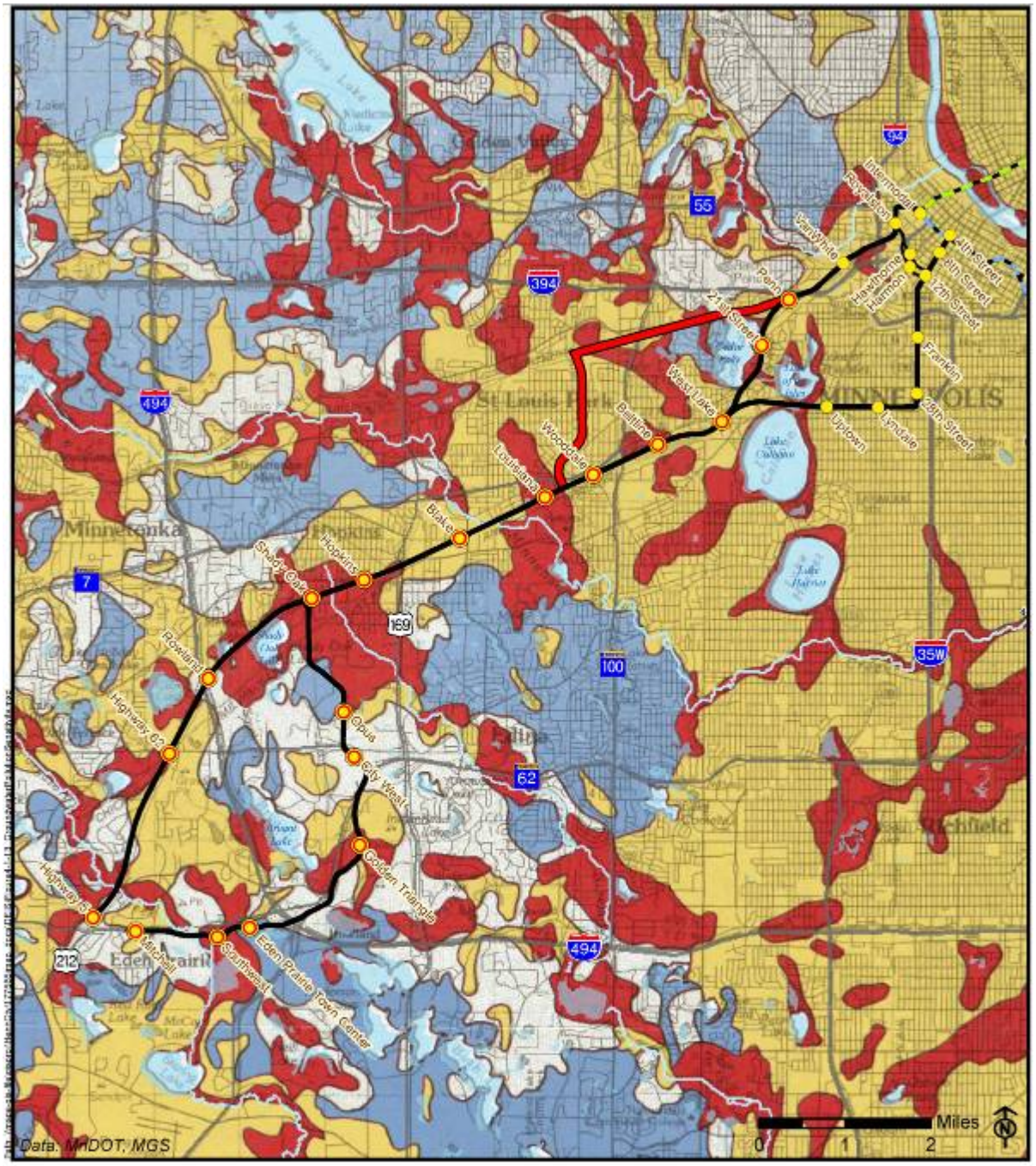
4.1.3.6 Groundwater Sensitivity

The sensitivity of an aquifer to contamination is based on the physical characteristics of the aquifer, the overlying geologic materials, and, for a specific contaminant, its chemical characteristics. "Sensitivity" is a relative term used to describe how well an aquifer is protected from infiltrating contamination. A highly sensitive aquifer would have little or no defense, whereas an aquifer with low sensitivity would be very well protected (http://www.waterencyclopedia.com/Oc-Po/Pollution-of-Groundwater-Vulnerability.html#ixzz0ve2lyzBj).

Several areas in the study area lie within zones of very high sensitivity to pollution of the water table system (Piegat 1989). This specific rating occurs where the depth to the water table is less than 10 feet and the geology consists of sand, gravel, or organic material (i.e., permeable materials). A groundwater pollution sensitivity map of the study area is shown on Figure 4.1-13 (Piegat 1989).

Eight areas of very high sensitivity were identified in the study area and include:

- Segment 1: TH 62 to Edenvale Boulevard in Eden Prairie
- Segment 3: From Prairie Center Drive west approximately 2,300 feet in Eden Prairie
- Segment 3: Flying Cloud Drive to W. 70th Street in Eden Prairie
- Segment 3: Bren Road in Minnetonka to Shady Oak Station in Hopkins
- Segments 1 and 4: Rowland Road in Minnetonka to Highway 169 in Hopkins
- Segment 4: Approximately 2,000 feet east and west of Louisiana Avenue in St. Louis Park
- Segment A: Portions of the land between Cedar Lake and Lake of the Isles
- Segment C: The land between Lake of the Isles and Lake Calhoun
- Freight Rail Relocation Segment: Areas of very high sensitivity are present in the vicinity of the Iron Triangle Area and north of Cedar Lake.


Data: MnDOT, MGS
Miles
0
1
2
Legend
Station
Park & Ride Station
Freight Rail Relocation
Alignment Alternatives
Hiawatha Light Rail
Northstar Commuter Rail
MATRIX FOR SUSCEPTIBILITY OF THE WATER TABLE
DEPTH TO WATER TABLE
< 10 FEET
> 10 FEET
OUTWASH, OTHER SANDY DEPOSITS, ORGANIC MATERIAL
SANDY LOAM TILL, LAKE SAND AND SILT
LOAMY TILL, CLAY LOAM TILL, LAKE SILT AND CLAY
MATERIALS IN UPDATE/FUTURE ZONE
VH
H
M
L
Figure 4.1-13
Groundwater
Pollution Sensitivity
SOUTHWEST transitway

Much of the remainder of the study area lies within the high sensitivity classification, and small percentages of land lie within the low and medium sensitivity classifications. The high sensitivity rating applies to two scenarios: the depth to the water table is greater than 10 feet, but the geology consists of sand, gravel, or organic material, or; the depth to the water table is less than 10 feet and the geology consists of sandy loam till, lake sand, or silt.

Areas of high and very high sensitivity were determined at a gross regional level. If local factors such as the geology and depth to the water table differ from those determined in the county atlas, the pollution sensitivity ratings may increase or decrease. The sensitivity ratings discussed relate to the water table system only.

4.1.4 Long-Term Effects

4.1.4.1 Geology

The primary concern regarding soils is erosion in areas where construction has occurred, which would be mitigated to prevent a long-term impact to soil resources. Another potential concern is the removal of native organic soils adjacent to water resource features such as wetlands and streams. These organic soils are often an important component of the wetland or stream environment. Removal is necessary where construction requires stronger soils that can support light rail components; sandy soils or lean clay soils are usually used as replacement fill.

No long-term impact to bedrock resources is anticipated.

4.1.4.2 Groundwater

The Build Alternatives may have long-term impacts on groundwater if a permanent water removal system (dewatering) is required. Permanent water removal is anticipated where the cut extends below the water table. There is a probable need for permanent water removal at one cut on both Segment 1 and Segment 3, and possible needs on Segment A and at a second cut along Segment 3, because of shallow groundwater. Evaluations and associated impacts of permanent water removal at the major excavations are summarized in Appendix H.

4.1.5 Short-Term Construction Effects

4.1.5.1 Geology

Short-term impacts to soil resources are limited to those construction activities that would disturb unpaved or permeable surfaces; however, development has already disturbed many of the soil resources in the study area. The Soil, Groundwater and Dewatering Conditions Information in Appendix H summarizes the anticipated side slopes for the major excavations or cuts, which will affect the amount of soil that is disturbed. Excavations in sandy soils may require a 1.5:1 side slope, which will result in the removal of more soil compared to clay-like soils, which may allow for a steeper (e.g., 1:1) side slope. If the total depth of the excavation or cut is greater than 20 feet, federal Occupational Safety and Health Administration (OSHA) guidance indicates that a site-specific excavation plan is warranted. A table showing the need for excavation **shoring** is also shown in Appendix H. If the limits of the work area prohibit excavation of proper side slopes, shoring would be necessary. Thus, shoring has the effect of reducing the amount of soil disturbance. Note that the design information available at this time indicates that no cuts are proposed along the Freight Rail Relocation Segment that would necessitate groundwater dewatering.

"Shoring" is bracing used to temporarily prevent an excavation, such as a tunnel, trench, or ditch, from caving in.

Construction activities may degrade soils through compaction and erosion. Shallow geologic materials may also be contaminated by spills of petroleum or other hazardous materials during construction. Potential impacts would be reviewed in more detail during Final Design. BMPs would be used to limit short-term impacts to soils from erosion, and accidental spills of petroleum products or hazardous substances. No short-term impact to bedrock resources is anticipated.

4.1.5.2 Groundwater

The Build Alternatives may have short-term impacts on groundwater. Evaluations of construction dewatering at the major excavations are summarized in Table 4.1-1. Use of a water removal system during construction may also be necessary for the construction of bridge footings. Water removal during construction is anticipated where a cut extends below the water table, and, in some cases, has been assigned a higher probability than permanent water removal because of the potential for over-excavation. Impacts relating to construction water removal would be temporary. Local potable water is supplied by the municipalities. Impacts from construction water removal to the surface and groundwater sources for potable supply would be minor, if any. Note that no significant cuts are proposed along the Freight Rail Relocation Segment.

Table 4.1-1. Construction Dewatering at Cuts

Cut Number	Segment	Cut Name	Water Removal System During Construction
1	1	TC&W Rail Crossing	Probable
2	3	Prairie Center Drive/TH 5	Probable
3	3	Nine Mile Creek-S. Fork	Possible
4	3	Flying Cloud Drive/ Shady Oak Road	Probable
5	A	North of Glenwood	Unlikely
6	A	Royalston Avenue/7th Street	Possible
7	C	Tunnel North, Mid, South	Unlikely

Groundwater contamination from construction related spills is most likely to affect the water table in areas of high and very high sensitivity as identified in Section 4.1.3. Several stations and cuts are located within areas of high sensitivity. When detailed construction activities have been identified, further consideration would be given to potential spill impacts and BMPs to be used during project construction.

4.1.6 Mitigation

4.1.6.1 Geology

The Build Alternatives and the Freight Rail Relocation Segment would have an impact on soils where excavations occur. During design, additional geotechnical data would be collected through soil borings, particularly in areas where stations, excavations, and bridge footings are proposed. These data would assist with the development of detailed design and construction plans. Potential impacts to soils may be mitigated by employing the following steps:

- Limit the size of excavations by using shoring instead of benching.All excavations will comply with applicable OSHA requirements.
- Use BMPs, such as sub soiling (turning, breaking, or stirring the subsoil) in compacted areas and establishment of permanent vegetation in areas where erosion may be a concern.
- Use engineering and safety measures to limit spills of petroleum or hazardous substances.
- Develop a spill prevention plan for the project.

Impacts to bedrock resources are not anticipated; therefore, no mitigation is proposed for bedrock.

4.1.6.2 Groundwater

Potential impacts to the local groundwater relating to the project may be mitigated by employing the following steps:

- Limit the amount and duration of water removal activities.
- Design water removal systems to reduce impact to wetlands.
- Use proper measures to limit spills of petroleum or hazardous substances during construction that could potentially affect groundwater.
- Include the development of a Stormwater Pollution Prevention Plan (SPPP) and spill prevention plan for the project during Final Design and permitting.

4.1.6.3 Summary

A summary of potential water removal activities by Build Alternative is shown in Table 4.1-2.

Table 4.1-2. Summary by Build Alternative

Environmental Metric	Alternative				
	1A	3A (LPA)	3A-1 (Co-location alternative)	3C-1 (Nicollet Mall)	3C-2 (11th/12th Street)
Temporary water removal systems anticipated (construction would temorarily remove soils from below the water table)	2	4	5[a]	3	3
Permanent water removal systems anticipated (cut extends below the water table)	1	2	2	2	2

[a]One of the temporary dewatering systems is not at a cut, but would be used to dewater a bridge footing.

4.2 Water Resources

This section provides an inventory of water resources defined as wetlands, streams, rivers, and floodplains for the Build Alternatives, documents potential long-term and short-term construction impacts to those resources identified, and presents potential mitigation options for those resources that may experience adverse impacts due to the implementation of the Build Alternatives.

4.2.1 Legal and Regulatory Overview

Ecosystems are protected by federal, state, and local laws because of their ecological and social functions and values. The primary federal regulations or statutes that apply to wetlands, streams, floodplains and public waters are the Clean Water Act (CWA) Section 404, the Endangered Species Act, the RHA, Executive Order 11988, and Department of Transportation Order 5650.2. State and local regulations that apply to these resources include the public waters work permits, WCA, and local sensitive/critical area ordinances. A general goal of these regulations is to protect water quality, shorelines, streams, wetlands, and **riparian** areas and associated terrestrial (land –based) habitats, as well as the species that depend on these areas.

"Riparian" areas are the banks of rivers, creeks, or lakes. Plants that grow in these areas are also referred to as riparian.

Impacts to wetlands, floodplains, and other water bodies require permitting from various agencies and regulatory bodies. The required permits vary depending on the feature, size of impact, location of impact, and other factors. Other permits relating to stormwater management, erosion control, stream crossings, etc., may also be necessary. The permitting agencies and corresponding regulatory responsibilities are included in Table 4.2-1.

Table 4.2-1. Permitting Agencies, Corresponding Regulatory Responsibilities, and Actions

Permitting Agency	Regulatory Responsibilities	Associated Permits/Action
United States Army Corp of Engineers (USACE)	Section 404 of the Clean Water Act	Section 404 Permit
	Section 10 of the Rivers and Harbors Act of 1899	Section 10 Permit
Federal Emergency Management Agency (FEMA)	National Flood Insurance Act	Establish Flood Insurance Rates
Minnesota Department of Natural Resources (DNR)	MN Statute 103G: Waters of the State	Public Waters Work Permits
	MN Statute 84.415: Utility Licenses, Permtis	License to Cross Public Waters
Minnesota Pollution Control Agency (MPCA)	Section 402 of the Clean Water Act	National Pollutant Discharge Elimination System (NPDES) Permit
Cities of Eden Prairie, Minneapolis and Minnetonka	Minnesota Wetland Conservation Act (WCA)	Local Govering Unit (LGU) Project Review and Approval
Riley/Purgatory/Bluff Creek Watershed District (RPBCWD)	WCA regulatory authority has been transferred to local municipalities	Participation in LGU project review and approval
Nine Mile Creek Watershed District (NMCWD)	Minnesota Statute 103B: Water Planning & Project Implementation. Minnesota Statute 103D: Watershed Districts	Local Watershed Permits
Minnehaha Creek Watershed District (MCWD)	Minnesota Wetland Conservation Act (WCA)	LGU Project Review and Approval for projects in Hopkins and St. Louis Park
	Minnesota Statute 103B: Water Planning & Project Implementation. Minnesota Statute 103D: Watershed Districts	Local Watershed Permits
Bassett Creek Watershed Management Commission (BCWMC)	Minnesota Statute 103B: Water Planning & Project Implementation. Minnesota Statute 103D: Watershed Districts	Local Watershed Permits
Mississippi Watershed Management Organization (MWMO)	WCA regulatory authority has been transferred to local municipalities	Participation in LGU project review and approval
City of St. Louis Park		Erosion Control Permit

4.2.1.1 United States Army Corp of Engineers

Navigable waters are regulated under Section 10 of the Rivers and Harbors Act (RHA) of 1899 (33 U.S.C. § 403) and Section 404 of the CWA (33 U.S.C, § 1344). The RHA regulates work involving a change in the course, current, or cross-section of navigable waters, including wetlands.

Impacts to wetlands connected or adjacent to "navigable waters" of the United States are regulated by two agencies: The U.S. Army Corps of Engineers (USACE) and the U.S. Environmental Protection Agency (EPA), under the CWA. Section 404 of the CWA requires a permit to be issued by USACE (or a delegated state agency) prior to the placement of any dredged or fill material into any waters of the United States, including wetlands. Section 401 of the CWA requires the affected state to issue a water quality certification, or a waiver, for each Section 404 permit.

4.2.1.2 Federal Emergency Management Agency

Floodplains are regulated under Executive Order (EO) 11988, signed on May 24, 1977, by President Jimmy Carter. This EO requires all federal agencies to evaluate and, to the extent possible, avoid adverse impacts to floodplain areas which may result from actions they administer, regulate, or fund. This EO specifically requires floodplain impacts to be considered in the preparation of an EIS for major federal actions. FEMA, under the National Flood Insurance Program (NFIP) as authorized according to the National Flood Insurance Act of 1968 (as amended), has the authority to regulate floodplains and floodways. The cities administer these regulations, including activities such as construction, excavation, or deposition of materials in, over, or under waters which may affect flood stage, floodplain, or floodway boundaries.

The 100-year flood is used by the NFIP as the standard for floodplain management and to determine the need for flood insurance. The boundary of this floodplain is defined by the flood elevation that has a 1percent chance of being equaled or exceeded each year.

Rivers or streams where FEMA has prepared detailed engineering studies may have designated floodways. For most waterways, the floodway is defined as the area where floodwaters are likely to run deepest and fastest (FEMA 2010). It is the area of the floodplain that should be reserved (free from obstruction) to allow floodwaters to move downstream. Placing fill or buildings in a floodway may block the flow of water and increase flood elevations. Such activities in the floodway are generally restricted and require mitigation in the form of compensatory volume to offset lost floodway storage.

The floodplain is defined by FEMA on Flood Insurance Rate Maps (FIRM). The 100-year floodplain is divided into Special Flood Hazard Areas (SFHA) as follows:

- Zone A: no base flood elevations determined.
- Zone AE: areas have been studied in detail where base flood elevations are determined.
- Zone AH: areas where ponding usually occurs and flood depths are between 1 and 3 feet.

- Zone AO: areas where flood depths are between 1 and 3 feet, usually sheet-flow on sloping terrain.
- Other zones identify the areas within the 500-year floodplain, areas determined to be outside the 500-year floodplain, areas where no flood hazards have been determined, and areas with a 0.2 percent annual chance of flooding.

4.2.1.3 State: Minnesota Pollution Control Agency

The MPCA establishes water quality standards and conducts periodic water quality (surface water, groundwater, and wastewater) and biological monitoring. Water quality standards are implemented primarily through National NPDES permits issued to dischargers by the member states (MN Statute 115; MN Rule 7050). The MPCA will review draft NPDES permits. The MPCA reviews USACE permits and is responsible for issuing Section 401 water quality certification.

4.2.1.4 State: Minnesota Department of Natural Resources

Wetlands are regulated by the DNR if they are identified as public waters or public waters wetlands. Public waters are all water basins and watercourses that meet the criteria set forth in Minnesota Statute, Section 103G.005, subd. 15, and that are identified on PWI maps and lists authorized by Minnesota Statute, Section 103G.201. Proposed impacts to these types of wetlands would require a permit from the DNR.

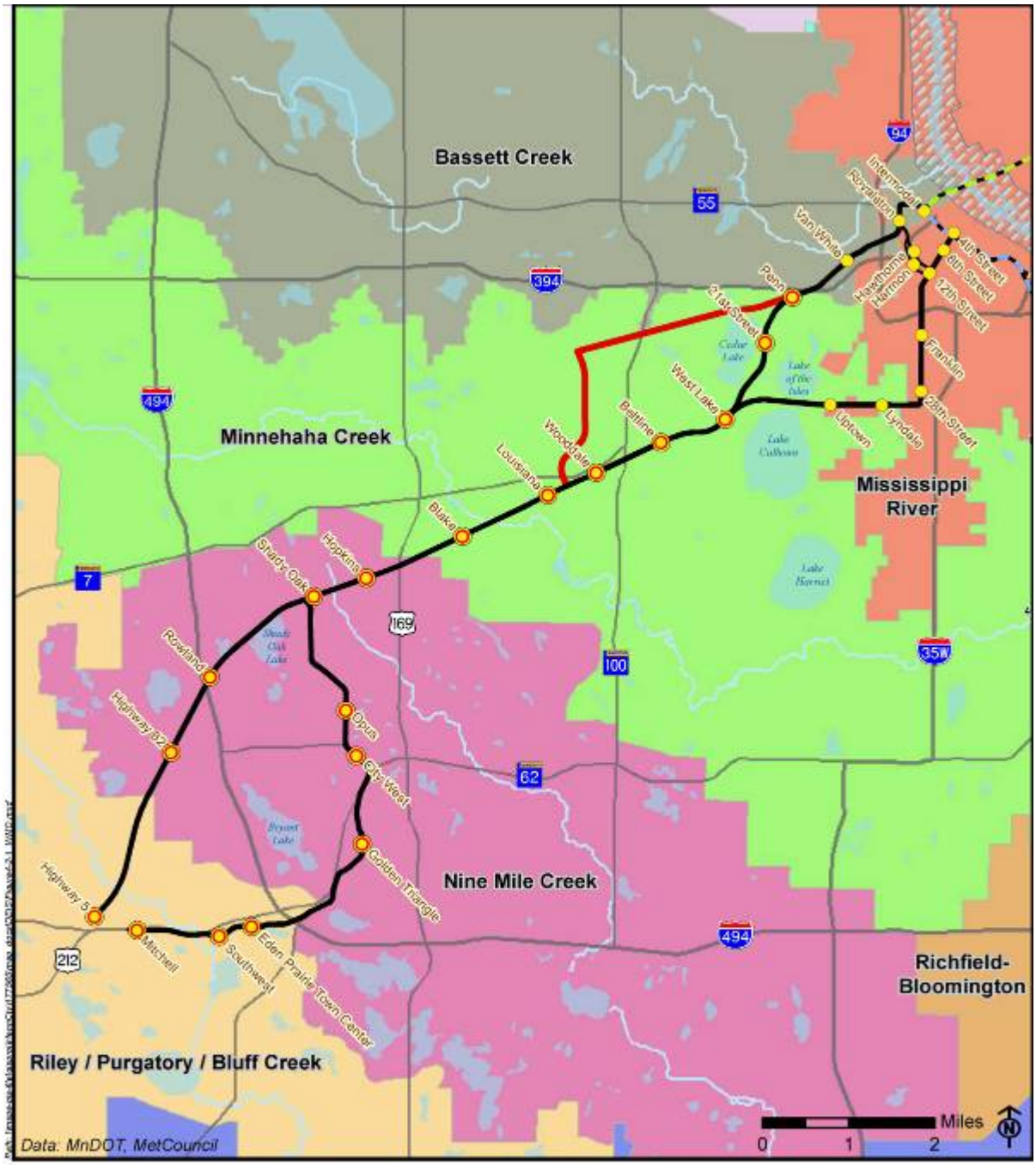
The DNR also requires cities to adopt zoning regulations to protect the environmental quality of surface waters and the natural and economic value of shoreline areas, and to provide for wise use of such waters.

4.2.1.5 Local: Cities

The cities of Eden Prairie and Minnetonka regulate wetlands under the Minnesota WCA. The city of Minneapolis regulates water quality through its building plan reviews, Erosion and Sediment Control Ordinance, and Stormwater Management Ordinance. The City of Eden Prairie requires a land alteration permit if more than 100 cubic yards or 1,000 square feet of land alteration occurs. If land disturbance is greater than one acre, the city requires a Storm Water Pollution Prevention Plan (SWPPP). An Erosion and Sediment Control Plan is required for projects that disturb in excess of either 5,000 square feet or 500 cubic yards of earth moved. A Stormwater Management Plan is required for project sites that exceed 1 acre. The SWPPP prepared for the MPCA for the NPDES General Construction Permit, in some cases, provides the information applicable to both of the Minneapolis regulations described in this section above. The cities, however, may have additional requirements. An Erosion Control Permit is required by the City of St. Louis Park for the Freight Rail Relocation Segment.

4.2.1.6 Local: Watershed Districts

The study area includes the following watershed organizations: the Riley/Purgatory/Bluff Creek Watershed District, the Nine Mile Creek Watershed District, the Minnehaha Creek Watershed Management District, the Bassett Creek Watershed Management Commission, and the Mississippi Watershed Management Organization. See Figure 4.2-1 for watershed district boundaries in the project area.


Bassett Creek
Minnehaha Creek
Mississippi River
Nine Mile Creek
Richfield-Bloomington
Riley / Purgatory / Bluff Creek
Data: MnDOT, MetCouncil
Miles
0
1
2
Legend
Station
Park & Ride Station
Build Alternatives
Freight Rail Relocation
Hiawatha Light Rail
Northstar Commuter Rail
Bassett Creek
Lower Minnesota River
Minnehaha Creek
Mississippi River
Nine Mile Creek
Orphan
Richfield-Bloomington
Riley/Purgatory/Bluff Creek
Shingle Creek
Stream
Mississippi National River & Recreation Area
Figure 4.2-1
Water Management Organizations
SOUTHWEST transitway

4.2.2 Methodology

The analyses were performed on each of the Build Alternatives and the Freight Rail Relocation Segment. The analysis also included four Operation and Maintenance Facilities (OMF): Eden Prairie 1, Eden Prairie 2, Eden Prairie 3, and Minneapolis 4. To eliminate redundancy in this Draft EIS, existing conditions along the Build Alternatives are being presented and analyzed by segment. For evaluation purposes the segments are then combined into the respective Build Alternative for reporting potential impacts. Refer to Table 4.1-1, above, and Figure 2.3-9 in Chapter 2 for the segments that comprise each Build Alternative and the stations included on each segment. The Computer Aided Design (CAD) drawings provided by HDR (March 25, 2009) were used to spatially identify where impacts were likely to occur along each major Light Rail Transit (LRT) segment, and the MN&S Freight Rail Study was used for the Freight Rail Relocation Segment.

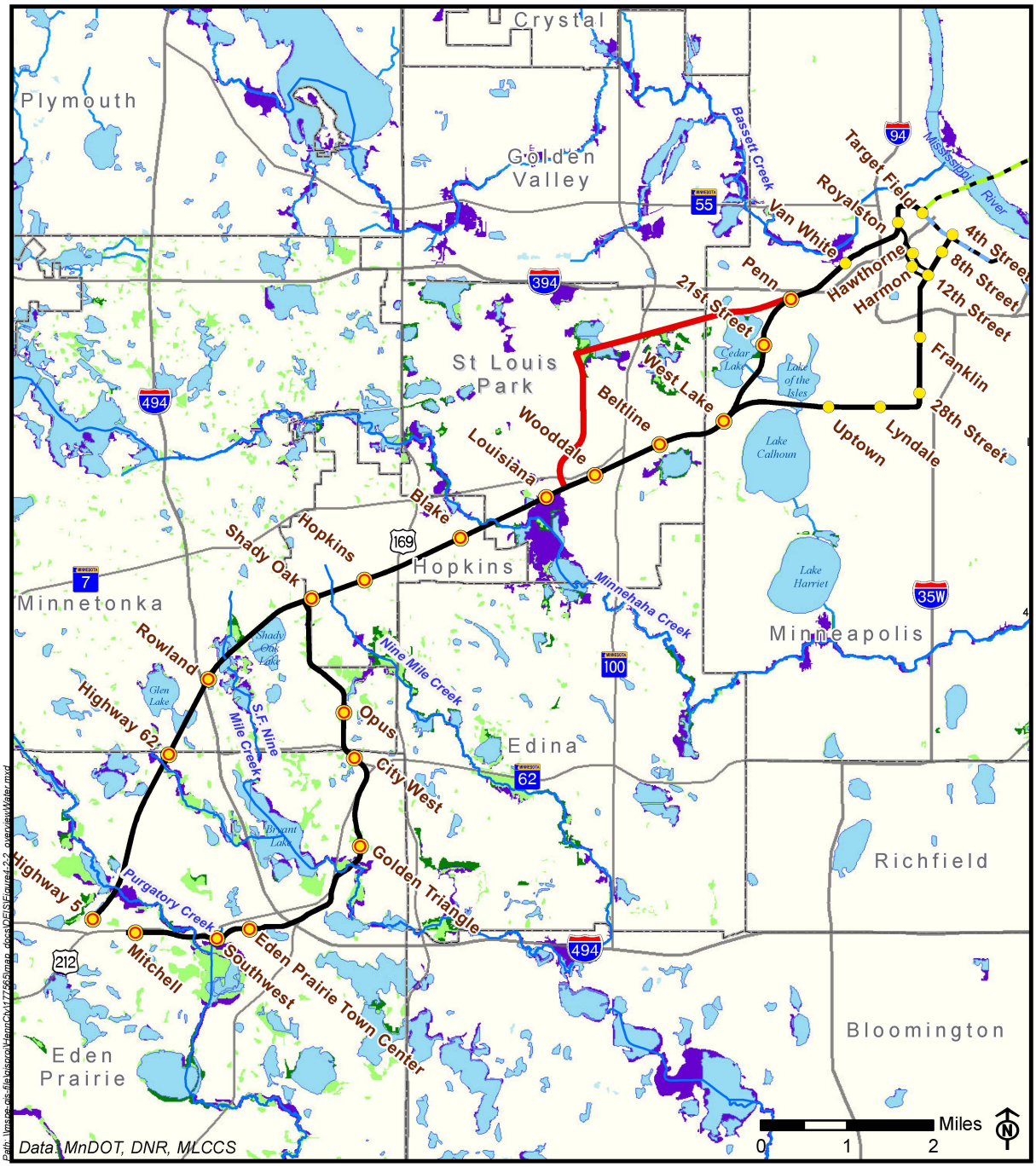
To quantify potential impacts, the cut-and-fill-limit line features of the CAD drawings were used as proxies for the extent of impact of the alignment corridors. These were then used to calculate wetland-related impacts using Geographic Information System (GIS) analyses. Conceptual engineering plans with the identified construction limits were used as the boundaries for determining if a water body would be potentially affected by the Build Alternatives.

Areas where aerial grade-separations (bridges) are planned were not included in this analysis, but will be included in the Final EIS, because the extent of impacts associated with bridge development is not yet determined. All spatial analyses and mapping were completed using the ArcView license of ESRI® ArcMap™ 9.3.

4.2.2.1 100-year Floodplain

Floodplain data used for this investigation were obtained from the Minnesota DNR Data Deli website (http://deli.dnr.state.mn.us); the data were published in 2003. The information is based on the Q3 Flood Data derived from the FIRMs published by FEMA. These data represent 100-year floodplain boundaries rather than floodway boundaries.[2] The floodplain boundaries are shown on Figure 4.2-2.

[2] Further information regarding floodplain impacts can be found in WSB's previously submitted Water Resources Inventory Technical Memorandum, dated February 13, 2009. WSB's Bassett Creek Tunnel Technical Memorandum, dated March 3, 2009 provides further information pertaining to the potential impacts to the Bassett Creek Tunnel in Minneapolis.



Legend

- Station
- Park & Ride Station
- Build Alternatives
- Freight Rail Relocation
- Hiawatha Light Rail
- Northstar Commuter Rail
- Stream
- Lake
- 100-Year Floodplain

Wetlands

- Emergent Wetland
- Deciduous Forest
- Exposed Sand or Clay

Figure 4.2-2
Water Resources

4.2.2.2 Wetlands, Streams and Lakes

Wetland impacts were defined as those areas where the proposed construction limits overlap an existing wetland feature, and would cause a change in the boundary of the wetland. It is important to note that no wetland delineations have been completed as part of this analysis and all wetland boundaries are approximate. Wetland delineations will be completed during Final Design; final design will also incorporate measures to reduce and avoid impacts to wetlands to the greatest extent feasible. Any impact to wetlands requires an approved delineated wetland boundary prior to permit application. The Section 404 and WCA permitting processes will be followed, and appropriate mitigation, if final impacts require it, will be developed through coordination with permitting agencies. Mitigation could be obtained through use of wetland banks, onsite replacement or other means such as restoration or enhancement of existing wetlands.

The DNR Minnesota Land Cover Classification System (MLCCS) results for Hennepin County (2008) were used to locate and map all wetlands, streams, and lakes within 100 feet of the proposed alignments. Wetlands were classified using Fish and Wildlife Service Circular 39 wetland type classification system.

National Wetland Inventory (NWI) data were used to develop a general concept of wetland types present in the Project area.

4.2.2.3 Watershed Management Areas

The watershed information used for this investigation was obtained from the Minnesota DNR Data Deli website. The data set was published by the Board of Soil and Water Resources (BWSR) and depicts watershed district and watershed management organization boundaries throughout Minnesota.

4.2.2.4 Identify Major Drainage and Watershed Management Issues

The Public Waters Inventory (PWI) shape files were obtained from the Minnesota DNR Data Deli website. These shape files are provisional representations of PWI basin delineations found on current paper regulatory maps and lists.

4.2.3 Existing Conditions

The study area is mostly urbanized and highly altered compared to pre-settlement conditions. The land is characterized by commercial, industrial, or residential development with some parkland and other open space. Wetlands, which are widespread and in complexes, public waters, and associated floodplains are located throughout the study area (Figure 4.2-2).

Because of the developed nature of the study area, limited surface water resources exist near the right-of-way (ROW) of Segments A, C, and 4, and Freight Rail Relocation. Historic wetlands have been modified or eliminated and natural stream courses have been rerouted into a network of channels, culverts, and storm sewers. Wetlands and streams are present near the ROW in Segments 1, 3, and Freight Rail Relocation.

4.2.3.1 Floodplains

FEMA Floodplains are present in the study area in low elevations along PWI streams and some wetlands. The following streams and wetlands have mapped FEMA floodplains.

- Purgatory Creek (Segments 1 and 3)
- Unnamed tributary of South Fork Nine Mile Creek (Segment 1)
- South Fork Nine Mile Creek (Segments 1 and 3)
- Nine Mile Creek (Segments 3 and 4)
- Minnehaha Creek (Segment 4)
- Bassett Creek (Segment A)
- Mississippi River (Not crossed)
- PWI #658W (Freight Rail Relocation Segment)
- PWI #659W (Freight Rail Relocation Segment)
- Unnamed wetland north of Twin Lake (Freight Rail Relocation Segment)

4.2.3.2 Wetlands and Public Waters

Wetlands and waterways are distributed across the study area's gently rolling terrain. Urban development throughout the study area has led to the decline of wetlands over time, as a result of drainage or filling, but more recently developed suburban areas retain many wetland areas. For this reason, wetlands within the study area are most densely concentrated near the proposed western end of the Southwest Transitway, in the vicinity of Segments 1 and 3, or in the vicinity of the Iron Triangle portion of the Freight Rail Relocation Segment. These wetlands are most commonly associated with PWI streams and basins. NWI data indicate that the most common study area wetland types are shallow, freshwater emergent; but deep freshwater wetlands are also common. Emergent wetlands support plants whose root systems grow underwater, but whose shoots grow above water. The DNR identifies 81 of these basins as PWI wetlands. In general, public watercourses in the study area flow from northwest to southeast and would be crossed regardless of which alignment was chosen. Public watercourses in the study area that would be crossed by a segment include:

- Purgatory Creek (Segments 1 and 3)
- Unnamed tributary of Purgatory Creek (Segment 3)
- Unnamed tributary of South Fork Nine Mile Creek (Segment 1)
- South Fork Nine Mile Creek (Segments 1 and 3)
- Nine Mile Creek (Segment 4)
- Minnehaha Creek (Segment 4)
- Unnamed channel connecting Cedar Lake and Lake of the Isles (Segment A
- Unnamed channel connecting Lake of the Isles and Lake Calhoun (Segment C)
- PWI #658W (Freight Rail Relocation Segment)
- PWI #659W (Freight Rail Relocation Segment)

4.2.3.3 Long-Term Effects

Based on the analysis of the Build Alternatives and the MN&S Freight Rail Study, there are multiple potential impacts to wetlands, floodplains, creeks, and channels. These impacts would be mitigated through the appropriate permitting processes, which

would include BMPs and design parameters to minimize impacts. At this point in the project's development, specific BMPs and design parameters have not been determined. This would occur during the Preliminary Engineering phase of the project.

Table 4.2-2 identifies wetland, floodplain, and type of wetland impacted, in addition to the permitting authority in each of the alternative areas. Expanded views of the study area wetland resources, sorted by segment, and specific discussions of impacts to floodplains and wetlands follow the table (Figure 4.2-3 through Figure 4.2-7).

