

Appendix A – Well Logs

208231

County Ramsey
 Quad St Paul East
 Quad ID 103A

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING REPORT
 Minnesota Statutes Chapter 1031

Entry Date 08/14/1991
 Update Date 03/10/2014
 Received Date

| | | | | | | | |
|---|--|--------------------|----------------------------|-----------------------------|---|-----------------------------------|----------------------------|
| Well Name HILLCREST | Township 29 | Range 22 | Dir Section W 23 | Subsection AABACD | Well Depth 550 ft. | Depth Completed 550 ft. | Date Well Completed |
| Elevation 1040 | Elev. Method 7.5 minute topographic map (+/- 5 feet) | | | | Drill Method Cable Tool | Drill Fluid | |
| Address | | | | | Use commercial | Status Sealed | |
| Contact 2200 LARPENTEUR AV ST PAUL MN 55109 | | | | | Well Hydrofractured? Yes <input type="checkbox"/> No <input type="checkbox"/> | From | To |
| Stratigraphy Information | | | | | Casing Type Drive Shoe? Yes <input type="checkbox"/> No <input type="checkbox"/> | Joint Above/Below | |
| Geological Material | From | To (ft.) | Color | Hardness | Casing Diameter 8 in. To | Weight 325 ft. lbs./ft. | |
| DRIFT | 0 | 165 | | | | | |
| PLATTEVILLE | 165 | 190 | | | | | |
| ST. PETER | 190 | 350 | | | | | |
| SHAKOPEE | 350 | 382 | | | | | |
| NEW RICHMOND | 382 | 395 | | | | | |
| ONEOTA | 395 | 490 | | | | | |
| JORDAN | 490 | 550 | | | | | |
| | | | | | Open Hole Screen? <input type="checkbox"/> | From 325 ft. | To 550 ft. |
| | | | | | Type | Make | |
| | | | | | Static Water Level 205 ft. land surface Measure 09/13/1999 | | |
| | | | | | Pumping Level (below land surface) | | |
| | | | | | Wellhead Completion Pitless adapter manufacturer Model <input type="checkbox"/> Casing Protection <input type="checkbox"/> 12 in. above grade <input type="checkbox"/> At-grade (Environmental Wells and Borings ONLY) | | |
| | | | | | Grouting Information Well Grouted? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not Specified | | |
| | | | | | Nearest Known Source of Contamination feet Direction Type Well disinfected upon completion? <input type="checkbox"/> Yes <input type="checkbox"/> No | | |
| | | | | | Pump <input type="checkbox"/> Not Installed Date Installed Manufacturer's name Model Number HP Volt Length of drop pipe ft Capacity g.p. Typ | | |
| | | | | | Abandoned Does property have any not in use and not sealed well(s)? <input type="checkbox"/> Yes <input type="checkbox"/> No | | |
| | | | | | Variance Was a variance granted from the MDH for this well? <input type="checkbox"/> Yes <input type="checkbox"/> No | | |
| | | | | | Miscellaneous First Bedrock Platteville Formation Aquifer multiple Last Strat Jordan Sandstone Depth to Bedrock 165 ft Located by Minnesota Geological Survey Locate Method Digitized - scale 1:24,000 or larger (Digitizing Table) System UTM - NAD83, Zone 15, Meters X 499340 Y 4981941 Unique Number Verification Information from Input Date 01/01/1990 | | |
| Remarks WELL SEALED 9-13-1999. BY KEYS WELL CO. H-141981. LOG IN MGS BULL. NO. 28 P. 252. WELL SEALED 09-13-1999 BY 62012 | | | | | Angled Drill Hole | | |
| | | | | | Well Contractor Licensee Business Lic. or Reg. No. Name of Driller | | |

603061

County Ramsey
 Quad St Paul East
 Quad ID 103A

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING REPORT
 Minnesota Statutes Chapter 1031

Entry Date 12/30/1999
 Update Date 03/10/2014
 Received Date

| | | | | | | | |
|--|-----------------------|--------------------|----------------------------|--------------------------|--|---|--|
| Well Name HILLCREST | Township 29 | Range 22 | Dir Section W 23 | Subsection ADA | Well Depth 486 ft. | Depth Completed 486 ft. | Date Well Completed 09/00/1999 |
| Elevation | Elev. Method | | | | Drill Method Cable Tool | Drill Fluid Water | |
| Address | | | | | Use irrigation | Status Active | |
| C/W 2200 LARPEN TEUR AV E ST PAUL MN 55109 | | | | | Well Hydrofractured? Yes <input type="checkbox"/> No <input type="checkbox"/> | From To | |
| Stratigraphy Information | | | | | Casing Type Step down | Joint Welded | |
| Geological Material | From | To (ft.) | Color | Hardness | Drive Shoe? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> | Above/Below | |
| DRIFT | 0 | 155 | TAN | SOFT | Casing Diameter | Weight | Hole Diameter |
| LIMESTONE | 155 | 187 | GRAY | HARD | 10 in. To 354 ft. | 46.4 lbs./ft. | 16 in. To 354 ft. |
| SANDSTONE/SHALE | 187 | 343 | GRAY | HARD | 16 in. To 155 ft. | 62.5 lbs./ft. | 10 in. To 486 ft. |
| LIMEROCK | 343 | 476 | GRAY | HARD | | | |
| SANDSTONE | 476 | 486 | TAN | MEDIUM | | | |
| | | | | | Open Hole From 354 ft. To 486 ft. | | |
| | | | | | Screen? <input type="checkbox"/> | Type | Make |
| | | | | | Static Water Level | | |
| | | | | | 207 ft. land surface | Measure | 09/03/1999 |
| | | | | | Pumping Level (below land surface) | | |
| | | | | | 226 ft. 8 hrs. Pumping at | 500 | g.p.m. |
| | | | | | Wellhead Completion | | |
| | | | | | Pitless adapter manufacturer | Model | |
| | | | | | <input type="checkbox"/> Casing Protection | <input checked="" type="checkbox"/> 12 in. above grade | |
| | | | | | <input type="checkbox"/> At-grade (Environmental Wells and Borings ONLY) | | |
| | | | | | Grouting Information Well Grouted? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not Specified | | |
| | | | | | Material | Amount | From To |
| | | | | | neat cement | 17 Cubic yards | 0 ft. 354 ft. |
| | | | | | Nearest Known Source of Contamination | | |
| | | | | | 75 feet North Direction | Body of water Type | |
| | | | | | Well disinfected upon completion? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | | |
| | | | | | Pump <input type="checkbox"/> Not Installed | Date Installed | 09/29/1999 |
| | | | | | Manufacturer's name | GOULD | |
| | | | | | Model Number | 8RJHC | HP 60 Volt 460 |
| | | | | | Length of drop pipe | 260 ft | Capacity 650 g.p. Typ Submersible |
| | | | | | Abandoned | | |
| | | | | | Does property have any not in use and not sealed well(s)? | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | |
| | | | | | Variance | | |
| | | | | | Was a variance granted from the MDH for this well? | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | |
| | | | | | Miscellaneous | | |
| | | | | | First Bedrock | Aquifer | |
| | | | | | Last Strat | Depth to Bedrock | 155 ft |
| | | | | | Located by | | |
| | | | | | Locate Method | | |
| | | | | | System | UTM - NAD83, Zone 15, Meters | X Y |
| | | | | | Unique Number Verification | Input Date | |
| | | | | | Angled Drill Hole | | |
| | | | | | Well Contractor | | |
| | | | | | Keys Well Co. | 62012 | RUSSELL, J. |
| | | | | | Licensee Business | Lic. or Reg. No. | Name of Driller |
| Remarks M.G.S. NO. 3995. | | | | | | | |
| Minnesota Well Index Report | | | | | 603061 | | |
| | | | | | Printed on 07/02/2021 HE-01205-15 | | |

849084

County Ramsey
 Quad St Paul East
 Quad ID 103A

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING REPORT
 Minnesota Statutes Chapter 1031

Entry Date 11/15/2020
 Update Date 11/18/2020
 Received Date 07/13/2020

| | | | | | | | |
|---|---|--|----------------------------|-----------------------------|---|----------------------------------|--|
| Well Name MW-1 ST PAUL | Township 29 | Range 22 | Dir Section W 23 | Subsection AABABC | Well Depth 25 ft. | Depth Completed 25 ft. | Date Well Completed 06/25/2020 |
| Elevation 1030 | Elev. Method LiDAR 1m DEM (MNDNR) | Drill Method | | Drill Fluid | | | |
| Address | | | | | Use monitor well | Status Active | |
| Well 2200 LARPENTEUR AV E ST PAUL MN | | | | | Well Hydrofractured? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> From To | | |
| Contact 250 ST PETER ST ST PAUL MN 55102 | | | | | Casing Type Single casing Joint | | |
| Stratigraphy Information | | | | | Drive Shoe? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Above/Below | | |
| Geological Material | | From | To (ft.) | Color | Hardness | | |
| SILTY SAND/ GRAVEL | | 0 | 17 | BLK/RED | HARD | | |
| WET SILTY SAND | | 17 | 25 | RED/BRN | HARD | | |
| CLAY COBBLES | | 17 | 17 | BLK/RED | | | |
| Casing Diameter | | | | | Weight | | |
| 2 in. | | To | 15 ft. | lbs./ft. | | | |
| Open Hole | | | | | From | ft. | To |
| Screen? <input checked="" type="checkbox"/> | | | | | Type slotted pipe | | Make JOHNSON |
| Diameter | | Slot/Gauze | Length | Set | | | |
| 2 in. | | 0 | 10 ft. | 15 ft. | 25 ft. | | |
| Static Water Level | | | | | | | |
| 17 ft. | | land surface | | Measure | 06/25/2020 | | |
| Pumping Level (below land surface) | | | | | | | |
| ft. | | hrs. | | Pumping at | g.p.m. | | |
| Wellhead Completion | | | | | | | |
| Pitless adapter manufacturer | | | | | Model | | |
| <input checked="" type="checkbox"/> Casing Protection | | <input type="checkbox"/> 12 in. above grade | | | | | |
| <input type="checkbox"/> At-grade (Environmental Wells and Borings ONLY) | | | | | | | |
| Grouting Information | | | | | Well Grouted? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not Specified | | |
| Material | | Amount | | From | To | | |
| bentonite | | 2 Sacks | | 4 | ft. 12 ft. | | |
| neat cement | | 2 Sacks | | ft. 4 | ft. | | |
| Nearest Known Source of Contamination | | | | | | | |
| feet | | Direction | | Type | | | |
| Well disinfected upon completion? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | | | | | | | |
| Pump <input checked="" type="checkbox"/> Not Installed Date Installed | | | | | | | |
| Manufacturer's name | | | | | | | |
| Model Number | | HP | | Volt | | | |
| Length of drop pipe | | ft | | Capacity | | g.p. Typ | |
| Abandoned | | | | | | | |
| Does property have any not in use and not sealed well(s)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | | | | | | | |
| Variance | | | | | | | |
| Was a variance granted from the MDH for this well? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | | | | | | | |
| Miscellaneous | | | | | | | |
| First Bedrock | | Aquifer | | | | | |
| Last Strat | | Depth to Bedrock | | ft | | | |
| Located by Minnesota Geological Survey | | | | | | | |
| Locate Method | | Digitization (Screen) - Map (1:24,000) (15 meters or | | | | | |
| System | | UTM - NAD83, Zone 15, Meters | | X 499325 | | Y 4982027 | |
| Unique Number Verification | | Info/GPS from data | | Input Date | | 11/18/2020 | |
| Angled Drill Hole | | | | | | | |
| Well Contractor | | | | | | | |
| Thein Well Co., Inc. | | 1337 | | HILBRANDS, B. | | | |
| Licensee Business | | Lic. or Reg. No. | | Name of Driller | | | |
| Remarks | | | | | | | |
| Minnesota Well Index Report | | | | | 849084 | | |
| | | | | | Printed on 07/02/2021 HE-01205-15 | | |

849085

County Ramsey
 Quad St Paul East
 Quad ID 103A

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING REPORT
 Minnesota Statutes Chapter 1031

Entry Date 11/15/2020
 Update Date 11/18/2020
 Received Date 07/13/2020

| | | | | | | | | |
|--|---|------------------------------|----------------------------|-----------------------------|---|---|--|--|
| Well Name MW-2 ST PAUL | Township 29 | Range 22 | Dir Section W 23 | Subsection ADDDAC | Well Depth 20 ft. | Depth Completed 20 ft. | Date Well Completed 06/25/2020 | |
| Elevation 1011 | Elev. Method LiDAR 1m DEM (MNDNR) | | | | Drill Method | Drill Fluid | | |
| Address | | | | | Use monitor well | Status Active | | |
| Well 2200 LARPENTEUR AV E ST PAUL MN | | | | | Well Hydrofractured? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> From To | | | |
| Contact 380 ST PETER ST ST PAUL MN | | | | | Casing Type Single casing Joint | | | |
| Stratigraphy Information | | | | | Drive Shoe? Yes <input type="checkbox"/> No <input type="checkbox"/> Above/Below | | | |
| Geological Material | | From | To (ft.) | Color | Hardness | | | |
| SANDY CLAY COBBLES | | 0 | 12 | RED | HARD | | | |
| WET SILTY SAND | | 12 | 20 | RED/BRN | HARD | | | |
| Open Hole | | | | | From | ft. | To | |
| Screen? <input checked="" type="checkbox"/> | | | | | Type | plastic | Make JOHNSON | |
| Diameter | | Slot/Gauze | Length | Set | | | | |
| 2 in. | | 0 | 10 ft. | 10 ft. | 20 | ft. | | |
| Static Water Level | | | | | 12 ft. | land surface | Measure 06/25/2020 | |
| Pumping Level (below land surface) | | | | | ft. | hrs. | Pumping at g.p.m. | |
| Wellhead Completion | | | | | Pitless adapter manufacturer Model | | | |
| <input checked="" type="checkbox"/> Casing Protection | | | | | <input type="checkbox"/> 12 in. above grade | | | |
| <input type="checkbox"/> At-grade (Environmental Wells and Borings ONLY) | | | | | | | | |
| Grouting Information | | | | | Well Grouted? | <input checked="" type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Not Specified |
| Material | | Amount | From | To | | | | |
| bentonite | | 1 Sacks | 4 | ft. 7 | ft. | | | |
| neat cement | | 2 Sacks | ft. 4 | ft. | | | | |
| Nearest Known Source of Contamination | | | | | feet | Direction | Type | |
| Well disinfected upon completion? | | | | | <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | | |
| Pump <input checked="" type="checkbox"/> Not Installed | | | | | Date Installed | | | |
| Manufacturer's name | | | | | | | | |
| Model Number | | HP | Volt | | | | | |
| Length of drop pipe | | ft | Capacity | g.p. | Typ | | | |
| Abandoned | | | | | Does property have any not in use and not sealed well(s)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | | | |
| Variance | | | | | Was a variance granted from the MDH for this well? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | | | |
| Miscellaneous | | | | | First Bedrock Aquifer | | | |
| Last Strat | | | | | Depth to Bedrock ft | | | |
| Located by Minnesota Geological Survey | | | | | | | | |
| Locate Method Digitization (Screen) - Map (1:24,000) (15 meters or | | | | | | | | |
| System | | UTM - NAD83, Zone 15, Meters | X 499578 | Y 4981319 | | | | |
| Unique Number Verification | | Info/GPS from data | Input Date | 11/18/2020 | | | | |
| Angled Drill Hole | | | | | | | | |
| Well Contractor | | | | | Thein Well Co., Inc. 1337 HILBRANDS, B. | | | |
| Licensee Business | | | | | Lic. or Reg. No. | | Name of Driller | |
| Minnesota Well Index Report | | | | 849085 | | Printed on 07/02/2021 HE-01205-15 | | |

849086

County Ramsey
 Quad St Paul East
 Quad ID 103A

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING REPORT
 Minnesota Statutes Chapter 1031

Entry Date
 Update Date 11/18/2020
 Received Date 07/13/2020

| | | | | | | | |
|--|---|--------------------|----------------------------|-----------------------------|--|----------------------------------|--|
| Well Name MW-3 ST PAUL | Township 29 | Range 22 | Dir Section W 23 | Subsection DADCBB | Well Depth 30 ft. | Depth Completed 30 ft. | Date Well Completed 06/25/2020 |
| Elevation 1014 | Elev. Method LiDAR 1m DEM (MNDNR) | | | | Drill Method Other | Drill Fluid | |
| Address | | | | | Use monitor well | Status Active | |
| Well 2200 LARPENTEUR AV E ST PAUL MN | | | | | Well Hydrofractured? Yes <input type="checkbox"/> No <input type="checkbox"/> From To | | |
| Contact 308 ST PETER ST ST PAUL MN | | | | | Casing Type Single casing Joint | | |
| Stratigraphy Information | | | | | Drive Shoe? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Above/Below | | |
| Geological Material From To (ft.) Color Hardness | | | | | Casing Diameter Weight | | |
| SANDY CLAY 0 23 BLK/RED HARD | | | | | 2 in. To 20 ft. lbs./ft. | | |
| SILTY SAND 23 30 RED/BRN HARD | | | | | | | |
| | | | | | Open Hole From ft. To ft. | | |
| | | | | | Screen? <input checked="" type="checkbox"/> Type plastic Make JOHNSON | | |
| | | | | | Diameter Slot/Gauze Length Set | | |
| | | | | | 2 in. 0 10 ft. 20 ft. 30 ft. | | |
| | | | | | Static Water Level | | |
| | | | | | 23 ft. land surface Measure 06/25/2020 | | |
| | | | | | Pumping Level (below land surface) | | |
| | | | | | ft. hrs. Pumping at g.p.m. | | |
| | | | | | Wellhead Completion | | |
| | | | | | Pitless adapter manufacturer Model | | |
| | | | | | <input checked="" type="checkbox"/> Casing Protection <input type="checkbox"/> 12 in. above grade | | |
| | | | | | <input type="checkbox"/> At-grade (Environmental Wells and Borings ONLY) | | |
| | | | | | Grouting Information Well Grouted? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not Specified | | |
| | | | | | Material Amount From To | | |
| | | | | | bentonite 2 Sacks 4 ft. 17 ft. | | |
| | | | | | neat cement 2 Sacks ft. 4 ft. | | |
| | | | | | Nearest Known Source of Contamination | | |
| | | | | | feet Direction Type | | |
| | | | | | Well disinfected upon completion? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | | |
| | | | | | Pump <input checked="" type="checkbox"/> Not Installed Date Installed | | |
| | | | | | Manufacturer's name | | |
| | | | | | Model Number HP Volt | | |
| | | | | | Length of drop pipe ft Capacity g.p. Typ | | |
| | | | | | Abandoned | | |
| | | | | | Does property have any not in use and not sealed well(s)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | | |
| | | | | | Variance | | |
| | | | | | Was a variance granted from the MDH for this well? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | | |
| | | | | | Miscellaneous | | |
| | | | | | First Bedrock Aquifer | | |
| | | | | | Last Strat Depth to Bedrock ft | | |
| | | | | | Located by Minnesota Geological Survey | | |
| | | | | | Locate Method Digitization (Screen) - Map (1:24,000) (15 meters or | | |
| | | | | | System UTM - NAD83, Zone 15, Meters X 499412 Y 4980929 | | |
| | | | | | Unique Number Verification Info/GPS from data Input Date 11/18/2020 | | |
| | | | | | Angled Drill Hole | | |
| | | | | | Well Contractor | | |
| | | | | | Thein Well Co., Inc. 1337 HILBRANDS, B. | | |
| | | | | | Licensee Business Lic. or Reg. No. Name of Driller | | |

Appendix B – DNR and USFWS Information



Minnesota Department of Natural Resources
Division of Ecological & Water Resources
500 Lafayette Road, Box 25
St. Paul, MN 55155-4025

June 16, 2022

Correspondence # MCE 2022-00297

Dustin Simonson
WSB & Associates

RE: Natural Heritage Review of the proposed Hill Crest Golf Course Redevelopment,
T29N R22W Section 23; Ramsey County

Dear Dustin Simonson,

As requested, the Minnesota Natural Heritage Information System has been reviewed to determine if the proposed project has the potential to impact any rare species or other significant natural features. Based on the project details provided with the request, the following rare features may be impacted by the proposed project:

State-listed Species

- Blanding's turtles (*Emydoidea blandingii*), a state-listed threatened species, have been documented in the vicinity of the proposed project. Blanding's turtles use upland areas up to and over a mile distant from wetlands, waterbodies, and watercourses. Uplands are used for nesting, basking, periods of dormancy, and traveling between wetlands. Factors believed to contribute to the decline of this species include collisions with vehicles, wetland drainage and degradation, and the development of upland habitat. Any added mortality can be detrimental to populations of Blanding's turtles, as these turtles have a low reproduction rate that depends upon a high survival rate to maintain population levels.

This project has the potential to impact this rare turtle through direct fatalities and habitat disturbance/destruction due to excavation, fill, and other construction activities associated with the project. Minnesota's Endangered Species Statute (*Minnesota Statutes*, section 84.0895) and associated Rules (*Minnesota Rules*, part 6212.1800 to 6212.2300 and 6134) prohibit the take of threatened or endangered species without a permit. As such, **the following avoidance measures are required:**

- Avoid aquatic impacts during hibernation season, between October 15th and April 15th, unless the area is unsuitable for hibernation.
- The use of [erosion control](#) blanket shall be limited to 'bio-netting' or 'natural-netting' types, and specifically not products containing plastic mesh netting or other plastic components.
 - Also, be aware that hydro-mulch products may contain small synthetic (plastic) fibers to aid in their matrix strength. These loose fibers could potentially re-suspend and make their way into Public Waters. As such, please review mulch products and not allow any materials with synthetic (plastic) fiber additives in areas that drain to Public Waters.
- Areas where there will be construction, especially aquatic areas, should be thoroughly checked for turtles before the use of heavy equipment or any ground disturbance.
 - The [Blanding's turtle flyer](#) must be given to all contractors working in the area.
 - Monitor for turtles during construction and report any sightings to the [DNR Nongame Specialist](#), Erica Hoaglund (Erica.Hoaglund@state.mn.us).
 - If turtles are in imminent danger they must be moved by hand out of harm's way, otherwise, they are to be left undisturbed.

If the above avoidance measures are not possible, please contact me as further action may be needed.

For additional information, see the [Blanding's turtle fact sheet](#), which describes the habitat use and life history of this species. The fact sheet also provides two lists of recommendations for avoiding and minimizing impacts to this rare turtle. **Please refer to both lists of recommendations and apply those that are relevant to your project.** For further assistance regarding the Blanding's turtle, please contact the DNR Regional Nongame Specialist, Erica Hoaglund.

Federally Protected Species

- The area of interest overlaps with a Rusty Patched Bumble Bee *High Potential Zone*. The rusty patched bumble bee (*Bombus affinis*) is federally listed as endangered and is likely to be present in suitable habitat within *High Potential Zones*. From April through October this species uses underground nests in upland grasslands, shrublands, and forest edges, and forages where nectar and pollen are available. From October through April the species overwinters under tree litter in upland forests and woodlands. The rusty patched bumble bee may be impacted by a variety of land management activities including, but not limited to, prescribed fire, tree-removal, haying, grazing, herbicide use, pesticide use, land-clearing, soil disturbance or compaction, or use of non-native bees. The [USFWS rusty patched bumble bee guidance](#) provides guidance on avoiding impacts to rusty patched bumble bee and a key for determining if actions are likely to affect the species; the determination key can be found in the appendix. If applicable, the DNR also

recommends reseeding disturbed soils with native species of grasses and forbs using [BWSR Seed Mixes](#) or [MnDOT Seed Mixes](#). Please visit the [USFWS Rusty Patched Bumble Bee Map](#) for the most current locations of *High Potential Zones*.

- To ensure compliance with federal law, conduct a federal regulatory review using the U.S. Fish and Wildlife Service's (USFWS) online [Information for Planning and Consultation \(IPaC\) tool](#).

Environmental Review and Permitting

- The Environmental Assessment Worksheet should address whether the proposed project has the potential to adversely affect the above rare features and, if so, it should identify specific measures that will be taken to avoid or minimize disturbance. Sufficient information should be provided so the DNR can determine whether a takings permit will be needed for any of the above protected species.
- Please include a copy of this letter and the MCE-generated Final Project Report in any state or local license or permit application. Please note that measures to avoid or minimize disturbance to the above rare features may be included as restrictions or conditions in any required permits or licenses.

The Natural Heritage Information System (NHIS), a collection of databases that contains information about Minnesota's rare natural features, is maintained by the Division of Ecological and Water Resources, Department of Natural Resources. The NHIS is continually updated as new information becomes available, and is the most complete source of data on Minnesota's rare or otherwise significant species, native plant communities, and other natural features. However, the NHIS is not an exhaustive inventory and thus does not represent all of the occurrences of rare features within the state. Therefore, ecologically significant features for which we have no records may exist within the project area. If additional information becomes available regarding rare features in the vicinity of the project, further review may be necessary.

For environmental review purposes, the results of this Natural Heritage Review are valid for one year; the results are only valid for the project location and project description provided with the request. If project details change or the project has not occurred within one year, please resubmit the project for review within one year of initiating project activities.

The Natural Heritage Review does not constitute project approval by the Department of Natural Resources. Instead, it identifies issues regarding known occurrences of rare features and potential impacts to these rare features. For information on the environmental review process or other natural resource concerns, you may contact your [DNR Regional Environmental Assessment Ecologist](#).

Thank you for consulting us on this matter, and for your interest in preserving Minnesota's rare natural resources.

Sincerely,

A handwritten signature in cursive script that reads "James Drake". The signature is written in black ink and is positioned above the typed name.

James Drake
Natural Heritage Review Specialist
James.F.Drake@state.mn.us

Cc: Melissa Collins



United States Department of the Interior



FISH AND WILDLIFE SERVICE

Minnesota-Wisconsin Ecological Services Field Office

4101 American Blvd E

Bloomington, MN 55425-1665

Phone: (952) 252-0092 Fax: (952) 646-2873

<http://www.fws.gov/midwest/Endangered/section7/s7process/step1.html>

In Reply Refer To:

October 11, 2021

Consultation Code: 03E19000-2022-SLI-0101

Event Code: 03E19000-2022-E-00383

Project Name: Hillcrest Redevelopment Project

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

This response has been generated by the Information, Planning, and Conservation (IPaC) system to provide information on natural resources that could be affected by your project. The U.S. Fish and Wildlife Service (Service) provides this response under the authority of the Endangered Species Act of 1973 (16 U.S.C. 1531-1543), the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d), the Migratory Bird Treaty Act (16 U.S.C. 703-712), and the Fish and Wildlife Coordination Act (16 U.S.C. 661 *et seq.*).

Threatened and Endangered Species

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and may be affected by your proposed project. The species list fulfills the requirement for obtaining a Technical Assistance Letter from the U.S. Fish and Wildlife Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. The Service recommends that verification be completed by visiting the ECOS IPaC website at regular intervals during project planning and implementation

for updates to species lists and information. An updated list may be requested through the ECOS IPaC system by completing the same process used to receive the enclosed list.

Consultation Technical Assistance

Please refer to the Midwest Region [S7 Technical Assistance](#) website for step-by-step instructions for making species determinations and for specific guidance on the following types of projects: projects in developed areas, HUD, CDBG, EDA, pipelines, buried utilities, telecommunications, and requests for a Conditional Letter of Map Revision (CLOMR) from FEMA.

Using the IPaC Official Species List to Make No Effect and May Affect Determinations for Listed Species

1. If IPaC returns a result of “There are no listed species found within the vicinity of the project,” then project proponents can conclude the proposed activities will have **no effect** on any federally listed species under Service jurisdiction. Concurrence from the Service is not required for **No Effect** determinations. No further consultation or coordination is required. Attach this letter to the dated IPaC species list report for your records. An example ["No Effect" document](#) also can be found on the S7 Technical Assistance website.
2. If IPaC returns one or more federally listed, proposed, or candidate species as potentially present in the action area of the proposed project – other than bats (see below) – then project proponents must determine if proposed activities will have **no effect** on or **may affect** those species. For assistance in determining if suitable habitat for listed, candidate, or proposed species occurs within your project area or if species may be affected by project activities, you can obtain [Life History Information for Listed and Candidate Species](#) through the S7 Technical Assistance website. If no impacts will occur to a species on the IPaC species list (e.g., there is no habitat present in the project area), the appropriate determination is **No Effect**. No further consultation or coordination is required. Attach this letter to the dated IPaC species list report for your records. An example ["No Effect" document](#) also can be found on the S7 Technical Assistance website.
3. Should you determine that project activities **may affect** any federally listed, please contact our office for further coordination. Letters with requests for consultation or correspondence about your project should include the Consultation Tracking Number in the header. Electronic submission is preferred.

Northern Long-Eared Bats

Northern long-eared bats occur throughout Minnesota and Wisconsin and the information below may help in determining if your project may affect these species.

This species hibernates in caves or mines only during the winter. In Minnesota and Wisconsin, the hibernation season is considered to be November 1 to March 31. During the active season (April 1 to October 31) they roost in forest and woodland habitats. Suitable summer habitat for northern long-eared bats consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags ≥ 3 inches dbh for northern long-eared bat that have exfoliating bark, cracks, crevices, and/or hollows), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit the characteristics of a potential roost tree and are located within 1,000 feet (305 meters) of forested/wooded habitat. Northern long-eared bats have also been observed roosting in human-made structures, such as buildings, barns, bridges, and bat houses; therefore, these structures should also be considered potential summer habitat and evaluated for use by bats. If your project will impact caves or mines or will involve clearing forest or woodland habitat containing suitable roosting habitat, northern long-eared bats could be affected.

Examples of unsuitable habitat include:

- Individual trees that are greater than 1,000 feet from forested or wooded areas,
- Trees found in highly developed urban areas (e.g., street trees, downtown areas),
- A pure stand of less than 3-inch dbh trees that are not mixed with larger trees, and
- A stand of eastern red cedar shrubby vegetation with no potential roost trees.

If IPaC returns a result that northern long-eared bats are potentially present in the action area of the proposed project, project proponents can conclude the proposed activities **may affect** this species **IF** one or more of the following activities are proposed:

- Clearing or disturbing suitable roosting habitat, as defined above, at any time of year,
 - Any activity in or near the entrance to a cave or mine,
 - Mining, deep excavation, or underground work within 0.25 miles of a cave or mine,
 - Construction of one or more wind turbines, or
-

- Demolition or reconstruction of human-made structures that are known to be used by bats based on observations of roosting bats, bats emerging at dusk, or guano deposits or stains.

If none of the above activities are proposed, project proponents can conclude the proposed activities will have **no effect** on the northern long-eared bat. Concurrence from the Service is not required for **No Effect** determinations. No further consultation or coordination is required. Attach this letter to the dated IPaC species list report for your records. An example "[No Effect](#)" [document](#) also can be found on the S7 Technical Assistance website.

If any of the above activities are proposed, please use the northern long-eared bat determination key in IPaC. This tool streamlines consultation under the 2016 rangewide programmatic biological opinion for the 4(d) rule. The key helps to determine if prohibited take might occur and, if not, will generate an automated verification letter. No further review by us is necessary. Please visit the links below for additional information about "may affect" determinations for the northern long-eared bat.

[NLEB Section 7 consultation](#)

[Key to the NLEB 4\(d\) rule for federal actions that may affect](#)

[Instructions for the NLEB 4\(d\) assisted d-key](#)

[Maternity tree and hibernaculum locations by state](#)

Other Trust Resources and Activities

Bald and Golden Eagles - Although the bald eagle has been removed from the endangered species list, this species and the golden eagle are protected by the Bald and Golden Eagle Act and the Migratory Bird Treaty Act. Should bald or golden eagles occur within or near the project area please contact our office for further coordination. For communication and wind energy projects, please refer to additional guidelines below.

Migratory Birds - The Migratory Bird Treaty Act (MBTA) prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Service. The Service has the responsibility under the MBTA to proactively prevent the mortality of migratory birds whenever possible and we encourage implementation of recommendations that minimize potential impacts to migratory birds. Such measures include clearing forested habitat outside the nesting season (generally March 1 to August 31) or conducting nest surveys prior to clearing to avoid injury to eggs or nestlings.

Communication Towers - Construction of new communications towers (including radio, television, cellular, and microwave) creates a potentially significant impact on migratory birds, especially some 350 species of night-migrating birds. However, the Service has developed [voluntary guidelines for minimizing impacts](#).

Transmission Lines - Migratory birds, especially large species with long wingspans, heavy bodies, and poor maneuverability can also collide with power lines. In addition, mortality can occur when birds, particularly hawks, eagles, kites, falcons, and owls, attempt to perch on uninsulated or unguarded power poles. To minimize these risks, please refer to [guidelines](#) developed by the Avian Power Line Interaction Committee and the Service. Implementation of these measures is especially important along sections of lines adjacent to wetlands or other areas that support large numbers of raptors and migratory birds.

Wind Energy - To minimize impacts to migratory birds and bats, wind energy projects should follow the Service's [Wind Energy Guidelines](#). In addition, please refer to the Service's [Eagle Conservation Plan Guidance](#), which provides guidance for conserving bald and golden eagles in the course of siting, constructing, and operating wind energy facilities.

State Department of Natural Resources Coordination

While it is not required for your Federal section 7 consultation, please note that additional state endangered or threatened species may also have the potential to be impacted. Please contact the Minnesota or Wisconsin Department of Natural Resources for information on state listed species that may be present in your proposed project area.

Minnesota

[Minnesota Department of Natural Resources - Endangered Resources Review Homepage](#)

Email: Review.NHIS@state.mn.us

Wisconsin

[Wisconsin Department of Natural Resources - Endangered Resources Review Homepage](#)

Email: DNRERReview@wi.gov

We appreciate your concern for threatened and endangered species. Please feel free to contact our office with questions or for additional information.

Attachment(s):

- Official Species List
 - Migratory Birds
-

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Minnesota-Wisconsin Ecological Services Field Office

4101 American Blvd E

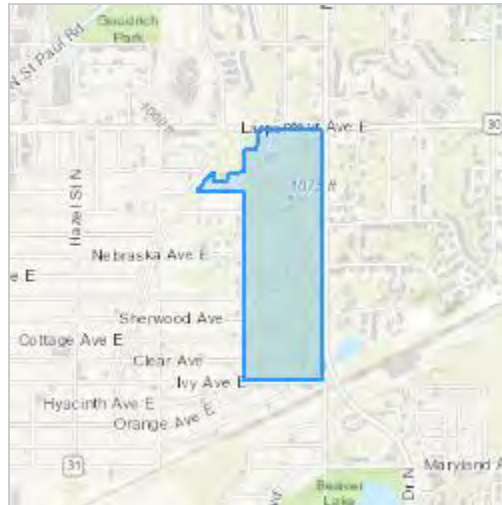
Bloomington, MN 55425-1665

(952) 252-0092

Project Summary

Consultation Code: 03E19000-2022-SLI-0101
Event Code: Some(03E19000-2022-E-00383)
Project Name: Hillcrest Redevelopment Project
Project Type: LAND - MANAGEMENT PLANS
Project Description: Land development project
Project Location:

Approximate location of the project can be viewed in Google Maps: <https://www.google.com/maps/@44.98654885,-93.00757286620384,14z>



Counties: Ramsey County, Minnesota

Endangered Species Act Species

There is a total of 3 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries¹, as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

1. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

| NAME | STATUS |
|--|------------|
| Northern Long-eared Bat <i>Myotis septentrionalis</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045 | Threatened |

Insects

| NAME | STATUS |
|--|------------|
| Monarch Butterfly <i>Danaus plexippus</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743 | Candidate |
| Rusty Patched Bumble Bee <i>Bombus affinis</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9383 General project design guidelines: https://ecos.fws.gov/ipac/project/CKAO46AEKJGH5FJMLQV7FST5QY/documents/generated/5967.pdf | Endangered |

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act¹ and the Bald and Golden Eagle Protection Act².

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described [below](#).

-
1. The [Migratory Birds Treaty Act](#) of 1918.
 2. The [Bald and Golden Eagle Protection Act](#) of 1940.
 3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the [USFWS Birds of Conservation Concern](#) (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ [below](#). This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the [E-bird data mapping tool](#) (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found [below](#).

