HAZARD RANKING SYSTEM (HRS) DOCUMENTATION RECORD COVER SHEET

Name of Site: Highway 100 and County Road 3 Groundwater Plume

EPA ID No.: MNN000506121

Contact Persons

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Pathways, Components, or Threats Not Scored

The surface water migration, soil exposure and subsurface intrusion, and air migration pathways were not scored in this Hazard Ranking System documentation record because the ground water migration pathway is sufficient to qualify the site for the National Priorities List (NPL). These pathways are of concern to the U.S. Environmental Protection Agency (EPA) and may be considered during future evaluation. At the time of the listing, the site score is sufficient without the pathways mentioned above.

Surface Water Migration: No surface water samples have been collected and no site-related release to surface water has been identified at this time. No surface water intakes are located along surface waters in the vicinity of the site.

Soil Exposure and Subsurface Intrusion: Soil, soil gas, and groundwater samples collected at and in the vicinity of commercial properties contain chlorinated solvents (Ref. 7, pp. 1977, 1978, 1989, 2006 through 2014). EPA subsequently installed vapor mitigation systems in residential properties where chlorinated volatile organic compounds (VOC) were present above sub-slab action levels (Refs. 7, pp. 30, 4244, 4257, 4260 to 4267, 4474; 45, p. 2; 53, pp. 3, 4; 60, p. 2; 63; 64). The listing of the site would not be changed by evaluating this pathway.

Air Migration: The listing of the site would not be changed by evaluating this pathway.

HAZARD RANKING SYSTEM (HRS) DOCUMENTATION RECORD

Name of Site:	Highway 100 and County Road 3 Groundwater Plume
EPA Region:	5
Date Prepared:	November 2019
Street Address of Site*:	Highway 100 and County Road 3
City, County, State, Zip:	St. Louis Park and Edina, Hennepin County, Minnesota, 55426
General Location in the State:	Southeastern portion of state
Topographic Map:	Hopkins, 1993 and Minneapolis South, 1993
Latitude:	44° 56' 06.9252" North
Longitude:	93° 21' 41.9567" West

The coordinates above for the Highway 100 and County Road 3 Groundwater Plume site were measured from permanent monitoring well W143 located about 0.67 mile northwest of the intersection of Highway 100 and County Road 3 in St. Louis Park (Ref. 4).

* The street address, coordinates, and contaminant locations presented in this HRS documentation record identify the general area where the site is located. They represent one or more locations the EPA considers to be part of the site based on the screening information EPA used to evaluate the site for NPL listing. EPA lists national priorities among the known "releases or threatened releases" of hazardous substances; thus, the focus is on the release, not precisely delineated boundaries. A site is defined as where a hazardous substance has been "deposited, stored, disposed, or placed, or has otherwise come to be located." Generally, HRS scoring and the subsequent listing of a release merely represent the initial determination that a certain area may need to be addressed under CERCLA. Accordingly, EPA contemplates that the preliminary description of facility boundaries at the time of scoring will be refined as more information is developed as to where the contamination has come to be located.

Pathway	**Pathway Score**
Ground Water[1] Migration	100.00
Surface Water Migration	NS
Soil Exposure and Subsurface Intrusion	NS
Air Migration	NS
HRS SITE SCORE	**50.00**

Notes:

HRS	Hazard Ranking System
NS	Not scored

[1] "Ground water" and "groundwater" are synonymous; the spelling is different due to "ground water" being codified as part of the HRS, while "groundwater" is the modern spelling.

WORKSHEET FOR COMPUTING HRS SITE SCORE

	S Pathway	S^2 Pathway
Ground Water Migration Pathway Score (S_{gw})	100.00	10,000
Surface Water Migration Pathway Score (S_{sw})	NS	NS
Soil Exposure and Subsurface Intrusion Pathway Score (S_{sessi})	NS	NS
Air Migration Pathway Score (S_a)	NS	NS
$S^2_{gw} + S^2_{sw} + S^2_{sessi} + S^2_a$		10,000
$(S^2_{gw} + S^2_{sw} + S^2_{sessi} + S^2_a) / 4$		2,500
$\sqrt{(S^2_{gw} + S^2_{sw} + S^2_{sessi} + S^2_a) / 4}$		**50.00**

Note:

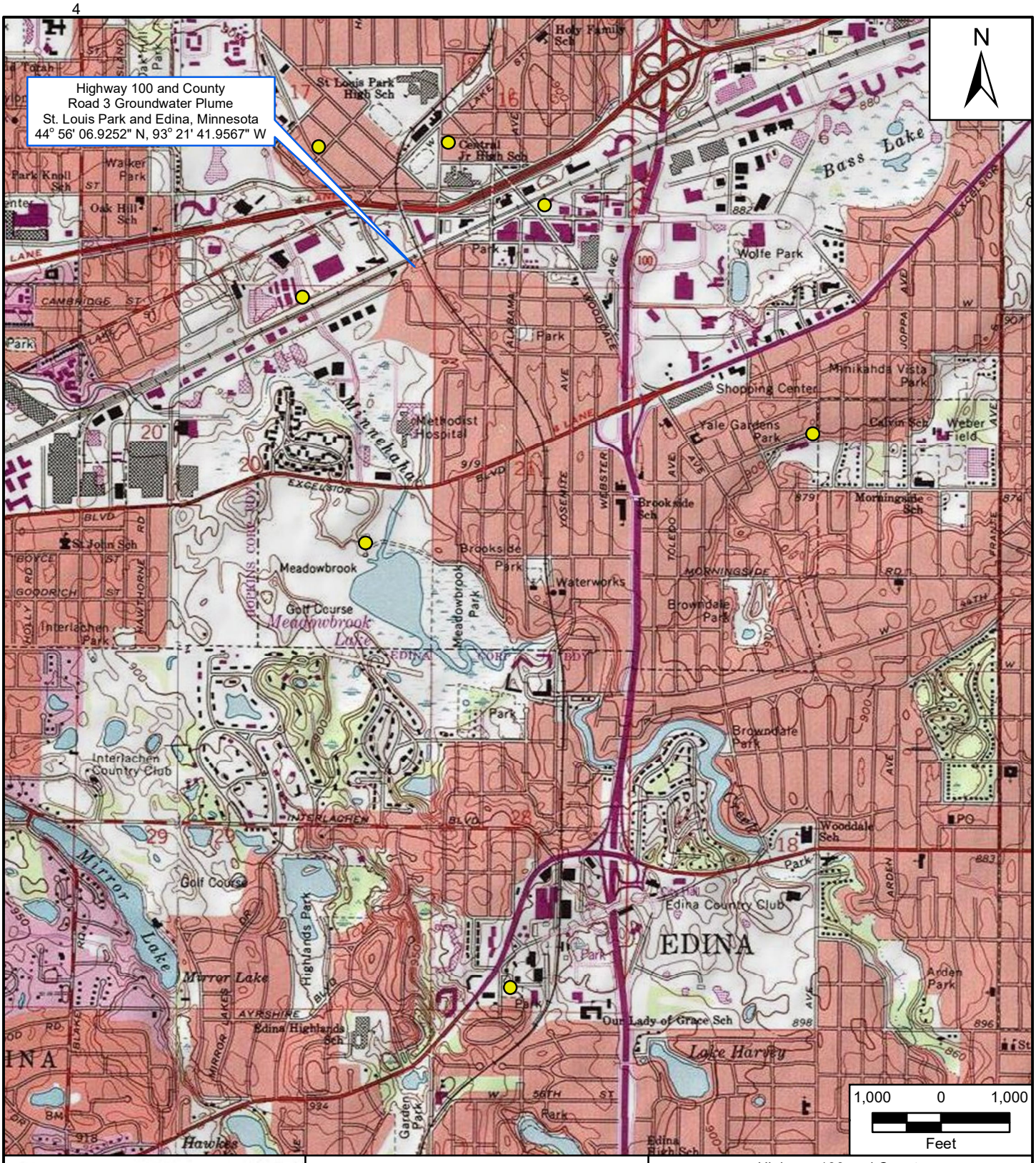
NS = Not scored

Table 3-1 -- Ground Water Migration Pathway Scoresheet
Aquifer Evaluated: Interconnected Quaternary Drift, Platteville-Glenwood, St. Peter, and Prairie du Chien-Jordan Aquifers

Factor Categories and Factors	Maximum Value	Value Assigned	
Likelihood of Release to an Aquifer:			
1. Observed Release	550	550	
2. Potential to Release:			
2a. Containment	10	NS	
2b. Net Precipitation	10	NS	
2c. Depth to Aquifer	5	NS	
2d. Travel Time	35	NS	
2e. Potential to Release [lines 2a(2b + 2c + 2d)]	500	NS	
3. Likelihood of Release (higher of lines 1 and 2e)	550		550
Waste Characteristics:			
4. Toxicity/Mobility	(a)	10,000	
5. Hazardous Waste Quantity	(a)	100	
6. Waste Characteristics	100		32
Targets:			
7. Nearest Well	50	50	
8. Population:			
8a. Level I Concentrations	(b)	80,245.4	
8b. Level II Concentrations	(b)	NS	
8c. Potential Contamination	(b)	NS	
8d. Population (lines 8a + 8b + 8c)	(b)	80,245.4	
9. Resources	5	NS	
10. Wellhead Protection Area	20	20	
11. Targets (lines 7 + 8d + 9 + 10)	(b)		80,315.4
Ground Water Migration Score for an Aquifer:			
12. Aquifer Score [(lines 3 x 6 x 11)/82,500][c]	100		100.00
Ground Water Migration Pathway Score:			
13. Pathway Score (S_{gw}), (highest value from line 12 for all aquifers evaluated)[c]	100		100.00

Notes:

NS = Not scored
[a] = Maximum value applies to waste characteristics category
[b] = Maximum value not applicable
[c] = Do not round to nearest integer



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Date Saved: 10/10/2019 EPA Contract No.: EP-S5-13-01 TDD No.: S05-0002-1804-206 Coordinate System: NAD 1983 UTM Zone 15N Projection: Transverse Mercator Datum:North American 1983 Units: Meter

Former Print Shop
6518 Walker St.

Dry Cleaner
6528 Lake St.

Former Metal Fabricator
6714 Walker St.

Former Metal Fabricator
6512 Walker St.

Former Metal Fabricator
7317 West Lake St.

Dry Cleaning Fluid Distributor
3938 Meadowbrook Rd.

Heat Transfer Facility
6981 Oxford St.

Computer Components Facility
6831 Oxfort St.

Dry Cleaner
8420 Excelsior Blvd.

Dry Cleaner
5017 Vernon Ave.

N

650 0 650
Feet

NORTH DAKOTA
MINNESOTA
Hennepin County
MICHIGAN
WISCONSIN
SOUTH DAKOTA
IOWA

Legend

- Groundwater Sample
- Possible Sources of Groundwater Contamination
- Reilly Tar and Chemical
- E Edina
- P Piezometer
- SLP St. Louis Park
- W Monitoring Well

Source: The source of this map is ERSI, used by EPA with ESRI's permission.
Refs. 6, pp. 21, 25, 33 through 41; 7, pp. 39, 41, 43, 44, 45, 46, 50, 51, 92, 93, 901, 902, 1166, 1167, 1168, 1169; 73, pp. 5, 6; 75, pp. 6, 7, 52, 53, 54, 58, 64, 65, 68, 69, 76, 77, 78, 79, 86, 87, 98, 99, 106, 107, 192, 193, 196; 79, pp. 3, through 6; 84, pp. 13; 86, p. 14

Highway 100 and County Road 3 Groundwater Plume
St. Louis Park and Edina
Hennepin County, Minnesota

Figure 2

Site Layout and Possible Sources of Groundwater Contamination

TETRA TECH

Prepared For: U.S. EPA Region V | Prepared By: Rachel Page

File Path: X:\G\9026\0002\05\1804\206\Projects\mxd\Figure2_104.mxd

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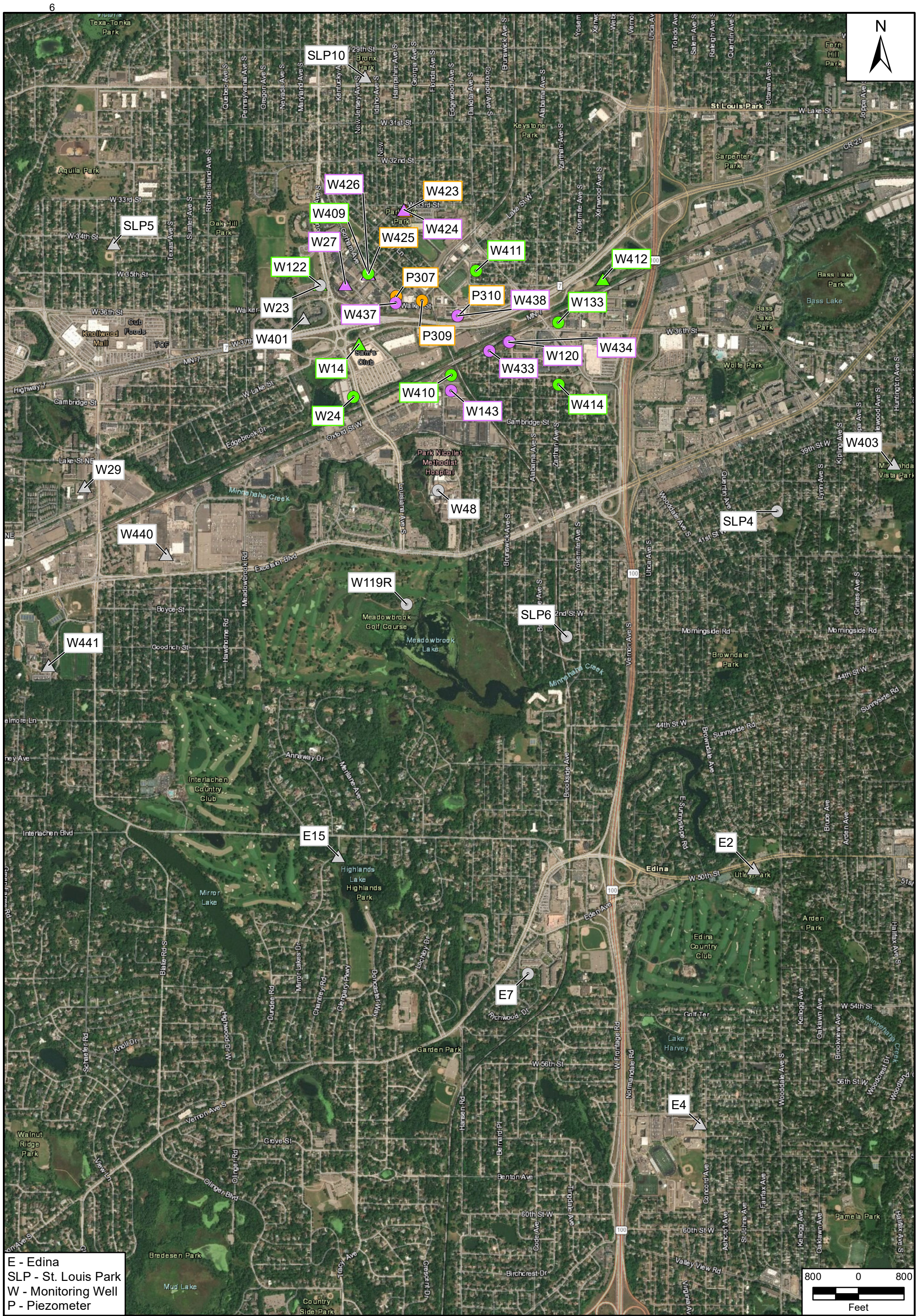
Coordinate System: NAD 1983 UTM Zone 15N Projection: Transverse Mercator Datum:North American 1983 Units: Meter



Source: The source of this map is ERSI, used by EPA with ESRI's permission.
Refs. 6, pp. 33 through 41; 73, pp. 5, 6; 75, pp. 6, 7, 52, 53, 54, 58, 65, 64,
65, 68, 69, 76, 77, 86, 87, 98, 99, 106, 107, 192, 193, 196; 79, pp. 3, through 6; 84, pp. 13; 86, p. 14

Highway 100 and County
Road 3 Groundwater Plume
St. Louis Park and Edina
Hennepin County, Minnesota

Figure 3

Groundwater Observed Release

TETRA TECH

Prepared For: U.S. EPA Region V | Prepared By: Rachel Page

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Date Saved: 10/10/2019 | EPA Contract No.: EP-S5-13-01 | TDD No.: S05-0002-1804-206

Coordinate System: NAD 1983 UTM Zone 15N Projection: Transverse Mercator Datum:North American 1983 Units: Meter

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86. Tetra Tech. Data Validation Checklist – Stage 2A. MDH Analytical Report No. 10475840, St. Louis Park Wells SLP5, SLP4, WTP1, WTP4, and SLP10. August 13, 2019. 46 Pages.