Table 4.2-2. Impact by Alternative

Alternative	Permitting Agency	Wetland Impact (acre)	Floodplain Impact (acre)	Impacted Wetland Type (Circular 39)*	Comments
LRT 1A	DNR COE PCA Eden Prairie NMCWD MCWD BCWMC City of Minneapolis	Approx. 2.8	Approx. 3.83	1, 2, 3, 4, 5	Impacts to multiple wetland types. Floodplain impacts are associated with Purgatory Creek and tributaries of Nine Mile Creek. Impacts associated with crossing the channel between Lake of the Isles and Cedar Lake. Bridging the crossing may eliminate impact.
LRT 3A (LPA)	DNR COE PCA Eden Prairie NMCWD MCWD City of Minneapolis	Approx. 2.9	Approx. 3.19	1, 2, 3, 5, 6	Impacts to multiple wetland types. Floodplain impacts are associated with Purgatory Creek, tributaries of Nine Mile Creek, and an unnamed waterbody. Impacts associated with crossing the channel between Lake of the Isles and Cedar Lake. Bridging the crossing may eliminate impact.
LRT 3A-1 (colocation alternative)	DNR COE PCA Eden Prairie NMCWD MCWD City of Minneapolis	Approx. 0.9	Approx. 1.19	1, 2, 3, 5, 6	Impacts to multiple wetland types. Floodplain impacts are associated with Purgatory Creek, tributaries of Nine Mile Creek, and an unnamed waterbody. Impacts associated with crossing the channel between Lake of the Isles and Cedar Lake. Bridging the crossing may eliminate impact.

Alternative	Permitting Agency	Wetland Impact (acre)	Floodplain Impact (acre)	Impacted Wetland Type (Circular 39)*	Comments
LRT 3C-1 (Nicollet Mall) and LRT 3C-2 (11th/12th Street)	DNR COE PCA Eden Prairie NMCWD MCWD BCWMD City of Minneapolis	Approx. 2.3	Approx. 3.19	1, 2, 3, 4, 5, 6	Impact to various wetlands and potential for affecting Minnehaha Creek. Floodplain impacts are associated with Nine Mile Creek and Minnehaha Creek. Impacts associated with crossing the channel between Lake of the Isles and Lake Calhoun. Bridging the crossing may eliminate impact.

* Circular 39 Wetland Type Definitions: Type 1: Seasonally Flooded Basin or Flat, Type 2: Wet Meadow, Type 3: Shallow Marsh, Type 4: Deep Marsh, Type 5: Shallow Open Water, Type 6: Shrub Swamp

4.2.3.4 Floodplains

Alternative LRT 1A

This alignment would result in floodplain impacts of 1.83 acres plus 2.0 acres for the Freight Rail Relocation Segment and would occur along the following watercourses (Figure 4.2-3, Figure 4.2-5, and Figure 4.2-6):

- Purgatory Creek
- Unnamed tributary to South Fork Nine Mile Creek
- South Fork Nine Mile Creek and around Lake Minnetoga
- Nine Mile Creek and surrounding wetlands
- Minnehaha Creek and surrounding wetlands
- PWI #659W (Freight Rail Relocation Segment)

Alternative LRT 3A (LPA)

This alignment and those of Alternatives LRT 3C-1(Nicollet Mall)/LRT 3C-2 (11th/12th Street) would result in floodplain impacts of 1.19 acres plus 2.0 acres for the Freight Rail Relocation Segment and would occur along the following watercourses (Figure 4.2-4, Figure 4.2-5, and Figure 4.2-6):

- Purgatory Creek
- South Fork Nine Mile Creek
- Nine Mile Creek and surrounding wetlands
- Minnehaha Creek and surrounding wetlands
- PWI #659W (Freight Rail Relocation Segment)

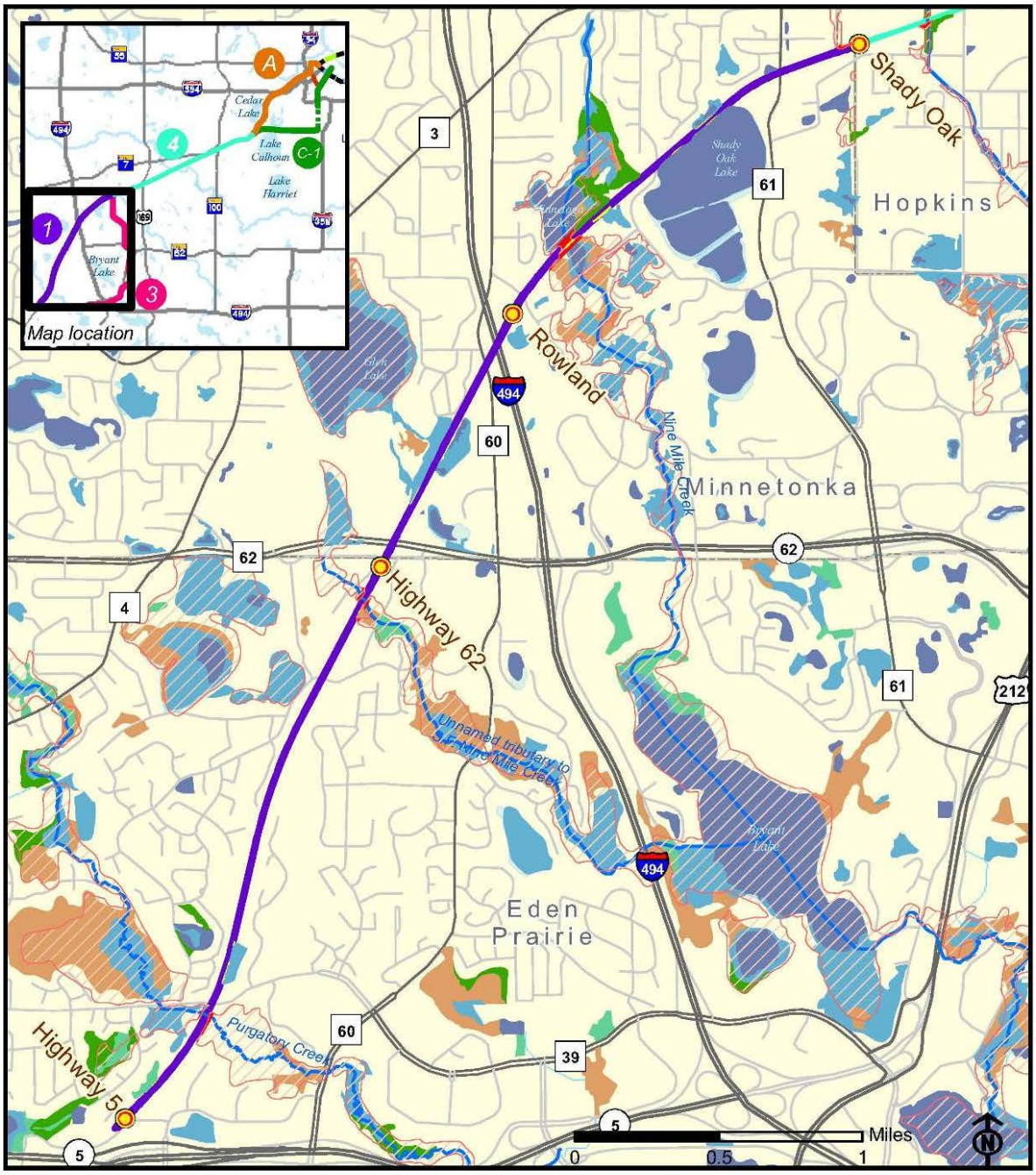


Figure 4.2-3
Water Resources
Segment 1

Data: MnDOT, MnDNR (MN Land Cover Classification System 2007), FEMA

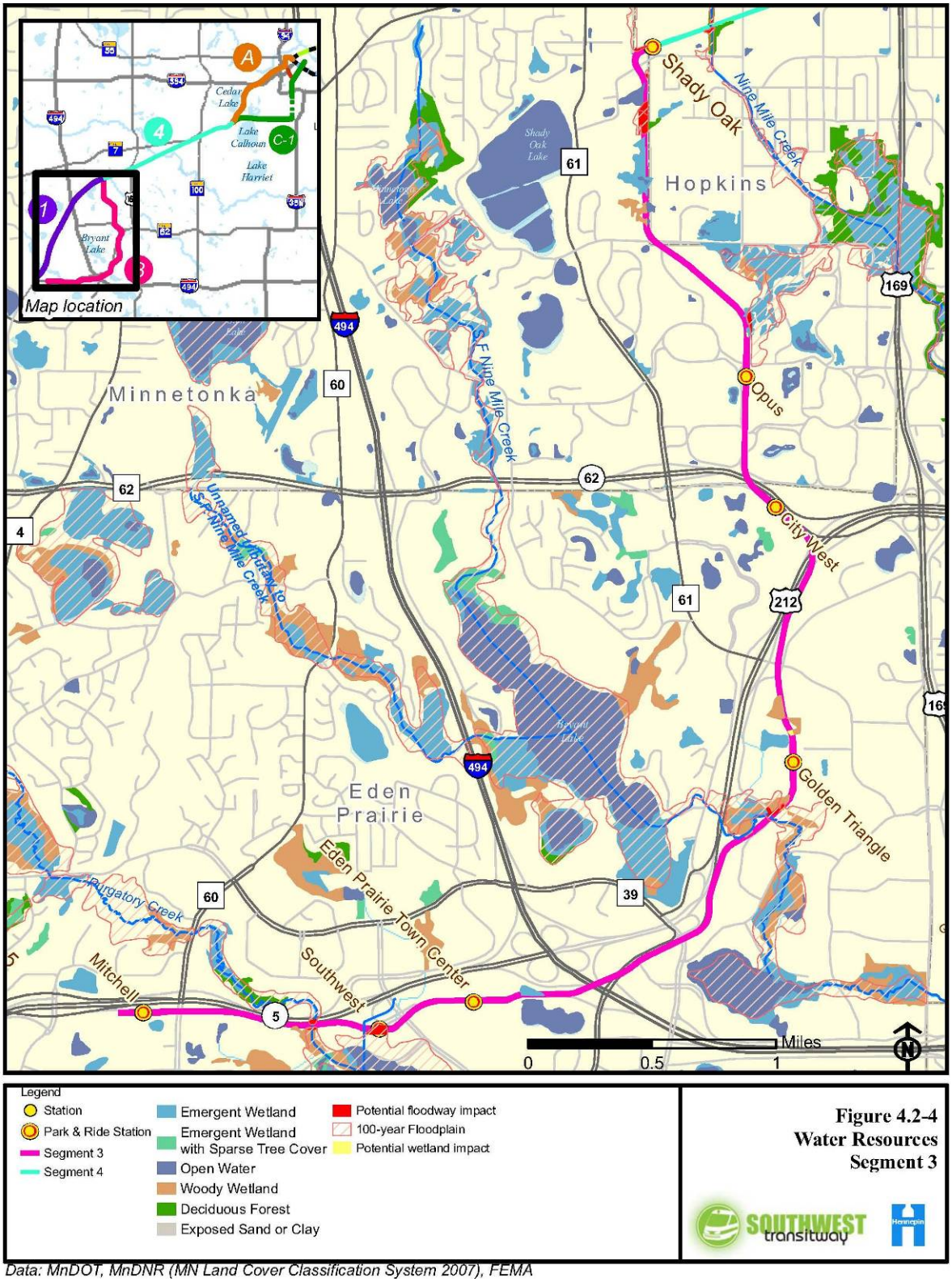
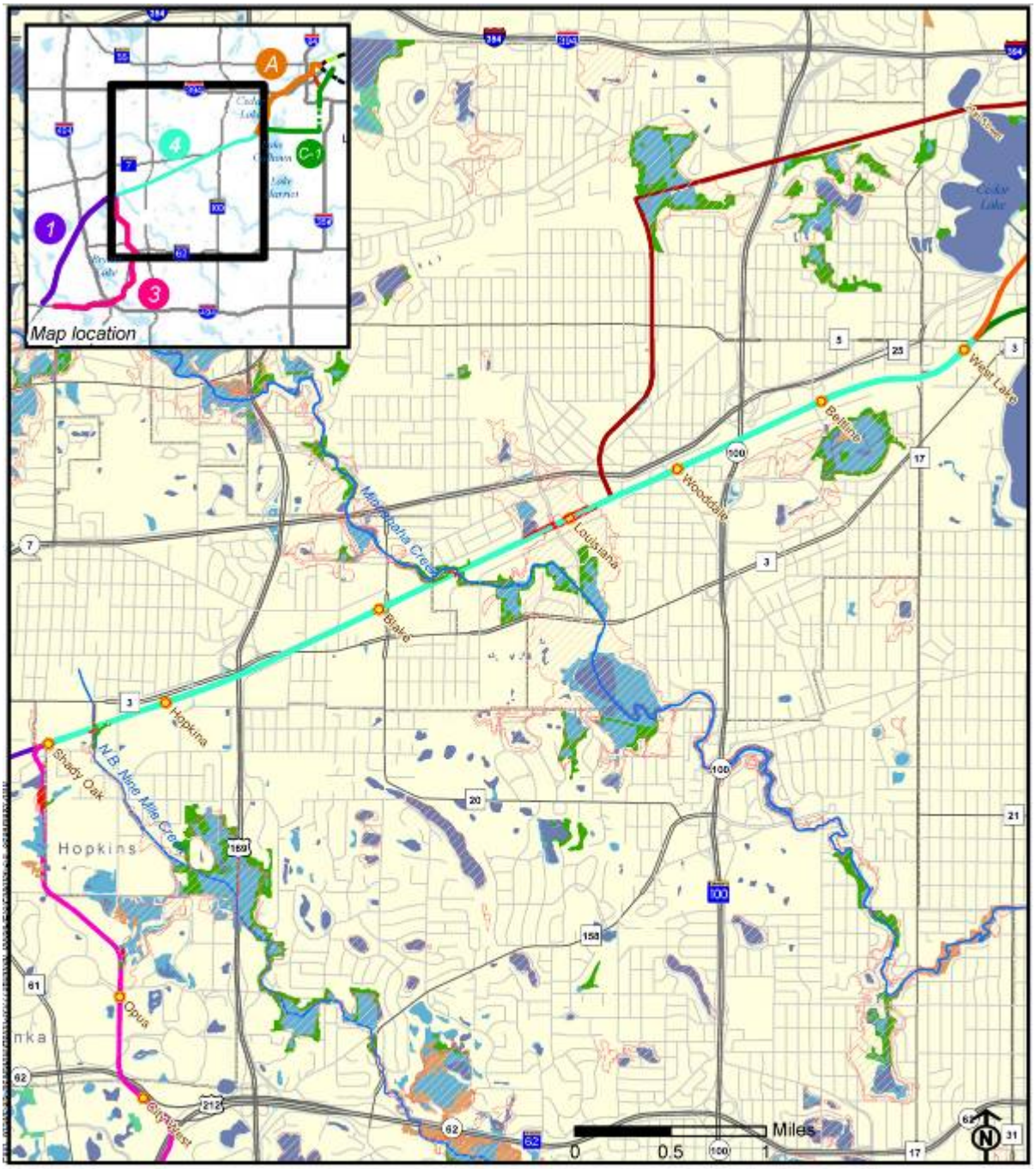


Figure 4.2-4
Water Resources
Segment 3

Data: MnDOT, MnDNR (MN Land Cover Classification System 2007), FEMA

Map Document: (\\mspe-gis-file\GISProj\HennCty\87130\map_docs\mxd\DEIS\CH4_Environmental\Figure4_2_4_Seg3Water.mxd) 4/2/2010

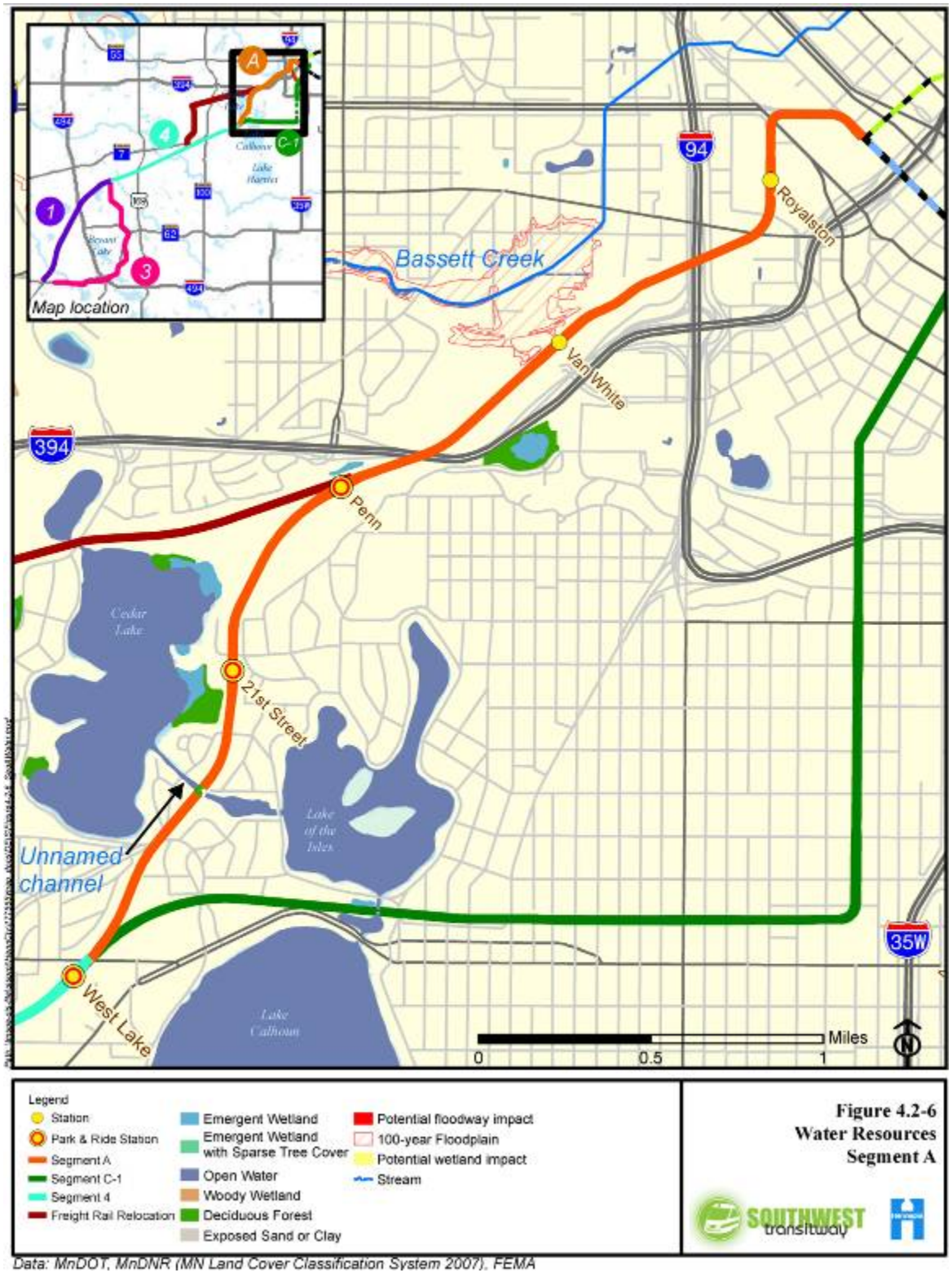


Legend

- Station
- Park & Ride Station
- Segment 1
- Segment 3
- Segment 4
- Segment A
- Segment C
- Freight Rail Relocation
- Emergent Wetland
- Emergent Wetland with Sparse Tree Cover
- Open Water
- Woody Wetland
- Deciduous Forest
- Exposed Sand or Clay
- Potential floodway impact
- 100-year Floodplain
- Potential wetland impact
- Stream

Figure 4.2-5
Water Resources
Segment 4

Data: MnDOT, MnDNR (MN Land Cover Classification System 2007), FEMA



Data: MnDOT, MnDNR (MN Land Cover Classification System 2007), FEMA

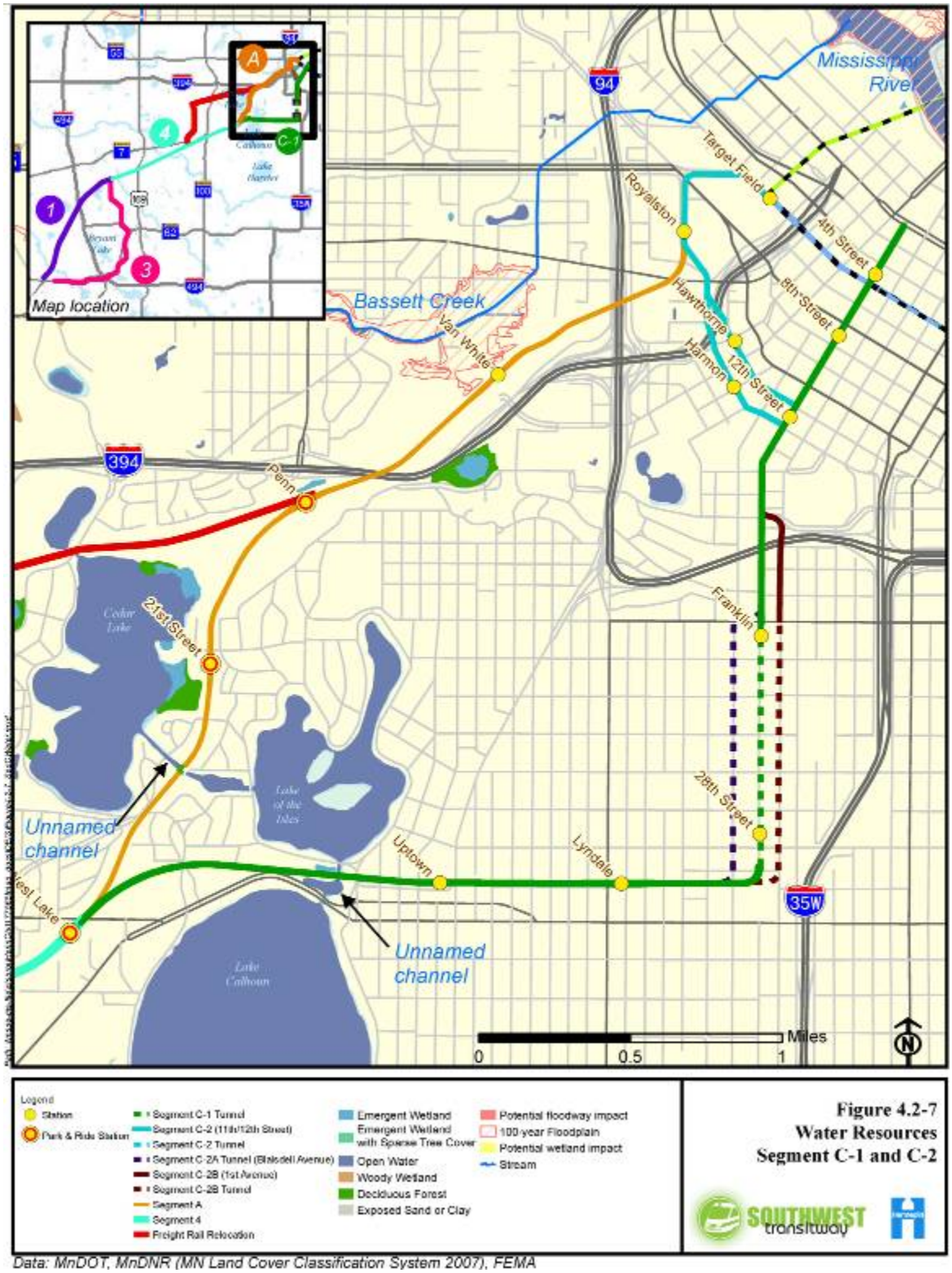


Figure 4.2-7
Water Resources
Segment C-1 and C-2

Data: MnDOT, MnDNR (MN Land Cover Classification System 2007), FEMA

Alternative LRT 3A-1 (co-location alternative)

This alignment would result in floodplain impacts of 1.19 acres and would occur along the following watercourses (Figure 4.2-4, Figure 4.2-5, and Figure 4.2-6):

- Purgatory Creek
- South Fork Nine Mile Creek
- Nine Mile Creek and surrounding wetlands
- Minnehaha Creek and surrounding wetlands

Alternatives LRT 3C-1 (Nicollet Mall) and LRT 3C-2 (11th/12th Street)

This alignment and that of Alternative LRT 3A (LPA) would result in floodplain impacts of 1.19 acres plus 2.0 acres for the Freight Rail Relocation Segment and would occur along the following watercourses (Figure 4.2-4, Figure 4.2-5, and Figure 4.2-7):

- Purgatory Creek
- South Fork Nine Mile Creek
- Nine Mile Creek and surrounding wetlands
- Minnehaha Creek and surrounding wetlands
- PWI #659W (Freight Rail Relocation Segment)

Potential OMF Sites

- No floodplain areas are present at the Eden Prairie 1, Eden Prairie 2, Eden Prairie 3, or Minneapolis 4 OMF sites.

4.2.3.5 Wetlands and Public Waters

Alternative LRT 1A

This alignment would result in wetland impacts of approximately 0.8 acre plus 2.0 acres for the Freight Rail Relocation Segment. Potential PWI crossings are shown on Figures 4.2-3, 4.2-5, and 4.2-6. They are:

- Crossing of Purgatory Creek
- Crossing of Nine Mile Creek (two locations)
- Proximity to Minnehaha Creek (future greenway corridor)
- Crossing of unnamed channel between Cedar Lake and Lake of the Isles
- PWI #659W (Freight Rail Relocation Segment)

Alternative LRT 3A (LPA)

This alignment would result in wetland impacts of approximately 0.9 acre plus 2.0 acres for the Freight Rail Relocation Segment. Potential PWI crossings are shown on Figure 4.2-4, Figure 4.2-5, and Figure 4.2-6. They are:

- Crossing of Purgatory Creek
- Crossing of Nine Mile Creek (two locations)
- Proximity to Minnehaha Creek (future greenway corridor)
- Crossing of unnamed channel between Cedar Lake and Lake of the Isles
- PWI #659W (Freight Rail Relocation Segment)

Alternative LRT 3A-1 (co-location alternative)

This alignment would result in wetland impacts of approximately 0.9 acre. Potential PWI crossings are shown on Figure 4.2-4, Figure 4.2-5, and Figure 4.2-6. They are:

- Crossing of Purgatory Creek
- Crossing of Nine Mile Creek (two locations)
- Proximity to Minnehaha Creek (future greenway corridor)
- Crossing of unnamed channel between Cedar Lake and Lake of the Isles

Alternatives LRT 3C-1 (Nicollet Mall) and LRT 3C-2 (11th/12th Street)

These alignments would impact approximately 0.3 acre plus 2.0 acres for the Freight Rail Relocation Segment. Potential PWI crossings are shown on Figure 4.2-4, Figure 4.2-5, and Figure 4.2-7. They are:

- Crossing of Purgatory Creek
- Crossing of Nine Mile Creek (two locations)
- Proximity to Minnehaha Creek (future greenway corridor)
- Crossing of unnamed channel between Lake of the Isles and Lake Calhoun
- PWI #659W (Freight Rail Relocation Segment)

Freight Rail Relocation Segment

For the Freight Rail Relocation Segment, construction limits have been reviewed and refined throughout the project development process to minimize impacts to wetlands to the extent possible. Due to its location in proximity to the existing railroad tracks, it is not feasible to completely avoid wetland impacts.

Potential OMF Sites

No wetlands or public waters are present at the three of the four potential OMF sites, including Eden Prairie 1, Eden Prairie 2, and Minneapolis 4.

The proposed Eden Prairie 3 OMF site at Mitchell Road (this OMF could be used for Alternatives 3A (LPA), 3A-1 (co-location alternative), 3C-1 (Nicollet Mall) or 3C-2 (11th/12th Street) and has at least one emergent and open water wetland in the vicinity that may be impacted if this site is chosen. The extent of this impact would depend on the Final Design of the OMF facility, but could be 1.3 acres or more. A wooded wetland may also be present on the north edge of the Eden Prairie 3 OMF site. Field review would be necessary to verify the presence/absence and size of this potential wetland.

4.2.4 Short-Term Construction Effects

Construction activities would expose soils and may generate sediment laden stormwater within the construction area. This stormwater runoff, if drained into a conduit leading to adjacent water resources, has the potential to affect water quality. Construction BMPs would be used to minimize water quality impacts. The Build Alternatives and Freight Rail Relocation would involve reconstruction of impervious surface. Additionally, the project would include construction of permanent BMPs such as stormwater ponds and grit chambers that would reduce pollutant loads as compared to existing conditions. The cities may require upgrades to the existing storm sewer system to provide additional treatment for stormwater runoff within the proposed construction limits. Likewise, the watershed district and watershed management organization (WMO) rules require practices that reduce runoff.

4.2.5 Mitigation

Impacts to wetlands as a result of the Build Alternatives and Freight Rail Relocation construction would require mitigation, either through replacement of wetland or purchasing of wetland bank credits.

Impacts to **stormwater ponds** that result in an insufficient stormwater treatment volume would require construction of additional treatment areas to compensate for the loss in treatment volume.

Generally, floodplain impacts are mitigated by compensatory storage. After Final Design, the amount of floodplain impacts will be calculated, and coordination with the appropriate entities (WMOs) will occur to determine the type, location, and extent of compensatory floodplain storage (likely in the form of excavation) required.

The project will require coordination with, and permitting from, local, state, and federal water resource agencies. Development of permit applications will be completed during the Final Design phase of the project. The proposed project will comply with applicable state, federal, and local regulations, and will install BMPs to control and minimize erosion and potential impacts to surface water resources as determined during the permitting process. Construction BMPs may include some or all of the following:

"Stormwater ponds" collect and temporarily store runoff water during storms to prevent flooding.

- Inlet protection of catch basins – filters, **bio-bags**, and catch-basin drop-filters.
- Excavation silt control – silt fence and bio-bags as appropriate.
- Temporary seeding of open excavations and stockpiles – as appropriate for surface soil areas that remain exposed for several weeks or longer.
- Swales with check dams – surface waterways with periodic check dams for silt removal.
- Temporary paving of area to receive traffic prior to final restoration.
- Infiltration of stormwater runoff after removal of heavy sediments.
- Temporary rerouting of stormwater away from exposed slopes and stockpiles.
- Temporary rock construction entrances to remove mud for construction vehicles before they leave the site.

"Bio-bags are plastic mesh bags filled with recycled wood chips.

When applicable, these BMPs would be installed prior to earthwork and grading activities, and would be kept in good working order for the duration of the project. The project would be monitored under grading permits issued by the watershed districts, WMOs, and the cities in the corridor.

Runoff volume control techniques such as those listed below will be considered during final, detailed design of this project to minimize the rate and volume, and improve the quality of surface runoff in the surrounding area:

- Green swales
- Infiltration strips
- Rainwater gardens
- Subsurface storage
- Grit chambers
- Sump manholes

Specific BMPs to be used would be determined during the Final Design and permitting stages of the project. They would be used when practical to help improve the receiving water resources from this project.

4.2.6 Summary

Table 4.2-3 presents a summary of impacts to surface waters and floodplains for each Build Alternative. Impacts associated with the Freight Rail Relocation are included in the alternatives that include the Freight Rail Relocation (FRR) segment. More detail is available in Table 4.2-1 and Table 4.2-2 and the text and maps in Section 4.2.3. Mitigation for impacts is described in Section 4.2.5. In this table, the impacts are expressed in acres, and a brief description about the type and area of impact is included.

Table 4.2-3. Summary of Surface Water Impacts

Environmental Metric	Build Alternatives				
	LRT 1A	LRT 3A (LPA)	LRT 3A-1 (Co-location alternative)	LRT 3C-1 (Nicollet Mall)	LRT 3C-2 (11th/12th Streets)
Wetland impact	2.8 acres Multiple wetland types and potential for affecting Minnehaha Creek.	2.9 acres Multiple wetland types and potential for affecting Minnehaha Creek.	0.9 acre Multiple wetland types and potential for affecting Minnehaha Creek.	2.3 acres Various wetlands and potential for affecting Minnehaha Creek.	2.3 acres Various wetlands and potential for affecting Minnehaha Creek.
Floodplain impact	3.83 acres Purgatory Creek and Nine Mile Creek. Crossing channel between Lake of the Isles and Cedar Lake.	3.19 acres Purgatory Creek and Nine Mile Creek and unnamed waterbody. Crossing channel between Lake of the Isles and Cedar Lake.	1.19 acres Purgatory Creek and Nine Mile Creek and unnamed waterbody. Crossing channel between Lake of the Isles and Cedar Lake.	3.19 acres Nine Mile Creek and Minnehaha Creek. Crossing channel between Lake of the Isles and Cedar Lake.	3.19 acres Nine Mile Creek and Minnehaha Creek. Crossing channel between Lake of the Isles and Cedar Lake.

4.3 Biota and Habitat

This section provides an inventory of existing **biota** and habitat, including vegetation, wildlife, and aquatic habitat resources within one-half-mile on either side of the Build Alternatives. It presents potential long-term and short-term construction impacts to identified resources, and potential mitigation options for those that may experience adverse impacts due to the implementation of the Build Alternatives.

"Biota" are plants and animals.

4.3.1 Legal and Regulatory Overview

Biota and habitat are not specifically protected by federal, state, or local regulations, except for those related to wetlands, water quality, and threatened and endangered species. The primary federal regulations or statutes that apply are the CWA, the Endangered Species Act (ESA) the Migratory Bird Treaty Act, and the Bald and Golden Eagle Protection Act. Similarly, state and local regulations that apply to biota and habitat include regulations on wetlands (Wetland Conservation Act [WCA]), water quality (NPDES), threatened and endangered species (Minnesota Endangered Species Act ([MN ESA]), as well as invasive species management (MN invasive species statutes). A general goal of these regulations is to protect water quality, shorelines, streams, wetlands, and riparian areas and associated terrestrial habitats, as well as the species that depend on these areas. Issues related to the ESA are discussed in detail in Section 4.4.

The Migratory Bird Treaty Act of 1918 (16 U.S.C. §§ 703–712) governs the taking, killing, possession, transportation, and importation of migratory birds, including their eggs, parts, and nests. Such actions are prohibited unless authorized under a valid permit. This law applies to migratory birds native to the U.S. and its territories. It does not apply to non-native migratory birds or resident species that do not migrate on a seasonal basis.

The Bald and Golden Eagle Protection Act of 1940 (16 U.S.C. §§ 668–668d, 54 Stat. 250) was established to provide protection for bald and golden eagles and to prohibit the taking, possession, or commerce of these species.

In general, aquatic habitat is protected by the DNR through the public waters permit (Minnesota Rules 6115.0150–1280). The DNR Protected Water Permit and Crossing License ensures that bridge construction or reconstruction is not detrimental to significant fish and wildlife habitat (including, but not limited to, obstructing the movement of game fish or disrupting fish spawning) or protected vegetation. Any anticipated adverse effects require implementation of feasible and practical measures to mitigate effects.

Invasive species are regulated by federal and state law. The Federal Noxious Weed Act, Title 7, Chapter 61, section 2803, regulates federally listed noxious weeds through the U.S. Department of Agriculture (USDA). Under this rule, the sale, purchase, exchange, or receipt of federal noxious weeds is illegal. Federally listed noxious weeds are listed on 7 C.F.R. § 360.200. In Minnesota, Chapter 84D.0, Invasive Species, of the 2009 Minnesota Statutes regulates invasive species. This statute is regulated by the DNR and generally prohibits possession, importation, purchase, transportation, or introduction of invasive species except under a permit for disposal,

control, research, or education. Minnesota invasive species are those listed under Minnesota Rules 1505.0730 and 1505.0732.

4.3.2 Methodology

The analyses were performed on each of the Build Alternatives. To eliminate redundancy in this Draft EIS, existing conditions along the Build Alternatives are being presented and analyzed by segment. For evaluation purposes the segments are then combined into the respective Build Alternative for reporting potential impacts. Refer to Table 4.1-1, above, and Figure 2.3-9 in Chapter 2 for the segments that comprise each Build Alternative. The (CAD) drawings provided by HDR (March 25, 2009) were used to spatially identify where impacts were likely to occur along each major segment.

Spatial impacts were determined using the cut and fill limits of each alternative. The DNR MLCCS for Hennepin County (2008) was used to locate and map habitat within and adjacent to the alignments (Figure 4.3-1).