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

| NAME | BREEDING SEASON |
|---|-------------------------|
| <p>Bald Eagle <i>Haliaeetus leucocephalus</i></p> <p>This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.</p> <p>https://ecos.fws.gov/ecp/species/1626</p> | Breeds Dec 1 to Aug 31 |
| <p>Black Tern <i>Chlidonias niger</i></p> <p>This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.</p> <p>https://ecos.fws.gov/ecp/species/3093</p> | Breeds May 15 to Aug 20 |

| NAME | BREEDING SEASON |
|--|-------------------------|
| Bobolink <i>Dolichonyx oryzivorus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. | Breeds May 20 to Jul 31 |
| Canada Warbler <i>Cardellina canadensis</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. | Breeds May 20 to Aug 10 |
| Cerulean Warbler <i>Dendroica cerulea</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/2974 | Breeds Apr 22 to Jul 20 |
| Golden-winged Warbler <i>Vermivora chrysoptera</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8745 | Breeds May 1 to Jul 20 |
| Red-headed Woodpecker <i>Melanerpes erythrocephalus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. | Breeds May 10 to Sep 10 |
| Rusty Blackbird <i>Euphagus carolinus</i> This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA | Breeds elsewhere |
| Wood Thrush <i>Hylocichla mustelina</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. | Breeds May 10 to Aug 31 |

Probability Of Presence Summary

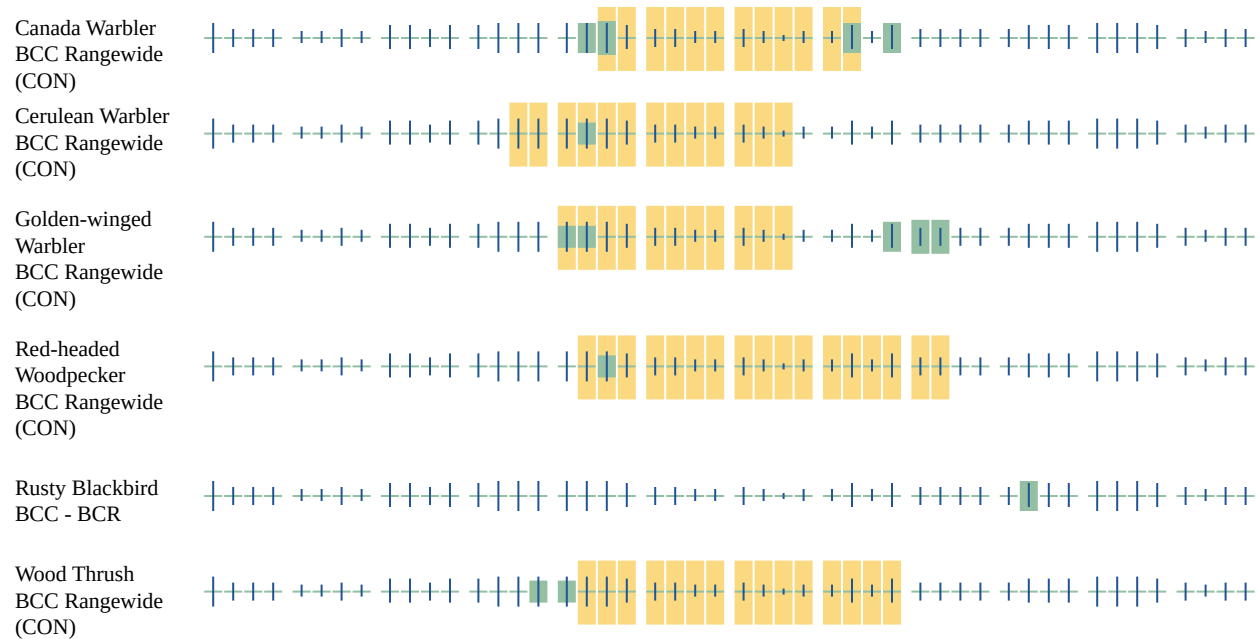
The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for



Additional information can be found using the following links:

- Birds of Conservation Concern <http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php>
- Measures for avoiding and minimizing impacts to birds <http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php>
- Nationwide conservation measures for birds <http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf>

Migratory Birds FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

[Nationwide Conservation Measures](#) describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. [Additional measures](#) or [permits](#) may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS [Birds of Conservation Concern \(BCC\)](#) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the [Avian Knowledge Network \(AKN\)](#). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets](#) and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle ([Eagle Act](#) requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the [AKN Phenology Tool](#).

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the [Avian Knowledge Network \(AKN\)](#). This data is derived from a growing collection of [survey, banding, and citizen science datasets](#).

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go to the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: [The Cornell Lab of Ornithology All About Birds Bird Guide](#), or (if you are unsuccessful in locating the bird of interest there), the [Cornell Lab of Ornithology Neotropical Birds guide](#). If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are [Birds of Conservation Concern](#) (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
 2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
 3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the [Eagle Act](#) requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).
-

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the [Northeast Ocean Data Portal](#). The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the [NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf](#) project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the [Diving Bird Study](#) and the [nanotag studies](#) or contact [Caleb Spiegel](#) or [Pam Loring](#).

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to [obtain a permit](#) to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Appendix C – Phase Ia Cultural Resources and SHPO Response

September 13, 2021

Andi Moffatt
Vice President of Environmental Services
WSB & Associates
701 Xenia Avenue S, Suite 300
Minneapolis, MN 55416

RE: Hillcrest Golf Course Redevelopment Project
St. Paul, Ramsey County
SHPO Number: 2021-2707

Dear Andi Moffatt:

Thank you for consulting with our office during the preparation of an Alternative Urban Areawide Review (AUAR) for the above referenced project. According to your correspondence, the City of St. Paul is the Responsible Governmental Unit (RGU) for the environmental review, and the St. Paul Port Authority is the proposed developer for industrial and multi-family residential land uses at this site. Our comments at this time are meant as technical assistance only, as the scope of the proposed project has not been clearly defined and the regulatory framework for this project has not been established.

We have reviewed the submitted report titled *A Phase Ia Cultural Resource Assessment of the Proposed Hillcrest Golf Course Redevelopment Project, Saint Paul, Ramsey County, Minnesota, 55109, Township 29N, Range 22W, Section 23* (August 6, 2021) as prepared by Blondo Consulting. Our comments are provided below.

Archaeological Resources

Based on the information provided, we agree with the consultant's recommendation that a Phase I archaeological survey should be completed prior to any ground disturbing activities. The survey must meet the requirements of the Secretary of the Interior's Standards for Identification and Evaluation and should include an evaluation of National Register eligibility for any sites that are identified.

History/Architecture Properties

According to the report, eight (8) previously inventoried properties were identified within a half mile radius of the proposed project area. The **St. Paul Minneapolis and Manitoba Railway**, which has been determined eligible for listing in the National Register of Historic Places (NRHP), is located just south of the project area. The remaining seven (7) properties have not been evaluated to determine their eligibility for listing in the NRHP. There may be additional historic properties in the project area that have not yet been identified. If this project becomes a federal undertaking subject to review under Section 106 of the National Historic Preservation Act, further identification and evaluation efforts may be needed.

Hillcrest Golf Course: Based on the information provided, we agree that the Hillcrest Golf Course is **not eligible** for listing in the NRHP. While the property does have connection with the Jewish community, the connection appears to be one of convenience and business as opposed to one of social or community significance.

MINNESOTA STATE HISTORIC PRESERVATION OFFICE

50 Sherburne Avenue ■ Administration Building 203 ■ Saint Paul, Minnesota 55155 ■ 651-201-3287 mn.gov/admin/shpo ■ mnshpo@state.mn.us

AN EQUAL OPPORTUNITY AND SERVICE PROVIDER

Therefore, we are not yet convinced of the golf course's significance under Criterion A. Regardless, the loss of the original clubhouse renders the property ineligible due to a lack of integrity, as any historic association would be represented best in the building that housed the administration and social functions of the club. Furthermore, the property does not appear to possess significance under Criterion C as a notable golf course because, while largely intact, the course was not designed by a prominent figure and does not represent a significant design. A.W. Tillinghast's role in augmenting the original design is not a significant enough association to consider the golf course eligible for listing in the NRHP.

We would appreciate receiving an individual inventory form for the Hillcrest Golf Course for our records, so we can record the findings of this evaluation. The consultant should request a single inventory number for the property as a whole. The completed inventory form can be submitted electronically to Kelly Gragg-Johnson, Environmental Review Program Specialist, at kelly.graggjohnson@state.mn.us.

Please note that this comment letter does not address the requirements of Section 106 of the National Historic Preservation Act of 1966 and 36 CFR § 800. If this project is considered for federal financial assistance, or requires a federal permit or license, then review and consultation with our office will need to be initiated by the lead federal agency. Be advised that comments and recommendations provided by our office for this state-level review may differ from findings and determinations made by the federal agency as part of review and consultation under Section 106.

Please contact Kelly Gragg-Johnson at (651) 201-3285 or kelly.graggjohnson@state.mn.us if you have any questions regarding our comments.

Sincerely,

A handwritten signature in blue ink that reads "Sarah J. Beimers". The signature is written in a cursive, slightly slanted style.

Sarah J. Beimers
Environmental Review Program Manager

**A Phase IA Cultural Resource Assessment
of the Proposed Hillcrest Golf Course Redevelopment Project
Saint Paul, Ramsey County, Minnesota, 55109
Township 29N Range 22W Section 23
SHPO Review and Compliance Number: PENDING
BC Project #: 2020-091**

**by
Steven J. Blondo, MA
and William Rayson
Blondo Consulting, LLC**

**August 6, 2021
FINAL REPORT**



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Attachment 1: Maps

Attachment 2: Photos

Management Summary/Abstract

Blondo Consulting, LLC (Blondo Consulting) was retained by WSB and Associates Inc. (WSB) to complete a Cultural Resource Assessment of the proposed Hillcrest Golf Course Redevelopment Project in Saint Paul, Ramsey County, Minnesota. This project involves the redevelopment of the Hillcrest Golf Course into mixed use industrial and residential. The proposed project is within Saint Paul's Northern Hayden Heights neighborhood, located in Section 23 of Township 29 North, Range 22 West. The project site is currently a recreational use area within an urban setting. The Area of Potential Effect (APE) is defined as the geographic area where an undertaking may directly or indirectly alter the character or use of existing historic properties. For the current project, the APE was defined as the approximately 105 acre site parcel.

The proposed project is being reviewed under an Alternative Urban Areawide Review (AUAR) by the Minnesota Environmental Quality Board (EQB) and requires compliance with state laws pertaining to cultural resources. The proposed project is also subject to review under Minnesota State Statute 138, the Historic Sites Act (138.666) and the Field Archaeology Act (138.40). Steven Blondo, MA was the Principal Investigator for the project. He meets the requirements of a qualified professional archaeologist under the Secretary of the Interior Standards and Qualifications and as defined by Minnesota Statute 138.31, subd. 10.

At project commencement, Blondo Consulting completed a literature search through the Minnesota State Historic Preservation Office (SHPO) and through the Office of the State Archaeologist (OSA) online Portal. The purpose of the literature search was to identify if previously reported or recorded archaeological and architectural sites exist within the proposed project area. No archaeological sites or historic structures were identified within the proposed project APE. An additional one-mile radius was addressed for archaeological sites and a half mile radius was addressed for historic structures to assist in developing a site context and better understand the prehistory and history of the area. The background search concluded in the finding of one previously recorded archaeological site within the one mile research radius, the Hillcrest Site 21RA0016. Additionally, eight previously inventoried architectural sites were identified within the half mile research radius of the proposed project area, including one National Register of Historic Places (NRHP) eligible Historic Property, the St. Paul and Minneapolis and Manitoba Railway.

The Hillcrest Golf Course was established in 1921 and meets the 50-year old threshold for historic property evaluation. An evaluation of the Hillcrest Golf Course revealed historic significance associated with the resilience of Minnesota's Jewish community during the height and heart of American anti-Semitism. The integrity of Hillcrest Golf Course relies on two key architectural features, the fairways and the clubhouse. Hillcrest's greens have been mostly unaltered since their professional redesign in 1936-1937, however the clubhouse, which was destroyed by fire in 1962 and rebuilt in 2000, does not meet the 50 year age criteria and does not resemble its original design. The Hillcrest Golf Course, lacking its original clubhouse does not retain historic integrity. Although the Hillcrest Golf Course is historically significant, it lacks

integrity and therefore does not meet the criteria for National Register eligibility. Additionally, although landscaping of the site has taken place, there is a potential to encounter previously unrecorded archaeological deposits. A Phase I Reconnaissance Survey is recommended prior to construction.

1.0 INTRODUCTION

Blondo Consulting, LLC (Blondo Consulting) was retained by WSB & Associates (WSB) to complete an assessment of potential cultural resources within the proposed Hillcrest Golf Course Redevelopment Project, Saint Paul, Ramsey County, Minnesota. The proposed project involves the redevelopment of the Hillcrest Golf Course into mixed use industrial and residential by the property's current owner, Saint Paul Port Authority (SPAA). SPAA hired WSB to conduct an Alternative Urban Areawide Review (AUAR), and in a letter to Blondo Consulting dated August 21, 2020 WSB requested a Phase IA Cultural Resource Assessment. This report is in answer to that request.

The proposed project is also subject for review under Minnesota Statute 138: Field Archaeology and the Historic Sites Act. Section 138.665 Subdivision 2 states,

the state, state departments, agencies, and political subdivisions, including the Board of Regents of the University of Minnesota, have a responsibility to protect the physical features and historic character of properties designated in section 138.662 and 138.664 or listed on the National Register of Historic Places created by Public Law 89-665. Before carrying out any undertaking that will affect designated or listed properties, or funding or licensing an undertaking by other parties, the state department or agency shall consult with the Minnesota Historical Society pursuant to the society's established procedures to determine appropriate treatments and to seek ways to avoid and mitigate any adverse effects on designated or listed properties. If the state department or agency and the Minnesota Historical Society agree in writing on a suitable course of action, the project may proceed (The Revisor of Statutes, 2018).

This Phase IA Cultural Resource Assessment involved a background literature search including a review of known archaeological sites and architectural properties. Results of the investigation are included in this report.

2.0 PROJECT AND SITE DESCRIPTION

The proposed project is located within Saint Paul's Northern Hayden Heights Neighborhood, in Section 23 of Township 29 North, Range 22 West, Saint Paul, Ramsey County, Minnesota. The proposed project involves the redevelopment of Hillcrest Golf Course into affordable housing units with limited commercial reality and a potential for business parks. The project is located in a recreational use area within an urban setting and contains the Hillcrest Golf Course, consisting of the eighteen-hole course, clubhouse, and a section of field to the northwest. The project parcel is approximately 105 acres (see Attachment I: Maps).

3.0 ENVIRONMENTAL SETTING

The project area lies within Minnesota SHPO Archaeological Region 4: Central Deciduous Region. Dr. Scott Anfinson (1990), former Minnesota State Archaeologist, first described these archaeological regions which help us to understand the prehistoric environment and better

understand where archaeological sites may be located. Archaeological Region 4: Central Deciduous is located in central and east central Minnesota. Its topography consists of a patchwork of moraines, till plains, and outwash plains (Anfinson, 1990; Gibbon et al., 2002). Prior to urban development, this area was a farm owned by Governor Alexander Ramsey (Emerson, 2006).

3.1 Soils

Within Archaeological Region 4, Soils reflect a diverse glacial and vegetational history. Most soils in this region range from medium to coarse textures with prairie soils in the south and west, and forest soils in the north and east (Anfinson 1990). Soils in the project area are described as part of the Kingley Sandy Loam complex found on 2 to 6 percent slopes. These soils are typically found on moraines and are made up of till as a parent material. A typical soil profile includes well drained soils to a depth of more than 80 inches where the water table is located (NRCS 2014).

3.2 Environmental Landscape

Numerous lakes are found throughout the region, some reaching depths of 30 meters. The Mississippi River flows through the eastern and central parts of the region with the St. Croix River forming the eastern boundary. The western part is drained by rivers that flow into the Red River. The natural vegetation is mostly Oak Openings and Barrens (Anfinson 1990; Gibbon et al. 2002). Today the area is located in the St. Paul Baldwin Plains and Moraines (222Md) subsection of the Minnesota and Northeast Iowa Morainal Section (222M). The Minnesota and Northeast Iowa Morainal Section consists of a long band of deciduous forest, woodland, and prairie. A large portion of this section consists of hummocky moraines that were deposited during the last glaciation along the eastern margin of the Des Moines ice lobe. Additional portions of this section consist of rolling or basal till that were deposited as drumlins with sand plains located within the moraines. These changes in landform directly affected the vegetation with sandy flat areas dominated by prairie, savanna, and oak/aspen woodlands; while hummocky moraines were dominated by mesic forests including sugar maple, basswood, American elm, and northern red oak (DNR, n.d.).

The St. Paul Baldwin Pains and Moraines subsection is dominated by a Superior lobe end moraine complex and associated series of outwash plains to the south. Topography is rolling to hummocky on the moraine (steep, short complex slopes) and level to rolling on the outwash. The topographic characteristics of this subsection are rolling to hummocky on the moraine and level to rolling on the outwash. The eastern boundary is formed by the St. Croix river, which flows into the Mississippi River southeast of the Twin Cities. Numerous lakes occur, mostly on the moraines (DNR ECS).

3.3 Geological Background

H.E. Wright (1972) identifies the physiographic regions overlaying the state. Overlaying the project area is the Owatonna Moraine Area (19) (Wright, 1972). Wright describes this area as extending southward from Minneapolis through the Iowa border. The eastern edge is bounded by the Rochester till plain and the western edge is bounded by the Blue Earth till plain. He

describes, “the northern part of the section carries a peninsula of the Big Woods southward into prairie” (Wright, 1972, pg. 573).

3.4 Prehistoric Flora and Fauna

Early prehistoric subsistence resources in the area may have included tundra species such as musk ox, and barren ground caribou. Over time the area was covered by pine forests, large herds of megafauna were rare. As prairies began to enter the southeastern portion of the region, large bison herds followed. Bison were common in all but the northeastern third of the region by about 7,000 years ago (Anfinson, 1990; Gibbon et al., 2002). As prairie retreated in the late Middle Prehistoric, faunal resources including beaver, moose, and black bear became abundant. Also, fish and waterfowl became common in the region’s numerous lakes and rivers. Wild Rice was an important food and economic resource during the Late Prehistoric and Early Historic periods (Anfinson, 1990; Gibbon et al., 2002).

4.0 CULTURAL HISTORY

Statewide contexts have been developed by the Minnesota State Historic Preservation Office (SHPO), which examines Minnesota’s recent Prehistoric through Historic past. These contexts are based on archaeological and historical research. They describe the history of the state and assist in predicting where specific types of sites may occur both geographically and temporally. Contexts allow us to identify property types and understand how to evaluate historic resources.

4.1 Pre-Contact Period

Native American contexts are commonly divided into three major traditions: Paleoindian, Archaic, and Woodland based on significant changes in how these communities lived and in what they ate. Historic contexts are generally divided into Contact and Post-Contact periods. The Contact period begins with early European exploration of the state and continues through the Post-Contact period including settlement and statehood.

4.1.1 Paleoindian Tradition (12,000 to 8,000 Before Present [B.P.]

The Paleoindian Tradition begins at the close of the Pleistocene era and beginning of the Holocene era. Native American Communities are small, mobile, and focused on hunting. During this period, the glacial ice retreats, Lake Agassiz (located on the edge of Traverse County, Minnesota) drains, and prairie vegetation advances into western Minnesota. Archaeological evidence from Paleoindian sites in Minnesota includes the Browns Valley Site, 21TR0005. They reflect the same general characteristics and patterns noted for Paleoindian sites throughout the central United States and Canada. Based on the small number of artifacts recovered from these sites, it can be assumed that these communities hunted a limited number of large animals, mainly mammoth and mastodons. As the Pleistocene era ended and the Holocene era began, these mega fauna gradually died out. Ancient species of bison followed the advance of prairie vegetation, giving Paleoindian peoples a new species to hunt. In addition to hunting large and small game, it is likely that gathering wild plant foods supplemented the diet of Paleoindian peoples.

Paleoindian peoples are known for their distinctive stone tools. Projectile points of this period show advanced craftsmanship and include large lanceolate projectile points. Because Paleoindian communities were small and nomadic, archaeologists have found only sparse, scattered evidence of Paleoindian peoples throughout the region.

4.1.2 Archaic Tradition (8,000 to 2,800 B.P.)

The beginning of the Archaic period is marked by a shift in diet and settlement patterns that represent an adaptation to environmental changes. Archaic peoples begin to use more diverse plant and animal resources. A broader range of tools including new projectile point forms, copper tools, and ground and pecked stone tools appear. Archaeological research does not present a clear picture of community size during this time. Research suggests both that community size increased and remained small with day-to-day activities taking place at a series of seasonal camps (Anfinson, 1987; 1997). Bison hunting remained an integral part of life for Archaic peoples. As with known Paleoindian sites, Archaic sites are relatively small and sparse.

4.1.3 Woodland Tradition (2,800 B.P. to European Contact)

In the Midwest region, archaeologists tend to divide the Woodland Tradition into three periods: Early, Middle, and Late. However, Anfinson (1987) suggests that in Minnesota it is more appropriate to divide the era into Initial and Terminal Woodland periods. Manufacturing ceramic vessels, utilizing bows and arrows, building burial mounds, and cultivating specific plant species, all mark the transition from the Archaic to the Woodland Tradition. Overall, subsistence during the Woodland Tradition remained similar to that of the Archaic period with communities dependent upon a diverse, seasonal resource base of plants and animals (Johnson, 1988; Anfinson, 1987).

Although community sizes have many similarities between the Early Woodland and Late Archaic period, by the Late Woodland period, populations are on the rise. This may be due to increased efficiency in food acquisition. Woodland period sites include burial mounds, small, limited-use sites, and large village and habitation sites. Sites are located either in areas where a community could focus on a specific resource or in environments capable of sustaining larger communities over longer periods of time.

4.1.4 Plains Village & Mississippian/Oneota Traditions (1,100 B.P. to European Contact)

Terminal Woodland period sites in Minnesota exhibit significant changes in subsistence and settlement patterns. Ceramic vessels with different form and decoration, settlement patterns shifting to larger and more permanent villages (usually near river settings) mark the change archaeologists refer to as the Plains Village and Mississippian/Oneota Traditions. Archaeological evidence indicates that both the Plains Village and Mississippian complexes relied heavily on bison hunting and intensive corn horticulture.

Archaeologists are unsure how the Oneota complexes developed. There are two common theories. The first suggests that groups migrating into the Upper Midwest brought with them new cultural traditions. The second theory proposes that people already living in the area began to adopt cultural changes different from groups around them.

Plains Village and Oneota site types are similar to those associated with the Woodland Tradition. The archaeological remains of these complexes range from burial mounds to small, limited-use sites and extensive habitation sites. Site location remains consistent with the Woodland Period.

4.2 Contact/Post-Contact Period (1630 to Present)

This period generally refers to the span of time extending from the first European explorations until intensive Euro-American settlement of the region. Minnesota's historical period began in 1673 when French explorers Marquette and Joliet discovered the upper portion of the Mississippi River. Ten years later, Catholic Missionary Father Louis Hennepin told his story of exploring Minnesota and being held captive by the Dakota Indians in the first book written about Minnesota, *Description de la Louisiane*.

The territory containing modern-day Minnesota was claimed by Spain, France, Great Britain, and the United States. Lieutenant Zebulon Montgomery Pike led the first United States expedition through Minnesota in 1805. Fort St. Anthony (later Ft. Snelling) was completed between 1819 and 1824, and in 1836 the Wisconsin Territory including a portion of Minnesota, was formed. Minnesota became a territory in 1849 and achieved statehood on May 11, 1858.

The fur trade drove much of the European exploration and settlement in Minnesota through the mid-1800s. While the fur trade impacted the Native American communities throughout all of Minnesota, the heaviest impacts came with European settlement after the 1860s. At that time, intensive settlement and agriculture dramatically transformed the landscape, displacing a large number of Native Americans. In 1862 tensions between white settlers and Native Americans resulted in the U.S. Dakota War. Ultimately, this war left 462 whites and "an unknown but substantial number" of Native Americans dead (Anderson and Woolworth, 1988). This conflict concluded with the hanging of 38 Dakota Indians in Mankato and the deportation of many others to Santee, Nebraska.

As white settlers made Minnesota their home, farming became the predominant industry. Wheat was the cash crop, and mills sprang up along major waterways across the state, notably in Minneapolis. Minnesota dominated the world in wheat processing until the 1930s.

In addition to milling, Minnesota was also a leader in lumbering and iron mining. Lumbering played a significant role in the development of northern Minnesota, with the industry peaking between 1899 and 1905. Iron mining began affecting the state's economy in 1884, when the Soudan Mine began shipping ore. The development of the Soudan Mine opened the Vermilion Iron Range, one of Minnesota's three iron ranges. Over the next two decades, mines sprang up across northern

and central portions of the state. The Mesabi, Cuyuna, and Vermilion Iron Ranges employed thousands of people and brought millions of dollars into Minnesota's economy. The rapid growth of mining cities such as Evelyth, Chisholm, Virginia, and Hibbing, as well as the port cities of Duluth, Minnesota and Superior, Wisconsin, were spurred by Minnesota's mining industry (Minnesota State University-Mankato, 2007).

Native American archaeological site types associated with this period are generally consistent with those of earlier periods, but European and Euro-American traders, missionaries, settlers, and industries affect the locations of these sites. This period also includes Euro-American immigrant settlement patterns, subsistence activities, and economic strategies. Sites associated with Euro-American immigrants appear in the mid-nineteenth century. Associated archaeological and historic site types categorized in the Contact/Post-Contact period include standing structures as well as archaeological sites. A number of these sites can be found near the project area and include schools and farms.

4.1.1 Saint Paul's Northern Hayden Heights Neighborhood

The land comprising the city of Saint Paul became part of the United States Northwest Territory in 1787. In 1805 Army officer Zebulon Pike negotiated a purchase of 100,000 acres from the Dakota, known as Pike's Purchase. The land Pike acquired was later used to establish Fort Snelling. In 1837 the United States government seized the remainder of the land comprising Saint Paul through a series of treaties. Following the recent annexations, Pierre "Pig's Eye" Parrant established the region's first settlement, Pig's Eye Landing, in 1838. Father Lucien Galtier of France established Saint Paul's Chapel on the bluffs above Pig's Eye Landing in 1841, later renaming the settlement after the church, Saint Paul. The territory of Minnesota was formally recognized in 1849, and Saint Paul was established as its capital. Saint Paul remains the capital of Minnesota (Visit Saint Paul, n.d.).

Saint Paul's Northern Hayden Heights neighborhood, which borders the city of Maplewood, is a roughly 350 acre neighborhood in the northeastern most part of the city. The Hillcrest Golf Course takes up nearly one third the Northern Hayden Heights Neighborhood. This area was formerly a 160 acre farm owned and operated by Minnesota Governor Alexander Ramsey. In 1913 Ramsey gave the property to his daughter, Marion Furness, who used the land for garden lots until selling it to White Bear Yacht Club golf pro Tom Vardon in 1921 (Empson, 2006; Shefchik, 2012). That same year, Tom Vardon opened the Hillcrest Golf Course, which remained in operation until 2017 (Shefchik, 2012). In 1997, major flooding one and a half miles west of Hillcrest Golf Course partially submerged sixty homes and as a result thirty-one homes were destroyed. Following the 1997 flood, Hillcrest Knoll Park, a public space operated by St. Paul Public Works was founded where the destroyed homes once stood. Hillcrest Knoll Park acts as a holding pond during rainy seasons. (Strudevant, 2016). Nearby Hillcrest Golf Course, which is on naturally high ground, was spared from the flooding.

5.0 BACKGROUND RESEARCH

A literature search was completed October 16, 2020 by Blondo Consulting staff member William Rayson. The Minnesota State Historic Preservation Office (SHPO) Inventory and Reports Database was accessed through an emailed request to the Survey and Inventory Coordinator, while the Office of the State Archaeologist’s (OSA) records were reviewed via the OSA Online Portal. During this search, previously recorded and reported architectural and archaeological sites were identified for a half-mile radius around the proposed project area.

Prior to the March 25, 2020 Stay At Home Order (issued by Governor Tim Walz), in person access to SHPO inventory files became limited. By March 25, 2020, state facilities (including the State Historic Preservation Office and Office of the State Archaeologist) were closed to prevent the spread of COVID-19. Office Staff began working from home, and accessible resources were reduced to previously digitized files. Due to these constraints, the current records search was limited to the Inventory and Reports Database search and Online Portal. An online search of the National Register of Historic Places and National Historic Landmark Database was also completed. These databases are limited by last being updated in 2014 and 2018. Mapping and files of local government HPCs (Historic/Heritage Preservation Councils), when available online, were also consulted.

5.1 Archaeology

The background records search, described above, was completed to identify previously recorded and reported archaeological and architectural sites within the project area. For a historic property (including archaeological sites) to be considered important within a cultural resource management context, it must meet a level of significance and retain historic integrity for National Register of Historic Places listing. The National Historic Landmark Database was also consulted. During that search, one archaeological site was identified within a one mile radius of the proposed project area (Table I).

| Table I. Previously Recorded Archaeological Sites | | | | | |
|--|------------------|-----------------------------|--------------------|------------------|---------------------------|
| Site Number | Site Name | Cultural Affiliation | Description | NR Status | Distance from Site |
| 21RA0016 | Hillcrest | Precontact | Single Artifact | Unevaluated | 0.59 miles |

Hillcrest Site (21RA0016)

Hillcrest Site, 21RA0016, is an unevaluated prehistoric isolated find of unknown cultural affiliation consisting of one lithic artifact. This site is located on residential private property off Montana Avenue East, which is surrounded by wetlands. Hillcrest site was discovered in 1992 during a Phase I archaeological survey (OSA files). Hillcrest site (21RA0016) is located 0.59 miles east of the proposed project area.

5.2 Architecture

Additionally a search of Historic Properties within a half mile radius of the proposed project area was conducted. As a result, eight previously inventoried historic properties were identified within a half mile radius of the proposed project area. Eligible Historic Property St. Paul Minneapolis and Manitoba Railway (HE-MPC-5615) is located 196 feet south of the proposed project area (Table 2).

| Table 2. Previously Inventoried Historic Properties | | | | |
|---|------------------------|---|-------------|--------------------|
| Site Number | Address | Name/Description | NR Status | Distance from Site |
| HE-MPC-5615 | --- | St. Paul Minneapolis and Manitoba Railway | Eligible | 196 Feet |
| RA-MWC-0027 | 2300 Larpenteur Ave. E | house | Unevaluated | 0.11 Miles |
| RA-MWC-0028 | 1709 McKnight Rd. N | Community Corrections | Unevaluated | 0.09 Miles |
| RA-SPC-1736 | 1350 Hazel St. N | Hayden Heights School | Unevaluated | 0.50 Miles |
| RA-SPC-1737 | 1435 Hazel St. N | house | Unevaluated | 0.50 Miles |
| RA-SPC-4781 | 1971 Orange Ave. E | house | Unevaluated | 0.36 Miles |
| RA-SPC-4782 | 1979 Orange Ave. E | house | Unevaluated | 0.37 Miles |
| RA-SPC-5751 | 2095 Clear Ave. | Water Tank | Unevaluated | 0.10 Miles |

Hillcrest Golf Course

The proposed Hillcrest Golf Course redevelopment project encompasses the entirety of the Hillcrest country club. Originally farmland operated by Governor Alexander Ramsey, the land was given to Ramsey’s daughter Marion Furness in 1913. Marion Furness used the property for garden lots until selling it to Tom Vardon in 1921 (Empson, 2006; Shefchik, 2012). The Hillcrest Golf Course was designed and constructed in 1921 by White Bear Yacht Club golf pro Tom Vardon (Shefchik, 2012). Originally named Lakeview, the private nine-hole golf course was renamed Hillcrest in 1923 (Bissen, 2019). Hillcrest opened up to the public for a couple years in order to fund a nine-hole expansion, then switched back to a private operation in 1928. In 1936 Hillcrest head pro Herb Snow invited famed golf course architect A.W. Tillinghast to visit, who suggested a series of alterations to the golf course. The following year, Tillinghast returned and approved of the club’s alterations, which resulted in the Minnesota Golf Association (MGA) officially approving the course. Since 1937, the golf course has not undergone significant alterations (Shefchik, 2012). Hillcrest’s ongoing financial troubles began during the Great Depression. In 1933, Hillcrest opened back up to the public in efforts to gain membership (Shefchik, 2012). It was during this time that anti-Semitism was surging across the country and in Minneapolis in particular.

German Jews, drawn to commercial opportunities in the Twin Cities were among the first of Minnesota's Jewish population to settle in the state. By 1880, Saint Paul had two Synagogues to accommodate its rising Jewish population. During the 1880s Eastern European Jews began to arrive in large numbers to the United States, fleeing anti-Semitism, poor economic conditions, and Russian race-riots. From 1900 to 1910, Minnesota's Jewish population more than doubled from 6,000 to 13,000. Minnesota's rising Jewish population was particularly vulnerable to the post World War I xenophobic "Americanism" which was directed inward at recent immigrants. Around this time, social, civic, and employment discrimination against Jews became commonplace. By the late 1930s most employment ads in Minnesota stated outright "Gentiles Preferred". The Great Depression accelerated discriminatory trends, and marginalized groups such as Minnesota's Jewish communities were hit particularly hard.

By 1936, Minneapolis was showing signs of economic recovery. During this time, hate group William Dudley Pelley's Silver Shirts began recruiting members in the Twin Cities, with one goal of segregating all Jews to one city in Minnesota. Minnesota's Silver Shirt chapter membership grew to 6,000, helping to normalize the increasing hate speech and discriminatory practices against Minnesota's Jewish population. Local efforts to counteract employment discrimination, including the Jewish Free Employment Bureau (later renamed the Jewish Employment Service) were successful, but employment discrimination climaxed as economic efforts shifted from Depression recovery to war efforts during the beginning of America's involvement in World War II. At this time, Jewish owned businesses which survived the Great Depression were facing boycotts. Journalist Selden Menefee noted in 1943 "*almost no evidence of anti-Semitism in the Northwest and West Central States. Except in Minneapolis, no one considered it to be a problem.*" Three years later Menefee followed up "*Signs of militant anti-Semitism I found almost entirely lacking [sic] except for Minneapolis.*" Another journalistic investigation by Carey McWilliams in 1946 concluded in deeming Minneapolis "*The capitol [sic] of anti-Semitism in the United States.*"

After WWII, Americans united over the defeat of fascism, and generally began to view discrimination as un-acceptable to their values. In 1947 Minneapolis mayor Hubert Humphrey conducted a "Mayor Self-Study" which concluded that 63% of Minneapolis firms racially discriminate in hiring practices. Following this study, several local organizations formed the Joint Committee for Employment Opportunity, which circulated a petition with over 10,000 signatures calling for racial and religious equal employment opportunities in the Twin Cities. As American values shifted, Jews became discriminated against less throughout the 1950s (Weber, 1991).

Discriminatory practices during the early 20th century extended to Minnesota's social clubs, as a result, Jewish social club Calumet Club was formed in Minneapolis in 1908. In 1913 Calumet Club members began talks of opening a Jewish golf club in the Twin Cities. In 1915 Calumet Club members opened up Minnesota's first Jewish country club, Northwood in Saint Paul, followed by Minneapolis club Oak Ridge in 1921 (Shefchik, 2012). In 1945 Hillcrest's ongoing financial troubles and the closing of Northwood culminated in a group of Jewish businessmen and Northwood

members purchasing Hillcrest. Hillcrest's timely switch to Jewish ownership coincided with the climax of anti-Semitism in Minnesota. During its Jewish ownership, Hillcrest had the distinction of hosting the Minnesota State Amateur Golf Tournament in 1962. Hillcrest Golf Course continued to run as an exclusively Jewish operation through the 1970s. Financial troubles continued with new ownership, Hillcrest experienced caddy strikes in the 1950s and a devastating clubhouse fire in 1962, which left Hillcrest without a clubhouse for 38 years (Orrick, 2017).

Hillcrest members were not spared from the reach of Bernie Madoff's fraudulent investment practices, which preyed on investors at affluent Jewish country clubs across the states (Biggs, 2009). One report concluded that during a period from the 1990s to the mid 2000s, members from Hillcrest and nearby Oak Ridge paid more than \$100 Million to Madoff's Ponzi scheme (Kansas, 2009; Wall Street Journal, 2009). In 2000 Hillcrest finally completed construction of a new clubhouse at a cost of \$2.8 Million, saddling the club with debt (Orrick, 2017). In 2011 the club was sold to Steamfitters Pipefitters Local 455 for \$4.3 Million, with an eventual plan to build a training center, which fell through. In 2017 Hillcrest closed due failing finances and hired SPAA to assist in selling.

Hillcrest's switch to Jewish ownership in 1945 represents the changing attitudes of Americans from the xenophobic aftermath of World War I to the post-World War II sense of unity, exemplifying the anti-Semitism in the Twin Cities in particular, and the triumph of the Jewish community. Due to its association with the height and heart of American anti-Semitism, and the backlash against discrimination it represents, Hillcrest Golf Course demonstrates historical significance under National Register Criterion A for its association with important historic events.

The period of significance for the Hillcrest Golf Course is linked to its Jewish ownership from 1945 through the 1970s. Prior to its Jewish ownership, in 1936-1937, famed golf architect A.W. Tillinghast recommended and approved of several alterations to the greens, including the utilization of his signature bunkers. Hillcrest's greens mostly retain Tillinghast's architectural integrity, however another key feature of the club, the clubhouse, has been absent since the clubhouse fire in 1962. Though the Hillcrest clubhouse was rebuilt in 2000, the redesigned clubhouse does not retain any historic resemblance to the original (Orrick, 2017). Examples of A.W. Tillinghast designed golf courses which are listed in the National Register, including Baltusrol Golf Club in Springfield, New Jersey and Winged Foot Golf Club in Mamaroneck, New York, have historic clubhouses which are crucial parts of their historic integrity (NRHP forms). The Hillcrest Golf Course, lacking its original clubhouse does not retain historic integrity. Having historical significance but not integrity, the Hillcrest Golf Course does not meet the criteria for National Register eligibility.

St. Paul Minneapolis and Manitoba Railway (HE-MPC-5615)

The St. Paul Minneapolis and Manitoba Railway was formed in 1879 when investors took over assets of St. Paul and Pacific. In 1890 ownership was transferred to Great Northern. Today the St. Paul and Manitoba Railway is still in use and is part of the BNSF Railway system (Schmidt and

Vermeer, 2009). Eligible Historic Property St. Paul Minneapolis and Manitoba Railway (HE-MPC-5615) is located 196 feet South of the proposed Hillcrest Golf Course Redevelopment Project.

6.0 RECOMMENDATIONS AND CONCLUSION

WSB retained Blondo Consulting to complete a Phase IA Cultural Resource Assessment for the proposed Hillcrest Golf Course Redevelopment Project in Saint Paul, Ramsey County, Minnesota. A literature search through the Minnesota SHPO and through the OSA online Portal concluded in the finding of one previously recorded archaeological site within one mile of the project area and eight previously inventoried properties within a half mile of the proposed project area. The Hillcrest Golf Course was established in 1921 and meets the 50-year old threshold for historic property evaluation. An evaluation of the Hillcrest Golf Course revealed historic significance associated with the resilience of Minnesota's Jewish community during the height and heart of American anti-Semitism. The Hillcrest Golf Course, lacking its original clubhouse does not retain historic integrity. Having historical significance but not integrity, the Hillcrest Golf Course does not meet the criteria for National Register eligibility.

Although landscaping of the site has taken place, there is a potential to encounter previously unrecorded archaeological deposits. A Phase I Reconnaissance Survey is recommended prior to construction. Due to the proximity of the project encompassing Hillcrest Golf Course, there is the potential to encounter cultural resources. Additional cultural resource investigations are recommended in consultation with the Minnesota State Historic Preservation Office, and the Office of the State Archaeologist.