SITE DESCRIPTION

The Highway 100 and County Road 3 Groundwater Plume (the Site) is a groundwater plume that is contaminated with 1,1-dichloroethene (DCE), cis-1,2-DCE, trans-1,2-DCE, trichloroethene (TCE), and vinyl chloride in monitoring and municipal water wells in Edina and St. Louis Park, Hennepin County, Minnesota. Some documents in the reference package refer to the Site as the St. Louis Park Solvent Plume; however, the Site will be referred to in this HRS documentation record as the Highway 100 and County Road 3 Groundwater Plume. The groundwater plume that comprises the Site likely originated from multiple unknown sources; possible contributors to the groundwater contamination include dry cleaners, print shops, and metal fabricators, among others (near the intersection of U. S. Highway 7 and Wooddale Avenue about 0.69 mile north of Highway 100 and County Road 3) in St. Louis Park (SLP) (References [Refs.] 3; 5; 6, pp. 3, 5, 6, 10 to 13, 22) (see Section 2.2.1, Source No. 1 and Figures 1 and 2 of this HRS documentation record). Groundwater samples collected from monitoring and municipal wells, including wells E7, P307, P309, P310, SLP4, SLP6, W119R, W120, W133, W143, W23, W24, W409, W410, W411, W414, W433, W434, W437, W438, and W48, within the Site and used to delineate the Site contain chlorinated solvents (Refs. 7, pp. 94 through 107; 8, pp. 42 to 50, 58 to 84; 12, pp. 8 through 33; 13, pp. 45, 55, 56; 14, pp. 29 to 32) (see Figure 3 of this HRS documentation record. The groundwater plume that comprises the Site is currently defined by documented observed releases in groundwater monitoring and municipal water wells in Edina and St. Louis Park that withdraw water from aquifers as follows: Quaternary Drift aquifer in wells P307, P309, P310 screened between 60 to 65 feet below ground surface (bgs); Platteville-Glenwood aquifer in wells W120, W143, W433, W434, W437, W438 (screened between 69.9 to 100 feet bgs); the St. Peter aquifer in wells W133, W24, W409, W410, W411, W414 screened between 83 and 260 feet bgs; and the Prairie du Chien-Jordan aquifer in wells E7, SLP4, SLP6, W23, W48, and W119R screened between 255 and 410 feet bgs (Refs. 6, pp. 4, 5, 12, 13, 21, 24, 25, 27, 28, 29, 34, 37, 40 162, 230, 232, 234, 236, 238, 244, 246, 248, 250, 252; 28, pp. 9, 24, 42, 51, 56, 60, 65, 83, 87, 91, 100, 101, 161, 163, 171, 172, 173, 178, 186, 188, 196, 198, 200; 73, pp. 5, 6; 75, pp. 6, 7, 52, 53, 54, 58, 64, 65, 68, 69, 76, 77, 86, 87, 98, 99, 106, 107, 192, 193, 196; 84, p. 13; 86, p. 14) (see also Sections 3.0.1 and 3.1.1 of this HRS documentation record). Aquifer transmissivity and pump tests and hydraulic conductivities of the stratigraphic materials document aquifer interconnection; and documented observed releases of 1,1-DCE, cis-12-DCE, trans-1,2-DCE, TCE, and vinyl chloride in the groundwater support the presence of one groundwater plume throughout portions of Edina and St. Louis Park (Refs. 6, pp. 162, 230, 232, 234, 236, 238, 244, 246, 248, 250, 252; 17, pp. 1, 2; 73, pp. 5, 6; 75, pp. 6, 7, 52, 53, 54, 58, 64, 65, 68, 69, 76, 77, 86, 87, 98, 99, 106, 107, 192, 193, 196; 84, p. 13; 86, p. 14). Actual contamination at Level I concentrations has been documented in two municipal water wells (Edina well 7 [E7] and St. Louis Park Well 4 [SLP4]) (see Section 3.1.1, Observed Release, and Tables 10, 14, 16, 18, and 19 of this HRS documentation record).

The geographic coordinates of the Site, as measured from permanent monitoring well W143 located in the western portion of the groundwater plume, are latitude 44° 56' 06.9252" north and longitude 93° 21' 41.9567" west (Ref. 4). The EPA identification number (ID), as recorded in the Superfund Site Information database, is MNN000506121 (Ref. 5). Land uses within and surrounding the Site are predominantly residential, commercial, and industrial (Refs. 3; 6, pp. 5, 6) (see Figure 2 of this HRS documentation record). In addition, a National Priorities List (NPL) site, Reilly Tar and Chemical Superfund Site (Reilly Tar), is located within 1/8 mile of the Site (see Figures 2 and 3 of this HRS documentation record).

The Minnesota Pollution Control Agency (MPCA), the Minnesota Department of Health (MDH), and the cities of Edina and St. Louis Park have made significant efforts to identify specific sources of groundwater contamination through numerous sampling events and by conducting an extensive search of MPCA records. Also, MPCA conducted an expanded site inspection (ESI) that compiled and evaluated existing data to identify the sources of contamination at the Site (Ref. 7, p. 5-11). Soil, soil gas, and groundwater samples collected at and in the vicinity of commercial properties contain chlorinated solvents (Ref. 7, pp. 1977, 1978, 1989, 2006 through 2014). While several likely sources have been identified in the vicinity of the groundwater plume, specific releases documented in monitoring and municipal wells cannot reasonably be attributed to a specific source or sources due to the comingled

nature of the releases that likely resulted from multiple sources including dry cleaners, print shops, a radiator coil manufacturing facility, metals fabricators, a heat treating facility, rubber manufacturer, computer components facility, and a distributor of dry cleaning fluid, among other commercial and industrial facilities, over time (Refs. 6, pp. 4, 5, 6, 33 through 41; 7, pp. 5 to 11, 92, 93, 523, 524, 526, 901, 902, 1167 to 1169, 1978, 1982, 1983, 1984, 1989, 2006 through 2014, 3571; 56, pp. 10, 11, 12; 81, pp. 1-1, 2-1). MPCA identified 48 facilities that used or may have used tetrachloroethene (PCE) in their operations (Ref. 7, p. 10). 1,1-DCE, cis-12-DCE, trans-1,2-DCE, vinyl chloride and TCE are breakdown products of PCE (Ref. 46, p. 24). Of the 48 facilities identified, 27 facilities were reviewed as possible sources of chlorinated VOCs based on proximity to W437 (due to high PCE concentrations detected in a 2006 investigation), type of historical commercial operations, record of PCE use, and sampling results (Ref. 7, pp. 10, 92, 93). Of the 27 facilities, MPCA identified eight facilities with hazardous waste records that show PCE/TCE use and 18 facilities were identified as having PCE/TCE detected on their properties (Ref. 7, pp. 92, 93). Twelve properties subsequently were sampled, and significant VOC contamination was detected on most of the 12 properties (Ref. 7, p. 1984). Additional sampling investigations have been conducted at commercial and industrial facilities and sampling results indicate contamination of chlorinated solvents (Ref. 7, pp. 8 to 11). As a result of the presence of multiple possible sources of the groundwater contamination and the likely comingling of releases over time, the site is being scored as a groundwater plume with no identified source.

The groundwater plume is contained within a series of interconnected aquifers that primarily are composed of sand, gravel, shale, dolomite, limestone, sandstone, and siltstone (Refs. 7, pp. 94 thorough 107; 27, pp. 7, 8, 9; 28, pp. 171, 172, 173). Groundwater flow in the interconnected aquifers is complex, generally flows east-southeast; recharge occurs through downward leakage from overlying aquifers and in areas where confining units are thin or absent due to erosion; and in some aquifers, groundwater flows through fractures, open joints, and solution channels and is believed to be influenced by pumping of multi-aquifer wells (Refs. 25; 27, pp. 5, 8, 9, 17; 80, pp. 5, 8; 65, p. 11).

Groundwater samples are collected from treated and untreated water from Edina by MDH and by Summit Environmental on behalf of the City of St. Louis Park. Samples of the untreated water contain detectable concentrations of chlorinated solvents. However, all water is treated prior to distribution to customers. New water treatment plants including air strippers and other technology are used to remove contaminants from the drinking water. These treatment systems are considered interim measures (Ref. 17). Drinking water provided by both the cities of Edina and St. Louis Park currently are in compliance with all Maximum Contaminant Levels (MCL) as established in the Safe Drinking Water Act (Ref. 85).

SITE HISTORY

Historical analytical results obtained from MDH indicate the presence of low levels (below EPA MCLs) of chlorinated volatile organic compounds (VOC), including 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, PCE, TCE, and vinyl chloride in City of Edina wells since 1993 and in City of St. Louis Park wells since 1994 (Refs. 2, pp. 1, 3, 5, 7, 9, 11; 11, pp. 1 to 17). Beginning in 2003, samples collected by MDH from Edina well E7 showed detections of vinyl chloride above the EPA MCL (Refs. 6, p. 310; 19, p. 4; 70, pp. 12, 21). After three consecutive detections of vinyl chloride above the MCL in 2004, Edina temporarily closed well E7 due to contamination and requested assistance from MPCA to determine the source of chlorinated VOCs in well E7 (Refs. 6, pp. 310 to 313; 19, p. 4; 70, p. 3). A new water treatment plant was opened in 2007 and Edina well E7 was returned to service and is currently active as a drinking water well (Ref. 17).

From July 2004 to June 2006, MPCA conducted numerous investigations to locate the sources of contamination in Edina well E7 (Ref. 7, pp. 8 to 11). These investigations included land use and source characterization surveys, database searches, well surveys, and soil and groundwater sampling (Ref. 7, pp. 8, 9, 157, 158, 513, 930). Results of these investigations revealed several potential chemical release facilities, including those that might have used PCE and TCE (Ref. 7, pp. 8 to 11). A groundwater sample collected from monitoring well W437, located about 2.3 miles northeast of Edina well E7, contained PCE up to 13,000 micrograms per liter (µg/L) (Ref. 7, pp. 9, 939) (see Figure 3 of this HRS documentation record). As a result, additional investigations were recommended and included more

extensive sampling in St. Louis Park (Ref. 7, pp. 8 to 11). As the investigations expanded, analytical results for groundwater samples collected identified several sources of chlorinated VOCs in the St. Louis Park area (along Highway 7, about 2 miles north of Edina well E7) (Ref. 7, pp. 1224, 1230, 1231, 1232, 1254 through 1258). Chlorinated VOCs, including 1,1-DCE (6.6 up to µg/L), cis-1,2-DCE (1,500 up to µg/L), trans-1,2-DCE (1,700 µg/L), PCE (13,000 up to µg/L), TCE (4,200 up to µg/L), and vinyl chloride (up to 160 µg/L), were detected in groundwater samples collected from multiple aquifers, including the Quaternary Drift (0 to 90 feet below ground surface [bgs]), Platteville-Glenwood (90 to 122 feet bgs), St. Peter (135 to 290 feet bgs), and Prairie du Chien-Jordan aquifers (290 to 417 feet bgs) (Ref. 7, pp. 12, 1239 through 1249). Further, water level data collected from August 2005 to June 2006 indicated that during the summer months, heavy pumping of the municipal wells creates a hydraulic gradient that allows contamination in the Prairie du Chien aquifer to migrate from north to south towards Edina. Contamination from the Quaternary Drift, Platteville-Glenwood, and St. Peter aquifers appears to be migrating laterally and vertically south-southeast and enters the Prairie du Chien-Jordan aquifer through the St. Peter bedrock valley (Ref. 7, pp. 24, 25, 26, 33, 1224, 1225; 55, pp. 10, 11).

In addition to the investigations mentioned above, MPCA also investigated a dry cleaner in Edina and a dry cleaner in Hopkins, located west of the Site (Refs. 3; 7, pp. 9, 1595). Samples collected at the dry cleaner facilities (in Edina and Hopkins) showed PCE up to 670 micrograms per kilogram (µg/kg) in soil (10 feet bgs), up to 15 µg/L in groundwater (83.1 feet bgs), and up to 4,990 micrograms per cubic meter (µg/m^3) in soil gas (8 feet bgs) (Ref. 7, pp. 9, 10, 1601 to 1606). Detectable concentrations of cis-1,2-DCE (9.6 µg/kg) and TCE (4.4 µg/kg) also were present in soil (2 feet bgs) collected at the dry cleaner facilities (Ref. 7, pp. 9, 10, 39, 1600, 1603).

High concentrations of PCE in the Quaternary Drift aquifer raised concerns about the potential for vapor intrusion. In 2007, MPCA requested assistance from EPA to conduct vapor testing in residential commercial areas (Ref. 7, p. 30). Subsequently in 2008, EPA conducted a vapor intrusion study that included the collection of sub-slab soil gas samples from 236 residential and commercial properties located north and south of Highway 7 (between Highway 100 and Louisiana Avenue). Of the 236 properties sampled, 40 residential and commercial properties contained chlorinated VOCs at concentrations above their respective sub-slab action levels set by MPCA. Subsequently, EPA installed vapor mitigation systems in 40 residential properties where chlorinated VOCs were present above sub-slab action levels (Refs. 7, pp. 30, 4244, 4257, 4260 to 4267, 4474; 45, p. 2; 53, pp. 3, 4; 60, p. 2; 63; 64).

In 2009, MPCA collected soil, soil gas, and groundwater samples from 12 facilities identified as potential source areas in St. Louis Park, near Highway 7 (Ref. 7, pp. 10, 1977, 1978, 1989) (see Figure 2 of this HRS documentation record). Soil samples collected from some of the suspected source areas contained PCE at concentrations of 57.5 to 35,200 µg/kg, at depths ranging from 3 to 70 feet bgs (Refs. 6, p. 6; 7, pp. 2006, 2007, 2008). Soil gas samples contained PCE (up to 17,000 µg/m^3) and TCE (up to 508 µg/m^3) (Ref. 7, pp. 2009, 2010, 2011). Groundwater samples collected from the temporary wells contained cis-1-2-DCE (up to 4,800 up µg/L), PCE (up to 21,000 µg/L), and vinyl chloride (up to 240 µg/L) at depths ranging from 44 to 56 feet bgs (Refs. 6, p. 6; 7, pp. 10, 11, 2012, 2013, 2014). It should be noted that some soil samples likely were collected below the water table.

In 2016, MCPA prepared a preliminary assessment (PA). The PA included a review and summary of background information, previous investigations, and exposure pathway discussions. The PA concluded that dense non-aqueous phase liquid (DNAPL) may be present at the Site, and additional investigation was needed to determine the extent and magnitude of releases and the suspected source areas. After the PA, MPCA conducted a site inspection (SI) and ESI under a cooperative agreement with EPA, Region 5 (Refs. 6, p. 3; 7, p. 5). In December 2016, the City of St. Louis Park temporarily closed municipal well SLP4 due to contamination detected during the SI (cis-1,2- DCE at 37 µg/L and vinyl chloride at 4.4 µg/L) until upgrades to the water treatment plant could be completed (Refs. 7, p. 3342; 39, p. 3). In March 2019, upgrades to the water treatment plant were completed and SLP4 was brought back online. MPCA and MDH continue to monitor contaminant concentrations in the Edina and St. Louis Park municipal water wells (Ref. 17; 42).

PREVIOUS INVESTIGATIONS

Since 2004, numerous sampling events were conducted within Edina and St. Louis Park to delineate the extent and identify the source of the groundwater contamination. The investigations primarily focused on four municipal wells that withdraw water from the Prairie du Chien-Jordan aquifer, two in Edina (E2 and E7) and two in St. Louis Park (SLP4 and SLP 6). St. Louis Park has designated municipal well SLP6 as an emergency well. It is regularly maintained and sampled on a quarterly basis; however, it is not used for drinking water (Ref. 39, pp. 2, 4).

Table 1 lists sampling events conducted at the Site since 2010, including hazardous substances detected in samples collected.

TABLE 1: Summary of Previous Investigations

Company/ Agency	Investigation	Report Date	Samples Collected	Hazardous Substances Detected	References
MPCA	SI - St. Louis Park Plume	February 2017	Groundwater	cis-1,2-DCE trans-1,2-DCE PCE TCE Vinyl chloride	6, pp. 3 to 6, 12, 13
AECOM – Prepared for MPCA	St. Louis Park Investigation – FY16	July 2016	Soil, Groundwater, Air, Soil Vapor	PCE TCE cis-1,2-DCE trans-1,2-DCE Vinyl chloride	9, pp. 1, 10 to 29
St. Louis Park	Annual Monitoring – FY 2015	March 2016	Groundwater	1,1-DCE cis-1,2-DCE trans-1,2-DCE PCE TCE Vinyl chloride	75, pp. 6, 7, 52, 53, 54, 58, 65, 64, 65, 68, 69, 76, 77, 86, 87, 98, 99, 106, 107, 183, 184, 192, 193, 197; 78, pp. 4, 27, 28
AECOM – Prepared for MPCA	St. Louis Park Investigation	April 2015	Soil, Sub-Slab Soil, Soil Vapor, Air, Groundwater	DCE cis-1,2-DCE trans-1,2-DCE PCE TCE Vinyl chloride	14, pp. 6 to 8, 22 to 25, 28 to 61
MPCA	PA St. Louis Park	December 2015	Desktop Review	NA	8, pp. 1, 4, 5, 6, 8
AECOM – Prepared for MPCA	Site Investigation Report	July 2014	Soil, Sub-Slab Soil, Soil Vapor, Groundwater	DCE cis-1,2-DCE trans-1,2-DCE PCE TCE 1,1,2-TCA Vinyl chloride	13, pp. 7, 8, 9, 12 to 23, 42 to 55

TABLE 1: Summary of Previous Investigations					
Company/ Agency	**Investigation**	**Report Date**	**Samples Collected**	**Hazardous Substances Detected**	**References**
AECOM – Prepared for MPCA	VOC Sampling of the Edina and St. Louis Park Wells in FY 2013	June 2013	Groundwater	1,1-DCA cis-1,2-DCE PCE TCE Vinyl chloride	12, pp. 1, 8 to 33
AECOM – Prepared for MPCA	Water Level Monitoring in Three OPCJ Wells, Edina - St. Louis Park Final Report	March 2010	NA	NA	33, pp. 1, 2
STS Consultants, LTD	Soil, Soil Vapor, and Groundwater Investigation	September 2007	Passive soil gas	PCE TCE	62, pp. 4, 5, 6

Notes:

DCA	Dichloroethane
DCE	Dichloroethene
FY	Fiscal year
MPCA	Minnesota Pollution Control Agency
NA	Not applicable
PA	Preliminary assessment
PCE	Tetrachloroethene
SI	Site investigation
TCA	Trichloroethane
TCE	Trichloroethene
VC	Vinyl Chloride
VOC	Volatile organic compound

The City of St. Louis Park conducts annual groundwater monitoring at Reilly Tar & Chemical facility, an NPL site located in St. Louis Park. The groundwater monitoring is conducted in accordance with Section 3.4 of the Consent Decree - Remedial Action Plan (CD-RAP) in the case of the United States of America, *et al.* vs. Reilly Tar & Chemical Corporation, *et al.* (effective date September 4, 1986) basis (Refs. 69, p. 4; 78, p. 4). The primary contaminants of concern for the Reilly Tar are polycyclic aromatic hydrocarbons (PAH); however, MPCA requires VOC monitoring at Reilly Tar, its monitoring well network, and Edina and St. Louis Park municipal wells (Ref. 69, p. 4). PAHs are not evaluated in this HRS documentation record. Analytical results of groundwater samples collected during the monitoring program have documented releases of 1,1-DCE (up to 2.3 µg/L), cis-12-DCE (up to 182 µg/L), TCE (up to 5 µg/L), and vinyl chloride (up 14.1 µg/L) in wells completed in the interconnected Quaternary drift, Platteville-Glenwood, St. Peter, and Prairie du Chien-Jordan aquifers (Refs. 17, p. 1; 27, pp. 1, 12, 13; 75, pp. 10, 11, 78, 79, 106, 107).