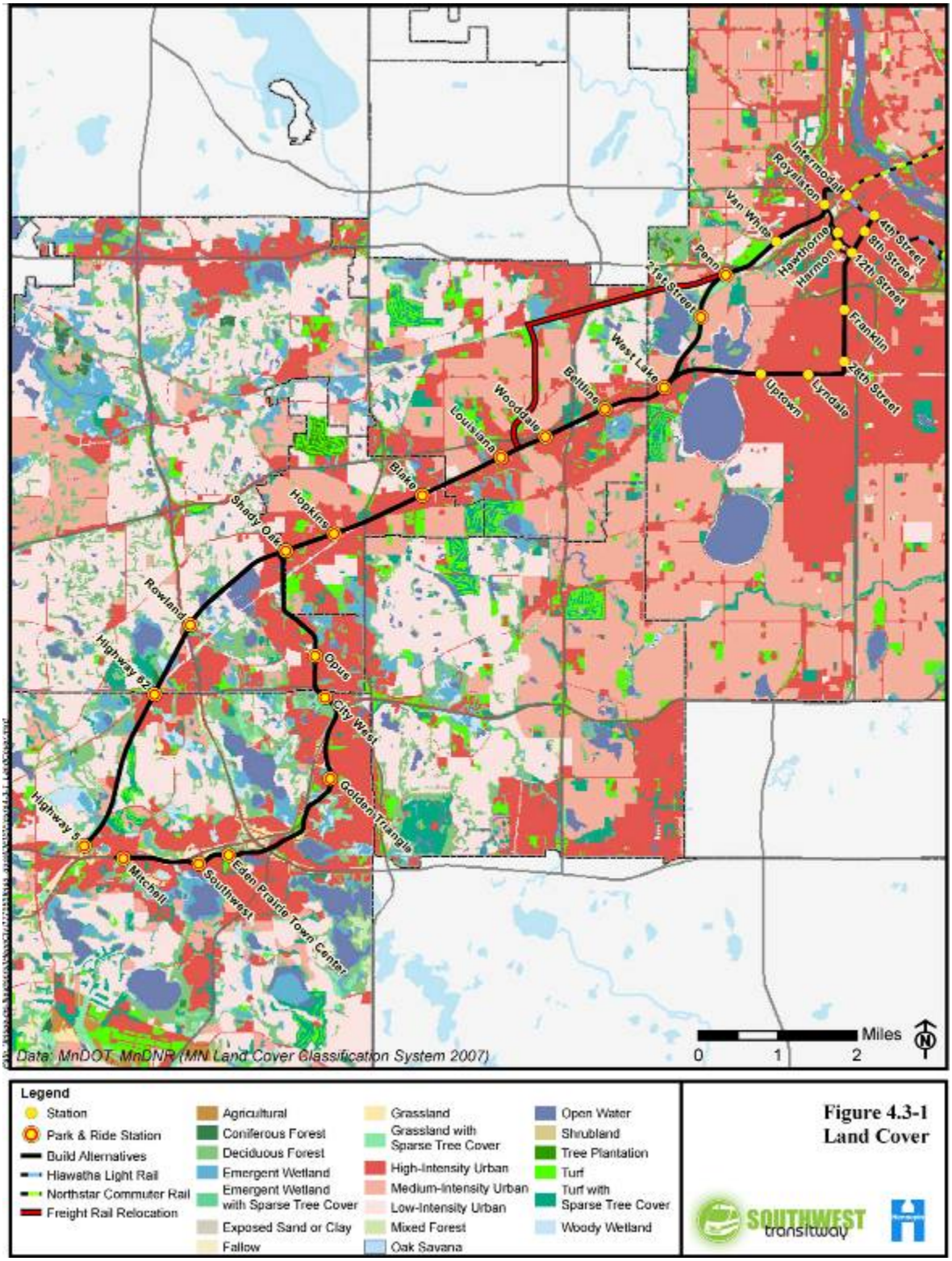
When the MLCCS was developed, quality modifiers were assigned to land cover types which included elements of native habitat. These areas were assigned letter grades (A through D) to denote the quality of the native habitat present. The following thresholds were used by the MLCCS to apply quality modifiers to natural communities:

- A = Highest quality natural community, no disturbances, and natural processes intact.
- B = Good quality natural community. Has its natural processes intact, but shows signs of past human impacts. Low levels of exotics.
- C = Moderate condition natural community with obvious past disturbance but is still clearly recognizable as a native community. Not dominated by weedy species in any layer.
- D = Poor condition of a natural community. Includes some natives, but is dominated by non-natives and/or is widely disturbed and altered.

Areas assigned a quality modifier but listed as non-native were excluded from this inventory. Areas not assigned a quality modifier are associated with urban development, are not considered sensitive, and were also excluded. Additionally, some areas listed as non-native habitat types but assigned a quality modifier were also excluded because they are not natural communities.

The Minnesota State-listed Noxious Weed list was reviewed to identify common invasive species located in the study area.

The Minnesota Ornithologists Union's (MOU) Hennepin County Species checklist was reviewed for bird species that may be sensitive to LRT construction or potential collisions with light rail vehicles because of the habitat that is present along the proposed segments and routes. The MOU county checklists contain accepted records of every species observed in a given county.


Intermodal
Royalston
Van White
Penn
Hawthorne
Harmon
4th Street
8th Street
12th Street
21st Street
Franklin
West Lake
Beltline
Uptown
Lyndale
28th Street
Louisiana
Wooddale
Blake
Hopkins
Shady Oak
Rowland
Highway 62
Opus
City West
Golden Triangle
Highway 5
Mitchell
Southwest
Eden Prairie Town Center
Data: MnDOT, MnDNR (MN Land Cover Classification System 2007)
Miles
0
1
2
N
Legend
Station
Park & Ride Station
Build Alternatives
Hiawatha Light Rail
Northstar Commuter Rail
Freight Rail Relocation
Agricultural
Coniferous Forest
Deciduous Forest
Emergent Wetland
Emergent Wetland with Sparse Tree Cover
Exposed Sand or Clay
Fallow
Grassland
Grassland with Sparse Tree Cover
High-Intensity Urban
Medium-Intensity Urban
Low-Intensity Urban
Mixed Forest
Oak Savana
Open Water
Shrubland
Tree Plantation
Turf
Turf with Sparse Tree Cover
Woody Wetland
Figure 4.3-1
Land Cover
SOUTHWEST
transitway

4.3.2.1 Existing Conditions

In general, areas that contain native plant species (i.e., natural areas) are considered to be higher quality habitat as compared to areas that contain non-native species that have been introduced through human activity. Locations that support native vegetation also tend to support a higher diversity of wildlife species.

The Southwest Transitway study area encompasses a number of natural areas. However, ecosystems that formerly supported substantial native vegetation and wildlife habitat have been mostly replaced with **impervious surfaces**, buildings, and non-native landscape plantings.

"Impervious surfaces" are those that keep water from being absorbed into the ground. They include asphalt and concrete for roads, parking lots, sidewalks, etc.

4.3.2.2 Riparian Habitat Areas, Unique or Sensitive Areas

Riparian habitats consist of the transitional area between wetlands, lakes, and streams, and the adjacent uplands areas. Riparian ecosystems provide habitat for multiple plant and animal species and are sensitive to disturbance.

Vegetation and wildlife bordering and within the study area are associated with lakes, wetlands, woodlands, ROW grassland, and urban landscaping. This environment is generally made up of scattered trees (sometimes concentrated in patches), mowed bluegrass, non-native vegetation (weeds), and human development. Compared to less-developed areas, the suburban/urban setting is generally considered low quality for wildlife habitat, but does provide habitat for wildlife that have adapted to this type of environment such as song birds and small mammals. Portions of the proposed alignments are situated around several lakes, wetlands, and riparian areas which are unsuitable for development. Although lower quality habitats are present throughout the study area, fragments of high quality habitat (quality modifier of C or higher) are present and are mostly made up of emergent wetlands generally associated with Purgatory Creek, North Anderson Lake, Bryant Lake, Glenn Lake, Minnetoga Lake, and Nine Mile Creek. These habitats may be more diverse and/or provide habitat to species not typically present within a suburban/urban landscape.

Based on the inventory of biological resources within and adjacent to the Southwest Transitway Build Alternatives and Freight Rail Relocation Segment, there are potential impacts to natural habitats including wetlands and riparian habitats. Most of the affected wetlands are smaller, lower-quality wetlands types that are relatively common in the area. These wetlands provide low quality habitat for common wildlife species.

4.3.2.3 Native Habitats

Land cover in the study area is dominated by urban use. Habitat offered in these areas is typically of low-quality and often includes a portion of non-native vegetation.

The study area, not including the Freight Rail Relocation Segment includes only small fragments of native habitat, because nearly 70 percent of the area is dominated by urban land use. Effects of project development on wildlife in these areas would vary

according to existing habitat quality. The most common natural cover types are deciduous forests (7.6 percent of the study area) and emergent wetlands (3.6 percent). Most of the non-urban land cover in the study area consists of low-quality, small, fragmented patches dominated by non-native shrubs and grasses, although some areas are contiguous, with patches of native, mature trees and shrubs. The native habitat patches are, for the most part, isolated from forming a continuous corridor and thus are of lesser quality or benefit to plant or wildlife species. Areas assigned a quality modifier make up approximately 5 percent of the study area and are most commonly associated with deciduous forest and emergent wetlands. No native habitats within the study area have been assigned a quality modifier of A. The remaining 95 percent of the study area is either urban or non-native habitat.

Segment 3 has the highest percentage of native cover (12.77 percent), followed by Segment 1 (10.62 percent), Segment A (2.34 percent), Segment C (0.78 percent), and Segment 4 (0.08 percent).

Vegetation within the Freight Rail Relocation Segment study area includes a mix of naturally occurring and landscaped plant species. Land use primarily consists of residential and industrial areas, railroad ROW, and open space with manicured lawns, sporadic tree cover, and some wetland area located in the northern portion of the MN&S section and lake shore area along Cedar and Brownie Lakes adjacent to the BNSF section of the project. Residential, industrial, railroad ROW, and open space do support wildlife, though the habitat is considered relatively low quality.

4.3.2.4 Migratory Birds

The MOU checklist for Hennepin County contains 353 bird species. It is unlikely that all species would be present along the Build Alternatives given the low quality habitat, seasonal avian (bird) use patterns, and the historical nature of some of the records. The checklist stipulates that 131 species breed in Hennepin County, including bald eagles. Bald eagle nests in Hennepin County are generally located along the shorelines of large lakes and along the Minnesota and Mississippi rivers (MOU 2010).

4.3.2.5 Invasive Species

Invasive species are generally defined as those that have been introduced, or moved to an area where they have not historically occurred. These species are of concern because they are prone to quickly colonize and dominate disturbance areas, often crowding out native species. They generally lack natural predators, and native fauna species are seldom able to adapt to use habitat dominated by ecologically invasive species. Once established, invasive species tend to aggressively persist and effective eradication may not be feasible.

Given the urban landscape of the study area, invasive species are common. Prohibited invasive plant species commonly found include Canada thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare*), purple loosestrife (*Lythrum vigatum*), Eurasian watermilfoil (*Myriophyllum spicatum*), garlic mustard (*Alliaria petiolata*), and poison ivy (*Toxicodendron radicans*). In addition, zebra mussels found in study area waterways are also listed as a prohibited invasive species.

Generally, invasive plant species congregate within urban areas in old fields or along abandoned or neglected ROW. Given the location of Segment 1 along an abandoned freight rail ROW, and Segments 4, A, and Freight Rail Relocation, which are along active freight rail lines, invasive species may be more common in these areas.

4.3.3 Long-Term Effects

4.3.3.1 Riparian Habitat Areas, Unique or Sensitive Areas

Table 4.3-1 (in Section 4.3.3.2) provides a summary of each Build Alternative's potential impact to native habitats. Following is a short description of these impacts. See Section 4.2 for a discussion of water resource impacts.

Alternative LRT 1A

Alternative LRT 1A passes over several riparian areas that are associated with Purgatory Creek, an unnamed tributary of South Fork Nine Mile Creek, South Fork Nine Mile Creek, Nine Mile Creek, Minnehaha Creek, and the Cedar Lake/Lake of the Isles channel

This alternative would impact native wetland or riparian habitats, although most of these areas are typified by non-native woody wetland habitat, non-native emergent wetland habitat, or open water habitat. Higher quality riparian habitat assigned a quality modifier is infrequent along the route (MLCCS 2008). Generally, habitats along this alignment have already been fragmented by the development of existing linear ROW. Development of this alternative would likely increase the fragmented nature of wetland and riparian habitats.

Alternative LRT 3A (LPA)

LRT 3A (LPA) passes over several riparian areas that are associated with Purgatory Creek, South Fork Nine Mile Creek, Nine Mile Creek, Minnehaha Creek, and the unnamed channel between Lake of the Isles and Cedar Lake.

This alternative would impact native wetland or riparian habitats, which are typified by non-native woody wetland habitat, non-native emergent wetland habitat, or open water habitat (MLCCS 2008). The development of linear ROW along portions of this alignment has fragmented many wetland habitats on both sides of these features. Development of this alternative would likely increase the fragmented nature of wetland and riparian habitats.

Alternative LRT 3A-1 (co-location alternative)

LRT 3A-1 (co-location alternative) passes over several riparian areas that are associated with Purgatory Creek, South Fork Nine Mile Creek, Nine Mile Creek, Minnehaha Creek, and the unnamed channel between Lake of the Isles and Cedar Lake.

This alternative would impact riparian areas. The development of linear ROW along portions of this alignment has fragmented many wetland habitats on both sides of these features. Development of this alternative would likely increase the fragmented nature of wetland and riparian habitats.

Alternatives LRT 3C-1 (Nicollet Mall) and LRT 3C-2 (11th/12th Street)

Both LRT 3C-1 (Nicollet Mall) and LRT 3C-2 (11th/12th Street) pass over several riparian areas associated with Purgatory Creek, South Fork Nine Mile Creek, Nine Mile Creek, Minnehaha Creek, and the Cedar Lake/Lake of the Isles channel.

These areas are typified by non-native woody wetland habitat, non-native emergent wetland habitat, or open water habitat (MLCCS 2008). Given the development of linear ROW along portions of this alignment, many wetland habitats are fragmented on either side of these features. Development of this alternative would likely increase the fragmented nature of wetland and riparian habitats.

Freight Rail Relocation Segment

Riparian stream habitats are not present along the Freight Rail Relocation Segment, and the wetlands that would be impacted contain non-native habitats.

Potential OMF Sites

Riparian habitats are not present at any of the proposed OMF sites.

4.3.3.2 Native Habitat

Table 4.3-1 details impacts to native habitats along each Build Alternative.

Table 4.3-1. Native Habitat Impacts by Alternative

Alternative	Cover Type	Impact (acres)	Comments
1A	Deciduous Forest	0.60	The area of highest quality along this alignment is an oak forest assigned a quality modifier B rating. Other habitats have been classified as a C or D but are mostly concentrated west of Shady Oak Lake.
	Emergent Wetland	0.53	
	Total	1.13	
3A (LPA)	Deciduous Forest	0.90	All native habitats included in this alignment are classified as quality modifier C or D. They are mostly concentrated along the portion of this alignment south of Shady Oak Lake.
	Emergent Wetland	0.05	
	Total	0.95	
3A-1 (co-location alternative)	Deciduous Forest	1.00	All native habitats included in this alignment are classified as quality modifier C or D. They are mostly concentrated along the portion of this alignment south of Shady Oak Lake.
	Emergent Wetland	0.05	
	Total	1.05	
3C-1 (Nicollet Mall) and 3C-2 (11th/12th Street)	Deciduous Forest	0.89	All native habitats included in this alignment are classified as quality modifier C or D. They are mostly concentrated along the portion of this alignment south of Shady Oak Lake.
	Emergent Wetland	0.05	
	Total	0.94	

Source: HDR Engineering, Inc.

Potential OMF Sites

The Eden Prairie 1, Eden Prairie 2, and Minneapolis 4 OMF sites are located in an urban area; no native habitat is present. The Eden Prairie 3 OMF site is located within an area of natural habitat, including old field grassland, open water and emergent wetland, and woodland. This combination of habitat types provides a relatively diverse area for typical urban wildlife, such as song birds, small and large mammals, and reptiles. However, the site has somewhat limited value because it is surrounded by urban infrastructure. Construction of the OMF facility at Eden Prairie 3 may convert the existing habitat from a natural to urban condition.

4.3.3.3 Migratory Birds

Given the lack of quality habitat along the proposed Build Alternatives, it is likely that the species present in the vicinity have adapted to survive in urban areas and tolerate high levels of human activity. Therefore, the Build Alternatives are not expected to have long term impacts to migratory bird populations.

4.3.3.4 Invasive Species

All of the Build Alternatives could potentially contribute to the spread of invasive species resulting from seed transportation in fill materials, or by clinging to mechanical equipment or workers' clothing. These impacts would be avoided to the extent practicable by developing an invasive species management plan.

Much of the project impact would occur on low quality grasslands, within existing developed areas, and within the existing ROW, resulting in overall minor impacts to vegetation and wildlife.

4.3.4 Short-Term Construction Effects

Grading of the existing land within the study area would be required for construction of any of the Build Alternatives. Within the ROW, existing topography and vegetation would be disturbed. Removal of grasses, shrubs, and trees would be necessary, causing impacts during and after construction. Disturbed areas would be re-vegetated.

Short-term effects to existing species would include the disruption of topsoil which could provide additional habitat for colonization by invasive species. These effects would be addressed by following an invasive species management plan.

4.3.5 Mitigation

Impacts to regulated resources, such as wetlands, threatened and endangered species, and water resources/water quality, would be mitigated in accordance with the appropriate permits as discussed in other sections of this Draft EIS. This mitigation would also benefit biota and habitat.

Increased habitat fragmentation could be expected from the construction of required safety/security barriers to separate the light rail tracks from adjacent bicycle/pedestrian trails and freight rail lines. This fragmentation could be mitigated through the use of wildlife underpasses and modified bridges over water features that would allow for the movement of terrestrial species beneath the bridge. An invasive species management plan would be developed and followed to minimize the contribution of the Build Alternative to the spread of invasive species. Typical strategies employed to prevent the spread of invasive species include proper disposal of soils disturbed by the project and known to contain a seed base of a prohibited invasive species, thorough washing of heavy equipment to remove all soils before the equipment leaves a site known to be contaminated with invasive species, and application of a native seed mix soon after grading or construction has been completed to avoid presenting colonization opportunities.

4.3.6 Summary

Table 4.3-2 presents a summary of anticipated impacts to native habitats, riparian habitat areas, areas of unique or sensitive species, migratory birds, and invasive species—environmental metrics—for each Build Alternative. Impacts associated with the Freight Rail Relocation are included in the related alternatives.

In this table, impacts are expressed in number of acres or fraction of an acre that would be permanently removed from the habitat. A brief description is included about the type of habitat affected and the general location of the impact. More detail is available in Table 4.3-1 and the text and maps in Section 4.3.2. Mitigation for impacts is described in Section 4.3.5.

Table 4.3-2. Summary of Biota Impacts

Environmental Metric	Build Alternatives				
	LRT 1A	LRT 3A (LPA)	LRT 3A-1 (Co-location alternative)	LRT 3C-1 (Nicollet Mall)	LRT 3C-2 (11th/12th Streets)
Removes native habitat-deciduous forest	0.60 acre high quality oak forest present	0.90 acre classified as C or D quality and concentrated south of Shady Oak Lake.	1.0 acre classified as C or D quality and concentrated south of Shady Oak Lake.	0.89 acre classified as C or D quality and concentrated south of Shady Oak Lake.	0.89 acre classified as C or D quality and concentrated south of Shady Oak Lake.
Removes native habitat-emergent wetland	0.53 acre classified as C or D quality and concentrated west of Shady Oak Lake	0.05 acre classified as C or D quality and concentrated south of Shady Oak Lake.	0.05 acre classified as C or D quality and concentrated south of Shady Oak Lake.	0.05 acre classified as C or D quality and concentrated south of Shady Oak Lake.	0.05 acre classified as C or D quality and concentrated south of Shady Oak Lake.
Total acreage of Native Habitat Impacts	1.13	0.95	1.05	0.94	0.94

Environmental Metric	Build Alternatives				
	LRT 1A	LRT 3A (LPA)	LRT 3A-1 (Co-location alternative)	LRT 3C-1 (Nicollet Mall)	LRT 3C-2 (11th/12th Streets)
Removes riparian habitat and unique or sensitive areas	Greatest amount of impacts on native habitats. Generally, already fragmented non-native habitats would be further fragmented.	Least amount of impacts on native habitats. Generally, already fragmented non-native habitats would be further fragmented.	Impacts greater than LRT 3A (LPA) because some crossings of riparian habitat would be wider. Generally, already fragmented non-native habitats would be further fragmented.	Impacts greater than LRT 3A (LPA) but less than LRT 1A. Generally, already fragmented non-native habitats would be further fragmented.	Impacts greater than LRT 3A (LPA) but less than LRT 1A. Generally, already fragmented non-native habitats would be further fragmented.
Affects migratory birds	Lack of quality habitat–no impacts	Lack of quality habitat–no impacts	Lack of quality habitat–no impacts	Lack of quality habitat–no impacts	Lack of quality habitat–no impacts
Disturbs invasive species	Low quality grasslands and existing developed areas–no impacts	Low quality grasslands and existing developed areas–no impacts	Low quality grasslands and existing developed areas–no impacts	Low quality grasslands and existing developed areas–no impacts	Low quality grasslands and existing developed areas–no impacts

4.4 Threatened and Endangered Species

This section provides an inventory of threatened and endangered species present within 1 mile of the Build Alternatives, outlines potential long-term and short-term construction impacts to those resources identified, and presents potential mitigation options for those resources that may experience adverse impacts because of the implementation of the Build Alternatives.

4.4.1 Legal and Regulatory Overview

Section 7 of the Endangered Species Act of 1973 (16 U.S.C. §§ 1531–1544) requires that all federal agencies consider and avoid, if possible, adverse impacts to federally listed threatened or endangered species or their critical habitats, which may result from their direct, regulatory, or funding actions. The U.S. Fish and Wildlife Service (USFWS) compiles and maintains the federal list of threatened and endangered species. Section 7 of the ESA also prohibits the taking of any federally listed species by any person without prior authorization. The USFWS uses the following criteria to designate a species as a threatened, endangered, or candidate species.

- An endangered species is considered to be in danger of extinction throughout all, or a significant portion of its range.
- A threatened species is considered to be at risk of becoming endangered in the foreseeable future, across all or a significant portion of its range.
- A candidate species is one for which the USFWS has sufficient biological information to list as threatened or endangered, but listing has been precluded due to more pressing listing activities (USFWS, 2010).

The State of Minnesota's endangered species law (Minn. Statute 84.0895) and associated rules (Minn. Rules 6212.1800-.2300) regulate the taking, importation, transportation, and sale of state endangered or threatened species. The DNR administers the state-listed special concern, threatened, and endangered species regulations. The MN DNR uses similar criteria to designate state threatened and endangered species, although this agency is focused only on a species range and population in Minnesota. For example, a species may be listed as a state endangered species, but Minnesota could be on the fringe of its range and the species could be more common near the heart of its range, outside of the state.

However, DNR uses a unique set of criteria to list a species as special concern. These species may be extremely uncommon, have a specific or sensitive habitat requirement, or be on the periphery of their range, or they may be a previously listed species whose population is stable or increasing (DNR 2008).

4.4.2 Methodology

This analysis includes all federal- and state-listed species within 1 mile of the Build Alternatives. The DNR Natural Heritage Information System (NHIS March 2010) was used in conjunction with the MLCCS dataset (2008) to identify all known locations of rare plant, animal, or native plant community features. The DNR MLCCS dataset (2008) was used in conjunction with the NHIS database to identify areas that may provide habitat for the rare species. These data are considered confidential and were provided to HDR by the DNR as part of License Agreement 488.

In accordance with Section 7 of the Endangered Species Act, consultation has occurred with the USFWS regarding the presence of federally listed threatened and endangered species, candidate species, and designated critical habitat in the study area. Available information regarding reported occurrences of rare, threatened and endangered (RT&E) species or critical habitats in proximity to the proposed alignment was obtained from the USFWS website (http://www.fws.gov/endangered/) for federally listed species.

4.4.3 Existing Conditions

This section includes a list of the species that have been documented within 1 mile of the Build Alternatives; the list is provided in Table 4.4-1.

Table 4.4-1. Federal- and State-listed Species or Native Plant Communities within 1 Mile of the Proposed Segments and OMF Sites as Contained in the NHIS

Scientific Name	Common Name	State Status	Federal Status	Most Recent Observation Date	Build Alternative Segment and OMF Locations
Emydoidea blandingii	Blanding's Turtle	Threatened	--	1986	4, C and Freight Rail Relocation (all alternatives)
Ligumia recta	Black Sandshell (mollusk)	Special Concern	--	2007	A and C, Minneapolis 4 OMF (all alts)
Valeriana edulis ssp. ciliata	Valerian (plant)	Threatened	--	1891	4, A, and C (all alternatives)
Gallinula chloropus	Common Moorhen (bird)	Special Concern	--	1986	1 and 3; Eden Prairie 1-3 OMF (all alternatives)
Arethusa bulbosa	Dragon's-mouth (plant)	Tracked, no legal status	--	1931	1 (LRT 1A)
Notropis anogenus	Pugnose Shiner (fish)	Special Concern	--	1941	4, A, and C (all alternatives)
Pipistrellus subflavus	Eastern Pipistrelle (bat)	Special Concern	--	2000	A and C (all alternatives)
Wilsonia citrina	Hooded Warbler (songbird)	Special Concern	--	1979	A (LRT 1A, 3A, 3A-1)
Falco peregrinus (3 occurrences)	Peregrine Falcon (raptor)	Threatened	--	2006	A and C, Minneapolis 4 OMF (all alternatives)
Besseya bullii	Kitten-tails (plant)	Threatened	--	1996	3, Eden Prairie 1-3 OMF (LRT 3A, 3A-1, 3C-1, 3C-2)
Etheostoma mircoperca	Least Darter	Special Concern	--	2006	4, A, and C (all alternatives)
Erythronium propullans	Dwarf Trout Lily (plant)	Endangered	Endangered	2005	A (LRT 1A, 3A, 3A-1)
Tamarack Swamp (Southern Type)	Tamarack Swamp (Southern)	Native Plant Community	--	1998	A (LRT 1A, 3A, 3A-1)
Bat Colony	Bat Concentration	N/A	--	2000	A and C (all alternatives)

Source: MN DNR 2010

4.4.3.1 Segment 1 (LRT 1A)

One occurrence of a state-listed threatened bird species (common moorhen) has been documented within 1 mile of Segment 1 and potentially affects Build Alternative LRT 1A. The dragon's mouth, a plant species that is not listed but is tracked by the state, was documented in 1931 within one mile of Segment 1.

4.4.3.2 Segment 3 [LRT 3A (LPA), LRT 3A-1 (Co-location alternative), LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street); Eden Prairie 1, 2, and 3 OMF sites)]

Within 1 mile of Segment 3, one occurrence of a state-listed threatened bird species (common moorhen) and one occurrence of a state-listed threatened plant (kitten-tails) have been documented.

4.4.3.3 Segment 4 [LRT 1A, LRT 3A (LPA), LRT 3A-1 (Co-location alternative), LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street)]

Within 1 mile of Segment 4, four occurrences of state-listed threatened or special concern plant or animal species have been documented. They include two special concern fish species (pugnose shiner and least darter), a threatened reptile (Blanding's turtle), and a threatened plant species (valerian). However, pugnose shiner and valerian records are historical, documenting observations from the late 19th and mid 20th centuries. It is probable that these features are no longer present due to land-use changes since the observation date.

4.4.3.4 Segment A [LRT 1A, LRT 3A (LPA), and LRT 3A-1 (Co-location alternative); Minneapolis 4 OMF site]

Within 1 mile of Segment A, 10 occurrences of federal- or state-listed threatened, endangered, or special concern plant or animal species have been documented. They include seven species, of which five are animals (black sandshell, pugnose shiner, least darter, hooded warbler, and peregrine falcon), and two are plants (dwarf trout lily and valerian). While all of the species are state listed, only the dwarf trout lily is federally listed. In the case of the pugnose shiner and valerian, the documented observations are from the late 19th and mid-20th centuries, so it is probable that these features are no longer present due to land-use changes since the observation date.

Additionally, this segment passes within 1 mile of a state-listed native plant community (tamarack swamp) and within 1 mile of a bat colony. These features are not legally protected by the state ESA, but are included in the database because they are examples of high quality or unique natural communities.

4.4.3.5 Segment C [LRT 3C-1 (Nicollet Mall) and LRT 3C-2 (11th/12th Street)]

Within 1 mile of Segment C, nine occurrences of state-listed threatened or special concern plant or animal species have been documented. They include six animal species (Blanding's turtle, black sandshell, eastern pipstrelle, peregrine falcon, pugnose shiner, and least darter) and one plant species (valerian). In the case of the pugnose shiner and valerian, the documented observations are from the late 19th and mid-20th centuries, so it is probable that these features are no longer present

due to land-use changes since the observation date. None of the nine state-listed threatened or special concern plant or animal species is federally listed.

Additionally, this segment passes within 1 mile of a bat colony. This feature is not legally protected by the state ESA, but is included in the database because it is an example of a high quality or unique natural community.

4.4.3.6 Freight Rail Relocation Segment

The DNR identified Blanding's turtles potentially within the project area. No other features were indentified that would be affected by the MN&S and BNSF alignments.

4.4.4 Long-Term Effects

Following is an analysis of potential long term effects to federal- and state-listed threatened, endangered, and special concern species that have been documented within 1 mile of the Build Alternatives.

Black Sandshell (*Ligumia recta*)

This species has been documented within 1 mile of LRT 1A, LRT 3A (LPA), LRT 3A-1 (co-location alternative), LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street). It is likely that the Build Alternatives would have only indirect effects, if any, on this aquatic species. Impacts to individuals would be limited to potential changes in water quality due to construction activities. Direct impacts to aquatic habitat are not anticipated; runoff would be controlled to minimize its effect on water quality. Impacts to this species are not anticipated.

Valerian (*Valeriana edulis ssp. ciliate*)

This species has been documented within 1 mile of LRT 1A, LRT 3A (LPA), LRT 3A-1 (co-location alternative), LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street). It is likely that the Build Alternatives would not directly affect the species because the record was made in the late 19th and mid-20th centuries and it is likely that land-use patterns in the area have changed, eliminating appropriate habitat. Impacts to this species are not anticipated.

Common Moorhen (*Gallinula chloropus*)

This species has been documented within 1 mile of LRT 1A, LRT 3A (LPA), LRT 3A-1 (co-location alternative) LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street). The most recent observation was recorded in 1986. Given this species' preference for large, emergent wetland habitats, there is potential for the Build Alternatives to negatively impact the species' habitat (DNR Ecological Services 2008). The proposed impacts to wetland and open water habitats, however, would be minor. Although the local population of the common moorhens would not be expected to be affected, individuals, if present, could be affected.

Dragon's Mouth (*Arethusa bulbosa*)

This species has been documented within 1 mile of LRT 1A. Because the record is from 1931, it is likely that land-use changes in the vicinity of this observation have changed sufficiently to extirpate (obliterate or wipe out) this species locally. Impacts to this species are not anticipated.

Pugnose Shiner (*Notropis anogenus*)

This species has been documented within 1 mile of LRT 1A, LRT 3A (LPA), LRT 3A-1 (co-location alternative) LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street). Since these records are from 1941, it is likely that land-use changes in the vicinity of these observations have changed sufficiently to extirpate this species locally. Furthermore, as an aquatic species, impacts would be limited to effects on water quality. Impacts to this species are not anticipated.

Eastern Pipistrelle (*Pipistrellus subflavus*)

This species has been documented within 1 mile LRT 1A, LRT 3A (LPA), LRT 3A-1 (co-location alternative) LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street). Given this observation's location along the Mississippi River, and nearby bat colonies, it is unlikely that the Build Alternatives would affect individuals because appropriate habitat would not be affected by the project. No impacts to caves or tunnels along the Mississippi would occur, thereby avoiding impacts to hibernacula. Impacts to roosting habitat (trees) would be minimal, as the Build Alternatives would result in very limited amounts of tree clearing. Therefore, impacts to this species are not anticipated.

Hooded Warbler (*Wilsonia citrine*)

This species has been documented within 1 mile of LRT 1A, LRT 3A (LPA), and LRT 3A-1 (co-location alternative). This species inhabits large tracts of mature deciduous woodlands with dispersed shrubs (DNR Ecological Services 2008). It is unlikely that Build Alternatives LRT 1A or LRT 3A (LPA)would impact areas of appropriate habitat. Impacts to this species are not anticipated.

Peregrine Falcon (*Falco peregrines*)

This species has been documented in downtown Minneapolis within 1 mile of LRT 1A, LRT 3A (LPA), LRT 3A-1 (co-location alternative) LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street). These documented individuals were introduced to the area as part of a greater effort to reestablish a sustainable population in Minnesota. This effort has been largely successful with many individuals adapting to life in urban habitats. Nests are typically located on building ledges. Given these factors, it is unlikely that the Build Alternatives would impact individuals. Impacts to this species are not anticipated.

Kitten-tails (*Besseya bullii*)

This species has been documented within 1 mile of LRT 3A (LPA), LRT 3A-1 (co-location alternative), LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street). Habitat for this species is largely restricted to forested bluffs along the Minnesota, Mississippi, and St. Croix rivers (DNR Ecological Services 2008). However, the specific type of habitat that would support kitten-tails is not present along the Build Alternatives. Impacts to this species are not anticipated.

Least Darter (*Etheostoma mircoperca*)

This species has been documented within 1 mile of LRT 1A, LRT 3A (LPA), LRT 3A-1 (co-location alternative) LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street). However, as an aquatic species, impacts would be limited to effects on water quality. Impacts to this species are not anticipated.

Dwarf Trout Lily (*Erythronium propullans*)

This species has been documented within 1 mile of LRT 1A, LRT 3A (LPA), LRT 3A-1 (co-location alternative) LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street). The population is located within a high quality, unfragmented stand of deciduous forest. The Build Alternatives would not directly impact this habitat, and it is unlikely that other appropriate habitat is present along the alignments. Impacts to this species are not anticipated.

Blanding's Turtle (*Emydoidea blandingii*)

This species occurs within 1 mile LRT 1A, LRT 3A (LPA), LRT 3A-1 (co-location alternative) LRT 3C-1 (Nicollet Mall), LRT 3C-2 (11th/12th Street), and the Freight Rail Relocation Segment, and is known to occur within watersheds affected by the project. Nest sites are generally located in sandy soils (DNR Division of Ecological Services 2008). In correspondence, the DNR raised concerns about the project's impacts to this species. Given the riparian habitat likely to be affected by the project, some individuals, if present, may experience habitat loss. It is not likely, however, that the project would cause a trend toward further state or federal listing, as no congregations of this species are known to occur within the project area and stable populations persist elsewhere in the state. According to NHIS data (MNDNR 2010), the most recent observation of this species in the project area is from 2000.

Tamarack Swamp

This community is located within 1 mile of LRT 1A, LRT 3A (LPA), and LRT 3A-1 (co-location alternative). This community would not be directly affected by this project. Because the swamp is located more than a half-mile from Segment A, on the north side of I-394, none of the Build Alternatives would result in temporary or permanent impacts to the swamp.

Bat Colony

This community is located within 1 mile of LRT 1A, LRT 3A (LPA), LRT 3A-1 (co-location alternative) LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street). Because the location is along the Mississippi River and there are unique subterranean habitat niches in the area, it is unlikely that this feature would be affected as a result of the Build Alternatives.

4.4.5 Short-Term Construction Effects

The evaluation of short-term construction effects is focused on animals, because they may be affected by human activity. Generally, the project is located in an urban/developed area that has a high level of human activity. Therefore, any sensitive animals that may be present are already habituated to such activity.

Blanding's turtles have been reported in the vicinity of the proposed project and may be encountered during construction activities. Nest sites are generally located in sandy soils. Grading activities that extend into natural areas having sandy soils may impact turtle nests, if present, depending on the construction timing.

4.4.6 Mitigation

According to the DNR, Blanding's turtles may be present near the project site. State law and rules prohibit the destruction of threatened or endangered species, except under certain prescribed conditions. If turtles are in imminent danger they should be moved by hand out of harm's way, otherwise they should be left undisturbed. Contractors and construction workers would be informed of the potential presence of Blanding's turtles and would be responsible for reporting any observations and taking appropriate action to move any Blanding's turtle to a safe area. The following is a list of DNR recommended BMPs; not all are appropriate for this project (DNR Ecological Services March 2008):

- A flier with an illustration of a Blanding's turtle should be given to all contractors working in the area. Homeowners should also be informed of the presence of Blanding's turtles in the area.
- Turtles that are in imminent danger should be moved, by hand, out of harm's way. Turtles that are not in imminent danger should be left undisturbed.
- If a Blanding's turtle nests along the project area, do not disturb the nest.
- Silt fencing should be set up to keep turtles out of construction areas. It is critical that silt fencing be removed after the area has been re-vegetated.
- Small, vegetated, temporary wetlands (Types 2 and 3) should not be dredged, deepened, filled, or converted to stormwater retention basins (these wetlands provide important habitat during spring and summer).
- Wetlands should be protected from pollution; use of fertilizers and pesticides should be avoided, and run-off from lawns and streets should be controlled. Erosion should be prevented to keep sediment from reaching wetlands and lakes.
- Roads should be kept to minimum standards on widths and lanes (this reduces road kills by slowing traffic and reducing the distance turtles need to cross).
- Roads should be ditched, not curbed or below grade. If curbs must be used, 4-inch high curbs at a 3:1 slope are preferred (Blanding's turtles have great difficulty climbing traditional curbs; curbs and below-grade roads trap turtles on the road and can cause road kills).
- Culverts between wetland areas, or between wetland areas and nesting areas, should be 36 inches or greater in diameter, and elliptical or flat-bottomed.
- Wetland crossings should be bridged, or include raised roadways with culverts which are 36 inches or greater in diameter and flat-bottomed or elliptical (raised roadways discourage turtles from leaving the wetland to bask on roads).
- Culverts under roads crossing streams should be oversized (at least twice as wide as the normal width of open water) and flat-bottomed or elliptical.
- Utility access and maintenance roads should be kept to a minimum (this reduces road-kill potential).
- Because trenches can trap turtles, trenches should be checked for turtles prior to being backfilled and the sites should be returned to original grade.
- Terrain should be left with as much natural contour as possible.