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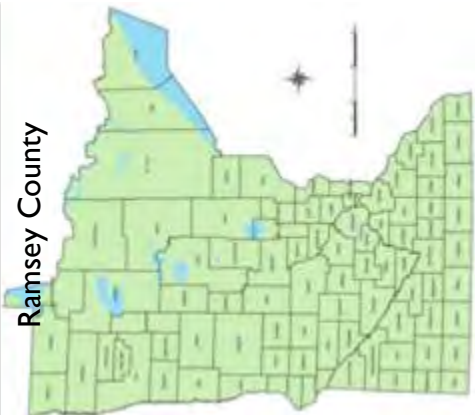
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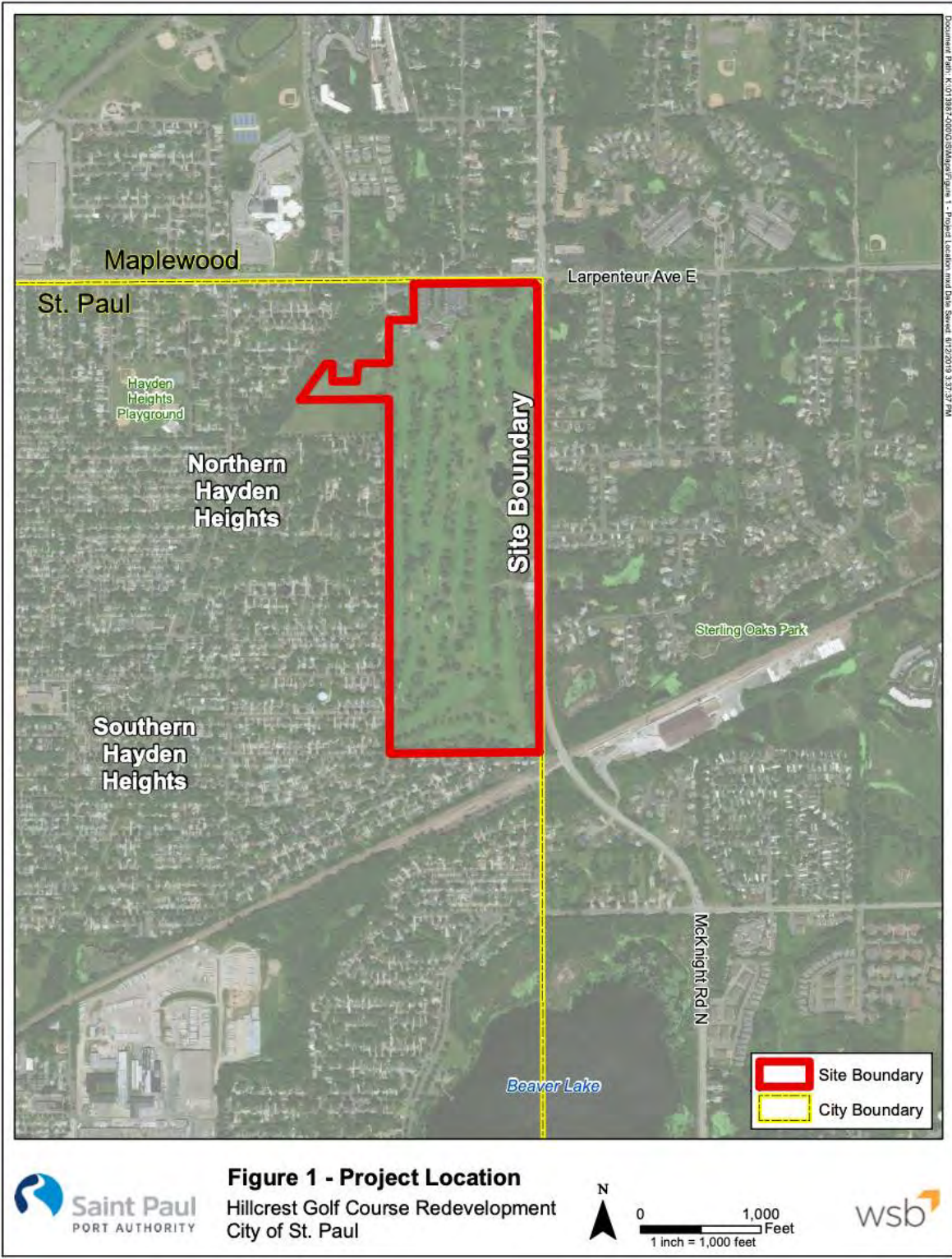
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Attachment I: Maps





**Attachment II: Photos
Provided by WSB**













Appendix D – Traffic Study

Memorandum

To: Bill Dermody, City of St. Paul
Monte Hillman, St Paul Port Authority

From: Chuck Rickart, PE, PTOE, WSB
Erik Seiberlich, WSB

Copy : Andi Moffatt, WSB

Date: June 24, 2022; Revised August 29, 2022

Re: Final Traffic Analysis
Hillcrest AUAR
St Paul, Minnesota
WSB Project No. 16695-000

INTRODUCTION

The St. Paul Port Authority (SPPA) is proposing to redevelop the former Hillcrest Golf Course located in the southwest corner of Larpenteur Avenue & McKnight Road in northeastern St. Paul along the border with the City of Maplewood. The study area which is approximately 113 acres, is covered in the draft **Hillcrest Master Plan (Hillcrest MP)** which is currently under review by the St. Paul City Council. The redevelopment is anticipated to include a mix of residential, light industrial, and commercial uses consistent with the Hillcrest MP. **Figure 1** shows the project location.

A Transportation Planning Analysis was completed in conjunction with the **Hillcrest MP**. The analysis included documentation of the existing and future alternative land use concepts for the area. Some of the background data and analysis from that study will be used to complete this Traffic Analysis for the AUAR.

The following sections of this memorandum document the existing traffic conditions, development scenarios, traffic projections, traffic operations analysis, mitigation analysis and study conclusions and recommendations.

EXISTING CONDITIONS

The transportation and traffic impacts from the Hillcrest Golf Course site were evaluated for the adjacent facilities and at the following study intersections.

- Larpenteur Avenue at Howard Street – Side Street Stop Controlled
- McKnight Road at Larpenteur Avenue – Traffic Signal Controlled
- McKnight Road at Montana Avenue - Side Street Stop Controlled
- McKnight Road at Nebraska Avenue - Side Street Stop Controlled
- McKnight Road at Arlington Avenue - Side Street Stop Controlled
- Ivy Avenue at Hawthorne Avenue - Side Street Stop Controlled

Roadway Characteristics

The two primary roadways providing access to the site are Larpenteur Avenue (CSAH 30) and McKnight Road (CSAH 68). Each is discussed below:

Larpenteur Avenue (CSAH 30): Larpenteur Avenue is a two lane east-west Ramsey County roadway. It is classified as an A-Minor Augmenter. Larpenteur Avenue was recently upgraded to include striped bike lanes in both directions between Hazel Street and McKnight Road. The existing Average Daily Traffic (ADT) on Larpenteur Avenue is 8,500 vehicles per day (vpd) within the study area. The roadway has a posted speed limit of 30mph.

McKnight Road (CSAH 68): McKnight Road is a Ramsey County north/south roadway with a three-lane cross section and paved shoulders designated for biking. It is classified as an A-Minor Augmenter roadway. The existing ADT on McKnight Road is 12,600 vpd within the study area. The roadway has a posted speed limit of 45mph.

Existing Traffic Volumes

Weekday peak hour turning movement traffic volumes were collected as part of the Transportation Planning Analysis for the **Hillcrest MP**. The AM peak hour was determined to be 7:15 AM to 8:15 AM and the PM peak hour was determined to be 4:30 PM to 5:30 PM. **Figure 2** shows the existing area intersections that were analyzed as part of this study, with the existing AM and PM peak hour traffic volumes.

Existing Pedestrian / Bike Facilities

In the study area there are several pedestrian and bike facilities that would provide access to the site including:

- Sidewalks on some of the streets in the neighborhood to the west. These sidewalks currently dead-end at the site.
- Sidewalk on the west side of McKnight Road north of Larpenteur Avenue.
- Trail on the west side of McKnight Road south of Larpenteur Avenue.
- Furness Parkway Trail west of the site.
- On road striped bike lane on Larpenteur Avenue in both directions west of McKnight Road.
- Striped shoulder on McKnight Road.
- Striped shoulder on Larpenteur Avenue east of McKnight Road
- Signed and striped pedestrian crossings across McKnight Road with raised concrete medians at Arlington Avenue, Nebraska Avenue, Montana Avenue and Hoyt Avenue.
- Signed and striped pedestrian crossing across Larpenteur Avenue at Beebe Road.

The primary destinations for pedestrians in the area are local businesses located at McKnight Road and Larpenteur Avenue and along White Bear Avenue approximately $\frac{3}{4}$ mile west of the site. Larpenteur Avenue does not have sidewalk or trail facilities except for a short stretch near Mounds Park Academy. The neighborhoods to the west of the site do have sidewalks on some of the blocks. These sidewalks currently dead-end at the site and do not connect to the trail along McKnight Road.

The site is well connected to promote bicycling as a viable mode of transportation to the east and south. However, there are gaps in the existing facilities for trips to/from the north and west of the site. Larpenteur Avenue was recently restriped to provide bike lanes, but the lanes end at Hazel Street resulting in a gap to the White Bear Avenue area.

Figure 3 shows the existing pedestrian and bike facilities including existing sidewalk gaps.

Figure 2 – Existing Traffic Volumes

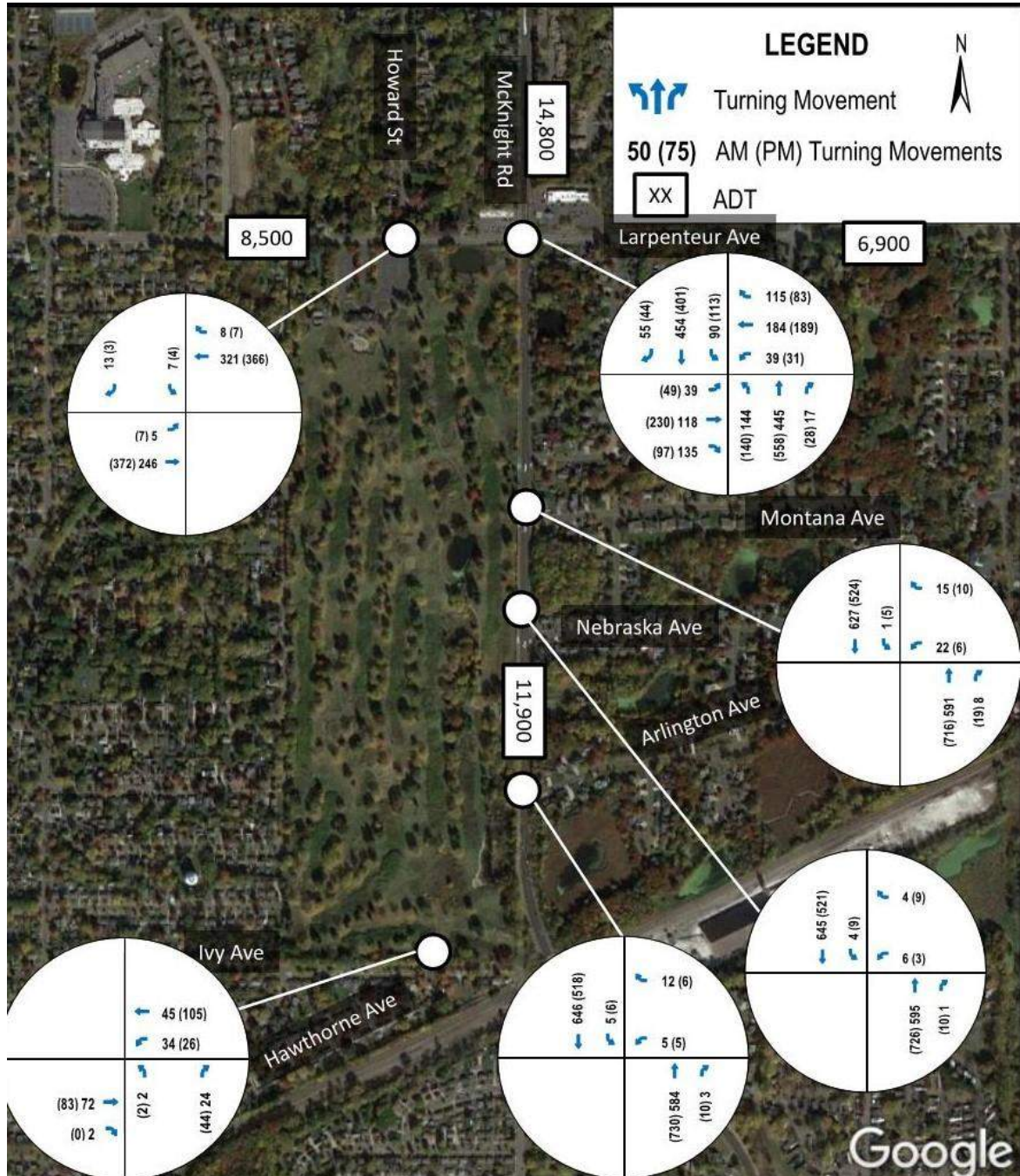


Figure 3 – Existing Pedestrian and Bike Facilities



Existing Transit Routes

Figure 4 shows the existing transit routes surrounding the site. Transit service in the project area is provided by Metro Transit however, there is no bus service provided directly adjacent to the site along either Larpenteur Avenue or McKnight Road. The routes in the area closest to the site include:

- **Route 64** is a local bus route from Downtown St. Paul to the Maplewood Mall via Payne Avenue, Maryland Avenue, White Bear Avenue, and continuing through North St. Paul and Maplewood. The route splits to Route 64N which passes closest to the site. The route operates during the weekdays and the weekend with 30-minute headway during the peak hours and 15 to 60-minute headways outside of peak hours. The current ridership (2019) for the bus stop closest to the site was 14 riders per day.
- **Route 74** is a local bus route from the 46th Street Station in Minneapolis to the Sun Ray Shopping Center in St. Paul via Ford Parkway, W 7th Street, Downtown St. Paul, and continuing through St. Paul to Maplewood. The route operates during the weekdays and the weekend with weekday 15 to 20-minute headways during the peak hours and 20 to 30-minute headways during the midday and evening hours. Service runs on a 20 to 30-minute headway on the weekends. The current ridership (2019) for the bus stops closest to the site was 3 riders per day.

DEVELOPMENT LAND USE SCENARIOS

Three redevelopment land use scenarios have been included in the AUAR. The redevelopment is anticipated to include a mix of residential, light industrial, and commercial uses.

Table 1 summarizes the land use and density for each Scenario. These scenarios are consistent with the **Hillcrest MP**. The three scenarios have the similar land uses based on coverages; however, Scenario 3 proposes a denser development plan than Scenario 1 or Scenario 2. Scenario 1 represents the actual Comprehensive Plan land use density and block lengths. Scenario 1 also provides a “grid: internal roadway system, where Scenarios 2 and 3 include only the primary access streets within the development area. **Figures 5 and 6** show the proposed Land Use areas. All scenarios are also consistent with the land use in the **St. Paul 2040 Comprehensive Plan**.

Table 1 – Development Scenario Land Use

| Land Use | Existing | Scenario 1 Comp Plan | Scenario 2 Master Plan | Scenario 3 Max Density |
|--------------------------|----------|-------------------------|---------------------------|---------------------------|
| Light Industrial | -- | 708,000 sf | 840,000 sf | 1,000,000 sf |
| Multi-family residential | | 960 units | 960 units | 2,615 units |
| <i>Low Density</i> | -- | 180 units | 180 units | 315 units |
| <i>Medium Density</i> | -- | 360 units | 360 units | 900 units |
| <i>High Density</i> | -- | 420 units | 420 units | 1,400 units |
| Golf Course | 107.7 ac | -- | | -- |
| Public Park | -- | 5.0 ac | 5.0 ac | 5.0 ac |
| Passive Open Space | -- | 7.0 ac | 7.0 ac | 7.0 ac |
| Trail and Right-of-Way | -- | 14.3 ac | 22.8 ac | 14.3 ac |
| Wetlands | 5.6 ac | 6.0 ac | 6.0 ac | 6.0 ac |
| Stormwater ponds | -- | 2.0 ac | 2.0 ac | 2.0 ac |

Figure 4 – Existing Transit Routes

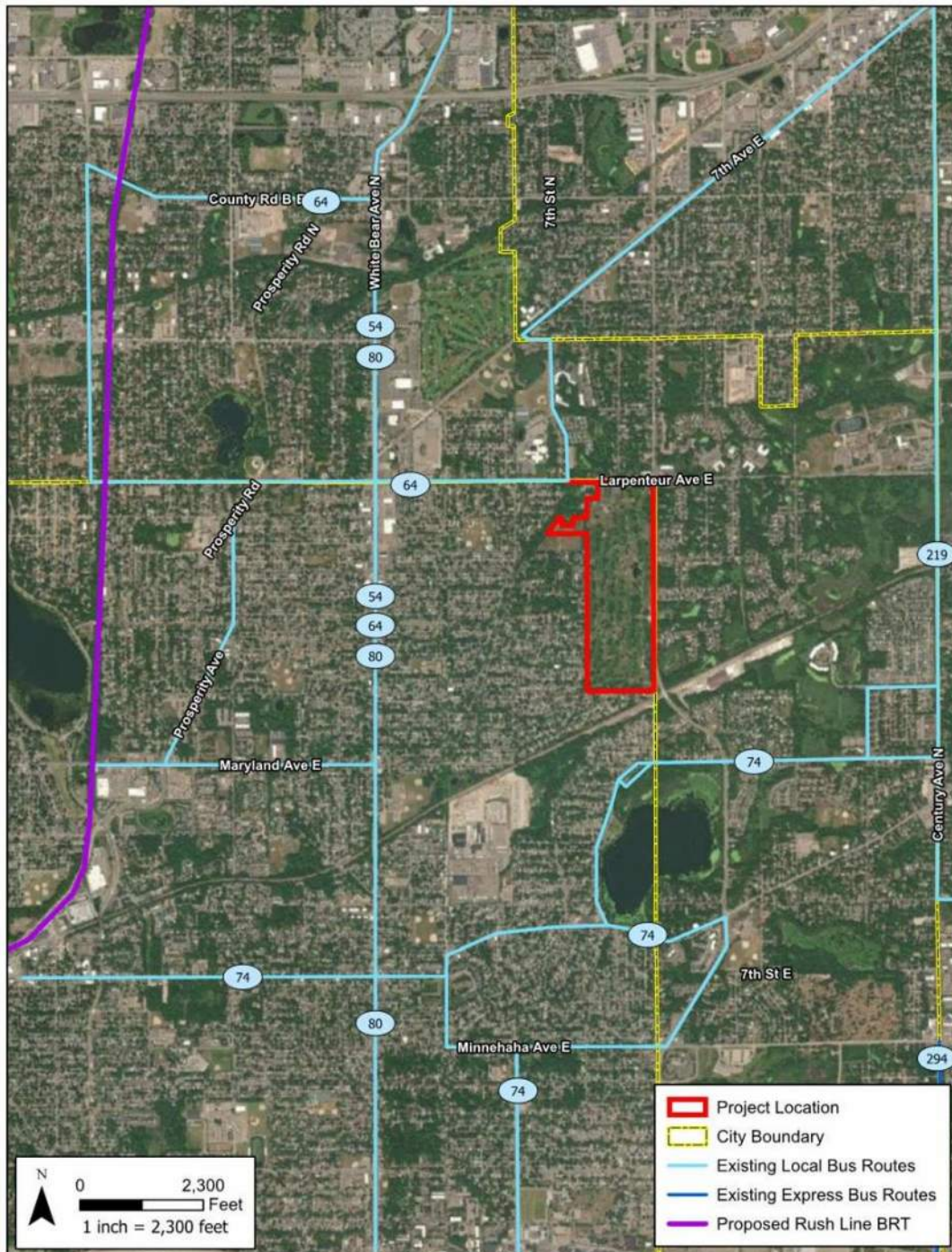


Figure 5 – Scenario 1

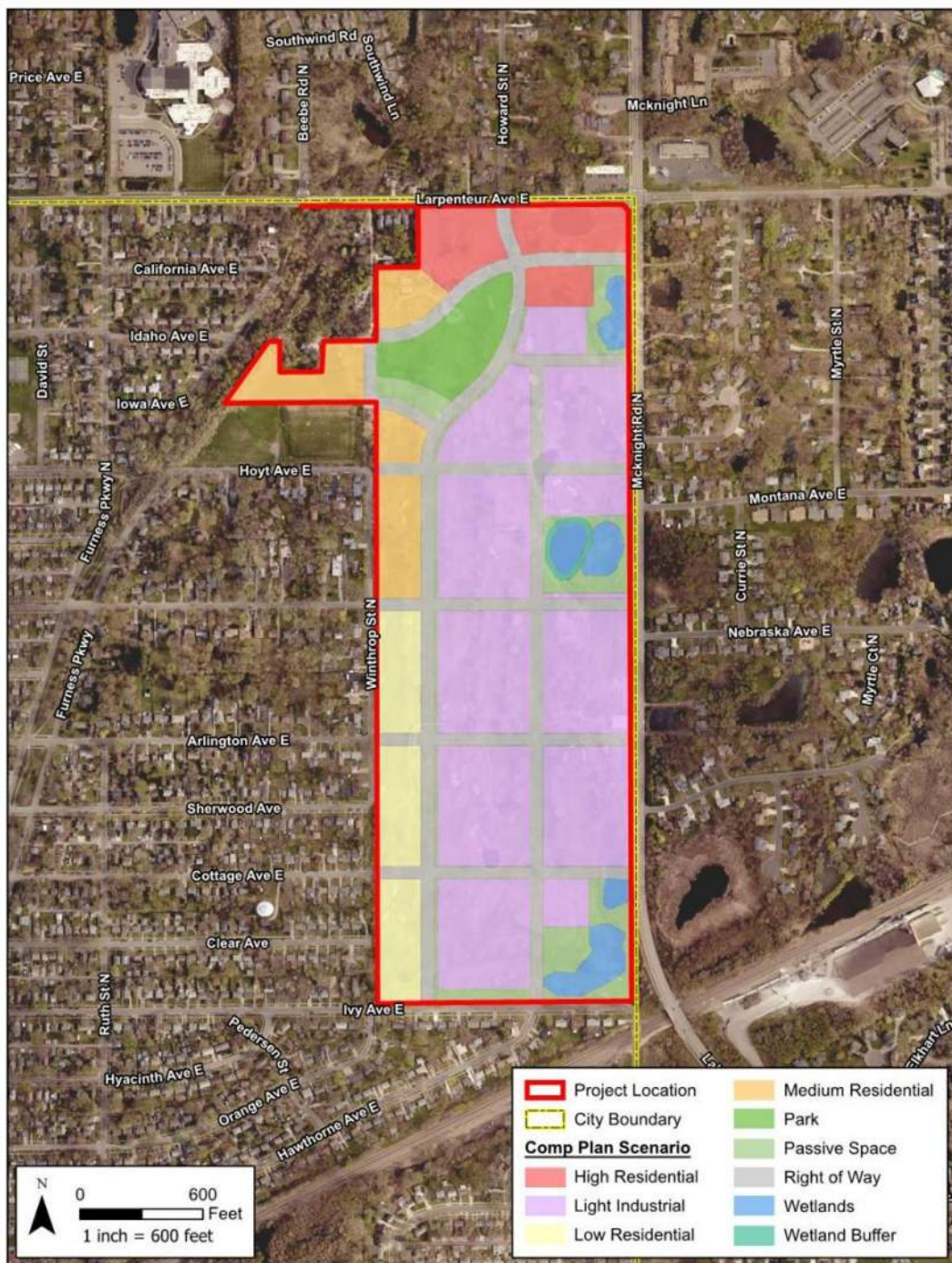
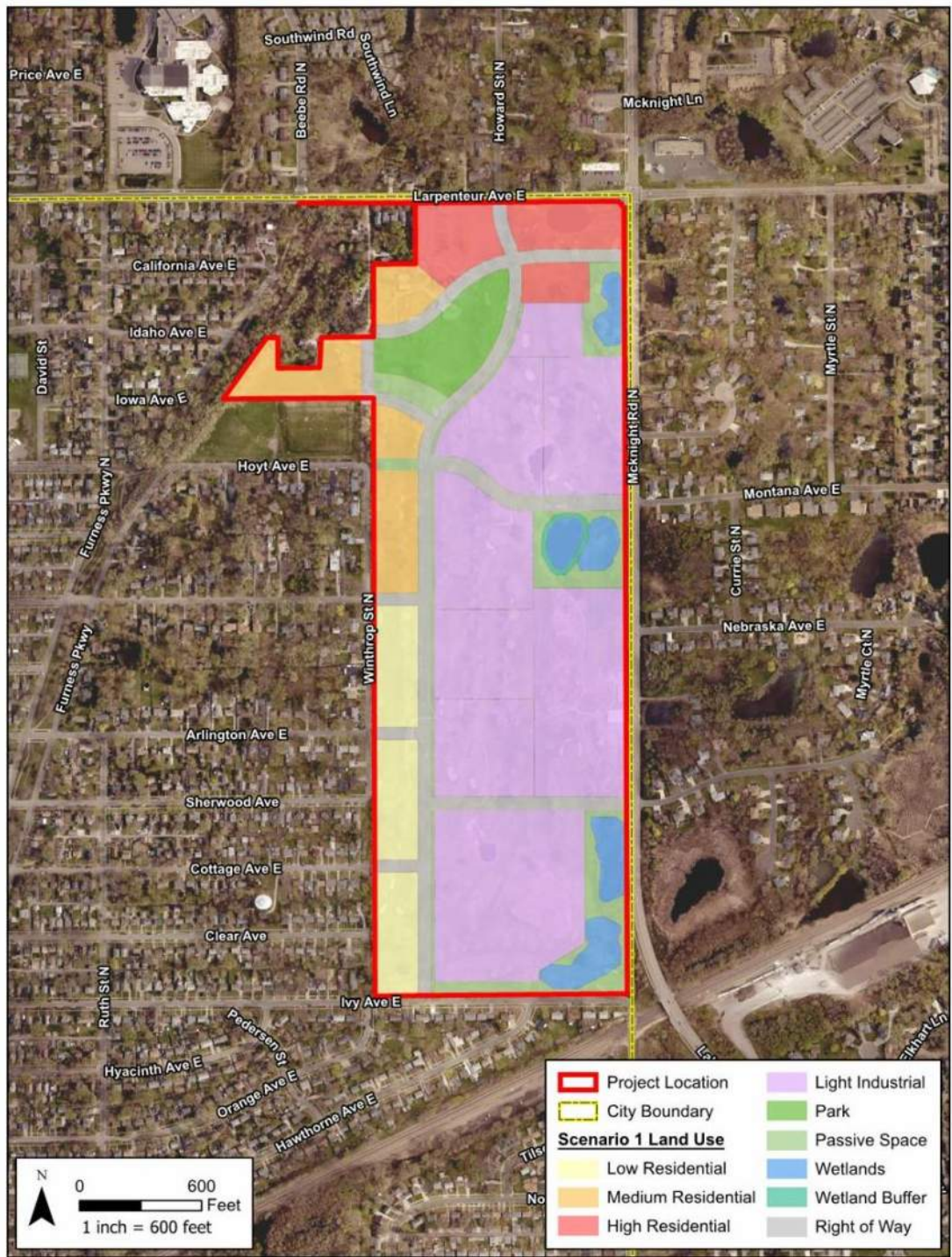


Figure 6 – Scenarios 2 and 3



BIKE / PEDESTRIAN FACILITIES

With each land use scenario, trail and sidewalk connections to the surrounding network will be provided.

As discussed previously and shown in **Figure 3**, the study area is connected to nearby bike facilities, with the most extensive network located to the east and south with gaps in the existing infrastructure for travel to/from the northern and western portion of the study area. Per the City of St. Paul Bike Plan, Ivy Avenue will provide an enhanced shared lane in the future that will run from the trail on McKnight Road to Prosperity Avenue. Arlington Avenue will also provide an enhanced shared lane in the future that will connect the Bruce Vento Trail to the Furness Trail. The exact bike facility type will be selected at the project design stage.

As shown in **Figure 3**, the neighborhood to the west of the site has sidewalks on some of the blocks. The city's goal is to provide sidewalks on the remaining city streets, however, there is no immediate plan to provide these improvements. Any sidewalk that currently dead ends at the site will be connected to the site development. With the conversion of McKnight Road from 4 lanes to 3 lanes, pedestrian refuge islands were installed at Hoyt Avenue, Montana Avenue, Nebraska Avenue, and Arlington Avenue to improve pedestrian crossings.

With each of the development scenarios the following bike and sidewalk connections should be provided:

- A trail connection north of Hoyt Ave to the Furness Trail on the west side of the study area with a direct connection through the site generally along Hoyt Avenue/Montana Avenue to the trail on McKnight Road.
- An off-road trail on the south side of Larpenteur Avenue from McKnight Road to the west.
- A trail connection from the site on Howard Street to Ivy Avenue.
- A pedestrian connection on the north side of Ivy Avenue from Winthrop Street to the existing pedestrian trail on McKnight Road with the reconstruction of Ivy Avenue.
- An extension of the future bicycle infrastructure (enhanced bike lane or other design) on Arlington Avenue through the site to the trail on McKnight Road
- Sidewalks along all roadways throughout the Hillcrest development Site.
- Reconstruct the existing pedestrian refuge islands on McKnight Road at Montana Avenue and Arlington Avenue as part of the construction of new left turn lanes for the site. The design will include a raised concrete median with signing and pavement markings. The detailed design will be completed as part of the final design for the site improvements and will be coordinated, reviewed and approved by Ramsey County.
- Design internal roadways to accommodate safe pedestrian crossings. Specific design features are not determined at this time but could include bump-outs at intersections, tabled concrete crosswalks, and a tabled intersection at Howard Street and Idaho Avenue.
- Ensure that the pedestrian connectivity across McKnight Road to the City of Maplewood is maintained. Any changes or modification in the existing infrastructure resulting from the development will be reviewed and approved by Ramsey County and the City of Maplewood.
- Provide a pedestrian crossing of Larpenteur Avenue from the development site at Howard Street.

TRANSIT CONNECTIONS

Currently the transit service adjacent to the site is limited with no existing bus service provided along either Larpenteur Avenue or McKnight Road. To promote increased transit use, it is recommended to work with Metro Transit, to alter the existing route 64 or route 74 to pass through or pass adjacent to the site. Which of these routes, the length of the route extended and where

bus stops are located, will be analyzed once a site development scenario is selected and Metro Transit reanalyzes the local bus routes in the area.

FREIGHT SERVICE

Truck activity within the Hillcrest Site is expected to be related to potential industrial truck traffic including, deliveries serving the site, garbage/recycling services, and school buses. Depending on the actual use on the industrial properties within the site, a large amount of truck or freight activity could occur. These uses are planned for the areas adjacent to McKnight Road and all truck access should be directed to McKnight Road. Trucks and freight activity should be limited and discouraged on all other roadways within the site by using methods such as:

- Design internal roadways to accommodate the expected level of freight activity within the area based on the proposed development, including:
 - Provide bump-outs at intersections to eliminate/discourage large vehicle turning toward residential neighborhoods.
 - Any industrial land use's access to Howard Street should not line up with Nebraska Avenue, Arlington Avenue, or Cottage Avenue to the west. Rather, any such access to Howard Street should be mid-block to discourage direct traffic access to the neighborhoods.
- Freight activity should be limited during the peak traffic periods to avoid potential conflicts. This can be accomplished through communication with the identified industrial business, area package services (i.e., UPS, FedEx, etc.) and refuse haulers.
- Evaluation of the need for on-street loading areas should be completed to accommodate some freight activity as actual development proposals are identified.

TRAFFIC PROJECTIONS

In order to analyze the land use scenarios and determine the appropriate lane configuration and traffic control needs on the area roadways and intersections, projected traffic volumes were determined. Projections were prepared for the 2040 horizon year. The following sections outline the projected background traffic growth, traffic generation from the study area, as well as the traffic distribution and projected traffic volumes.

Background Traffic Growth

Traffic growth in the vicinity of a proposed site will occur between existing conditions and any given future year due to other development within the region. This background growth must be accounted for and included in future year traffic forecasts. Based on the analysis included in the Transportation Planning Analysis for the *Hillcrest MP* a 0.5% annual growth rate was applied to the Existing traffic volumes to determine the 2040 No-Build traffic volumes.

Proposed Development Area Traffic Generation

The estimated trip generation from each of the proposed development scenarios is shown in **Tables 2a – 2c**. The trip generation rates used to estimate the proposed area traffic is based on other similar land uses as documented in the Institute of Transportation Engineers (ITE) *Trip Generation Manual*, 10th Edition. The tables show the Daily, AM peak and PM peak hour trip generation for each development scenario.

The traffic generation also includes a 5% internal trip reduction and 5% multimodal trip reduction. The internal trip reduction rate was calculated based on the ITE Trip Generation Manual guideline to determine a percentage of trips that would be destined to another land use within the site and not utilize the exterior roadways. ITE and the NCHRP conclude that trip capture rates for similar uses are 2% to 8%. With mainly housing and industrial land uses, the goal to increase

walking opportunities to employment areas and engineering judgement, it was assumed that only 5% of the site traffic would be considered internal trips.

With the site development it was assumed that transit ridership will increase, and the majority of the transit trips were to occur in the peak periods. A 2.5% transit reduction was assumed for site. This percentage could increase if transit routes were rerouted closer to the site.

The City of St. Paul's goal is to increase the walking and bicycle mode share to 5%. The site development will focus on providing substantial trail and sidewalk connections throughout the site and to the adjacent neighborhoods so it is anticipated that a higher percentage of trips within the site will be walking or bicycling between the housing, community node, and active park. Therefore, it was assumed that a 2.5% bicycle mode split would be more feasible for the site. Transit use and bicycle use will therefore result in a reduction of 5% of the vehicular trips.

Proposed Development Area Traffic Distribution

Area generated trips were distributed to the adjacent roadway system based on several factors including the information in the Transportation Planning Analysis for the **Hillcrest MP**, the City's current Transportation Plan; anticipated origins and destinations for the residential land use, and existing travel patterns and future roadway connections. Based on these parameters the following general traffic distribution was used to distribute the projected traffic volumes to the area roadway network:

- 20% to/from the west on Larpenteur Avenue towards White Bear Avenue
- 25% to/from the north on McKnight Road
- 10% to/from the east on Larpenteur Avenue
- 25% to/from the south on McKnight Road
- 10% to/from the west/southwest on Ivy Avenue, Orange Avenue, and Hawthorne Avenue
- 10% to/from the west on various roadways in the Hayden Heights Neighborhood

Projected Traffic Volumes

Traffic forecasts were prepared for the 2040 no-build and build conditions. The traffic forecasts were prepared by adding the projected annual background traffic growth to the existing adjusted traffic volumes to determine the 2040 no-build condition and, by adding the projected annual background traffic growth to the existing adjusted traffic volumes and the anticipated area development site traffic generation to determine the 2040 build conditions for each Build Scenario.

Figure 7 – Figure 10 shows the 2040 no-build and 2040 build traffic volumes for each scenario.

