October 2019

MERRIAM JUNCTION SANDS, LLC

GROUNDWATER AND SURFACE WATER QUALITY MONITORING PLAN

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GROUNDWATER AND SURFACE WATER QUALITY MONITORING PLAN

1.0 Introduction

This Groundwater and Surface Water Quality Monitoring Plan (Water Quality Monitoring Plan) has been developed for the Merriam Junction Sands' proposed sandstone mining facility (Project) in Louisville Township (Site). An Environmental Impact Statement (EIS) was prepared for the Site.

2.0 Purpose and Scope

The Water Quality Monitoring Plan has been developed to monitor for changes in groundwater and surface water quality as a result of the development of sandstone mining and processing activities. The Water Quality Monitoring Plan includes a baseline data collection component and ongoing operational data collection. A monitoring program related to monitoring water level impacts from dewatering activity has been developed separately as a component of the Department of Natural Resources Water Appropriations Permit. Stormwater runoff from the mining and processing areas of the Site and dewatering discharges are monitored separately under the National Pollutant Discharge Elimination Systems Permit (NPDES).

The purpose of the Water Quality Monitoring Plan is to demonstrate that the mining and processing activities are conducted in a manner that protects and maintains the current level of water quality necessary to sustain the existing water uses. These uses include on-site groundwater drinking water supplies and the adjacent surface waters that support both aquatic life/biological diversity and recreational opportunities.

3.0 Groundwater and Surface Water Receptors

3.1 Surrounding Water Supply Wells

Hydrogeologic work conducted as part of the EIS has confirmed that the direction of groundwater flow beneath the Site is generally towards the west-northwest towards the discharge areas of Gifford Lake and the floodplain of the Minnesota River. Groundwater levels fluctuate seasonally and in response to precipitation and flooding events, but generally vary from approximately 730 feet above mean sea level (msl) in the eastern portion of the Site, to approximately 702 feet above msl in the northwestern portion of the Site.

There are no off-site water supply wells located downgradient of the Site and the Project does not have the potential to impact the water quality of any existing off-site water supply wells. There are three on-site drinking water supply wells located downgradient of future mining and processing areas. Two of these wells are associated with the Renaissance Festival and will be sealed at some point in the future when the Renaissance Festival grounds are relocated and limestone mining reaches the festival grounds. The third well is located near the stables and is used to provide water to the stable area. Two other on-site production wells (the Malkerson Sales scale house well, used to wash equipment, and the Bryan Rock production well, used for aggregate washing) are not used for drinking water supplies.

The three existing drinking water supply wells are completed in aquifers below the Jordan Aquifer. None of the wells are open to the Jordan Sandstone. Construction information for the three drinking water supply wells is included in Attachment 1. The three wells are described below:

Stable Well: One of the three on-site drinking water supply wells is located in the stable area. The stable well supplies water to the buildings and residences located in the stable area. The well is located within the future sand and gravel mining area and is situated downgradient of future sand and gravel mining areas, but not downgradient of existing or proposed limestone or sandstone mining or processing operations. The stable well is a five inch well that is 345 feet deep and is cased into the St. Lawrence. There is 157 feet of open hole and the aquifer is St. Lawrence-Tunnel City. This well supplies water to various buildings within the stable area including the residences located in this area.

Renaissance Festival Wells: The other two potable water supply wells are located in the Renaissance Festival booth area and supply water to the public during the Renaissance Festival and other events. One of the Renaissance Festival wells (RF-1) is an eight inch well that is 455 feet deep and is cased into the Tunnel City Formation. RF-1 has 199 feet of open hole and the aquifer is the Tunnel City/Wonewoc. The second Renaissance Festival Well (RF-2) is a four inch well that is 200 feet deep and cased into the St. Lawrence Formation. RF-2 has 45 feet of open hole and the aquifer is the St. Lawrence. Figure 1 illustrates the elevation of the groundwater table across the site, groundwater flow direction, and the location of downgradient water supply wells.

3.2 Surrounding Surface Waters:

There are two surface waters adjacent to the Site that receive both surface water runoff from the Site and groundwater discharges from the Site. These are the wetland complex and Gifford Lake, both located along the western portion of the Site. These surface waters support aquatic life/biological diversity and recreational uses.

4.0 Monitoring Network

The monitoring network will consist of samples taken from monitoring wells, water supply wells, surface water and open water features created during the course of mining. The location of the monitoring sites depends upon the plant location. Monitoring networks have been developed for each alternative and are included as Figures 2 through 8. In all of the alternatives, there will be one monitoring point in the southern portion of the wetland complex, one in the Phase 1 created water feature(s), one Renaissance Festival well (RF-2, the shallower of the two wells), one upgradient (background) monitoring well, and at the dewatering discharge location (off-site and/or infiltration area). Additional monitoring points will be alternative specific to monitor downgradient of the plant site(s) and end of season process water discharge locations. Figures 2 through 8 illustrate the location of the groundwater monitoring network associated with each of the alternatives. Sampling locations may be adjusted based on final design of plant layouts and post season process water discharge locations associated with each alternative.