- Graded areas should be re-vegetated with native grasses and forbs (some non-natives form dense patches through which it is difficult for turtles to travel).
- Vegetation management in infrequently mowed areas—such as in ditches, along utility access roads, and under power lines—should be done mechanically (chemicals should not be used). Work should occur fall through spring (after October 1 and before June 1).

Coordination with the USFWS and the DNR is ongoing; letters sent and received are included in Appendix E.

4.4.7 Summary

Table 4.4-2 presents a summary of impacts to threatened and endangered species for each Build Alternative. Impacts associated with the Freight Rail Relocation are included in the affected alternatives.

This table presents the number of potential species that may be within a mile of the alignment of the proposed alternative, and which of them—if any—might be affected. More detail is available in Table 4.4-1and the text and maps in Sections 4.4.3 and 4.4.4. Mitigation for impacts is described in Section 4.4.6.

Table 4.4-2. Summary of Threatened and Endangered Species Impacts

Environmental Metric	Build Alternatives				
	LRT 1A	LRT 3A (LPA)	LRT 3A-1 (Co-location alternative)	LRT 3C-1 (Nicollet Mall)	LRT 3C-2 (11th/12th Streets)
State-listed species potentially present within 1 mile	11 species Project may affect Common Moorhen individuals if present. Project may affect Blanding's Turtle habitat and individuals if present.	11 species Project may affect Common Moorhen individuals if present. Project may affect Blanding's Turtle habitat and individuals if present.	11 species Project may affect Common Moorhen individuals if present. Project may affect Blanding's Turtle habitat and individuals if present.	13 species Project may affect Common Moorhen individuals if present. Project may affect Blanding's Turtle habitat and individuals if present.	13 species Project may affect Common Moorhen individuals if present. Project may affect Blanding's Turtle habitat and individuals if present.
Federal-listed species potentially present within 1 mile	1 species No direct impacts to dwarf trout lily habitat	1 species No direct impacts to dwarf trout lily habitat	1 species No direct impacts to dwarf trout lily habitat	1 species No direct impacts to dwarf trout lily habitat	1 species No direct impacts to dwarf trout lily habitat

Environmental Metric	Build Alternatives				
	LRT 1A	LRT 3A (LPA)	LRT 3A-1 (Co-location alternative)	LRT 3C-1 (Nicollet Mall)	LRT 3C-2 (11th/12th Streets)
State-listed community within 1 mile	1 community Tamarack swamp would have no direct impacts	1 community Tamarack swamp would have no direct impacts	1 community Tamarack swamp would have no direct impacts	N/A	N/A
State-listed bat colony within 1 mile	1 colony Unlikely to be affected	1 colony Unlikely to be affected	1 colony Unlikely to be affected	1 colony Unlikely to be affected	1 colony Unlikely to be affected

4.5 Farmlands

This section provides an inventory of farmlands within the study area for the Build Alternatives, documents potential long-term and short-term construction impacts to those resources identified, and presents potential mitigation options for those resources that may experience adverse impacts due to the implementation of the Build Alternatives.

4.5.1 Legal and Regulatory Overview

The Farmland Protection Policy Act (FPPA) (Public Law 97–98, 7 U.S.C. § 4201) was passed by Congress as part of the Agriculture and Food Act of 1981 in an effort to reduce urban sprawl and protect farmland, specifically to reduce the impact of federal projects on this trend. The FPPA is designed to protect lands that are currently used for agricultural production and those that possess the best combination of physical and chemical characteristics for agricultural production. The FPPA is administered by the USDA Natural Resource Conservation Service and divides protected farmland into three groups.

"Prime farmland" is land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion.

"Unique farmland" is land other than prime farmland that is used for production of specific high-value food and fiber crops, as determined by the Secretary [of Agriculture. Examples of such crops include citrus, tree nuts, olives, cranberries, fruits, and vegetables.

Areas designated as **prime and unique farmlands** are considered "a unique natural resource ... [that] provides food and fiber necessary for the continued welfare of the people of the United States" (7 U.S.C. § 4201). Urban or built-up land and water areas cannot be considered prime farmland, but land does not have to be in use for agricultural purposes to be considered prime farmland.

Minnesota does not have any state regulations pertaining to prime and unique farmlands and relies on FPPA for farmland protection.

4.5.2 Methodology

The methods for implementing the FPPA are defined in the FPPA Rule (7 C.F.R. § 658), which establishes applicability and exemptions, criteria for determining whether the actions of a project are subject to the FPPA, and guidelines for using the criteria. In addition, soil types that have been identified as providing the physical and chemical components that meet the above definitions are defined by the NRCS and lists are provided in the county level soil surveys. This information, along with information provided by the lead federal agency, the Federal Transit Administration (FTA), is used to complete an NRCS Farmland Impact Conversion Rating Form for Corridor Type Projects (NRCS-CPA-106 Form). This completed form produces an impact rating. It is important to note the FPPA does not apply and the NRCS-CPA-106 form is not needed when farmland areas have been previously converted to urban development. Farmland already in urban development is defined in 7 C.F.R. § 658as "lands identified as 'urbanized area' (UA) on the Census Bureau Map, or as urban area mapped with a 'tint overprint' on the USGS topographical maps, or as 'urban-built-up' on the USDA Important Farmland Maps."

Since NRCS Soil Survey-mapped prime and unique farmland soil types are present within the construction limits, it was necessary to review U.S. Census maps to determine if the study area, and thus construction limits, is already considered to be converted to urban development. The U.S. Census Bureau 2000 urbanized area maps designate the entire study area, and thus the construction limits, as "urbanized area." This U.S. Census designation exempts the areas of prime and unique farmland soils mapped by the NRCS from protection by the FPPA.

4.5.3 Existing Conditions

The majority of the study area is urban with small pockets of forest, wetlands, shrubland, and grassland as discussed in more detail in Section 3.1, Land Use and Socioeconomics, and Section 4.3, Biota and Habitat. NRCS-designated prime and unique farmland soil types are located within Segments 1 and 3. (See Figure 2.3-9 in Chapter 2 for a project segment map.)

4.5.4 Long-Term Effects

The No Build, Enhanced Bus, and Build Alternatives would not have a long-term effect on prime and unique farmland because all of the NRCS mapped prime and unique farmland soils within the study area have already been converted to urban use.

4.5.5 Short-Term Construction Effects

The No Build, Enhanced Bus, and Build Alternatives would not have short term construction effects on prime and unique farmland because all of the NRCS mapped prime and unique farmland soils within the study area have already been converted to urban use.

4.5.6 Mitigation

No mitigation for farmland impacts is needed because all of the prime and unique farmland soils in the study area have been converted to urban use.

4.6 Air Quality

Air quality is regulated by the EPA. EPA delegates this authority to the State of Minnesota, represented by the MPCA, for monitoring and enforcing air quality regulations in Minnesota.

4.6.1 Legal and Regulatory Overview

Air quality is typically evaluated, either qualitatively or quantitatively, as part of the NEPA review process for large projects that receive federal funding or approvals. The level and type of such analyses are selected commensurate with the potential for adverse air quality impacts due to construction or operation of the project.

4.6.1.1 Criteria Air Pollutants

In compliance with the requirements of the Federal Clean Air Act (CAA) of 1970 and the Clean Air Act Amendments (CAAA) of 1977 and 1990, EPA promulgated and adopted the National Ambient Air Quality Standards (NAAQS) to protect public health, safety, and welfare from known or anticipated effects of six criteria pollutants. These criteria pollutants are ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), particulate matter (PM_{10} and $PM_{2.5}$), and lead (Pb). Table 4.6-1 lists the primary and secondary NAAQS and Minnesota Ambient Air Quality Standards (AAQS0 for these pollutants in micrograms per cubic meter ($\mu g/m^3$) and, in some cases, parts per million (ppm). Primary standards set limits to protect public health, including the health of "sensitive" populations (e.g., asthmatics, children, and the elderly) while secondary standards set limits to protect public welfare (e.g., animals, crops, vegetation, buildings, and visibility). For the purpose of this study only CO was analyzed to determine potential impacts on air quality from the project.

Table 4.6-1. National and Minnesota Ambient Air Quality Standards

Pollutant	Averaging Period	NAAQS and MN AAQS (µg/m3 unless noted)	
		Primary	Secondary
Carbon Monoxide (CO)	8-hour[a]	10,000 (9 ppm)	10,000
	1-hour[a]	40,000 (35 ppm)	40,000
Sulfur Dioxide (SO_2)	Annual[e, f]	80 (0.03 ppm)	60 (0.02 ppm)
	24-hour[a, e, f]	365 (0.14 ppm)	- -
	3-hour[a]	- -	1,300 (0.5 ppm)
	1-hour[a, g]	196.5 (0.075 ppm)	- -
Nitrogen Dioxide (NO_2)	Annual	100 (0.053 ppm)	100
	1-hour[a, e]	188 (0.100 ppm)	- -
Ozone (O_3)	8-hour[b] (2008)	0.075 ppm	0.075 ppm
	8-hour[b] (1997)	0.08 ppm	0.08 ppm

Pollutant	Averaging Period	NAAQS and MN AAQS (µg/m3 unless noted)	
		Primary	Secondary
	1-hour[h] (Applies only in limited areas)	0.12 ppm	0.12 ppm
Lead (Pb)	Three-month (Calendar Quarter)[e, i]	1.5	1.5
	Rolling Three-month Average	0.15	0.15
PM_{10}	Annual[e]	50	50
	24-hour[a]	150	150
$PM_{2.5}$[d]	Annual[d]	15	15
	24-hour[c]	35	35
		65[e]	65[e]

Source: EPA, National Primary and Secondary Ambient Air Quality Standards (40 CFR 50).
http://www.epa.gov/air/criteria.html - Information Retrieved March 16, 2012
https://www.revisor.mn.gov/rules/?id=7009.0080 – Information Retrieved March 16, 2012.

Notes:

[a] Not to exceed more than once per year, per monitor location. For PM_{10}, averaged over three years.

[b] The 8-hour ozone standard is met if the fourth highest 8-hour ozone concentration, averaged over 3 years, is not greater than 0.075 ppm. This was a new standard published in the Federal Register in 2008. The 1997 standard (0.08 ppm)—and the implementation rules for that standard—will remain in place for implementation purposes as EPA undertakes rulemaking to address the transition from the 1997 standard to the 2008 standard. EPA is in the process of reconsidering the 2008 standard.

[c] In September 2006 EPA revised the 24-hour $PM_{2.5}$ standard from 65 µg/m³ to 35 µg/m³. Minnesota has retained the 65 µg/m³ standard, but the new NAAQS is applicable in Minnesota as well. During any 12 consecutive months 98 percent of the values shall not exceed 35 µg/m³ under the new standard, and 65 µg/m³ under the original applicable standard.

[d] Spatial average standard, applied by EPA over a neighborhood scale.

[e] Minnesota standard only.

[f] The annual and 24-hour SO_2 standards (set in 1971) were revoked in June 2010. However, these standards remain in effect until one year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved. Designations for the 2010 standard are expected to be made by June 2012.

[g] Minnesota also has a 1-hour primary standard which is equal to 3-hour secondary SO_2 standard listed. The National standard is calculated as the 99th percentile of 1-hour daily maximum concentrations (highest fourth high), averaged over 3 years.

[h] The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is < 1. As of June 15, 2005 EPA revoked the 1-hour ozone standard in all areas except the fourteen 8-hour ozone nonattainment Early Action Compact Areas. The 1-hour ozone standard does not apply to the project area.

[i] The calendar quarter lead standard (set in 1978) remains in effect as a National standard until November 8, 2012, except that in areas designated nonattainment for the 1978 standard. In those locations, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

4.6.1.2 Air Toxics

In addition to the criteria air pollutants for which there are NAAQS, the EPA also regulates **air toxics**, known under the CAA as Hazardous Air Pollutants (HAPs). Most air toxics originate from human-made sources, including on-road mobile sources (cars, trucks, etc.), non-road mobile sources (such as locomotives, construction equipment, or airplanes), **area sources** (such as dry cleaners), and stationary sources (such as factories or refineries). The Federal Highway Administration (FHWA) has prepared guidance (FHWA 2009) on the analysis of mobile source air toxics (MSAT) for highway projects. In this guidance, FHWA recommends:

"Air Toxics" are pollutants that are known or suspected to cause cancer or other serious health effects or adverse environmental effects. Examples include benzene, which is found in gasoline; perchlorethlyene, which is emitted from some dry cleaning facilities; and methylene chloride, which is used as a solvent and paint stripper.

The EPA defines "area sources" as those sources that emit less than 10 tons annually of a single hazardous air pollutant or less than 25 tons annually of a combination of hazardous air pollutants.

- No analysis -- for projects which qualify as categorical exclusion status (under 23 C.F.R. §771.117(c), exempt under 40 C.F.R. §93.126, or which have no meaningful potential MSAT effects because of no meaningful impacts on traffic volumes or vehicle mix.
- Qualitative analysis -- for projects that serve to improve operations of highway, transit, or freight without adding substantial new capacity or without creating a facility that is likely to meaningfully increase MSAT emissions.
- Quantitative analysis -- for projects which alter a major intermodal freight facility that has the potential to concentrate high levels of diesel particular matter in a single location or those which create new or add significant capacity to urban highways where traffic volume is projected to be in the range of 140,000 to 150,000 annual average daily traffic (AADT) or greater by the design year.

Although this guidance is not directly applicable to this (non-highway) project, air toxics are addressed qualitatively here based on the above descriptions.

MSATs are a subset of the 188 air toxics, or HAPs, defined by the CAA. MSATs are compounds emitted from highway vehicles and non-road equipment. Some toxic compounds are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary products of combustion. Metal air toxics also result from engine wear and from impurities in oil or gasoline (EPA 2000).

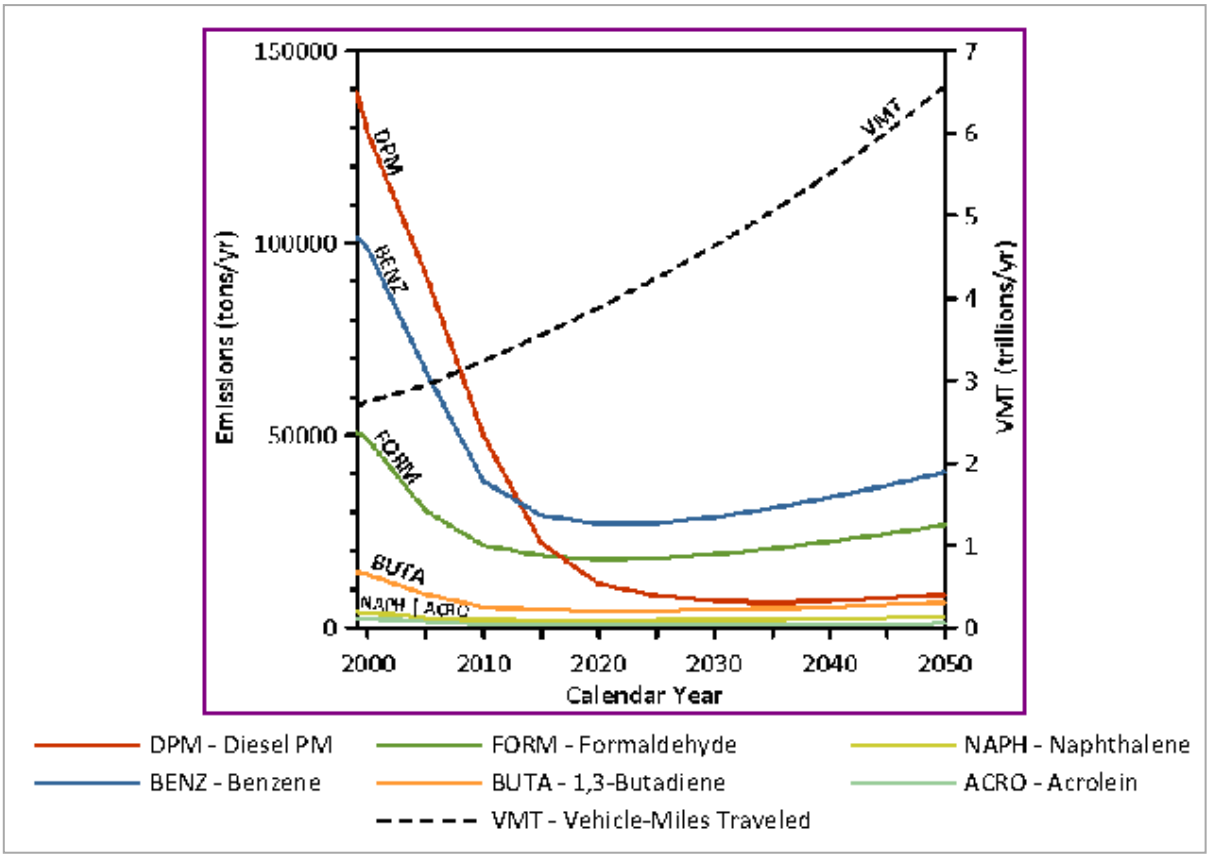
EPA is the lead federal agency for administering the CAA and has certain responsibilities regarding the health effects of MSATs. EPA issued a Final Rule for the Control of Hazardous Air Pollutants from Mobile Sources (*Federal Register* 2007). This rule was issued under the authority of Section 202 of the CAA. In its rule, the EPA examined the impacts of existing and newly promulgated mobile source emission control and fuel quality programs on emissions of MSATs, including impacts of the final rule referenced above. According to an FHWA analysis using EPA's MOBILE6.2 model, even if vehicle activity (vehicle-miles travelled or VMT) increases by 145 percent as assumed, a combined reduction of 72 percent in the total annual

emission rate for the priority MSAT is projected from 1999 to 2050, which is the difference in the sum of starting and ending emissions for the pollutants shown in Figure 4.6-1.

4.6.1.3 Traffic Analysis

The traffic analysis completed for this Draft EIS indicates that several intersections are anticipated to degrade to level of service (LOS) D, E, or F because of LRT at-grade crossings. LRT stations, specifically those with park and ride facilities, will cause localized increases in traffic along the adjacent roadways. For these intersections and locations near LRT stations, MSAT emissions can be expected to temporarily increase. As noted in the above paragraph, however, FHWA estimates that an overall reduction in MSATs will occur by 2050, so whatever increases occur at these locations are expected to be offset in the future, regardless of the alternative chosen.

Figure 4.6-1. National MSAT Emission Trends 1999 – 2050 for Vehicles Operating on Roadways Using EPA's MOBILE6.2 Model[a]



Source: U.S. Environmental Protection Agency. MOBILE6.2 Model run 20 August 2009, retrieved from http://www.fhwa.dot.gov/environment/airtoxic/100109guidmem.htm on April 2, 2010.

Notes:

[a] Annual emissions of polycyclic organic matter are projected to be 561 tons/yr for 1999, decreasing to 373 tons/yr for 2050. Trends for specific locations may be different, depending on locally derived information representing vehicle-miles travelled, vehicle speeds, vehicle mix, fuels, emission control programs, meteorology, and other factors

According to EPA estimates, the lifetime cancer risk from all sources of air pollution ranges from one to 25 cases per million people in rural areas, and 25 to 50 cases per million people in urban areas. These risks compare to an overall lifetime cancer risk from all causes of 330,000 cases per million people. Although little is known about the existing levels of MSATs near roadways in the Southwest Transitway Study Area, it is apparent, based on the nationwide reductions forecast using by EPA's MOBILE6.2 model as shown in Figure 4.6-1, that MSAT concentrations and associated risks should generally decline in coming decades, even with substantial traffic growth. In FHWA's view, information is incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with a proposed set of highway alternatives. Information related to incomplete or Unavailable Information for Project-Specific MSAT Analysis is presented in Appendix H.

4.6.1.4 Local Regulatory Setting

Transportation air quality conformity is a CAA requirement that calls for EPA, U.S. Department of Transportation (USDOT), and various regional, state, and local government agencies to integrate the air quality and transportation planning processes. Transportation air quality conformity supports the development of transportation plans, programs, and projects that enable areas to meet and maintain NAAQS for O_3, PM, and CO. Transportation plans, programs, and projects have to support, and must be in conformity with, the **State Implementation Plan** (SIP) for achieving NAAQS.

States submit "State Implementation Plans" to EPA for approval to meet specific requirements of the Clean Air Act, including the requirement to attain and maintain the National Ambient Air Quality Standards (NAAQS).

Under Section 176(c) of the CAA [42 U.S.C. § 7670(c)], federal agencies such as the FTA are prohibited from engaging in, supporting in any way, providing financial assistance for, licensing or permitting, or approving any activity that does not conform to an approved SIP. Based on measurements of National Ambient Air Quality Standards (NAAQS), EPA designates areas as being equal to or better than NAAQS (attainment), worse than NAAQS (nonattainment), or recently re-designated as attainment from nonattainment (maintenance). This project is located in an EPA designated maintenance area. Because the proposed project is located in a maintenance area, FTA is responsible for ensuring that projects conform to the SIP. A conforming project is defined as one that conforms to the SIP objectives of eliminating or reducing the severity and number of violations of NAAQS and achieving expeditious attainment of those standards.

4.6.2 Methodology

According to the Transportation Conformity Rule (40 C.F.R. § 93.116(a)), FHWA/FTA projects must not cause or contribute to any new localized CO violations (a hot spot) or increase the severity of any existing CO violations in CO nonattainment and maintenance areas. Procedures for determining hot-spot CO concentrations are set forth in 40 C.F.R. § 93.123. However, EPA has approved a screening method for the Twin Cities area to determine if a hot-spot analysis is necessary. The first criterion in this screening method is to determine if the project annual average daily traffic

(AADT) is greater than the benchmark AADT. The AADT is the average number of motor vehicle trips per day based on a calendar year period. The benchmark AADT for the Twin Cities is 79,400, as identified in The Minnesota Department of Transportation's (MnDOT's) Hot Spot Screening Method Flow Chart. This value is equal to the Twin Cities intersection with the highest AADT (Trunk Highway [TH] 169 at CSAH 81, based on 2007 data). However, this criterion is not applicable as project ADT is not applicable to this LRT project.

The second criterion is to determine whether the project involves one of the "top 10" intersections in the Twin Cities CO Maintenance Area. None of the top 10 intersections listed in the screening procedure are affected by the project. One of the intersections (Hennepin Avenue at Lake Street) is within the general study area, but the proposed LRT alignment [Alternatives LRT 3C-1 (Nicollet Mall) and LRT 3C-2 (11th/12th Street)] is grade separated at the point where it intersects Hennepin Avenue closest to Lake Street, and traffic at the intersection is not expected to be affected. The results of the screening procedure indicate that the project does not require "hot-spot analysis."

The CAA amendments of 1977 and 1990 require federal agencies and metropolitan planning organizations to demonstrate that all transportation projects conform to the approved air quality SIPs, which is defined as "conformity to a SIP's purpose of eliminating or reducing the severity and number of violations of the national ambient air quality standards" (*Federal Register* 1993, p. 62188).

4.6.3 Existing Conditions

The study area is located in Hennepin County, which has been designated as a maintenance area for CO and SO_2 by EPA. Maintenance designations are applied to areas that were previously designated as nonattainment areas, but now attain the NAAQS. Maintenance areas must have an EPA-approved plan in place to ensure that they do not revert to nonattainment status. Because of the maintenance designation for CO, the transportation air quality conformity rule (40 C.F.R. § 93, Subpart A) applies to the region.

This project is consistent with the region's long-range transportation plan, the 2030 Transportation Policy Plan (TPP) (2009). This project is included in the transportation conformity section of the 2030 TPP. The regional analysis shows that emissions are below the EPA-established emissions budget for the region. This project does not interfere with the implementation of any transportation control measure included in the SIP. The 2030 TPP (2009) was determined to conform to the requirements of the 1990 CAA (according to 40 C.F.R. §§ 1 and 93) by FHWA and FTA on September 26, 2009. The project's design concept and scope are not significantly different from that used in the 2030 TPP conformity analyses.

The proposed Southwest Transitway is included in the 2030 TPP, as amended by the Metropolitan Council on May 26, 2010, and meets all relevant regional emissions analysis and budget tests. As such, the project conforms to the relevant sections of the Federal Conformity Rule and to the applicable sections of Minnesota SIP for air quality. The Council made a new conformity determination for the 2030 TPP on May 26, 2010, and is awaiting FHWA and FTA concurrence. Therefore, the project meets and conforms to the requirements of the CAA and the Transportation

Conformity Rule (40 C.F.R. § 93) and no additional project-specific regional emissions analysis is needed under Transportation Conformity rules.

The Freight Rail Relocation Segment, however, is not included in the Metropolitan Planning Organization's Long Range Transportation Policy Plan (LRTPP) or in the four-year Transportation Improvement Program (TIP). As defined by MnDOT, a regionally significant project (unless specifically exempted) is a transportation project that is on a facility which serves regional transportation needs (such as access to and from the area outside of the region, major activity centers in the region, major planned developments such as new retail malls, sports complexes, etc., or transportation terminals as well as most terminals themselves) and would normally be included in the modeling of a metropolitan area's transportation network, including at a minimum all principal arterial highways and all fixed guide-way transit facilities that offer an alternative to regional highway travel. The Freight Rail Relocation Segment would not result in additional train trips or unforeseen stops or idling compared to the current freight operating scenario for the region (e.g., no net increase in train operations in the region, but rather a relocation of existing operations).

Under the MnDOT definition, the Freight Rail Relocation Segment is not considered a regionally significant project for the purposes of air quality conformity and, as such, is in conformance with the requirements of the CAAA and the Conformity Rules, 40 C.F.R. § 93. In the event that federal funds are secured to construct the Southwest Transitway, the Metropolitan Council will either adopt or amend (depending on timing) their annual Transportation Improvement Program (TIP). The TIP is a fiscally constrained document listing all federally funded projects to be implemented within a four-year timeframe.

The three most recent complete calendar years of air pollutant monitoring data available (2008–2010) for Hennepin County were obtained from EPA's on-line AirData database (EPA 2012). For some pollutants (NO_2 and O_3), monitoring data applicable to the proposed project are not available.

Air quality data from the monitoring locations nearest the study area are summarized in Table 4.6-2 to Table 4.6-6. All of the monitoring data shown in the following tables indicate compliance with Minnesota AAQS and NAAQS.

Table 4.6-2. Monitored Carbon Monoxide

Year	No. of 1-hour observations	1-hour H2Hb (ppm)	1-hour NAAQS/MN AAQS (ppm)	8-hour H2H (ppm)	8-hour NAAQS/MN AAQS (ppm)
2008	8,730a	2	35	1	9
2009	8,373a	2		2	
2010	8,669a	3		2	

Notes:
[a] Monitor located at 528 Hennepin Avenue in Minneapolis.
[b] High second high value

Table 4.6-3. Sulfur Dioxide

Year	No. of 1-hour observations	1-hour H2H[b] (ppm)	1-hour NAAQS/MN AAQS (ppm)	24-hour H2H (ppm)	24-hour MN AAQS (ppm)
2008	7,797[a]	0.042	0.075	0.013	0.140
2009	8,603[a]	0.049		0.026	
2010	8,564[a]	0.030		0.010	

Notes:
[a] Monitor located at 528 Hennepin Avenue in Minneapolis.
[b] High second high value

Table 4.6-4. Monitored Particulate Matter under 10 Microns in Diameter

Year	No. of 24-hour observations	24-hour H2H[c] (µg/m³)	24-hour NAAQS/MN AAQS (µg/m³)
2008	54[a]	47	150
	59[b]	40	
2009	56[a]	50	
	57[b]	43	
2010	53[a]	52	
	42[b]	42	

Notes:
[a] Monitor located at 309 2nd Avenue S in Minneapolis.
[b] Monitor located at 4646 North Humboldt in Minneapolis.
[c] high second high value

Table 4.6-5. Monitored Particulate Matter under 2.5 Microns in Diameter

Year	No. of 24-hour observations	24-hour H4H[e] (µg/m3)	24-hour NAAQS/MN AAQS (µg/m3)	Weighted Annual Mean (µg/m³)	Annual NAAQS/MN AAQS (µg/m3)
2008	120[a]	21.8	35	9.4	15
	122[b]	21.2		10	
	121[c]	25.7		10.3	
	120[d]	24.8		10.1	
2009	94[a]	29.2		10.1	
	122[b]	32.6		10.1	
	109[c]	33.2		10.6	
	113[d]	26.6		9.4	
2010	114[b]	26.4		9.1	
	114[d]	25.7		9	

Notes:
[a] Monitor located at 7020 12th Avenue S in Richfield.
[b] Monitor located at 2727 10th Avenue S in Minneapolis.
[c] Monitor located at 4646 North Humboldt in Minneapolis.
[d] Monitor located at 5005 Minnetonka Boulevard in St. Louis Park.
[e] High second high value

Table 4.6-6. Monitored Lead

Year	No. of 24-hour observations	24-hour maximum[e]	Rolling 3-Month Average NAAQS/MN AAQS (µg/m³)
2008	59[a]	0.04	0.15
	58[b]	0.01	
	58[c]	0.02	
	54[d]	0.04	
2009	58[a]	0.03	
	58[b]	0.01	
	58[c]	0.01	
	57[d]	0.02	
2010	58[a]	0.02	
	59[b]	0.2	
	43[c]	0.01	

Notes:

[a] Monitor located at 2727 10th Avenue S in Minneapolis.
[b] Monitor located at 309 2nd Avenue S in Minneapolis.
[c] Monitor located at 4646 North Humboldt in Minneapolis.
[d] Monitor located at 5005 Minnetonka Boulevard in St. Louis Park.
[e] The 3-month average statistic currently is not available from EPA's AirData database. Annual maximum is shown.

4.6.4 Long-Term Effects

The EPA has approved a screening method to determine which intersections require hot-spot analysis. Application of the screening method to this project demonstrates that the intersections within the Southwest Transitway study area including the Freight Rail Relocation Segment do not require hot-spot analysis. The Freight Rail Relocation Segment is not directly adding additional vehicle traffic volume to any local intersection; therefore, air quality localized impacts should be similar with or without the Freight Rail Relocation Segment. Queuing of vehicles when freight trains block at-grade crossings would be similar with or without the Freight Rail Relocation Segment and would not adversely affect air quality. Therefore, detailed air quality modeling using available traffic model data has not been completed at this time. The long-term effects presented in this section provide a general understanding of potential changes to traffic patterns, and a general expectation that air quality will generally improve as applicable mobile source regulations require and technology allows.

The traffic analysis completed for this Draft EIS indicates that several intersections are anticipated to degrade to LOS D, E, or F as a result of LRT at-grade crossings (see Section 6.2 of this Draft EIS). LRT stations, specifically those with park and ride facilities, will cause localized increases in traffic along adjacent roadways. For these intersections and locations near LRT stations, air quality can be expected to degrade in the short-term. In spite of short-term impacts to localized areas, EPA expects air quality to improve in general as recent regulations are fully implemented over the long-term. Key regulations yet to be fully employed and relating to mobile sources include the Tier II Vehicle and Gasoline Sulfur Rule, the Heavy-Duty Highway Diesel Rule, and the Mobile Source Air Toxics (MSAT) Rule.

As shown in the energy analysis completed for this Draft EIS (see Section 4.11), all of the Build Alternatives have slightly lower operational energy consumption as compared to the No Build Alternative(assuming the source of energy is a source that produces air pollution, using less of that source will create less air pollution). The amount and type of emissions resulting from the electricity used to power the light rail are dependent on the type of electric generation (i.e., coal versus wind versus nuclear, etc.) used to supply power to the system. The energy decrease would contribute to slightly lower emissions for any of the Build Alternatives as compared to the No Build Alternative if one assumes equivalent sources of power generation across all alternatives. Additionally, while the energy usage associated with conventionally-powered heavy duty vehicles, buses, and passenger vehicles contribute to emissions increases along their locally travelled routes, energy usage due to light rail contribute to emissions increases near the source of the power generation. Given that the change in regional energy consumption between any of the alternatives and the No Build Alternative is much less than one percent of the total regional energy consumption, however, it is anticipated that these impacts will be negligible regardless of where the emissions are generated or how the increased energy is produced.

The Freight Rail Relocation Segment will improve the operational efficiency of freight through the City of St. Louis Park. This Freight Rail Relocation Segment has been determined to generate minimal air quality impacts for CAAA criteria pollutants and

has not been linked with any special MSAT concerns. As such, the Freight Rail Relocation Segment will not result in changes in traffic volumes, vehicle mix, basic project location, or any other factor that would cause an increase in MSAT impacts of the project from that of a no action option. Queuing of vehicles when freight trains block at-grade crossings would be similar with or without the Freight Rail Relocation Segment and would not adversely affect air quality.

4.6.5 Short-Term Construction Effects

The potential for short-term impacts to air quality from construction exists for all the Build Alternatives. Impacts would be similar for all alternatives, and would be related to emissions from construction equipment, fugitive dust from exposed soils, and emissions from traffic interruption or detours.

4.6.6 Mitigation

Project-related construction equipment and vehicles that show excessive emissions of exhaust gases due to poor engine adjustments, or other inefficient operating conditions, will be shut down until repairs or adjustments have been made. Temporary impacts from fugitive dust will be minimized or avoided by using BMPs. These may include, but are not limited to, applying water to exposed soils, limiting the extent and duration of exposed soil, and limiting the amount of idle time for construction equipment.

4.7 Noise

This section discusses the existing conditions, and potential impacts related to operational and construction-related airborne noise from the proposed Southwest Transitway Project. The noise analysis followed FTA guidelines published in "Transit **Noise** and **Vibration** Impact Assessment" (FTA 2006, *www.fta.dot.gov/documents/FTA_Noise_and_Vibration_Manual.pdf*).

"Noise" is any disagreeable or undesired sound or other audible disturbance.

"Vibration" is an oscillation wherein the quantity is a parameter that defines the motion of a mechanical system.

The project team performed a Detailed Noise Assessment in accordance with FTA guidelines to assess project-related airborne noise. Analysis results identified the potential noise impacts throughout the project corridor. Noise from bells, horns, wheel squeal, and wheel-rail interaction (wayside noise) contribute to the projected noise impacts. Noise Analysis results determined that all of the proposed project alternatives have potential to cause noise impacts according to the FTA definition.

4.7.1 Methodology

Airborne noise effects associated with the proposed Southwest Transitway Project were evaluated using the FTA's Detailed Noise Assessment methods (FTA 2006). The methodology included identifying noise-sensitive land uses, measuring existing outdoor noise levels in the project area, using the existing noise levels to identify noise impact thresholds, calculating project-related outdoor noise levels, and determining if project-related noise levels exceed FTA noise impact thresholds.

FTA noise impact thresholds vary depending on land use and existing noise exposure. Two types of noise impacts are included in the FTA criteria. The type of impact affects whether noise mitigation is implemented.

- **Severe Impact.** A significant percentage of people are highly annoyed by noise in this range. Noise mitigation would normally be specified for severe impact areas unless it is not feasible or reasonable (unless there is no practical method of mitigating the impact).
- **Moderate Impact.** In this range, other project-specific factors are considered to determine the magnitude of the impact and the need for mitigation. Other factors include the predicted increase over existing noise levels, the types and number of noise-sensitive land uses affected, existing outdoor-indoor sound insulation, and the cost-effectiveness of mitigating noise to more acceptable levels.

Refer to Appendix H for details on the noise impact criteria.

The project team identified noise-sensitive land uses during windshield surveys of the project corridor while performing noise monitoring activities. Digital aerial photographs, land use-related GIS files, and maps were used to identify noise-sensitive land uses in the project area; cities along the corridor also provided input on likely noise sensitive sites.

Additionally, several proposed locations for a new Operation and Maintenance Facility (OMF) were assessed. For the OMF noise assessment, a screening-level assessment was performed according to the FTA manual. This results in a broad appraisal of the number of potentially noise-sensitive land uses.

4.7.2 Existing Conditions

FTA noise impact criteria are based upon land use and existing noise levels. The project team initially identified noise-sensitive land uses that could possibly be affected by project-related noise. Then the existing noise levels at these noise-sensitive land uses was either measured directly, or estimated based upon these representative measurements.

4.7.2.1 Noise-sensitive Land Uses

To determine noise-sensitive land uses, the FTA screening procedure was used. Parcels within a certain distance of the project were identified for application of the FTA criteria for land use Category 1, Category 2, or Category 3, according to the descriptions of these categories. Table 4.7-1 summarizes the noise-sensitive land uses included located along the corridor.

Table 4.7-1. Summary of Noise-Sensitive Land Uses

Segment	Land Use Category	Noise-Sensitive Parcels (Units[a])
Segment 1	1	2 (2)
	2	730 (735)
	3	9 (9)
Total		741 (746)
Segment 3	1	3 (3)
	2	90 (527)
	3	9 (9)
Total		102 (539)
Segment 4	1	1 (1)
	2	646 (1,076)
	3	16 (16)
Total		663 (1,093)
Segment A	1	3 (3)
	2	642 (1,143)
	3	12 (12)
Total		657 (1,158)
Segment C-1	1	13 (13)
	2	1,300 (4,892)
	3	75 (75)
Total		1,388 (4,980)
Segment C-2	1	6 (6)
	2	1,291 (4,554)
	3	62 (62)
Total		1,359 (4,622)

[a] "Units" refers to the number of dwelling units, offices, commercial spaces, or other land uses that occupy a single parcel and that would be affected by noise. For example, a single parcel of land may be occupied by an apartment complex with 10 apartments or dwelling "units".