Table 2a – Scenario 1 Trip Generation

| Land Use Scenario 1 - Comp Plan | | | | | | | | | | | | | | | | | |
|---|---------|-------|------|-----------------------|------------------|------------|------|-------|--|-------|------------|------------|--|-------|------------|------------|------------|
| Planned Use | Size | Unit | ITE | | | | ADT | | Weekday AM Peak of Adjacent Street Traffic | | | | Weekday PM Peak of Adjacent Street Traffic | | | | |
| | | | Code | Description | Setting/Location | Variable | Rate | Total | Rate | Total | In | Out | Rate | Total | In | Out | |
| Industrial | 708,000 | Sq Ft | 130 | Industrial Park | Urban/Suburban | per 1000sf | 3.37 | 2,386 | 0.34 | 241 | 195 | 46 | 0.34 | 241 | 53 | 188 | |
| Multi-Family (Low Density) | 180 | Unit | 220 | Multi Family Low Rise | Urban/Suburban | per unit | 6.74 | 1,213 | 0.40 | 72 | 17 | 55 | 0.51 | 92 | 58 | 34 | |
| Multi-Family (Medium Density) | 360 | Unit | 220 | Multi Family Low Rise | Urban/Suburban | per unit | 6.74 | 2,426 | 0.40 | 144 | 35 | 109 | 0.51 | 184 | 116 | 68 | |
| Multi-Family (High Density) | 420 | Unit | 221 | Multi Family Mid Rise | Urban/Suburban | per unit | 4.54 | 1,907 | 0.37 | 155 | 36 | 120 | 0.39 | 164 | 100 | 64 | |
| Total Site Trips | | | | | | | | | 7,932 | | 612 | 283 | 330 | | 680 | 326 | 354 |
| Internal Capture & Multimodal Reduction (10%) | | | | | | | | | 793 | | 61 | 28 | 33 | | 68 | 33 | 35 |
| Total Scenario 1 Trips | | | | | | | | | 7,139 | | 612 | 283 | 330 | | 680 | 326 | 354 |

Source: Institute of Transportation Engineers
 Trip Generation Manual, 11th Edition

Table 2b – Scenario 2 Trip Generation

| Land Use Scenario 2 - Master Plan | | | | | | | | | | | | | | | | | |
|---|---------|-------|------|-----------------------|------------------|------------|------|-------|--|-------|------------|------------|--|-------|------------|------------|------------|
| Planned Use | Size | Unit | ITE | | | | ADT | | Weekday AM Peak of Adjacent Street Traffic | | | | Weekday PM Peak of Adjacent Street Traffic | | | | |
| | | | Code | Description | Setting/Location | Variable | Rate | Total | Rate | Total | In | Out | Rate | Total | In | Out | |
| Industrial | 840,000 | Sq Ft | 130 | Industrial Park | Urban/Suburban | per 1000sf | 3.37 | 2,831 | 0.34 | 286 | 231 | 54 | 0.34 | 286 | 63 | 223 | |
| Multi-Family (Low Density) | 180 | Unit | 220 | Multi Family Low Rise | Urban/Suburban | per unit | 6.74 | 1,213 | 0.40 | 72 | 17 | 55 | 0.51 | 92 | 58 | 34 | |
| Multi-Family (Medium Density) | 360 | Unit | 220 | Multi Family Low Rise | Urban/Suburban | per unit | 6.74 | 2,426 | 0.40 | 144 | 35 | 109 | 0.51 | 184 | 116 | 68 | |
| Multi-Family (High Density) | 420 | Unit | 221 | Multi Family Mid Rise | Urban/Suburban | per unit | 4.54 | 1,907 | 0.37 | 155 | 36 | 120 | 0.39 | 164 | 100 | 64 | |
| Total Site Trips | | | | | | | | | 8,377 | | 657 | 319 | 338 | | 725 | 336 | 389 |
| Internal Capture & Multimodal Reduction (10%) | | | | | | | | | 838 | | 66 | 32 | 34 | | 72 | 34 | 39 |
| Total Scenario 2 Trips | | | | | | | | | 7,539 | | 657 | 319 | 338 | | 725 | 336 | 389 |

Source: Institute of Transportation Engineers
 Trip Generation Manual, 11th Edition

Table 2c -Scenario 3 Trip Generation

| Land Use Scenario 3 - Max Density | | | | | | | | | | | | | | | | | |
|---|-----------|-------|------|------------------------|-------------------|------------|------|-------|--|-------|--------------|------------|--|-------|--------------|------------|------------|
| Planned Use | Size | Unit | ITE | | | | ADT | | Weekday AM Peak of Adjacent Street Traffic | | | | Weekday PM Peak of Adjacent Street Traffic | | | | |
| | | | Code | Discription | Setting/ Location | Variable | Rate | Total | Rate | Total | In | Out | Rate | Total | In | Out | |
| Industrial | 1,000,000 | Sq Ft | 130 | Industrial Park | Urban/ Suburban | per 1000sf | 3.37 | 3,370 | 0.34 | 340 | 275 | 65 | 0.34 | 340 | 75 | 265 | |
| Multi-Family (Low Density) | 315 | Unit | 220 | Multi Family Low Riise | Urban/ Suburban | per unit | 6.74 | 2,123 | 0.40 | 126 | 30 | 96 | 0.51 | 161 | 101 | 59 | |
| Multi-Family (Medium Density) | 900 | Unit | 220 | Multi Family Low Rise | Urban/ Suburban | per unit | 6.74 | 6,066 | 0.40 | 360 | 86 | 274 | 0.51 | 459 | 289 | 170 | |
| Multi-Family (High Density) | 1,400 | Unit | 221 | Multi Family Mid Rise | Urban/ Suburban | per unit | 4.54 | 6,356 | 0.37 | 518 | 119 | 399 | 0.39 | 546 | 333 | 213 | |
| Total Site Trips | | | | | | | | | 17,915 | | 1,344 | 511 | 833 | | 1,506 | 798 | 707 |
| Internal Capture & Multimodal Reduction (10%) | | | | | | | | | 1,792 | | 134 | 51 | 83 | | 151 | 80 | 71 |
| Total Scenario 3 Trips | | | | | | | | | 16,124 | | 1,344 | 511 | 833 | | 1,506 | 798 | 707 |

Source: Institute of Transportation Engineers
 Trip Generation Manual, 11th Edition

Figure 7 – Projected 2040 No-Build Traffic Volumes

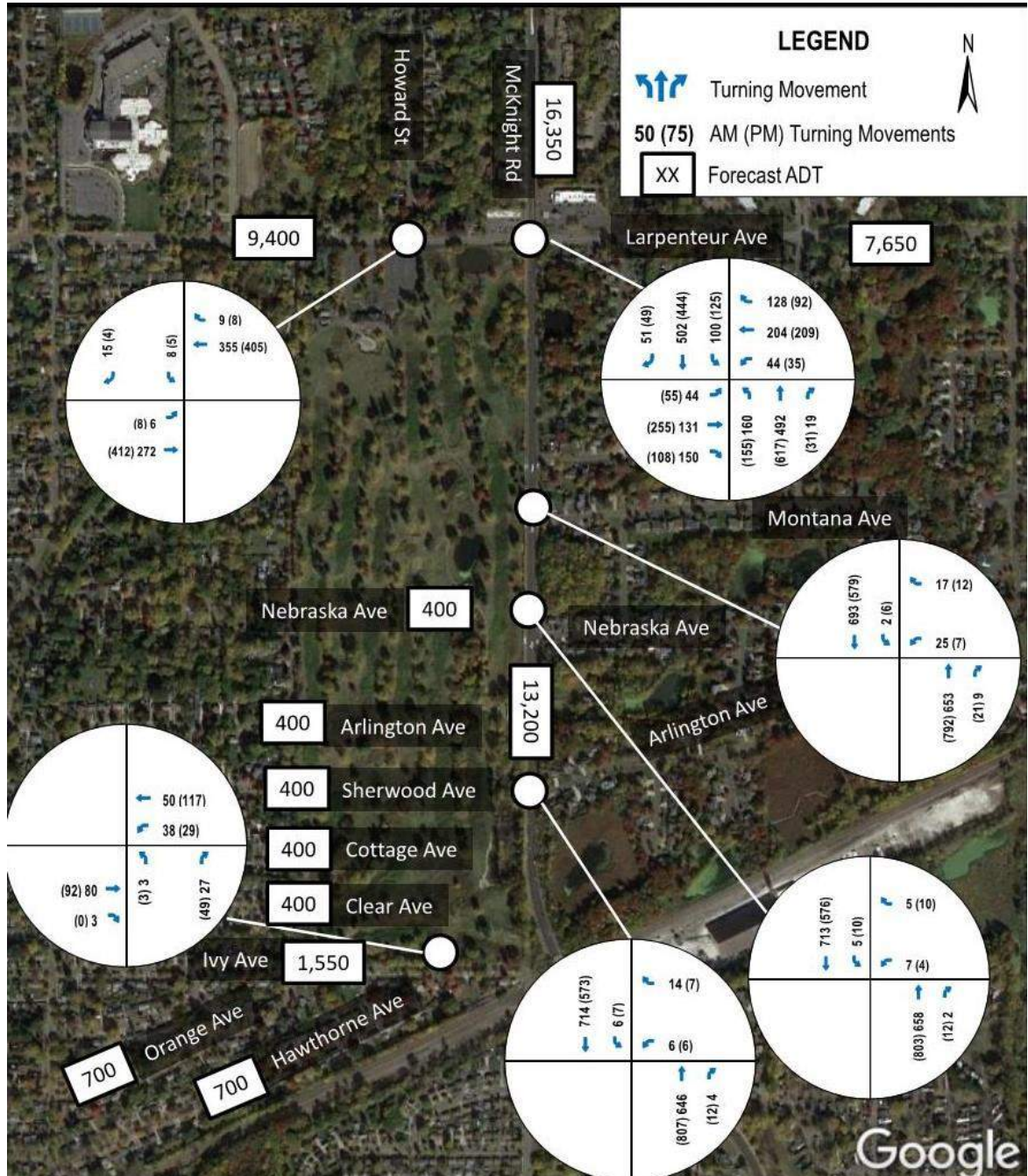


Figure 8 – Projected 2040 Build Scenario 1 Traffic Volumes

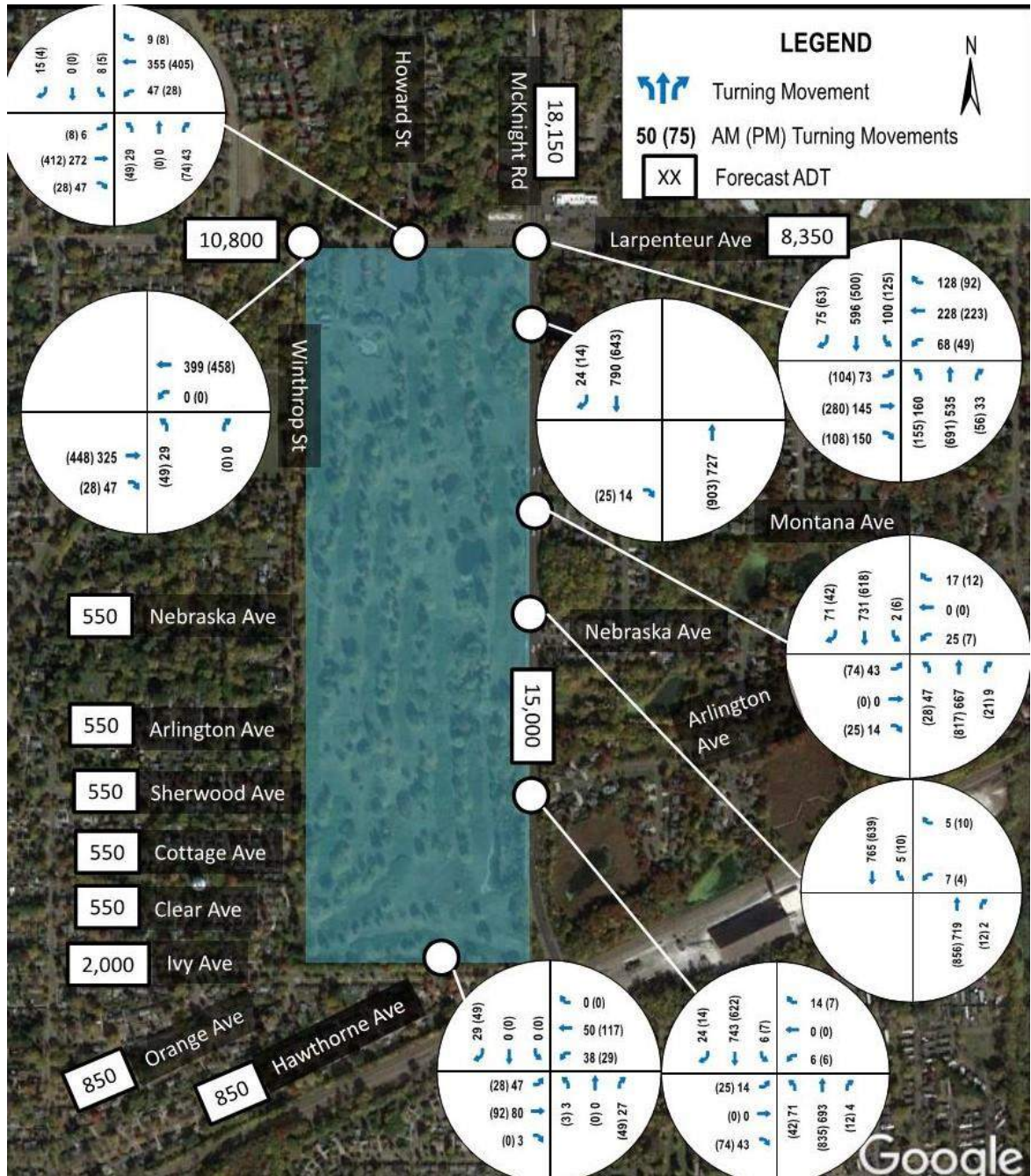


Figure 9 – Projected 2040 Build Scenario 2 Traffic Volumes

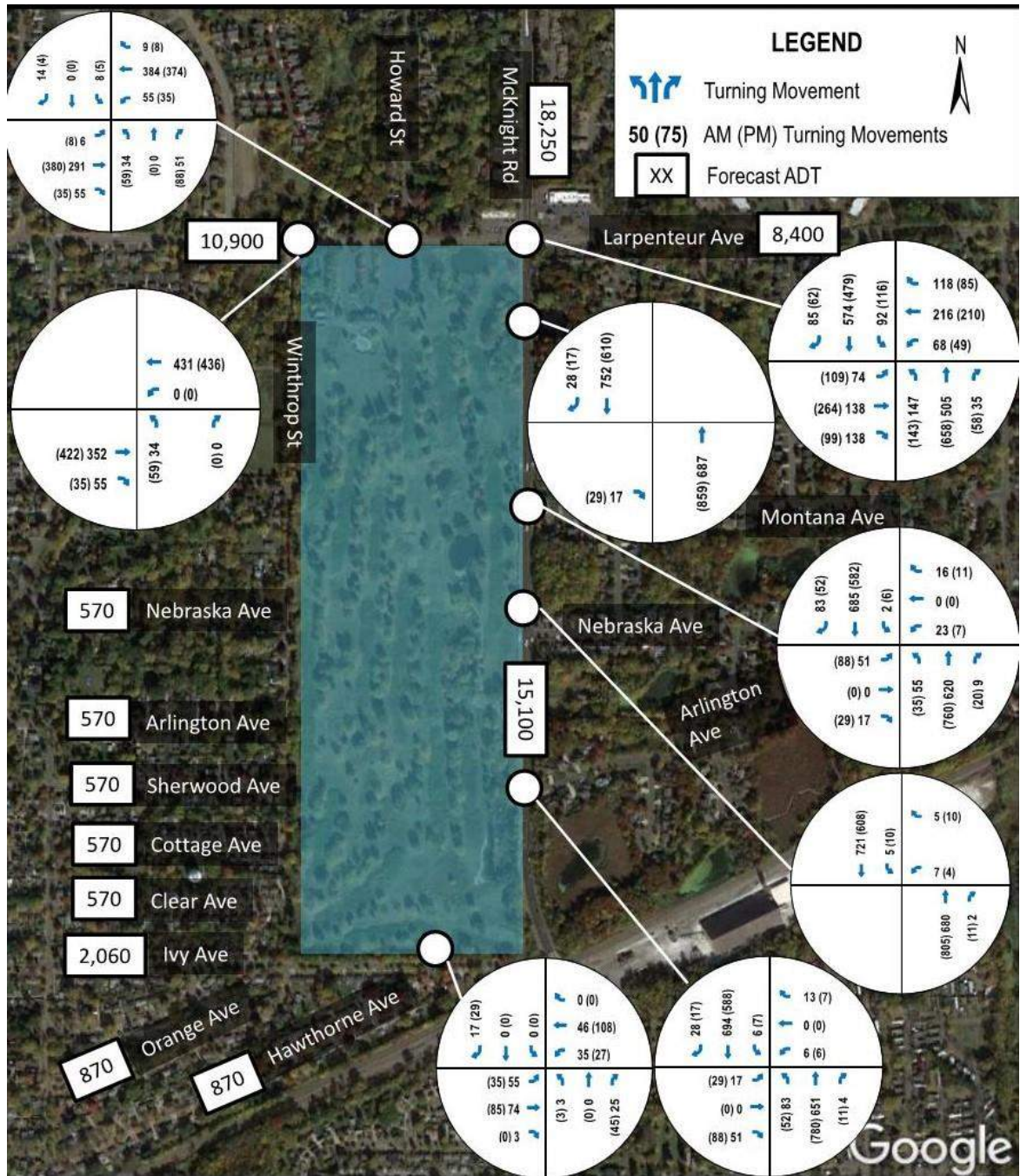
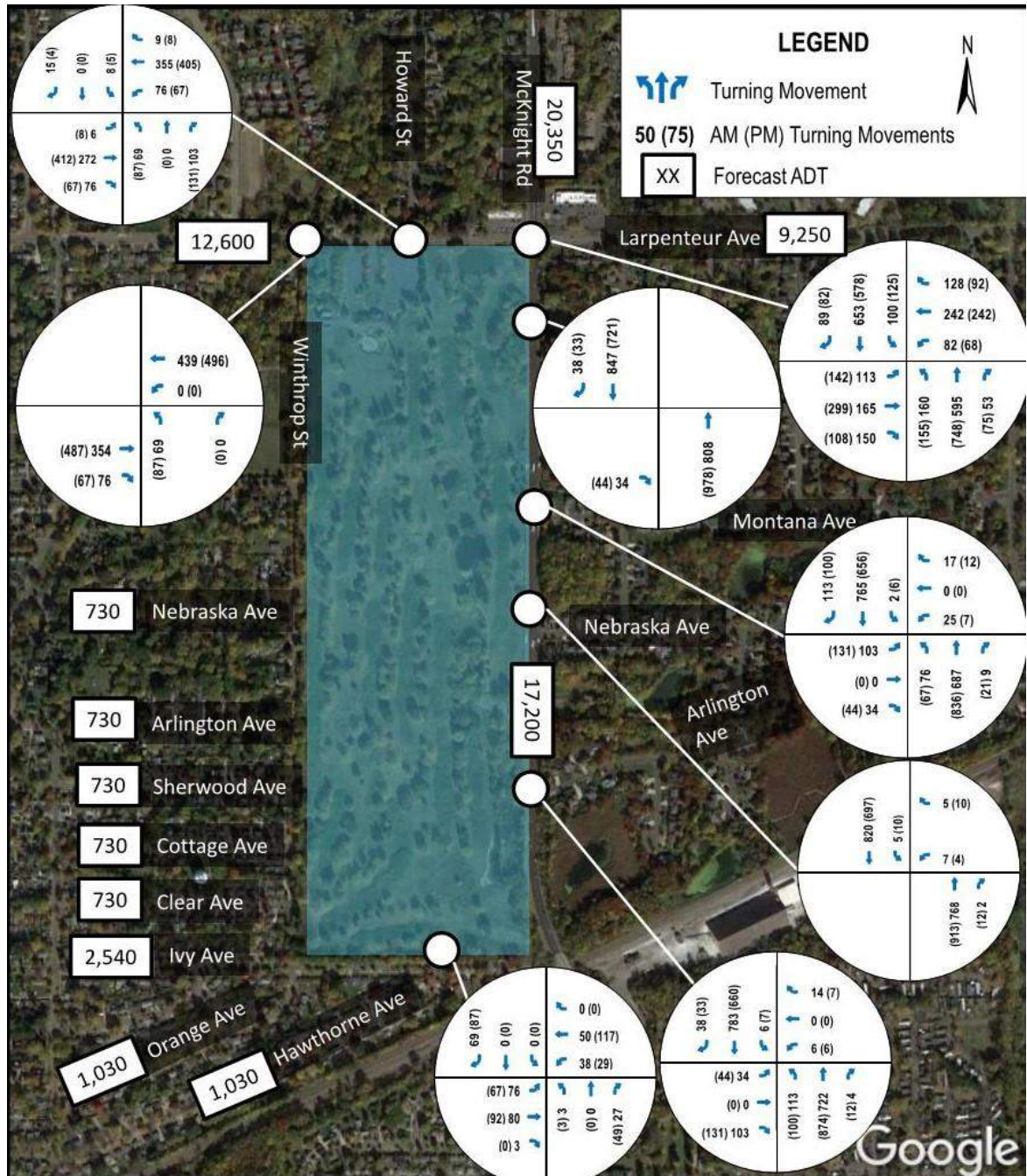


Figure 10 – Projected 2040 Build Scenario 3 Traffic Volumes



NEIGHBORHOOD TRAFFIC IMPACTS

The neighborhoods adjacent to the proposed Hillcrest development were evaluated based on the future traffic conditions. The projected 2040 traffic volumes on the streets through the Hayden Heights neighborhood west and south of the site were determined to evaluate the anticipated traffic impacts on the existing street system. The neighborhood streets that were included with the analysis are:

- Nebraska Avenue
- Arlington Avenue
- Sherwood Avenue
- Cottage Avenue
- Clear Avenue
- Ivy Avenue
- Orange Avenue
- Hawthorne Avenue

The 2040 No-Build traffic volume was estimated based on ITE trip generation rates for the number of houses on each block. The traffic conditions for each scenario were developed by adding the anticipated Hillcrest Development site traffic to the No-Build volumes to get the 2040 Build condition.

The traffic analysis discussed previously concluded that the 10% of the site traffic would be destined to/from the streets to the west and 10% of the site traffic would be destined to/from the streets to the south. **Table 3** below shows the projected 2040 traffic volumes on the adjacent streets for the No-build and each Build Scenario.

Table 3 – 2040 Neighborhood Street Traffic Conditions (vehicles per day)

| Street | 2040 No-Build | 2040 Build Scenario 1 | 2040 Build Scenario 2 | 2040 Build Scenario 3 |
|------------------|---------------|-----------------------|-----------------------|-----------------------|
| Nebraska Avenue | 400 | 550 | 570 | 730 |
| Arlington Avenue | 400 | 550 | 570 | 730 |
| Sherwood Avenue | 400 | 550 | 570 | 730 |
| Cottage Avenue | 400 | 550 | 570 | 730 |
| Clear Avenue | 400 | 550 | 570 | 730 |
| Ivy Avenue | 1,550 | 2,000 | 2,060 | 2,570 |
| Orange Avenue | 700 | 850 | 870 | 1,030 |
| Hawthorne Avenue | 700 | 850 | 870 | 1,030 |

All streets within the area are considered local residential streets with low expected traffic volumes providing access to residences, parks, and schools. Based on accepted guidelines from Metropolitan Council, typical residential streets will carry less than 1,000 vpd. The only street in the area not classified as a local street is Ivy Avenue which is classified as a Major Collector in

the City's Comprehensive Plan. Major Collectors are streets that are anticipated to carry higher volumes of traffic, typically up to 8,000 vpd.

Based on the 2040 projected traffic volumes for each scenario outlined in **Table 3**, all the streets within the study area are at or below the typical traffic thresholds for a local residential street or Major Collector Street (Ivy Avenue). However, to discourage vehicle traffic through the neighborhood from the proposed site the following should be considered with the proposed Hillcrest development:

- Any industrial land use's access to Howard Street should not line up with Nebraska Avenue, Arlington Avenue, or Cottage Avenue to the west. Rather, any such access to Howard Street should be mid-block to discourage direct traffic access to the neighborhoods.
- No direct vehicular access should be provided to Howard Street or Winthrop Street from the residential land uses south of Hoyt Avenue.
- Provide off road pedestrian accommodations along the streets accessing the neighborhoods, including extension / connection of sidewalks.
- Provide the recommended improvements at the site access locations on Larpenteur Avenue at Howard Street, McKnight Road at Montana Avenue and McKnight Road at Arlington Avenue to discourage traffic from using the neighborhood streets.
- Implement the recommendations in the Freight Service section to discourage heavy vehicle traffic from using the neighborhood streets.
- As traffic in the area increases over time, especially on streets such as Ivy Avenue, traffic calming measures will be required to manage vehicle speed and public safety. The type of traffic calming measures that could be installed will be consistent with city policies and practices. It should be noted that installation of some traffic calming measures will result in a diversion of traffic to other neighborhood roadways. The determination of what type of traffic calming measure, the implementation, and financial responsibilities will be outlined in the developer's agreement between the St. Paul Port Authority and the City, if one is agreed to. If not, this mitigation item should be reconsidered with the updated of this AUAR in 2027.
- If Scenario 3 Maximum Intensity is pursued, the City and developer will coordinate with the Metropolitan Council to evaluate the Transportation Analysis Zone (TAZ) adjustments that may be needed.

TRAFFIC OPERATIONS ANALYSIS

Existing and/or forecasted traffic operations were evaluated at the impacted area intersections in the study area. The analysis was conducted for the following scenarios.

1. Existing Conditions
2. Projected 2040 No-Build
3. Projected 2040 Build Scenario 1 – Comp Plan
4. Projected 2040 Build Scenario 2 – Master Plan
5. Projected 2040 Build Scenario 3 – Max Density

The following sections describe the methodology used to assess the operations and provide a summary of traffic operations for each scenario.

Methodology

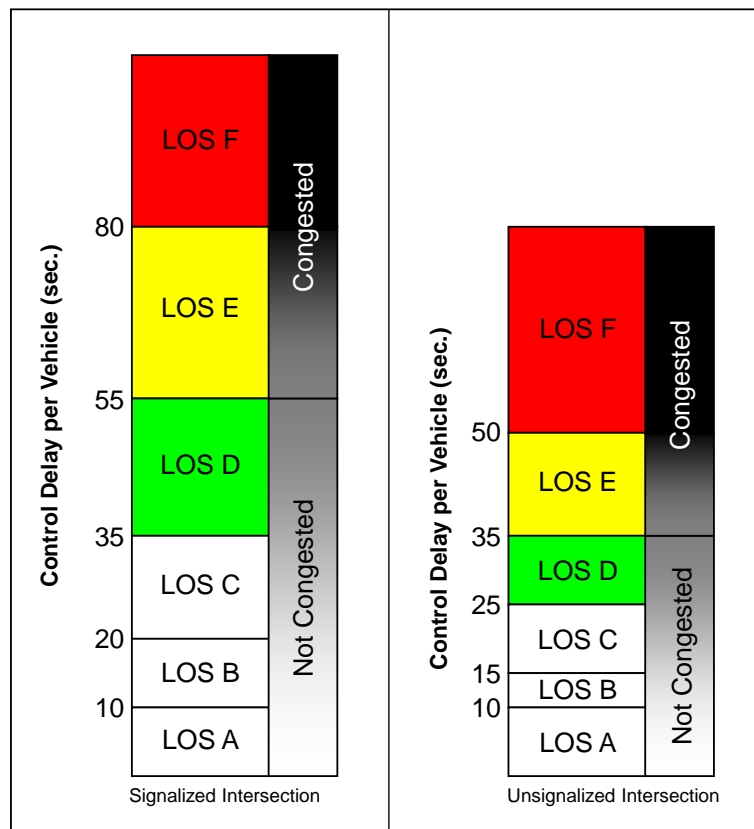
The intersections in the study area were evaluated during the AM and PM peak hours using Synchro/SimTraffic micro simulation software. The results are derived from established methodologies documented in the Highway Capacity Manual (HCM) The software was used to

evaluate the characteristics of the roadway network including lane geometrics, turning movement volumes, traffic control, and signal timing. In addition, the signal timing parameters for future year conditions were optimized using Synchro. This information was then transferred to SimTraffic, the traffic simulation model, to estimate average peak hour vehicle delays and queues. Due to the stochastic nature of the simulation models, there can be minor variations in the Measure of Effectiveness (MOEs) reported by the model between various runs. MOEs at the signal is similar in Synchro and SimTraffic, but adjacent intersections show varying MOEs because SimTraffic accounts for queuing and blocking more realistically than Synchro.

One of the primary measures of effectiveness used to evaluate intersection traffic operations, as defined in the HCM, is Level of Service (LOS) – a qualitative letter grade, A – F, based on seconds of vehicle delay due to a traffic control device at an intersection. LOS A conditions represent high quality operations (i.e., motorists experience very little delay or interference) and LOS F conditions represent very poor operations (i.e., extreme delay or severe congestion). For side street stop intersections, the overall intersection LOS is reported as the worst side street movement.

Figure 11 depicts a graphical interpretation of delay times that define level of service. The delay thresholds are lower for un-signalized intersections than signalized intersections due to the public’s perception of acceptable delays for different traffic controls as indicated in the HCM. In accordance with the Minnesota Department of Transportation (MnDOT) guidelines, this analysis used the LOS D/E boundary as an indicator of acceptable traffic operations.

Figure 11: LOS Ranges for Signalized and Un-signalized Intersections



SOURCE: Level of Service thresholds from the Highway Capacity Manual, 2000.

LOS and other Measure of Effectiveness (MOEs) were calculated from the models and are discussed in the following sections for each scenario. The capacity analysis worksheets are included in **Appendix A**.

Existing Conditions

The existing traffic operations were evaluated at intersections in the study area for the AM and PM peak hours. The traffic volumes shown in **Figure 2** were used in the Existing Conditions analysis. **Table 4 – Existing Traffic Operations Summary** shown below, summarizes the existing LOS and delays at the primary intersections in the study area based on the current lane geometry, traffic control and existing traffic volumes. The existing traffic signal timing received from Ramsey County was used to analyze the intersection of Larpenteur Avenue at McKnight Road.

Table 4 – Existing Traffic Operations Summary

| Control | Intersection | AM Peak Hour | | PM Peak Hour | |
|-----------|--|--------------|-----------------------------------|--------------|-----------------------------------|
| | | LOS | Delay ⁽¹⁾ (sec/veh) | LOS | Delay ⁽¹⁾ (sec/veh) |
| Thru-Stop | Larpenteur Ave at Howard St | (A) | 8 | (A) | 8 |
| Sig | McKnight Rd at Larpenteur Ave ⁽²⁾ | C (E) | 32 | C (E) | 34 |
| Thru-Stop | McKnight Rd at Montana Ave | (C) | 16 | (B) | 11 |
| Thru-Stop | McKnight Rd at Nebraska Ave | (B) | 13 | (B) | 10 |
| Thru-Stop | McKnight Rd at Arlington Ave | (B) | 12 | (B) | 14 |
| Thru-Stop | Ivy Ave at Hawthorne Ave | (A) | 5 | (A) | 6 |

C = Overall LOS, (D) = Worst movement LOS, (1) = Overall Delay (worst movement for thru-stop intersections)
 (2) = Existing traffic signal timing

The analysis results show that all intersections are operating at an acceptable overall LOS C or better during both the weekday AM and PM peak hours with all movements operating at LOS C or better except at the Larpenteur Avenue and McKnight Road intersection where the following movements are operating at LOS E:

- Larpenteur Avenue at McKnight Road
 - AM Peak Hour
 - Southbound left LOS E
 - PM Peak Hour
 - Southbound left LOS E
 - Northbound left LOS E

2040 No-Build Analysis

Table 5 – 2040 No-Build Traffic Operations Summary shown below, summarizes the LOS and delays at the primary intersections in the study area based on the current lane geometry, traffic control and projected 2040 traffic volumes shown in **Figure 7** without any area development. The traffic signal timing was optimized for the analysis at the Larpenteur Avenue at McKnight Road intersection.

Table 5 – 2040 No-Build Traffic Operations Summary

| Control | Intersection | AM Peak Hour | | PM Peak Hour | |
|-----------|--|--------------|-----------------------------------|--------------|-----------------------------------|
| | | LOS | Delay ⁽¹⁾ (sec/veh) | LOS | Delay ⁽¹⁾ (sec/veh) |
| Thru-Stop | Larpenteur Ave at Howard St | (A) | 9 | (B) | 13 |
| sig | McKnight Rd at Larpenteur Ave ⁽²⁾ | D (F) | 35 | D (F) | 43 |
| Thru-Stop | McKnight Rd at Montana Ave | (C) | 17 | (C) | 18 |
| Thru-Stop | McKnight Rd at Nebraska Ave | (C) | 18 | (C) | 19 |
| Thru-Stop | McKnight Rd at Arlington Ave | (C) | 22 | (C) | 22 |
| Thru-Stop | Ivy Ave at Hawthorne Ave | (A) | 4 | (A) | 4 |

C = Overall LOS, (D) = Worst movement LOS, (1) = Overall Delay (worst movement for thru-stop intersections)
 (2) = Optimized signal timing

The analysis results show that all intersections would be operating at an acceptable overall LOS D or better during both the weekday AM and PM peak hours with slight delay increase from existing conditions. All movements will be operating at LOS D or better except at the Larpenteur Avenue and McKnight Road intersection where the following movements would be operating at LOS E/F:

- Larpenteur Avenue at McKnight Road
 - AM Peak Hour
 - Northbound left LOS F
 - PM Peak Hour
 - Southbound left LOS F
 - Northbound left LOS E

Discussion with Ramsey County concluded that any need for improvements at the Larpenteur Avenue at McKnight Road intersection would be well into the future and the existing operation is adequate at this time. The intersection should continue to be monitored as the area develops.

2040 Build Analysis – Scenario 1 (Comp Plan)

Table 6 – 2040 Build Scenario 1 Traffic Operations Summary shown below, summarizes the LOS and delays at the primary intersections in the study area based on the existing lane geometry, traffic control and projected 2040 traffic volumes with full development of the area assuming Land Use Scenario 1 (Comp Plan) (**Figure 8**). The lane configuration on all site access streets included a single lane of approach. The traffic signal timing was optimized for the analysis at the Larpenteur Avenue at McKnight Road intersection.

Table 6 – 2040 Build Traffic Operations Summary – Scenario 1

| Control | Intersection | AM Peak Hour | | PM Peak Hour | |
|-----------|--|--------------|-----------------------------------|--------------|-----------------------------------|
| | | LOS | Delay ⁽¹⁾ (sec/veh) | LOS | Delay ⁽¹⁾ (sec/veh) |
| Thru-Stop | Larpenteur Ave at Howard St | (B) | 12 | (B) | 21 |
| Sig | McKnight Rd at Larpenteur Ave ⁽²⁾ | D (F) | 45 | D (F) | 46 |
| Thru-Stop | McKnight Rd at Montana Ave | (E) | 36 | (E) | 47 |
| Thru-Stop | McKnight Rd at Nebraska Ave | (C) | 19 | (C) | 21 |
| Thru-Stop | McKnight Rd at Arlington Ave | (D) | 29 | (D) | 25 |
| Thru-Stop | Ivy Ave at Hawthorne Ave | (A) | 4 | (A) | 6 |
| Thru-Stop | Larpenteur Ave at Winthrop St | (B) | 9 | (B) | 13 |
| Thru-Stop | McKnight Rd at North Site Access | (B) | 11 | (A) | 11 |

C = Overall LOS, (D) = Worst movement LOS, (1) = Overall Delay (worst movement for thru-stop intersections)
 (2) = Optimized signal timing

The analysis results show that all intersections would be operating at an acceptable overall LOS D or better during both the weekday AM and PM peak hours with all movements operating at LOS D or better except the following movements operating at LOS E / F:

- McKnight Road at Larpenteur Avenue
 - AM Peak Hour
 - Northbound left LOS F
 - Westbound left/thru LOS E
 - Southbound left LOS F
 - Eastbound left LOS E
 - PM Peak Hour
 - Northbound left LOS F
 - Westbound left/thru LOS E
 - Southbound left LOS F
 - Eastbound left/thru LOS E
- McKnight Road at Montana Avenue
 - AM Peak Hour
 - Eastbound left LOS E
 - PM Peak Hour
 - Eastbound left LOS E

To improve the delay and level of service at the intersections with movements at LOS E or F mitigation improvements were analyzed. The mitigation included lengthening of the left turn lanes at the McKnight Road and Larpenteur Avenue and addition of two exit lanes (left/thru lane and right turn lane) on all the site access streets (northbound Howard Street, eastbound Montana Avenue and eastbound Arlington Avenue). The results of the analysis are included in **Table 7** and show that all intersections and movements would be operating at LOS D or better except the movements:

- McKnight Road at Larpenteur Avenue

- AM Peak Hour
 - Northbound left LOS E
- PM Peak Hour
 - Northbound left LOS E
- McKnight Road at Montana Avenue
 - PM Peak Hour
 - Eastbound left LOS E

Table 7 – 2040 Build Traffic Operations Summary – Scenario 1 with Mitigation

| Control | Intersection | AM Peak Hour | | PM Peak Hour | |
|-----------|--|--------------|-----------------------------------|--------------|-----------------------------------|
| | | LOS | Delay ⁽¹⁾ (sec/veh) | LOS | Delay ⁽¹⁾ (sec/veh) |
| Thru-Stop | Larpenteur Ave at Howard St | (B) | 12 | (B) | 13 |
| Sig | McKnight Rd at Larpenteur Ave ⁽²⁾ | C (E) | 29 | C (D) | 28 |
| Thru-Stop | McKnight Rd at Montana Ave | (D) | 34 | (E) | 37 |
| Thru-Stop | McKnight Rd at Nebraska Ave | (C) | 18 | (C) | 21 |
| Thru-Stop | McKnight Rd at Arlington Ave | (C) | 22 | (C) | 20 |
| Thru-Stop | Ivy Ave at Hawthorne Ave | (A) | 4 | (A) | 6 |
| Thru-Stop | Larpenteur Ave at Winthrop St | (B) | 11 | (B) | 13 |
| Thru-Stop | McKnight Rd at North Site Access | (B) | 13 | (A) | 8 |

C = Overall LOS, (D) = Worst movement LOS, (1) = Overall Delay (worst movement for thru-stop intersections)
 (2) = Optimized signal timing

As the mitigation analysis indicates, two intersections would continue to have movements with LOS E. As indicated with the 2040 No-Build conditions Ramsey County concluded that any need for improvements at the Larpenteur Avenue at McKnight Road intersection would be well into the future and the existing operation is adequate at this time. The intersection would continue to be monitored as the area develops.

The other intersection that would continue to have movements with operations at LOS E is McKnight Road at Montana Avenue which is side street stop controlled. Even though this access is one of the main entrances to the development, the only movement at LOS E is the northbound left turn from Montana Avenue to McKnight Road. This is not uncommon for side street stop-controlled intersections on higher volume roadways like McKnight Road. With no side street queuing issues in either peak hour or the fact that this intersection would not meet warrants for signalization, no mitigation is recommended with this proposed Land Use Scenario. This intersection should however be monitored as the area develops.

2040 Build Analysis – Scenario 2 (Master Plan)

Table 8 – 2040 Build Scenario 2 Traffic Operations Summary shown below, summarizes the LOS and delays at the primary intersections in the study area based on the existing lane geometry, traffic control and projected 2040 traffic volumes with full development of the area assuming Land Use Scenario 2 (Master Plan) (**Figure 9**). The lane configuration on all site access streets included a single lane of approach. The traffic signal timing was optimized for the analysis at the Larpenteur Avenue at McKnight Road intersection.