In June 2016, MCPA conducted a SI at the Site (Ref. 6, pp. 3 to 5). The SI was conducted to verify the presence of chlorinated VOCs in Edina and St. Louis Park municipal water wells, evaluate groundwater quality within Edina and St. Louis Park, and provide updated details regarding the conceptual site model (Ref. 6, p. 4). During the SI, MPCA focused on collecting groundwater samples from four municipal water wells, two from Edina (E2 and E7) and two from St. Louis Park (SLP4 and SLP6) that withdraw water from the Prairie du Chien-Jordan aquifer (Ref. 6, p. 4). In addition to the municipal wells, MPCA collected groundwater samples from permanent monitoring wells downgradient of Reilly Tar (Ref. 6, pp. 5, 9). The Reilly Tar & Chemical NPL site is located about 0.6- and 0.7-mile northwest of SLP4 and

SLP6, respectively (Ref. 6, p. 21) (see Figure 2 of this HRS documentation record). Five-Year reviews conducted for Reilly Tar do not list chlorinated solvents contaminants related to operations at Reilly Tar (Refs. 43, pp. 6, 7, 60, 63; 66, pp. 2, 3, 4; 67, pp. 13, 14; 68, pp. 15, 16, 17). Groundwater samples also were collected from monitoring and municipal wells outside of the plume to establish background levels (Ref. 6, pp. 5, 24). Analytical results showed chlorinated VOC contamination in the interconnected aquifers (Quaternary Drift, Platteville-Glenwood, and Prairie du Chien-Jordan) that underlie the Site (Ref. 6, pp. 12, 13). Concentrations of vinyl chloride, the most toxic contaminant of concern, were detected in the interconnected aquifer system as follows: Quaternary Drift aquifer, up to 460 µg/L; Platteville-Glenwood, up to 760 µg/L; and Prairie du Chien-Jordan, up to 4.4 µg/L (Ref. 6, pp. 4, 5, 12, 13, 34, 37, 40). Cis-1,2-DCE (up to 6,500 µg/L in monitoring wells and up to 37 µg/L in municipal water wells), trans-1,2-DCE (up to 320 µg/L in monitoring wells and up to 3.3 µg/L in municipal wells), and TCE (up to 8.5 µg/L in monitoring wells) also were detected in the groundwater samples (Ref. 6, pp. 34, 37, 40). The SI recommended additional investigation to characterize surface soil at the release source areas and establish the contaminant pathway from the source area to the bedrock valley and deeper Prairie du Chien-Jordan aquifer (Ref. 6, p. 16).

In 2018, MPCA conducted an ESI at the Site to identify sources of chlorinated VOCs and document aquifer interconnection within a 4-mile radius of the Site (Ref. 7, pp. 6, 7). The ESI presented a detailed analysis and evaluation of all existing data for the Site and a hydrogeologic investigation, including aquifer pump tests. Releases to groundwater were categorized by aquifer in the interconnected system and hydraulic conductivities in each zone were calculated (Ref. 7, pp. 12 to 28). The ESI concluded that the aquifers that underlie the Site are laterally continuous and are hydraulically interconnected between St. Louis Park and Edina (Ref. 7, p. 32). Aquifer interconnection was documented through aquifer pump tests that showed drawdown in the test wells, and analytical results that document the migration of chlorinated VOCs from the Quaternary Drift, Platteville-Glenwood, St. Peter, and Prairie du Chien-Jordan aquifers (see Section 3.0.1 of this HRS documentation record) (Ref. 7, pp. 26, 32, 33).

2.2 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Number of source: 1

Name of source: Contaminated Groundwater Plume

Source Type: Other – Groundwater Plume with No Identified Source

Description and Location of Source (with reference to a map of site):

The Site consists of a contaminated groundwater plume with no identified source in the interconnected Quaternary Drift, Platteville-Glenwood, St. Peter, and Prairie du Chien-Jordan aquifers underlying portions of Edina and St. Louis Park (Refs. 3; 5; 6, pp. 3, 5, 6, 10 to 13, 21, 22, 24, 25, 34, 37, 40; 75, pp. 6, 7, 52, 53, 54, 58, 65, 64, 65, 68, 69, 76, 77, 86, 87, 98, 99, 106, 107, 183, 184, 192, 193, 197; 84, p. 13) (see Figures 1 and 2 of this HRS documentation record). The groundwater plume that comprises the Site is currently defined by documented observed releases in groundwater monitoring and municipal water wells in Edina and St. Louis Park that are completed in the aquifers as follows: Quaternary Drift aquifer in wells P307, P309, P310; Platteville-Glenwood aquifer in wells W120, W143, W433, W434, W437, W438; the St. Peter aquifer in wells W133, W24, W409, W410, W411, W414; and the Prairie du Chien-Jordan aquifer in wells E7, SLP4, SLP6, W23, W48, and W119R (Refs. 6, pp. 4, 5, 12, 13, 21, 24, 25, 34, 37, 40; 28, pp. 9, 24, 42, 51, 56, 60, 65, 83, 87, 91, 100, 101, 161, 163, 171, 172, 173, 178, 186, 188, 196, 198, 200; 75, pp. 6, 7, 52, 53, 54, 58, 64, 65, 68, 69, 76, 77, 86, 87, 98, 99, 106, 107, 192, 193, 196; 84, p. 13; 86, p. 14) (see Figure 2 of this HRS documentation record).

Analytical results for samples collected from monitoring and municipal wells during the MPCA SI, annual groundwater monitoring events related to Reilly Tar & Chemical, and Edina and St. Louis Park municipal water monitoring programs showed contamination in the Quaternary Drift, Platteville-Glenwood, St. Peter, and Prairie du Chien-Jordan aquifers, indicating that contamination has moved from the Quaternary Drift aquifer to the Prairie du Chien-Jordan aquifer (Refs. 6, pp. 33 through 41; 7, pp. 28, 3619 through 4105; 73, pp. 5, 6; 75, pp. 6, 7, 52, 53, 54, 58, 65, 64, 65, 68, 69, 76, 77, 86, 87, 98, 99, 106, 107, 183, 184, 192, 193, 197; 84, p. 13). More specifically, groundwater samples collected during the MPCA SI document observed releases of cis-1,2-DCE (up to 6,500 µg/L), trans-1,2-DCE (up to 320 µg/L), TCE (up to 8.5 µg/L), and vinyl chloride (up to 760 µg/L) that define the approximate extent of the Site (Ref. 6, pp. 21, 24, 25, 34, 37, 40) (see Table 14 of this HRS documentation record). Groundwater samples collected during the 2015 annual monitoring (3rd Quarter) document observed releases of 1,1-DCE (up to 2.3 µg/L), cis-1,2-DCE (up to 182 µg/L), trans-1,2-DCE (up to 8.7 µg/L), TCE (5.0 up to µg/L), and vinyl chloride (up to 14.1 µg/L) (Ref. 75, pp. 10, 79, 107) (see Table 10 of this HRS documentation record). Groundwater samples collected from the Edina wells in 2003 contained cis-1,2-DCE (up to 23 µg/L), trans-1,2-CDE (up to 0.9 µg/L), and vinyl chloride (up to 3.1 µg/L) (Ref. 70, pp. 11, 12, 20, 21). Groundwater samples collected from the St. Louis Park municipal wells contained cis-1,2-DCE (at 17.3 µg/L), trans-1,2-CDE (0.95 µg/L), TCE (0.44 µg/L), and vinyl chloride (up to 2.2 µg/L) (Ref. 73, pp. 5, 6).

In 2018, MPCA conducted an ESI that compiled and evaluated existing data to identify potential sources of contamination (Ref. 7, pp. 5, 8 to 11). Soil, soil gas, and groundwater samples collected at and in the vicinity of numerous commercial/industrial properties in Edina and St. Louis Park areas contain chlorinated solvents (Ref. 7, pp. 1977, 1978, 1989, 2006 through 2014). While several likely sources and/or potential contributors were identified, specific releases documented in monitoring and municipal wells cannot reasonably be attributed to one or more specific sources due to the comingled nature of the releases that likely resulted from multiple sources, including dry cleaners, print shops, metals fabricators, and heat treating operations, among other commercial and industrial facilities (Refs. 6, pp. 4, 5, 6; 7, pp. 5 to 11, 92, 93, 1989, 3043; 58 p. 1; 59, p. 2; 81, pp. 5, 6). Chlorinated VOC contamination has been

documented in Quaternary Drift, Platteville-Glenwood, St. Peter, and Prairie du Chien-Jordan aquifers in the Edina and St. Louis Park areas, indicating that contamination has migrated laterally and vertically (see Sections 3.0.1 and 3.1.1 of this HRS documentation record). Additionally, water level data collected from August 2005 to June 2006 indicates that during the summer months, heavy pumping of the municipal wells creates a hydraulic gradient that allows contamination to migrate from north to south (towards Edina), and contamination from the Quaternary Drift aquifer appears to be migrating laterally and vertically to the Prairie du Chien-Jordan aquifer (Ref. 7, pp. 1224, 1225). As a result of the presence of multiple possible sources of the groundwater contamination and the likely comingling of releases over time, the Site is being scored as a groundwater plume with no identified source.

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

Groundwater samples were collected from monitoring and municipal water wells in 2015, 2016, 2018, and 2019. Table 2 presents samples collected during the 2016 MPCA SI from monitoring and municipal water wells and hazardous substances associated with Source No. 1, a groundwater plume with no identified source. For more complete analytical results documenting the groundwater plume, see Section 3.1.1 of this HRS documentation record.

TABLE 2: Source No. 1 Groundwater Wells and Associated Hazardous Substances

Well No./CLP Sample No.	Hazardous Substances	References
P307/E5QX6	cis-1,2-DCE trans-1,2-DCE Vinyl chloride	6, p. 232
P309/E5QX7	cis-1,2-DCE trans-1,2-DCE Vinyl chloride	6, p. 234
P310/E5QX8	cis-1,2-DCE trans-1,2-DCE Vinyl chloride	6, p. 236
W120/E5QY5	cis-1,2-DCE Trans-1,2-DCE	6, p. 238
W143/E5QY7	cis-1,2-DCE trans-1,2-DCE TCE Vinyl chloride	6, p. 244
W433/E5QZ4	cis-1,2-DCE trans-1,2-DCE Vinyl chloride	6, p. 246
W434/E5QZ5	cis-1,2-DCE Vinyl chloride	6, p. 248
W437/E5QZ6	Cis-1,2-DCE trans-1,2-DCE Vinyl chloride	6, p. 250
W438/E5QZ7	cis-1,2-DCE Vinyl chloride	6, p. 252
E7/E5QX1[1]	cis-1,2-DCE Vinyl chloride	6, pp. 29, 230; 75, pp. 192, 193; 84, p. 13
SLP4/E5QX9[2]	cis-1,2-DCE Vinyl chloride	6, pp. 29, 162; 73, pp. 5, 6; 75, pp. 98, 99; 86, pp. 7, 14

TABLE 2: Source No. 1 Groundwater Wells and Associated Hazardous Substances		
Well No./CLP Sample No.	**Hazardous Substances**	**References**
SLP6[2]	cis-1,2-DCE trans-1,2-DCE TCE Vinyl chloride	6, p. 29; 75, pp. 106, 107
W133	cis-1,2-DCE Vinyl chloride	75, pp. 68, 69
W24	cis-1,2-DCE	75, p. 196
W409	trans-1,2-DCE	75, p. 58
W410 W410D	cis-1,2-DCE trans-1,2-DCE TCE	75, pp. 52, 53, 54, 55
W411	Vinyl chloride	75, p. 87
W414 W414D	1,1-DCE TCE Vinyl chloride	75, pp. 76, 77, 78, 79
W23	cis-1,2-DCE trans-1,2-DCE Vinyl chloride	75, pp. 64, 65
W48	cis-1,2-DCE trans-1,2-DCE TCE Vinyl chloride	75, pp. 6, 7
W119R	cis-1,2-DCE trans-1,2-DCE TCE Vinyl chloride	75, pp. 134, 135

Notes:

[1] Sample E7 was collected from an Edina well, pubic water system identification (PWSID) 1270011, Edina (Refs. 6, p. 29; 84, p. 5)
[2] Samples SLP4 and SLP6 were collected from St. Louis Park wells (Ref. 6, p. 29).
DCE Dichloroethene
E Edina
No. Number
P Piezometer
SLP St. Louis Park
TCE Trichloroethene
W Monitoring well

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

Samples collected from Source No. 1 contained cis-1,2-DCE, trans-1,2-DCE, TCE, and vinyl chloride. Source No. 1 consists of a contaminated groundwater plume with no identified source underlying portions of Edina and St. Louis Park (Ref. 6, pp. 21, 34, 37, 40) (see Figure 3 of this HRS documentation record). Analytical results for groundwater samples collected from monitoring and municipal wells indicate that a release of hazardous substances has occurred to the ground water migration pathway, as documented in Section 3.1.1 of this HRS documentation record. Soil borings and well logs completed during soil and groundwater investigations to identify possible sources of groundwater contamination do not indicate the presence of a liner (Refs. 6, pp. 105 to 126; 7, pp. 2955 to 2990; 9, pp. 68 to 138). Therefore, a containment factor value of 10, as noted in Table 3, was assigned for the ground water migration pathway (Ref. 1, Section 3.1.2.1, Table 3-2).

TABLE 3: Containment Factors for Source No. 1

Containment Description	Containment Factor Value	References
Gas release to air	NS	NA
Particulate release to air	NS	NA
Release to groundwater: No liner; evidence of migration	10	1, Section 3.1.2.1, Table 3-2; 6, pp. 105 to 126; 7, pp. 2955 to 2990; 9, pp. 68 to 138; see also Section 3.1.1 of this HRS documentation record.
Release via overland migration and/or flood	NS	NA

Notes:

NA Not applicable
NS Not scored

2.4.2.1 HAZARDOUS WASTE QUANTITY

2.4.2.1.1 Hazardous Constituent Quantity

The total hazardous constituent quantity for Source No. 1 could not be adequately determined according to the HRS requirements; that is, the total mass of all CERCLA hazardous substances in the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.1). Insufficient historical and current data [manifests, potentially responsible party (PRP) records, State records, permits, waste concentration data, etc.] are available to adequately calculate the total or partial mass of all CERCLA hazardous substances in the groundwater plume. Therefore, there is insufficient information to calculate a total or partial Hazardous Constituent Quantity estimate for Source No. 1 with reasonable confidence. Scoring proceeds to the evaluation of Tier B, hazardous wastestream quantity (Ref. 1, Section 2.4.2.1.1).

Hazardous Constituent Quantity Assigned Value: NS

2.4.2.1.2 Hazardous Wastestream Quantity

The total hazardous wastestream quantity for Source No. 1 could not be adequately determined according to the HRS requirements; that is, the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.2). Insufficient historical and current data (manifests, PRP records, State records, permits, waste concentration data, annual reports, etc.) are available to adequately calculate the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants in the groundwater plume. Therefore, there is insufficient information to adequately calculate the total or partial mass of the wastestream plus the mass of all CERCLA pollutants and contaminants in the groundwater plume. Therefore, there is insufficient information to calculate the hazardous wastestream quantity for Source No. 1 with reasonable confidence. Scoring proceeds to the evaluation of Tier C, Volume (Ref. 1, Section 2.4.2.1.2).

Hazardous Wastestream Quantity Assigned Value: NS

2.4.2.1.3 Volume

For migration pathways, the source is assigned a value using the appropriate Tier C equation from HRS Table 2-5 (Ref. 1, Section 2.4.2.1.3). The hazardous waste quantity for a groundwater plume site with no identified source can be determined by measuring the area within all observed release samples combined with the vertical extent of contamination to arrive at an estimate of the plume volume (Ref. 1, Section 2.4.2.1).

However, the lack of vertical extent of contaminant delineation prohibits an adequate volume calculation. The presence of contaminated groundwater samples shows that the volume is greater than zero (see Table 2 of this HRS documentation record). Therefore, the volume of the Site is assigned a volume hazardous waste quantity value greater than zero. The value of greater than zero reflects that the volume is known to be greater than zero, but is unknown.

Volume Assigned Value: unknown but >0

2.4.2.1.4 Area

Tier D is not evaluated for source type “other” (Ref. 1, Section 2.4.2.1.4).

Area Assigned Value: NS

2.4.2.1.5 Source Hazardous Waste Quantity Value

As described in Section 2.4.2.1.5 of the HRS, the highest value assigned to a source from among the four tiers of hazardous constituent quantity (Tier A), hazardous wastestream quantity (Tier B), volume (Tier C), or Area (Tier D) was selected as the source hazardous waste quantity (HWQ) value (Ref. 1, Section 2.4.2.1). Tier C was assigned the greatest value of unknown but greater than zero.

Highest assigned value from Ref. 1, Table 2-5: unknown but >0

SUMMARY OF SOURCE DESCRIPTIONS

TABLE 4: Summary of Source Descriptions

Source No.	Source Hazardous Waste Quantity Value	Source Hazardous Constituent Quantity Complete? (Yes/No)	Containment Factor Value by Pathway			
			Groundwater (Ref. 1, Table 3-2)	Surface Water Overland/ Flood (Ref. 1, Table 4-2)	Air	
					Gas (Ref. 1, Table 6-3)	Particulate (Ref. 1, Table 6-9)
1	>0	No	10	NS	NS	NS

Notes:

> Greater than
NS Not scored

Total Source Hazardous Waste Quantity Value: >0.

Other Possible Sources –

No other possible sources at the site have been identified.

3.0 GROUND WATER MIGRATION PATHWAY

3.0.1 GENERAL CONSIDERATIONS

Ground Water Migration Pathway Description

Regional Geology

The Site is located in St. Louis Park and Edina, Hennepin County, Minnesota, which is situated about 3 miles west of Minneapolis (Ref. 3) (see Figure 1 of this HRS documentation record). The elevation of the Site, as determined by the City of St. Louis Park municipal well SLP4, is 900 feet above mean sea level (amsl) (Ref. 28, pp. 24, 25). The elevation of municipal well SLP4 is used throughout the geology section in relation to depths at which aquifers are encountered.