The following are brief discussions of noise-sensitive land uses along the corridor.

Segment 1 (LRT 1A): Highway 5 Station to Shady Oak Station

Noise-sensitive land uses the project team identified along Segment 1 included the following:

- Category 1 noise-sensitive land uses: 2
- Category 2 noise-sensitive land uses: 730 (735 units)
- Category 3 noise-sensitive land uses: 9

The Category 1 noise-sensitive land uses included two recording studios. The Category 2 noise-sensitive land uses were mostly single-family or multifamily

residences in a suburban setting. The Category 3 noise-sensitive land uses included several parks, schools, and churches.

Segment 3 [LRT 3A (LPA), LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street)]: Mitchell Station to Shady Oak Station

Noise-sensitive land uses the project team identified along Segment 3 included the following:

- Category 1 noise-sensitive land uses: 3
- Category 2 noise-sensitive land uses: 90 (527 units)
- Category 3 noise-sensitive land uses: 9

The Category 1 noise-sensitive land uses included two recording studios and a park with a band-shell. The Category 2 noise-sensitive land uses were single-family and multifamily residences in a suburban setting, as well as several hotels. The Category 3 noise-sensitive land uses included several schools and churches.

Segment 4 [LRT 1A, LRT 3A (LPA), LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street)]: Shady Oak Station to West Lake Station

Noise-sensitive land uses the project team identified along Segment 4 included the following:

- Category 1 noise-sensitive land uses: 1
- Category 2 noise-sensitive land uses: 646 (1,076 units)
- Category 3 noise-sensitive land uses: 16

The Category 1 noise-sensitive land uses included one recording studio. The Category 2 noise-sensitive land uses were mostly single-family and multifamily residences in an urban setting. The Category 3 noise-sensitive land uses included several schools, a few churches, and a few parks.

Segment A [LRT 1A and LRT 3A (LPA)]: West Lake Station to Intermodal Station

Noise-sensitive land uses the project team identified along Segment A included the following:

- Category 1 noise-sensitive land uses: 3
- Category 2 noise-sensitive land uses: 642 (1,143 units)
- Category 3 noise-sensitive land uses: 12

The Category 1 noise-sensitive land uses included three recording studios. The Category 2 noise-sensitive land uses were mostly single-family and multifamily residences in an urban setting, and some residences in a dense urban setting. The Category 3 noise-sensitive land uses included several parks, two schools, and one meditation center.

Segment C-1 [LRT 3C-1 (Nicollet Mall)]: West Lake Station to 4th Street Station

Noise-sensitive land uses the project team identified along Segment C included the following:

- Category 1 noise-sensitive land uses: 13
- Category 2 noise-sensitive land uses: 1,300 (4,892 units)
- Category 3 noise-sensitive land uses: 75

The Category 1 noise-sensitive land uses included a couple of recording studios in a dense urban setting, as well as several recording studios located downtown. Orchestra Hall on the Nicollet Mall is also a Category 1 land use. The Category 2 noise-sensitive land uses were mostly single-family and multifamily residences in a dense urban setting, along with several downtown hotels. The Category 3 noise-sensitive land uses include parks, churches, public libraries, a few museums and other cultural buildings, several regional dramatic theaters, movie theaters, auditoria on Hennepin Avenue, which frequently feature touring acts, and the Minneapolis Convention Center. Schools are also included in Category 3 land uses including several primary and secondary schools, Minneapolis College of Art and Design, and portions of the University of St. Thomas.

Segment C-2 [LRT 3C-2 (11th/12th Street)]: West Lake Station to Intermodal Station

Noise-sensitive land uses along Segment C-2 were largely the same as for Segment C-1, but differed north of Grant Street, at the south end of downtown. Land uses the project team identified along Segment C-1, including the duplicates with Segment C, included the following:

- Category 1 noise-sensitive land uses: 6
- Category 2 noise-sensitive land uses: 1,291 (4,554 residential units)
- Category 3 noise-sensitive land uses: 62

The Category 1 noise-sensitive land uses included two recording studios in a dense urban setting, as well as two recording studios located downtown. Orchestra Hall on the Nicollet Mall is also a Category 1 land use. The Category 2 noise-sensitive land uses were mostly single-family and multifamily residences in a dense urban setting. The Category 3 noise-sensitive land uses include parks, churches, public libraries, museums and other cultural buildings, several regional dramatic theaters, movie theaters, auditoria on Hennepin Avenue which frequently feature touring acts, and the Minneapolis Convention Center. Schools are also included in Category 3 land uses including several primary and secondary schools, Minneapolis Community and Technical College, Minneapolis College of Art and Design, and portions of the University of St. Thomas.

There are further sub-alternatives for the tunnel portion of the C-2 segment. Segment C-2A is the same as Segment C-2 except the tunnel will run underneath Blaisdell Avenue. Likewise for Segment C-2B, the tunnel is planned to run underneath 1st Avenue. Although some **receptors** are included or excluded depending upon the tunnel location, the nature of the land uses along these alignments are largely the same.

"Receptors" (noise and vibration) are places or areas that may be affected by changes in noise and vibration. Generally they are residential areas, churches, schools, recreation areas, hospitals, etc.

4.7.2.2 Existing Noise Level Measurements

The project team characterized the existing noise levels by conducting long-term (24-hour) and short-term (1-hour) noise measurements at representative noise-sensitive locations. Measurements were executed according to requirements and descriptions in the FTA manual, and according to best practices and applicable portions of national and international standards. Figure 4.7-1 shows the general monitoring locations and Figure 4.7-2 illustrates the location of noise-sensitive land uses by category.

4.7.3 Long-Term Effects

4.7.3.1 No Build Alternative

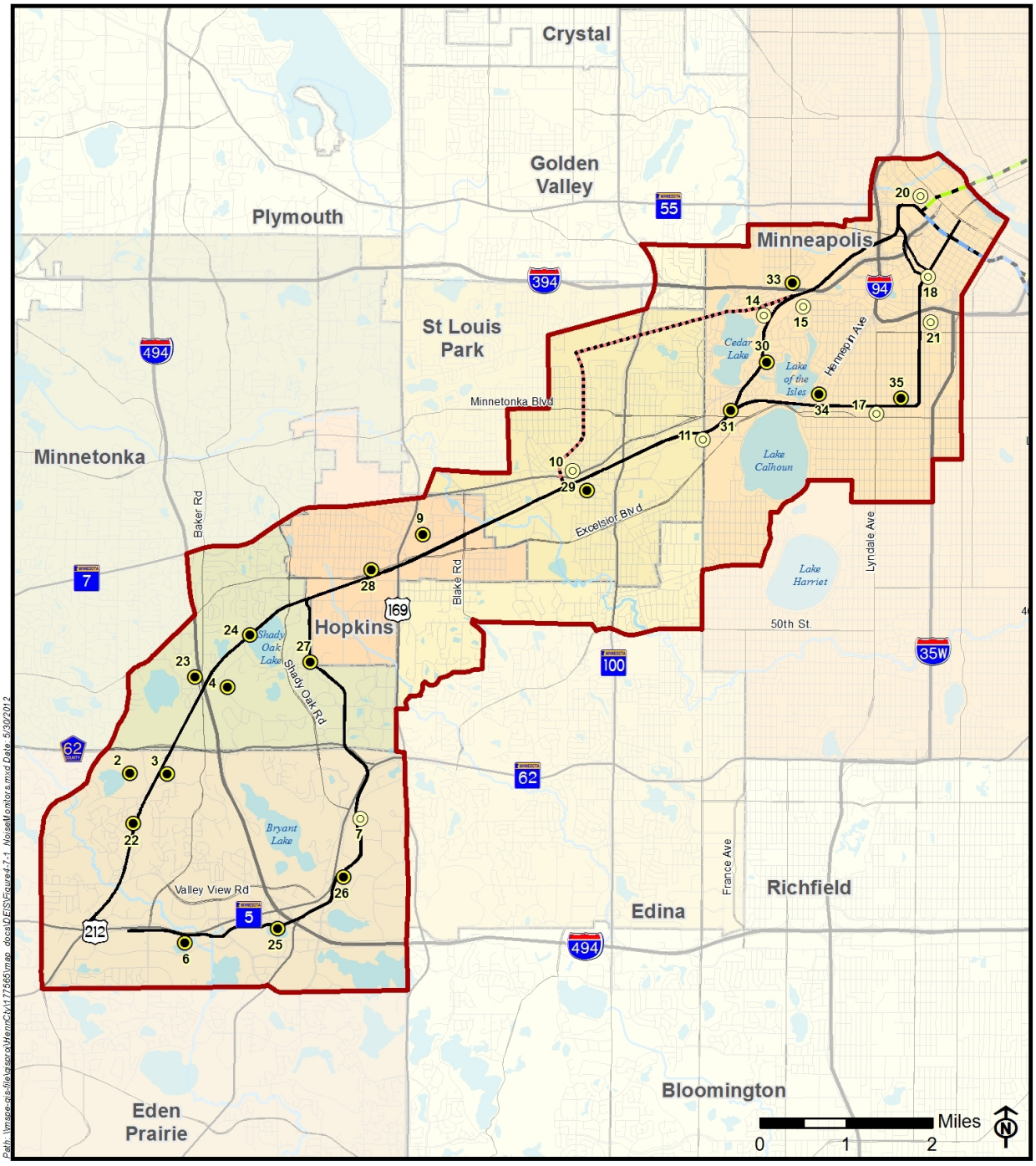
The No Build Alternative would not provide a new option for mobility or congestion mitigation, nor would it improve access and cohesion between neighborhoods. The primary mode of travel in the study area is, and would continue to be, the private automobile. The No Build Alternative would not result in project-related changes to the noise environment.

4.7.3.2 Enhanced Bus Route Alternative

Potential noise effects associated with the Enhanced Bus Alternative include the addition of a new noise source and an increased frequency of noise events. Buses, that would not be present otherwise, would provide the service for the alternative and represent the new noise source adjacent to noise-sensitive receptors along the enhanced bus route. This increase in bus service would increase the number of buses per hour, and thus the noise events.

4.7.3.3 Build Alternatives

The introduction of a new LRT route would add a new noise source to the existing noise environment along the proposed alignments. The assessment of long-term effects to the environment requires a prediction of future project-related noise levels, comparing them to the existing ambient noise levels, and employing FTA criteria to determine any impact.



Legend

- Study Area
- Potential LRT Alignment
- Hiawatha Light Rail
- Freight Rail Relocation
- Northstar Commuter Rail

Noise Monitor Location

- 24-Hour Monitoring
- 1-Hour Monitoring

Figure 4.7-1
Noise Monitoring Locations

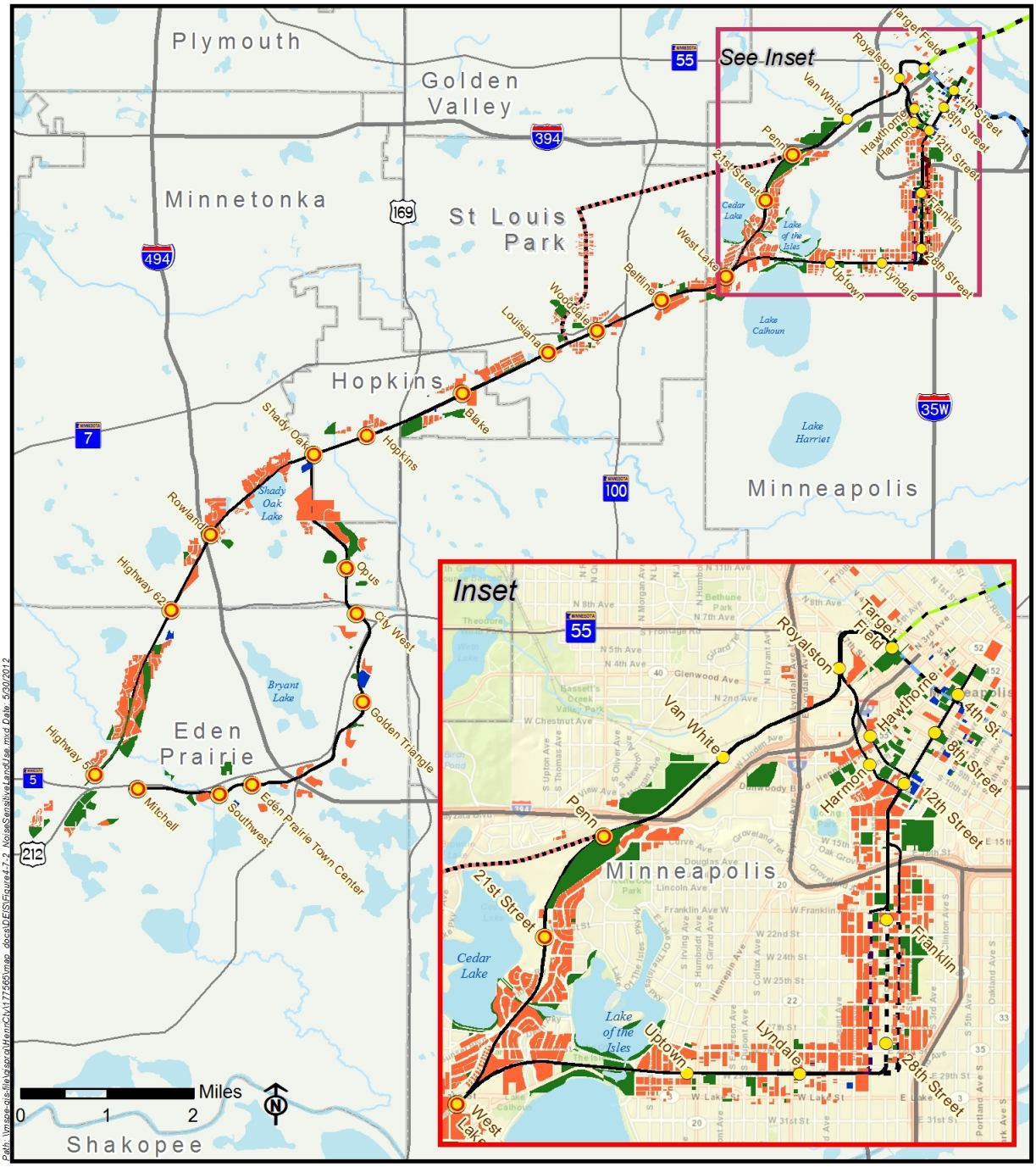


Figure 4.7-2
Noise Sensitive Land Use

Data: MnDOT, DNR, MetCouncil, Hennepin County

4.7.3.4 Project Noise Levels

Future project-related noise levels are determined through calculation procedures in the FTA guidance manual. The manual includes general noise emission levels for the noise sources proposed for this project. Measured noise emission levels of similar or identical noise sources are more accurate than the general noise emission levels because they represent project-specific conditions. The project team measured airborne noise from the Hiawatha LRT as the basis for the sound exposure levels used in the analysis. Reference sound exposure levels (SEL) for Southwest Transitway noise sources were determined using field measurements on the Hiawatha line and FTA guidance.

Table 4.7-2 summarizes the sound exposure levels used in Southwest Transitway detailed noise analysis.

Table 4.7-2. Sound Exposure Levels used in the Noise Analysis

Noise Source	Sound Exposure Level (SEL), dBA	Notes
Light Rail Vehicle Pass-by on embedded track	84	This value is based on measurements of light rail vehicle pass-bys on the Hiawatha line. The site included at-grade, embedded track.
Light Rail Vehicle Pass-by on ballast track	81	This value is based on measurements of light rail vehicle pass-bys on the Hiawatha line. The site included at-grade, ballast track.
Stationary Crossing Signal	106	This value is based on measurements of stationary crossing signals on the Hiawatha line.
Light Rail Vehicle Audible Warning Signal (bells)	88	This value is based on measurements of bell operation during light rail vehicle pass-bys on the Hiawatha line.
Light Rail Vehicle Warning Horns	99	This value is based on measurements of high-horn operation during light rail vehicle pass-bys on the Hiawatha line.
Light Rail Vehicle Curve Squeal	114	This value is based on measurements of curve squeal by light rail vehicle pass-bys on the Hiawatha line.

Airborne noise impacts were determined using Detailed Noise Assessment methods from the FTA (May 2006) guidance document. The following operational assumptions were incorporated into the assessment.

- 198 LRT trips during the day (7:00 a.m. to 10:00 p.m.).
- 60 LRT trips during the night (10:00 p.m. to 7:00 a.m.).
- 16 trips during each peak hour of operation (6:00 a.m. to 9:00 a.m., 3:00 p.m. to 6:30 p.m.).
- Three articulating cars per transit train.
- Speeds range from 20 to 50 miles per hour (mph), and vary in different segments of the project corridor.
- Light Rail Vehicle bells are used for five seconds as vehicles approach grade crossings, crosswalks and station platforms.

- Light Rail Vehicle horns are sounded at grade crossings and crosswalks where vehicle speeds exceed 45 mph (not including 45 mph).
- Stationary bells are used at preemptive grade crossings and crosswalks for five seconds at each passing of a train.
- This analysis modeled each segment-specific speed to accurately account for proposed operational conditions. Additionally, the acoustical shielding effects of intervening buildings were applied where more than one row of buildings existed. The analysis applied ground attenuation where applicable.

4.7.3.5 Assessment

The unit counts for this analysis were arrived at using Hennepin County GIS parcel data. These data identify multiple property owners for the same parcel of residential property. Using aerial photographs to verify the parcel data, these were determined to be multiunit residences. Each parcel was counted as one land-use, and the number of owners was used to estimate the number of units. This may have omitted from the unit count some multiunit housing where there is one owner with one or more tenants, but these properties would still be counted in the land-uses.

Ambient noise is measured by what is present in existing conditions. Low ambient noise levels cause the impact threshold (the point at which there is an impact) to be lower. Ambient noise levels were as low as 48 dBA on an Leq basis and 51 dBA on an Ldn basis for Segment 1, 55 dBA on an Leq basis and 56 dBA on an Ldn basis for Segment 3, 56 dBA on an Leq basis and 54 dBA on an Ldn basis for Segment 4, 44 dBA on an Leq basis and 52 dBA on an Ldn basis for Segment A, and 58 dBA on an Leq basis and 58 dBA on an Ldn basis for Segment C.

Table 4.7-3 summarizes the results of the noise impact assessment included category 1, 2 and 3 land uses for the four major alternatives. Both the land parcel and individual housing/business unit impacts are presented. Brief discussions of noise impacts along the corridor follow, separated by track segment. A complete list of representative receptors is provided Appendix H, Supporting Technical Reports and Memoranda. Each representative receptor was assessed for project-related noise and it is compared to the existing noise level. LRT 3A (LPA) and LRT 3A-1 (co-location alternative) include the fewest number of moderate and severe impacts overall. LRT 1A has a lower number of moderate and severe impacts than LRT 3C-1 (Nicollet Mall) and LRT 3C-2 (11th/12th Street) because it has a lower number of total units than these alternatives. LRT C-1 (Nicollet Mall) and LRT 3C-2 (11th/12th Street) are located in more densely populated urban areas with a greater number of units per residential parcel.

Table 4.7-3. LRT Noise Impact Summary

Alternative[bc]	Land Use Category	Moderate Impacts Land (Units[a])	Severe Impacts Land (Units[a])
LRT 1A	1	-	-
	2	506 (683)	358 (587)
	3	1 (1)	1 (1)
Total		507 (684)	359 (588)
LRT 3A (LPA)	1	1 (1)	-
	2	271 (598)	201 (520)
	3	1 (1)	-
Total		273 (600)	201 (520)
LRT 3A-1 (co-location alternative)	1	1 (1)	-
	2	221 (639)	267 (610)
	3	1 (1)	-
Total		223 (641)	267 (610)
LRT 3C-1 (Nicollet Mall)	1	4 (4)	-
	2	463 (1425)	262 (1,027)
	3	-	-
Total		467(1429)	262 (1,027)
LRT 3C-2 (11th/12th Street)	1	1 (1)	-
	2	434 (1247)	302 (1,190)
	3	-	-
Total		435 (1248)	302 (1,190)

[a] "Units" refers to the number of dwelling units, offices, commercial spaces, or other land uses that occupy a single parcel and that would be affected by noise. For example, a single parcel of land may be occupied by an apartment complex with 10 apartments or dwelling "units"..

[b] LRT 1A is inclusive of segments 1, 4, A, and FR. LRT 3A (LPA) is inclusive of segments 3, 4, A, and FR. LRT 3A-1 (co-location alternative) is inclusive of segments 3, 4, and A. LRT 3C-1 (Nicollet Mall) is inclusive of segments 3, 4, C-1, and FR. LRT 3C-2 (11th/12th Street) is inclusive of segments 3, 4 C-2, and FR.

[c] Impact counts for alternatives LRT 1A, LRT 3A (LPA), LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street) reflect quiet zones along the MN&S freight rail relocation corridor

It should be noted that potential noise impacts on historical structures will be evaluated as part of the Section 106 process for the project; see Section 3.4 for more information.

Segment 1 (LRT 1A): Highway 5 Station to Shady Oak Station

Category 1

There are no noise impacts to Category 1 land uses in this segment.

Category 2

There are a total of 281 Moderate Noise Impacts and 175 Severe Noise Impacts to Category 2 land uses in this segment. The estimated number of affected residential units is 281 Moderate and 181 Severe (see Table 4.7-4). Some of the impacts are caused by low existing ambient noise levels combined with proximity of residential neighborhoods to the alignment and high anticipated speeds of operation. Many

other impacts stem from low existing ambient noise levels combined with light rail vehicle-mounted audible warning signal use at stations, grade crossings, and crosswalks, specifically the Highway 5 Station, the Roland Station, and the anticipated at-grade crossings at Edenvale Boulevard and Dominick Drive. Light rail vehicles are anticipated to use both horns and bells at the Edenvale Boulevard, Baker Road, and Rowland Road at-grade crossings because of operating speeds higher than 45 mph.

Category 3

There is one Severe Noise Impact to Category 3 land use in this segment due to low existing ambient noise levels combined with proximity to the at-grade crossing at Edenvale Boulevard.

Table 4.7-4 shows the impacts by noise subsegment.

Table 4.7-4. Potential Noise Impacts in Segment 1 (LRT 1A)

Noise Subsegment		Land Use Category	Moderate Impacts Land (Units[a])	Severe Impacts Land (Units[a])
ID	Description			
1-A	Segment 1 between Highway 5 Station and Highway 62 Station	1	-	-
		2	102 (102)	148 (154)
		3	-	1 (1)
1-B	Segment 1 between Highway 62 Station and Rowland Station	1	-	-
		2	14 (14)	27 (27)
		3	-	-
1-C	Segment 1 between Rowland Station and Shady Oak	1	-	-
		2	165 (165)	-
		3	-	-
Segment 1 TOTAL		1	-	-
		2	281 (281)	175 (181)
		3	-	1 (1)

[a] "Units" refers to the number of dwelling units, offices, commercial spaces, or other land uses that occupy a single parcel and that would be affected by noise. For example, a single parcel of land may be occupied by an apartment complex with 10 apartments or dwelling "units".

Segment 3 [LRT 3A (LPA), LRT 3A-1 (Co-location alternative), LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street)]: Mitchell Station to Shady Oak Station

Category 1

There is one Severe Noise Impact to Category 1 land use in this segment due to proximity to the anticipated at-grade crossing at 5th Street South combined with high speeds of operation and light rail vehicle-mounted audible warning signal use at the at-grade crossing. Light rail vehicles are anticipated to use both horns and bells at the 5th Street South at-grade crossing due to operating speeds higher than 45 mph.

Category 2

There are a total of 46 Moderate Noise Impacts and 18 Severe Noise Impacts to Category 2 land uses in this segment. The estimated number of impacted residential units is 196 Moderate and 114 Severe. Some of the impacts are due to proximity of receptors to the alignment and high speeds of operation. Additional impacts are due to an anticipated at-grade crossing at Smetana Road. Light rail vehicles are anticipated to use both horns and bells at the Smetana Road at-grade crossing due to operating speeds higher than 45 mph.

Category 3

There are no noise impacts to Category 3 land uses in this segment.

Table 4.7-5 shows the impacts by noise subsegment.

Table 4.7-5. Potential Noise Impacts in Segment 3 [LRT 3A (LPA), LRT 3C-1 (Nicollet Mall) and LRT 3C-2 (11th/12th Street)]

Noise Subsegment		Land Use Category	Moderate Impacts Land (Units[a])	Severe Impacts Land (Units[a])
ID	Description			
3-A	Segment 3 between Mitchell Station and Southwest Station	1	-	-
		2	2 (146)	1 (91)
		3	-	-
3-B	Segment 3 between Southwest Station and Eden Prairie Town Center Station	No impacts predicted		
3-C	Segment 3 between Eden Prairie Town Center Station and Golden Triangle Station	No impacts predicted		
3-D	Segment 3 between Golden Triangle Station and City West Station	No impacts predicted		
3-E	Segment 3 between City West Station and Opus Station	No impacts predicted		
3-F	Segment 3 between Opus Station and Shady Oak Station	1	1 (1)	-
		2	44 (50)	17 (23)
		3	-	-
Segment 3 TOTAL		1	1 (1)	-
		2	46 (196)	18 (114)
		3	-	-

[a] "Units" refers to the number of dwelling units, offices, commercial spaces, or other land uses that occupy a single parcel and that would be affected by noise. For example, a single parcel of land may be occupied by an apartment complex with 10 apartments or dwelling "units".

Segment 4 [LRT 1A, LRT 3A (LPA), LRT 3C-1 (Nicollet Mall) and LRT 3C-2 (11th/12th Street)]: Shady Oak Station to West Lake Station

Under Build Alternatives LRT 1A, LRT 3A (LPA), LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street) existing Twin Cities & Western (TC&W) Railroad traffic on the Kenilworth Corridor would be relocated to the MN&S Spur. Due to the relocation, noise levels associated with freight rail traffic are anticipated to decrease along

portions of Segment 4. Estimates of airborne-noise associated with Segment 4 (with the freight relocation), were calculated based on existing noise exposure including existing TC&W freight rail traffic. These estimates account for the decrease in sound level which would occur due to the absence of freight pass-by events.

Category 1

There are no noise impacts to Category 1 land uses in this segment.

Category 2

There are a total of 107 Moderate Noise Impacts predicted to occur in Segment 4. There are no Severe Noise Impacts in this segment. The estimated number of impacted residential units is 273 Moderate. Some of the impacts are due to moderate existing ambient noise levels, combined with proximity of residential neighborhoods to the tracks and high speeds of operation. Many other impacts are due to low existing ambient noise levels combined with light rail vehicle-mounted audible warning signal use at stations and grade crossings near stations, specifically the Hopkins Station, the Blake Station, the Louisiana Station, the Wooddale Station, the Beltline Station, and the West Lake Station.

Category 3

There are no noise impacts to Category 3 land uses in this segment.

Table 4.7-6 shows the impacts for Segment 4, with the freight rail relocation, by noise subsegment.

Table 4.7-6. Potential Noise Impacts in Segment 4 [LRT 1A, LRT 3A (LPA), LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street)]

Noise Subsegment		Land Use Category	Moderate Impacts Land (Units[a])	Severe Impacts Land (Units[a])
ID	Description			
4-A	Segment 4 between Shady Oak Station and Hopkins Station	No impacts predicted		
4-B	Segment 4 between Hopkins Station and Blake Station	1	-	-
		2	16 (19)	-
		3	-	-
4-C	Segment 4 between Blake Station and Louisiana Station	1	-	-
		2	1 (1)	-
		3	-	-
4-D	Segment 4 between Louisiana Station and Wooddale Station	1	-	-
		2	15 (75)	-
		3	-	-
4-E	Segment 4 between Wooddale Station and Beltline Station	1	-	-
		2	1 (1)	-
		3	-	-
4-F	Segment 4 between Beltline Station and West Lake Station	1	-	-
		2	74 (177)	-
		3	-	-
Segment 4 TOTAL		1	-	-
		2	107 (273)	-
		3	-	-

[a] "Units" refers to the number of dwelling units, offices, commercial spaces, or other land uses that occupy a single parcel and that would be affected by noise. For example, a single parcel of land may be occupied by an apartment complex with 10 apartments or dwelling "units".

Segment 4 with Freight Rail Co-location (LRT 3A-1): Shady Oak Station to West Lake Station

Under Build Alternative LRT 3A-1 (co-location alternative) light rail and TC&W freight traffic would be co-located on the Kenilworth Corridor. Existing TC&W traffic on the Kenilworth Corridor would continue normal operations under the freight rail co-location alternative. Airborne-noise effects associated with Segment 4, with the freight rail co-location, were calculated based on existing noise exposure, including existing TC&W freight rail traffic.

Category 1

There are no noise impacts to Category 1 land uses in this segment.

Category 2

There are a total of 107 Moderate Noise Impacts predicted to occur in Segment 4. There are no Severe Noise Impacts in this segment. The estimated number of residential units projected to experience Moderate Noise Impacts is 273. Some of the impacts are due to relatively low existing ambient noise levels, combined with

proximity of residential neighborhoods to the tracks and high speeds of operation. In other areas where noise impacts are projected to occur, existing ambient noise levels are also low. However use of vehicle-mounted audible warning signals at stations and grade crossings contribute to the projected noise impacts. These occur near stations, specifically the Hopkins Station, the Blake Station, the Louisiana Station, the Wooddale Station, the Beltline Station, and the West Lake Station.

Category 3

There are no noise impacts to Category 3 land uses in this segment.

Table 4.7-7 shows the impacts by noise subsegment.

Table 4.7-7. Potential Noise Impacts in Segment 4 with LRT 3A-1 (co-location alternative)

Noise Subsegment		Land Use Category	Moderate Impacts Land (Units[a])	Severe Impacts Land (Units[a])
ID	Description			
4-A	Segment 4 between Shady Oak Station and Hopkins Station	No impacts predicted		
4-B	Segment 4 between Hopkins Station and Blake Station	1	-	-
		2	16 (19)	-
		3	-	-
4-C	Segment 4 between Blake Station and Louisiana Station	1	-	-
		2	1 (1)	-
		3	-	-
4-D	Segment 4 between Louisiana Station and Wooddale Station	1	-	-
		2	15 (75)	-
		3	-	-
4-E	Segment 4 between Wooddale Station and Beltline Station	1	-	-
		2	1 (1)	-
		3	-	-
4-F	Segment 4 between Beltline Station and West Lake Station	1	-	-
		2	46 (235)	66 (90)
		3	-	-
Segment 4 TOTAL		1	-	-
		2	79 (331)	66 (90)
		3	-	-

[a] "Units" refers to the number of dwelling units, offices, commercial spaces, or other land uses that occupy a single parcel and that would be affected by noise. For example, a single parcel of land may be occupied by an apartment complex with 10 apartments or dwelling "units".

Segment A [LRT 1A and LRT 3A (LPA)]: West Lake Station to Intermodal Station

Under Build Alternatives LRT 1A and LRT 3A (LPA) existing TC&W traffic on the Kenilworth Corridor would be relocated to the MN&S Spur. (Freight rail traffic on the spur would be the existing traffic in the Kenilworth corridor with no change in train activity, consist, etc. This makes the analysis consistent with the noise studies for the Kenilworth Corridor.) Due to the relocation noise levels associated with freight rail

traffic are anticipated to decrease along portions of Segment 4. Airborne-noise impacts associated with Segment A, with the freight relocation, were calculated based on existing noise exposure, including existing TC&W freight rail traffic and account for the decrease in sound level which would occur due to the absence of freight pass-by events.

Category 1

There are no noise impacts to Category 1 land uses in this segment.

Category 2

There are a total of 73 Moderate Noise Impacts and 183 Severe Noise Impacts to Category 2 land uses in this segment. The estimated number of impacted residential units is 85 Moderate and 406 Severe. Many of the impacts are due to low existing ambient noise levels combined with proximity of residential neighborhoods to the alignment and high anticipated speeds of operation. Some impacts are due to low existing ambient noise levels combined with light rail vehicle-mounted audible warning signal (bell) use at the 21st Street Station and the nearby 21st Street at-grade crossing.

Category 3

There is one moderate impact to a Category 3 land use. The impact is due to very low ambient background noise levels found in the walking-trails of the Cedar Lake portion of the Minneapolis Chain of Lakes Regional Park combined with close proximity to the tracks and bell use at grade crossings and crosswalks. This may not apply to the entire Cedar Lake portion of the park, especially in areas where park-goers themselves create higher noise levels, and in areas of the park farther from the tracks.

Table 4.7-8 shows the impacts by noise subsegment.

Table 4.7-8. Potential Noise Impacts in Segment A [LRT 1A and LRT 3A (LPA)]

Noise Subsegment		Land Use Category	Moderate Impacts Land (Units[a])	Severe Impacts Land (Units[a])
ID	Description			
A-A	Segment A between West Lake Station and 21st Street Station	1	-	-
		2	14 (14)	176 (399)
		3	-	-
A-B	Segment A between 21st Street Station and Penn Station	1	-	-
		2	47 (54)	7 (7)
		3	-	-
A-C	Segment A between Penn Station and Van White Station	1	-	-
		2	10 (10)	-
		3	1 (1)	
A-D	Segment A between Van White Station and Royalston Station	1	-	-
		2	2 (6)	-
		3	-	-
A-E	Segment A between Royalston Station and Intermodal Station	No impacts predicted		
Segment A TOTAL		1	-	-
		2	73 (85)	183 (406)
		3	1 (1)	-

[a] "Units" refers to the number of dwelling units, offices, commercial spaces, or other land uses that occupy a single parcel and that would be affected by noise. For example, a single parcel of land may be occupied by an apartment complex with 10 apartments or dwelling "units".

Segment A with Freight Rail Co-location (LRT 3A-1): West Lake Station to Intermodal Station

Under Build Alternative LRT 3A-1 (co-location alternative) light rail and TC&W freight traffic would be co-located on the Kenilworth Corridor. Existing TC&W traffic on the Kenilworth Corridor would continue normal operations under the freight rail co-location alternative. Airborne-noise impacts associated with Segment A, with the freight rail co-location, were calculated based on existing noise exposure, including existing TC&W freight rail traffic.

Category 1

There are no noise impacts to Category 1 land uses in this segment.

Category 2

There are a total of 73 Moderate Noise Impacts and 183 Severe Noise Impacts to Category 2 land uses in this segment. The estimated number of impacted residential units is 85 Moderate and 406 Severe. Many of the impacts are due to low existing ambient noise levels combined with proximity of residential neighborhoods to the alignment and high anticipated speeds of operation. Some impacts are due to low existing ambient noise levels combined with light rail vehicle-mounted audible warning signal (bell) use at the 21st Street Station and the nearby 21st Street at-grade crossing.

Category 3

There is one moderate impact to a Category 3 land use. The impact is due to very low ambient background noise levels found in the walking-trails of the Cedar Lake portion of the Minneapolis Chain of Lakes Regional Park combined with close proximity to the tracks and bell use at grade crossings and crosswalks. This may not apply to the entire Cedar Lake portion of the park, especially in areas where park-goers themselves create higher noise levels, and in areas of the park farther from the tracks.

Table 4.7-9 shows the impacts by noise subsegment.

Table 4.7-9. Potential Noise Impacts in Segment A with LRT 3A-1 (co-location alternative)

Noise Subsegment		Land Use Category	Moderate Impacts Land (Units[a])	Severe Impacts Land (Units[a])
ID	Description			
A-A	Segment A between West Lake Station and 21st Street Station	1	-	-
		2	25 (29)	176 (399)
		3	-	-
A-B	Segment A between 21st Street Station and Penn Station	1	-	-
		2	59 (67)	7 (7)
		3	-	-
A-C	Segment A between Penn Station and Van White Station	1	-	-
		2	10 (10)	-
		3	1 (1)	
A-D	Segment A between Van White Station and Royalston Station	1	-	-
		2	2 (6)	-
		3	-	-
A-E	Segment A between Royalston Station and Intermodal Station	No impacts predicted		
Segment A TOTAL		1	-	-
		2	96 (112)	183 (406)
		3	1 (1)	-

[a] "Units" refers to the number of dwelling units, offices, commercial spaces, or other land uses that occupy a single parcel and that would be affected by noise. For example, a single parcel of land may be occupied by an apartment complex with 10 apartments or dwelling "units".

Segment C-1[LRT 3C-1 (Nicollet Mall)]: West Lake Station to 4th Street Station

Category 1

There are a total of three Moderate Noise Impacts to Category 1 land uses in this segment due to proximity to the tracks and bell use at grade crossings and crosswalks. These land uses include Orchestra Hall, the WCCO television studio, and a recording studio, all of which are near the tracks on Nicollet Mall.

Category 2

There are a total of 286 Moderate Noise Impacts and 254 Severe Noise Impacts to Category 2 land uses in this segment. The estimated number of impacted residential units is 1,033 Moderate and 926 Severe. Some of the impacts are due to proximity of receptors to the alignment combined with bell use at all stations and bell use at at-grade crossings every block north of 19th Street. Between West Lake Station and Uptown Station much of the surrounding residential neighborhoods exhibit low existing ambient noise levels, and both horns and bells will be used at at-grade crossings and crosswalks due to operating speeds higher than 45 mph.