Table 8 – 2040 Build Traffic Operations Summary – Scenario 2

| Control | Intersection | AM Peak Hour | | PM Peak Hour | |
|-----------|--|--------------|-----------------------------------|--------------|-----------------------------------|
| | | LOS | Delay ⁽¹⁾ (sec/veh) | LOS | Delay ⁽¹⁾ (sec/veh) |
| Thru-Stop | Larpenteur Ave at Howard St | (B) | 12 | (B) | 14 |
| Sig | McKnight Rd at Larpenteur Ave ⁽²⁾ | D (F) | 48 | D (F) | 49 |
| Thru-Stop | McKnight Rd at Montana Ave | (E) | 48 | (F) | 100+ |
| Thru-Stop | McKnight Rd at Nebraska Ave | (C) | 20 | (C) | 25 |
| Thru-Stop | McKnight Rd at Arlington Ave | (D) | 30 | (D) | 26 |
| Thru-Stop | Ivy Ave at Hawthorne Ave | (A) | 4 | (A) | 6 |
| Thru-Stop | Larpenteur Ave at Winthrop St | (A) | 10 | (B) | 11 |
| Thru-Stop | McKnight Rd at North Site Access | (B) | 11 | (B) | 11 |

C = Overall LOS, (D) = Worst movement LOS, (1) = Overall Delay (worst movement for thru-stop intersections)
 (2) = Optimized signal timing

The analysis results show that all intersections would be operating at an acceptable overall LOS D or better during both the weekday AM and PM peak hours with all movements operating at LOS D or better except the following movements:

- McKnight Road at Larpenteur Avenue
 - AM Peak Hour
 - Northbound left LOS E
 - Southbound left LOS F
 - Southbound right LOS E
 - PM Peak Hour
 - Northbound left LOS E
 - Southbound left LOS F
- McKnight Road at Montana Avenue
 - AM Peak Hour
 - Eastbound left LOS E
 - PM Peak Hour
 - Westbound left and right LOS F
 - Eastbound left and right LOS F

To improve the delay and level of service at the intersections with movements at LOS E or F, mitigation improvements were analyzed. The mitigation included, lengthening of the left turn lanes at the McKnight Road and Larpenteur Avenue and addition of two exit lanes (left/thru lane and right turn lane) on all the site access streets (northbound Howard Street, eastbound Montana Avenue, and eastbound Arlington Avenue). The results of the analysis are included in **Table 9** and show that all intersections and movements would be operating at LOS D or better except the movements:

- McKnight Road at Larpenteur Avenue
 - AM Peak Hour

- Southbound left LOS E
 - PM Peak Hour
 - Southbound left LOS F
- McKnight Road at Montana Avenue
 - AM Peak Hour
 - Eastbound left LOS E
 - PM Peak Hour
 - Eastbound left LOS E

Table 9 – 2040 Build Traffic Operations Summary – Scenario 2 with Mitigation

| Control | Intersection | AM Peak Hour | | PM Peak Hour | |
|-----------|--|--------------|-----------------------------------|--------------|-----------------------------------|
| | | LOS | Delay ⁽¹⁾ (sec/veh) | LOS | Delay ⁽¹⁾ (sec/veh) |
| Thru-Stop | Larpenteur Ave at Howard St | (B) | 12 | (B) | 13 |
| Sig | McKnight Rd at Larpenteur Ave ⁽²⁾ | C (E) | 29 | C (F) | 33 |
| Thru-Stop | McKnight Rd at Montana Ave | (E) | 37 | (E) | 43 |
| Thru-Stop | McKnight Rd at Nebraska Ave | (C) | 19 | (C) | 23 |
| Thru-Stop | McKnight Rd at Arlington Ave | (D) | 29 | (C) | 21 |
| Thru-Stop | Ivy Ave at Hawthorne Ave | (A) | 4 | (A) | 6 |
| Thru-Stop | Larpenteur Ave at Winthrop St | (A) | 9 | (B) | 11 |
| Thru-Stop | McKnight Rd at North Site Access | (C) | 15 | (B) | 10 |

C = Overall LOS, (D) = Worst movement LOS, (1) = Overall Delay (worst movement for thru-stop intersections)
 (2) = Optimized signal timing

Similar to Scenario 1 the mitigation analysis for Scenario 2 indicates that two intersections would continue to have movements with unsatisfactory levels of service with slightly longer delays. Based on the analysis, no additional improvements would be recommended at either the Larpenteur Avenue at McKnight Road or McKnight Road at Montana Avenue intersections. However, both should be monitored as the area develops.

2040 Build Analysis – Scenario 3 (Max Build)

Table 10 – 2040 Build Scenario 3 Traffic Operations Summary shown below, summarizes the LOS and delays at the primary intersections in the study area based on the existing lane geometry, traffic control and projected 2040 traffic volumes full development of the area assuming Land Use Scenario 3 (Max Build) (**Figure 10**). The lane configuration on all site access streets included a single lane of approach. The traffic signal timing was optimized for the analysis at the Larpenteur Avenue at McKnight Road intersection.

Table 10 – 2040 Build Traffic Operations Summary – Scenario 3

| Control | Intersection | AM Peak Hour | | PM Peak Hour | |
|-----------|--|--------------|-----------------------------------|--------------|-----------------------------------|
| | | LOS | Delay ⁽¹⁾ (sec/veh) | LOS | Delay ⁽¹⁾ (sec/veh) |
| Thru-Stop | Larpenteur Ave at Howard St | (B) | 13 | (E) | 38 |
| Sig | McKnight Rd at Larpenteur Ave ⁽²⁾ | D (F) | 49 | D (F) | 54 |
| Thru-Stop | McKnight Rd at Montana Ave | (F) | 100+ | (F) | 100+ |
| Thru-Stop | McKnight Rd at Nebraska Ave | (C) | 22 | (C) | 27 |
| Thru-Stop | McKnight Rd at Arlington Ave | (E) | 44 | (F) | 55 |
| Thru-Stop | Ivy Ave at Hawthorne Ave | (A) | 4 | (A) | 6 |
| Thru-Stop | Larpenteur Ave at Winthrop St | (B) | 10 | (B) | 14 |
| Thru-Stop | McKnight Rd at North Site Access | (C) | 15 | (B) | 11 |

C = Overall LOS, (D) = Worst movement LOS, (1) = Overall Delay (worst movement for thru-stop intersections)
 (2) = Optimized signal timing

The analysis results show that similar to 2040 Build Scenario 2, all intersections would be operating at an acceptable overall LOS D or better during both the AM and PM peak hours except at the McKnight Road at Montana Avenue intersection which would operate at LOS F in the PM peak hour. In addition, all movements would operate at LOS D or better except the following movements operating at LOS E / F:

- Larpenteur Avenue at Howard Street
 - PM Peak Hour
 - Northbound left LOS E
 - Southbound left LOS E
- McKnight Road at Larpenteur Avenue
 - AM Peak Hour
 - Westbound approach LOS F
 - Eastbound left LOS E
 - PM Peak Hour
 - Westbound approach LOS F
 - Eastbound approach LOS F
- McKnight Road at Montana Avenue
 - AM Peak Hour
 - Westbound left LOS E
 - Eastbound left and right LOS F
 - PM Peak Hour
 - Westbound left LOS E
 - Eastbound left and right LOS F
- McKnight Road at Arlington Avenue
 - AM Peak Hour
 - Eastbound left LOS E
 - PM Peak Hour
 - Eastbound left LOS F

To improve the delay and level of service at the intersections with movements at LOS E or F mitigation improvements were analyzed. The mitigation included, lengthening of the left turn lanes at the McKnight Road and Larpenteur Avenue and addition of two exit lanes (left/thru lane and right turn lane) on all the site access streets (northbound Howard Street, eastbound Montana Avenue, and eastbound Arlington Avenue). The results of the analysis are included in **Table 11** and show that all intersections and movements would be operating at LOS D or better except the movements:

- McKnight Road at Larpenteur Avenue
 - AM Peak Hour
 - Southbound left LOS F
 - PM Peak Hour
 - Southbound left LOS F
- McKnight Road at Montana Avenue
 - AM Peak Hour
 - Westbound left LOS E
 - Eastbound left and right LOS F
 - PM Peak Hour
 - Eastbound left and right LOS F
- McKnight Road at Arlington Avenue
 - PM Peak Hour
 - Eastbound left LOS E

Table 11 - 2040 Build Traffic Operations Summary – Scenario 3 with Mitigation

| Control | Intersection | AM Peak Hour | | PM Peak Hour | |
|-----------|--|--------------|-----------------------------------|--------------|-----------------------------------|
| | | LOS | Delay ⁽¹⁾ (sec/veh) | LOS | Delay ⁽¹⁾ (sec/veh) |
| Thru-Stop | Larpenteur Ave at Howard St | (B) | 12 | (C) | 19 |
| Sig | McKnight Rd at Larpenteur Ave ⁽²⁾ | C (E) | 31 | D (F) | 36 |
| Thru-Stop | McKnight Rd at Montana Ave | (F) | 100+ | (F) | 100+ |
| Thru-Stop | McKnight Rd at Nebraska Ave | (C) | 23 | (D) | 27 |
| Thru-Stop | McKnight Rd at Arlington Ave | (D) | 34 | (E) | 46 |
| Thru-Stop | Ivy Ave at Hawthorne Ave | (A) | 4 | (A) | 6 |
| Thru-Stop | Larpenteur Ave at Winthrop St | (B) | 10 | (B) | 14 |
| Thru-Stop | McKnight Rd at North Site Access | (B) | 15 | (B) | 13 |

C = Overall LOS, (D) = Worst movement LOS, (1) = Overall Delay (worst movement for thru-stop intersections)
 (2) = Optimized signal timing

With the addition of the site traffic for Scenario 3 (Max Density) and even including the proposed improvement mitigation, three intersections would have movements with increased delays and level of service over the other Build Scenarios.

Larpenteur Avenue at McKnight Road – Similar to the 2040 No-Build and other Build Scenarios it was concluded that any need for improvements at the intersection would be well into the future and the existing operation is adequate at this time. The intersection would continue to be monitored as the area develops.

McKnight Road at Montana Avenue – This intersection would continue to have significant delays for the Montana Avenue traffic with side street stop control. With this access as one of the main entrances to the development, delays of this magnitude will result in site traffic diverting to other site intersection. Other mitigation improvements should be considered including signalization or a roundabout. With either of these improvements the overall intersection would improve to a LOS B in the AM peak hour and LOS C in the PM peak hour with all movements at LOS C or better.

McKnight Road at Arlington Avenue – This intersection is also one of the main entrances to the development. For this intersection, the eastbound left turn would be operating at a LOS E in only the PM peak hour. Similar to the other Build Scenario this is not uncommon for side street stop-controlled intersections on higher volume roadways like McKnight Road. With no side street queuing issues or the fact that this intersection would not meet warrants for signalization, no mitigation would be recommended with this proposed Land Use Scenario. This intersection should however be monitored as the area develops.

EXTENDED ROADWAY ANALYSIS

A review of the potential traffic impacts from the proposed Hillcrest Golf Course development site was completed for the extended area roadway network including McKnight Road to the north and south; Larpenteur Avenue to the east and west, White Bear Avenue west of the site, Century Avenue east of the site, and Maryland Street south of the site. This review focused on the Average Daily Traffic (ADT) volumes for existing conditions, 2040 No-Build and 2040 Build conditions with the site related traffic volumes on the various roadway segments surrounding the Hillcrest Development Site.

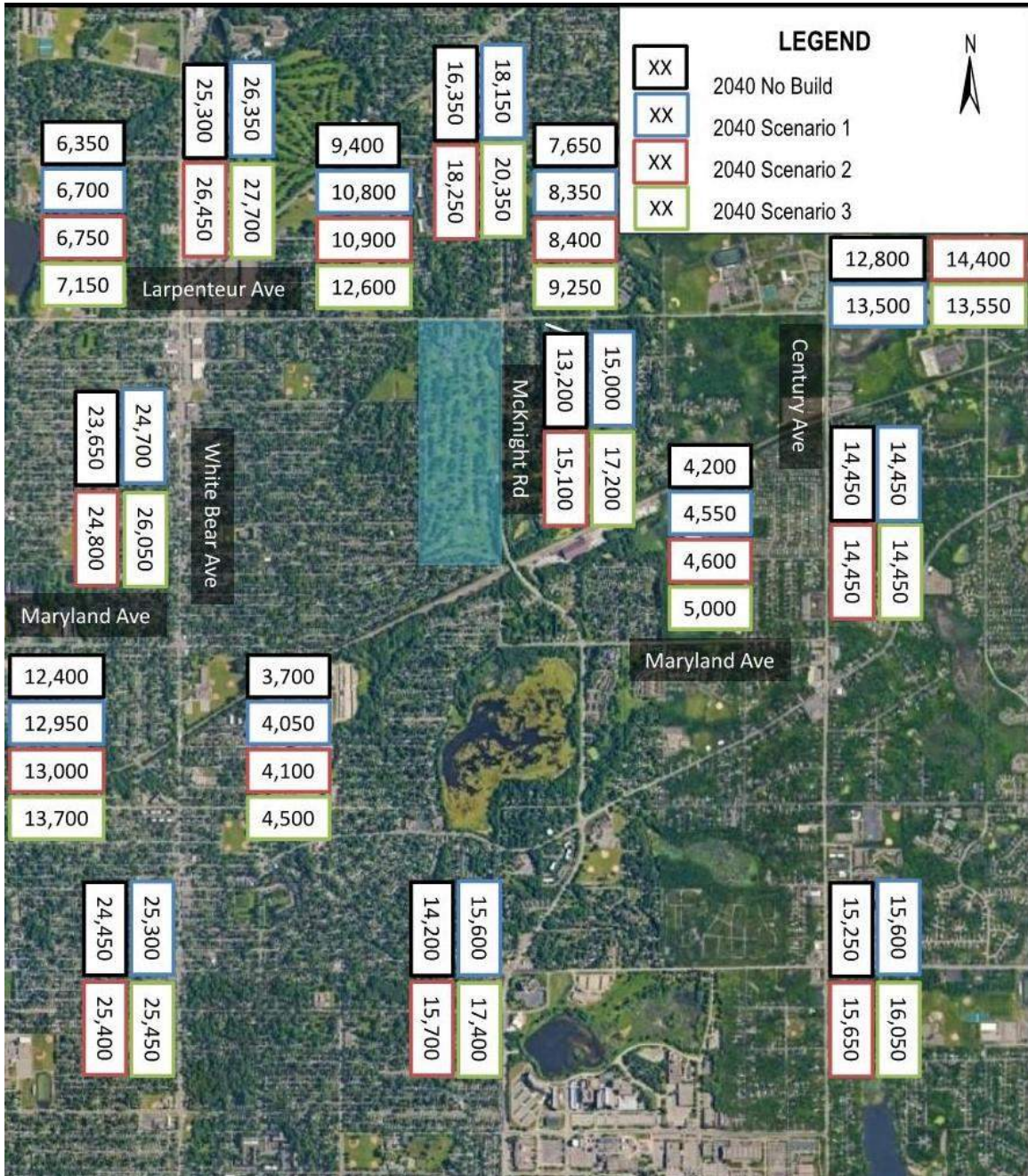
The primary roadways within the area and their expected future ADT traffic volumes under each scenario along with the estimated roadway capacities is summarized in **Table 12**. The planning level roadway capacities are based on the Highway Capacity Manual (HCM) standards. Although traffic volumes on these roadways are expected to increase, they are mostly within or below the estimated capacity of the roadway facilities (exceptions being Scenarios 2 & 3, Larpenteur Avenue West of McKnight Rd.; Scenarios 2 and 3, Maryland Avenue West of White Bear Ave). A summary of the ADT traffic volumes is shown in **Figure 12**.

Table 12 – Extended Roadway Network Traffic Volume Change

| Roadway | Existing ⁽¹⁾ (year) | 2040 No-Build | 2040 Build Scenario 1 | 2040 Build Scenario 2 | 2040 Build Scenario 3 | Roadway Capacity |
|--|-----------------------------------|------------------|-----------------------------|-----------------------------|-----------------------------|---------------------|
| McKnight Road North of Larpenteur Ave | 14,800 (2019) | 16,350 | 18,150 | 18,250 | 20,350 | 14,000 – 18,500 |
| McKnight Road South of Larpenteur Ave | 11,900 (2019) | 13,200 | 15,000 | 15,100 | 17,200 | 14,000 – 18,500 |
| McKnight Road South of Maryland Ave | 12,800 (2019) | 14,200 | 15,600 | 15,700 | 17,400 | 14,000 – 18,500 |
| Larpenteur Avenue West of White Bear Ave | 5,700 (2018) | 6,350 | 6,700 | 6,750 | 7,150 | 8,000 – 10,000 |
| Larpenteur Avenue West of McKnight Rd | 8,500 (2018) | 9,400 | 10,800 | 10,900 | 12,600 | 8,000 – 10,000 |
| Larpenteur Avenue East of McKnight Rd | 6,900 (2018) | 7,650 | 8,350 | 8,400 | 9,250 | 8,000 – 10,000 |
| White Bear Avenue North of Larpenteur Ave | 22,800 (2019) | 25,300 | 26,350 | 26,450 | 27,700 | 28,000 – 32,000 |
| White Bear Avenue South of Larpenteur Ave | 21,300 (2019) ⁽²⁾ | 23,650 | 24,700 | 24,800 | 26,050 | 28,000 – 32,000 |
| White Bear Avenue South of Maryland Ave | 22,000 (2019) ⁽²⁾ | 24,450 | 25,300 | 25,400 | 26,450 | 28,000 – 32,000 |
| Century Avenue North of Larpenteur Ave | 11,400 (2017) | 12,800 | 13,500 | 13,550 | 14,400 | 14,000 – 18,500 |
| Century Avenue South of Larpenteur Ave | 13,000 (2019) | 14,450 | 14,450 | 14,450 | 14,450 | 14,000 – 18,500 |
| Century Avenue South of Maryland Ave | 13,600 (2017) | 15,250 | 15,600 | 15,650 | 16,050 | 14,000 – 18,500 |
| Maryland Avenue West of White Bear Ave | 11,100 (2018) | 12,400 | 12,950 | 13,000 | 13,700 | 8,000 – 10,000 |
| Maryland Avenue East of White Bear Ave | 3,300 (2018) | 3,700 | 4,050 | 4,100 | 4,500 | 8,000 – 10,000 |
| Maryland Avenue East of McKnight Road | 3,750 (2018) | 4,200 | 4,550 | 4,600 | 5,000 | 8,000 – 10,000 |

(1) = Source: MnDOT Traffic Mapping Application

Figure 12 – Extended Road Network Traffic Volumes



INTERNAL ROADWAY ANALYSIS

In addition to the external study intersection analysis, the proposed roadway network within the Hillcrest study area was evaluated to ensure the facilities are appropriately sized and to provide guidance on access and traffic controls. This evaluation was completed using Synchro/SimTraffic software and engineering judgement, focusing on the future 2040 conditions for each build scenario.

As discussed previously, Scenario 1 shows a “grid” internal roadway system, where Scenarios 2 and 3 include only the primary streets within the development area. The Scenario 1 roadway system shows direct access to McKnight Road at six locations, none of which line up with the existing street network on the east side of McKnight Road. These access locations would not meet Ramsey County access spacing guidelines. The additional north/south street shown in Scenario 1 would represent similar driveway access that would be assumed for Scenarios 2 or 3. Therefore, the internal roadway system shown for Scenario 2 and 3 was used for the internal roadway analysis.

All internal roadways were assumed to be two-lanes with side-street stop control at all internal intersections. **Figure 13** shows the proposed internal roadway network with the intersections included as part of the analysis and the locations of the assumed access from the land use areas.

Traffic forecasts were prepared assuming that traffic from each specific land use scenario was distributed to the internal roadway system based on the traffic distribution outline previously from the assumed access locations. The traffic forecasts for each build scenario are illustrated in **Figures 14-16**.

Results of the internal roadway system analysis indicates that in general, all internal roadways and intersections are all expected to operate acceptably under future year 2040 conditions during both the AM and PM peak hours with any of the 2040 build scenarios. **Table 13** provides a summary of the year 2040 internal intersection capacity analysis for each scenario.

Based on the results of the internal roadway capacity analysis and engineering judgement, the following should be considered:

- All internal streets should be two lanes (one lane in each direction) conforming to the guidance of the City of St. Paul Street Design Manual.
- All internal intersections should have side street stop control.
 - Idaho Avenue stops at Street A
 - Idaho Avenue stops at Howard Street
 - Street A stops Howard Street
 - Hoyt Avenue/Montana Avenue stops at Howard Street
 - Nebraska Avenue stops at Howard Street
 - Arlington Avenue W stops at Howard Street
 - Arlington Avenue E stops at Howard Street
 - Cottage Avenue stops at Howard Street
- Private access should be evaluated individually with each development proposal to ensure that all potential constraints are considered, including providing for truck traffic.
- Pedestrian facilities should be provided adjacent to each internal roadway with connections to external pedestrian facilities (see Bike / Pedestrian Facilities recommendations)

Table 13 – 2040 Build Internal Roadways Traffic Operations Summary

| Control | Intersection | Scenario 1 | | Scenario 2 | | Scenario 3 | |
|-----------|-----------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|
| | | AM Peak | PM Peak | AM Peak | PM Peak | AM Peak | PM Peak |
| Thru-Stop | Street A at Idaho Ave | A (6 sec) | A (6 sec) | A (5 sec) | A (4 sec) | A (5 sec) | A (4 sec) |
| Thru-Stop | Howard St at Idaho Ave | A (7 sec) | A (6 sec) | A (6 sec) | A (6 sec) | A (8 sec) | A (8 sec) |
| Thru-Stop | Howard St at Street A | A (5 sec) | A (4 sec) | A (7 sec) | A (5 sec) | A (7 sec) | A (6 sec) |
| Thru-Stop | Howard St at Hoyt Ave/Montana Ave | A (7 sec) | A (7 sec) | A (7 sec) | A (5 sec) | A (7 sec) | A (7 sec) |
| Thru-Stop | Howard St at Nebraska Ave | A (5 sec) | A (5 sec) | A (6 sec) | A (5 sec) | A (7 sec) | A (6 sec) |
| Thru-Stop | Howard St at Arlington Ave W | A (4 sec) | A (5 sec) | A (6 sec) | A (5 sec) | A (7 sec) | A (7 sec) |
| Thru-Stop | Howard St at Arlington Ave E | A (7 sec) | A (7 sec) | A (6 sec) | A (6 sec) | A (7 sec) | A (6 sec) |
| Thru-Stop | Howard St at Cottage Ave | A (5 sec) | A (5 sec) | A (4 sec) | A (5 sec) | A (6 sec) | A (5 sec) |

A = Worst movement LOS, (6 sec) = Worst movement delay for thru-stop intersections

Figure 13 – Internal Roadway Network and Access Locations

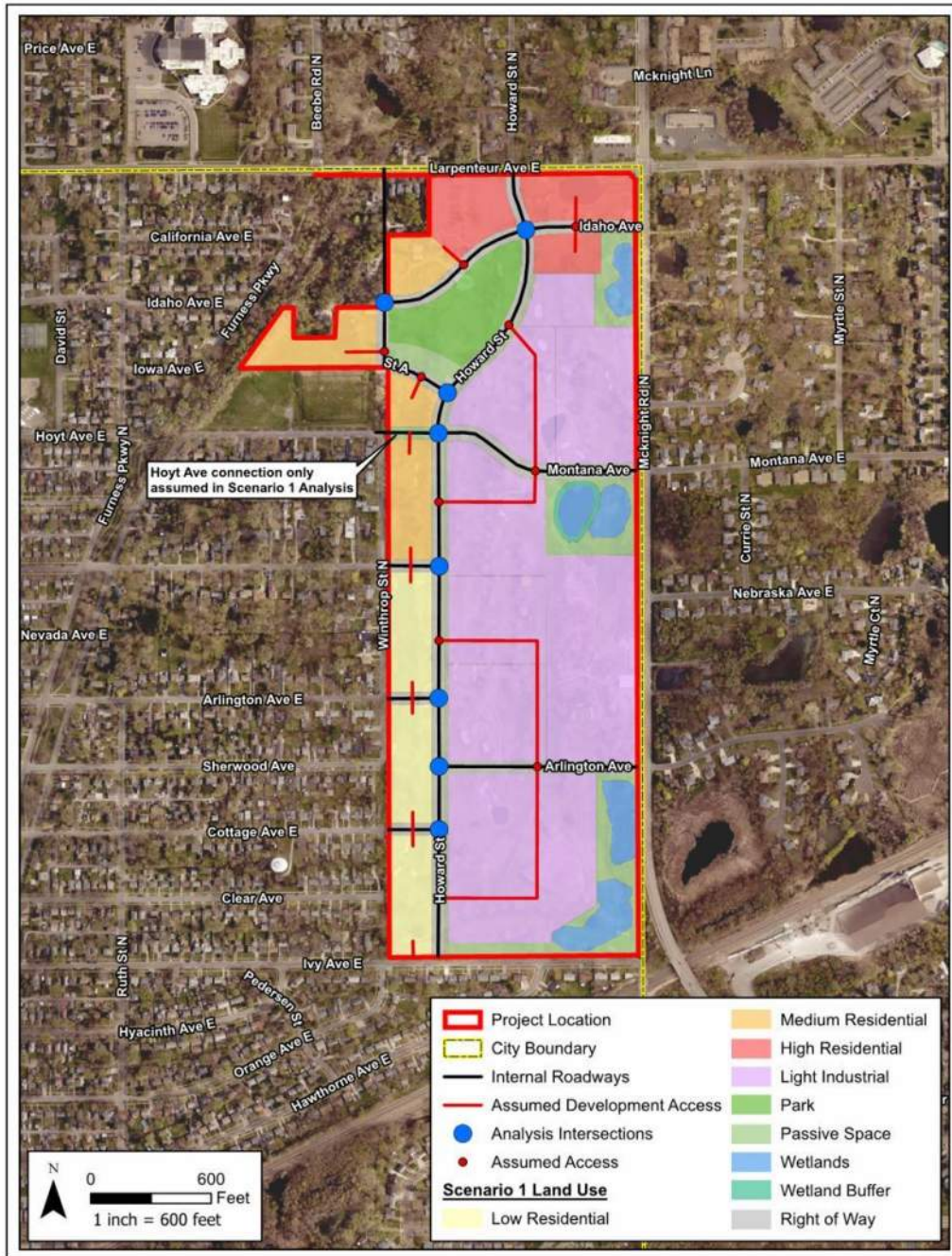


Figure 14 – 2040 Internal Roadway Traffic – Scenario 1

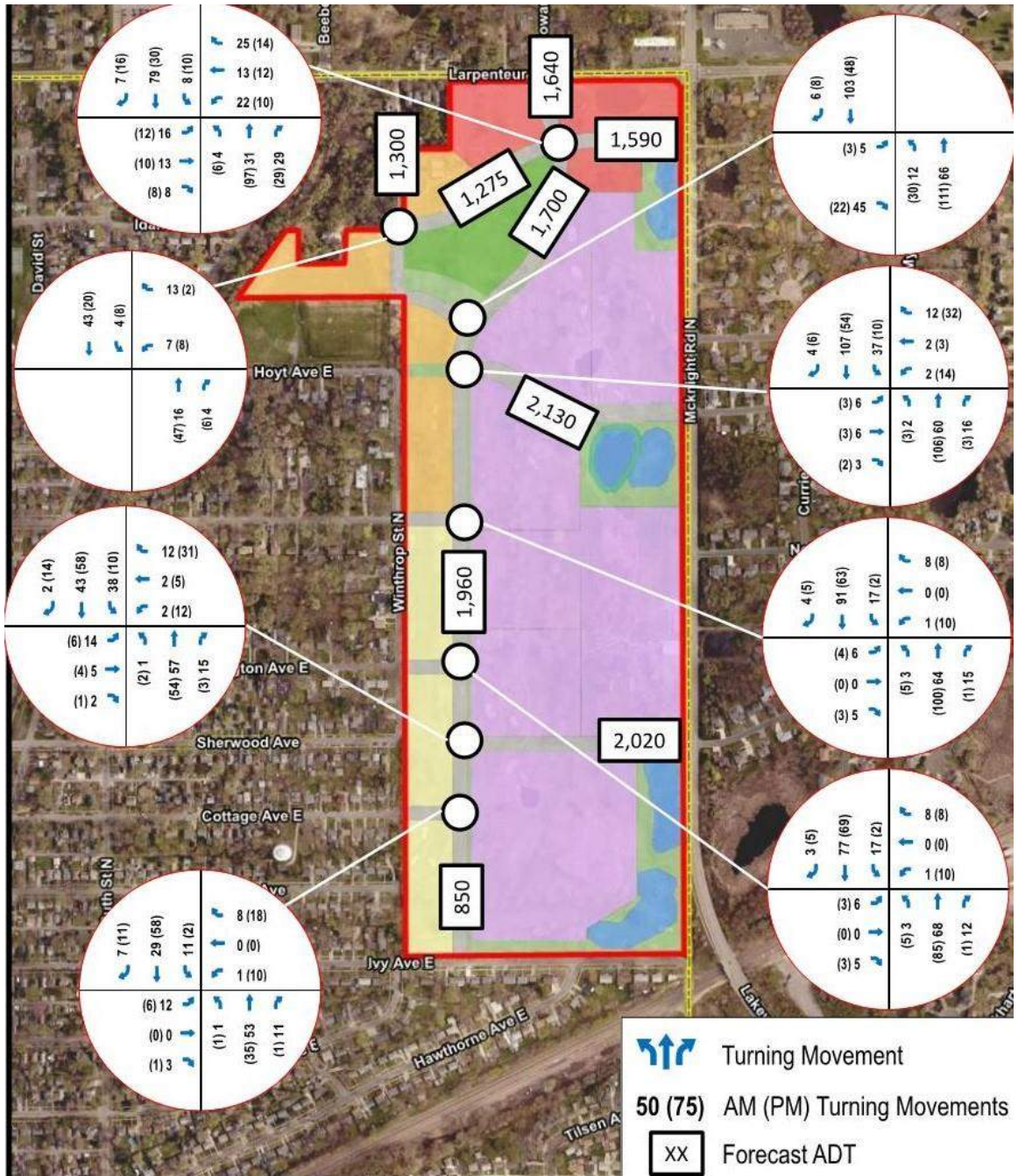


Figure 15 – 2040 Internal Roadway Traffic – Scenario 2

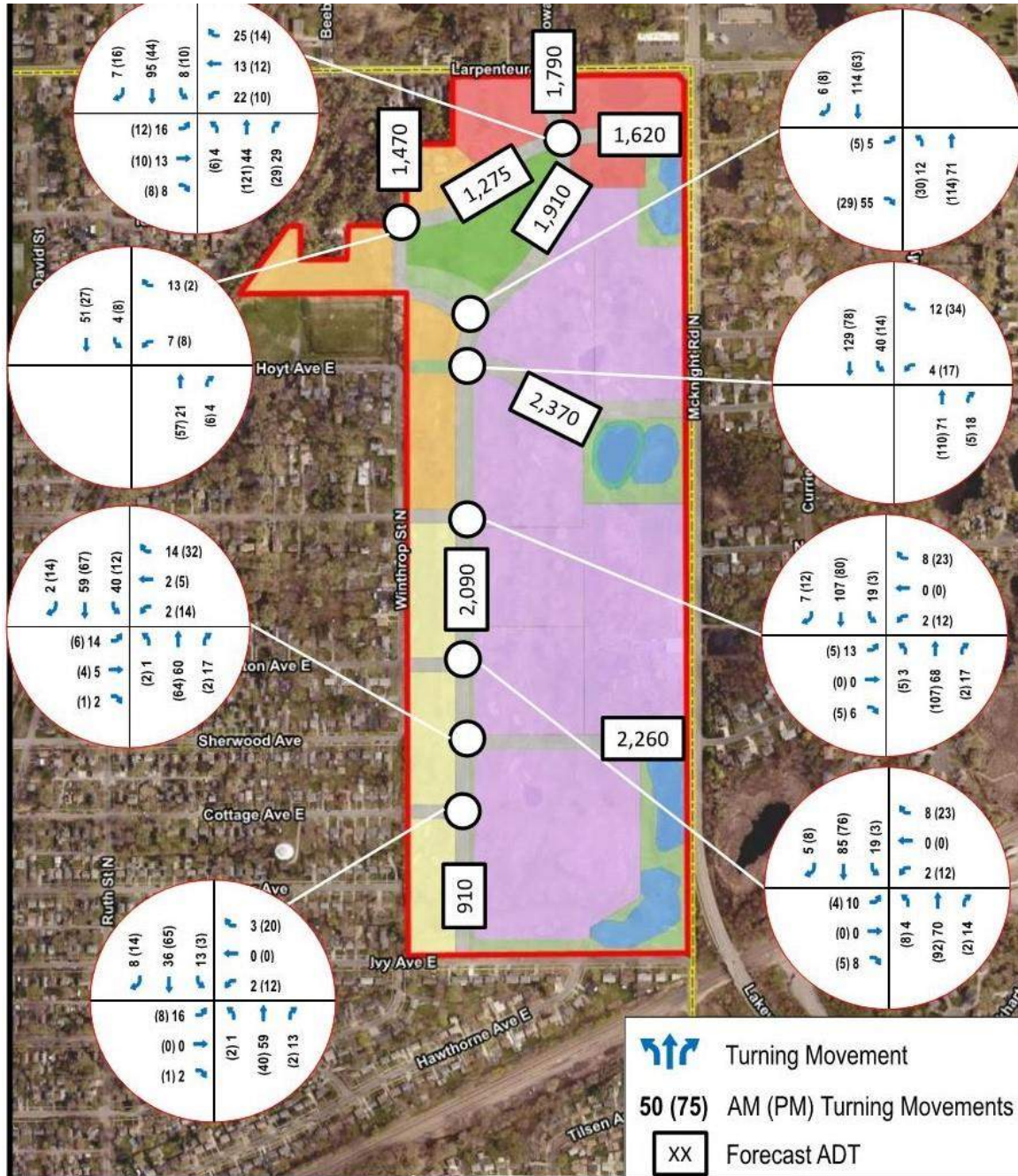
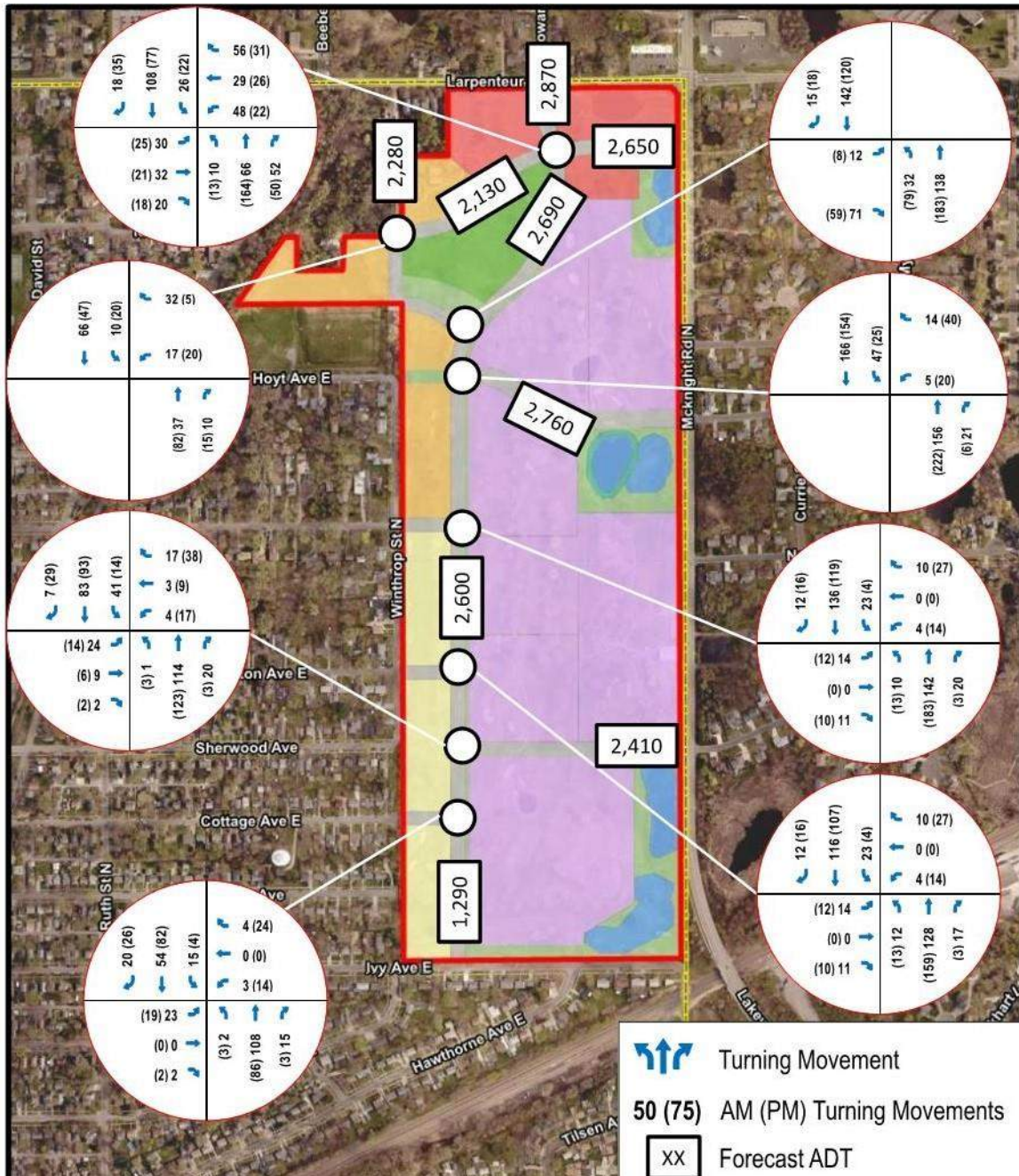


Figure 16 – 2040 Internal Roadway Traffic – Scenario 3



RECOMMENDATION / PROPOSED MITIGATION

Based on the analysis and conclusions documented in this study for each land use Scenario, the following is a summary of the 2040 Build transportation recommendations and proposed mitigation:

1. Roadway Improvements - Land Use Scenario 1 (Comp Plan)

- A. Lengthening of the left turn lanes to 300 ft at McKnight Road and Larpenteur Avenue. Monitor the intersection for additional improvements.
- B. Two exit lanes (left/thru lane and right turn lane) on all the site access streets (northbound Howard Street, eastbound Montana Avenue and eastbound Arlington Avenue).
- C. Monitor the intersection of McKnight Road at Montana Avenue as traffic volumes increase for lane configuration and/or traffic control improvements.

2. Roadway Improvements - Land Use Scenario 2 (Master Plan)

- A. Lengthening of the left turn lanes to 300 ft at McKnight Road and Larpenteur Avenue. Monitor the intersection for additional improvements.
- B. Two exit lanes (left/thru lane and right turn lane) on all the site access streets (northbound Howard Street, eastbound Montana Avenue and eastbound Arlington Avenue).
- C. Monitor the intersection of McKnight Road at Montana Avenue as traffic volumes increase for lane configuration and/or traffic control improvements.

3. Roadway Improvements - Land Use Scenario 3 (Max Density)

- A. Lengthening of the left turn lanes to 300ft at McKnight Road and Larpenteur Avenue. Monitor the intersection for additional improvements.
- B. Two exit lanes (left/thru lane and right turn lane) on all the site access streets (northbound Howard Street, eastbound Montana Avenue, and eastbound Arlington Avenue).
- C. Improve the intersection of McKnight Road at Montana Avenue as traffic increases to include either traffic signal or roundabout control. Provide additional right-of-way to accommodate the improvements if necessary.
- D. Monitor the intersection of McKnight Road at Arlington Avenue as traffic volumes increase for lane configuration and/or traffic control improvements. Provide additional right-of-way to accommodate future improvements if necessary.