Hennepin County is underlain in descending stratigraphic order by all or some of the following units: the Des Moines Lobe glacial outwash, Platteville Formation, Glenwood Formation, St. Peter Sandstone, Prairie Du Chien Group, Jordan Sandstone, St. Lawrence Formation, Franconia Formation, Ironton and Galesville Sandstones, Eau Clair Formation, and Mt. Simon Sandstone (Refs. 21; 22).

The Des Moines Lobe glacial outwash consists of sand, loamy sand, and gravel that is overlain by less than four feet of loess (Ref. 21). The outwash ranges from 51 to 100 feet thick in the St. Louis Park area (Ref. 23).

Underlying the glacial outwash is the Platteville and Glenwood Formations, together they can be up to 34 feet thick; however, their thickness is generally less due to erosion of the upper part of the Platteville Formation where it is the uppermost bedrock unit (Ref. 24). The Platteville Formation is composed of yellowish-gray to light brown-gray, thick- to medium-bedded dolostone overlying yellowish-gray to light gray, thin-bedded limestone and is as much as 30 feet thick where uneroded. A thin bed of sandy, phosphatic dolostone lies at the bottom of the formation. The Glenwood Formation is grayish-green to brownish-gray, calcareous, sandy, phosphatic shale that is usually 3 to 5 feet thick (Ref. 24).

Underlying the Platteville and Glenwood Formations is the St. Peter Sandstone, which varies in thickness from 145 to 155 feet (Ref. 24). The upper part is characterized by thick beds of white to light gray, medium- to fine-grained quartzose sandstone. The basal part is light to medium gray, fine- to coarse-grained, and poorly sorted quartzose sandstone with interbedded shale and feldspathic siltstone of varied colors (Ref. 24). The basal St. Peter Sandstone is absent in some areas due to erosion and the Quaternary Drift is in direct contact with the Prairie du Chien Group (Refs. 54, pp. 12, 13; 80, p. 5).

The Prairie du Chien Group consists of grayish-orange to yellowish-gray, dolostone, sandy dolostone, and sandstone in the upper portion (referred to as the Shakopee Formation) and yellowish-gray to pale brown dolostone in the basal portion (referred to as the Oneota Formation). The Group is generally 125 to 140 feet thick where covered by St. Peter Sandstone (Ref. 24).

The Jordan Sandstone underlies the Prairie du Chien Group and is generally 85 to 100 feet thick where un-eroded (Ref. 24). The sandstone is a dominantly light gray sandstone characterized by coarsening-upward sequences consisting of two interlayered facies. The facies are fine- to coarse-grained, cross stratified, generally friable, quartz sandstone and very fine-grained, commonly bioturbated, feldspathic sandstone (Ref. 24).

Underlying the Jordan Sandstone in descending order are: the St. Lawrence Formation, Tunnel City Group (formerly named the Franconia Formation), the Wonewoc Sandstone (formerly the Ironton-Galesville Sandstone), the Eau Claire Formation, and the Mt. Simon Sandstone (Refs. 22; 24; 29, pp. 1, 8). Collectively these formations are about 480 feet thick and are composed of dolomite, siltstone, sandstone, and shale (Ref. 22). Wells that are evaluated in this HRS documentation record are not

completed in these deeper formations; therefore, these formations are not further characterized in this HRS documentation record (See Tables 7, 9, 11, 14, 15, and 17 of this HRS documentation record).

Regional Aquifer Description

The following aquifers underlie all or portions of the St. Louis Park area: Quaternary Drift aquifer, Platteville aquifer, St. Peter aquifer, Prairie du Chien-Jordan aquifer, Tunnel City-Wonewoc bedrock aquifer, and the Mt. Simon-Hinckley bedrock aquifer (Refs. 25; 26; 27, pp. 3, 7 through 21). It should be noted that the Quaternary Drift aquifer, Platteville aquifer, Glenwood confining unit, and the St. Peter Formation basal confining unit are not continuous at and within a 2-mile radius of the Site, as detailed below (Refs. 17, pp. 1, 2; 18; 27, pp. 1, 8, 11, 12, 13, 14; 34, pp. 1 through 4; 54, pp. 12, 13).

Information pertaining to the following wells is used to help describe the aquifers that underlie the Site.

Well No.	Background or Release[1]	Distance from Site Reference Point (W143)	Reference[2]
E2	Background	About 1.8 miles southwest of W143	3; 79, p. 3
E7	Release	About 2 miles south of W143	3; 79, p. 3
E15	Background	About 1.65 miles southwest of W143	3; 79, p. 3
SLP4	Release	About 1.25 miles southeast of W143	3; 79, p. 3
SLP5	Background	About 1.23 miles northwest of W143	3; 79, p. 3
SLP6	Release	About 0.95 mile southeast of W143	3; 79, p. 3
W122	Background	About 0.55 mile northwest of W143	3; 79, p. 4
W133	Release	About 0.4 mile northeast of W143	3; 79, p. 4

Notes:

[1] Background wells are outside the of groundwater plume and release wells are inside the groundwater plume
[2] Also see Figure 3 of this HRS documentation record.
E Edina
No. Number
SLP St. Louis Park
W Well (monitoring)

The Quaternary Drift aquifer is one aquifer consisting of geologic materials, such as till, outwash and valley train sand and gravel, lake deposits, and alluvium. The vertical and horizontal distribution of units is complex (Ref. 27, p. 7). In portions of St. Louis Park, the Quaternary Drift aquifer is stratified. While local stratified areas contain thicker strata of clay, till, and sandy till that are local barriers to groundwater migration, these areas are not continuous and there is evidence of contaminant migration throughout this aquifer (Ref. 27, pp. 7, 10 through 21) (see Table 5 in this HRS documentation record). Quaternary Drift aquifer is comprised of an upper, middle, and lower portions; however, these layers are considered to be a combined aquifer because the confining beds between them are not continuous at or near the Site (Ref. 27, p. 12). Well logs of municipal wells SLP4 and E2 show that the Quaternary Drift geologic materials are discontinuous. Municipal well E2 contains Quaternary Drift from 878 to 816 feet above msl (0 to 62 feet bgs). However, municipal well SLP4 is underlain by fill, sand, and gravel from 900 to 824 feet above msl (0 to 76 feet bgs) and only a thin layer of Quaternary Drift is present from 824 to 808 feet msl (16 feet) at this location (Ref. 28, pp. 2, 3, 25, 27). Municipal well SLP4 is evaluated as an observed release well in this HRS documentation record and municipal well E2 is used to establish background levels in this HRS documentation record (see Tables 7 through 14 of this HRS documentation record).

The Platteville aquifer underlies the Quaternary Drift aquifer in portions of St. Louis Park and Edina. The Platteville Formation locally yields small to moderate supplies of water to wells and is classified as an aquifer in historical geology references (Ref. 27, p. 17). The Platteville aquifer is a gray to buff, thin-to-

medium bedded dolomitic limestone and dolomite, with some shale parting. Groundwater flow in the Platteville aquifer primarily is through fractures, open joints, and solution channels (Ref. 27, p. 17). Where present, the Platteville aquifer is as much as 35 feet thick (Ref. 28, pp. 2, 20, 24, 35, 42, 61, 65, 67, 71, 77, 83, 91).

Underlying the Platteville aquifer is the Glenwood confining unit. The unit consists of a green to buff, plastic to slightly fissile shale and claystone, was dissected by erosion, and is discontinuous throughout portions of St. Louis Park and Edina (Refs. 27, pp. 11, 17; 28, pp. 2, 20, 24, 35, 37, 42, 44, 61, 68, 72, 78, 92). Where present, the Glenwood confining unit, is as much as 24 feet thick (Ref. 28, p. 67).

The Platteville aquifer and Glenwood confining unit are not continuous at and within a 2-mile radius of the Site (Refs. 3; 27, pp. 11, 12, 13; 28, pp. 37, 44). The Platteville aquifer is absent at monitoring wells W48, W129, W133, W122, and W401 (Refs. 28, pp. 174 to 181, 200, 201; 79, pp. 3, 4) (see Figure 3 of this HRS documentation record). Monitoring wells W129 and W133 (evaluated as an observed release well) are located within the groundwater plume and monitoring wells W122 and W401 (both evaluated as background wells) are located about 1,000 feet from the groundwater plume (Ref. 79, pp. 3, 4) (see Tables 7 and 9 and Figure 3 of this HRS documentation record). The Platteville and Glenwood Formations behave as a single aquifer when saturated and the composite aquifer is referred to as the Platteville-Glenwood aquifer (Ref. 7, p. 13). Most of the leakage from the Quaternary Drift and Platteville aquifer to the underlying St. Peter aquifer occurs through areas where the Glenwood confining unit is absent or discontinuous (Ref. 27, p. 1).

The St. Peter aquifer underlies the Glenwood confining unit and is a white to yellow fine-to-medium-grained, well-sorted, friable sandstone (Ref. 27, p. 8). In the St. Louis Park and Edina areas, the St. Peter aquifer ranges from 154 to 167 feet in thickness (Ref. 28, pp. 2, 3, 9, 20, 21, 24, 25, 42, 68). A basal confining unit is present in the lower 5 to 65 feet of the St. Peter Formation and consists of siltstone and shale. The basal confining unit is present in most of the southern two thirds of Hennepin County, but it is locally absent due to erosion (Ref. 27, p. 8). The St. Peter basal confining unit is present in observed release municipal well SLP4 and monitoring well W119R (Ref. 28, pp. 25, 27, 172, 173). However, it is absent in well HS-1 located near Lake Bde Maka Ska (formerly Lake Calhoun) about 1.55 miles east of municipal well SLP4 (Refs. 18; 34, pp. 1 through 4; 80, pp. 5, 6). Therefore, the St. Peter basal confining unit is not continuous within a 2-mile radius of the groundwater plume (Refs. 3; 17, pp. 1, 2; 18; 28, pp. 25, 27, 172, 173, 192; 34, pp. 1 through 4; 80, pp. 5, 6) (See Tables 7 and 9 and Figure 3 of this HRS Documentation Record).

The Prairie Du Chien-Jordan aquifer consists of the Prairie du Chien Group and the Jordan Sandstone. The aquifer is primarily composed of dolomite and contains fractures, joints, and solution cavities that control the flow of water through it (Refs. 25; 57, p. 8). The Jordan Sandstone portion of the aquifer consists of fairly uniform quartzose sandstone and is highly permeable. Flow through it is primarily intergranular. The Prairie du Chien Group and the Jordan Sandstone function as a single aquifer because no regional confining bed separates them (Ref. 25). Groundwater flow in the Prairie du Chien-Jordan aquifer is to the southeast (Ref. 25). Because groundwater flows in the Prairie du Chien-Jordan through fractures, joints, solution enlarged openings/cavities, and conduits, the aquifer can be considered karst (Refs. 17; 25). The flow pattern may be altered by localized pumping, particularly during the summer months when there is heavy demand (Ref. 25).

Site Geology/Hydrogeology

Table 5 below provides a summary of the stratigraphy for several of the Edina and St. Louis Park municipal and monitoring wells (Ref. 28, pp. 2, 3, 9, 10, 12, 20, 21, 24 to 26, 35 to 39, 42, 45, 47, 174, 175, 178, 179).

TABLE 5: Site-Specific Stratigraphy				
Municipal Well/Ref.	**Geologic Material**	**Stratigraphy**	**Elevation (ft. amsl)**	**Depth (ft bgs)**
W133/ Ref. 28, pp. 178, 179	Sand	Sand brown	917 to 913	0 to 4
	Sand and Gravel	Sand and larger brown	913 to 902	4 to 15
	Coarse Sand	Sand and larger brown	902 to 892	15 to 25
	Sand and Gravel	Sand and larger brown	892 to 862	25 to 55
	Fine Sand	Sand black	862 to 842	55 to 75
	Sand and Gravel	Sand and larger brown	842 to 808	75 to 109
	St. Peter	St. Peter Sandstone	808 to 795	109 to 122
	End of boring at 795 feet above msl (122 feet bgs)			
	First water encountered at 876 feet above msl (50 feet bgs)			
	Well screened from 801 to 795 feet above msl (116 to 122 to feet bgs)			
	Aquifer – St. Peter Sandstone			
W122/ Ref. 28, pp. 174, 175	Sand and Gravel	Sand and larger, yellow	920 to 887	0 to 33
	Clay and Gravel	Pebbly sand/silt/clay	887 to 865	33 to 55
	Sand	Sand brown	865 to 850	55 to 70
	Muddy Sand and Gravel	Sand and brown silt	850 to 800	70 to 120
	Sandstone and Gravel	St. Peter Sandstone	800 to 683	120 to 237
	Shale	St. Peter Sandstone	683 to 681	237 to 239
	End of boring at 681feet above msl (239 feet bgs)			
	First water encountered at 885 feet above msl (35 feet bgs)			
	Well completed as open hole 703 to 681feet above msl (217 to 239 to feet bgs)			
	Aquifer – St. Peter Sandstone			
SLP4/ Ref. 28, pp. 24 to 26	Fill	Man-made fill	900 to 897	0 to 3
	Unconsolidated Sands and Gravels	Sand and larger	897 to 824	3 to 76
	Platteville Lime	Quaternary deposit, drift	824 to 808	76 to 92
	Platteville Lime	Platteville Formation, limestone	808 to 794	92 to 106
	St. Peter Sand	Platteville Formation, limestone	794 to 784	106 to 116
	St. Peter Sand	Glenwood Formation, shale	784 to 778	116 to 122
	St. Peter Sand	St. Peter Sandstone, sandstone	778 to 665	122 to 235
	Hard Sandstone and Shale	St. Peter Sandstone, sandstone	665 to 623	235 to 277
	Lime	St. Peter Sandstone, sandstone	623 to 611	277 to 289
	Lime	Prairie du Chien, dolomite	611 to 502	289 to 398
	Jordan Sandstone	Prairie du Chien, dolomite	502 to 483	398 to 417
	Jordan Sandstone	Jordan Sandstone and Hard Shale, sandstone	483 to 430	417 to 470
	St. Lawrence	Jordan Sandstone and Hard Shale, sandstone	430 to 403	470 to 497
	St. Lawrence	St. Lawrence, dolomite	403 to 397	497 to 503
	End of boring at 397 feet above msl (503 feet bgs)			
	First water encountered at 812 feet above msl (85 feet bgs)			
	Well completed as open hole - 490 to 397 feet above msl (410 to 503 feet bgs)			
	Aquifer – Prairie du Chien-Jordan			
SLP5/ Ref. 28, pp. 35 to 39	Unconsolidated Sands and Gravels	Sand, gravel, clay, and boulders	930 to 821	0 to 109
	Platteville Lime	Limestone	821 to 810	109 to 120
	Shale and rock	Glenwood	810 to 798	120 to 132
	Sandrock, shale, and rock	St. Peter Sand	798 to 645	132 to 285

TABLE 5: Site-Specific Stratigraphy				
Municipal Well/Ref.	**Geologic Material**	**Stratigraphy**	**Elevation (ft. amsl)**	**Depth (ft bgs)**
	Shakopee lime	Prairie du Chien Group	645 to 523	285 to 407
	Sands	Jordan Sand	523 to 470	407 to 460
	Dolomite	St. Lawrence	470 to 465	460 to 465
	End of boring at 465 feet above msl (465 feet bgs)			
	First water encountered at 839 feet above msl (91 feet bgs)			
	Well completed as open hole - 625 to 465 feet above msl (305 to 465 feet bgs)			
	Aquifer – Prairie du Chien-Jordan			
SLP6/ Ref. 28, pp. 42, 45, 47	Unconsolidated Sands and Gravels	Gravel drift	915 to 825	0 to 90
	Limerock	Platteville Lime	825 to 793	90 to 122
	Shale	Glenwood	793 to 788	122 to 127
	St. Peter Sand	St. Peter Sand	788 to 625	127 to 290
	Shakopee lime	Prairie du Chien Group	625 to 498	290 to 417
	Jordan Sandstone St. Lawrence, dolomite	Jordan Sand St. Lawrence	498 to 435 435 to 433	417 to 480 480 to 482
	End of boring at 433 feet above msl (482 feet bgs)			
	Water encountered – 855 feet above msl (60 feet bgs)			
	Well completed as open hole – 612 to 433 feet above msl (303 to 482 feet bgs)			
	Aquifer – Prairie du Chien-Jordan			
Edina 2 (E2)/ Ref. 28, pp. 2, 3	Drift	Quaternary deposit, drift	878 to 816	0 to 62
	Platteville Limestone	Quaternary deposit, drift	816 to 815	62 to 63
	Platteville Limestone	Platteville Formation, limestone	815 to 792	63 to 86
	Platteville Limestone	Glenwood Formation, shale	792 to 787	86 to 91
	Platteville Limestone	St. Peter Sandstone, sandstone	787 to 781	91 to 97
	St. Peter Sandstone	St. Peter Sandstone, sandstone	781 to 619	97 to 259
	St. Peter Sandstone	Prairie du Chien, dolomite	619 to 616	259 to 262
	Prairie du Chien Group	Prairie du Chien, dolomite	616 to 497	262 to 381
	Prairie du Chien Group	Jordan Sandstone, sandstone	497 to 493	381 to 385
	Jordan Sandstone	Jordan Sandstone, sandstone	493 to 430	385 to 448
	End of boring at 430 feet above msl (448 feet bgs)			
	Water encountered at 776 feet above msl (102 feet bgs)			
	Well completed as open hole – 612 to 432 feet above msl (266 to 446 feet bgs)			
	Aquifer - Prairie du Chien-Jordan			
Edina 7 (E7)/ Ref. 28, pp. 9, 10, 12	Unconsolidated Sands and Gravels	Clay, sand, and sand and gravel	951 to 819	0 to 132
	Limerock	Platteville	819 to 792	132 to 159
	Soapstone, shale	Glenwood	792 to 789	159 to 162
	Sandrock, sandrock and shale	St. Peter	789 to 627	162 to 324
	Shakopee, dolomite	Prairie du Chien Group	627 to 498	324 to 453
	Jordan	Jordan, sands	498 to 406	453 to 545
	Shale	Jordan-St. Lawrence	406 to 404	545 to 547
	End of boring at 404 feet above msl (547 feet bgs)			
	Water encountered at 839 feet above msl (112 feet bgs)			
	Well completed as open hole – 601 to 404 feet above msl (350 to 547 feet bgs)			
	Aquifer - Prairie du Chien-Jordan			
Edina 15 (E15)/	Sand and clay	Sand and clay, primarily sand	897 to 806	0 to 91
	Platteville Rock	Platteville-Glenwood,	806 to 786	91 to 111

TABLE 5: Site-Specific Stratigraphy				
Municipal Well/Ref.	**Geologic Material**	**Stratigraphy**	**Elevation (ft. amsl)**	**Depth (ft bgs)**
Ref. 28, pp. 20, 21		limestone		
	St. Peter Sandstone	Sandstone	786 to 692	111 to 205
	Shale and sand mix	St. Peter Sandstone	692 to 637	205 to 260
	Shale	St. Peter Sandstone	637 to 632	260 to 265
	Rock	Prairie du Chien, dolomite	632 to 497	265 to 400
	Jordan Sandstone	Sandstone	497 to 492	400 to 405
	Jordan	Jordan Sandstone, sandstone	492 to 422	405 to 475
	End of boring at 422 feet above msl (475 feet bgs)			
	Water encountered at 828 feet above msl (112 feet bgs)			
	Well completed as open hole – 622 to 422 feet above msl (275 to 475 feet bgs)			
	Aquifer - Prairie du Chien-Jordan			

Notes:

ft bgs Feet below ground surface
ft amsl Feet above mean sea level
Ref. Reference

Aquifer Discontinuity

Aquifer boundaries that completely transect the interconnected Quaternary Drift, Platteville-Glenwood, St. Peter, and Prairie du Chien-Jordan aquifers within 4 miles of the Site have not been identified (Ref. 27, pp. 11 to 16, 18, 19, 20). Confining units in the upper, middle, and lower portions of the Quaternary Drift aquifer and some areas of the Glenwood Formation and St. Peter basal confining unit are thin or absent (Refs. 3; 17, pp. 1, 2; 18; 27, pp. 1, 8, 12, 13, 14; 34, pp. 1 through 4; 80, pp. 5, 6). However, these are not aquifer discontinuities for HRS scoring purposes as they do not create a continuous boundary to groundwater flow within 4 miles of the site. In such areas, the Quaternary Drift is directly on top of the Prairie du Chien-Jordan aquifer and contaminants migrating within the shallow Quaternary Drift may enter directly into the Prairie du Chien-Jordan aquifer (Refs. 1, Section 3.0.1.2.2; 54, pp. 12, 13; 18; 34, pp. 1 through 4; 80, pp. 5, 6).