Category 3

There are no noise impacts to Category 3 land uses in this segment. Table 4.7-10 shows the impacts by noise subsegment.

Table 4.7-10. Potential Noise Impacts in Segment C-1 [LRT 3C-1 (Nicollet Mall)]

Noise Subsegment		Land Use Category	Moderate Impacts Land (Units[a])	Severe Impacts Land (Units[a])
ID	Description			
C-A	Segment C-1 between West Lake Station and Uptown Station	1	-	-
		2	160 (571)	213 (531)
		3	-	-
C-B	Segment C-1 between Uptown Station and Lyndale Station	1	-	-
		2	35 (116)	3 (3)
		3	-	-
C-C	Segment C-1 between Lyndale Station and 28th Street Station	1	-	-
		2	66 (222)	6 (6)
		3	-	-
C-D	Segment C-1 between 28th Street Station and Franklin Station	1	-	-
		2	12 (84)	7 (33)
		3	-	-
C-E	Segment C-1 between Franklin Station and 12th Street Station	1	-	-
		2	12 (39)	25 (353)
		3	-	-
C-F	Segment C-1 between 12th Street Station and 8th Street Station	1	3 (3)	-
		2	-	-
		3	-	-
C-G	Segment C-1 between 8th Street Station and 4th Street	1	-	-
		2	1 (1)	-
		3	-	-
C-H	Segment C-1 between 4th Street and Washington Avenue	No impacts predicted		
Segment C-1 TOTAL		1	3 (3)	-
		2	286 (1,033)	254 (926)
		3	-	-

[a] "Units" refers to the number of dwelling units, offices, commercial spaces, or other land uses that occupy a single parcel and that would be affected by noise. For example, a single parcel of land may be occupied by an apartment complex with 10 apartments or dwelling "units"..

Segment C-2 [LRT 3C-2 (11th/12th Street)]: West Lake Station to Intermodal Station

Category 1

There are no noise impacts to Category 1 land uses in this segment.

Category 2

There are a total of 255 Moderate Noise Impacts and 294 Severe Noise Impacts to Category 2 land uses in this segment. The estimated number of impacted residential units is 749 Moderate and 1,089 Severe. The reasons for impacts in this segment are similar to those for Segment C-1, though their respective alignments diverge north of 13th Street.

Category 3

There are no noise impacts to Category 3 land uses in this segment. Table 4.7-11 shows the impacts by noise subsegment.

Table 4.7-11. Potential Noise Impacts in Segment C-2 [LRT 3C-2 (11th/12th Street)]

Noise Subsegment		Land Use Category	Moderate Impacts Land (Units[a])	Severe Impacts Land (Units[a])
ID	Description			
C-2-A	Segment C-2 between West Lake Station and Uptown Station	1	-	-
		2	126 (282)	248 (590)
		3	-	-
C-2-B	Segment C-2 between Uptown Station and Lyndale Station	1	-	-
		2	35 (116)	-
		3	-	-
C-2-C	Segment C-2 between Lyndale Station and 28th Street Station	1	-	-
		2	66 (222)	6 (6)
		3	-	-
C-2-D	Segment C-2 between 28th Street Station and Franklin Station	1	-	-
		2	12 (84)	7 (33)
		3	-	-
C-2-E	Segment C-2 and C-2B between Franklin Station and West 14th Street	1	-	-
		2	12 (39)	19 (78)
		3	-	-
C-2-F	Segment C-2 and C-2B between West 14th Street and 12th Street Station	1	-	-
		2	-	3 (5)
		3	-	-
C-2-G	Segment C-2 between 12th Street Station and Harmon/Hawthorne Station	1	-	-
		2	2 (4)	5 (356)
		3	-	-
C-2-H	Segment C-2 between Harmon/Hawthorne Station and Royalston Station	1	-	-
		2	2 (2)	6 (21)
		3	-	-
C-2-I	Segment C-2 between Royalston Station and Intermodal Station	No impacts predicted		
Segment C-2 TOTAL		1	-	-
		2	255 (749)	294 (1,089)
		3	-	-

[a] "Units" refers to the number of dwelling units, offices, commercial spaces, or other land uses that occupy a single parcel and that would be affected by noise. For example, a single parcel of land may be occupied by an apartment complex with 10 apartments or dwelling "units".

The additional sub-alternatives were assessed qualitatively. The difference in potentially affected receptors between LRT 3C-2 (11th/12th Street) alternative and the LRT 3C-2A (Blaisdell tunnel) sub-alternative and the LRT 3C-2B (First Avenue tunnel) sub-alternative is expected to be small. The track alignment is only different

by one block through the tunnel, and the broad mix of land uses in the surrounding blocks is relatively homogeneous. Therefore the net number of impacts should be similar. One major exception is the Blaisdell sub-alternative, where the crossing at Franklin Avenue is at-grade instead of grade-separated. This will make it necessary to add signal-bell use and will add to or increase the level of receptor impacts.

4.7.4 Operation and Maintenance Facility

The Build Alternatives for the Southwest Transitway will require an LRT OMF. The proposed facility would be used for maintenance and repairs for the LRT vehicles, as well as a storage area for vehicles that are not in service. See the OMF Site Evaluation technical memorandum in Appendix H for additional information regarding the OMF sites under consideration. The sites under consideration include:

- Eden Prairie 1
- Eden Prairie 2
- Eden Prairie 3
- Minneapolis 4

A screening level analysis (Table 4.7-12) was performed to assess whether any noise-sensitive land uses were near each OMF site. Results of the OMF noise screening analysis are shown below.

Table 4.7-12. OMF Noise Screening Results

OMF Site	Noise-sensitive Land Uses			
	Category 1	Category 2	Category 3	Total
Eden Prairie 1	0	130	6	136
Eden Prairie 2	0	14	5	19
Eden Prairie 3	0	0	0	0
Minneapolis 4	0	9	0	9

The noise screening analysis identified 136 noise-sensitive land uses within the screening distance from the Eden Prairie 1 OMF option. None of these noise-sensitive land uses were assessed further for noise from the transit line operation. Land uses near the Eden Prairie 1 site include many single-family and multifamily residential properties, as well as some school properties and church properties.

The noise screening analysis identified 19 noise-sensitive land uses within the screening distance from the Eden Prairie 2 OMF option. None of these noise-sensitive land uses were otherwise assessed for noise from the transit line operation. Land uses near the Eden Prairie A site include several single-family and multifamily residential properties, as well as school properties and church properties.

No noise-sensitive land uses were identified within the screening distance from the Eden Prairie 3 OMF location.

The noise screening analysis identified 9 noise-sensitive land uses within the screening distance from the Minneapolis 4 OMF options. Most of these noise-sensitive land uses were also assessed for noise from the transit line operation. Land uses near the Minneapolis 4 site include several multifamily residential properties.

When project planning and engineering have advanced and there is more certainty with respect to the size, location, equipment, and activities that will occur at the OMF facility, a more detailed noise analysis will be conducted.

4.7.5 MN&S Freight Rail Relocation

Under build alternatives LRT 1A, LRT 3A (LPA), LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street) TC&W freight activity which currently follows portions of the Segment 4 and Segment A alignments would be relocated. TC&W freight rail operations currently operating in the Kenilworth Corridor in St. Louis Park and Minneapolis would be relocated to the CP MN&S Spur and BNSF Wayzata Subdivision in St. Louis Park. An Environmental Assessment Worksheet (EAW) for the MN&S freight rail study was completed in May of 2011 and included an assessment of the airborne-noise impacts associated with the freight relocation. Refer to Appendix H for the complete airborne-noise assessment of the MN&S freight rail relocation project (Noise and Vibration Assessment Report, HMMH, May 2011).

Future noise levels associated with the MN&S freight rail relocation were projected based on the assumptions defined below. In order to account for trains that have less than one daily operation, the assessment assumed an average number of trains per day over a two-week period. This results in a more conservative estimate of the project noise. Specific project assumptions include:

- All trains will travel at no more than 25 mph.
- The track will be continuously welded rail.
- The CP operations will remain unchanged (one round trip train at up to 30 cars)
- The TC&W operations include:
  - One freight train with 2-4 locomotives and 50 cars operating six days per week,
  - Another freight train with 2-4 locomotives and 20 cars operating 3-4 days per week,
  - A unit ethanol train with 2 locomotives and 80 cars operating once every 2 weeks, and
  - A unit coal train with 4 locomotives and 120 cars, operating once every 2 weeks in one direction only.
  - The unit coal trains were assumed to be equally likely to operate during the day or night. All other trains were assumed to operate during the day.
- The train horns were assumed to be sounded at all highway-rail grade crossings, but not at pedestrian crossings. Based on FRA requirements, the horns are sounded for 20 seconds prior to each grade-crossing, starting 750 feet from the crossings.

Airborne-noise impacts associated with the MN&S freight rail relocation are summarized below in Table 4.7-13.

Table 4.7-13. MN&S Freight Relocation Noise Impacts

Location	Number of Impacts	
	Moderate	Severe
Category 2 Land Uses		
25 ½ St to 27th St (East)	0	0
27th St to 28th St (West)	17	15
27th St to 28th St (East)	14	14
28th St to 29th St (West)	14	14
28th St to 29th St (East)	14	11
29th St to Rt. 5 (West)	10	1
29th St to Rt. 5 (East)	9	1
Rt. 5 to 32nd St (West)	0	0
Rt. 5 to 32nd St (East)	0	0
32nd St to 33rd St (West)	4	2
Dakota/Colorado Ave from 33rd to Lake St	2	7
Alabama/Blackstone Ave from 32nd St to Lake St	0	0
South of Lake St from Alabama Ave to Wooddale Ave	4	0
Lake St from Wooddale Ave to Walker St	2	8
Library Ln/Brownlow Ave from 1st St to Lake St	5	0
Dakota Ave from 37th St to Oxford St	0	0
Land Use Category 2 Impacts	95	73
Category 3 Land Uses		
Dakota Park	0	0
Roxbury Park	0	0
Keystone Park	0	0
St. Louis Park Senior High School	0	1
Masonic Meeting Hall at 6509 Walker Street	0	1
Metropolitan Open School	0	0
Land Use Category 3 Impacts	0	2
Total Number of Impacts	95	75

As shown in Table 4.7-13 results of this analysis indicate that the MN&S freight relocation has the potential to cause severe noise impacts at 73 residences and moderate impacts at 95 residences without mitigation. Additional Category 3 impacts, without mitigation, include severe noise impact at the Masonic Meeting Hall and the St. Louis Park Senior High School. Impacts at both locations are due to freight rail locomotive horn sounding at the Library Lane, Wooddale Avenue and Walker Street grade-crossings.

The results of this noise assessment indicate that all the severe noise impacts in the corridor are due to the freight locomotive horn noise at highway-rail grade-crossings. The implementation of quiet zones at all grade-crossings would eliminate all severe noise impacts throughout the corridor by removing the freight locomotive horn noise, which is the dominant noise source on the trains and the cause of the severe noise impacts. Noise barriers would not be as effective at reducing noise from freight locomotive horns, since there are physical limitations on barriers which would only potentially reduce freight locomotive horn noise by a small amount, rather than eliminating it altogether.

Airborne-noise impacts associated with the MN&S freight rail relocation with the implementation of quiet zones are summarized below in Table 4.7-14.

Table 4.7-14. MN&S Freight Relocation Noise Impacts with Quiet Zones

Location	Civil Stn.	Exist Noise Level.	Future Noise Level	Noise Level Increase	Impact Criteria (Increase)		Impact Category	Number of Impacts	
					Mod.	Severe		Mod.	Severe
Category 2 Land Uses									
25 ½ St to 27th St (East)	710	55	57	2.5	3.2	7.2	No Impact	0	0
27th St to 28th St (West)	294	55	58	3.5	3.2	7.2	Moderate	11	0
27th St to 28th St (East)	294	55	58	3.4	3.2	7.2	Moderate	4	0
28th St to 29th St (West)	288	55	58	3.3	3.2	7.2	Moderate	9	0
28th St to 29th St (East)	288	55	58	2.6	3.2	7.2	No Impact	0	0
29th St to Rt. 5 (West)	282	55	58	3.4	3.2	7.2	Moderate	10	0
29th St to Rt. 5 (East)	282	55	58	3.2	3.2	7.2	Moderate	9	0
Rt. 5 to 32nd St (West)	273	56	58	1.7	2.8	6.4	No Impact	0	0
Rt. 5 to 32nd St (East)	273	56	56	-0.1	2.8	6.4	No Impact	0	0
32nd St to 33rd St (West)	265	56	60	3.5	2.8	6.4	Moderate	1	0
Dakota/Colorado Ave from 33rd to Lake St	255	56	58	2.1	2.8	6.4	No Impact	0	0

Location	Civil Stn.	Exist Noise Level.	Future Noise Level	Noise Level Increase	Impact Criteria (Increase)		Impact Category	Number of Impacts	
					Mod.	Severe		Mod.	Severe
Alabama/Blackstone Ave from 32nd St to Lake St	264	56	58	2.0	2.8	6.4	No Impact	0	0
South of Lake St from Alabama Ave to Wooddale Ave	256	56	56	-0.9	2.8	6.4	No Impact	0	0
Lake St from Wooddale Ave to Walker St	236	58	63	5.4	2.5	6.0	Moderate	2	0
Library Ln/Brownlow Ave from 1st St to Lake St	236	58	57	-0.3	2.5	6.0	No Impact	0	0
Dakota Ave from 37th St to Oxford St	528	58	56	-1.8	2.5	6.0	No Impact	0	0
							Land Use Category 2 Impacts	46	0
Category 3 Land Uses									
Dakota Park	309	60	56	-4.2	4.7	9.1	No Impact	0	0
Roxbury Park	270	54	57	2.9	6.7	11.9	No Impact	0	0
Keystone Park	271	54	58	3.4	6.7	11.9	No Impact	0	0
St. Louis Park Senior High School	249	58	60	1.5	5.2	9.9	No Impact	0	0
Masonic Meeting Hall at 6509 Walker Street	233	58	62	4.3	5.2	9.9	No Impact	0	0
Metropolitan Open School	239	58	57	-1.1	5.2	9.9	No Impact	0	0
							Land Use Category 3 Impacts	0	0
							Total Number of Impacts	46	0

As shown in Table 4.7-14 all severe noise impacts would be mitigated with the implementation of quiet zones within the Freight Rail Relocation Segment. With mitigation the MN&S freight relocation has the potential to cause 46 moderate impacts at residences. If quiet zones were implemented, there would be no noise impacts at Category 3 land uses.

4.7.6 Long-Term Mitigation

Whether mitigation is warranted is based on the severity of potential impacts. Project noise levels that result in a "Severe Impact" to a receptor pose a compelling need for mitigation. Most of the severe impacts are due to warning signals such as horns and bells near at-grade crossings, crosswalks, and stations. Use of these

warning signals is required for safe operation of the LRT system, but, this does not exclude mitigation options for these impacts.

Project noise levels which result in a "Moderate Impact" are also largely due to horn and bell use, but typically are farther away than those receptors with a finding of Severe Impact. Most mitigation measures to address the Severe Impacts will also reduce or completely eliminate Moderate Impact findings at many receptors.

Quiet Zone upgrades along the freight rail relocation segment may be implemented as mitigation for noise impacts at all remaining at-grade crossings between Walker Street and 28th Street. The Quiet Zone design concept includes improved pedestrian safety at the study area grade crossings in the form of pedestrian gates at all existing and proposed sidewalk locations.

A public authority may establish a Quiet Zone without approval from the Federal Railroad Administration (FRA) if they comply with one of the following conditions as defined in FRA Use of Locomotive Horns at Highway-Rail Grade Crossings; Final Rule (49 C.F.R. Parts 222 and 229):

- Install one or more approved supplementary safety measures (SSMs)
  - Temporary closure of grade crossing(s) during hours the Quiet Zone is in effect
  - Four-quadrant gate system at all grade crossing in the Quiet Zone
  - Gates with median or channelization devices
  - One-way streets with gate(s)
  - Permanent closure of grade crossing(s)
- A Quiet Zone may be established if its Quiet Zone Risk Index is at or below the Nationwide Significant Risk Threshold
- Install SSMs sufficient to reduce the Quiet Zone Risk Index at, or below, the Risk Index with Horns

In addition to the quiet zone design, there will be further discussion with the City of St. Louis Park, St. Louis Park School Board, railroads, and other stakeholders regarding additional feasible and effective safety mitigation in the vicinity of the St. Louis Park High School. Additional mitigation could include a grade-separated pedestrian crossing, High Intensity Activated Crosswalk (HAWK) signal, or overhead flashers to improve safety of pedestrians traveling between the high school and PSI or the high school and the football field.

4.7.7 Construction Noise Mitigation

The simplest strategy to prevent or mitigate noise impacts due to construction occurring near noise-sensitive land uses is to restrict construction activities using heavy machinery to normal working hours, which are generally considered to be "noise tolerant" periods.

Construction contractors should be required to develop a noise mitigation plan that includes:

- A summary of noise related criteria for construction contractors to abide by including compliance with local ordinances.
- Minimization of noise impacts on adjacent noise-sensitive stakeholders while maintaining construction progress.
- An outline of the project's noise control objectives and potential components.
- An approach for deciding the appropriateness of mitigation.

Additional mitigation options could include coordination of construction activities and maintaining a web-based work schedule to allow contractors and stakeholders to schedule noisier activities in avoidance of noise sensitive events. Coordination of construction activities can be used to reduce noise impacts at Category 1 land uses by scheduling the greatest noise producing activities during less noise-sensitive periods. The use of a web based work schedule could serve as an ongoing database throughout the life of the project and be a valuable source of stakeholder and contractor information.

Through these measures and commitments, and by consistently implementing processes and over-sight, implementing a detailed construction noise mitigation plan can be a successful in minimizing noise impacts and stakeholder surprises, while keeping construction delays to a minimum.

4.7.8 Summary

Table 4.7-15 lists the anticipated impacts to categories of land uses, which comprise the environmental metric for noise, and the anticipated severity of the noise for each proposed alternative.

Land use categories are described in Table 4.7-1 and a description of severity levels can be found in Section 4.7-1, Methodology. Note that the number of impacts to land uses is often different from the number of units affected, especially in the case of Category 1 land uses, which includes residential uses. Other details about noise, land use categories, the number of receivers in each segment, and so forth are described above in Section 4.7 or in the technical report in Appendix H.

Table 4.7-15. Noise impacts summary

Environmental Metric	Build Alternatives				
	LRT 1A	LRT 3A (LPA)	LRT 3A-1 (Co-location alternative)	LRT 3C-1 (Nicollet Mall)	LRT 3C-2 (11th/12th Streets)
Moderate impacts Land Use Category 1	0	1 (1 unit)	1 (1 unit)	4 (4 units)	1 (1 unit)
Severe impacts Land Use Category 1	0	0	0	0	0
Moderate impacts Land Use Category 2	506 (683 units)	271 (598 units)	221 (639 units)	463 (1,425 units)	434 (1,247 units)
Severe impacts Land Use Category 2	358 (587 units)	201 (520 units)	267 (610 units)	262 (1,027 units)	302 (1,190 units)
Moderate impacts Land Use Category 3	1 (1 unit)	1 (1 unit)	1 (1 unit)	0	0
Severe impacts Land Use Category 3	1 (1 units)	0	0	0	0

4.8 Vibration

This section discusses the potential impacts related to operational and construction-related vibration from the Southwest Transitway Build Alternatives, the TC&W freight relocation and the proposed LRT OMF. The General Vibration Assessment described here was prepared in accordance with FTA guidelines ("Transit Noise and Vibration Impact Assessment" (FTA 2006)) to evaluate effects of the proposed project on vibration-sensitive land uses throughout the project corridor.

4.8.1 Methodology

Ground-borne vibration (GBV) and ground-borne noise (GBN) effects associated with the proposed Southwest Transitway were evaluated using the General Vibration Assessment, in accordance with FTA guidelines. The methodology for each alternative included identification of vibration-sensitive land uses, the selection of a base curve for ground surface vibration levels, and a determination of propagation characteristics.

Projections of vibration were calculated for individual receptors or clusters of receptors. Receptors of similar land use and project-related vibration exposure were

placed in a cluster. Impact evaluation for the cluster of receptors is based on the calculation of a representative receptor.

Additionally, several proposed locations for a new OMF were assessed. The OMF vibration assessment, a screening-level assessment, was performed according to FTA guidance. This results in a broad appraisal of the number of potentially affected vibration-sensitive land uses in the vicinity of the OMF locations.

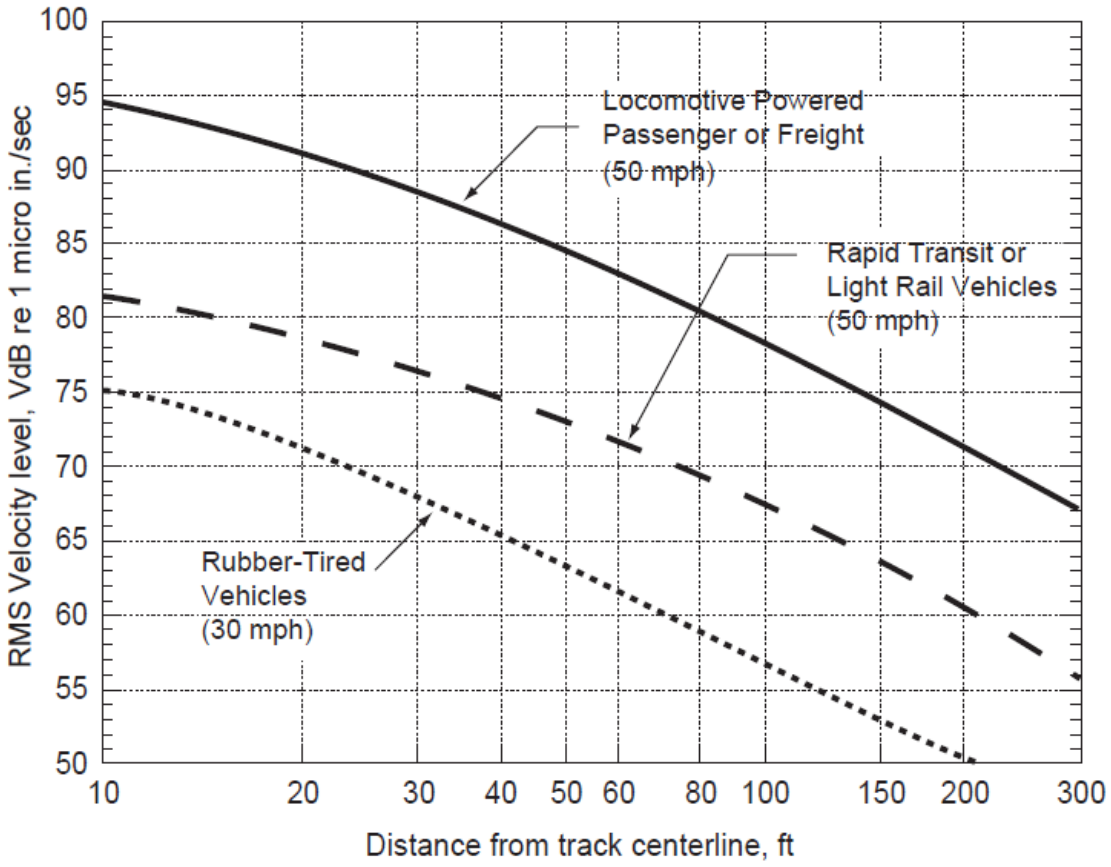
4.8.1.1 Land Use Identification

Land use identification included a review of land use-related GIS data, windshield surveys and a review of digital aerial photographs. Vibration-sensitive land uses in the study area were identified and categorized according to FTA land use category. Receptors of similar vibration exposure and land use were clustered.

4.8.1.2 Base Vibration Curve

The FTA generalized vibration curve for light rail vehicles was used as the base curve for the GBV and GBN assessments. Figure 4.8-1 illustrates the generalized ground surface vibration curve defined by FTA.

Figure 4.8-1. FTA Generalized Ground Surface Vibration Curves



Adjustments factors used to develop vibration predictions at representative receivers included corrections for speed, track configuration, distance, and geologic conditions.

4.8.1.3 Ground-borne Vibration Conditions

Soil and subsurface conditions are known to have a strong influence on the levels of GBV. Vibration levels are generally higher in stiff, clay-type soils than in loose, sandy soils and at-grade track when the depth to bedrock is 30 feet or less (Table 4.8-1). Soil layering and the depth to the water table can also affect GBV, but the effects are not always predictable and are not well established. (Hanson, et. al 2006) Refer to Section 4.1 for a complete discussion on the study area geology.

The potential for GBV was assessed by:

- Logs of water wells contained in the Minnesota CWI were screened for the occurrence of bedrock within 30 feet of the surface and located within one-quarter mile of the alignment alternatives. The CWI database has certain limitations, including the technical accuracy of individual records, so the data from a single borehole must be viewed in the context of the surrounding boreholes. In addition, there is potential variability in the depth to bedrock data. To overcome these issues, areas with clusters of wells with apparent shallow bedrock were identified as having a high potential to propagate GBV.
- Soils geomorphology from the Hennepin County Soil Survey (USDA, 2005) were categorized with high, medium or low potential based on interpretation of the likelihood for containing dense clay soils (Table 4.8-1).

Table 4.8-1. Ground-Borne Vibration Potential

Geomorphological Description	Assigned GBV Potential
Beach	Low
Escarpment	Moderate
Flood Plain	Moderate
Hill	Moderate
Lake Plain	High
Moraine	High
Outwash Plain	Low
Stream Terrace	Low

4.8.2 Existing Conditions

In most cases, the existing environment does not include a notable number of perceptible GBV or GBN events. The FTA methodology prescribes comparing project-related vibration to existing vibration only in those cases where the project follows an existing rail corridor with at least 5 trains per day and the proposed operational changes will not substantially increase the number of vibration events. While most of the project either is not in an active rail corridor, or is in a rail corridor with fewer than 5 trains per day; portions of the build alternatives experience vibration from existing rail corridors along the BNSF Wayzata Subdivision and Kenilworth Corridor.

Existing transit-related vibration along Segment 4 and Segment A includes current train activity operating on the Kenilworth Corridor. Existing rail operations in Segment 4 include approximately 3 freight pass-by events per day. TC&W locomotive pass-by events are less than 5 per day therefore are considered infrequent. Vibration events

due to TC&W rail cars are greater than 100 per day therefore are considered a heavily used corridor. The build alternatives will more than double the amount of train pass-by events therefore the FTA vibration criteria presented in Table 4.8-2 and Table 4.8-3 were utilized in the vibration assessment.

From Penn Avenue Station to Glenwood Avenue, the project follows the BNSF Wayzata Subdivision, which carries approximately 15 trains per day. With this number of trains, the existing train pass-by events would have to exceed 80 VdB before the project-related vibration events are compared to existing train vibration events at the two assessed receptors. Therefore the project-related vibration assessment is compared to the standard FTA vibration criteria at the vibration-sensitive land-uses.

4.8.2.1 Vibration-Sensitive Land Uses

The FTA vibration screening distances for LRT projects are 450 feet, 150 feet, and 100 feet for land use categories 1, 2, and 3 (as described in Section 4.8.1.1) respectively. These distances were used to determine if any vibration sensitive land uses exist within the screening distances adjacent to each of the alternative alignments. These are illustrated in Figure 4.8-2. Table 4.8-2 summarizes the number of vibration sensitive land uses found within the vibration screening area.

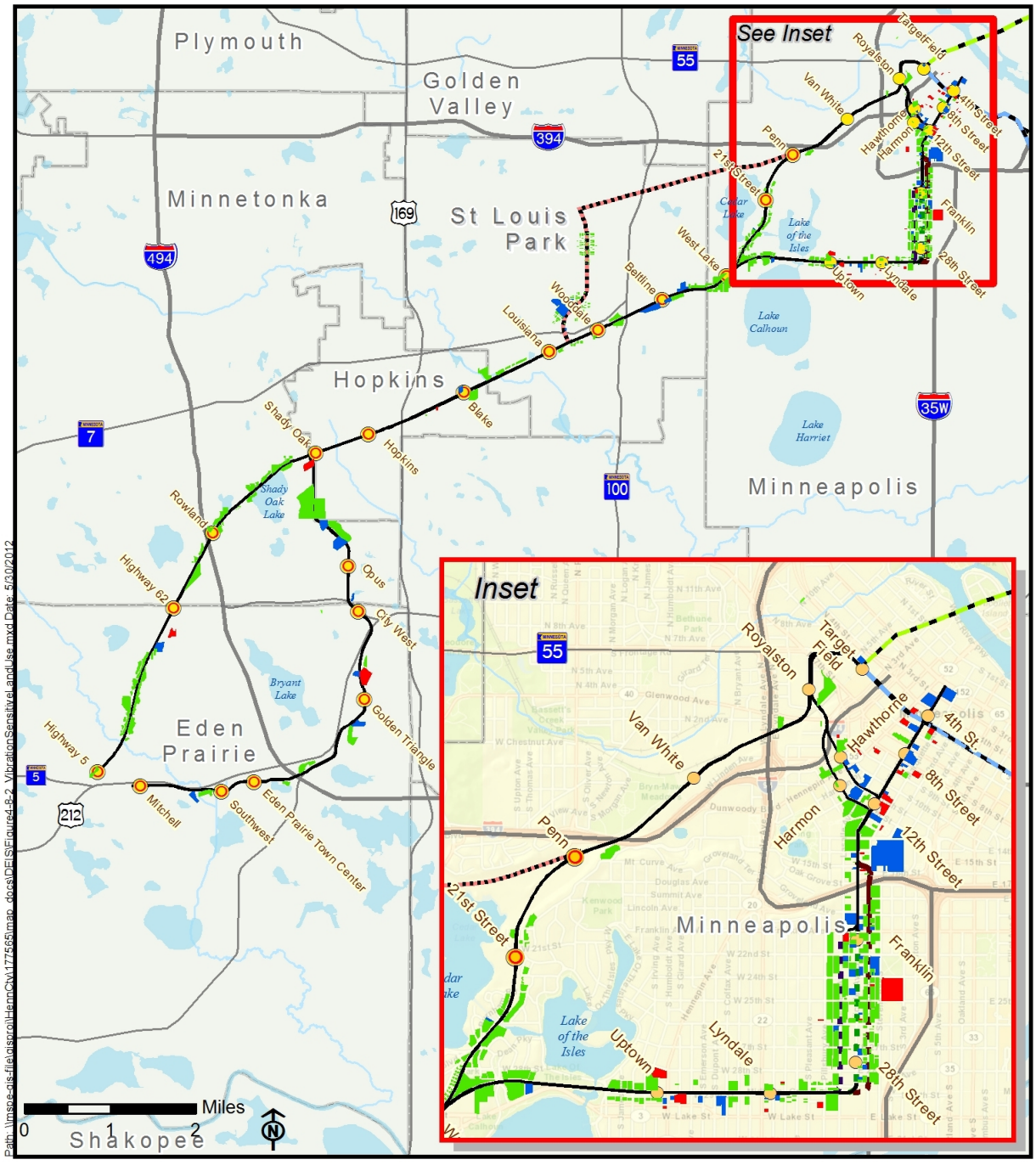


Figure 4.8-2
Vibration Sensitive Land Use

Data: MnDOT, DNR, MetCouncil, Hennepin County

Table 4.8-2. Summary of Vibration-Sensitive Land Uses

Segment	Land Use Category	Vibration-Sensitive Parcels
Segment 1	1	2
	2	354
	3	1
Total		357
Segment 3	1	2
	2	14
	3	5
Total		21
Segment 4	1	1
	2	166
	3	5
Total		172
Segment A	1	0
	2	247
	3	2
Total		249
Segment C-1	1	33
	2	619
	3	36
Total		688
Segment C-2	1	20
	2	727
	3	39
Total		786

Following are brief discussions of vibration-sensitive land uses along the corridor by segment.

Segment 1(LRT 1A): Highway 5 Station to Shady Oak Station

Vibration-sensitive land uses the project team identified along Segment 1 include the following:

- Category 1 vibration-sensitive land uses: 2
- Category 2 vibration-sensitive land uses: 354
- Category 3 vibration-sensitive land uses: 1

The Category 1 noise-sensitive land uses include two recording studios. The Category 2 noise-sensitive land uses include mostly single-family or multifamily residences in a suburban setting. A school of music is the only Category 3 land use identified within the Segment 1 vibration screening buffer.

Segment 3 [LRT 3A (LPA), LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street)]: Mitchell Station to Shady Oak Station

Vibration-sensitive land uses the project team identified along Segment 3 include the following:

- Category 1 vibration-sensitive land uses: 2
- Category 2 vibration-sensitive land uses: 14
- Category 3 vibration-sensitive land uses: 5

The Category 1 noise-sensitive land uses included two recording studios. The Category 2 noise-sensitive land uses were single-family and multifamily residences as well as several hotels. The Category 3 noise-sensitive land uses include several schools and churches.

Segment 4 [LRT 1A, LRT 3A (LPA), LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street)]: Shady Oak Station to West Lake Station

Vibration-sensitive land uses the project team identified along Segment 4 include the following:

- Category 1 vibration-sensitive land uses: 1
- Category 2 vibration-sensitive land uses: 166
- Category 3 vibration-sensitive land uses: 5

The Category 1 vibration-sensitive land use was one recording studio. The Category 2 vibration-sensitive land uses were mostly single-family and multifamily residences. The Category 3 vibration-sensitive land uses include several schools and a few churches.

There are two alternatives for the existing TC&W freight trains operating on Kenilworth Corridor. Under alternatives LRT 1A, LRT 3A (LPA), LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street), TC&W freight trains currently operating in Kenilworth Corridor will be relocated to the MN&S Spur and BNSF Wayzata Subdivision in St. Louis Park. Under build alternative LRT 3A-1 (co-location alternative) TC&W freight activity would continue to operate in the Kenilworth Corridor and will result in a portion of shared rail corridor along Segment 4. While relocation of existing freight activity will cause a decrease in the number of freight pass-by events along the Kenilworth Corridor the net increase in the number of pass-by events along these Segment 4 alternatives are largely the same.

Segment A [LRT 1A and LRT 3A (LPA)]: West Lake Station to Intermodal Station

Vibration-sensitive land uses the project team identified along Segment A include the following:

- Category 1 vibration-sensitive land uses: 0
- Category 2 vibration-sensitive land uses: 247
- Category 3 vibration-sensitive land uses: 2

There are no Category 1 land uses that fall within the Segment A vibration screening area. The Category 2 vibration-sensitive land uses were mostly single-family and multifamily residences. The Category 3 vibration-sensitive land uses are a school and an office building.

Segment C-1 [LRT 3C-1 (Nicollet Mall)]: West Lake Station to 4th Street Station

Vibration-sensitive land uses the project team identified along segment C include the following:

- Category 1 vibration-sensitive land uses: 33
- Category 2 vibration-sensitive land uses: 619
- Category 3 vibration-sensitive land uses: 36

The Category 1 vibration-sensitive land uses include recording studios and theaters. Orchestra Hall on the Nicollet Mall is also a Category 1 land use. The Category 2 vibration-sensitive land uses were mostly single-family and multifamily residences, along with several downtown hotels. The Category 3 vibration-sensitive land uses include churches, public libraries, cultural buildings, and the Minneapolis Convention Center. Schools are also included in Category 3 land uses including several primary and secondary schools.

Segment C-2 [LRT 3C-2 (11th/12th Street)]: West Lake Station to Intermodal Station

Vibration-sensitive land uses along Segment C-2 (11th/12th Street) were largely the same as for Segment C at the south end of downtown. Land uses the project team identified along Segment C, including the duplicates with Segment C, included the following:

- Category 1 vibration-sensitive land uses: 20
- Category 2 vibration-sensitive land uses: 727
- Category 3 vibration-sensitive land uses: 39

The Category 1 vibration-sensitive land uses include recording studios and theaters. Orchestra Hall on the Nicollet Mall is also a Category 1 land use. The Category 2 vibration-sensitive land uses were mostly single-family and multifamily residences, along with several downtown hotels. The Category 3 vibration-sensitive land uses include churches, public libraries, cultural buildings, and the Minneapolis Convention Center. Schools are also included in Category 3 land uses including several primary and secondary schools.

There are further sub-alternatives for the tunnel portion of the C-2 segment. Segment C-2A is the same as Segment C-2 except the tunnel will run underneath Blaisdell Avenue. Likewise for Segment C-2B the tunnel is planned to run underneath 1st Avenue. While some receptors are included or excluded depending upon the tunnel location, the nature of the receptors along these alignments are largely the same.

4.8.3 Long-Term Effects

4.8.3.1 No Build Alternative

The No Build Alternative would not result in any project-related adverse vibration impacts.

4.8.3.2 Enhanced Bus Route Alternative

Potential vibration effects associated with the Enhanced Bus Alternative include the addition of a new vibration source and an increased frequency of vibration events to vibration-sensitive receptors adjacent to the enhanced bus route.