4. Internal Street System (All Land Use Scenarios):

- A. All internal streets should be two lanes (one lane in each direction) conforming to the guidance of the City of St. Paul Street Design Manual.
- B. All internal intersections should have side street stop control.
 - i. Idaho Avenue stops at Street A
 - ii. Idaho Avenue stops at Howard Street
 - iii. Street A stops Howard Street

- iv. Hoyt Avenue/Montana Avenue stops at Howard Street
 - v. Nebraska Avenue stops at Howard Street
 - vi. Arlington Avenue W stops at Howard Street
 - vii. Arlington Avenue E stops at Howard Street
 - viii. Cottage Avenue stops at Howard Street
- C. Private access should be evaluated individually with each development proposal to ensure that all potential constraints are considered, including providing for truck traffic.
- D. Pedestrian facilities should be provided adjacent to each internal street with connections to external pedestrian facilities (see Bike / Pedestrian Facilities recommendations)

5. Bike / Pedestrian Improvements (All Land use Scenarios):

- A. A trail connection north of Hoyt Avenue to the Furness Trail on the west side of the study area with a direct connection through the site generally along Hoyt Avenue/Montana Avenue to the trail on McKnight Road.
- B. An off-road trail on the south side of Larpenteur Avenue from McKnight Road to the west.
- C. A trail connection from the site on Howard Street at Ivy Avenue.
- D. A pedestrian connection on the north side of Ivy Avenue from Winthrop Street to the existing pedestrian trail on McKnight Road with the reconstruction of Ivy Avenue.
- E. An extension of the future bicycle infrastructure (enhanced bike lane or other design) on Arlington Avenue through the site to the trail on McKnight Road.
- F. Sidewalks along all roadways throughout the Hillcrest development Site.
- G. Reconstruct the existing pedestrian refuge islands on McKnight Road at Montana Avenue and Arlington Avenue as part of the construction of new left turn lanes for the site. The design will include a raised concrete median with signing and pavement markings. The detailed design will be completed as part of the final design for the site improvements and will be coordinated, reviewed and approved by Ramsey County.
- H. Design internal roadways to accommodate safe pedestrian crossings. Specific design features are not determined at this time but could include bump-outs at intersections, tabled concrete crosswalks, and a tabled intersection at Howard Street and Idaho Avenue.
- I. Ensure that the pedestrian connectivity across McKnight Road to the City of Maplewood is maintained. Any changes or modification in the existing infrastructure resulting from the development will be reviewed and approved by Ramsey County and the City of Maplewood..
- J. Provide a pedestrian crossing of Larpenteur Avenue from the development site at Howard Street.

6. Transit Service (All Land Use Scenarios)

- A. Coordinate with Metro Transit to possibly alter the existing transit routes to pass through or adjacent to the site to promote increased transit use. Which route and where bus stops are located will be analyzed once a site development scenario is selected and Metro Transit reanalyzes the local bus routes in the area.

7. Freight Service (All Land Use Scenarios)

- A. Design internal roadways to accommodate the expected level of freight activity within the area based on the proposed development, including:
 - Provide bump-outs at intersections to elimination/discourage large vehicle turning towards residential neighborhoods.
 - i. Any industrial land use's access to Howard Street should not line up with Nebraska Avenue, Arlington Avenue, or Cottage Avenue to the west. Rather, any such access to Howard Street should be mid-block to discourage direct traffic access to the neighborhoods.
- B. Freight activity should be limited during the peak traffic periods to avoid potential conflicts through communication with the identified industrial business, area package services (i.e., UPS, FedEx, etc.) and refuse haulers.
- C. Evaluation of the need for on-street loading areas should be completed to accommodate some freight activity as actual development proposals are identified.

8. Neighborhood Improvements (All Land Use Scenarios)

- A. Any industrial land use's access to Howard Street should not line up with Nebraska Avenue, Arlington Avenue, or Cottage Avenue to the west. Rather, any such access to Howard Street should be mid-block to discourage direct traffic access to the neighborhoods.
- B. No direct vehicular access should be provided to Howard Street or Winthrop Street from the residential land uses south of Hoyt Avenue.
- C. Provide off road pedestrian accommodations on the streets accessing the neighborhoods, including extension/connection of sidewalks.
- D. Provide the recommended improvements at the site access locations on Larpenteur Avenue at Howard Street, McKnight Road at Montana Avenue and McKnight Road at Arlington Avenue to discourage traffic from using neighborhood streets.
- E. Implement the recommendations in the Freight Service section to discourage heavy vehicle traffic from using the neighborhood streets.
- F. As traffic in the area increases over time, especially on streets such as Ivy Avenue, traffic calming measures will be required to manage vehicle speed and public safety. The type of traffic calming measures that could be installed will be consistent with city policies and practices. It should be noted that installation of some traffic calming measures will result in a diversion of traffic to other neighborhood roadways. The determination of what type of traffic calming measure, the implementation, and financial responsibilities will be outlined in the developer's agreement between the St. Paul Port Authority and the City, if one is agreed to. If not, this mitigation item should be re-considered with the update of this AUAR in 2027.

- G. If Scenario 3 Maximum Intensity is pursued, the City and developer will coordinate with the Metropolitan Council to evaluate the Transportation Analysis Zone (TAZ) adjustments that may be needed.

APPENDIX A – CAPACITY ANALYSIS WORKSHEETS

1: Larpenteur Avenue & Howard Street Performance by movement

| Movement | EBL | EBT | WBT | WBR | SBL | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 |
| Total Del/Veh (s) | 2.7 | 0.5 | 1.7 | 1.3 | 7.8 | 3.5 | 1.4 |

2: McKnight Road & Larpenteur Avenue Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|--------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Denied Del/Veh (s) | 0.6 | 0.1 | 0.1 | 2.7 | 0.4 | 0.4 | 0.0 | 0.0 | 0.0 | 3.2 | 0.7 | 0.8 |
| Total Del/Veh (s) | 33.6 | 34.5 | 22.6 | 36.7 | 40.4 | 29.0 | 53.1 | 22.8 | 18.0 | 57.0 | 30.4 | 23.0 |

2: McKnight Road & Larpenteur Avenue Performance by movement

| Movement | All |
|--------------------|------|
| Denied Del/Veh (s) | 0.5 |
| Total Del/Veh (s) | 32.1 |

3: McKnight Road & Montana Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 16.0 | 5.3 | 0.7 | 0.1 | 3.6 | 1.5 | 1.5 |

4: McKnight Road & Nebraska Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 12.6 | 5.2 | 0.7 | 0.2 | 4.7 | 1.2 | 1.0 |

5: McKnight Road & Arlington Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.4 | 0.5 | 0.0 | 0.0 | 0.2 |
| Total Del/Veh (s) | 21.7 | 5.1 | 0.6 | 0.1 | 4.6 | 1.8 | 1.3 |

6: Hawthorne Avenue & Ivy Avenue Performance by movement

| Movement | EBT | EBR | WBL | WBT | NBL | NBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 |
| Total Del/Veh (s) | 0.2 | 0.0 | 2.1 | 0.2 | 5.0 | 2.7 | 1.0 |

Total Network Performance

| | |
|--------------------|------|
| Denied Del/Veh (s) | 0.6 |
| Total Del/Veh (s) | 34.8 |

Queuing and Blocking Report
Existing AM (with existing signal timing)

05/05/2022

Intersection: 1: Larpenteur Avenue & Howard Street

| Movement | EB | SB |
|-----------------------|-----|-----|
| Directions Served | LT | LR |
| Maximum Queue (ft) | 31 | 31 |
| Average Queue (ft) | 1 | 16 |
| 95th Queue (ft) | 10 | 41 |
| Link Distance (ft) | 582 | 923 |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 2: McKnight Road & Larpenteur Avenue

| Movement | EB | EB | WB | WB | NB | NB | B8 | SB | SB |
|-----------------------|-----|-----|-----|------|-----|-----|------|-----|------|
| Directions Served | L | TR | L | TR | L | TR | T | L | TR |
| Maximum Queue (ft) | 136 | 263 | 139 | 404 | 174 | 356 | 66 | 174 | 410 |
| Average Queue (ft) | 31 | 131 | 39 | 181 | 118 | 220 | 6 | 94 | 227 |
| 95th Queue (ft) | 82 | 223 | 105 | 347 | 193 | 357 | 39 | 177 | 381 |
| Link Distance (ft) | | 586 | | 1469 | | 288 | 1091 | | 1075 |
| Upstream Blk Time (%) | | | | | | 4 | | | |
| Queuing Penalty (veh) | | | | | | 23 | | | |
| Storage Bay Dist (ft) | 140 | | 115 | | 150 | | | 150 | |
| Storage Blk Time (%) | | 10 | | 25 | 3 | 15 | | 0 | 19 |
| Queuing Penalty (veh) | | 4 | | 10 | 15 | 22 | | 2 | 17 |

Intersection: 3: McKnight Road & Montana Avenue

| Movement | WB | SB |
|-----------------------|------|-----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 54 | 7 |
| Average Queue (ft) | 23 | 0 |
| 95th Queue (ft) | 51 | 5 |
| Link Distance (ft) | 1450 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | 300 |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Queuing and Blocking Report
Existing AM (with existing signal timing)

05/05/2022

Intersection: 4: McKnight Road & Nebraska Avenue

| Movement | WB | SB |
|-----------------------|------|-----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 36 | 31 |
| Average Queue (ft) | 9 | 2 |
| 95th Queue (ft) | 32 | 13 |
| Link Distance (ft) | 1260 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | 150 |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 5: McKnight Road & Arlington Avenue

| Movement | WB | SB |
|-----------------------|------|-----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 40 | 31 |
| Average Queue (ft) | 13 | 3 |
| 95th Queue (ft) | 38 | 18 |
| Link Distance (ft) | 1146 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | 150 |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 6: Hawthorne Avenue & Ivy Avenue

| Movement | WB | NB |
|-----------------------|-----|------|
| Directions Served | LT | LR |
| Maximum Queue (ft) | 23 | 46 |
| Average Queue (ft) | 3 | 17 |
| 95th Queue (ft) | 17 | 40 |
| Link Distance (ft) | 491 | 1280 |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Network Summary

Network wide Queuing Penalty: 93

1: Larpenteur Avenue & Howard Street Performance by movement

| Movement | EBL | EBT | WBT | WBR | SBL | SBR | All |
|--------------------|-----|-----|-----|-----|------|-----|-----|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 |
| Total Del/Veh (s) | 3.5 | 0.7 | 1.9 | 1.1 | 13.3 | 3.7 | 1.4 |

2: McKnight Road & Larpenteur Avenue Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|--------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 2.7 | 0.3 | 0.4 | 0.0 | 0.0 | 0.0 | 3.3 | 0.7 | 0.7 |
| Total Del/Veh (s) | 33.4 | 38.3 | 26.1 | 35.6 | 38.4 | 30.4 | 61.7 | 26.0 | 22.5 | 58.3 | 29.8 | 22.0 |

2: McKnight Road & Larpenteur Avenue Performance by movement

| Movement | All |
|--------------------|------|
| Denied Del/Veh (s) | 0.4 |
| Total Del/Veh (s) | 34.3 |

3: McKnight Road & Montana Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 11.4 | 6.0 | 1.2 | 0.5 | 4.9 | 1.5 | 1.4 |

4: McKnight Road & Nebraska Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 10.0 | 4.8 | 1.1 | 0.3 | 5.4 | 1.2 | 1.2 |

5: McKnight Road & Arlington Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.6 | 0.5 | 0.0 | 0.0 | 0.3 |
| Total Del/Veh (s) | 14.4 | 5.0 | 0.8 | 0.3 | 6.4 | 1.8 | 1.3 |

6: Hawthorne Avenue & Ivy Avenue Performance by movement

| Movement | EBT | WBL | WBT | NBL | NBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.2 | 0.1 | 0.2 | 0.1 | 0.1 | 0.2 |
| Total Del/Veh (s) | 0.2 | 2.0 | 0.3 | 6.0 | 2.7 | 0.9 |

Total Network Performance

| | |
|--------------------|------|
| Denied Del/Veh (s) | 0.6 |
| Total Del/Veh (s) | 36.6 |

Queuing and Blocking Report
Existing PM (with existing signal timing)

05/05/2022

Intersection: 1: Larpenteur Avenue & Howard Street

| Movement | EB | SB |
|-----------------------|-----|-----|
| Directions Served | LT | LR |
| Maximum Queue (ft) | 54 | 42 |
| Average Queue (ft) | 3 | 6 |
| 95th Queue (ft) | 23 | 28 |
| Link Distance (ft) | 582 | 923 |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 2: McKnight Road & Larpenteur Avenue

| Movement | EB | EB | WB | WB | NB | NB | B8 | SB | SB |
|-----------------------|-----|-----|-----|------|-----|-----|------|-----|------|
| Directions Served | L | TR | L | TR | L | TR | T | L | TR |
| Maximum Queue (ft) | 164 | 405 | 123 | 342 | 175 | 374 | 238 | 174 | 485 |
| Average Queue (ft) | 48 | 194 | 29 | 164 | 130 | 283 | 35 | 105 | 205 |
| 95th Queue (ft) | 132 | 337 | 82 | 289 | 210 | 401 | 147 | 184 | 377 |
| Link Distance (ft) | | 586 | | 1469 | | 288 | 1091 | | 1075 |
| Upstream Blk Time (%) | | | | | | 11 | | | |
| Queuing Penalty (veh) | | | | | | 83 | | | |
| Storage Bay Dist (ft) | 140 | | 115 | | 150 | | | 150 | |
| Storage Blk Time (%) | 0 | 21 | | 20 | 7 | 26 | | 3 | 15 |
| Queuing Penalty (veh) | 1 | 10 | | 6 | 41 | 37 | | 12 | 17 |

Intersection: 3: McKnight Road & Montana Avenue

| Movement | WB | SB |
|-----------------------|------|-----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 42 | 31 |
| Average Queue (ft) | 16 | 3 |
| 95th Queue (ft) | 42 | 17 |
| Link Distance (ft) | 1450 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | 300 |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 4: McKnight Road & Nebraska Avenue

| Movement | WB | SB |
|-----------------------|------|-----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 31 | 31 |
| Average Queue (ft) | 11 | 5 |
| 95th Queue (ft) | 35 | 24 |
| Link Distance (ft) | 1260 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | 150 |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 5: McKnight Road & Arlington Avenue

| Movement | WB | SB |
|-----------------------|------|-----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 30 | 31 |
| Average Queue (ft) | 9 | 4 |
| 95th Queue (ft) | 30 | 21 |
| Link Distance (ft) | 1146 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | 150 |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 6: Hawthorne Avenue & Ivy Avenue

| Movement | WB | NB |
|-----------------------|-----|------|
| Directions Served | LT | LR |
| Maximum Queue (ft) | 37 | 40 |
| Average Queue (ft) | 2 | 22 |
| 95th Queue (ft) | 17 | 44 |
| Link Distance (ft) | 491 | 1280 |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Network Summary

| |
|-----------------------------------|
| Network wide Queuing Penalty: 208 |
|-----------------------------------|

1: Larpenteur Avenue & Howard Street Performance by movement

| Movement | EBL | EBT | WBT | WBR | SBL | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.1 | 0.0 |
| Total Del/Veh (s) | 3.2 | 0.6 | 1.8 | 1.8 | 8.5 | 4.1 | 1.5 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|--------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Denied Del/Veh (s) | 0.7 | 0.1 | 0.1 | 2.5 | 0.4 | 0.4 | 0.0 | 0.0 | 0.0 | 3.1 | 0.7 | 0.7 |
| Total Del/Veh (s) | 24.5 | 24.1 | 17.2 | 23.1 | 25.1 | 20.5 | 91.3 | 30.1 | 25.2 | 51.5 | 39.8 | 31.8 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | All |
|--------------------|------|
| Denied Del/Veh (s) | 0.5 |
| Total Del/Veh (s) | 35.5 |

3: McKnight Road & Montana Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 16.5 | 8.1 | 0.9 | 0.4 | 7.1 | 1.7 | 1.7 |

4: McKnight Road & Nebraska Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 17.7 | 5.0 | 0.8 | 0.3 | 4.2 | 1.3 | 1.2 |

5: McKnight Road & Arlington Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.5 | 0.6 | 0.0 | 0.0 | 0.2 |
| Total Del/Veh (s) | 11.7 | 4.0 | 0.7 | 0.1 | 4.6 | 2.0 | 1.4 |

6: Hawthorne Avenue & Ivy Avenue Performance by movement

| Movement | EBT | EBR | WBL | WBT | NBL | NBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.2 | 0.3 | 0.2 | 0.2 | 0.1 | 0.1 | 0.2 |
| Total Del/Veh (s) | 0.2 | 0.1 | 2.2 | 0.4 | 4.4 | 2.6 | 1.0 |

Total Network Performance

| | |
|--------------------|------|
| Denied Del/Veh (s) | 0.6 |
| Total Del/Veh (s) | 39.0 |

Intersection: 1: Larpenteur Avenue & Howard Street

| Movement | EB | SB |
|-----------------------|-----|-----|
| Directions Served | LT | LR |
| Maximum Queue (ft) | 24 | 38 |
| Average Queue (ft) | 1 | 16 |
| 95th Queue (ft) | 12 | 42 |
| Link Distance (ft) | 582 | 923 |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 2: Larpenteur Avenue & McKnight Road

| Movement | EB | EB | WB | WB | NB | NB | B8 | SB | SB |
|-----------------------|-----|-----|-----|------|-----|-----|------|-----|------|
| Directions Served | L | TR | L | TR | L | TR | T | L | TR |
| Maximum Queue (ft) | 163 | 226 | 118 | 275 | 174 | 376 | 291 | 174 | 500 |
| Average Queue (ft) | 38 | 121 | 31 | 147 | 145 | 260 | 47 | 100 | 276 |
| 95th Queue (ft) | 101 | 196 | 81 | 239 | 213 | 409 | 201 | 196 | 448 |
| Link Distance (ft) | | 586 | | 1469 | | 288 | 1091 | | 1075 |
| Upstream Blk Time (%) | | | | | | 16 | | | |
| Queuing Penalty (veh) | | | | | | 106 | | | |
| Storage Bay Dist (ft) | 140 | | 115 | | 150 | | | 150 | |
| Storage Blk Time (%) | | 6 | | 15 | 22 | 21 | | 0 | 30 |
| Queuing Penalty (veh) | | 3 | | 7 | 111 | 33 | | 0 | 30 |

Intersection: 3: McKnight Road & Montana Avenue

| Movement | WB | SB |
|-----------------------|------|-----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 64 | 30 |
| Average Queue (ft) | 30 | 2 |
| 95th Queue (ft) | 57 | 12 |
| Link Distance (ft) | 1450 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | 300 |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 4: McKnight Road & Nebraska Avenue

| Movement | WB | SB |
|-----------------------|------|-----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 31 | 31 |
| Average Queue (ft) | 11 | 3 |
| 95th Queue (ft) | 34 | 17 |
| Link Distance (ft) | 1260 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | 150 |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 5: McKnight Road & Arlington Avenue

| Movement | WB | SB |
|-----------------------|------|-----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 40 | 30 |
| Average Queue (ft) | 16 | 2 |
| 95th Queue (ft) | 40 | 15 |
| Link Distance (ft) | 1146 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | 150 |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 6: Hawthorne Avenue & Ivy Avenue

| Movement | WB | NB |
|-----------------------|-----|------|
| Directions Served | LT | LR |
| Maximum Queue (ft) | 42 | 54 |
| Average Queue (ft) | 4 | 18 |
| 95th Queue (ft) | 22 | 43 |
| Link Distance (ft) | 491 | 1280 |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Network Summary

| |
|-----------------------------------|
| Network wide Queuing Penalty: 290 |
|-----------------------------------|

1: Larpenteur Avenue & Howard Street Performance by movement

| Movement | EBL | EBT | WBT | WBR | SBL | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 |
| Total Del/Veh (s) | 4.1 | 0.8 | 1.9 | 1.7 | 8.3 | 3.8 | 1.4 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|--------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 2.4 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 3.1 | 0.8 | 0.8 |
| Total Del/Veh (s) | 30.1 | 31.2 | 23.9 | 26.7 | 30.5 | 22.8 | 78.8 | 44.9 | 38.0 | 89.6 | 42.3 | 34.8 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | All |
|--------------------|------|
| Denied Del/Veh (s) | 0.5 |
| Total Del/Veh (s) | 43.4 |

3: McKnight Road & Montana Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 17.8 | 7.9 | 1.6 | 0.5 | 7.9 | 1.5 | 1.7 |

4: McKnight Road & Nebraska Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 34.7 | 8.1 | 1.3 | 0.5 | 5.7 | 1.2 | 1.4 |

5: McKnight Road & Arlington Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.7 | 0.8 | 0.0 | 0.0 | 0.4 |
| Total Del/Veh (s) | 22.0 | 6.6 | 1.1 | 0.3 | 9.0 | 1.7 | 1.5 |

6: Hawthorne Avenue & Ivy Avenue Performance by movement

| Movement | EBT | WBL | WBT | NBL | NBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 |
| Total Del/Veh (s) | 0.2 | 2.0 | 0.3 | 3.7 | 2.6 | 0.8 |

Total Network Performance

| | |
|--------------------|------|
| Denied Del/Veh (s) | 0.7 |
| Total Del/Veh (s) | 58.2 |

Intersection: 1: Larpenteur Avenue & Howard Street

| Movement | EB | SB |
|-----------------------|-----|-----|
| Directions Served | LT | LR |
| Maximum Queue (ft) | 48 | 31 |
| Average Queue (ft) | 4 | 7 |
| 95th Queue (ft) | 24 | 28 |
| Link Distance (ft) | 582 | 923 |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 2: Larpenteur Avenue & McKnight Road

| Movement | EB | EB | WB | WB | NB | NB | B8 | SB | SB |
|-----------------------|-----|-----|-----|------|-----|-----|------|-----|------|
| Directions Served | L | TR | L | TR | L | TR | T | L | TR |
| Maximum Queue (ft) | 164 | 365 | 139 | 317 | 174 | 382 | 774 | 174 | 717 |
| Average Queue (ft) | 46 | 178 | 39 | 162 | 148 | 347 | 375 | 125 | 297 |
| 95th Queue (ft) | 123 | 309 | 100 | 269 | 215 | 417 | 871 | 208 | 616 |
| Link Distance (ft) | | 586 | | 1469 | | 288 | 1091 | | 1075 |
| Upstream Blk Time (%) | | | | | | 45 | | | 0 |
| Queuing Penalty (veh) | | | | | | 361 | | | 0 |
| Storage Bay Dist (ft) | 140 | | 115 | | 150 | | | 150 | |
| Storage Blk Time (%) | 0 | 18 | | 19 | 10 | 48 | | 10 | 20 |
| Queuing Penalty (veh) | 0 | 10 | | 7 | 66 | 75 | | 52 | 26 |

Intersection: 3: McKnight Road & Montana Avenue

| Movement | WB | SB |
|-----------------------|------|-----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 47 | 37 |
| Average Queue (ft) | 15 | 4 |
| 95th Queue (ft) | 41 | 22 |
| Link Distance (ft) | 1450 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | 300 |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 4: McKnight Road & Nebraska Avenue

| Movement | WB | SB |
|-----------------------|------|-----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 42 | 36 |
| Average Queue (ft) | 12 | 6 |
| 95th Queue (ft) | 39 | 27 |
| Link Distance (ft) | 1260 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | 150 |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 5: McKnight Road & Arlington Avenue

| Movement | WB | SB |
|-----------------------|------|-----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 30 | 48 |
| Average Queue (ft) | 11 | 7 |
| 95th Queue (ft) | 33 | 31 |
| Link Distance (ft) | 1146 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | 150 |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 6: Hawthorne Avenue & Ivy Avenue

| Movement | WB | NB |
|-----------------------|-----|------|
| Directions Served | LT | LR |
| Maximum Queue (ft) | 42 | 61 |
| Average Queue (ft) | 3 | 23 |
| 95th Queue (ft) | 19 | 47 |
| Link Distance (ft) | 491 | 1280 |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Network Summary

| |
|-----------------------------------|
| Network wide Queuing Penalty: 596 |
|-----------------------------------|

1: Larpenteur Avenue & Howard Street Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBR | SBL | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|------|-----|------|-----|-----|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.1 | 0.1 | 0.1 | 0.0 |
| Total Del/Veh (s) | 5.3 | 1.4 | 0.9 | 6.1 | 3.1 | 2.9 | 12.2 | 5.0 | 11.0 | 4.9 | 3.1 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|--------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 2.7 | 0.4 | 0.4 | 0.0 | 0.0 | 0.0 | 3.0 | 0.9 | 0.9 |
| Total Del/Veh (s) | 56.7 | 48.7 | 39.4 | 61.8 | 61.4 | 50.2 | 81.6 | 22.2 | 17.7 | 91.9 | 41.6 | 35.2 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | All |
|--------------------|------|
| Denied Del/Veh (s) | 0.5 |
| Total Del/Veh (s) | 45.5 |

3: McKnight Road & Montana Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 35.8 | 20.9 | 24.2 | 6.3 | 8.6 | 1.0 | 0.2 | 4.6 | 3.2 | 2.4 | 4.0 |

4: McKnight Road & Nebraska Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 18.6 | 4.4 | 0.8 | 0.1 | 4.2 | 1.4 | 1.2 |

5: McKnight Road & Arlington Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|------|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.1 | 0.1 | 3.1 | 0.7 | 0.6 | 0.0 | 0.0 | 0.0 | 0.5 |
| Total Del/Veh (s) | 19.1 | 8.8 | 30.2 | 6.7 | 5.8 | 1.4 | 0.1 | 6.1 | 2.1 | 1.6 | 2.6 |

6: Hawthorne Avenue & Ivy Avenue Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | NBL | NBR | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Total Del/Veh (s) | 2.0 | 0.6 | 0.7 | 2.0 | 0.3 | 3.8 | 2.8 | 2.4 | 1.4 |

7: Winthrop Street & Larpenteur Avenue Performance by movement

| Movement | EBT | EBR | WBT | NBL | All |
|--------------------|-----|-----|-----|------|-----|
| Denied Del/Veh (s) | 0.3 | 0.3 | 0.0 | 0.1 | 0.2 |
| Total Del/Veh (s) | 1.3 | 0.8 | 1.0 | 10.3 | 1.5 |

8: McKnight Road & N Site Access Performance by movement

| Movement | EBR | NBT | SBT | SBR | All |
|--------------------|------|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 11.0 | 7.4 | 3.9 | 2.1 | 5.6 |

Total Network Performance

| | |
|--------------------|------|
| Denied Del/Veh (s) | 0.7 |
| Total Del/Veh (s) | 43.0 |

Intersection: 1: Larpenteur Avenue & Howard Street

| Movement | EB | WB | NB | SB |
|-----------------------|-----|-----|-----|-----|
| Directions Served | LTR | LTR | LTR | LTR |
| Maximum Queue (ft) | 88 | 99 | 72 | 53 |
| Average Queue (ft) | 5 | 29 | 34 | 17 |
| 95th Queue (ft) | 36 | 82 | 60 | 44 |
| Link Distance (ft) | 582 | 591 | 738 | 923 |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | | | | |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

Intersection: 2: Larpenteur Avenue & McKnight Road

| Movement | EB | EB | WB | WB | NB | NB | SB | SB |
|-----------------------|-----|-----|-----|------|-----|-----|-----|------|
| Directions Served | L | TR | L | TR | L | TR | L | TR |
| Maximum Queue (ft) | 174 | 388 | 174 | 525 | 174 | 302 | 174 | 721 |
| Average Queue (ft) | 82 | 200 | 69 | 280 | 142 | 234 | 111 | 383 |
| 95th Queue (ft) | 178 | 343 | 166 | 475 | 204 | 339 | 198 | 634 |
| Link Distance (ft) | | 591 | | 1469 | | 288 | | 1075 |
| Upstream Blk Time (%) | | | | | | 7 | | |
| Queuing Penalty (veh) | | | | | | 50 | | |
| Storage Bay Dist (ft) | 150 | | 150 | | 150 | | 150 | |
| Storage Blk Time (%) | 1 | 21 | 1 | 33 | 13 | 18 | 4 | 31 |
| Queuing Penalty (veh) | 3 | 15 | 2 | 22 | 71 | 27 | 26 | 29 |

Intersection: 3: McKnight Road & Montana Avenue

| Movement | EB | WB | NB | SB | SB |
|-----------------------|------|------|-----|-----|------|
| Directions Served | LTR | LTR | L | L | TR |
| Maximum Queue (ft) | 129 | 59 | 52 | 14 | 22 |
| Average Queue (ft) | 46 | 22 | 22 | 0 | 2 |
| 95th Queue (ft) | 94 | 51 | 48 | 7 | 13 |
| Link Distance (ft) | 1504 | 1450 | | | 1085 |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | | | 300 | 300 | |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

Intersection: 4: McKnight Road & Nebraska Avenue

| Movement | WB | SB |
|-----------------------|------|-----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 36 | 31 |
| Average Queue (ft) | 9 | 3 |
| 95th Queue (ft) | 32 | 17 |
| Link Distance (ft) | 1260 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | 150 |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 5: McKnight Road & Arlington Avenue

| Movement | EB | WB | NB | SB | SB |
|-----------------------|-----|------|-----|-----|-----|
| Directions Served | LTR | LTR | L | L | TR |
| Maximum Queue (ft) | 84 | 52 | 71 | 30 | 20 |
| Average Queue (ft) | 34 | 16 | 25 | 3 | 1 |
| 95th Queue (ft) | 65 | 42 | 54 | 18 | 10 |
| Link Distance (ft) | 923 | 1146 | | | 797 |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | | | 150 | 150 | |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

Intersection: 6: Hawthorne Avenue & Ivy Avenue

| Movement | EB | WB | NB | SB |
|-----------------------|------|-----|------|-----|
| Directions Served | LTR | LTR | LTR | LTR |
| Maximum Queue (ft) | 28 | 32 | 59 | 29 |
| Average Queue (ft) | 2 | 3 | 21 | 14 |
| 95th Queue (ft) | 15 | 16 | 48 | 37 |
| Link Distance (ft) | 1004 | 484 | 1278 | 645 |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | | | | |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

Intersection: 7: Winthrop Street & Larpenteur Avenue

| Movement | NB |
|-----------------------|-----|
| Directions Served | LR |
| Maximum Queue (ft) | 66 |
| Average Queue (ft) | 27 |
| 95th Queue (ft) | 59 |
| Link Distance (ft) | 779 |
| Upstream Blk Time (%) | |
| Queuing Penalty (veh) | |
| Storage Bay Dist (ft) | |
| Storage Blk Time (%) | |
| Queuing Penalty (veh) | |

Intersection: 8: McKnight Road & N Site Access

| Movement | EB | NB |
|-----------------------|-----|------|
| Directions Served | R | T |
| Maximum Queue (ft) | 42 | 329 |
| Average Queue (ft) | 14 | 59 |
| 95th Queue (ft) | 40 | 229 |
| Link Distance (ft) | 434 | 1085 |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Network Summary

| |
|-----------------------------------|
| Network wide Queuing Penalty: 246 |
|-----------------------------------|

1: Larpenteur Avenue & Howard Street Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBR | SBL | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|------|-----|------|-----|-----|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 4.0 | 0.1 | 0.1 | 0.2 |
| Total Del/Veh (s) | 3.2 | 1.3 | 0.8 | 5.6 | 2.8 | 2.4 | 11.9 | 3.7 | 10.1 | 5.2 | 2.8 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|--------------------|------|------|------|------|------|------|------|------|-----|------|------|------|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 2.5 | 0.6 | 2.5 | 0.0 | 0.0 | 0.0 | 3.0 | 1.0 | 3.2 |
| Total Del/Veh (s) | 23.0 | 23.9 | 10.2 | 24.3 | 26.9 | 10.4 | 54.8 | 22.0 | 4.7 | 47.7 | 40.0 | 13.9 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | All |
|--------------------|------|
| Denied Del/Veh (s) | 0.8 |
| Total Del/Veh (s) | 28.9 |

3: McKnight Road & Montana Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|------|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 1.9 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 33.8 | 6.8 | 26.2 | 7.2 | 7.5 | 1.0 | 0.2 | 4.7 | 3.5 | 2.6 | 3.9 |

4: McKnight Road & Nebraska Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 17.9 | 3.9 | 0.8 | 0.1 | 3.9 | 1.5 | 1.2 |

5: McKnight Road & Arlington Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|------|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.2 | 3.9 | 0.1 | 0.1 | 3.1 | 0.7 | 0.6 | 0.0 | 0.0 | 0.0 | 0.6 |
| Total Del/Veh (s) | 17.3 | 7.3 | 22.0 | 6.2 | 5.3 | 1.3 | 0.1 | 7.0 | 2.2 | 1.6 | 2.4 |

6: Hawthorne Avenue & Ivy Avenue Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | NBL | NBR | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Total Del/Veh (s) | 2.0 | 0.6 | 0.7 | 2.0 | 0.3 | 3.8 | 2.8 | 2.4 | 1.4 |

7: Winthrop Street & Larpenteur Avenue Performance by movement

| Movement | EBT | EBR | WBT | NBL | All |
|--------------------|-----|-----|-----|------|-----|
| Denied Del/Veh (s) | 0.3 | 0.3 | 0.0 | 0.1 | 0.2 |
| Total Del/Veh (s) | 1.3 | 0.8 | 0.9 | 10.5 | 1.5 |

8: McKnight Road & N Site Access Performance by movement

| Movement | EBR | NBT | SBT | SBR | All |
|--------------------|------|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 12.6 | 4.5 | 4.3 | 2.3 | 4.5 |

Total Network Performance

| | |
|--------------------|------|
| Denied Del/Veh (s) | 1.0 |
| Total Del/Veh (s) | 30.2 |

Intersection: 1: Larpenteur Avenue & Howard Street

| Movement | EB | WB | NB | NB | SB |
|-----------------------|-----|-----|-----|-----|-----|
| Directions Served | LTR | LTR | LT | R | LTR |
| Maximum Queue (ft) | 38 | 92 | 57 | 51 | 42 |
| Average Queue (ft) | 2 | 19 | 22 | 25 | 16 |
| 95th Queue (ft) | 19 | 63 | 51 | 49 | 42 |
| Link Distance (ft) | 582 | 565 | 738 | | 923 |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | | | | 200 | |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

Intersection: 2: Larpenteur Avenue & McKnight Road

| Movement | EB | EB | EB | WB | WB | WB | NB | NB | NB | SB | SB | SB |
|-----------------------|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|------|-----|
| Directions Served | L | T | R | L | T | R | L | T | R | L | T | R |
| Maximum Queue (ft) | 97 | 136 | 99 | 89 | 208 | 80 | 256 | 294 | 106 | 234 | 613 | 275 |
| Average Queue (ft) | 39 | 65 | 38 | 35 | 99 | 37 | 105 | 181 | 18 | 86 | 274 | 56 |
| 95th Queue (ft) | 79 | 118 | 76 | 74 | 177 | 72 | 202 | 293 | 90 | 214 | 546 | 203 |
| Link Distance (ft) | | 565 | | | 1457 | | | 276 | | | 1062 | |
| Upstream Blk Time (%) | | | | | | | 0 | 3 | 0 | | 0 | |
| Queuing Penalty (veh) | | | | | | | 0 | 20 | 0 | | 0 | |
| Storage Bay Dist (ft) | 300 | | 250 | 250 | | 250 | 300 | | 250 | 250 | | 250 |
| Storage Blk Time (%) | | | | | 0 | | 0 | 5 | 0 | | 13 | 0 |
| Queuing Penalty (veh) | | | | | 0 | | 3 | 8 | 0 | | 22 | 0 |

Intersection: 3: McKnight Road & Montana Avenue

| Movement | EB | EB | WB | NB | SB | SB |
|-----------------------|------|-----|------|-----|-----|------|
| Directions Served | LT | R | LTR | L | L | TR |
| Maximum Queue (ft) | 101 | 47 | 64 | 52 | 8 | 27 |
| Average Queue (ft) | 35 | 14 | 23 | 17 | 0 | 2 |
| 95th Queue (ft) | 76 | 41 | 54 | 41 | 7 | 12 |
| Link Distance (ft) | 1504 | | 1450 | | | 1085 |
| Upstream Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |
| Storage Bay Dist (ft) | | 200 | | 300 | 300 | |
| Storage Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |

Intersection: 4: McKnight Road & Nebraska Avenue

| Movement | WB | SB |
|-----------------------|------|-----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 36 | 31 |
| Average Queue (ft) | 9 | 2 |
| 95th Queue (ft) | 32 | 16 |
| Link Distance (ft) | 1260 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | 150 |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 5: McKnight Road & Arlington Avenue

| Movement | EB | EB | WB | NB | SB | SB |
|-----------------------|-----|-----|------|-----|-----|-----|
| Directions Served | LT | R | LTR | L | L | TR |
| Maximum Queue (ft) | 42 | 66 | 51 | 59 | 31 | 5 |
| Average Queue (ft) | 13 | 28 | 16 | 21 | 3 | 0 |
| 95th Queue (ft) | 40 | 57 | 41 | 46 | 17 | 3 |
| Link Distance (ft) | 923 | | 1146 | | | 797 |
| Upstream Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |
| Storage Bay Dist (ft) | | 200 | | 150 | 150 | |
| Storage Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |

Intersection: 6: Hawthorne Avenue & Ivy Avenue

| Movement | EB | WB | NB | SB |
|-----------------------|------|-----|------|-----|
| Directions Served | LTR | LTR | LTR | LTR |
| Maximum Queue (ft) | 28 | 32 | 59 | 29 |
| Average Queue (ft) | 2 | 3 | 21 | 14 |
| 95th Queue (ft) | 15 | 16 | 48 | 37 |
| Link Distance (ft) | 1004 | 484 | 1278 | 645 |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | | | | |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

Intersection: 7: Winthrop Street & Larpenteur Avenue

| Movement | NB |
|-----------------------|-----|
| Directions Served | LR |
| Maximum Queue (ft) | 66 |
| Average Queue (ft) | 26 |
| 95th Queue (ft) | 56 |
| Link Distance (ft) | 779 |
| Upstream Blk Time (%) | |
| Queuing Penalty (veh) | |
| Storage Bay Dist (ft) | |
| Storage Blk Time (%) | |
| Queuing Penalty (veh) | |

Intersection: 8: McKnight Road & N Site Access

| Movement | EB | NB |
|-----------------------|-----|------|
| Directions Served | R | T |
| Maximum Queue (ft) | 42 | 206 |
| Average Queue (ft) | 15 | 18 |
| 95th Queue (ft) | 40 | 103 |
| Link Distance (ft) | 434 | 1085 |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Network Summary

| |
|----------------------------------|
| Network wide Queuing Penalty: 54 |
|----------------------------------|