Aquifer Interconnection

The Quaternary Drift and Platteville-Glenwood aquifers and associated confining units, as well as the St. Peter basal confining unit, are not continuous within 2 miles of the groundwater plume (Refs. 3; 17, pp. 1, 2; 27, pp. 1, 8, 12, 13, 14; 18; 34, pp. 1 through 4; 54, pp. 12, 13; 80, p. 6). Specific locations where these units are not encountered in well logs at and within a 2-mile radius of the groundwater plume are detailed below. The well logs are presented in Reference 28 and the locations of the wells are provided in Reference 79, pp. 3, 4, 5, 6 and Figure 3 of this HRS documentation record.

<u>Quaternary Drift</u>

- Present throughout the entire study area (Refs. 7, pp. 12, 13; 21; 28)
- Specific examples include well logs for wells E2, E13, E15, SLP4, SLP5, SLP6, W143, W48 (Ref. 2, 22, 25, 26, 29, 37, 44, 65, 112, 200, 201).

<u>Platteville Formation and Glenwood Confining Unit</u>

- Present at observed release municipal well E7 (Ref. 28, pp. 9, 10, 12)
- Absent at observed release monitoring well W133 (Ref. 28, pp. 178, 179)
- Absent in monitoring wells W122 and W401 (both of which are evaluated as background wells) (Ref. 28, pp. 174, 175, 180, 181)
- Absent at monitoring well W129 (within the Site boundary) (Ref. 28, p. 176, 177)

St. Peter Formation Basal Confining Unit

- Present in observed release municipal well SLP4 and monitoring well W119R (Ref. 28, pp. 25, 27, 173)
- Absent in well HS-1 about 1.55 miles east of municipal well SLP4 near Lake Bde Maka Ska (Lake Calhoun) (Refs. 18; 34, pp. 1 through 4).

In addition to discontinuity in aquifers and confining units; horizontal communication across Prairie du Chien-Jordan aquifer has been documented. In 2014, a groundwater production test was completed by MDH to correlate groundwater elevations in between the newly installed Meadowbrook Golf Course well (W119R also known as Meadowbrook 2), Meadowbrook 1 (W119), and the Methodist Hospital well (W48) (Refs. 7, pp. 19, 63, 3372 to 3376; 17, pp. 1, 2). All three wells are installed in the Prairie du Chien-Jordan aquifer (Refs. 7, p. 19; 28, p. 171, 172, 173; 78, pp. 15, 27). The test indicated (1) well construction techniques and geological character of aquifer materials cause a large effective radius for the pumped well; (2) the connection between the pumped well and observation well was essentially identical, even though the distance between the two wells was 133 feet; (3) open conduits and/or bedding-plane fractures within the Prairie du Chien-Jordan aquifer (dolostone-sandstone aquifer) transmit pumping stresses very quickly over a wide area; and (4) other pumping wells influence water levels (Refs. 7, p. 3376; 17, pp. 1, 2).

In January 2017, MDH conducted an aquifer pump test on Edina municipal well E6 to evaluate the effect pumping had on water levels in monitoring well W403 in St. Louis Park (Ref. 7, pp. 66, 3400 to 3404). Both wells are installed in the Prairie du Chien-Jordan aquifer (Ref. 7, p. 3406; 28, p. 67). The effect of pumping Edina municipal well E6 and the related drawdown effects on W403 and other Edina municipal wells indicates hydraulic communication in the Prairie du Chien-Jordan aquifer between St. Louis Park and Edina (Ref. 7, pp. 19, 66 to 70). The hydraulic response of W403 is related to the pumping of Edina wells E6 and E2. However, the daily water level variation observed in well W403 cannot be attributed to only one well, but instead results from the additive effects of many high-capacity wells (Ref. 7, pp. 19, 4039).

Groundwater contamination has also been shown in monitoring wells that withdraw water from the Quaternary Drift, Platteville-Glenwood, St. Peter, and Prairie du Chien-Jordan aquifers as documented in Section 3.1.1 Observed Release (see Tables 10, 14, 16, and 18 of this HRS documentation record). Groundwater flow in the interconnected aquifers is complex, generally flows east-southeast; recharge occurs through downward leakage from overlying aquifers and in areas where confining units are thin or absent due to erosion; and in some aquifers, groundwater flows through fractures, open joints, and solution channels and is believed to be influenced by pumping of multi-aquifer wells (Refs. 25; 27, pp. 5, 8, 9, 17; 80, pp. 5, 8; 65, p. 11).

Groundwater contamination has been shown in St. Louis Park municipal wells SLP4 and SLP6, as well as Edina municipal well E7 (see Tables 10, 14, 16, and 18 of this HRS documentation record). St. Louis Park municipal wells SLP4 and SLP6 and Edina municipal well E7 withdraw water from the Prairie du Chien-Jordan aquifer. Each of these wells is cased from the top of the well and is completed as an open hole within the Prairie du Chien-Jordan Sandstone aquifer (Refs. 28, pp. 9, 10, 11, 24, 25, 42 to 46; 30, pp. 1, 2).

The St. Louis Park and Edina municipal wells have been shown to be hydraulically connected. While partial discontinuities exist at and within a 2-mile radius of the groundwater plume as presented above, well logs (for wells E2, E4, E7, E15, W119R, W122, W129, W133, W401, W440, and SLP4) show the absence of some or all of the units including the Quaternary aquifer, Platteville aquifer, Glenwood Formation, and St. Peter basal confining unit at and within a 2-mile radius of the groundwater plume (Refs. 3; 17, pp. 1, 2; 27, pp. 1, 8, 12, 13, 14; 28, pp. 2, 9, 10, 12, 24, 106, 173 to 181, 192; 54, pp. 12, 13). Additionally, groundwater contamination has been shown in St. Louis Park and Edina municipal

wells, as well as monitoring wells that withdraw water from Quaternary Drift, Platteville-Glenwood, St. Peter, and the Prairie du Chien-Jordan aquifers. Based on this information, the Quaternary Drift, Platteville-Glenwood, St. Peter, and the Prairie du Chien-Jordan aquifers are considered interconnected for HRS scoring purposes, and a strong hydraulic connection exists between St. Louis Park and Edina municipal wells (Refs. 7, pp. 19, 66 to 70, 3372 to 3376, 3400 to 3404, 4039; 27, pp, 11, 12, 13, 14; 54, pp. 12, 13) (also see Tables 10, 14, 16, and 18 in Section 3.1.1, Observed Release, of this HRS documentation record).

SUMMARY OF AQUIFERS BEING EVALUATED

TABLE 6: Summary of Aquifers Being Evaluated

Aquifer Name	Is Aquifer Interconnected with Upper Aquifer within 2 Miles? (Yes/No/NA)	Is Aquifer Continuous within 4-mile TDL? (Yes/No)	Is Aquifer Karst? (Yes/No)	References
Quaternary Drift	NA	Yes	No	3; 18; 27, pp. 7, 10, 17; 28, pp. 2, 24
Platteville-Glenwood	Yes	No	No	3; 18; 27, pp. 11 through 19; 28, pp. 2, 8, 9, 20, 24, 35, 42, 51, 52, 56, 57, 60, 65, 67, 71, 77, 83, 87, 91
St. Peter	Yes	No	No	3; 18; 27, pp. 8, 11, 12, 13, 20; 34, pp. 1 through 4; 54, pp. 12, 13
Prairie du Chien-Jordan	Yes	Yes	Yes	3; 25; 28, pp. 2, 3, 9, 10, 20, 21, 24, 25, 26, 35, 39, 42, 45, 47; 54, p, 13

Notes:

NA Not applicable
TDL Target distance limit

3.1 LIKELIHOOD OF RELEASE

3.1.1 OBSERVED RELEASE

Aquifer Being Evaluated: Interconnected Quaternary Drift, Platteville-Glenwood, St. Peter, Prairie du Chien-Jordan Aquifers

- Hazardous Substances in Release: 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, TCE, and vinyl chloride

Chemical Analysis

An observed release by chemical analysis is established by showing that the hazardous substance in release samples is significantly greater in concentration than in the background samples and by documenting that at least part of the significant increase is attributed to a release from the site being evaluated. The significant increase can be documented in one of two ways for HRS purposes. If the background concentration is not detected (or is less than the detection limit), an observed release is established when the sample measurement equals or exceeds the appropriate quantitation or detection limit. If the background sample concentration equals or exceeds the quantitation or detection limit, an observed release is established when the sample measurement is three times or more above the background concentration and above the appropriate quantitation or detection limit (Ref. 1, Table 2-3). An observed release of 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, TCE, and vinyl chloride is documented in the following sections by comparing the hazardous substance concentrations in similar background and observed release monitoring and municipal well water samples (see Tables 8, 10, 12, 14, 15, and 16 in this section). Several sampling events are used to establish observed release for each aquifer evaluated. The samples documenting this observed release were collected by St. Louis Park during the Reilly Tar & Chemical 2015 annual monitoring event, MPCA during the 2016 SI, MDH in 2018 for the City of Edina (municipal well E7) and the City of St. Louis Park in 2019 (municipal well SLP4) after they were brought back online (Refs. 6, pp. 3, 4, 5; 72, pp. 1, 3, 4; 74, p. 2; 78, pp. 1, 4, 5; 84, p. 13). Groundwater samples collected from municipal and monitoring wells contain 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, TCE, and vinyl chloride at concentrations that establish observed releases (see Tables 8 through 16 of this HRS documentation record).

TCE, 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride are manufactured chemicals, not thought to occur naturally, and are at very low to non-detect concentrations in all background well samples collected from the St. Louis Park and Edina monitoring well network (Refs. 38; 47; 48; 49) (see Section 3.1.1 and Tables 8 and 10 of this HRS documentation record). Chlorinated solvents (such as TCE and PCE) are man-made compounds commonly used in commercial/industrial operations, such as dry cleaning and metal degreasing, while other contaminants, such as cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride, are common breakdown products of TCE and PCE (Refs. 46, p. 24; 47; 48; 49; 82, pp. 1, 173).

The analytical data sheets contained in the background and observed release results tables of this HRS documentation record use the terms dichloroethene, which is another name for dichloroethylene and trichloroethene, which is another term for trichloroethylene (TCE) (Ref. 46, p. xiv).

2015 St. Louis Park Annual Groundwater Monitoring Event

Background samples listed in Table 7 were collected by the City of St. Louis Park during the 2015 annual monitoring event for the Reilly Tar & Chemical NPL site. The samples were collected in accordance with Section 3.4 of the Consent Decree - Remedial Action Plan (CD-RAP) in the case of the United States of America, *et al.* vs. Reilly Tar & Chemical Corporation, *et al.* (effective date September 4, 1986) (Ref. 78, pp. 1, 4). The field collection sheets are provided in Appendix B of Reference 78 (Ref. 78, pp. 125, 132, 135, 138, 149, 151, 154, 157, 159, 161, 163). The chain-of-custody records are provided in Reference 77. Background and release monitoring and municipal water samples were collected from wells of similar depths and screened intervals, selected to establish releases by aquifer, and were selected to encapsulate the approximate extent of the Site. The background and release samples were collected during the same time period, following the same sampling procedures, and analyzed for the same analytical parameters using the same analytical methods (Refs. 6, pp. 28, 28; 75, pp. 1, 2, 12, 48, 70, 90, 122, 126, 152; 78, pp. 9, 10, 27; 79, pp. 3, 4).

TABLE 7: 2015 Background Well Locations

Well No.	Laboratory ID	Well Depth/ Screened Interval (ft amsl)	Date Sampled	Location	References[1]
St. Peter Aquifer					
W122	10321172008	681/ 703 to 681[2]	9/8/2015	About 0.55 mile northwest of W143	28, pp. 174, 175; 77, pp. 97, 98; 78, p. 125
W14	10321361006	795/ 800 to 795	9/9/2015	About 0.35-mile northwest of W143	28, p. 157; 77, pp. 126, 127; 78, p. 135
W412	10321361001	776.17/ 803.17 to 776.17	9/9/2015	About 0.6-mile northeast of W143	77, pp. 126, 127; 78, pp. 21, 132; 79, p. 4
Prairie du Chien-Jordan Aquifer					
W29	10322146006	560/ 638 to 560[2]	9/15/2015	About 1.34 mile west-southwest of W143	28, p. 165; 77, pp. 203, 204; 78, p. 154
W403	10322146003	482/ 632 to 482[2]	9/15/2015	About 1.5 miles east-southeast of W143	28, p. 67; 77, pp. 203, 204; 78, p. 151
E2	10322385006	430/ 612 to 432[2]	9/16/2015	About 1.8 miles southwest of W143	28, p. 2; 77, pp. 245, 246; 78, p. 162
E4	10322385007	415/ 617 to 415[2]	9/16/2015	About 2.6 miles southeast of W143	28, p. 105; 77, pp. 245, 246; 78, p. 163
E15	10322385005	422/ 622 to 422[2]	9/16/2015	About 1.65 miles southwest of W143	28, p. 20; 77, pp. 245, 246; 78, p. 161
SLP5	10322385001	465/ 625 to 465[2]	9/16/2015	About 1.23 miles northwest of W143	28, pp. 35, 38, 39; 77, pp. 245, 246; 78, p. 159
W401	10321936008	439/ 629 to 439[2]	9/14/2015	About 0.6 mile northwest of W143	28, p. 180; 75, pp. 108, 109; 78, p. 138
W440	10322146011	518/ 613 to 518[2]	9/15/2015	About 1.10 miles southwest of W143	28, p. 190; 77, pp. 203, 204; 78, p. 157
W441	10322146001	589/ 668 to 589[2]	9/15/2015	About 1.7 miles southwest of W143	28, p. 193; 77, pp. 203, 204; 78, p. 149

Notes:

[1] Also see Figure 3 of this HRS Documentation Record
[2] Well completed as an open hole from the bottom of the casing to the total well depth.
E Edina
ft amsl Feet above mean sea level
ID Identification
NA Not available
No. Number
SLP St. Louis Park
W Monitoring well

Background Concentrations

The background groundwater samples listed in Table 8 of this HRS documentation record were collected by St. Louis Park and analyzed by Pace Analytical Services (Pace) for VOCs using EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846) Method 8260B. Tetra Tech conducted a Stage 2A validation of the analytical data packages (Ref. 75). The reporting limits are listed on the analytical data sheets contained in Reference 75. The reporting limits are equivalent to sample quantitation limits (SQL) as defined in Section 1.1, Definitions of the HRS (Refs. 1, Section 1.1; 83, p.7).