4.8.3.3 Build Alternatives

Vibration impacts were predicted for each Build Alternative using the General Vibration Assessment methodology in accordance with FTA guidelines, as described in Section 4.8.11. Predicted project-related GBV and GBN were calculated for individual receptors or clusters of receptors. Calculated GBV and GBN include adjustments for speed, distance from track, configuration and geology were applied to the general vibration curve (See Figure 4.8-1, above).

The unit counts for this analysis were arrived at by using the Hennepin County GIS parcel data. These data identify multiple property owners for the same parcel of residential property. Aerial photographs were used to determine that these were multiunit residential properties. The parcel was counted as one land-use, and the number of owners was used as a proxy for the number of units. This may have omitted from the unit-count some multiunit housing where there is one owner with one or more tenants, but these properties would still be counted in the land-uses. Table 4.8-3 summarizes the predicted vibration impacts by Build Alternative.

Table 4.8-3. General Vibration Assessment Results by Build Alternative

Alternative[a]	Land Use Category	Number of Vibration Impacts (No. of Affected Units)
LRT 1A	Category 1	1 (1)
	Category 2	255 (367)
	Category 3	2 (2)
Total Number of 1A Impacts		258 (370)
LRT 3A (LPA)	Category 1	3 (3)
	Category 2	143 (484)
	Category 3	5 (5)
Total Number of 3A (LPA) Impacts		151 (492)
LRT 3A-1 (co-location alternative)	Category 1	3 (3)
	Category 2	142 (483)
	Category 3	5 (5)
Total Number of 3A-1 (co-location) Impacts		150 (491)
LRT 3C-1 (Nicollet Mall)	Category 1	4 (4)
	Category 2	96 (575)
	Category 3	5 (5)
Total Number of 3C-1 (Nicollet Mall)Impacts		105 (584)
LRT 3C-2 (11th/12th Street)	Category 1	4 (4)
	Category 2	96 (575)
	Category 3	6 (6)
Total Number of 3C-2 (11th/12th Street) Impacts		106 (585)

LRT 1A is inclusive of segments 1, 4 A, and FR. LRT 3A (LPA) is inclusive of segments 3, 4, A, and FR. LRT 3A-1 (co-location alternative) is inclusive of segments 3, 4, and A. LRT 3C-1 (Nicollet Mall) is inclusive of segments 3, 4, C-1, and FR. LRT 3C-2 (11th/12th Street) is inclusive of segments 3, 4 C-2, and FR.

It should be noted that potential vibration impacts on historical structures will be evaluated as part of the Section 106 process for the project; see Section 3.4 for more information.

4.8.3.4 Segments

Table 4.8-4 summarizes the predicted vibration impacts for each segment. Refer to Appendix H for a detailed summary of each segment including each land use category, side of track location, distance to track, speed, predicted vibration level, and impact criterion.

Table 4.8-4. Segment General Vibration Assessment Results

Segment	Total Number of Impacts (No. of impacted units)
Segment 1	118 (123)
Segment 3	11 (245)
Segment 4	15 (15)
Segment A	124 (231)
Segment C-1	78 (323)
Segment C-2	79 (324)
Segment FR	1 (1)

Segment 1

The general vibration assessment for Segment 1 (LRT 1A) indicates that the Southwest Transitway project has the potential to impact 118 Category 2 land uses in Segment 1. Vibration impacts in this segment would be caused by geologic conditions and increased train speeds. Segment 1 geologic conditions are predominantly characterized as having a high potential for efficient vibration propagation. There are few homogenous zones of ground with normal propagation characteristics.

Segment 3

There are 11 potential vibration impacts in Segment 3 [LRT 3A (LPA), LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street)]. Vibration impacts in this segment would be caused by geologic conditions and increased train speeds. Segment 3 geologic conditions are predominantly characterized as having a high potential for efficient vibration propagation. There are few homogenous zones of ground with normal propagation characteristics.

Segment 4

There are 15 potential vibration impacts in Segment 4 [LRT 1A, LRT 3A (LPA), LRT 3A-1 (co-location alternative), LRT 3C-1 (Nicollet Mall), and LRT 3C-2 (11th/12th Street)]. Vibration impacts in this segment would be caused by increased train speeds and distance from track. Geologic conditions in Segment 4 vary. One zone with high potential for efficient propagation is located near Blake Station between Washington Avenue and Meadowbrook Road. The second zone with likely efficient vibration propagation is located between the Beltine Boulevard and West Lake stations.

Segment A

There are 124 potential vibration impacts in Segment A [LRT 1A and LRT 3A (LPA)]. Vibration impacts in this segment would be caused by geologic conditions and increased train speeds. Geologic conditions adjacent to Segment A are predominantly characterized as having a high potential for efficient vibration propagation west of Van White Station. East of Van White Station ground adjacent to the rail line is likely to have normal propagation characteristics.

Segment C-1

There are 78 potential vibration impacts in Segment C-1[LRT 3C-1 (Nicollet Mall)]. Vibration impacts in this segment would be caused primarily by distance from track. Geologic conditions in Segment C-1 (Nicollet Mall) are likely to have normal propagation characteristics. There are few zones with high potential for efficient propagation characteristics.

Segment C-1 includes a tunnel on Nicollet Avenue between 28th Street Station and Franklin Station. Receptors adjacent to the tunnel area were assessed for both GBV and GBN.

Segment C-2

There are 79 potential vibration impacts in Segment C-2 [LRT 3C-2 (11th/12th Street)]. Vibration impacts in this segment would be caused primarily by distance from track. Geologic conditions in Segment C-2 are likely to have normal propagation characteristics. There are few zones with high potential for efficient propagation characteristics.

Segment C-2 includes three tunnel options between 28th Street Station and Franklin Station. For the purpose of the general vibration assessment, impacts were assessed based on the Nicollet tunnel option. Potential vibration impacts along the Segments C-2A and C-2B, with tunnel options on Blaisdell and 1st Avenue respectively, would be anticipated to have comparable impacts to Segment C-2. Receptors adjacent to the Nicollet tunnel were assessed for both GBV and GBN.

4.8.3.5 Operation and Maintenance Facilities

The Build Alternatives for the Southwest Transitway will require an LRT OMF. The proposed facility would be used for maintenance and repairs for the LRT vehicles, as well as a storage area for vehicles that are not in service. See the OMF Site Evaluation technical memorandum in Appendix H for details regarding OMF sites under consideration. These include:

- Eden Prairie 1
- Eden Prairie 2
- Eden Prairie 3
- Minneapolis 4

A screening level analysis was performed to assess the potentially affected receptors near each OMF site. Results of the OMF vibration screening analysis are presented in Table 4.8-5.

Table 4.8-5. OMF Vibration Screening Results

OMF Site	Number of Potential Vibration Impacts			Total Number of Potential Vibration Impacts
	Category 1	Category 2	Category 3	
Eden Prairie 1	0	0	1	1
Eden Prairie 2	0	0	1	1
Eden Prairie 3	0	0	0	0
Minneapolis 4	0	1	0	1

The Minneapolis 4 OMF site has the potential to cause vibration impacts at one adjacent Category 2 residential land use. The vibration screening analysis identified one Category 3 land use (an office building) within the screening area for Eden Prairie 2. The potentially affected office building was not otherwise assessed for vibration from the transit line operation due to its distance from the proposed alignment. For the Eden Prairie 1 site, one Category 3 land use (a church) was identified within the screening area. This church was not otherwise assessed for vibration from the transit line operation due to its distance from the proposed alignment. No vibration-sensitive sites were identified within the screening distance for the Eden Prairie 3 OMF site.

4.8.4 MN&S Freight Rail Relocation

Under build alternatives LRT 1A, LRT 3A (LPA), LRT 3C-1 (Nicollet Mall) and LRT 3C-2 (11th/12th Street) TC&W freight activity, which currently follows portions of the Segment 4 and Segment A alignments would be relocated. TC&W freight rail operations currently operating in the Kenilworth Corridor in St. Louis Park and Minneapolis would be relocated to the CP MN&S Spur and BNSF Wayzata Subdivision in St. Louis Park. The MN&S Freight Rail Report included an assessment of the vibration impacts associated with the freight relocation. Refer to Appendix H for the complete vibration assessment of the MN&S freight rail relocation project.

Future vibration levels associated with the MN&S freight rail relocation were assessed in accordance with FTA methodology. The potential vibration impacts of the MN&S freight rail relocation are primarily related to the increased speeds in the corridor. The assessment started with the reference vibration curve for locomotives and assumed an increase in speed from 10 to 25 mph, and also assumed the improvement from jointed rail to continuously welded rail will lower vibration levels by 5 VdB. The results of the vibration analysis indicate that locomotive vibration levels of 80 VdB (the impact criterion for infrequent events) would be experienced up to 40 feet from the tracks and that rail car vibration levels of 75 VdB (the impact criterion for occasional events) would also be experienced up to 40 feet from the tracks. There is only one building, an apartment above a business at the southern end of the corridor on Library Lane, which is located within 40 feet of the tracks.

4.8.5 Short-Term Construction Effects

Construction activities that may induce noticeable vibration may include blasting, pile driving, concrete demolition, jackhammers, and the use of heavy tracked vehicles such as bulldozers and earth movers. The most serious of these would be blasting and pile driving. While it is anticipated that some pile driving may occur, the likeliness of any blasting is low. The Final EIS will identify which site specific locations

may induce short term construction vibration and which mitigation methods are appropriate.

Mitigation options to reduce the effects of construction vibration may include coordinating the construction schedule to reduce interference with vibration-sensitive activities and use of alternative low vibration construction procedures. Use of low vibration construction methods can minimizing the impact from construction vibration is by limiting the use of high-vibration procedures such as impact pile driving.

4.8.6 Mitigation

Detailed vibration analyses will be conducted during the Final EIS in coordination with Preliminary Engineering. The Detailed Vibration Assessment may include performing vibration propagation measurements. These detailed assessments during the Final EIS/preliminary engineering phase have more potential to reduce project-related effects than assessments of mitigation options at the conceptual engineering phase of the project. Potential mitigation measures may include maintenance, planning and design of special trackwork, vehicle specifications, and special track support systems such as resilient fasteners, ballast mats, resiliently supported ties, and floating slabs.

4.8.7 Summary

Table 4.8-6 lists the anticipated impacts to categories of land uses, which comprise the environmental metric for vibration, and the anticipated severity of the vibration for each proposed alternative.

The evaluation criteria for vibration are presented in the technical report in Appendix H. Note that the number of impacts to land uses, as in the evaluation of noise, is often different from the number of units affected. Other details about vibration, land use and special building categories, the number of receivers in each segment, and so forth are described above in Section 4.8 or in the technical report in Appendix H.

Table 4.8-6. Summary of General Vibration Assessment Results by Build Alternative

Environmental Metric	Build Alternatives				
	LRT 1A	LRT 3A (LPA)	LRT 3A-1 (co-location alternative)	LRT 3C-1 (Nicollet Mall)	LRT 3C-2 (11th/12th Streets)
Impacts in land use category 1	1 (1 unit)	3 (3 units)	3 (3 units)	4 (4 units)	4 (4 units)
Impacts in land use category 2	255 (367 units)	143 (484 units)	142 (483 units)	96 (575 units)	96 (575 units)
Impacts in land use category 3	2 (2 units)	5 (5 units)	5 (5 units)	5 (5 units)	6 (6 units)

LRT 1A is inclusive of segments 1, 4 A, and FR. LRT 3A (LPA) is inclusive of segments 3, 4, A, and FR. LRT 3A-1 (co-location alternative) is inclusive of segments 3, 4, and A. LRT 3C-1 (Nicollet Mall) is inclusive of segments 3, 4, C-1, and FR. LRT 3C-2 (11th/12th Street) is inclusive of segments 3, 4 C-2, and FR.

4.9 Hazardous and Contaminated Materials

The purpose of this section is to evaluate the potential for soil and/or groundwater contamination within or immediately adjacent to the Southwest Transitway study area. This impact analysis does not attempt to measure the hazardous material impacts at the **contaminated sites** themselves. It does attempt to evaluate the impact of site contaminants that could be encountered during construction activities, or that have the potential to migrate through the soil or groundwater from nearby sites to the project alignments.

A "contaminated site" is a location where a substance that creates a risk to human health or natural ecosystems has been released into the environment.

A "Phase I Environmental Site Assessment" documents existing or potential environmental contamination based on available information about contamination sources on and near a site. Based on the results of the Phase I ESA, a Phase II ESA might be ordered. The Phase II ESA is a field investigation including actual sampling of soil, air, groundwater, or site materials to confirm or refute the presence of a contaminant source.

This is a preliminary assessment of the presence of known contaminated sites. In most of the study area, it is anticipated that the project would encounter, to varying degrees, contaminants migrating from sites adjacent to or near the alignments. A **Phase I Environmental Site Assessment** (ESA)—consisting of a review of regulatory databases by a national information vendor, review of available site reports, and a windshield survey—would be conducted after the locally preferred alternative is selected. **Phase II ESAs** may be conducted at some sites where warranted by the results of the Phase I ESA. In cases where the presence of contamination is verified during the Phase II ESA, additional environmental field investigations would take place as Preliminary Engineering advances to identify the extent and magnitude of contamination within rights-of-way being purchased by or used by the Southwest Transitway. Based on the results of these investigations and corresponding risk assessments,, action plans for remediation would be developed and submitted to the MPCA for approval prior to the start of any project construction activities.

During early stages of Preliminary Engineering, a Phase I ESA and subsequent regulatory file review and field research would be conducted to identify potential

contaminated sites that could be encountered by the project. Phase II ESAs would subsequently be conducted for specific areas along the alignment. An application may be made to enroll the project in the MPCA Voluntary Investigation and Cleanup (VIC) and/or Voluntary Petroleum Investigation and Clean-up (VPIC) programs upon initiation of Phase II studies. The Phase II ESAs would include preparation of investigative work plans, field investigations, contaminant sampling and testing, and recommendations to mitigate detected contamination.

4.9.1 Methodology

4.9.1.1 Database Review

Three online databases available in Minnesota were consulted to identify potentially contaminated properties. These databases are found on the "What's In My Neighborhood" Internet sites maintained by the MPCA and the Minnesota Department of Agriculture (MDA). The databases are described below:

- MPCA leaking underground storage tank (LUST) database: Contains locations of active and closed investigations of petroleum releases.
- MPCA Master Entity System (MES): Contains locations of Superfund sites (Comprehensive Environmental Response, Compensation and Liability Information System – CERCLIS; National Priority List – NPL; and Permanent List of Priorities – PLP sites), voluntary investigation and cleanup (VIC) sites, Resource Conservation and Recovery Act (RCRA) facilities, unpermitted dump sites and NFRAP (no further remedial action planned) sites.
- MDA AgChem database: Contains locations of agricultural chemical spill and investigation sites. Database includes active and closed spill sites, and the locations of pesticide and herbicide investigations.

For the Freight Rail Relocation Segment, a records database search was completed in January of 2011, with subsequent search of the BNSF section in February 2011. The assessment included all properties within a 1-mile radius around the existing rail lines. Sites located within the construction limits were ranked as having high, medium, low, or unlikely potential for contamination.

- Sites with high potential for contamination include all active and inactive VIC and MERLA sites, all active and inactive dump sites, and all active LUST sites;
- Sites with medium potential for contamination include all closed LUST sites, all sites with USTs or ASTs, all sites with vehicle repair activities, and all sites with historical demolitions;
- Sites with low potential for contamination include small hazardous waste generators and possibly residences; and
- Sites that are classified as unlikely appear to have an unlikely chance of contamination.

4.9.2 Existing Conditions

For the purposes of this assessment, the databases were used to identify contaminated sites within 500 feet of the Build Alternatives. Table 4.9-1 summarizes the number of sites identified by segment.

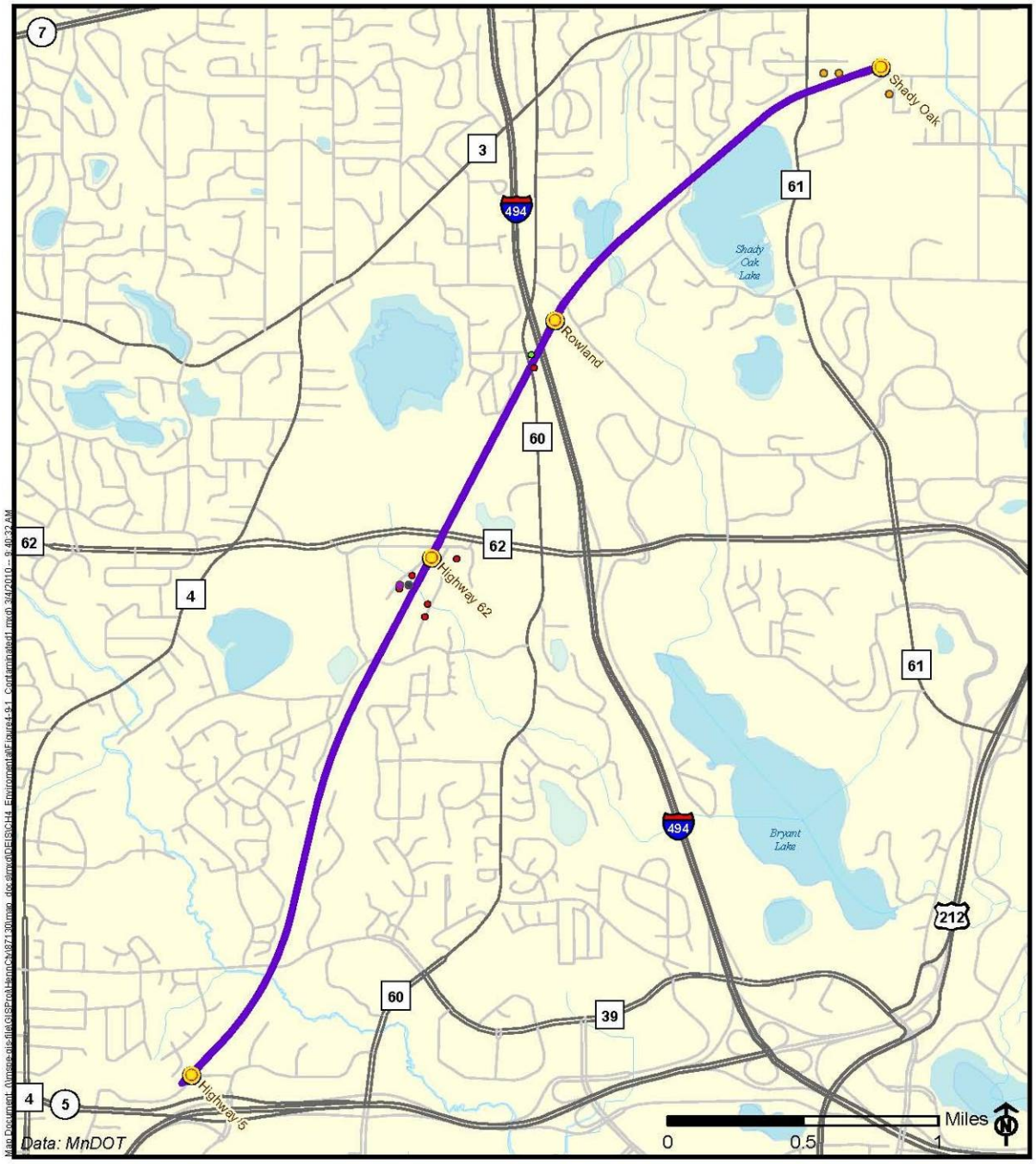
Table 4.9-1. Numbers of Contaminated Sites by Segment

Site Type	Segment						
	1	3	4	A	C-1	C-2	FR
LUST	6	5	27	22	53	71	9
Superfund	0	0	2	0	0	0	0
VIC	2	3	15	12	26	42	6
AgChem	1	2	4	2	2	2	0
Dump	1	0	3	0	2	1	2
Other	1	0	0	1	0	1	0
Total	11	10	51	37	83	117	17

Table 4.9-2 summarizes known contaminated sites by Build Alternative. The locations of the sites identified by this evaluation are shown on Figure 4.9-1 through Figure 4.9-5, which display contaminated properties by segment.

Table 4.9-2. Numbers of Contaminated Sites by Build Alternative

Site Type	Build Alternative				
	LRT 1A	LRT 3A (LPA)	LRT 3A-1 (Co-location alternative)	LRT 3C-1 (Nicollet Mall)	LRT 3C-2 (11th/12th Street)
LUST	64	63	54	94	112
Superfund	2	2	2	2	2
VIC	35	36	30	50	64
AgChem	7	8	8	8	8
Dump	6	5	3	7	6
Other	2	1	1	0	1
Total	116	115	98	161	195



Legend

- Station
- Park & Ride Station
- Segment 1
- Lake
- Streams

Site Type

- Superfund
- Unpermitted Dump
- VIC/NFRAP
- Other
- Agricultural Chemical Spill
- Leaking Underground Storage Tank Site
- Agricultural Chemical Site Investigation

Figure 4.9-1
Contaminated Properties: Segment 1

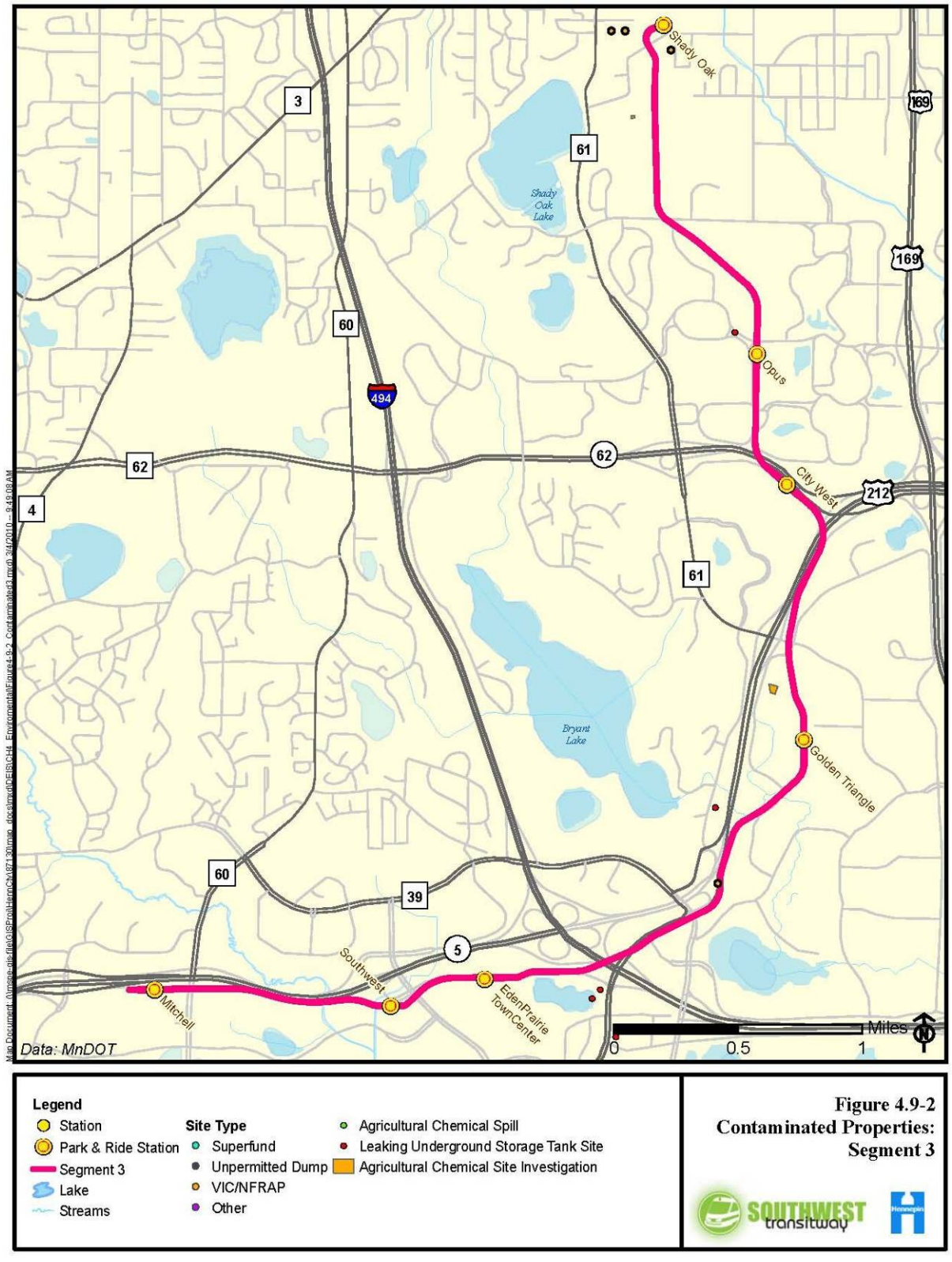


Figure 4.9-2
Contaminated Properties: Segment 3

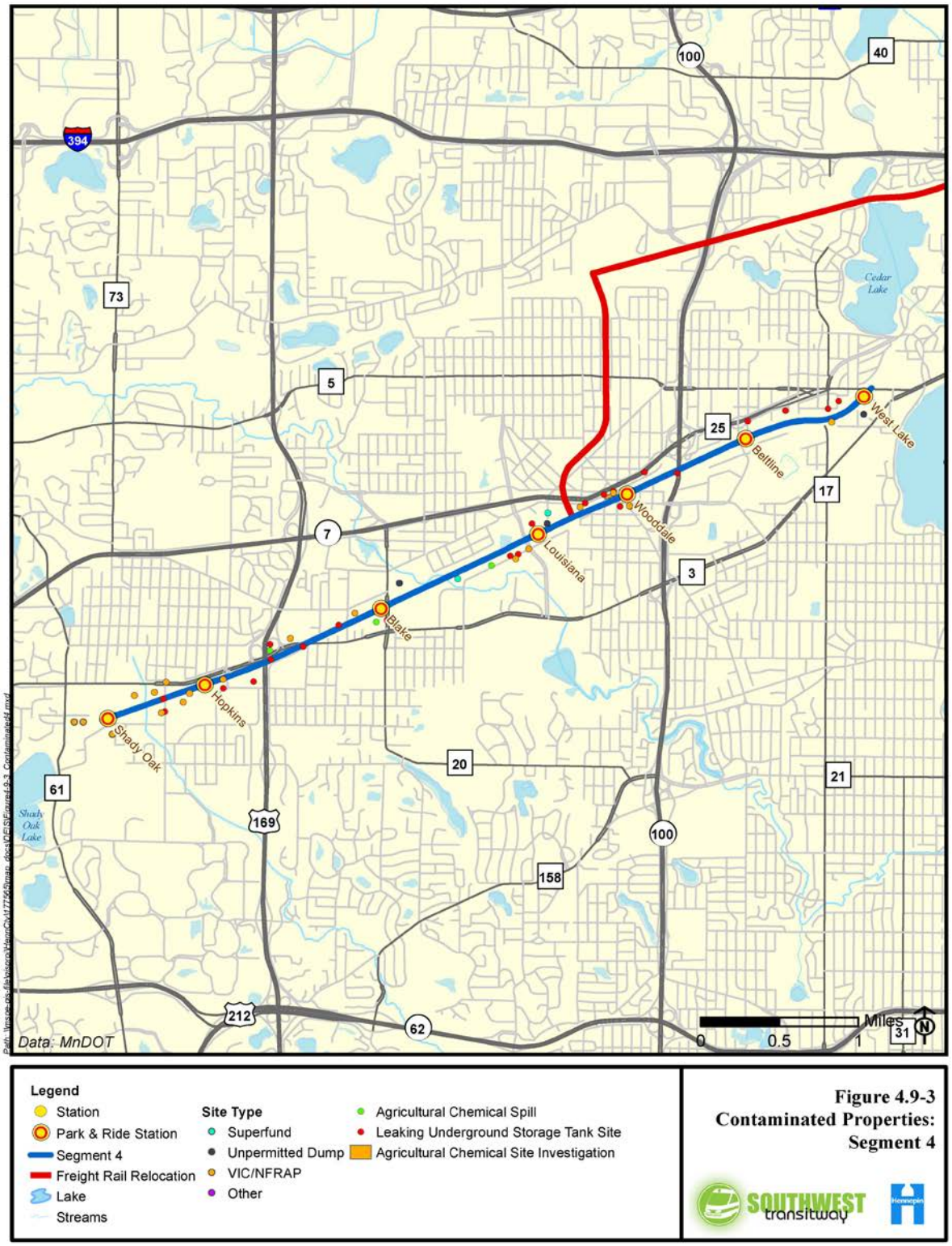


Figure 4.9-3
Contaminated Properties: Segment 4

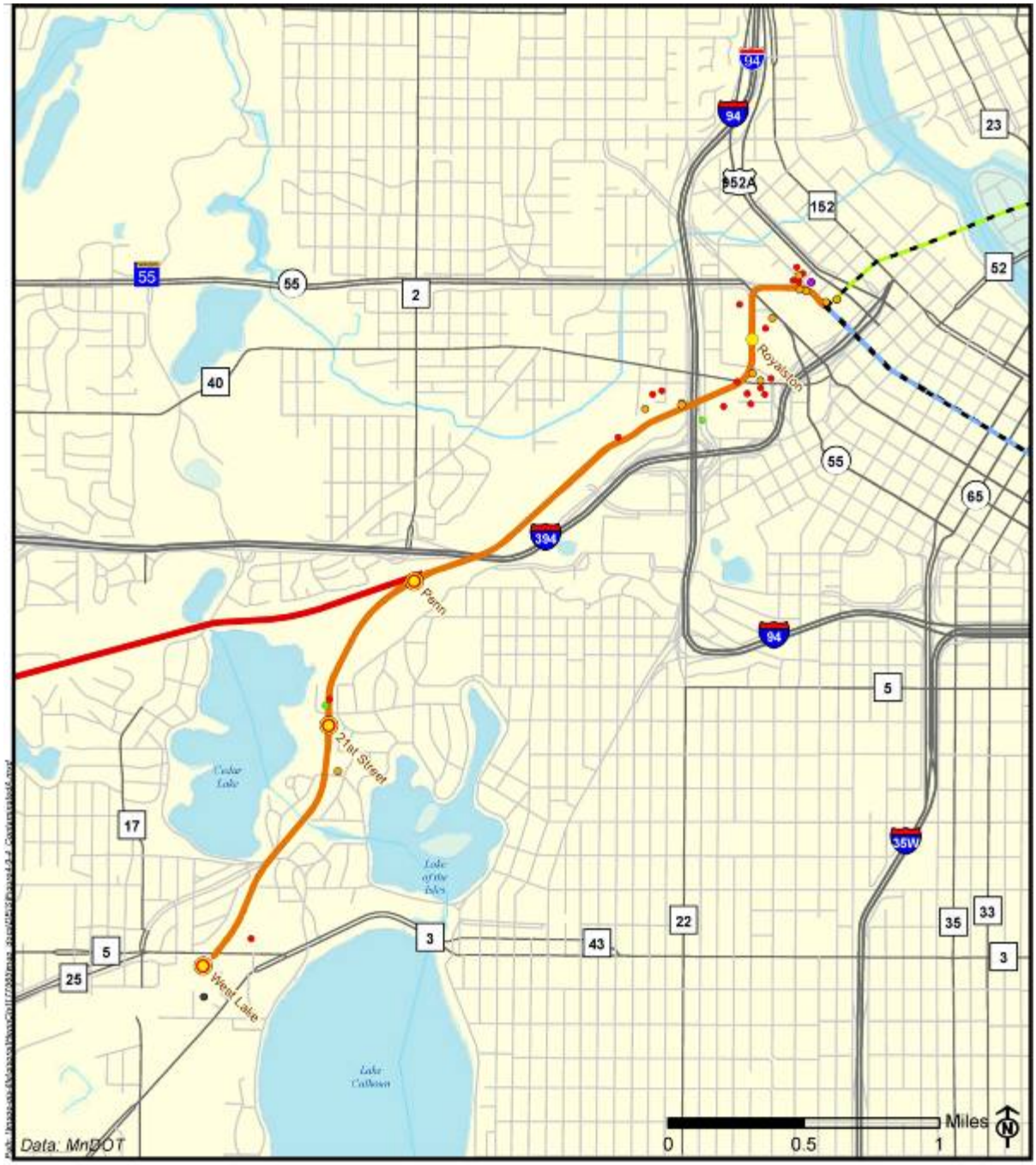


Figure 4.9-4
Contaminated Properties: Segment A

Figure 4.9-5
Contaminated Properties: Segments C-1 and C-2

Table 4.9-3 summarizes the known contaminated sites at or within 500 feet of each of the four potential OMF sites.

Table 4.9-3: Numbers of Contaminated Sites – Potential OMF Locations

Site Type	Eden Prairie 1	Eden Prairie 2	Eden Prairie 3	Minneapolis 4
LUST	6	2	0	7
Superfund	0	0	0	0
VIC	1	1	0	6
AgChem	0	0	0	0
Dump	0	0	0	0
Other	0	0	0	2
Total	7	3	0	15

The LUST and AgChem site types include sites listed in the MPCA LUST "What's in my neighborhood database." The remaining site types are groupings from the MPCA MES database. The VIC site type includes is the VIC sites and the NFRAP sites from the MES database. The Superfund site type includes CERCLIS, PLP, National Priorities List (NPL), Delisted (DPLP) sites from the MES database. The dump site type is the unpermitted dump sites from the MES. Finally, the "other" site type represents all other types—primarily permitted solid waste facilities and RCRA generators. All of these sites have some potential to create or result in an environmental action as the project is constructed. For the purposes of this evaluation, the potential for contamination is the same at all sites and the sites are not differentiated by the magnitude of potential impact. The objective of the measurement is to understand the likelihood of what could occur. Therefore, the greater the number of sites present, the greater the potential that the construction of the project could open environmental issues that would need to be addressed.

The Golden Auto National Lead site is located adjacent to the MN&S track, just south of Highway 7 in the Freight Rail Relocation Segment. This site was removed from the NPL in 1998, which is the list of the most hazardous sites across the U.S. The site is no longer considered to be a threat to human health, but it is still monitored and subject to some restrictions due to contaminants beneath an existing asphalt cap. The construction of a rail structure across the eastern corner of the Golden Auto site would alter the asphalt cap and contaminants may be disturbed.

4.9.3 Long-Term Effects

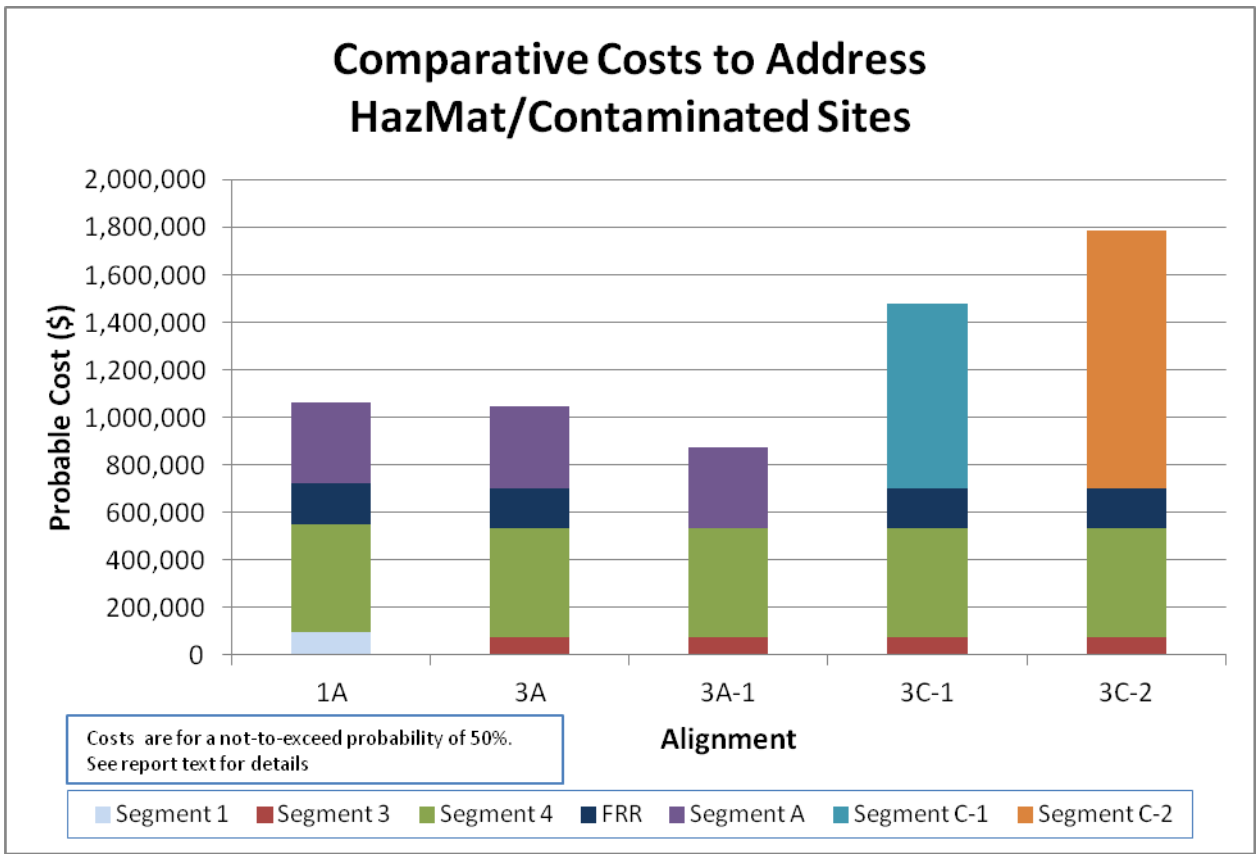
No positive or negative long-term effects are anticipated for the Southwest Transitway because project features would not produce hazardous materials or regulated wastes. The collection and disposal of oils, grease, and other waste materials generated during vehicle maintenance and repair activities would be accomplished in accordance with industry BMPs for rail transit maintenance facilities. Phase I and II ESAs will be conducted. The purposes of the ESAs are to avoid the acquisition of liability for contaminated properties. Therefore, no long-term liability for remediation is anticipated. If third-party contamination is present near a project site where permanent dewatering is needed, there is potential for contaminated groundwater to enter the dewatering system. Proper treatment,

sampling, and disposal would be necessary to avoid effects from the discharge of potentially contaminated groundwater.