1: Larpenteur Avenue & Howard Street Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBR | SBL | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|------|-----|------|-----|-----|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.2 | 0.1 | 0.1 | 0.0 |
| Total Del/Veh (s) | 3.5 | 1.3 | 0.5 | 5.3 | 3.0 | 1.8 | 14.4 | 8.6 | 10.0 | 5.2 | 3.6 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|--------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 2.9 | 0.4 | 0.4 | 0.0 | 0.0 | 0.0 | 3.1 | 0.7 | 0.8 |
| Total Del/Veh (s) | 64.8 | 56.8 | 47.4 | 54.6 | 55.2 | 45.0 | 90.5 | 25.8 | 22.4 | 89.5 | 35.5 | 29.9 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | All |
|--------------------|------|
| Denied Del/Veh (s) | 0.4 |
| Total Del/Veh (s) | 45.3 |

3: McKnight Road & Montana Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.2 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 47.1 | 23.8 | 22.0 | 9.2 | 5.5 | 1.7 | 0.5 | 7.4 | 2.7 | 2.0 | 5.2 |

4: McKnight Road & Nebraska Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 14.5 | 5.6 | 1.2 | 0.5 | 6.2 | 1.3 | 1.3 |

5: McKnight Road & Arlington Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|------|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.2 | 0.2 | 0.1 | 0.1 | 3.0 | 0.8 | 0.8 | 0.0 | 0.0 | 0.0 | 0.5 |
| Total Del/Veh (s) | 25.4 | 9.5 | 17.2 | 8.4 | 4.3 | 1.4 | 0.4 | 4.9 | 2.0 | 1.6 | 2.6 |

6: Hawthorne Avenue & Ivy Avenue Performance by movement

| Movement | EBL | EBT | WBL | WBT | NBL | NBR | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.2 | 0.2 | 0.1 | 0.2 | 0.3 | 0.1 | 0.1 | 0.2 |
| Total Del/Veh (s) | 2.1 | 0.5 | 2.0 | 0.3 | 5.9 | 3.0 | 2.7 | 1.3 |

7: Winthrop Street & Larpenteur Avenue Performance by movement

| Movement | EBT | EBR | WBT | NBL | All |
|--------------------|-----|-----|-----|------|-----|
| Denied Del/Veh (s) | 0.3 | 0.4 | 0.0 | 0.1 | 0.2 |
| Total Del/Veh (s) | 1.4 | 1.1 | 1.0 | 13.2 | 2.0 |

8: McKnight Road & N Site Access Performance by movement

| Movement | EBR | NBT | SBT | SBR | All |
|--------------------|-----|------|-----|-----|------|
| Denied Del/Veh (s) | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 9.2 | 18.0 | 3.7 | 1.6 | 11.8 |

Total Network Performance

| | |
|--------------------|------|
| Denied Del/Veh (s) | 0.6 |
| Total Del/Veh (s) | 46.1 |

Intersection: 1: Larpenteur Avenue & Howard Street

| Movement | EB | WB | NB | SB |
|-----------------------|-----|-----|-----|-----|
| Directions Served | LTR | LTR | LTR | LTR |
| Maximum Queue (ft) | 41 | 100 | 116 | 31 |
| Average Queue (ft) | 3 | 21 | 54 | 11 |
| 95th Queue (ft) | 20 | 71 | 92 | 35 |
| Link Distance (ft) | 582 | 591 | 738 | 923 |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | | | | |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

Intersection: 2: Larpenteur Avenue & McKnight Road

| Movement | EB | EB | WB | WB | NB | NB | SB | SB |
|-----------------------|-----|-----|-----|------|-----|-----|-----|------|
| Directions Served | L | TR | L | TR | L | TR | L | TR |
| Maximum Queue (ft) | 175 | 550 | 174 | 459 | 174 | 304 | 174 | 518 |
| Average Queue (ft) | 118 | 305 | 69 | 238 | 146 | 280 | 115 | 309 |
| 95th Queue (ft) | 206 | 502 | 165 | 387 | 204 | 328 | 196 | 485 |
| Link Distance (ft) | | 591 | | 1469 | | 288 | | 1075 |
| Upstream Blk Time (%) | | 0 | | | | 18 | | |
| Queuing Penalty (veh) | | 0 | | | | 157 | | |
| Storage Bay Dist (ft) | 150 | | 150 | | 150 | | 150 | |
| Storage Blk Time (%) | 2 | 35 | 0 | 31 | 17 | 30 | 5 | 26 |
| Queuing Penalty (veh) | 8 | 38 | 0 | 15 | 124 | 43 | 27 | 30 |

Intersection: 3: McKnight Road & Montana Avenue

| Movement | EB | WB | NB | SB | SB |
|-----------------------|------|------|-----|-----|------|
| Directions Served | LTR | LTR | L | L | TR |
| Maximum Queue (ft) | 178 | 37 | 40 | 30 | 5 |
| Average Queue (ft) | 74 | 15 | 11 | 3 | 0 |
| 95th Queue (ft) | 141 | 40 | 35 | 18 | 3 |
| Link Distance (ft) | 1504 | 1450 | | | 1085 |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | | | 300 | 300 | |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

Intersection: 4: McKnight Road & Nebraska Avenue

| Movement | WB | SB |
|-----------------------|------|-----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 36 | 31 |
| Average Queue (ft) | 13 | 4 |
| 95th Queue (ft) | 39 | 20 |
| Link Distance (ft) | 1260 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | 150 |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 5: McKnight Road & Arlington Avenue

| Movement | EB | WB | NB | SB |
|-----------------------|-----|------|-----|-----|
| Directions Served | LTR | LTR | L | L |
| Maximum Queue (ft) | 107 | 46 | 47 | 35 |
| Average Queue (ft) | 47 | 10 | 17 | 4 |
| 95th Queue (ft) | 84 | 35 | 41 | 20 |
| Link Distance (ft) | 923 | 1146 | | |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | | | 150 | 150 |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

Intersection: 6: Hawthorne Avenue & Ivy Avenue

| Movement | EB | WB | NB | SB |
|-----------------------|------|-----|------|-----|
| Directions Served | LTR | LTR | LTR | LTR |
| Maximum Queue (ft) | 35 | 34 | 50 | 38 |
| Average Queue (ft) | 4 | 3 | 24 | 19 |
| 95th Queue (ft) | 21 | 18 | 47 | 41 |
| Link Distance (ft) | 1004 | 484 | 1278 | 645 |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | | | | |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

Intersection: 7: Winthrop Street & Larpenteur Avenue

| Movement | NB |
|-----------------------|-----|
| Directions Served | LR |
| Maximum Queue (ft) | 80 |
| Average Queue (ft) | 36 |
| 95th Queue (ft) | 66 |
| Link Distance (ft) | 779 |
| Upstream Blk Time (%) | |
| Queuing Penalty (veh) | |
| Storage Bay Dist (ft) | |
| Storage Blk Time (%) | |
| Queuing Penalty (veh) | |

Intersection: 8: McKnight Road & N Site Access

| Movement | EB | NB |
|-----------------------|-----|------|
| Directions Served | R | T |
| Maximum Queue (ft) | 69 | 591 |
| Average Queue (ft) | 24 | 194 |
| 95th Queue (ft) | 54 | 478 |
| Link Distance (ft) | 434 | 1085 |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Network Summary

| |
|-----------------------------------|
| Network wide Queuing Penalty: 442 |
|-----------------------------------|

1: Larpenteur Avenue & Howard Street Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBR | SBL | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 3.9 | 0.1 | 0.1 | 0.4 |
| Total Del/Veh (s) | 3.6 | 1.3 | 0.5 | 5.5 | 2.9 | 1.9 | 13.3 | 5.2 | 9.6 | 5.5 | 3.2 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|--------------------|------|------|-----|------|------|------|------|------|-----|------|------|-----|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 2.7 | 0.5 | 2.6 | 0.0 | 0.0 | 0.0 | 3.2 | 0.8 | 3.2 |
| Total Del/Veh (s) | 26.6 | 29.4 | 9.2 | 26.1 | 30.4 | 13.6 | 55.5 | 25.4 | 6.5 | 53.3 | 26.6 | 7.9 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | All |
|--------------------|------|
| Denied Del/Veh (s) | 0.6 |
| Total Del/Veh (s) | 27.7 |

3: McKnight Road & Montana Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|------|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.2 | 1.8 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 37.4 | 8.9 | 19.2 | 9.6 | 6.5 | 1.7 | 0.5 | 6.1 | 3.0 | 2.1 | 4.5 |

4: McKnight Road & Nebraska Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 20.6 | 5.3 | 1.3 | 0.5 | 5.7 | 1.4 | 1.4 |

5: McKnight Road & Arlington Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|------|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.4 | 3.6 | 0.1 | 0.1 | 3.0 | 0.8 | 0.8 | 0.0 | 0.0 | 0.0 | 0.7 |
| Total Del/Veh (s) | 21.0 | 7.4 | 20.4 | 8.1 | 4.5 | 1.4 | 0.3 | 5.1 | 2.0 | 1.6 | 2.5 |

6: Hawthorne Avenue & Ivy Avenue Performance by movement

| Movement | EBL | EBT | WBL | WBT | NBL | NBR | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.2 | 0.2 | 0.1 | 0.2 | 0.3 | 0.1 | 0.1 | 0.2 |
| Total Del/Veh (s) | 2.1 | 0.5 | 2.0 | 0.3 | 5.9 | 3.0 | 2.7 | 1.3 |

7: Winthrop Street & Larpenteur Avenue Performance by movement

| Movement | EBT | EBR | WBT | NBL | All |
|--------------------|-----|-----|-----|------|-----|
| Denied Del/Veh (s) | 0.3 | 0.4 | 0.0 | 0.1 | 0.2 |
| Total Del/Veh (s) | 1.4 | 1.1 | 1.1 | 12.8 | 2.0 |

8: McKnight Road & N Site Access Performance by movement

| Movement | EBR | NBT | SBT | SBR | All |
|--------------------|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 7.8 | 6.7 | 4.0 | 1.7 | 5.6 |

Total Network Performance

| | |
|--------------------|------|
| Denied Del/Veh (s) | 1.0 |
| Total Del/Veh (s) | 30.2 |

Intersection: 1: Larpenteur Avenue & Howard Street

| Movement | EB | WB | NB | NB | SB |
|-----------------------|-----|-----|-----|-----|-----|
| Directions Served | LTR | LTR | LT | R | LTR |
| Maximum Queue (ft) | 32 | 92 | 79 | 78 | 31 |
| Average Queue (ft) | 2 | 15 | 35 | 36 | 11 |
| 95th Queue (ft) | 19 | 58 | 63 | 60 | 35 |
| Link Distance (ft) | 582 | 565 | 738 | | 923 |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | | | | 200 | |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

Intersection: 2: Larpenteur Avenue & McKnight Road

| Movement | EB | EB | EB | WB | WB | WB | NB | NB | NB | SB | SB | SB |
|-----------------------|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|------|-----|
| Directions Served | L | T | R | L | T | R | L | T | R | L | T | R |
| Maximum Queue (ft) | 119 | 244 | 118 | 72 | 204 | 102 | 275 | 289 | 217 | 205 | 363 | 215 |
| Average Queue (ft) | 61 | 125 | 30 | 32 | 111 | 33 | 120 | 237 | 32 | 78 | 188 | 23 |
| 95th Queue (ft) | 107 | 210 | 89 | 66 | 179 | 69 | 239 | 323 | 140 | 153 | 306 | 93 |
| Link Distance (ft) | | 565 | | | 1457 | | | 276 | | | 1062 | |
| Upstream Blk Time (%) | | | | | | | 0 | 5 | 0 | | | |
| Queuing Penalty (veh) | | | | | | | 0 | 45 | 0 | | | |
| Storage Bay Dist (ft) | 300 | | 250 | 250 | | 250 | 300 | | 250 | 250 | | 250 |
| Storage Blk Time (%) | | 0 | 0 | | | | 0 | 10 | 0 | | 3 | 0 |
| Queuing Penalty (veh) | | 1 | 0 | | | | 0 | 20 | 0 | | 5 | 0 |

Intersection: 3: McKnight Road & Montana Avenue

| Movement | EB | EB | WB | NB | SB | SB |
|-----------------------|------|-----|------|-----|-----|------|
| Directions Served | LT | R | LTR | L | L | TR |
| Maximum Queue (ft) | 117 | 59 | 36 | 45 | 30 | 26 |
| Average Queue (ft) | 57 | 21 | 15 | 9 | 4 | 1 |
| 95th Queue (ft) | 109 | 51 | 39 | 31 | 20 | 9 |
| Link Distance (ft) | 1504 | | 1450 | | | 1085 |
| Upstream Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |
| Storage Bay Dist (ft) | | 200 | | 300 | 300 | |
| Storage Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |

Intersection: 4: McKnight Road & Nebraska Avenue

| Movement | WB | SB |
|-----------------------|------|-----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 36 | 31 |
| Average Queue (ft) | 14 | 4 |
| 95th Queue (ft) | 39 | 21 |
| Link Distance (ft) | 1260 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | 150 |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 5: McKnight Road & Arlington Avenue

| Movement | EB | EB | WB | NB | SB | SB |
|-----------------------|-----|-----|------|-----|-----|-----|
| Directions Served | LT | R | LTR | L | L | TR |
| Maximum Queue (ft) | 59 | 79 | 40 | 41 | 30 | 5 |
| Average Queue (ft) | 18 | 38 | 10 | 14 | 4 | 0 |
| 95th Queue (ft) | 49 | 62 | 35 | 34 | 19 | 3 |
| Link Distance (ft) | 923 | | 1146 | | | 797 |
| Upstream Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |
| Storage Bay Dist (ft) | | 200 | | 150 | 150 | |
| Storage Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |

Intersection: 6: Hawthorne Avenue & Ivy Avenue

| Movement | EB | WB | NB | SB |
|-----------------------|------|-----|------|-----|
| Directions Served | LTR | LTR | LTR | LTR |
| Maximum Queue (ft) | 35 | 34 | 50 | 38 |
| Average Queue (ft) | 4 | 3 | 24 | 19 |
| 95th Queue (ft) | 21 | 18 | 47 | 41 |
| Link Distance (ft) | 1004 | 484 | 1278 | 645 |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | | | | |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

Intersection: 7: Winthrop Street & Larpenteur Avenue

| Movement | NB |
|-----------------------|-----|
| Directions Served | LR |
| Maximum Queue (ft) | 75 |
| Average Queue (ft) | 35 |
| 95th Queue (ft) | 65 |
| Link Distance (ft) | 779 |
| Upstream Blk Time (%) | |
| Queuing Penalty (veh) | |
| Storage Bay Dist (ft) | |
| Storage Blk Time (%) | |
| Queuing Penalty (veh) | |

Intersection: 8: McKnight Road & N Site Access

| Movement | EB | NB |
|-----------------------|-----|------|
| Directions Served | R | T |
| Maximum Queue (ft) | 69 | 199 |
| Average Queue (ft) | 23 | 51 |
| 95th Queue (ft) | 52 | 166 |
| Link Distance (ft) | 434 | 1085 |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Network Summary

| |
|----------------------------------|
| Network wide Queuing Penalty: 71 |
|----------------------------------|

1: Larpenteur Avenue & Howard Street Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBR | SBL | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|------|-----|------|-----|-----|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 |
| Total Del/Veh (s) | 4.4 | 1.3 | 0.7 | 5.3 | 2.8 | 3.1 | 10.4 | 4.8 | 11.6 | 3.9 | 2.8 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|--------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Denied Del/Veh (s) | 0.6 | 0.1 | 0.1 | 2.7 | 0.4 | 0.4 | 0.0 | 0.0 | 0.0 | 4.7 | 2.4 | 2.5 |
| Total Del/Veh (s) | 38.2 | 35.5 | 26.4 | 39.5 | 44.2 | 35.1 | 72.7 | 24.6 | 24.6 | 95.3 | 67.2 | 59.8 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | All |
|--------------------|------|
| Denied Del/Veh (s) | 1.1 |
| Total Del/Veh (s) | 47.4 |

3: McKnight Road & Montana Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 47.5 | 20.5 | 27.2 | 10.4 | 7.7 | 1.2 | 0.3 | 4.2 | 3.2 | 2.3 | 4.3 |

4: McKnight Road & Nebraska Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 20.0 | 5.0 | 1.0 | 0.7 | 5.6 | 1.5 | 1.3 |

5: McKnight Road & Arlington Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|------|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.1 | 0.1 | 3.0 | 0.8 | 0.9 | 0.0 | 0.0 | 0.0 | 0.5 |
| Total Del/Veh (s) | 27.2 | 9.6 | 29.2 | 6.4 | 5.5 | 1.2 | 0.4 | 5.8 | 2.2 | 1.8 | 2.4 |

6: Hawthorne Avenue & Ivy Avenue Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | NBL | NBR | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Total Del/Veh (s) | 2.0 | 0.6 | 0.3 | 2.0 | 0.4 | 4.3 | 2.8 | 2.4 | 1.3 |

7: Winthrop Street & Larpenteur Avenue Performance by movement

| Movement | EBT | EBR | WBT | NBL | All |
|--------------------|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.3 | 0.3 | 0.0 | 0.1 | 0.2 |
| Total Del/Veh (s) | 1.4 | 0.8 | 0.9 | 8.8 | 1.3 |

8: McKnight Road & N Site Access Performance by movement

| Movement | EBR | NBT | SBT | SBR | All |
|--------------------|------|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 11.3 | 9.0 | 4.1 | 1.8 | 6.5 |

Total Network Performance

| | |
|--------------------|------|
| Denied Del/Veh (s) | 1.1 |
| Total Del/Veh (s) | 45.9 |

Intersection: 1: Larpenteur Avenue & Howard Street

| Movement | EB | WB | NB | SB |
|-----------------------|-----|-----|-----|-----|
| Directions Served | LTR | LTR | LTR | LTR |
| Maximum Queue (ft) | 53 | 147 | 85 | 42 |
| Average Queue (ft) | 3 | 22 | 34 | 17 |
| 95th Queue (ft) | 22 | 79 | 67 | 42 |
| Link Distance (ft) | 582 | 591 | 738 | 923 |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | | | | |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

Intersection: 2: Larpenteur Avenue & McKnight Road

| Movement | EB | EB | WB | WB | NB | NB | SB | SB |
|-----------------------|-----|-----|-----|------|-----|-----|-----|------|
| Directions Served | L | TR | L | TR | L | TR | L | TR |
| Maximum Queue (ft) | 174 | 355 | 174 | 405 | 174 | 301 | 174 | 934 |
| Average Queue (ft) | 70 | 164 | 67 | 222 | 153 | 250 | 102 | 513 |
| 95th Queue (ft) | 160 | 293 | 169 | 376 | 200 | 343 | 192 | 908 |
| Link Distance (ft) | | 591 | | 1469 | | 288 | | 1075 |
| Upstream Blk Time (%) | | | | | | 9 | | 3 |
| Queuing Penalty (veh) | | | | | | 66 | | 0 |
| Storage Bay Dist (ft) | 150 | | 150 | | 150 | | 150 | |
| Storage Blk Time (%) | 0 | 11 | 0 | 24 | 16 | 23 | 2 | 45 |
| Queuing Penalty (veh) | 1 | 8 | 1 | 17 | 90 | 36 | 12 | 45 |

Intersection: 3: McKnight Road & Montana Avenue

| Movement | EB | WB | NB | SB | SB |
|-----------------------|------|------|-----|-----|------|
| Directions Served | LTR | LTR | L | L | TR |
| Maximum Queue (ft) | 142 | 75 | 66 | 15 | 18 |
| Average Queue (ft) | 47 | 32 | 19 | 0 | 1 |
| 95th Queue (ft) | 101 | 66 | 51 | 7 | 11 |
| Link Distance (ft) | 1504 | 1450 | | | 1085 |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | | | 300 | 300 | |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

Intersection: 4: McKnight Road & Nebraska Avenue

| Movement | WB | SB |
|-----------------------|------|-----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 48 | 31 |
| Average Queue (ft) | 10 | 2 |
| 95th Queue (ft) | 36 | 14 |
| Link Distance (ft) | 1260 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | 150 |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 5: McKnight Road & Arlington Avenue

| Movement | EB | WB | NB | SB | SB |
|-----------------------|-----|------|-----|-----|-----|
| Directions Served | LTR | LTR | L | L | TR |
| Maximum Queue (ft) | 68 | 44 | 63 | 30 | 11 |
| Average Queue (ft) | 33 | 16 | 21 | 4 | 0 |
| 95th Queue (ft) | 59 | 41 | 49 | 21 | 5 |
| Link Distance (ft) | 923 | 1146 | | | 797 |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | | | 150 | 150 | |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

Intersection: 6: Hawthorne Avenue & Ivy Avenue

| Movement | EB | WB | NB | SB |
|-----------------------|------|-----|------|-----|
| Directions Served | LTR | LTR | LTR | LTR |
| Maximum Queue (ft) | 22 | 32 | 50 | 52 |
| Average Queue (ft) | 2 | 3 | 14 | 18 |
| 95th Queue (ft) | 13 | 17 | 41 | 43 |
| Link Distance (ft) | 1004 | 484 | 1278 | 645 |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | | | | |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

Intersection: 7: Winthrop Street & Larpenteur Avenue

| Movement | NB |
|-----------------------|-----|
| Directions Served | LR |
| Maximum Queue (ft) | 57 |
| Average Queue (ft) | 22 |
| 95th Queue (ft) | 50 |
| Link Distance (ft) | 779 |
| Upstream Blk Time (%) | |
| Queuing Penalty (veh) | |
| Storage Bay Dist (ft) | |
| Storage Blk Time (%) | |
| Queuing Penalty (veh) | |

Intersection: 8: McKnight Road & N Site Access

| Movement | EB | NB |
|-----------------------|-----|------|
| Directions Served | R | T |
| Maximum Queue (ft) | 41 | 352 |
| Average Queue (ft) | 11 | 78 |
| 95th Queue (ft) | 36 | 254 |
| Link Distance (ft) | 434 | 1085 |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Network Summary

| |
|-----------------------------------|
| Network wide Queuing Penalty: 276 |
|-----------------------------------|

1: Larpenteur Avenue & Howard Street Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBR | SBL | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|------|-----|------|-----|-----|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 4.1 | 0.1 | 0.1 | 0.2 |
| Total Del/Veh (s) | 4.2 | 1.3 | 0.7 | 5.0 | 2.9 | 3.2 | 12.4 | 3.9 | 10.5 | 4.3 | 2.8 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|--------------------|------|------|------|------|------|------|------|------|-----|------|------|------|
| Denied Del/Veh (s) | 0.0 | 0.1 | 0.6 | 2.7 | 0.6 | 2.5 | 0.0 | 0.0 | 0.0 | 3.1 | 1.0 | 3.0 |
| Total Del/Veh (s) | 32.7 | 28.2 | 12.3 | 27.7 | 30.6 | 11.8 | 49.5 | 20.9 | 4.1 | 55.8 | 34.8 | 10.8 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | All |
|--------------------|------|
| Denied Del/Veh (s) | 0.8 |
| Total Del/Veh (s) | 28.4 |

3: McKnight Road & Montana Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|------|-----|------|------|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.2 | 2.4 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 37.4 | 9.6 | 28.8 | 11.9 | 8.9 | 1.2 | 0.3 | 7.4 | 3.7 | 2.9 | 4.2 |

4: McKnight Road & Nebraska Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 19.4 | 4.8 | 1.0 | 0.8 | 4.8 | 1.6 | 1.4 |

5: McKnight Road & Arlington Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|------|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 3.7 | 0.1 | 0.1 | 3.0 | 0.8 | 0.9 | 0.0 | 0.0 | 0.0 | 0.6 |
| Total Del/Veh (s) | 27.9 | 8.9 | 28.8 | 6.5 | 6.6 | 1.2 | 0.4 | 5.0 | 2.2 | 1.7 | 2.5 |

6: Hawthorne Avenue & Ivy Avenue Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | NBL | NBR | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Total Del/Veh (s) | 2.0 | 0.6 | 0.3 | 2.0 | 0.4 | 4.3 | 2.8 | 2.4 | 1.3 |

7: Winthrop Street & Larpenteur Avenue Performance by movement

| Movement | EBT | EBR | WBT | NBL | All |
|--------------------|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.3 | 0.3 | 0.0 | 0.1 | 0.2 |
| Total Del/Veh (s) | 1.4 | 0.8 | 1.0 | 9.2 | 1.4 |

8: McKnight Road & N Site Access Performance by movement

| Movement | EBR | NBT | SBT | SBR | All |
|--------------------|------|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 14.8 | 4.5 | 4.3 | 1.9 | 4.5 |

Total Network Performance

| | |
|--------------------|------|
| Denied Del/Veh (s) | 1.1 |
| Total Del/Veh (s) | 30.9 |

Intersection: 1: Larpenteur Avenue & Howard Street

| Movement | EB | WB | NB | NB | SB |
|-----------------------|-----|-----|-----|-----|-----|
| Directions Served | LTR | LTR | LT | R | LTR |
| Maximum Queue (ft) | 59 | 126 | 66 | 77 | 42 |
| Average Queue (ft) | 4 | 19 | 21 | 24 | 17 |
| 95th Queue (ft) | 25 | 70 | 54 | 53 | 43 |
| Link Distance (ft) | 582 | 565 | 738 | | 923 |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | | | | 200 | |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

Intersection: 2: Larpenteur Avenue & McKnight Road

| Movement | EB | EB | EB | WB | WB | WB | NB | NB | NB | SB | SB | SB |
|-----------------------|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|------|-----|
| Directions Served | L | T | R | L | T | R | L | T | R | L | T | R |
| Maximum Queue (ft) | 128 | 159 | 117 | 134 | 263 | 145 | 232 | 292 | 209 | 249 | 507 | 275 |
| Average Queue (ft) | 47 | 70 | 46 | 37 | 116 | 42 | 118 | 194 | 16 | 97 | 257 | 57 |
| 95th Queue (ft) | 98 | 131 | 86 | 89 | 201 | 95 | 193 | 300 | 86 | 226 | 418 | 203 |
| Link Distance (ft) | | 565 | | | 1457 | | | 276 | | | 1062 | |
| Upstream Blk Time (%) | | | | | | | 0 | 2 | 0 | | | |
| Queuing Penalty (veh) | | | | | | | 0 | 16 | 0 | | | |
| Storage Bay Dist (ft) | 300 | | 250 | 250 | | 250 | 300 | | 250 | 250 | | 250 |
| Storage Blk Time (%) | | | | | 0 | | 0 | 4 | 0 | 0 | 10 | 0 |
| Queuing Penalty (veh) | | | | | 1 | | 0 | 7 | 0 | 0 | 18 | 0 |

Intersection: 3: McKnight Road & Montana Avenue

| Movement | EB | EB | WB | NB | SB | SB |
|-----------------------|------|-----|------|-----|-----|------|
| Directions Served | LT | R | LTR | L | L | TR |
| Maximum Queue (ft) | 107 | 37 | 75 | 61 | 30 | 5 |
| Average Queue (ft) | 36 | 14 | 32 | 17 | 1 | 0 |
| 95th Queue (ft) | 82 | 39 | 66 | 49 | 10 | 6 |
| Link Distance (ft) | 1504 | | 1450 | | | 1085 |
| Upstream Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |
| Storage Bay Dist (ft) | | 200 | | 300 | 300 | |
| Storage Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |

Intersection: 4: McKnight Road & Nebraska Avenue

| Movement | WB | SB |
|-----------------------|------|-----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 42 | 23 |
| Average Queue (ft) | 10 | 2 |
| 95th Queue (ft) | 35 | 15 |
| Link Distance (ft) | 1260 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | 150 |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 5: McKnight Road & Arlington Avenue

| Movement | EB | EB | WB | NB | SB | SB |
|-----------------------|-----|-----|------|-----|-----|-----|
| Directions Served | LT | R | LTR | L | L | TR |
| Maximum Queue (ft) | 47 | 63 | 50 | 67 | 30 | 16 |
| Average Queue (ft) | 12 | 28 | 16 | 20 | 3 | 1 |
| 95th Queue (ft) | 39 | 53 | 43 | 47 | 19 | 7 |
| Link Distance (ft) | 923 | | 1146 | | | 797 |
| Upstream Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |
| Storage Bay Dist (ft) | | 200 | | 150 | 150 | |
| Storage Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |

Intersection: 6: Hawthorne Avenue & Ivy Avenue

| Movement | EB | WB | NB | SB |
|-----------------------|------|-----|------|-----|
| Directions Served | LTR | LTR | LTR | LTR |
| Maximum Queue (ft) | 22 | 32 | 50 | 52 |
| Average Queue (ft) | 2 | 3 | 14 | 18 |
| 95th Queue (ft) | 13 | 17 | 41 | 43 |
| Link Distance (ft) | 1004 | 484 | 1278 | 645 |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | | | | |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

Intersection: 7: Winthrop Street & Larpenteur Avenue

| Movement | EB | NB |
|-----------------------|------|-----|
| Directions Served | TR | LR |
| Maximum Queue (ft) | 5 | 61 |
| Average Queue (ft) | 0 | 22 |
| 95th Queue (ft) | 3 | 52 |
| Link Distance (ft) | 1342 | 779 |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 8: McKnight Road & N Site Access

| Movement | EB | NB |
|-----------------------|-----|------|
| Directions Served | R | T |
| Maximum Queue (ft) | 41 | 198 |
| Average Queue (ft) | 11 | 21 |
| 95th Queue (ft) | 36 | 102 |
| Link Distance (ft) | 434 | 1085 |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Network Summary

| |
|----------------------------------|
| Network wide Queuing Penalty: 43 |
|----------------------------------|

1: Larpenteur Avenue & Howard Street Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBR | SBL | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|------|-----|------|-----|-----|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.2 | 0.1 | 0.2 | 0.0 |
| Total Del/Veh (s) | 2.5 | 1.3 | 0.7 | 5.4 | 2.5 | 1.1 | 12.3 | 6.6 | 12.6 | 4.8 | 2.9 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|--------------------|------|------|------|------|------|------|------|------|------|-------|------|------|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 2.5 | 0.4 | 0.4 | 0.0 | 0.0 | 0.0 | 6.2 | 3.5 | 3.5 |
| Total Del/Veh (s) | 50.4 | 48.0 | 40.0 | 40.0 | 42.4 | 31.7 | 78.7 | 36.6 | 28.9 | 108.8 | 55.3 | 50.9 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | All |
|--------------------|------|
| Denied Del/Veh (s) | 1.2 |
| Total Del/Veh (s) | 49.4 |

3: McKnight Road & Montana Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|-------|-------|------|------|-----|-----|-----|------|-----|-----|------|
| Denied Del/Veh (s) | 0.2 | 0.2 | 0.1 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 291.1 | 300.9 | 56.6 | 72.8 | 6.7 | 8.5 | 5.9 | 13.9 | 2.5 | 1.6 | 24.9 |

4: McKnight Road & Nebraska Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 46.5 | 8.0 | 1.5 | 0.5 | 6.6 | 1.3 | 1.6 |

5: McKnight Road & Arlington Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.2 | 0.1 | 0.1 | 2.9 | 0.8 | 0.7 | 0.0 | 0.0 | 0.0 | 0.5 |
| Total Del/Veh (s) | 22.1 | 11.9 | 21.4 | 6.3 | 4.2 | 1.3 | 0.5 | 6.6 | 2.0 | 1.4 | 2.6 |

6: Hawthorne Avenue & Ivy Avenue Performance by movement

| Movement | EBL | EBT | WBL | WBT | NBL | NBR | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 |
| Total Del/Veh (s) | 2.3 | 0.6 | 1.9 | 0.4 | 5.8 | 3.0 | 3.0 | 1.4 |

7: Winthrop Street & Larpenteur Avenue Performance by movement

| Movement | EBT | EBR | WBT | NBL | All |
|--------------------|-----|-----|-----|------|-----|
| Denied Del/Veh (s) | 0.4 | 0.4 | 0.0 | 0.1 | 0.2 |
| Total Del/Veh (s) | 1.3 | 0.9 | 0.9 | 10.9 | 1.6 |

8: McKnight Road & N Site Access Performance by movement

| Movement | EBR | NBT | SBT | SBR | All |
|--------------------|------|------|-----|-----|------|
| Denied Del/Veh (s) | 0.1 | 1.6 | 0.0 | 0.0 | 0.9 |
| Total Del/Veh (s) | 10.5 | 94.4 | 3.9 | 2.1 | 54.2 |

Total Network Performance

| | |
|--------------------|------|
| Denied Del/Veh (s) | 1.7 |
| Total Del/Veh (s) | 79.2 |

Intersection: 1: Larpenteur Avenue & Howard Street

| Movement | EB | WB | NB | SB |
|-----------------------|-----|-----|-----|-----|
| Directions Served | LTR | LTR | LTR | LTR |
| Maximum Queue (ft) | 39 | 84 | 94 | 37 |
| Average Queue (ft) | 3 | 12 | 45 | 9 |
| 95th Queue (ft) | 20 | 50 | 76 | 32 |
| Link Distance (ft) | 582 | 591 | 738 | 923 |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | | | | |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

Intersection: 2: Larpenteur Avenue & McKnight Road

| Movement | EB | EB | WB | WB | NB | NB | SB | SB |
|-----------------------|-----|-----|-----|------|-----|-----|-----|------|
| Directions Served | L | TR | L | TR | L | TR | L | TR |
| Maximum Queue (ft) | 174 | 517 | 174 | 392 | 175 | 302 | 174 | 668 |
| Average Queue (ft) | 109 | 263 | 56 | 185 | 137 | 292 | 132 | 411 |
| 95th Queue (ft) | 209 | 454 | 142 | 321 | 209 | 317 | 212 | 886 |
| Link Distance (ft) | | 591 | | 1469 | | 288 | | 1075 |
| Upstream Blk Time (%) | | 0 | | | | 37 | | 6 |
| Queuing Penalty (veh) | | 0 | | | | 333 | | 0 |
| Storage Bay Dist (ft) | 150 | | 150 | | 150 | | 150 | |
| Storage Blk Time (%) | 0 | 30 | 0 | 17 | 8 | 48 | 11 | 27 |
| Queuing Penalty (veh) | 2 | 31 | 0 | 8 | 57 | 75 | 61 | 34 |

Intersection: 3: McKnight Road & Montana Avenue

| Movement | EB | WB | NB | NB | SB |
|-----------------------|------|------|-----|-----|-----|
| Directions Served | LTR | LTR | L | TR | L |
| Maximum Queue (ft) | 625 | 73 | 114 | 341 | 30 |
| Average Queue (ft) | 232 | 22 | 13 | 62 | 5 |
| 95th Queue (ft) | 647 | 56 | 66 | 254 | 24 |
| Link Distance (ft) | 1504 | 1450 | | 586 | |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | | | 300 | | 300 |
| Storage Blk Time (%) | | | | 2 | |
| Queuing Penalty (veh) | | | | 1 | |

Intersection: 4: McKnight Road & Nebraska Avenue

| Movement | WB | SB |
|-----------------------|------|-----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 36 | 31 |
| Average Queue (ft) | 12 | 5 |
| 95th Queue (ft) | 36 | 24 |
| Link Distance (ft) | 1260 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | 150 |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 5: McKnight Road & Arlington Avenue

| Movement | EB | WB | NB | SB |
|-----------------------|-----|------|-----|-----|
| Directions Served | LTR | LTR | L | L |
| Maximum Queue (ft) | 117 | 40 | 34 | 35 |
| Average Queue (ft) | 46 | 10 | 15 | 4 |
| 95th Queue (ft) | 86 | 33 | 37 | 20 |
| Link Distance (ft) | 923 | 1146 | | |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | | | 150 | 150 |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

Intersection: 6: Hawthorne Avenue & Ivy Avenue

| Movement | EB | WB | NB | SB |
|-----------------------|------|-----|------|-----|
| Directions Served | LTR | LTR | LTR | LTR |
| Maximum Queue (ft) | 40 | 27 | 55 | 55 |
| Average Queue (ft) | 4 | 2 | 27 | 23 |
| 95th Queue (ft) | 22 | 15 | 48 | 46 |
| Link Distance (ft) | 1004 | 484 | 1278 | 645 |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | | | | |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

Intersection: 7: Winthrop Street & Larpenteur Avenue

| Movement | NB |
|-----------------------|-----|
| Directions Served | LR |
| Maximum Queue (ft) | 69 |
| Average Queue (ft) | 28 |
| 95th Queue (ft) | 58 |
| Link Distance (ft) | 779 |
| Upstream Blk Time (%) | |
| Queuing Penalty (veh) | |
| Storage Bay Dist (ft) | |
| Storage Blk Time (%) | |
| Queuing Penalty (veh) | |

Intersection: 8: McKnight Road & N Site Access

| Movement | EB | NB |
|-----------------------|-----|------|
| Directions Served | R | T |
| Maximum Queue (ft) | 59 | 1096 |
| Average Queue (ft) | 22 | 751 |
| 95th Queue (ft) | 52 | 1382 |
| Link Distance (ft) | 434 | 1085 |
| Upstream Blk Time (%) | | 3 |
| Queuing Penalty (veh) | | 31 |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Network Summary

| |
|-----------------------------------|
| Network wide Queuing Penalty: 633 |
|-----------------------------------|

1: Larpenteur Avenue & Howard Street Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBR | SBL | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|------|-----|------|-----|-----|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 4.0 | 0.1 | 0.2 | 0.3 |
| Total Del/Veh (s) | 4.3 | 1.3 | 0.7 | 5.6 | 2.6 | 1.2 | 12.5 | 4.9 | 13.5 | 4.3 | 2.8 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|--------------------|------|------|-----|------|------|------|------|------|-----|------|------|------|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 2.6 | 0.5 | 2.8 | 0.0 | 0.0 | 0.0 | 3.6 | 1.3 | 3.4 |
| Total Del/Veh (s) | 29.1 | 29.5 | 9.9 | 27.4 | 30.2 | 16.3 | 47.8 | 32.0 | 8.4 | 88.4 | 34.4 | 16.8 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | All |
|--------------------|------|
| Denied Del/Veh (s) | 0.7 |
| Total Del/Veh (s) | 33.2 |