TABLE 8: 2015 Background Well Results

Well No./ Unique Well No.	Hazardous Substance	Hazardous Substance Concentration (µg /L)	Sample Reporting Limit (µg /L)	References
St. Peter Aquifer				
W122	1,1-DCE	1.0 U	1.0	75, pp. 66, 67
	cis-1,2-DCE	1.0 U	1.0	
	trans-1,2-DCE	1.0 U	1.0	
	TCE	0.40 U	0.40	
	Vinyl chloride	0.40 U	0.40	
W14	1,1-DCE	1.0 U	1.0	75, pp. 84, 85
	cis-1,2-DCE	1.0 U	1.0	
	trans-1,2-DCE	1.0 U	1.0	
	TCE	0.40 U	0.40	
	Vinyl chloride	0.40 U	0.40	
W412	1,1-DCE	1.0 U	1.0	75, pp. 74, 75
	cis-1,2-DCE	1.0 U	1.0	
	trans-1,2-DCE	1.0 U	1.0	
	TCE	0.40 U	0.40	
	Vinyl chloride	0.40 U	0.40	
Prairie du Chien – Jordan Aquifer				
W29	1,1-DCE	1 U	1.0	75, pp. 136, 137
	cis-1,2-DCE	5.6	1.0	
	trans-1,2-DCE	1 U	1.0	
	TCE	0.77	0.40	
	Vinyl chloride	1.0 U	1.0	
W403	1,1-DCE	1.0 U	1.0	75, pp. 130, 131
	cis-1,2-DCE	1.0 U	1.0	
	trans-1,2-DCE	1.0 U	1.0	
	TCE	0.40 U	0.40	
	Vinyl chloride	1.0 U	1.0	
E2	1,1-DCE	1.0 U	1.0	75, pp. 188, 189
	cis-1,2-DCE	2.4	1.0	
	trans-1,2-DCE	1.0 U	1.0	
	TCE	0.40 U	0.40	
	Vinyl chloride	1.0 U	1.0	
E4	1,1-DCE	1.0 U	1.0	75, pp. 190, 191
	cis-1,2-DCE	1.0 U	1.0	
	trans-1,2-DCE	1.0 U	1.0	
	TCE	0.40 U	0.40	
	Vinyl chloride	1.0 U	1.0	

TABLE 8: 2015 Background Well Results				
Well No./ Unique Well No.	**Hazardous Substance**	**Hazardous Substance Concentration (µg /L)**	**Sample Reporting Limit (µg /L)**	**References**
E15	1,1-DCE cis-1,2-DCE trans-1,2-DCE TCE Vinyl chloride	1.0 U 4.3 1.0 U 0.67 1.0 U	1.0 1.0 1.0 0.40 1.0	75, pp. 186, 187
SLP5	1,1-DCE cis-1,2-DCE trans-1,2-DCE TCE Vinyl chloride	1.0 U 1.0 U 1.0 U 0.40 U 1.0 U	1.0 1.0 1.0 0.40 1.0	75, pp. 178, 179
W401	1,1-DCE cis-1,2-DCE trans-1,2-DCE TCE Vinyl chloride	1.0 U 4.4 1.0 U 0.40 U 1.0 U	1.0 1.0 1.0 0.4 1.0	75, pp. 108, 109
W440	1,1-DCE cis-1,2-DCE trans-1,2-DCE TCE Vinyl chloride	1.0 U 1.0 U 1.0 U 0.40 U 1.0 U	1.0 1.0 1.0 0.4 1.0	75, pp. 146, 147
W441	1,1-DCE cis-1,2-DCE trans-1,2-DCE TCE Vinyl chloride	1.0 U 2.3 1.0 U 0.40 U 1.0 U	1.0 1.0 1.0 0.4 1.0	75, pp. 126, 127

Notes:

DCE	Dichloroethene
E	Edina
No.	Number
µg/L	Micrograms per liter
SLP	St. Louis Park
TCE	Trichloroethene
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit (Ref. 75, p. 51).
W	Monitoring well

Release Samples St. Louis Park Groundwater Monitoring 2015 Results

Release groundwater samples listed in Table 9 were collected by the City of St. Louis Park during the 2015 annual monitoring event for the Reilly Tar & Chemical NPL site. The samples were collected in accordance with Section 3.4 of CD-RAP in the case of the United States of America, *et al.* vs. Reilly Tar & Chemical Corporation, *et al.* (effective date September 4, 1986) (Ref. 78, p. 1, 4). The field collection sheets are provided in Appendix B of Reference 78 (Ref. 78, pp. 23, 126, 129, 130, 131, 133, 136, 144, 145, 153, 164, 166). The chain-of-custody records are provided in Reference 77. Background and release monitoring and municipal water samples were collected from wells of similar depths and screened intervals, selected to establish releases by aquifer, and were selected to encapsulate the approximate extent of the Site. The background and release samples were collected during the same time period, following the same sampling procedures, and analyzed for the same analytical parameters using the same analytical methods (Refs. 6, pp. 28, 29; 75, pp. 1, 2, 12, 48, 70, 90, 122, 126, 152; 78, pp. 9, 10, 27, 28; 79, pp. 3, 4).

TABLE 9: 2015 Release Wells

Well No.	Laboratory ID	Well Depth/ Screened Interval (ft amsl)	Date Sampled	Location	References[1]
St. Peter Aquifer					
W133	10321172009	795/ 801 to 795	9/8/2015	About 0.4 mile northeast of W143	28, p. 178; 77, pp. 97, 98; 78, p. 131
W24	10322385010	799/ 802 to 799[2]	9/16/2015	About 0.33 mile west of W143	28, pp. 163, 164; 77, pp. 245, 246; 78, p. 166
W409	10321172004	700/ 780 to 700[3]	9/8/2015	About 0.5 mile northwest of W143	28, pp. 186, 187; 77, pp. 97, 98; 78, p. 129
W410 W410D	10321172001 10321172002	722/ 812 to 722	9/8/2015	About 0.4 mile northwest of W143	28, p. 188; 77, pp. 97, 98; 78, p. 130
W411	10321361007	782.4/ 809.4 to 782.4	9/9/2015	About 0.44 mile northwest of W143	6, p. 29; 28, pp. 196, 197; 77, pp. 126, 127; 78, p. 136; 79, p. 4
W414 W414D	10321361002 10321361002	704/ 714 to 704	9/9/2015	About 0.35 mile east of W143	28, pp. 198, 199; 77, pp. 126, 127; 78, p. 133
Prairie du Chien – Jordan Aquifer					
SLP4	10321936003	397/ 490 to 397[2]	9/14/2015	About 1.25 miles southeast of W143	28, p. 24; 77, pp. 167, 168; 78, p. 145
SLP6	10321936007	433/ 612 to 433[2]	9/14/2015	About 0.95 mile southeast of W143	28, p. 42; 77, pp. 167, 168; 78, p. 144
E7	10299956010	404/ 601 to 404[2]	9/16/2015	About 2 miles south of W143	28, p. 9; 77, pp. 245, 246; 78, p. 164
W23	10321172007	445/ 635 to 445[2]	9/8/2015	About 0.3 mile west of W143	28, p. 161; 77, pp. 97, 98; 78, p. 126
W48[4]	10297782003	404.8/ 664.8 to 404.8	2/25/2015	About 0.35 mile south of W143	77, pp. 20, 21; 78, p. 23

TABLE 9: 2015 Release Wells					
Well No.	**Laboratory ID**	**Well Depth/ Screened Interval (ft amsl)**	**Date Sampled**	**Location**	**References[1]**
W119R	10322146005	428.5/ 633.5 to 428.5[2]	9/15/2015	About 0.73 mile south-southwest of W143	28, p. 171, 172, 173; 77, pp. 203, 204; 78, p. 153

Notes:

[1] Also see Figure 3 of this HRS Documentation Record
[2] Well completed as an open hole from the bottom of the casing to the total well depth.
[3] Well is screened at multiple intervals in the St. Peter aquifer
[4] Sample collected during Quarter 1
D Duplicate sample
E Edina
ft amsl Feet above mean sea level
ID Identification
NA Not available
No. Number
SLP St. Louis Park
W Monitoring well

Release Concentrations – St. Louis Park 2015 Groundwater Monitoring Event

The release groundwater samples listed in Table 10 of this HRS documentation record were analyzed by Pace for VOCs using EPA SW-846 Method 8260B. Tetra Tech conducted a Stage 2A validation of the analytical data packages (Ref. 75). The reporting limits are listed on the analytical data sheets contained in References 75 and 77. The reporting limits are equivalent to SQLs as defined in Section 1.1, Definitions of the HRS (Refs. 1, Section 1.1; 83, p.7).

TABLE 10: 2015 Release Well Results

Well No./ Unique Well No.	Hazardous Substance	Hazardous Substance Concentration (µg/L)	Reporting Limit (µg/L)	References
St. Peter Aquifer				
W133	cis-1,2-DCE vinyl chloride	2.3 2.5	1.0 0.40	75, pp. 68, 69
W24	cis-1,2-DCE	2.2	1.0	75, p. 196
W409	trans-1,2-DCE	1.8	1.0	75, p. 58
W410	cis-1,2-DCE trans-1,2-DCE TCE	5.2 3.6 0.51	1.0 1.0 0.40	75, pp. 52, 53
W410D	cis-1,2-DCE trans-1,2-DCE TCE	5.5 3.8 0.63	1.0 1.0 0.40	75, pp. 54, 55
W411	vinyl chloride	2.3	1.0	75, p. 87
W414	1,1-DCE vinyl chloride	1.9 12.8	1.0 0.04	75, pp. 76, 77
W414D	1,1-DCE TCE vinyl chloride	2.3 0.52 14.1	1.0 0.40 0.40	75, pp. 78, 79
Prairie du Chien – Jordan Aquifer				
SLP4	cis-1,2-DCE vinyl chloride	17.9 1.8	1.0 1.0	75, pp. 98, 99
SLP6	cis-1,2-DCE trans-1,2-DCE TCE vinyl chloride	66 3.4 5.0 5.6	1.0 1.0 0.40 1.0	75, pp. 106, 107
E7	cis-1,2-DCE trans-1,2-DCE vinyl chloride	31.1 1.4 2.0	1.0 1.0 1.0	75, pp. 192, 193
W23	cis-1,2-DCE trans-1,2-DCE vinyl chloride	57.9 3.0 3.3	1.0 1.0 0.40	75, pp. 64, 65
W48[a]	1,1-DCE cis-1,2-DCE trans-1,2-DCE vinyl chloride	1.2 182 8.7 11.9	1.0 1.0 1.0 0.40	75, pp. 10, 11
W119R	cis-1,2-DCE trans-1,2-DCE vinyl chloride	91.6 4.5 6.7	1.0 1.0 1.0	75, pp. 134, 135

Notes:

[a]	Sample collected during Quarter 1
D	Duplicate sample
DCE	Dichloroethene
E	Edina
No.	Number
µg/L	Micrograms per liter
SLP	St. Louis Park
TCE	Trichloroethene
W	Monitoring well

2016 MPCA Site Inspection

Background Samples

In 2016, MPCA collected groundwater samples from six monitoring and two municipal water wells located outside of the Site (Ref. 6, pp. 9, 24) (see Figure 3 of this HRS documentation record). These monitoring and municipal wells were evaluated as background groundwater samples for comparison to release groundwater samples that withdraw water from similar aquifers, including the Quaternary Drift, Platteville-Glenwood, St. Peter, and Prairie du Chien-Jordan aquifers that underlie areas of Edina and St. Louis Park (Ref. 6, pp. 9, 24) (see Figure 3 and Tables 12 and 14 of this HRS documentation record). Groundwater samples collected from wells screened in the Quaternary Drift and Platteville-Glenwood aquifers did not exhibit detectable concentrations of cis-1,2-DCE, trans-1,2-DCE, TCE, or vinyl chloride (Ref. 6, pp. 33, 35). Groundwater samples collected from wells that withdraw water from the Prairie du Chien-Jordan aquifer contained low detections or exhibited no detectable concentrations of cis-1,2-DCE, trans-1,2-DCE, TCE, or vinyl chloride (Ref. 6, p. 38) (see Figure 3 of this HRS documentation record).

MPCA collected the background and release samples in accordance with the EPA-approved SI work plan dated January 2016 and the MPCA Site Assessment Program (SA) quality assurance project plan (QAPP) dated September 2014 (Refs. 6, pp. 5, 10, 17; 50, pp. i, 1). Samples were analyzed under the EPA Contract Laboratory Program (CLP) (Ref. 6, pp. 132, 216, 284). The background and release monitoring and municipal water well samples were collected from wells of similar depths and screened intervals, selected to establish releases by aquifer, and were selected to encapsulate the approximate extent of the Site (Refs. 6, pp. 4, 5, 27 to 32; 28, pp. 2, 9, 10, 20, 21, 24, 25, 26, 35, 38, 39, 42, 43, 51, 52, 56, 57, 60, 61, 65 to 68, 71, 72, 74, 75, 77, 78, 83, 84, 87, 88, 91, 92, 94, 95, 100, 101, 102, 104) (see Tables 11 and 13, and Figure 3 of this HRS documentation record). The background and release samples were collected during the same time period, by similar sampling techniques, and were analyzed using similar methods. Tables 12 and 14 of this HRS documentation record present releases by aquifer (Refs. 6, p. 10; 15, p. 8; 50, pp. 72 through 89).

The locations of the background groundwater samples are provided in Table 11 and depicted in Figure 3 of this HRS documentation record. Chain-of-custody forms, which provide the well numbers, sample identification numbers (ID), and the date and time of sampling, are provided in Reference 16, pages 3 and 5. The depths and screened intervals of the wells in feet above mean sea level (ft amsl) were calculated by subtracting the total depth and screened interval from the well elevation provided on the well log for each well (Ref. 28, pp. 1 through 103).

TABLE 11: Background Groundwater Samples – MPCA SI 2016

Well No.	CLP Sample No.	Well Depth/ Screened Interval (ft amsl)	Date Sampled	Location	References[1]
Quaternary Drift Aquifer					
W423	E5QZ0	871/ 881 to 871	6/27/2016	About 0.65-mile northwest of W143	6, p. 108; 16, p. 3; 28, p. 104
W425	E5QZ2	877/ 887 to 877	6/27/2016	About 0.53-mile northwest of W143	6, p. 109; 16, p. 3; 28, pp. 74, 75
Platteville-Glenwood Aquifer[1]					
W27	E5QY8	793/ 824 to 793[2]	6/27/2016	About 0.5-mile northwest of W143	6, p. 115; 16, p. 3; 28, pp. 94, 95

TABLE 11: Background Groundwater Samples – MPCA SI 2016					
Well No.	**CLP Sample No.**	**Well Depth/ Screened Interval (ft amsl)**	**Date Sampled**	**Location**	**References[1]**
W424	E5QZ1	823/ 833 to 823[2]	6/27/2016	About 0.65-mile northwest W143	6, p. 116; 16, p. 3; 28, pp. 71, 72
W426	E5QZ3	807/ 824 to 807[1]	6/27/2016	About 0.53 mile northwest of W143	6, p. 117; 16, p. 3; 28, pp. 77, 78
Prairie du Chien – Jordan Sandstone Aquifer[1]					
E2	E5QX0	430/ 612 to 432[2]	6/28/2016	About 1.8 miles southwest of W143	6, pp. 123;16, p. 9: 28, p. 2
E15	E5QW9	422/ 622 to 422[2]	6/28/2016	About 1.65 miles southwest of W143	6, p. 125; 16, p. 5; 28, pp. 20, 21
SLP5	E5QY0	465/ 625 to 465[2]	6/28/2016	About 1.23 miles northwest of W143	6, p. 121; 16, p. 5; 28, pp. 35, 38, 39
W403	E5QY9	482/ 632 to 482[2]	6/28/2016	About 1.5 miles east-southeast of W143	6, p. 126; 16, p. 5; 28, pp. 67, 68

Notes:

[1] Also see Figure 3 of this HRS documentation record.
[2] Well completed as an open hole from the bottom of the casing to the total well depth.
CLP Contract Laboratory Program
E Edina well
ft amsl Feet above mean sea level
MPCA Minnesota Pollution Control Agency
No. Number
SI Site inspection
SLP St. Louis Park well
W Monitoring well

Background Concentrations

The background groundwater samples listed in Table 12 of this HRS documentation record were analyzed for trace VOCs under the EPA CLP in accordance with the CLP Statement of Work (SOW) for Organic Superfund Methods, SOM02.3 and were reviewed according to the National Functional Guidelines (NFG) for SOM02.2 (including changes from SOM02.2 to SOM02.3) and the Environmental Services Assistance Team (ESAT) standard operating procedures (SOP) for Organic CLP Data Validation (Ref. 6, pp. 10, 132, 216, 284). The sample adjusted contract-required quantitation limits (CRQL) are provided in Reference 10 (Ref. 10 pp. 8, 9, 10, 12, 13 to 16). The sample adjusted CRQLs are equivalent to sample quantitation limits (SQL) in accordance with Section 1.1, Definitions of the HRS Rule (Refs. 1, Section 1.1; 76).

TABLE 12: Analytical Results for Background Samples – 2016

Well No/ CLP Sample No.	Hazardous Substance	Hazardous Substance Concentration (µg/L)	Sample-Adjusted CRQL (µg/L)	References
Quaternary Drift Samples				
W423/E5QZ0	cis-1,2-DCE trans-1,2-DCE vinyl chloride	0.50 U 0.50 U 0.50 U	0.50 0.50 0.50	6, p. 176; 10, pp. 13, 14
W425/E5QZ2	vinyl chloride	0.50 U	0.50	6, pp. 135, 180; 10, p. 15
Platteville-Glenwood Aquifer				
W27/E5QY8	cis-1,2-DCE trans-1,2-DCE TCE vinyl chloride	0.50 U 0.50 U 0.50 U 0.50 U	0.50 0.50 0.50 0.50	6, p. 172; 10, p. 12
W424/E5QZ1	TCE vinyl chloride	0.50 U 0.50 U	0.50 0.50	6, pp. 135, 178; 10, pp. 14, 15
W426/E5QZ3	cis-1,2-DCE trans-1,2-DCE TCE vinyl chloride	0.50 U 0.50 U 0.50 U 0.50 U	0.50 0.50 0.50 0.50	6, p. 182; 10, p. 16
Prairie du Chien – Jordan Sandstone Aquifer				
E2/E5QX0	cis-1,2-DCE	3.3J (3.3)	5.0	6, pp. 219, 223, 228; 10, p. 24; 31, p. 8
E15/E5QW9	cis-1,2-DCE	2.8	0.50	6, p. 148; 10, pp. 8, 9
SLP5/E5QY0	cis-1,2-DCE	4.2	0.50	6, p. 164; 10, p. 10
W403/E5QY9	cis-1,2-DCE	0.50 U	0.50	6, p. 174; 10, p. 13

Notes:

CLP Contract Laboratory Program
CRQL Contract-required quantitation limit
DCE Dichloroethene
E Edina
J The result is qualified as estimated due to detection greater than or equal to the detection limit and below the quantitation limit. The associated numerical value is the approximate concentration of the analyte in the sample. A bias is not associated with this sample concentration, therefore no adjustment is necessary per the EPA fact sheet Using Qualified Data to Document an Observed Release and Observed Contamination (Refs. 6, pp, 219, 223; 31, p. 8).
µg/L Micrograms per liter
No. Number
SLP St. Louis Park

TCE	Trichloroethene
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit (Ref. 6, p. 141).
W	Monitoring well

Release Samples

In 2016, MPCA collected the release groundwater samples presented in Table 13 from nine monitoring and two municipal water wells that withdraw water from the Quaternary Drift, Platteville-Glenwood, and the Prairie du Chien-Jordan aquifers that underlie Edina and St. Louis Park (Ref. 6, pp. 4, 5, 9, 24) (see Figure 3 and Table 13 of this HRS documentation record). MPCA collected the release groundwater samples in accordance with the approved SI work plan dated January 2016 and the MPCA SA QAPP dated September 2014 (Refs. 6, pp. 5, 10, 17; 50, pp, i, 1). The locations of the release groundwater samples are provided in Table 13 and depicted on Figure 3 of this HRS documentation record. Chain-of-custody forms, which provide the well numbers, sample IDs, and the date and time of sampling, are provided in Reference 16, pages 5 through 10. The depths and screened intervals of the wells in ft amsl were calculated by subtracting the total depth and screened interval from the well elevation provided on the well log for each well (Ref. 28, pp. 9, 10, 24, 25, 26, 42, 43, 51, 52, 56, 57, 60, 61, 65, 66, 83, 84, 87, 88, 91, 92, 100, 101, 102).