4.9.4 Short-Term Construction Effects

Construction effects include the time and expense of identifying, testing, removing, transporting, and disposing of contaminated materials to properly licensed facilities. Project construction could also be affected through contact with contaminated soil and/or groundwater during excavation or drilling activities. For example, the environmental remediation costs for each segment (estimated using the probabilistic method described in Appendix H) are displayed in Figure 4.9-6.

Figure 4.9-6. Comparative Environmental Remediation Costs



Note: Shown is the 50 percent probable costs (i.e., a 50 percent chance that the actual cost will be less than or equal to the given amount).

In addition to impacts to the project cost, contamination remediation could impact the project schedule. In addition to construction impacts, people present within and adjacent to the project construction area could potentially be exposed to hazardous materials. Site workers may be exposed through physical contact with, or ingestion or inhalation of, contaminants uncovered in excavations. Exposures to passersby would likely be limited to inhalation of contaminant vapors emanating from freshly uncovered contaminants. Public exposure through physical contact with a contaminated material or contaminant ingestion would be prevented by site access barriers.

4.9.5 Mitigation

Contaminated sites will likely be enrolled in the MPCA VIC program. Remedial investigations, consisting of Phase I and Phase II ESAs, and subsequent environmental field investigations, will be conducted to delineate the extent and magnitude of contamination. The risks posed by the contamination (as determined by the ESAs and field investigations) will be evaluated and a Response Action Plan will be developed to address the risks. Upon MPCA approval of the Response Action Plan, cleanup of identified contamination would begin prior to, or in concert with, project excavation and/or drilling activities. All clean-up activity would be conducted with prior MPCA approval and in accordance with the approved Site Safety and Health Plan and would be continuously monitored by qualified inspectors. A final report would be prepared and submitted to the MPCA documenting all removal and disposal activity.

It is reasonable to expect that previously undocumented soil or groundwater contamination may be encountered during construction. A Construction Contingency Plan would be prepared prior to the start of construction to account for the discovery of unknown contamination. This plan would outline procedures for initial contaminant screening, soil and groundwater sampling, laboratory testing, and removal, transport, and disposal of contaminated materials at licensed facilities. Contaminated material removal and disposal would be in accordance with this plan, monitored by qualified inspectors, and documented in final reports for submittal to MPCA.

In addition to contaminated soil and groundwater, the potential exists for structures on acquired lands to contain asbestos, lead paint, or other hazardous materials. Any existing structures would be surveyed for the presence of hazardous/regulated materials prior to their demolition or modification. Potentially hazardous materials would be handled and managed in compliance with all applicable regulatory standards and would be disposed of in accordance with an approved remediation plan.

Because this site is still monitored and subject to some restrictions due to contaminants beneath an existing asphalt cap, activities on the Golden Auto site would require coordination with the EPA and MPCA to review the project and plan for proper safety and containment or removal measures during construction, and any monitoring required after construction.

4.9.6 Summary

Table 4.9-4 lists the types of contaminated sites within 500 feet of the alignments of the proposed alternatives; these comprise the environmental metric for this section. The number of each site type within 500 feet of each alternative are also listed. Details about each site type and how the sites might be affected by implementation of any of the alternatives are contained in the section above and are available in Appendix H.

Three online databases available in Minnesota were consulted to identify potentially contaminated properties. These databases are found on the "What's In My Neighborhood" Internet sites maintained by the MPCA and the MDA.

Table 4.9-4. Summary of Contaminated Sites within 500 feet of Build Alternative

Environmental Metric	Build Alternative				
	LRT 1A	LRT 3A (LPA)	LRT 3A-1 (co-location alternative)	LRT 3C-1 (Nicollet Mall)	LRT 3C-2 (11th/12th Street)
Contaminated sites within 500 feet of alignment					
LUST	64	63	54	94	112
Superfund	2	2	2	2	2
VIC	35	36	30	50	64
AgChem	7	8	8	8	8
Dump	6	5	3	7	6
Other	2	1	1	0	1
Total	116	115	98	161	195

Source: Databases found at Minnesota Pollution Control Agency (MPCA) and the Minnesota Department of Agriculture (MDA)

4.10 Electromagnetic Interference and Utilities

This section provides general information regarding existing electromagnetic fields (EMF), **electromagnetic interference** (EMI), and utilities, and identifies potential effects that may result from the proposed Southwest Transitway project.

Utilities and distribution systems within the project study area include public underground water, sanitary sewer, storm sewer, underground electrical distribution, underground communications, overhead electrical distribution, communications, and electric transmission.

"Electromagnetic interference" occurs when the use of one electric device interferes with the use of another, such as a cell phone interfering with magnetic resonance imaging (MRI). Properly designed LRT power lines will minimize or avoid such interference.

4.10.1 Legal and Regulatory Overview

Neither the federal government nor the State of Minnesota has set standards for EMF exposure and/or EMI levels for electrical equipment. Federal guidelines are under consideration by the U.S. Food and Drug Administration, (FDA) Federal Communications Commission (FCC), U.S. Department of Defense, and the EPA.

Laws dealing with utility relocation and accommodation are contained in U.S. Code, Title 23, Sections 123 and 109(l)(1). Regulations dealing with utility relocation and accommodation matters are based upon laws contained in U.S. Code, Title 23, Code of Federal Regulations 645, Chapter I, Subchapter G, Part 645, Subparts A and B (FHWA 2003). In addition, federal transit projects are subject to the FTA's Project and Construction – Management Guidelines (2003), Appendix C – Utility Agreements.

All utilities, both public and private, must conform to Mn/DOT's Procedures for Accommodation of Utilities on Highway Right of Way.

The following Minnesota State Constitution articles, laws, and rules apply to utility accommodation and relocation.

- Minnesota State Constitution
  - Article 1, section 13, deals with just compensation for private property taken, destroyed, or damaged for public use.
- Minnesota Statutes
  - Minnesota Statutes, section 161.20, subdivision 1, deals with the general powers of the commissioner to carry out the provisions of Article 14, section 2, of the Minnesota State Constitution regarding the public highway system. Subdivision 2 deals with the commissioner's power regarding acquisition of property.
  - Minnesota Statutes, section 161.45 deals with relocation of utilities on highway rights-of-way, and includes sections on rulemaking authority and utility owner interests when real property is conveyed.
  - Minnesota Statutes, section 161.46, deals with reimbursement of utility owners for the relocation of facilities, and includes sections on definitions, lump sum settlement, acquisition of relocated facility for utility, and relocation work by the state.
  - Minnesota Statutes, section 222.37, subdivision 2, deals with pipeline relocations.
  - Minnesota Statutes, section 216D.04, deals with the Department of Public Safety's notice and plan requirements for excavation projects involving underground facilities.
- Minnesota Rules
  - Minnesota Rules, parts 8810.3100 through 8810.3600, deal with the utility permit process, standards for work conducted under permit, aerial lines, and underground lines.

Utilities that lie within the ROW owned by cities may be subject to an individual franchise agreement as authorized by Minnesota Statute 216B, Public Utilities. These individual agreements/ordinances provide the terms for which the utility companies may operate in the public ROW.

4.10.2 Methodology

The potential effects of EMF associated with the Southwest Transitway project were assessed based upon review of relevant literature and identification of locations with potentially sensitive electronic equipment.

An inventory of existing utilities within the project study area was prepared using a combination of existing information and field investigations. The Gopher One Call utility hotline system was used to determine the approximate location and extent of the utilities. A field investigation was performed to determine the location and encroachment of underground chambers within the proposed alternates for the Southwest Transitway study area.

For the Freight Rail Relocation Segment, utilities within the proposed construction limits were observed in the field by representatives in November 2010. This

information was supplemented by viewing available utility plans from the Metropolitan Council and the City of St. Louis Park.

4.10.2.1 Private Utilities

Private utility information was obtained through the Gopher State One Design Locate Process to identify private utility owners within the study area. Private utility crossings and facilities existing within 100 feet either side of the corridor were evaluated.

4.10.2.2 Public Utilities

The cities of Eden Prairie, Minnetonka, Hopkins, St. Louis Park, and Minneapolis were contacted to obtain public utility information for water main, sanitary sewer, and storm sewer. The utility locations were then compared to the proposed alignment alternatives and crossing conflicts were noted. In addition, any utilities within 100 feet of the identified centerline were identified for conflicts.

4.10.3 Existing Conditions

4.10.3.1 Electromagnetic Interference

EMI derives from the presence of unwanted EMF, which is produced by voltages and currents wherever wires distribute electric power and wherever electrical equipment is used. EMF levels decrease with distance from operating equipment or from electric lines carrying current.

A review of land uses in the study area was conducted to identify potential EMI-sensitive locations. Sensitive land uses may have instruments that could be sensitive to potential EMI disturbance. The locations considered include research and manufacturing facilities, hospitals, recording studios, concert halls, schools, and churches. EMI-sensitive land uses were categorized according to the vibration-sensitive land uses categories outlined in Chapter 8 of the FTA Transit Noise and Vibration Impact Assessment Manual (May 2006). Vibration categories are comparable to EMI sensitivities because the most sensitive equipment is considered Category 1 and the least sensitive equipment is considered Category 3.

A screening distance of 900 feet from the proposed segments was used for the most EMI-sensitive land uses. Category 1 represents the most sensitive land uses and includes research and manufacturing facilities, hospitals, concert halls, and recording studios. A screening distance of 150 feet from the proposed segments was used for less EMI-sensitive land uses. Category 3 represents the less sensitive land uses and includes schools, churches, and other institutional facilities. These screening distances are equivalent to or greater than those used for the vibration screening analysis, which is presented in Table 9-2 of the FTA Manual.

More sensitive land uses have a greater potential to have sensitive instrumentation onsite than less sensitive land uses.

The key determinants of EMF/EMI potential consist of the:

- Magnitude of electric currents and voltages used by LRT vehicles
- Mass and size of the ferromagnetic material in the vehicle (for "moving metal" fields)
- Proximity of sensitive receptors to the transit corridor
- Pattern of current and voltage time variations
- Spatial configuration of the conductors supplying electric power
- Quantity of traffic
- Degree of EMF/EMI isolation required by sensitive receptors

As shown in Table 4.10-1 and Table 4.10-2 the land use study identified no high-sensitivity research facilities near the proposed route segments. Potential EMI-sensitive locations, all near the Minneapolis route segments, include University of St. Thomas facilities located on LaSalle Avenue, Orchestra Hall on Marquette Avenue, the Allina Medical Clinic on Nicollet Avenue, and various recording studios.

Table 4.10-1. Summary of Potential Impacts to Electromagnetic Fields/Electromagnetic Interference by Segment

Segment Name	Potential EMF/EMI Impacts	Total Potential EMF/EMI Impacts
Segment 1	Higher sensitivity – recording studio (1)[a] Lower sensitivity – school (1)	Higher sensitivity (1) Lower sensitivity (1)
Segment 3	Higher sensitivity – recording studio (2) Lower sensitivity – industrial/commercial (5), church (1)	Higher sensitivity (2) Lower sensitivity (6)
Segment 4	Higher sensitivity – recording studio (1) Lower sensitivity – industrial/commercial (3), school (1), church (1)	Higher sensitivity (1) Lower sensitivity (5)
Segment A	Higher sensitivity – None Lower sensitivity – School (1), Church (1)	Higher sensitivity (0) Lower sensitivity (2)
Segment C	Higher sensitivity – recording studio (12), concert hall/theater (6) Lower sensitivity – Industrial/Commercial (15), School (14), Church (1), Library (1)	Higher sensitivity (18) Lower sensitivity (31)
Segment C-2	Higher sensitivity – Recording studio (2), theater (3) Lower sensitivity – School (7), Church (4), Industrial/Commercial (2)	Higher sensitivity (5) Lower sensitivity (13)

Note: [a] (#) = Number of land uses.

Table 4.10-2. Summary of Potential Impacts to Electromagnetic Fields/Electromagnetic Interference by Alternative

LRT Alternative	Potential EMF/EMI Impacts	Total Potential EMF/EMI Impacts
LRT 1A	Higher sensitivity – recording studio (2)[a] Lower sensitivity – school (3), industrial/commercial (3), church (2)	Higher sensitivity (2) Lower sensitivity (8)
LRT 3A (LPA)	Higher sensitivity – recording studio (3) Lower sensitivity – industrial/commercial (8), church (3), school (2)	Higher sensitivity (3) Lower sensitivity (13)
LRT 3C-1 (Nicollet Mall)	Higher sensitivity – recording studio (15), concert hall/theater (6) Lower sensitivity – industrial/commercial (23), church (3), school (15), Library (1)	Higher sensitivity (21) Lower sensitivity (42)
LRT 3C-2 (11th/12th Street) 3, 4 and C-2	Higher sensitivity – recording studio (5), theater (3) Lower sensitivity – industrial/commercial (10), church (6), school (8),	Higher sensitivity (8) Lower sensitivity (24)

Note: LRT 1A is inclusive of segments 1, 4 and A. LRT 3A (LPA) is inclusive of segments 3, 4, and A. LRT 3C-1 (Nicollet Mall) is inclusive of segments 3, 4, and C-1. LRT 3C-2 (11th/12th Street) is inclusive of segments 3, 4 and C-2.

[a] (#) = Number of land uses.

Identified higher-sensitivity locations have a greater likelihood of having sensitive instrumentation than do lower-sensitivity locations. Industrial/commercial are land use types that may have sensitive instrumentation on site. At this time and based on the information available, there is no equipment located along the build alternative alignments that would be affected by LRT induced EMI. In the event that equipment is identified during PE and found to be sensitive to LRT induced EMI, potential long term EMI effects will be documented and will be disclosed in the Final EIS.

4.10.3.2 Utilities

The activities associated with the construction of a light rail transitway often require significant excavation and the erection of bridges, catenary systems, and other vertical infrastructure. Excavation can occur in areas where existing underground utilities are in place; in these situations the utilities would need to be reconstructed and/or relocated. Similarly, vertical infrastructure components could interfere with overhead utilities, especially electrical transmission and distribution lines. The Freight Rail Relocation Segment will also involve some excavation and erection of bridges.

To identify underground and above ground utilities that could be affected by the construction of a light rail transitway, a review of existing plans and other utility information was conducted. The potential conflicts from major private and public utilities for each of the Southwest Transitway alignment alternatives were inventoried. The major private and public utilities are defined as follows:

- Above- or below-ground electrical transmission lines
- High pressure gas lines
- Petroleum pipelines

- Fiber optic conduit banks
- Gas-main substations and gas lines 12 inches or greater in diameter
- Specialty utilities such as nitrogen gas lines, steam lines, and utility tunnels, or utilities that would require special methods of construction
- Watermains 12 inches or greater in diameter
- Sanitary sewer lines 12 inches or greater in diameter
- Sanitary forcemains 8 inches or greater in diameter
- Storm sewer lines 24 inches or greater in diameter
- Utility corridors greater than 200 feet in length, aligned parallel to centerline
- Utilities located within the transitway corridor

Minor utilities were not inventoried; however, information obtained on the major utilities adequately depicts the degree to which the alternatives could affect various utilities and to which they could present potential construction and operation impacts.

In general, there is a greater concentration of utilities in the more densely developed portions of the project, especially the City of Minneapolis. A listing of the aerial and underground utilities located within 100 feet of the proposed alternative segment centerlines may be found in Appendix H.

4.10.4 Long-Term Effects

4.10.4.1 No Build Alternative

No impacts are anticipated as a result of the No Build Alternative.

4.10.4.2 Enhanced Bus Alternative

No impacts are anticipated as a result of the Enhanced Bus Alternative

4.10.4.3 Build Alternatives

EMF/EMI

At this time, insufficient information is available regarding the operational specifics of the proposed LRT line and specific sensitive equipment in the study area to evaluate long-term effects of EMF/EMI. Adverse effects from EMF/EMI are unlikely. However, in the event equipment is identified during PE and found to be sensitive to LRT induced EMI, potential long term EMI effects will be documented and will be disclosed in the Final EIS. In the unlikely event there are adverse effects, mitigation can be implemented based on the specifics of the situation and these strategies may be source-based (systems) or receiver-based (sensitive equipment).

Utilities

Generally, those areas of the project that require cut and cover construction methods, followed by those areas requiring at-grade construction methods, would have the greatest impacts on utility infrastructure because these segments require more relocations of underground pipes and aboveground utility poles for trackways, stations, and ROW acquisition. Utilities that run parallel to the trackway have greater relocation costs as compared with utilities that intersect the trackway.

Private and Public Utilities

Both private and public utilities running parallel and crossing within the transitway corridor would be relocated.

Overhead electric and communication lines would be adjusted as necessary to provide adequate vertical clearance for the LRT vehicles and the overhead catenary system. In some cases, aboveground utilities located on poles could be relocated to taller poles or a different type of pole.

Underground utilities which cross the proposed alignment would be evaluated on a case-by-case basis to determine their condition, potential reaction to loadings from the proposed guideway facility, and if their vertical clearances meet Minnesota Department of Transportation and utility owner requirements. Underground utilities may be encased for additional protection, lowered to provide vertical clearance, or relocated. Access to underground utilities—such as manholes or vaults—for maintenance activities could be affected depending on the location of the light rail facilities. In some cases these access points may need to be relocated. Relocating water mains could affect access to and use of fire hydrants. In some cases, establishing a parallel water main to avoid utility lines crossing under the trackway may be considered.

All underground utilities consisting of metallic materials would be evaluated for potential corrosion resulting from possible stray-current from the proposed electrification systems. Corrosion may occur over many years and could potentially result in utility line failure.

Freight Rail Relocation Segment studies have shown the following potential long-term impacts:

- Met Council Force Main: The Metropolitan Council has programmed the upgrade on this force main to two 24-inch mains in the future. The proposed project will not impact the existing force main directly, but the rail crossing of TH 7 would need to accommodate this future expansion.
- Fiber optic utility (FOU): Bridge construction for the connecting track over the CP Bass Lake Spur is not anticipated to impact in place FOU. Even though track profile grade elevations would increase in the area between TH 7 and Dakota Avenue; FOU infrastructure would not likely be impacted in this segment. FOU would likely be impacted by bridge construction over TH 7. The reconstruction of track on new horizontal alignment and slightly increased vertical alignment between Dakota Avenue and 27th Street would also likely impact FOU infrastructure. In addition, construction of new track on the abandoned Iron Triangle alignment, between West 27th Street and the connection with the BNSF Wayzata Subdivision would likely impact FOU infrastructure.
- Electrical transmission towers: Impacts are anticipated to electrical transmission towers in vicinity of the new track connecting the CP Bass Lake Spur and MN&S Spur. These impacts are illustrated in the plan sheets in Appendix F. It is assumed that the Proposed Action would not impact any of the other in place poles noted in Existing Conditions, with the exception of the pole just east of the proposed North Cedar Lake Trail bridge crossing over the proposed Iron Triangle track. This pole is anticipated to be impacted as part of the construction of the overpass.

- Municipal utilities: Municipal utilities including water main, sanitary sewer, and storm sewer may be impacted as a result of proposed connecting track alignment and closure of the 29th Street grade crossing. Storm sewer and drainage issues may need to be addressed in conjunction with construction of the proposed North Cedar Lake Trail crossing.

4.10.5 Short-Term Construction Effects

4.10.5.1 EMF/EMI

There are no short-term construction effects from EMF/EMI.

4.10.5.2 Utilities

Impacts to utilities are most likely to occur during excavation and grading activities, and during placement of structural foundations. Disruptions to utility service during utility relocations would likely be minimal. Typically, temporary connections to customers would be provided prior to permanent relocation activities. Utility owners would ultimately decide when and if disruptions to service would be allowed.

Unintentional damage to underground utilities, however, can occur during construction if utility locations are uncertain or misidentified. The large number of utilities present within the project area increases the likelihood of encountering previously unidentified utilities.

4.10.6 Mitigation

4.10.6.1 EMF/EMI

At this time, insufficient information is available regarding the operational specifics of the proposed LRT line and specific sensitive equipment in the study area to evaluate long-term effects of EMF/EMI. Adverse effects from EMF/EMI are unlikely. However, in the event equipment is identified during Preliminary Engineering and found to be sensitive to LRT induced EMI, potential long term EMI effects will be documented and will be disclosed in the Final EIS. Also, in the unlikely event there are adverse effects, mitigation can be implemented based on the specifics of the situation and that strategies may be source-based (systems) or receiver-based (sensitive equipment).

4.10.6.2 Utilities

To minimize damage to existing utilities, conflicts during construction and disruption of LRT service, a utility-free zone will be established during design and will be based on project design criteria. An evaluation of potential utility conflicts and whether affected utilities within the utility-free zone would require relocation will be conducted during design. The complete relocation of a conflicting utility line beyond the limits of construction will prevent conflicts with the LRT construction and future disturbances to the route during maintenance of the underground utilities.

Prior to construction, affected area utility companies and utility agencies would be contacted and requested to provide line relocation measures and approval of the proposed alteration of utility lines. In addition, utility location excavations and

preconstruction surveys in general accordance with the Mn/DOT policy of Subsurface Utility Engineering will help minimize unintended utility service disruptions.

The utility contractor would be required to notify affected businesses and residences of any planned disruption of service due to construction activities. Should utilities be discovered during construction that were not identified in the contract documents, work would be discontinued and appropriate utility companies and agencies would be contacted to identify the line(s). The discovered line(s) would not be disturbed until businesses and residences were notified and the utility owner approved the proposed alteration.

The Freight Rail Relocation Segment would be constructed to accommodate the future expansion of the Metropolitan Council force main.

4.10.7 Summary

The locations where buildings and land uses that are sensitive to potential EMI emission along the alignments include University of St. Thomas facilities located on LaSalle Avenue, Orchestra Hall on Marquette Avenue, the Allina Medical Clinic on Nicollet Avenue, and various recording studios.

Table 4.10-3 briefly summarizes the utilities that might be affected by implementation of the proposed alternatives, particularly where deep cuts would be needed. In general, there is a greater concentration of utilities in the more densely developed portions of the project, especially the City of Minneapolis.

Table 4.10-3. Summary of Potential Impacts to Utilities

Environmental Metric	Build Alternative				
	LRT 1A	LRT 3A (LPA)	LRT 3A-1 (Co-location alternative)	LRT 3C-1 (Nicollet Mall)	LRT 3C-2 (11th/12th Street)
Potential impacts from cut and cover construction (underground utilities)	Segment 1: underpass near CR 62 Segment A: underpass crossing N. 7th Street	Segment 3: tunnel under Prairie Center Drive. Tunnel beneath Shady Oak Road. Segment A: underpass crossing N. 7th Street	Segment 3: tunnel under Prairie Center Drive. Tunnel beneath Shady Oak Road. Segment A underpass crossing N. 7th Street	Segment 3: tunnel under Prairie Center Drive. Tunnel beneath Shady Oak Road. Segment C: tunnel under Nicollet Avenue	Segment 3: tunnel under Prairie Center Drive. Tunnel beneath Shady Oak Road. Segment C: tunnel under 11th/12th Street.
Potential impacts from at-grade construction (overhead and underground utilities)	All segments: parallel and crossing utilities would likely need to be relocated, raised, lowered, and possibly encased. FR Segment: Allow for future force main expansion.	All segments: parallel and crossing utilities would likely need to be relocated, raised, lowered, and possibly encased. FR Segment: Allow for future force main expansion.	All segments: parallel and crossing utilities would likely need to be relocated, raised, lowered, and possibly encased.	All segments: parallel and crossing utilities would likely need to be relocated, raised, lowered, and possibly encased. FR Segment: Allow for future force main expansion.	All segments: parallel and crossing utilities would likely need to be relocated, raised, lowered, and possibly encased. FR Segment: Allow for future force main expansion.

Note: LRT 1A is inclusive of segments 1, 4 A, and FR. LRT 3A (LPA) is inclusive of segments 3, 4, A, and FR. LRT 3A-1 (co-location alternative) is inclusive of segments 1, 4, and A. LRT 3C-1 (Nicollet Mall) is inclusive of segments 3, 4, C-1, and FR. LRT 3C-2 (11th/12th Street) is inclusive of segments 3, 4, C-2 and FR.

4.11 Energy and Climate Change

For the purposes of this analysis, **regional energy consumption** (energy use) focuses on energy consumption by transportation activity. This section discusses the relative transportation energy use of the various transit alternatives, as well as the no build alternative. Regional energy consumption is based on regional **vehicle miles** traveled that are derived from the Metropolitan Council travel demand model. Transit operating consumption is defined as the energy used for vehicle propulsion, operation of stations and ancillary facilities, and the maintenance of transit vehicles and track systems.

"Regional energy consumption" is a measurement of how much energy is used by a given geographic area.

A "vehicle mile" is one vehicle traveling one mile.

This section also addresses the potential effects on climate change associated with the implementation of any of the proposed build alternatives, as well as the enhanced bus alternative. Changes in land use can also contribute to local climate

changes such as the **urban heat island** effect, which occurs when cities replace natural land cover with pavement, buildings, and other infrastructure. In the U.S., energy-related carbon dioxide emissions from residential, commercial, industrial, and transportation end-use sectors account for more than 80 percent of greenhouse gas (GHG) emissions, mostly from burning fossil fuels. The remaining 20 percent of GHG emissions are made up of methane, nitrous oxide, various high global-warming potential gases (such as refrigerants), and non-energy related carbon dioxide emissions. Forty percent of the total energy-related carbon dioxide emissions are attributed to electricity generation across all sectors, mainly from large stationary sources such as power plants, and about a third of the total energy-related carbon dioxide emissions are attributed to the transportation sector. (EPA 2010, EIA 2010). A more detailed discussion of GHG emissions is located is Section 9.5.

An "urban heat island is a metropolitan area which has warmer temperatures than the surrounding suburban or rural area due to the higher density of development and energy use.

4.11.1 Methodology

The energy impacts of the Build Alternative alignments were determined by comparing total energy consumption for each Build Alternative alignment with the Enhanced Bus Alternative and the No Build Alternative for year 2030. The amount of energy used per mile by each mode of transportation is presented in Table 4.11-1. By multiplying these energy-use factors by the total miles traveled, annual energy use can be estimated.

Table 4.11-1. Energy Consumption Factors

Mode	Factor
Light Rail Transit	62,833 BTU*/**Vehicle Mile**
Heavy Duty Vehicles	23,238 BTU/Vehicle Mile
Bus	39,408 BTU/Vehicle Mile
Passenger Vehicles	5,952 BTU/Vehicle Mile

* British Thermal Units

Source: Transportation Energy Data Book: Edition 28 – 2009, USDOE Oak Ridge National Laboratory (passenger vehicle value is weighted average of cars, personal trucks, and motorcycles)

Potential climate change impacts were determined by estimating carbon dioxide emissions associated with energy consumption for each Build Alternative as compared to the Enhanced Bus and No Build alternatives. Carbon dioxide emission rate assumptions are presented in Table 4.11-2.

Table 4.11-2. Carbon Dioxide Emission Rates

Mode	Factor
Light Rail Transit[a]	0.41 pounds CO_2/Passenger Mile
Heavy Duty Vehicles[b]	3.73 pounds CO_2/Vehicle Mile
Bus[a]	0.65 pounds CO_2/Passenger Mile
Passenger Vehicles[b]	0.59 pounds CO_2/Passenger Mile

Source: [a] "Transit and Reducing Greenhouse Gases: A Look at the Numbers" – FTA Presentation at Rail-Volution 2008
[b] U.S. Energy Information Administration – Voluntary Report of Greenhouse Gases Program – Retrieved April 2009.

It is important to note that LRT, bus, and passenger vehicle modes carry an average of more than one passenger; therefore, **passenger miles** are an appropriate measure. For heavy duty vehicles (commercial trucks, semis, etc.) there is generally one "passenger" (the driver) therefore vehicle miles traveled is the appropriate measure.

A "passenger mile" is one passenger transported one mile.

4.11.2 Long-Term Operation Effects

Long term operational effects are presented in Table 4.11-3, and are discussed below. All of the Build Alternatives have slightly lower energy consumption and carbon dioxide emissions as compared to the No Build Alternative; however given assumptions used in the analysis the differences between the alternatives may not be statistically significant. Of the Build Alternatives, however, LRT 3A (LPA) has the lowest operational energy consumption and carbon dioxide emissions.

4.11.2.1 No Build Alternative

The annual regional direct energy consumption for the No Build Alternative would be approximately 234.05 trillion **British Thermal Units** (BTUs) annually, based on output from the Metropolitan Council 2030 Regional Travel Model.[3] Refer to Section 6.1.1 of this Draft EIS for additional information on the Regional Travel Model. Carbon dioxide emissions are estimated at 17.099 million metric tons annually.

"British Thermal Unit" is a commonly used unit of energy that is equal to the amount of heat required to increase the temperature of a pint of water by one degree Fahrenheit.

[3] BTUs were calculated using information from the Daily VMT found in Metropolitan Council's 2030 Regional Travel Model using the following steps: 1) Daily VMT was annualized to determine Annual VMT by vehicle type (light rail, heavy duty vehicles, bus, and passenger vehicles) for each alternative. 2) Annual VMTs (calculated in Step 1) were multiplied by BTU using the VMT factors—shown in Table 4.11-1 Energy Consumption Factors—to calculate BTU by vehicle type. 3) The data calculated in Step 2 were summed to determine total BTU for each alternative.

Table 4.11-3 presents the estimated energy use by alternative by 2030.

Table 4.11-3. Estimated Energy Use of Alternatives for Year 2030

Vehicle Type	No Build	Enhanced Bus	LRT 1A	LRT 3A (LPA) and LRT 3A-1 (co-location)	3C-1 (Nicollet Mall)	3C-2 (11th/12th Street)
2030 Annual VMT (in thousands)[a]						
Light Rail	2,192	2,192	3,230	3,383	3,439	3,487
Heavy Duty Vehicles	1,552,081	1,551,866	1,551,373	1,551,163	1,551,288	1,551,223
Bus	45,982	46,963	46,157	46,200	46,078	46,129
Passenger Vehicles	32,938,610	32,934,044	32,923,579	32,919,118	32,921,774	32,920,397
Total	34,538,866	34,535,065	34,524,338	34,519,864	34,522,578	34,521,237
2030 Annual Energy Consumption (billions of BTUs)						
Light Rail	138	138	203	213	216	219
Heavy Duty Vehicles	36,067	36,062	36,050	36,046	36,049	36,047
Bus	1,812	1,851	1,819	1,821	1,816	1,818
Passenger Vehicles	196,036	196,008	195,946	195,919	195,935	195,927
Total	234,052	234,059	234,019	233,999	234,016	234,012
Difference from No Build	---	6	(34)	(54)	(37)	(41)

[a] Source: HDR Engineering, Inc., April 2010. VMT is for the 20-county greater metropolitan area in the Metropolitan Council travel demand model.

Values have been rounded, and may not add/subtract exactly as presented.

Table 4.11-4 presents the estimated direct CO_2 emissions for each alternative by 2030.

Table 4.11-4. Estimated Direct CO_2 Emissions by Alternative for Year 2030

Vehicle Type	No Build	Enhanced Bus	LRT 1A	LRT 3A (LPA) and LRT 3A-1 (co-location)	3C-1 (Nicollet Mall)	3C-2 (11th/12th Street)
2030 Annual Passenger Miles (in thousands)[a]						
Light Rail	53,482	53,482	78,818	82,541	83,906	85,085
Heavy Duty Vehicles[b]	NA	NA	NA	NA	NA	NA
Bus	418,439	427,365	420,025	420,422	419,307	419,778
Passenger Vehicles	53,406,033	53,398,629	53,381,661	53,374,429	53,378,735	53,376,503
2030 Estimated Annual Direct CO_2 Emissions (metric tons)						
Light Rail	9,946	9,946	14,658	15,351	15,604	15,824
Heavy Duty Vehicles[b]	2,672,887	2,672,517	2,671,667	2,671,305	2,671,521	2,671,409
Bus	123,372	126,004	123,839	123,956	123,628	123,767
Passenger Vehicles	14,292,643	14,290,661	14,286,120	14,284,184	14,285,337	14,284,739
Total	17,098,848	17,099,127	17,096,285	17,094,797	17,096,090	17,095,739
Difference from No Build	-	280	(2,563)	(4,051)	(2,758)	(3,109)

[a] Source: HDR Engineering, Inc., April 2010; Transportation Energy Data Book: Edition 28 -2009, USDOE – Oak Ridge National Laboratory

[b] Heavy Duty Vehicle emissions calculated as a measure of vehicle miles traveled, average fuel economy (5.9 mi/gal), and emissions per gallon of fuel used (22.37 lb CO_2/gal).

4.11.2.2 Enhanced Bus Alternative

The annual regional direct energy consumption for the Enhanced Bus Alternative would be approximately 234.06 trillion BTUs annually, based on output from the Metropolitan Council 2030 Regional Travel Model. Carbon dioxide emissions are estimated at 17.099 million metric tons annually.

4.11.2.3 LRT 1A

The annual regional direct energy consumption for LRT 1A would be approximately 234.02 trillion BTUs, which is less than the No Build Alternative by 34 billion BTU. Carbon dioxide emissions are estimated at 17.096 million metric tons annually, which is slightly lower than the No Build Alternative.

4.11.2.4 LRT 3A (LPA) and LRT 3A-1 (Co-location alternative)

The annual regional direct energy consumption for LRT 3A (LPA) would be approximately 234.00 trillion BTUs, which is less than the No Build Alternative by

54 billion BTU. Carbon dioxide emissions are estimated at 17.095 million metric tons annually, which is slightly lower than the No Build Alternative.

4.11.2.5 LRT 3C-1 (Nicollet Mall)

The annual regional direct energy consumption for LRT 3C-1 (Nicollet Mall) would be approximately 234.02 trillion BTUs, which is less than the No Build Alternative by 37 billion BTU. Carbon dioxide emissions are estimated at 17.096 million metric tons annually, which is slightly lower than the No Build Alternative.

4.11.2.6 LRT 3C-2 (11th/12th Street)

The annual regional direct energy consumption for LRT 3C-2 (11th/12th Street) would be approximately 234.01 trillion BTUs, which is less than the No Build Alternative by 41 billion BTU. Carbon dioxide emissions are estimated at 17.096 million tons annually, which is slightly lower than the No Build Alternative.

As shown in Table 4.11-4, the net annual change in CO_2 emissions due to the any of the alternatives is a minor fraction of the total CO_2 emissions in the world or country, and on the order of the annual CO_2 emissions output by 10,000 passenger vehicles. Over time periods of a year or longer, it can be assumed that CO_2 is essentially evenly distributed throughout the atmosphere across the globe.

Although no individual transportation project can make a notable difference in the rate of CO_2 emissions, the Build Alternatives would provide slight reductions in emissions relative to the No Build and Enhanced Bus alternatives. When considered in a cumulative context with other greenhouse gas emission reduction efforts, implementation of any of the Build Alternatives could have a positive impact on greenhouse gas emissions.

4.11.3 Short-Term Construction Effects

Energy would be required for construction of the Build Alternatives, for the production of the raw materials used in construction, and for the operation of construction equipment. Energy use would be localized and temporary. Compared to the energy consumption of the entire metro area, the construction of the Build Alternatives would not have significant impact on regional energy consumption. Because the operation of any of the Build Alternatives would use slightly more energy than the operation of a No Build Alternative, the energy used in construction would not be recouped as a result of the project. There would obviously be no LRT-related construction energy use for the No Build Alternative.

Limited short-term energy use would likely be required for implementation of the Enhanced Bus Alternative through the construction of some bus stations and park and ride facilities, although such energy use would be to a much lesser extent than the Build Alternatives.

A short-term increase in greenhouse gas emissions would occur from implementation of the Enhanced Bus Alternative, and to a greater extent, implementation of the Build Alternatives. This would primarily be from construction equipment exhaust.

4.11.4 Mitigation

Implementation of any of the Build Alternatives would result in a decrease in total energy used annually by a small amount compared to the No Build Alternative. No mitigation has been identified or recommended.

Implementation of any of the Build Alternatives would result in a decrease in total annual carbon dioxide emissions by a small amount compared to the No Build Alternative. No mitigation has been identified or recommended.

Although the analysis indicates that the project would not increase energy consumption or GHG emissions, opportunities exist to further reduce energy consumption. These opportunities include construction of energy efficient structures (such as stations and operation and maintenance facilities). These opportunities would be evaluated further during the preliminary and final phases of the project.