3: McKnight Road & Montana Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|------|-----|------|------|-----|-----|-----|------|-----|-----|-----|
| Denied Del/Veh (s) | 0.2 | 2.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 42.5 | 7.5 | 33.8 | 13.0 | 5.3 | 1.8 | 0.3 | 11.4 | 2.9 | 1.8 | 4.4 |

4: McKnight Road & Nebraska Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 22.5 | 6.4 | 1.3 | 0.6 | 7.7 | 1.4 | 1.5 |

5: McKnight Road & Arlington Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|------|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.4 | 3.5 | 0.1 | 0.1 | 2.9 | 0.8 | 0.7 | 0.0 | 0.0 | 0.0 | 0.7 |
| Total Del/Veh (s) | 22.9 | 8.2 | 21.0 | 6.4 | 4.0 | 1.3 | 0.5 | 7.6 | 2.1 | 1.0 | 2.5 |

6: Hawthorne Avenue & Ivy Avenue Performance by movement

| Movement | EBL | EBT | WBL | WBT | NBL | NBR | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 |
| Total Del/Veh (s) | 2.3 | 0.6 | 1.9 | 0.4 | 5.8 | 3.0 | 3.0 | 1.4 |

7: Winthrop Street & Larpenteur Avenue Performance by movement

| Movement | EBT | EBR | WBT | NBL | All |
|--------------------|-----|-----|-----|------|-----|
| Denied Del/Veh (s) | 0.4 | 0.4 | 0.0 | 0.1 | 0.2 |
| Total Del/Veh (s) | 1.3 | 0.9 | 1.0 | 10.9 | 1.6 |

8: McKnight Road & N Site Access Performance by movement

| Movement | EBR | NBT | SBT | SBR | All |
|--------------------|------|------|-----|-----|------|
| Denied Del/Veh (s) | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 10.3 | 25.2 | 3.9 | 2.2 | 16.0 |

Total Network Performance

| | |
|--------------------|------|
| Denied Del/Veh (s) | 1.1 |
| Total Del/Veh (s) | 39.9 |

Intersection: 1: Larpenteur Avenue & Howard Street

| Movement | EB | WB | NB | NB | SB |
|-----------------------|-----|-----|-----|-----|-----|
| Directions Served | LTR | LTR | LT | R | LTR |
| Maximum Queue (ft) | 69 | 87 | 68 | 70 | 37 |
| Average Queue (ft) | 5 | 13 | 30 | 32 | 9 |
| 95th Queue (ft) | 38 | 51 | 57 | 54 | 31 |
| Link Distance (ft) | 582 | 565 | 738 | | 923 |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | | | | 200 | |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

Intersection: 2: Larpenteur Avenue & McKnight Road

| Movement | EB | EB | EB | WB | WB | WB | NB | NB | NB | SB | SB | SB |
|-----------------------|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|------|-----|
| Directions Served | L | T | R | L | T | R | L | T | R | L | T | R |
| Maximum Queue (ft) | 136 | 282 | 178 | 87 | 226 | 89 | 275 | 292 | 220 | 274 | 545 | 164 |
| Average Queue (ft) | 58 | 133 | 38 | 30 | 106 | 35 | 136 | 268 | 30 | 115 | 252 | 24 |
| 95th Queue (ft) | 109 | 232 | 98 | 66 | 186 | 72 | 263 | 328 | 131 | 239 | 584 | 105 |
| Link Distance (ft) | | 565 | | | 1457 | | | 276 | | | 1062 | |
| Upstream Blk Time (%) | | | | | | | 0 | 19 | 0 | | 1 | |
| Queuing Penalty (veh) | | | | | | | 0 | 175 | 0 | | 0 | |
| Storage Bay Dist (ft) | 300 | | 250 | 250 | | 250 | 300 | | 250 | 250 | | 250 |
| Storage Blk Time (%) | | 1 | 0 | | 0 | | 0 | 27 | 0 | 6 | 4 | 0 |
| Queuing Penalty (veh) | | 1 | 0 | | 0 | | 1 | 57 | 0 | 34 | 7 | 0 |

Intersection: 3: McKnight Road & Montana Avenue

| Movement | EB | EB | WB | NB | SB | SB |
|-----------------------|------|-----|------|-----|-----|------|
| Directions Served | LT | R | LTR | L | L | TR |
| Maximum Queue (ft) | 138 | 67 | 54 | 42 | 36 | 10 |
| Average Queue (ft) | 53 | 21 | 18 | 8 | 5 | 0 |
| 95th Queue (ft) | 111 | 51 | 47 | 27 | 24 | 5 |
| Link Distance (ft) | 1504 | | 1450 | | | 1085 |
| Upstream Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |
| Storage Bay Dist (ft) | | 200 | | 300 | 300 | |
| Storage Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |

Intersection: 4: McKnight Road & Nebraska Avenue

| Movement | WB | SB |
|-----------------------|------|-----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 36 | 41 |
| Average Queue (ft) | 12 | 6 |
| 95th Queue (ft) | 36 | 27 |
| Link Distance (ft) | 1260 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | 150 |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 5: McKnight Road & Arlington Avenue

| Movement | EB | EB | WB | NB | SB | SB |
|-----------------------|-----|-----|------|-----|-----|-----|
| Directions Served | LT | R | LTR | L | L | TR |
| Maximum Queue (ft) | 57 | 88 | 40 | 35 | 30 | 11 |
| Average Queue (ft) | 23 | 36 | 10 | 9 | 4 | 0 |
| 95th Queue (ft) | 53 | 66 | 33 | 28 | 20 | 5 |
| Link Distance (ft) | 923 | | 1146 | | | 797 |
| Upstream Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |
| Storage Bay Dist (ft) | | 200 | | 150 | 150 | |
| Storage Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |

Intersection: 6: Hawthorne Avenue & Ivy Avenue

| Movement | EB | WB | NB | SB |
|-----------------------|------|-----|------|-----|
| Directions Served | LTR | LTR | LTR | LTR |
| Maximum Queue (ft) | 40 | 27 | 55 | 55 |
| Average Queue (ft) | 4 | 2 | 27 | 23 |
| 95th Queue (ft) | 22 | 15 | 48 | 46 |
| Link Distance (ft) | 1004 | 484 | 1278 | 645 |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | | | | |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

Intersection: 7: Winthrop Street & Larpenteur Avenue

| Movement | EB | NB |
|-----------------------|------|-----|
| Directions Served | TR | LR |
| Maximum Queue (ft) | 6 | 83 |
| Average Queue (ft) | 0 | 28 |
| 95th Queue (ft) | 3 | 64 |
| Link Distance (ft) | 1342 | 779 |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 8: McKnight Road & N Site Access

| Movement | EB | NB |
|-----------------------|-----|------|
| Directions Served | R | T |
| Maximum Queue (ft) | 64 | 714 |
| Average Queue (ft) | 22 | 240 |
| 95th Queue (ft) | 52 | 615 |
| Link Distance (ft) | 434 | 1085 |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Network Summary

| |
|-----------------------------------|
| Network wide Queuing Penalty: 274 |
|-----------------------------------|

1: Larpenteur Avenue & Howard Street Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBR | SBL | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.2 | 0.1 | 0.1 | 0.0 |
| Total Del/Veh (s) | 3.0 | 1.6 | 0.8 | 5.5 | 3.1 | 2.7 | 12.6 | 6.9 | 9.2 | 5.5 | 3.8 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|--------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Denied Del/Veh (s) | 0.6 | 0.1 | 0.2 | 2.4 | 0.5 | 0.5 | 0.0 | 0.0 | 0.0 | 3.2 | 1.0 | 0.9 |
| Total Del/Veh (s) | 58.5 | 43.4 | 33.3 | 92.3 | 97.2 | 93.3 | 32.6 | 19.0 | 16.3 | 44.3 | 44.5 | 38.4 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | All |
|--------------------|------|
| Denied Del/Veh (s) | 0.6 |
| Total Del/Veh (s) | 46.3 |

3: McKnight Road & Montana Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|-------|-------|------|------|------|-----|-----|-----|-----|-----|------|
| Denied Del/Veh (s) | 0.2 | 0.2 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 204.9 | 169.1 | 43.3 | 17.3 | 10.9 | 1.3 | 0.3 | 6.4 | 3.6 | 2.7 | 19.1 |

4: McKnight Road & Nebraska Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 21.5 | 6.5 | 1.0 | 0.3 | 6.2 | 1.5 | 1.4 |

5: McKnight Road & Arlington Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.2 | 0.2 | 0.1 | 0.1 | 3.1 | 0.9 | 0.6 | 0.0 | 0.0 | 0.0 | 0.6 |
| Total Del/Veh (s) | 43.5 | 21.9 | 21.6 | 7.8 | 7.5 | 1.9 | 0.8 | 6.3 | 2.3 | 1.5 | 4.4 |

6: Hawthorne Avenue & Ivy Avenue Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | NBL | NBR | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Total Del/Veh (s) | 2.2 | 0.7 | 0.1 | 1.9 | 0.4 | 3.0 | 2.6 | 2.9 | 1.7 |

7: Winthrop Street & Larpenteur Avenue Performance by movement

| Movement | EBT | EBR | WBT | NBL | All |
|--------------------|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.3 | 0.4 | 0.0 | 0.1 | 0.2 |
| Total Del/Veh (s) | 1.5 | 1.1 | 0.9 | 9.7 | 1.8 |

8: McKnight Road & N Site Access Performance by movement

| Movement | EBR | NBT | SBT | SBR | All |
|--------------------|------|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 14.6 | 4.7 | 4.4 | 2.2 | 4.7 |

Total Network Performance

| | |
|--------------------|------|
| Denied Del/Veh (s) | 0.8 |
| Total Del/Veh (s) | 49.6 |

Intersection: 1: Larpenteur Avenue & Howard Street

| Movement | EB | WB | NB | SB |
|-----------------------|-----|-----|-----|-----|
| Directions Served | LTR | LTR | LTR | LTR |
| Maximum Queue (ft) | 14 | 138 | 131 | 52 |
| Average Queue (ft) | 1 | 32 | 53 | 20 |
| 95th Queue (ft) | 9 | 92 | 92 | 46 |
| Link Distance (ft) | 582 | 591 | 738 | 923 |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | | | | |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

Intersection: 2: Larpenteur Avenue & McKnight Road

| Movement | EB | EB | WB | WB | NB | NB | SB | SB |
|-----------------------|-----|-----|-----|------|-----|-----|-----|------|
| Directions Served | L | TR | L | TR | L | TR | L | TR |
| Maximum Queue (ft) | 174 | 381 | 175 | 693 | 174 | 294 | 174 | 677 |
| Average Queue (ft) | 102 | 193 | 123 | 399 | 108 | 226 | 95 | 388 |
| 95th Queue (ft) | 190 | 324 | 229 | 750 | 195 | 316 | 201 | 609 |
| Link Distance (ft) | | 591 | | 1469 | | 288 | | 1075 |
| Upstream Blk Time (%) | | | | | | 2 | | |
| Queuing Penalty (veh) | | | | | | 16 | | |
| Storage Bay Dist (ft) | 150 | | 150 | | 150 | | 150 | |
| Storage Blk Time (%) | 4 | 17 | 1 | 53 | 1 | 19 | 0 | 38 |
| Queuing Penalty (veh) | 12 | 19 | 2 | 43 | 4 | 31 | 1 | 38 |

Intersection: 3: McKnight Road & Montana Avenue

| Movement | EB | WB | NB | SB | SB |
|-----------------------|------|------|-----|-----|------|
| Directions Served | LTR | LTR | L | L | TR |
| Maximum Queue (ft) | 508 | 75 | 88 | 22 | 30 |
| Average Queue (ft) | 237 | 33 | 32 | 1 | 2 |
| 95th Queue (ft) | 475 | 67 | 69 | 11 | 14 |
| Link Distance (ft) | 1504 | 1450 | | | 1085 |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | | | 300 | 300 | |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

Intersection: 4: McKnight Road & Nebraska Avenue

| Movement | WB | SB |
|-----------------------|------|-----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 47 | 23 |
| Average Queue (ft) | 12 | 3 |
| 95th Queue (ft) | 39 | 18 |
| Link Distance (ft) | 1260 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | 150 |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 5: McKnight Road & Arlington Avenue

| Movement | EB | WB | NB | SB | SB |
|-----------------------|-----|------|-----|-----|-----|
| Directions Served | LTR | LTR | L | L | TR |
| Maximum Queue (ft) | 170 | 41 | 82 | 31 | 16 |
| Average Queue (ft) | 68 | 15 | 38 | 4 | 1 |
| 95th Queue (ft) | 133 | 39 | 71 | 22 | 9 |
| Link Distance (ft) | 923 | 1146 | | | 797 |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | | | 150 | 150 | |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

Intersection: 6: Hawthorne Avenue & Ivy Avenue

| Movement | EB | WB | NB | SB |
|-----------------------|------|-----|------|-----|
| Directions Served | LTR | LTR | LTR | LTR |
| Maximum Queue (ft) | 34 | 13 | 34 | 57 |
| Average Queue (ft) | 3 | 1 | 16 | 28 |
| 95th Queue (ft) | 19 | 9 | 39 | 47 |
| Link Distance (ft) | 1004 | 484 | 1278 | 645 |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | | | | |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

Intersection: 7: Winthrop Street & Larpenteur Avenue

| Movement | NB |
|-----------------------|-----|
| Directions Served | LR |
| Maximum Queue (ft) | 74 |
| Average Queue (ft) | 36 |
| 95th Queue (ft) | 61 |
| Link Distance (ft) | 779 |
| Upstream Blk Time (%) | |
| Queuing Penalty (veh) | |
| Storage Bay Dist (ft) | |
| Storage Blk Time (%) | |
| Queuing Penalty (veh) | |

Intersection: 8: McKnight Road & N Site Access

| Movement | EB | NB |
|-----------------------|-----|------|
| Directions Served | R | T |
| Maximum Queue (ft) | 74 | 160 |
| Average Queue (ft) | 24 | 19 |
| 95th Queue (ft) | 55 | 91 |
| Link Distance (ft) | 434 | 1085 |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Network Summary

| |
|-----------------------------------|
| Network wide Queuing Penalty: 166 |
|-----------------------------------|

1: Larpenteur Avenue & Howard Street Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBR | SBL | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 3.8 | 0.1 | 0.1 | 0.4 |
| Total Del/Veh (s) | 3.7 | 1.6 | 0.8 | 5.6 | 3.2 | 3.0 | 11.7 | 4.7 | 8.5 | 5.4 | 3.6 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|--------------------|------|------|------|------|------|------|------|------|-----|------|------|-----|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.5 | 2.3 | 0.6 | 2.2 | 0.0 | 0.0 | 0.0 | 3.2 | 1.1 | 3.0 |
| Total Del/Veh (s) | 33.4 | 25.3 | 13.5 | 30.1 | 31.2 | 13.8 | 23.3 | 15.0 | 3.9 | 22.4 | 23.8 | 8.9 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | All |
|--------------------|------|
| Denied Del/Veh (s) | 0.8 |
| Total Del/Veh (s) | 21.0 |

3: McKnight Road & Montana Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|-------|------|------|------|------|-----|-----|-----|-----|-----|------|
| Denied Del/Veh (s) | 0.2 | 2.4 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 |
| Total Del/Veh (s) | 154.7 | 20.7 | 47.4 | 27.8 | 12.7 | 1.4 | 0.2 | 5.0 | 4.0 | 3.0 | 13.2 |

4: McKnight Road & Nebraska Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 22.9 | 6.3 | 1.0 | 0.3 | 6.8 | 1.6 | 1.4 |

5: McKnight Road & Arlington Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.4 | 3.5 | 0.1 | 0.1 | 3.1 | 0.9 | 0.6 | 0.0 | 0.0 | 0.0 | 0.8 |
| Total Del/Veh (s) | 33.6 | 10.5 | 27.7 | 7.8 | 8.6 | 1.9 | 0.9 | 6.6 | 2.4 | 1.7 | 3.7 |

6: Hawthorne Avenue & Ivy Avenue Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | NBL | NBR | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Total Del/Veh (s) | 2.2 | 0.7 | 0.1 | 1.9 | 0.4 | 3.0 | 2.6 | 2.9 | 1.7 |

7: Winthrop Street & Larpenteur Avenue Performance by movement

| Movement | EBT | EBR | WBT | NBL | All |
|--------------------|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.3 | 0.4 | 0.0 | 0.1 | 0.2 |
| Total Del/Veh (s) | 1.5 | 1.1 | 1.0 | 9.6 | 1.9 |

8: McKnight Road & N Site Access Performance by movement

| Movement | EBR | NBT | SBT | SBR | All |
|--------------------|------|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 12.9 | 3.6 | 4.3 | 2.1 | 4.1 |

Total Network Performance

| | |
|--------------------|------|
| Denied Del/Veh (s) | 1.2 |
| Total Del/Veh (s) | 28.8 |

Intersection: 1: Larpenteur Avenue & Howard Street

| Movement | EB | WB | NB | NB | SB |
|-----------------------|-----|-----|-----|-----|-----|
| Directions Served | LTR | LTR | LT | R | LTR |
| Maximum Queue (ft) | 34 | 115 | 65 | 77 | 37 |
| Average Queue (ft) | 3 | 26 | 34 | 37 | 19 |
| 95th Queue (ft) | 16 | 77 | 60 | 61 | 44 |
| Link Distance (ft) | 582 | 565 | 738 | | 923 |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | | | | 200 | |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

Intersection: 2: Larpenteur Avenue & McKnight Road

| Movement | EB | EB | EB | WB | WB | WB | NB | NB | NB | SB | SB | SB |
|-----------------------|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|------|-----|
| Directions Served | L | T | R | L | T | R | L | T | R | L | T | R |
| Maximum Queue (ft) | 163 | 164 | 118 | 108 | 246 | 157 | 240 | 269 | 85 | 273 | 459 | 275 |
| Average Queue (ft) | 60 | 77 | 50 | 47 | 112 | 49 | 68 | 173 | 14 | 55 | 208 | 31 |
| 95th Queue (ft) | 117 | 136 | 94 | 91 | 202 | 105 | 138 | 255 | 57 | 146 | 348 | 133 |
| Link Distance (ft) | | 565 | | | 1457 | | | 276 | | | 1062 | |
| Upstream Blk Time (%) | | | | | | | 0 | 0 | 0 | | | |
| Queuing Penalty (veh) | | | | | | | 0 | 3 | 0 | | | |
| Storage Bay Dist (ft) | 300 | | 250 | 250 | | 250 | 300 | | 250 | 250 | | 250 |
| Storage Blk Time (%) | | | | | 0 | 0 | 0 | 1 | | | 4 | 0 |
| Queuing Penalty (veh) | | | | | 0 | 0 | 0 | 2 | | | 7 | 0 |

Intersection: 3: McKnight Road & Montana Avenue

| Movement | EB | EB | WB | NB | SB | SB |
|-----------------------|------|-----|------|-----|-----|------|
| Directions Served | LT | R | LTR | L | L | TR |
| Maximum Queue (ft) | 343 | 187 | 86 | 101 | 15 | 38 |
| Average Queue (ft) | 150 | 52 | 35 | 31 | 1 | 3 |
| 95th Queue (ft) | 315 | 167 | 76 | 69 | 8 | 18 |
| Link Distance (ft) | 1504 | | 1450 | | | 1085 |
| Upstream Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |
| Storage Bay Dist (ft) | | 200 | | 300 | 300 | |
| Storage Blk Time (%) | 15 | 0 | | | | |
| Queuing Penalty (veh) | 5 | 0 | | | | |

Intersection: 4: McKnight Road & Nebraska Avenue

| Movement | WB | SB |
|-----------------------|------|----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 52 | 23 |
| Average Queue (ft) | 13 | 2 |
| 95th Queue (ft) | 40 | 14 |
| Link Distance (ft) | 1260 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | 150 | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 5: McKnight Road & Arlington Avenue

| Movement | EB | EB | WB | NB | SB | SB |
|-----------------------|-----|-----|------|-----|-----|-----|
| Directions Served | LT | R | LTR | L | L | TR |
| Maximum Queue (ft) | 63 | 114 | 40 | 74 | 30 | 16 |
| Average Queue (ft) | 26 | 43 | 15 | 34 | 4 | 2 |
| 95th Queue (ft) | 57 | 78 | 39 | 65 | 21 | 11 |
| Link Distance (ft) | 923 | | 1146 | | | 797 |
| Upstream Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |
| Storage Bay Dist (ft) | | 200 | | 150 | 150 | |
| Storage Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |

Intersection: 6: Hawthorne Avenue & Ivy Avenue

| Movement | EB | WB | NB | SB |
|-----------------------|------|-----|------|-----|
| Directions Served | LTR | LTR | LTR | LTR |
| Maximum Queue (ft) | 34 | 13 | 34 | 57 |
| Average Queue (ft) | 3 | 1 | 16 | 28 |
| 95th Queue (ft) | 19 | 9 | 39 | 47 |
| Link Distance (ft) | 1004 | 484 | 1278 | 645 |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | | | | |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

Intersection: 7: Winthrop Street & Larpenteur Avenue

| Movement | NB |
|-----------------------|-----|
| Directions Served | LR |
| Maximum Queue (ft) | 59 |
| Average Queue (ft) | 35 |
| 95th Queue (ft) | 58 |
| Link Distance (ft) | 779 |
| Upstream Blk Time (%) | |
| Queuing Penalty (veh) | |
| Storage Bay Dist (ft) | |
| Storage Blk Time (%) | |
| Queuing Penalty (veh) | |

Intersection: 8: McKnight Road & N Site Access

| Movement | EB | NB |
|-----------------------|-----|------|
| Directions Served | R | T |
| Maximum Queue (ft) | 65 | 66 |
| Average Queue (ft) | 25 | 4 |
| 95th Queue (ft) | 55 | 37 |
| Link Distance (ft) | 434 | 1085 |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Network Summary

Network wide Queuing Penalty: 17

1: Larpenteur Avenue & Howard Street Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBR | SBL | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|------|------|------|-----|-----|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.3 | 0.2 | 0.1 | 0.0 |
| Total Del/Veh (s) | 4.0 | 4.5 | 2.6 | 6.6 | 3.4 | 2.5 | 38.1 | 27.7 | 34.5 | 9.2 | 9.5 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|--------------------|-------|------|------|-------|------|------|------|------|------|------|------|------|
| Denied Del/Veh (s) | 0.2 | 1.3 | 0.9 | 2.7 | 0.5 | 0.4 | 0.0 | 0.0 | 0.0 | 3.2 | 1.0 | 1.1 |
| Total Del/Veh (s) | 101.8 | 84.2 | 82.4 | 119.0 | 99.4 | 95.6 | 42.0 | 30.3 | 26.5 | 53.9 | 30.9 | 27.1 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | All |
|--------------------|------|
| Denied Del/Veh (s) | 0.7 |
| Total Del/Veh (s) | 54.9 |

3: McKnight Road & Montana Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|-------|-------|------|------|-----|-----|-----|------|-----|-----|------|
| Denied Del/Veh (s) | 92.2 | 123.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 10.0 |
| Total Del/Veh (s) | 614.9 | 609.6 | 42.3 | 21.1 | 9.0 | 3.7 | 0.9 | 12.7 | 3.1 | 2.3 | 60.6 |

4: McKnight Road & Nebraska Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 22.2 | 9.8 | 1.7 | 0.7 | 8.0 | 1.3 | 1.6 |

5: McKnight Road & Arlington Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.2 | 0.2 | 0.1 | 0.1 | 2.8 | 1.1 | 1.4 | 0.0 | 0.0 | 0.0 | 0.7 |
| Total Del/Veh (s) | 54.5 | 30.0 | 24.1 | 9.8 | 5.9 | 2.2 | 0.9 | 8.9 | 2.1 | 1.3 | 5.7 |

6: Hawthorne Avenue & Ivy Avenue Performance by movement

| Movement | EBL | EBT | WBL | WBT | NBL | NBR | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.2 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | 0.2 |
| Total Del/Veh (s) | 2.4 | 0.7 | 2.2 | 0.4 | 5.6 | 3.0 | 3.3 | 1.7 |

7: Winthrop Street & Larpenteur Avenue Performance by movement

| Movement | EBT | EBR | WBT | NBL | All |
|--------------------|-----|-----|-----|------|-----|
| Denied Del/Veh (s) | 0.4 | 0.5 | 0.0 | 0.1 | 0.2 |
| Total Del/Veh (s) | 1.8 | 1.4 | 1.0 | 14.1 | 2.4 |

8: McKnight Road & N Site Access Performance by movement

| Movement | EBR | NBT | SBT | SBR | All |
|--------------------|------|------|-----|-----|------|
| Denied Del/Veh (s) | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 10.7 | 56.2 | 4.2 | 1.7 | 32.9 |

Total Network Performance

| | |
|--------------------|------|
| Denied Del/Veh (s) | 5.6 |
| Total Del/Veh (s) | 87.6 |

Intersection: 1: Larpenteur Avenue & Howard Street

| Movement | EB | WB | NB | SB |
|-----------------------|-----|-----|-----|-----|
| Directions Served | LTR | LTR | LTR | LTR |
| Maximum Queue (ft) | 202 | 131 | 319 | 36 |
| Average Queue (ft) | 28 | 36 | 105 | 11 |
| 95th Queue (ft) | 123 | 101 | 234 | 35 |
| Link Distance (ft) | 582 | 591 | 738 | 923 |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | | | | |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

Intersection: 2: Larpenteur Avenue & McKnight Road

| Movement | EB | EB | WB | WB | NB | NB | SB | SB |
|-----------------------|-----|-----|-----|------|-----|-----|-----|------|
| Directions Served | L | TR | L | TR | L | TR | L | TR |
| Maximum Queue (ft) | 175 | 600 | 174 | 729 | 174 | 302 | 174 | 562 |
| Average Queue (ft) | 150 | 412 | 101 | 365 | 126 | 289 | 108 | 283 |
| 95th Queue (ft) | 215 | 676 | 207 | 715 | 218 | 317 | 192 | 461 |
| Link Distance (ft) | | 591 | | 1469 | | 288 | | 1075 |
| Upstream Blk Time (%) | | 6 | | | | 27 | | |
| Queuing Penalty (veh) | | 32 | | | | 269 | | |
| Storage Bay Dist (ft) | 150 | | 150 | | 150 | | 150 | |
| Storage Blk Time (%) | 10 | 49 | 2 | 49 | 1 | 43 | 0 | 24 |
| Queuing Penalty (veh) | 42 | 69 | 8 | 33 | 8 | 67 | 3 | 31 |

Intersection: 3: McKnight Road & Montana Avenue

| Movement | EB | WB | NB | NB | SB | SB |
|-----------------------|------|------|-----|-----|-----|------|
| Directions Served | LTR | LTR | L | TR | L | TR |
| Maximum Queue (ft) | 1241 | 53 | 67 | 65 | 30 | 28 |
| Average Queue (ft) | 731 | 17 | 25 | 13 | 4 | 1 |
| 95th Queue (ft) | 1533 | 46 | 54 | 93 | 21 | 12 |
| Link Distance (ft) | 1504 | 1450 | | 586 | | 1085 |
| Upstream Blk Time (%) | 14 | | | | | |
| Queuing Penalty (veh) | 0 | | | | | |
| Storage Bay Dist (ft) | | | 300 | | 300 | |
| Storage Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |

Intersection: 4: McKnight Road & Nebraska Avenue

| Movement | WB | SB |
|-----------------------|------|-----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 42 | 31 |
| Average Queue (ft) | 12 | 5 |
| 95th Queue (ft) | 38 | 24 |
| Link Distance (ft) | 1260 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | 150 |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 5: McKnight Road & Arlington Avenue

| Movement | EB | WB | NB | SB | SB |
|-----------------------|-----|------|-----|-----|-----|
| Directions Served | LTR | LTR | L | L | TR |
| Maximum Queue (ft) | 243 | 46 | 77 | 30 | 5 |
| Average Queue (ft) | 94 | 11 | 29 | 3 | 0 |
| 95th Queue (ft) | 204 | 36 | 58 | 17 | 3 |
| Link Distance (ft) | 923 | 1146 | | | 797 |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | | | 150 | 150 | |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

Intersection: 6: Hawthorne Avenue & Ivy Avenue

| Movement | EB | WB | NB | SB |
|-----------------------|------|-----|------|-----|
| Directions Served | LTR | LTR | LTR | LTR |
| Maximum Queue (ft) | 52 | 27 | 58 | 62 |
| Average Queue (ft) | 9 | 4 | 25 | 32 |
| 95th Queue (ft) | 34 | 18 | 49 | 52 |
| Link Distance (ft) | 1004 | 484 | 1278 | 645 |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | | | | |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

Intersection: 7: Winthrop Street & Larpenteur Avenue

| Movement | NB |
|-----------------------|-----|
| Directions Served | LR |
| Maximum Queue (ft) | 100 |
| Average Queue (ft) | 43 |
| 95th Queue (ft) | 76 |
| Link Distance (ft) | 779 |
| Upstream Blk Time (%) | |
| Queuing Penalty (veh) | |
| Storage Bay Dist (ft) | |
| Storage Blk Time (%) | |
| Queuing Penalty (veh) | |

Intersection: 8: McKnight Road & N Site Access

| Movement | EB | NB |
|-----------------------|-----|------|
| Directions Served | R | T |
| Maximum Queue (ft) | 71 | 852 |
| Average Queue (ft) | 27 | 518 |
| 95th Queue (ft) | 57 | 1107 |
| Link Distance (ft) | 434 | 1085 |
| Upstream Blk Time (%) | | 0 |
| Queuing Penalty (veh) | | 5 |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Network Summary

| |
|-----------------------------------|
| Network wide Queuing Penalty: 566 |
|-----------------------------------|

1: Larpenteur Avenue & Howard Street Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBR | SBL | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|------|-----|------|-----|-----|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 3.8 | 0.1 | 0.1 | 0.4 |
| Total Del/Veh (s) | 4.3 | 1.7 | 1.1 | 6.4 | 3.7 | 2.5 | 19.4 | 6.3 | 17.1 | 6.3 | 4.5 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|--------------------|------|------|------|------|------|------|------|------|-----|------|------|-----|
| Denied Del/Veh (s) | 0.0 | 0.0 | 0.0 | 2.5 | 0.6 | 2.6 | 0.0 | 0.0 | 0.0 | 3.1 | 1.1 | 3.2 |
| Total Del/Veh (s) | 34.6 | 43.7 | 14.3 | 36.6 | 46.1 | 17.9 | 26.1 | 19.9 | 7.4 | 33.6 | 21.3 | 8.2 |

2: Larpenteur Avenue & McKnight Road Performance by movement

| Movement | All |
|--------------------|------|
| Denied Del/Veh (s) | 0.7 |
| Total Del/Veh (s) | 26.4 |

3: McKnight Road & Montana Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|-------|-------|------|------|------|-----|-----|-----|-----|-----|------|
| Denied Del/Veh (s) | 0.3 | 1.9 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 |
| Total Del/Veh (s) | 314.3 | 144.9 | 30.4 | 13.0 | 10.3 | 1.9 | 0.5 | 8.5 | 3.5 | 2.4 | 27.2 |

4: McKnight Road & Nebraska Avenue Performance by movement

| Movement | WBL | WBR | NBT | NBR | SBL | SBT | All |
|--------------------|------|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 26.5 | 9.3 | 1.6 | 0.7 | 6.5 | 1.5 | 1.7 |

5: McKnight Road & Arlington Avenue Performance by movement

| Movement | EBL | EBR | WBL | WBR | NBL | NBT | NBR | SBL | SBT | SBR | All |
|--------------------|------|-----|------|------|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.4 | 3.6 | 0.1 | 0.1 | 2.9 | 1.1 | 0.8 | 0.0 | 0.0 | 0.0 | 0.9 |
| Total Del/Veh (s) | 46.3 | 9.3 | 30.7 | 10.3 | 6.4 | 2.1 | 0.8 | 8.1 | 2.3 | 1.5 | 4.0 |

6: Hawthorne Avenue & Ivy Avenue Performance by movement

| Movement | EBL | EBT | WBL | WBT | NBL | NBR | SBR | All |
|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 |
| Total Del/Veh (s) | 2.4 | 0.7 | 2.2 | 0.4 | 5.2 | 3.0 | 3.3 | 1.8 |

7: Winthrop Street & Larpenteur Avenue Performance by movement

| Movement | EBT | EBR | WBT | NBL | All |
|--------------------|-----|-----|-----|------|-----|
| Denied Del/Veh (s) | 0.5 | 0.4 | 0.0 | 0.1 | 0.2 |
| Total Del/Veh (s) | 1.8 | 1.4 | 1.2 | 14.4 | 2.5 |

8: McKnight Road & N Site Access Performance by movement

| Movement | EBR | NBT | SBT | SBR | All |
|--------------------|------|-----|-----|-----|-----|
| Denied Del/Veh (s) | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Del/Veh (s) | 12.5 | 7.4 | 4.1 | 2.0 | 6.0 |

Total Network Performance

| | |
|--------------------|------|
| Denied Del/Veh (s) | 1.2 |
| Total Del/Veh (s) | 40.0 |

Intersection: 1: Larpenteur Avenue & Howard Street

| Movement | EB | WB | NB | NB | SB |
|-----------------------|-----|-----|-----|-----|-----|
| Directions Served | LTR | LTR | LT | R | LTR |
| Maximum Queue (ft) | 64 | 162 | 105 | 84 | 36 |
| Average Queue (ft) | 4 | 35 | 43 | 43 | 10 |
| 95th Queue (ft) | 27 | 99 | 82 | 71 | 34 |
| Link Distance (ft) | 582 | 565 | 738 | | 923 |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | | | | 200 | |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

Intersection: 2: Larpenteur Avenue & McKnight Road

| Movement | EB | EB | EB | WB | WB | WB | NB | NB | NB | SB | SB | SB |
|-----------------------|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|------|-----|
| Directions Served | L | T | R | L | T | R | L | T | R | L | T | R |
| Maximum Queue (ft) | 324 | 378 | 275 | 158 | 376 | 271 | 275 | 288 | 275 | 205 | 339 | 230 |
| Average Queue (ft) | 89 | 180 | 57 | 44 | 150 | 53 | 85 | 235 | 36 | 66 | 186 | 34 |
| 95th Queue (ft) | 197 | 309 | 186 | 100 | 292 | 160 | 190 | 327 | 146 | 138 | 310 | 138 |
| Link Distance (ft) | | 565 | | | 1457 | | | 276 | | | 1062 | |
| Upstream Blk Time (%) | | | | | | | 0 | 4 | 0 | | | |
| Queuing Penalty (veh) | | | | | | | 0 | 42 | 0 | | | |
| Storage Bay Dist (ft) | 300 | | 250 | 250 | | 250 | 300 | | 250 | 250 | | 250 |
| Storage Blk Time (%) | | 4 | 0 | | 3 | 0 | 0 | 8 | 0 | 0 | 2 | 0 |
| Queuing Penalty (veh) | | 11 | 0 | | 4 | 0 | 0 | 19 | 0 | 0 | 4 | 0 |

Intersection: 3: McKnight Road & Montana Avenue

| Movement | EB | EB | WB | NB | SB | SB |
|-----------------------|------|-----|------|-----|-----|------|
| Directions Served | LT | R | LTR | L | L | TR |
| Maximum Queue (ft) | 615 | 225 | 47 | 56 | 30 | 22 |
| Average Queue (ft) | 345 | 118 | 17 | 23 | 3 | 2 |
| 95th Queue (ft) | 670 | 287 | 43 | 45 | 18 | 13 |
| Link Distance (ft) | 1504 | | 1450 | | | 1085 |
| Upstream Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |
| Storage Bay Dist (ft) | | 200 | | 300 | 300 | |
| Storage Blk Time (%) | 64 | 0 | | | | |
| Queuing Penalty (veh) | 28 | 0 | | | | |

Intersection: 4: McKnight Road & Nebraska Avenue

| Movement | WB | SB |
|-----------------------|------|----|
| Directions Served | LR | L |
| Maximum Queue (ft) | 47 | 31 |
| Average Queue (ft) | 11 | 6 |
| 95th Queue (ft) | 37 | 25 |
| Link Distance (ft) | 1260 | |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | 150 | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Intersection: 5: McKnight Road & Arlington Avenue

| Movement | EB | EB | WB | NB | SB | SB |
|-----------------------|-----|----|------|----|-----|----|
| Directions Served | LT | R | LTR | L | L | TR |
| Maximum Queue (ft) | 91 | 94 | 34 | 64 | 30 | 28 |
| Average Queue (ft) | 36 | 45 | 11 | 25 | 4 | 1 |
| 95th Queue (ft) | 80 | 77 | 34 | 52 | 22 | 11 |
| Link Distance (ft) | 923 | | 1146 | | 797 | |
| Upstream Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |
| Storage Bay Dist (ft) | 200 | | 150 | | 150 | |
| Storage Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |

Intersection: 6: Hawthorne Avenue & Ivy Avenue

| Movement | EB | WB | NB | SB |
|-----------------------|------|-----|------|-----|
| Directions Served | LTR | LTR | LTR | LTR |
| Maximum Queue (ft) | 47 | 26 | 53 | 54 |
| Average Queue (ft) | 7 | 3 | 27 | 30 |
| 95th Queue (ft) | 30 | 17 | 48 | 49 |
| Link Distance (ft) | 1004 | 484 | 1278 | 645 |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | | | | |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

Intersection: 7: Winthrop Street & Larpenteur Avenue

| Movement | NB |
|-----------------------|-----|
| Directions Served | LR |
| Maximum Queue (ft) | 95 |
| Average Queue (ft) | 42 |
| 95th Queue (ft) | 73 |
| Link Distance (ft) | 779 |
| Upstream Blk Time (%) | |
| Queuing Penalty (veh) | |
| Storage Bay Dist (ft) | |
| Storage Blk Time (%) | |
| Queuing Penalty (veh) | |

Intersection: 8: McKnight Road & N Site Access

| Movement | EB | NB |
|-----------------------|-----|------|
| Directions Served | R | T |
| Maximum Queue (ft) | 71 | 205 |
| Average Queue (ft) | 25 | 59 |
| 95th Queue (ft) | 56 | 195 |
| Link Distance (ft) | 434 | 1085 |
| Upstream Blk Time (%) | | |
| Queuing Penalty (veh) | | |
| Storage Bay Dist (ft) | | |
| Storage Blk Time (%) | | |
| Queuing Penalty (veh) | | |

Network Summary

Network wide Queuing Penalty: 109