TABLE 13: Release Groundwater Samples – MPCA SI 2016

Well No.	CLP Sample No.	Well Depth/ Screened Interval (ft amsl)	Date Sampled	Location	Reference[1]
Quaternary Drift Aquifer					
P307	E5QX6	839/ 849 to 839	6/27/2016	About 0.4 mile northwest of W143	6, p. 105; 16, p. 6; 28, p. 100
P309	E5QX7	848/ 858 to 848	6/27/2016	About 0.32 mile north of W143	6, p. 106; 16, p. 6; 28, pp. 51, 52
P310	E5QX8	849/ 859 to 849	6/27/2016	About 0.38 mile north of W143	6, p. 107; 16, p. 7; 28, pp. 56, 57
Platteville-Glenwood Aquifer					
W120	E5QY5	811/ 820 to 811[2]	6/27/2017	About 0.27 mile northeast of W143	6, p. 110; 16, p. 7; 28, pp. 60, 61
W143	E5QY7	817/ 837 to 817[2]	6/27/2016	Site reference point, 0 mile from W143	6, p. 119; 16, p. 7; 28, p. 65, 66
W433	E5QZ4	806/ 818 to 806	6/27/2016	About 0.20 mile northeast of W143	6, p. 111; 16, p. 8; 28, pp. 83, 84
W434	E5QZ5	804.6/ 821.6 to 806.6	6/28/2016	About 0.27 mile northeast of W143	6, p. 112; 16, p. 9; 28, pp. 87, 88
W437	E5QZ6	808/ 818 to 808[2]	6/27/2016	About 0.35-mile northwest of W143	6, p. 113; 16, p. 8; 28, pp. 91, 92
W438	E5QZ7	812.1/ 849.1 to 812.1	6/27/2016	About 0.28 mile north of W143	6, p. 114; 16, p. 8; 28, pp. 101, 102
Prairie du Chien – Jordan Sandstone Aquifer					
E7	E5QX1	404/ 601 to 404[2]	6/28/2016	About 2 miles south of W143	6, p. 124; 16, p. 9; 28, pp. 9, 10

TABLE 13: Release Groundwater Samples – MPCA SI 2016					
Well No.	**CLP Sample No.**	**Well Depth/ Screened Interval (ft amsl)**	**Date Sampled**	**Location**	**Reference[1]**
SLP4	E5QX9	397/ 490 to 397[2]	6/28/2016	About 1.25 miles southeast of W143	6, p. 120; 16, p. 5; 28, pp. 24, 25, 26

Notes:

[1] Also see Figure 3 of this HRS documentation record
[2] Well completed as an open hole from the bottom of the casing to the total well depth.
CLP Contract Laboratory Program
E Edina
ft amsl Feet above mean sea level
ID Identification number
No. Number
SLP St. Louis Park
W Monitoring well

Release Concentrations

The release groundwater samples listed in Table 14 of this HRS documentation record were analyzed for trace and low/medium VOCs under the EPA CLP in accordance with the CLP SOW for Organic Superfund Methods, SOM02.3 and were reviewed according to the NFG for SOM02.2 (including changes from SOM02.2 to SOM02.3) and ESAT SOP for Organic CLP Data Validation (Ref. 6, pp. 132, 216, 284). The sample-adjusted CRQLs are provided in Reference 10 pages 9, 10, 25 to 33, and 40. The sample-adjusted CRQLs are equivalent to SQLs in accordance with Section 1.1, Definitions of the HRS Rule (Refs. 1, Section 1.1; 76).

TABLE 14: Analytical Results for Release Samples – 2016

Well No./ CLP Sample No.	Hazardous Substance	Hazardous Substance Concentration (µg/L)	Sample-Adjusted CRQL* (µg/L)	References
Quaternary Drift Aquifer				
P307/E5QX6	cis-1,2-DCE trans-1,2-DCE Vinyl chloride	5,000 120 460	200 5.0 200	6, p. 232; 10, p. 26
P309/E5QX7	cis-1,2-DCE trans-1,2-DCE Vinyl chloride	990 43 390	50 5.0 50	6, p. 234; 10, p. 27
P310/E5QX8	cis-1,2-DCE trans-1,2-DCE Vinyl chloride	2,300 36 91	130 10.0 10.0	6, p. 236; 10, p. 28
Platteville-Glenwood Aquifer				
W120/E5QY5	cis-1,2-DCE trans-1,2-DCE	33 11	5.0 5.0	6, p. 238; 10, p. 29
W143/E5QY7	cis-1,2-DCE trans-1,2-DCE TCE Vinyl chloride	6,500 320 8.5 760	200 200 5.0 200	6, p. 244; 10, pp. 29, 30
W433/E5QZ4	cis-1,2-DCE trans-1,2-DCE Vinyl chloride	640 45 320	50 10.0 10.0	6, p. 246; 10, p. 30
W434/E5QZ5	cis-1,2-DCE Vinyl chloride	320 59	25 5.0	6, p. 248; 10, p. 31
W437/E5QZ6	cis-1,2-DCE Trans-1,2-DCE Vinyl chloride	3,100 48 450	400 25.0 25.0	6, p. 250; 10, p. 32
W438/E5QZ7	cis-1,2-DCE Vinyl chloride	370 59	25.0 10.0	6, p. 252; 10, p. 33
Prairie du Chien – Jordan Aquifer				
E7/E5QX1	cis-1,2-DCE	26	5.0	6, p. 230; 10, p. 25
SLP4/E5QX9	cis-1,2-DCE	37	2.0	6, p. 162; 10, p. 9

Notes:

*	The sample-adjusted CRQLs are adjusted for dilution and are provided in Reference 10.
CLP	Contract Laboratory Program
CRQL	Contract required quantitation limit
DCE	Dichloroethene
E	Edina
No.	Number
µg/L	Micrograms per liter
P	Piezometer
SLP	St. Louis Park
TCE	Trichloroethene
W	Monitoring well

2018 MDH Edina Public Water Supply - Background and Release Samples

MDH collected the samples listed in Table 15 below in March and June 2018. The samples were collected from the City of Edina municipal wells (Ref. 84, pp. 31, 33). Well Nos. E2, E4, E7 and E15 are completed as open holes and withdraw water from the Prairie du Chien-Jordan aquifer that underlie the City of Edina (Ref. 28, pp. 9, 10, 20, 21, 105). The samples collected from wells E2, E4 and E15 are presented to represent background levels for comparison to results for the sample collected from well E7, the release well. Wells E2, E4, and E15 are located about 0.8 mile southeast, 0.75-mile northwest, and 0.83 mile northeast, respectively, of well E7 (see Figure 3 of this HRS documentation record). The background and release samples were collected from municipal wells that have similar depths and screened intervals and the samples were collected during the same time frame (Refs. 28, pp. 9, 20, 105; 84, pp. 10, 13, 22). The chain of custody records are provided on pages 31 and 33 of Reference 84.

TABLE 15: MDH Samples from City of Edina Wells

Well No.	Sample No.	Well Depth/ Screened Interval (ft amsl)[1]	Date Sampled	Location	References[2]
Background Wells					
E2	18C0571-01	430/ 612 to 432	3/14/2018	About 1.8 miles southwest of W143	28, p. 2; 84, pp. 6, 7, 31
E4	18C0571-02	415/ 617 to 415	3/14/2018	About 2.6 miles southeast of W143 and about 0.8 mile southeast of well E7	28, p. 105; 84, pp. 10, 31
E15	18F1381-01	422/ 622 to 422	6/25/2018	About 1.65 miles southwest of well W143; and about 0.75 mile northwest of well E7	28, p. 20; 84, pp. 22, 33
Release Well					
E7	18C0571-03	404/ 601 to 404	3/14/2018	Well 7 entry point, about 2 miles south of well W143	28, p. 9; 84, pp. 13, 31

Notes:

[1] Well completed as an open hole from the bottom of the casing to the total well depth.
[2] Also see Figure 3 of this HRS documentation record
E Edina
ft amsl Feet above mean sea level
ID Identification number
No. Number

2018 MDH Edina Public Water Supply - Background and Release Concentrations

The background and release groundwater samples listed in Table 16 of this HRS documentation record were analyzed for VOCs using EPA Method 524.2 (Ref. 84, pp. 10, 13, 22, 23, 31, 33). The reporting limits (RL) are provided on the data sheets received from the MDH laboratory. The RLs are equivalent to SQLs in accordance with Section 1.1 of the HRS Rule (Refs. 1, Section 1.1; 71).

TABLE 16: MDH Results for Samples from City of Edina Wells

Well No./ Sample No.	Hazardous Substance	Hazardous Substance Concentration (µg/L)	Reporting Limit (µg/L)	References
Background Samples				
E2/18C0571-01	cis-1,2-DCE	3.2	0.20	84, pp. 6, 7
E2/18C0571-01	Vinyl chloride	0.42	0.20	84, pp. 6, 7
E4/18C0571-02	cis-1,2-DCE	0.25	0.20	84, p. 10
E4/18C0571-02	Vinyl chloride	0.20U	0.20	84, p. 10
E15/18F1381-01	cis-1,2-DCE	12	0.20	84, p. 22
E15/18F1381-01	Vinyl chloride	1.2	0.20	84, p. 23
Release Sample				
E7/18C0571-03	cis-1,2-DCE	47	0.20	84, p. 13
E7/18C0571-03	Vinyl chloride	5.2	0.20	84, p. 13

Notes:

U The analyte was analyzed for, but was not detected above the reported sample quantitation (Ref. 84, p. 4)
DCE Dichloroethene
E Edina
No. Number
µg/L Micrograms per liter

2019 St. Louis Park Water Supply - Background and Release Samples

The samples listed in Table 17 below were collected by the City of St. Louis Park in May and June 2019. The samples were collected from the City's municipal wells (Refs. 72, p. 15; 86, p. 44). On May 2, 2019, SLP4 was brought back on-line as a source of drinking water (Ref. 74, p. 3). SLP4 samples listed in Table 17 were collected in May and June 2019, after SLP4 was brought on-line (Refs. 73, p. 5; 74, p. 3; 86, p. 44). Well Nos. SLP4, SLP5, and SLP10 are completed as open holes and withdraw water from the Prairie du Chien-Jordan aquifer that underlie the City of St. Louis Park (Ref. 28, pp. 24, 25, 35, 129). The samples collected from wells SLP5 and SLP10 are presented to represent background levels for comparison to results for the sample collected from well SLP4, the release well. Wells SLP5 and SLP10 are located about 2 and 2.3 miles northwest, respectively, of well SLP4 (see Figure 3 of this HRS documentation record). Background and release samples were collected from municipal wells that have similar screened intervals and the samples were collected during the same time frame (Refs. 28, pp. 24, 25, 35, 129; 72, p. 15; 86, p. 44). The chain of custody records are provided on page 15 of Reference 72 and page 44 of Reference 86.

TABLE 17: St. Louis Park 2019 Samples

Well No.	Sample No.	Well Depth/ Screened Interval (ft amsl)[1]	Date Sampled	Location	References[2]
Background Wells					
SLP5/ SLP5-20190521	10475840001	465/ 625 to 465[2]	5/21/2019	About 1.23 miles northwest of W143; and about 2 miles north west from SLP4	28, p. 35; 86, pp. 7, 8, 44
SLP10/ SLP10-20190521 SLP10D-20190521	10475840005 10475840006	425/ 609 to 425[2]	5/21/2019	About 1.23 miles northwest of W143; and about 2.3 mile from SLP4	28, p. 129; 86, pp. 7, 8, 44
Release Well					
SLP4/SLP4-20190521	10475840002	397/ 490 to 397[2]	5/21/2019	About 1.25 miles southeast of well W143	28, pp. 24, 25; 86, pp. 7, 8, 44
SLP4/Well 4 Raw	10478002001	397/ 490 to 397[2]	6/06/2019	About 1.25 miles southeast of well W143	28, pp. 24, 25; 72, pp. 14, 15

Notes:

[1] Well completed as an open hole from the bottom of the casing to the total well depth.
[2] Also see Figure 3 of this HRS documentation record
D Duplicate sample
ft amsl Feet above mean sea level
No. Number
SLP St. Louis Park

2019 St. Louis Park Water Supply - Background and Release Concentrations

The samples listed in Table 18 below were collected by the City of St. Louis Park from municipal wells SLP4, SLP5, SLP10 (Refs. 72, p. 15; 86, p. 44). The samples collected from wells SLP5 and SLP10 are presented to represent background levels for comparison to results for the samples collected from well SLP4, the release well. The background and release groundwater samples listed in Table 18 of this HRS documentation record were analyzed for VOCs using EPA Methods 524.2 (June 2019) and 8260B (sample SLP4 in May 2019) (Refs. 73, pp. 1, 6; 86, pp. 7, 8, 44). The practical quantitation limits (PQL) (May 2019) and RLs (June 2019) are listed on the analytical data sheets contained in References 73 and 86. The PQLs and RLs are equivalent to SQLs as defined in Section 1.1, Definitions of the HRS (Refs. 1, Section 1.1; 83, pp. 1, 2, 7).

TABLE 18: St. Louis Park 2019 Results

Well No./ Sample No.	Hazardous Substance	Hazardous Substance Concentration (µg/L)	PQL/RL[1] (µg/L)	References
Background Samples				
SLP5/10475840001	TCE	0.40 U	0.40	86, p. 11
SLP5/10475840001	Vinyl chloride	0.35	0.20	86, p. 11
SLP10/10475840005	TCE	0.40 U	0.40	86, p. 23
SLP10/10475840005	Vinyl chloride	0.20 U	0.20	86, p. 23
SLP10D/10475840006	TCE	0.40 U	0.40	86, p. 26
SLP10D/10475840006	Vinyl chloride	0.20 U	0.20	86, p. 26
Release Sample				
SLP4/10475840002	TCE	0.56	0.40	86, p. 14
SLP4/10475840002	Vinyl chloride	1.5	0.20	86, p. 14
SLP4/10478002001	TCE	0.44	0.40	73, p. 6
SLP4/10478002001	Vinyl chloride	2.2	0.20	73, p. 6

Notes

[1] The limit for May 2019 data is the practical quantitation limit (PQL); the limit for June 2019 data is the reporting limit (RL) (Refs. 72, p. 13; 86, p. 42).
D Duplicate sample
µg/L Micrograms per liter
No. Number
PQL Practical quantitation limit
RL Reporting limit
SLP St. Louis Park
TCE Trichloroethene
U The analyte was analyzed for, but was not detected at or above the associated value (reporting limit, the PQL for May 2019 data) (Ref. 86, p. 4).

Level I Samples

Groundwater samples listed in Table 19 were collected from municipal drinking water wells that withdraw water from the Prairie du Chien-Jordan aquifer (Refs. 28, pp. 9, 24). City of Edina Well No. 7 (E7) is an active well; a sample collected from the raw (untreated) water in March 2018 contained vinyl chloride above its EPA MCL of 2 µg/L (Refs. 2, p.11; 6, pp. 308, 310; 84, p. 13). City of St. Louis Park Well No. 4 (SLP4) is active; a sample collected from the raw (untreated) water in June 2019 contained vinyl chloride above its EPA MCL of 2 µg/L and above its cancer risk screening concentration of 0.021 µg/L in May 2019 (Refs. 2, p. 11; 72, pp. 1, 4, 15; 74).

TABLE 19: LEVEL I SAMPLES

Well No./ Sample ID	Hazardous Substance	Concentration and Sample Date	Level I or Level II	Benchmark Exceeded and Concentration	References
E7	Vinyl chloride	5.2 µg/L – 3/14/2018	Level I	MCL - 2 µg/L CR - 0.021 µg/L	2, p. 11; 84, pp. 13, 31
SLP4	Vinyl chloride Vinyl chloride	1.5 µg/L – 5/21/2019 2.2 µg/L – 6/06/2019	Level I	CR - 0.021 µg/L MCL - 2 µg/L	2, p. 11; 73, p. 6; 86, p. 14

Notes:

CR	Cancer risk
E	Edina
ID	Identification number
MCL	Maximum Contaminant Level
µg/L	Micrograms per liter
No.	Number
SLP	St. Louis Park

Groundwater samples are collected from treated and untreated water from Edina by MDH and by Summit Environmental on behalf of the City of St. Louis Park. Samples of the untreated water contain detectable concentrations of chlorinated solvents. However, all water is treated prior to distribution to customers. New water treatment plants including air strippers and other technology are used to remove contaminants from the drinking water. These treatment systems are considered interim measures (Ref. 17). Drinking water provided by both the cities of Edina and St. Louis Park currently are in compliance with all MCLs as established in the Safe Drinking Water Act (Ref. 85).

Attribution

The Site is a 1,1-DCE, cis-1,2- DCE, trans-1,2-DCE, TCE, and vinyl chloride-contaminated groundwater plume defined by monitoring and municipal water wells in portions of Edina and St. Louis Park (Refs. 3; 6, pp. 3, 5, 6, 10 to 13, 22). MPCA has made significant efforts to identify specific sources of groundwater contamination through numerous sampling events and by conducting an extensive search of hazardous waste generator records (Ref. 7, pp. 8 to 11, 513, 515 to 527). While several likely sources have been identified, specific releases documented in monitoring and municipal wells cannot reasonably be attributed to a specific source or sources due to the comingled nature of the releases that likely resulted from multiple sources, including dry cleaners, print shops, a radiator coil manufacturing facility, metals fabricators, a heat treating facility, rubber manufacturer, computer components facility, and a distributor of dry cleaning fluid, among other commercial and industrial facilities, over time (Refs. 6, pp. 4, 5, 6, 33 through 41; 7, pp. 5 to 11, 92, 93, 523, 524, 526, 901, 902, 1167 to 1169, 1978, 1982, 1983, 1984, 1989, 2006 through 2014, 3571; 56, pp. 10, 11, 12; 81, pp. 1-1, 2-1). As a result, the Site is being scored as a groundwater plume with no identified source.