It is also anticipated that sampling locations will change as mining progresses through the Site, new phases are opened up and Renaissance Festival wells are sealed. MJS will work with the County as modifications to the monitoring locations are warranted.

5.0 Monitoring Parameters:

The Water Quality Monitoring Plan has been developed to monitor for impacts to groundwater and surface water quality as a result of the proposed mining operations. The mining operation will use diesel fuel, gasoline, and chemical flocculants and coagulants. Water quality analysis will be performed to evaluate general water quality. The parameter list will depend upon the sampling location and the Alternative. Table 1, *Groundwater and Surface Water Monitoring*, lists parameters to be monitored at each sampling location for each alternative.

6.0 Frequency:

Baseline: MJS will conduct baseline sampling prior to initiating sandstone mining or processing activity. Two rounds of water quality samples will be taken at each sample location (except the mine waterbody(s), at least one month, and up to three months, apart to establish baseline of groundwater quality in the area.

Routine monitoring will begin at a frequency of once per quarter (April, July, October), excluding winter quarter. After two years of quarterly monitoring, results will be reviewed and should results warrant, parameter lists and/or schedule may be adjusted per approval by the County.

7.0 Threshold Levels

Table 2, *Threshold Levels* indicates the threshold levels of contaminants associated with each monitoring location. If monitoring indicates an exceedance of any threshold level, the monitoring location will be resampled within 14 days of receiving the initial results to verify the exceedance. If the exceedance is verified, the County will be notified within 10 business days. MJS will work with the County to adopt the appropriate mitigation measures as identified in Section 8.0.

8.0 Mitigation Measures

8.1.1 Mitigation for Impacts to Drinking Water Supply Wells (RF-1 and RF-2):

If contaminants determined to be from the mining operation impact the RF-2 well, RF-1 will be sampled. In this instance, RF-1 will be sampled when the RF-2 well is resampled to verify the exceedance. Should results verify an exceedance of drinking water standards in one or both wells, an alternative source of water will be provided. The two RF wells are used on a seasonal basis. The alternative water supply would be a new well. The impacted well would be properly sealed.

8.1.2 Mitigation for Impacts to Water Quality at Wetlands (S-1):

If contaminants determined to be from the mining operation are detected above background levels, concentration above levels which are similar to expected natural concentrations, such that designated use will be adversely affected, MJS will work with the MDNR to develop appropriate mitigation strategies based on the exceedance that is identified. Mitigation measures may include pretreatment of infiltrated water, additional stormwater management/treatment methods, or other appropriate measures.

8.1.3 Exceedance of DRO or GRO thresholds:

If a DRO or GRO monitoring result exceeds the threshold and is verified by resampling, a Polycyclic Aromatic Hydrocarbons (PAH) testing analysis will be conducted to determine if the occurrence is

due to anthropogenic sources. Based on the results of the PAH analysis, MJS will work with the MPCA to develop an appropriate remedial investigation.
Note: If monitoring results are below background levels, no mitigation measures are necessary.

9.0 REPORTING

Water quality data will be summarized in an annual report for each year that sandstone mining, dewatering or backfilling activities are conducted on-site. The report will include a compilation of the current monitoring results, baseline and cumulative water quality data that is presented in graphical form. The report will be submitted to the Scott County Environmental Health Department by March 31 of the subsequent year of monitoring.