Chlorinated VOCs detected in the monitoring and municipal water wells are manufactured chemicals, not thought to occur naturally, and are at very low to non-detected concentrations in all background well samples collected from the St. Louis Park monitoring well network and Edina and St. Louis Park municipal wellfields. Therefore, cis-1,2-DCE, trans-1,2-DCE, TCE, and vinyl chloride are not ubiquitous throughout Edina and St. Louis Park (Refs. 47; 48; 49) (see Section 3.1.1 and Tables 8 and 10 of this HRS documentation record). Chlorinated VOCs (such as TCE) are man-made compounds commonly used in commercial/industrial operations, such as dry cleaning and metal degreasing, while other contaminants, such as cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride, are common breakdown products of TCE and PCE (Refs. 46, p. 24; 47; 48; 49; 82, pp. 1, 173).

In April 2004, the City of Edina contacted the MPCA requesting assistance to find the source of vinyl chloride contamination that had been detected in two municipal wells (E2 and E7) (Ref. 6, p. 10). Beginning in 2004, MPCA began investigating the contamination in order to define the extent and magnitude, as well as to identify the source of the contamination in Edina's wells (Ref. 6, p. 10). During the investigation, MPCA sampled Prairie du Chien-Jordan aquifer wells throughout the cities of Edina, St. Louis Park, and Hopkins. The analytical results showed a pattern of increasing chlorinated solvent concentrations to the north, from Edina into St. Louis Park about 2.4 miles away (Ref. 6, p. 10). Between 2005 and 2014, MPCA conducted a land use and source characterization study; searched the MPCA "What's in My Backyard?" database and the Hennepin County Hazardous Waste Generator database; interviewed business owners, reviewed reverse telephone book records to identify potential sources that may have used chlorinated solvents prior to the promulgation of the Hazardous and Solid Waste amendments to the Resource Conservation and Recovery Act (RCRA); and conducted numerous sampling events, which included the collection of soil, groundwater and soil gas samples (Ref. 7, pp. 7 to 10, 92, 93, 513, 515 to 527, 901, 902, 1977). MPCA identified 48 facilities that used or may have used PCE in their operations (Ref. 7, p. 10). Of the 48 facilities identified, 27 facilities were reviewed as possible sources of chlorinated VOCs based on proximity to W437 (due to high PCE concentrations detected in a 2006 investigation), type of historical commercial operations, record of PCE use, and sampling results (Refs. 7, pp. 10, 92, 93; 61, p. 1). Of the 27 facilities, MPCA identified eight facilities with hazardous waste records that show PCE/TCE use and 18 facilities were identified as having PCE/TCE detected on their properties (Ref. 7, pp. 92, 93). Twelve properties subsequently were sampled, and significant VOC contamination was detected on most of the 12 properties (Ref. 7, p. 1984). Additional sampling investigations have been conducted at commercial and industrial facilities and sampling results indicate contamination of chlorinated solvents (Refs. 7, pp. 8 to 11, 513, 515 to 527, 901, 902; 56, pp. 10, 11, 12; 81, pp. 1-1, 2-1).

Observed releases have been documented in groundwater monitoring and municipal water wells that withdraw water from the Quaternary Drift, Platteville-Glenwood, St. Peter, and Prairie du Chien-Jordan

aquifers in portions of Edina and St. Louis Park (see section 3.1.1 Observed Release of this HRS documentation record) (Refs. 6, pp. 33 through 41; 73, pp. 5, 6; 75, pp. 6, 7, 52, 53, 54, 58, 65, 64, 65, 68, 69, 76, 77, 86, 87, 98, 99, 106, 107, 183, 184, 192, 193, 197; 84, pp. 13; 86, p. 14).

The St. Louis Park and Edina municipal wells have been shown to be hydraulically connected; pump tests of wells installed in the Quaternary Drift, Platteville-Glenwood, St. Peter, Prairie Du Chien-Jordan, and Jordan aquifers show no significant difference in hydraulic conductivity; well logs of the municipal wells indicate the same stratigraphic units; and groundwater contamination has been shown in St. Louis Park and Edina municipal wells, as well as monitoring wells that withdraw water from Quaternary Drift, Platteville-Glenwood, St. Peter, Prairie Du Chien-Jordan, and Jordan aquifers (Ref. 7, pp. 23 to 28, 3620, 3863, 3914, 3972) (see Tables 10, 14, 16, 17 and 18 of this HRS documentation record). Based on this information, the Quaternary Drift, Platteville-Glenwood, St. Peter, and Prairie Du Chien-Jordan aquifers are interconnected, and a strong hydraulic connection exists between St. Louis Park and Edina municipal wells (Refs. 7, pp. 23 to 28, 3620 to 4106; 17, pp. 1, 2). In response to address the chlorinated VOCs in their drinking water supplies, St. Louis Park and Edina have constructed new water treatment plants. During the construction phase, the affected wells were taken offline. When SLP4 was taken offline in 2016, within a year an increase in the concentrations of cis-1,2-DCE and other chlorinated solvents was evident in the Edina well E7 (Ref. 17, pp. 3, 4). Although it is notable that each of these wells would qualify independently for the NPL, this increase in chlorinated solvents further supports the presence of one groundwater plume likely consisting of multiple comingled releases stretching from St. Louis Park to Edina (Refs. 17, pp. 1 through 9; 35; 36).

While several likely sources have been identified, specific releases documented in monitoring and municipal wells cannot reasonably be attributed to a specific source or sources due to the comingled nature of the releases that likely resulted from multiple sources, including dry cleaners, print shops, a radiator coil manufacturing facility, metals fabricators, a heat treating facility, rubber manufacturer, computer components facility, and a distributor of dry cleaning fluid, among other commercial and industrial facilities (Refs. 6, pp. 4, 5, 6; 7, pp. 5 to 11, 92, 93, 523, 524, 526, 901, 902, 1167 to 1169, 1978, 1982, 1983, 1984, 1989, 2006 through 2014, 3571; 56, pp. 10, 11, 12; 81, pp. 1-1, 2-1). As a result, the Site is being scored as a groundwater plume with no identified source.

Hazardous Substances in the Release

TCE
1,1-DCE
cis-1,2-DCE
trans-1,2-DCE
Vinyl chloride

Groundwater Observed Release Factor Value: 550.00

3.1.2 POTENTIAL TO RELEASE

As specified in the HRS, potential to release was not evaluated because an observed release to the interconnected Quaternary Drift, Platteville-Glenwood, St. Peter, and Prairie du Chien-Jordan aquifers was established (Ref. 1, Section 3.1.1).

3.2 WASTE CHARACTERISTICS

3.2.1 TOXICITY/MOBILITY

The toxicity and mobility factor values for the hazardous substances detected in the source samples with containment factor values of greater than 0 are summarized in Table 20. The combined toxicity and mobility factor values are assigned in accordance with Reference 1, Section 3.2.1. Hazardous substances detected in the observed release to groundwater are assigned a mobility factor value of 1 (Ref. 1, Section 3.2.1.2).

TABLE 20: Groundwater Toxicity/Mobility

Hazardous Substance	Source No.	Toxicity Factor Value	Mobility Factor Value[1]	Does Hazardous Substance Meet Observed Release? (Yes/No)	Toxicity/ Mobility (Ref. 1, Table 3-9)	Reference
1,1-DCE	1	10	1	Yes	10	2, p. 1
cis-1,2-DCE	1	1,000	1	Yes	1,000	2, p. 3
trans-1,2-DCE	1	100	1	Yes	100	2, p. 5
TCE	1	1,000	1	Yes	1,000	2, p. 9
Vinyl chloride	1	10,000	1	Yes	10,000	2, p. 11

Notes:

[1] The default mobility factor value of 1 was used because the substance was detected at observed release concentrations (Ref. 1, Section 3.2.1.2).
DCE Dichloroethene
No. Number
TCE Trichloroethene

Toxicity/Mobility Factor Value: 10,000.00
(Refs. 1, Table 3-9; 1a)

3.2.2 HAZARDOUS WASTE QUANTITY

TABLE 21: Hazardous Waste Quantity		
Source No.	**Source Type**	**Source Hazardous Waste Quantity**
1	Other – Groundwater plume with no identified source	Undetermined, but greater than zero

The hazardous constituent quantity for Source No. 1 is not adequately determined. The HWQ is undetermined, but greater than zero. Because Level I actual contamination is present in municipal water wells the HWQ receives a minimum factor value of 100 for the ground water migration pathway (Ref. 1, Section 2.4.2.2).

Hazardous Waste Quantity Factor Value: 100
(Ref. 1, Section 2.4.2.2)

3.2.3 WASTE CHARACTERISTICS FACTOR CATEGORY VALUE

The waste characteristics factor category was obtained by multiplying the toxicity/mobility and HWQ factor values, subject to a maximum product of 1×10^8. Based on this product, a value was assigned in accordance with Reference 1, Table 2-7. Vinyl chloride has the highest toxicity/mobility factor value of 10,000 (see Table 20: Groundwater Toxicity/Mobility) (Ref. 2, p. 11).

Toxicity/Mobility Factor Value: 10,000.00
Hazardous Waste Quantity Factor Value: 100

Toxicity/Mobility Factor Value ×
Hazardous Waste Quantity Factor Value: 1,000,000.00 (1×10^6)

Waste Characteristics Factor Category Value: 32
(Refs. 1, Table 2-7; 1a)

3.3 TARGETS

Municipal water in Edina and St. Louis Park is supplied by wells that withdraw water from the Prairie du Chien-Jordan and the confined Mt. Simon aquifers (Refs. 7, pp. 5, 6; 37, p. 8; 40, p. 3; 44, p. 10). The Mt. Simon aquifer is not evaluated in this HRS documentation record (see Section 3.0.1 of this HRS documentation record). Edina maintains 18 wells that serve about 50,000 people. Of the 18 wells, 11 are primary wells that are pumped to water treatment plants (WTP) and seven are seasonal wells. The seasonal wells primarily are used in May/June and September/October depending on summer demand (Ref. 19, p. 3). The depths of the Edina wells range from 381 to 1,080 feet bgs and are completed as open holes in the interconnected Prairie due Chien-Jordan (15 wells), and in the Mt. Simon (three wells) aquifers (Refs. 20, p. 2; 37, pp. 8, 16, 17). The Edina wells are part of a blended system where the water is mixed at WTPs and in the distribution lines. In 2004, Edina well E7 was taken out of service due to detections of vinyl chloride above its MCL of 2 µg/L (Refs. 2, p. 11; 6, p. 310; 19, pp. 3, 4; 70, pp. 2, 3). A new water treatment plant was constructed in 2007 and well E7 was brought back online (Ref. 17, p. 1). A groundwater sample collected of the untreated water from Edina well E7 in March 2018 contained vinyl chloride at 5.2 µg/L, which is above its EPA MCL (Refs. 2, p. 11; 84, p. 13). None of the Edina wells provides more than 40 percent of the total water supply; therefore, each well serves about 2,777.77 people (50,000 people ÷ 18 wells = 2,777.77 people) (Refs. 19, p. 3; 32, p. 1).

St. Louis Park maintains nine municipal wells that provide drinking water to 47,221 people (Refs. 39, pp. 1, 2, 3; 74, p. 3). The depths of the St. Louis Park wells range from 482 to 1,095 feet bgs and are screened as open holes in the Prairie du Chien–Jordan (six wells) or the Mt. Simon (three wells) aquifers (Refs. 41, p. 2; 44, pp. 10, 69). St. Louis Park well SLP6 (Prairie Du Chien-Jordan) is an emergency well; it is maintained and sampled on a quarterly basis but is designated as non-potable due to the lack of a proper treatment system. Therefore, it is not included as part of the nine municipal well count to apportion the drinking water population (Refs. 39, pp. 2, 3, 4; 44, p. 10). In December 2016, Well SLP4 was taken out of service due contamination (Ref. 7, p. 3342; 39 pp. 3, 4). In March 2019, work on the SLP4 WTP was completed and in May 2019, well SLP4 was brought back online (Ref. 42, pp. 1, 2; 74, p. 3). The City of St. Louis Park wells are part of a blended system where the water is mixed at WTPs, in elevated storage tanks, and in the distribution lines (Refs. 39, pp. 3, 4; 74, p. 3). None of the City of St. Louis Park wells provides more than 40 percent of the total water supply; therefore, each well serves about 5,246.77 people (47,221 people ÷ 9 wells = 5,246.77 people) (Refs. 39, pp. 1, 3, 4, 6, 7, 8; 32, p. 2; 74, p. 3). In May and June 2019, groundwater samples of the untreated water were collected from St. Louis Park well SLP4 after it was brought back online (Refs. 72, p. 15; 74, p. 3; 86, p. 14). Analytical results of the untreated water samples collected showed vinyl chloride at 1.5 µg/L in May 2019, which is above the cancer risk screening concentration of 0.021 µg/L, and at 2.2 µg/L in June 2019, which is above the MCL of 2.0 µg/L (Refs. 2, p. 11; 73, p. 6; 86, p. 14).

Groundwater samples from the municipal water wells are collected from treated and untreated water from Edina by MDH and by Summit Environmental on behalf of the City of St. Louis Park. Samples of the untreated water contain detectable concentrations of chlorinated solvents. However, all water is treated prior to distribution to customers. New water treatment plants including air strippers and other technology are used to remove contaminants from the drinking water. These treatment systems are considered interim measures (Ref. 17, p. 2). Drinking water provided by both the cities of Edina and St. Louis Park currently are in compliance with all MCLs as established in the Safe Drinking Water Act (Ref. 85).

3.3.1 NEAREST WELL

As documented in Table 19 of this HRS documentation record, two municipal wells (E7 that serves Edina and SLP4 that serves St. Louis Park), are subject to actual contamination at Level I concentrations. Vinyl chloride has been detected in Edina well E7 and St. Louis Park well SLP4 above its EPA MCL and cancer risk screening concentration (see Tables 16, 17, 18, and 19 of this HRS documentation record). Because actual contamination at Level I concentrations has been documented, a nearest well factor value of 50 is assigned (Ref. 1, Section 3.3.1, Table 3-11).

Level of Contamination (I, II, or potential): I

Nearest Well Factor Value: 50.0
(Ref. 1, Section 3.3.1, Table 3-11)

3.3.2 POPULATION

3.3.2.1 Level of Contamination

3.3.2.2 Level I Concentrations

Edina well E7 serves about 2,777.77 people (50,000 people ÷ 18 wells = 2,777.77 people) (Ref. 19, p. 3). St. Louis Park well SLP4 serves about 5,246.77 people (47,221 people ÷ 9 = 5,246.77 people) (Ref. 74, p. 3). Therefore, about 8,024.54 people are subject to actual contamination at Level I concentrations (Refs. 17, p. 1; 19, pp. 1, 3; 35; 36; 72, p. 4; 74, p. 3; 84, p. 13) (see Sections 3.1.1, Observed Release and 3.3 Targets of this HRS documentation record). The population served by the City of Edina well E7 and City of St. Louis Park well SLP4 that are impacted by vinyl chloride above its MCL and cancer risk screening concentration, is presented in Table 22. Edina well E7 and St. Louis Park well SLP4 withdraw water from the Prairie Du Chien-Jordan aquifer (Refs. 2, p. 11; 17; 19, p. 3; 28, pp. 24, 25; 37, p. 16; 44, p. 69; 74, p. 3).

TABLE 22: LEVEL I POPULATION

Well No./ Sample No.	Hazardous Substance	Population	References
E7	Vinyl chloride	2,777.77	19, p. 3; 17; 35; 84, p. 13
SLP4/Well 4 Raw	Vinyl chloride	5,246.77	36; 39, pp. 1, 3; 42; 72, p. 4; 73; 74, p. 3; 86, p.14

Notes:

ID	Identification
No.	Number
p.	Page
Refs.	References
SLP	St. Louis Park

Sum of Population Served by Level I Wells: 8,024.54 Individuals
Sum of Population Served by Level I Wells × 10: 80,245.4 Individuals

Level I Concentrations Factor Value: 80,245.4

3.3.2.3 Level II Concentrations

Level II concentration targets are not scored.

Level II Concentrations Factor Value: Not scored

3.3.2.4 Potential Contamination

Potential contamination targets are not scored.

Potential Contamination Factor Value: NS

3.3.2.5 CALCULATION OF POPULATION FACTOR VALUE

A value of 80,245.4 (Level I population) is assigned for the population factor value (Ref. 1, Section 3.3.2.5).

Total Population Factor Value: 80,245.4

3.3.3 RESOURCES

No resources were identified.

Resources Factor Value: NS

3.3.4 WELLHEAD PROTECTION AREA

The Wellhead Protection Program is a pollution prevention and management program that is designed to protect underground sources of drinking water from contamination (Refs. 51, p. 3; 52, pp. 13, 14). The federal Safe Drinking Water Act, as amended in 1986, required every state to develop a wellhead protection program (Ref. 52, p. 14).

HRS Section 3.3.4 states that a wellhead protection area factor value of 20 should be used if either a source having a groundwater containment factor value greater than 0 lies either partially or fully within or above a designated Wellhead Protection Area or if observed groundwater contamination attributable to the source lies either partially or fully within the designated Wellhead Protection Area. Table 3 of the HRS documentation record identifies the groundwater containment factor as 10.

Wellhead protection areas have been established for the Edina and St. Louis Park public water systems (Refs. 37, p. 112; 44, pp. 2, 50). Observed releases of 1-1,DCE, cis-1,2-DCE, trans-1,2-DCE, TCE, and vinyl chloride have been documented in City of Edina municipal well E7 and City of St. Louis Park municipal well SLP4 and emergency well SLP6 (Refs. 6, pp. 162, 230; 73, pp. 5, 6; 75, pp. 98, 99, 106, 107, 192, 193; 84, p. 13). The wellhead protection areas for these municipal wells are within the Site (Refs. 37, p. 112; 44, p. 50) (see Figure 3 of this HRS documentation record). Therefore, the Wellhead Protection Area factor value of 20 is supported (Ref. 1, Section 3.3.4).

Wellhead Protection Area Factor Value: 20