TABLE 1-1 ***ALTERNATIVE 1 Groundwater and Surface Water Quality***

ALTERNATIVE 1			
Sample ID	**Parameters**	**Frequency**	**Purpose**
P-1, P-2	Field Parameters: pH, temperature, dissolved oxygen. Laboratory Parameters: acrylamide, diesel range organics (DRO), and gasoline range organics (GRO)	Quarterly: April, July, October	Created water features in intial phases of mine. Monitor for parameters utilized at the facility
S-1	Field Parameters: pH, temperature, dissolved oxygen. Laboratiory Parameters: Acrylamide, chlorides, hardness (Ca+Mg as $CaCO_3$), hydrogen sulfide as S, and total suspended solids (TSS)	Quarterly: April, July, October	Southern wetland complex and downgradient of end of season process water discharge from BRP plant site. Monitor to verify that water quality is similar to expected natural concentrations and that existing uses will be maintainted and not be adversly affected.
S-2	Field Parameters: pH, Temperature, dissolved oxygen Laboratory Parameters: Acrylamide	Quarterly: April, July, October	Stormwater pond prior to discharge to Gifford Lake downgradient of end of season process water discharge from MS-N plants site, water quality influenced by Mn River Flooding.
RF-2	Field Parametrs: pH, temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO, GRO, Nitrate, as N and Nitrite as N	Quarterly: April, July, October	Renaisance Fesitival Water Supply Well downgradient of BRP plant site. Monitor for parameters utilized at the facility.
MW-X	Field Parametrs: pH, temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO and GRO	Quarterly: April, July, October	New monitoring well downgradient of MS-N plant site. Monitor for parameters used at the facility.
DW-1, DW-2	Field Parameters: Flow, pH, temperature, dissolved oxygen Laboratory Parameters: Nitrate (as N), Nitrite (as N), Nitrogen (Kjeldahl, Total), Phospohorus, Total (as P), acrylamide, cholride, hardness (Ca+Mg as CaCO3), hydrogen sulfide (as S), and TSS[1]	Quarterly: April, July, October	Dewatering discharge to infiltration basin and as applicable to off-site surface water.
MW-7	Field Parameters: pH, Temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO, and GRO	Quarterly: April, July, October for first year of mining	Background monitoring well. Monitor for parameters utilized at the facility.
MW-9	Field Parameters: pH, Temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO, and GRO	Quarterly: April, July, October for first year of mining	downgtradient BRP upgradient MS . Monitor for parameters utilized at the facility.
W-114	Field Parameters: pH, Temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO, and GRO	Quarterly: April, July, October for first year of mining	Background monitoring well. Monitor for parameters utilized at the facility.

[1] Additional monitoring of quarry dewatering discharge offsite will be performed as required under the NPDES permit in effect at the time.

Currently, prior to permit renewal, the General nonmetallic mineral mining permit requires a one time sampling event prior to permit renewal that includes:

a. Total Dissolved Solids.

b. Hardness.

c. Oil & Grease and surfactants.

d. Antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, selenium, silver, thallium, and zinc.

e. Aluminum, barium, boron, cobalt, iron, magnesium, manganese, molybdenum, total tin, and total aluminun

TABLE 1-2 ***ALTERNATIVE 2 Groundwater and Surface Water Quality***

ALTERNATIVE 2			
Sample ID	**Parameters**	**Frequency**	**Purpose**
P-1, P-2	Field Parameters: pH, temperature, dissolved oxygen Laboratory Parameters: acrylamide, diesel range organics (DRO), and gasoline range organics (GRO)	Quarterly: April, July, October	Created water features in intial phases of mine. Monitor for parameters utilized at the facility
S-1	Field Parameters: pH, temperature, dissolved oxygen Laboratiory Parameters: Acrylamide, chlorides, hardness (Ca+Mg as $CaCO_3$), hydrogen sulfide as S, and total suspended solids (TSS)	Quarterly: April, July, October	Southern wetland complex and downgradient of end of season process water discharge from BRP plant site. Monitor to verify that water quality is similar to expected natural concentrations and that existing uses will be maintainted and not be adversly affected.
MW-X	Field Parameters: pH, Temperature, dissolved oxygen Laboratory Parameters: Acrylamide	Quarterly: April, July, October	New monitoring well downgradient of end of season process water discharge from MS-S plant site, TBD based on final plant design.
RF-2	Field Parametrs: pH, temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO, GRO, Nitrate, as N and Nitrite as N	Quarterly: April, July, October	Renaisance Fesitival Water Supply Well downgradient of BRP plant site. Monitor for parameters utilized at the facility.
MW-6	Field Parametrs: pH, temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO and GRO	Quarterly: April, July, October	Monitoring well downgradient of MS-S plant site. Monitor for parameters used at the facility.
DW-1, DW-2	Field Parameters: Flow, pH, temperature, dissolved oxygen Laboratory Parameters: Nitrate (as N), Nitrite (as N), Nitrogen (Kjeldahl, Total), Phospohorus, Total (as P), acrylamide, chloride, hardness (Ca+Mg as CaCO3), hydrogen sulfide (as S), and TSS1	Quarterly: April, July, October	Dewatering discharge to infiltration basin and as applicable to off-site surface water.
MW-7	Field Parameters: pH, Temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO, and GRO	Quarterly: April, July, October for first year of mining	Background monitoring well. Monitor for parameters utilized at the facility.
MW-9	Field Parameters: pH, Temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO, and GRO	Quarterly: April, July, October for first year of mining	downgtradient BRP upgradient MS . Monitor for parameters utilized at the facility.

[1] Additional monitoring of quarry dewatering discharge offsite will be performed as required under the NPDES permit in effect at the time.

Currently, prior to permit renewal, the General nonmetallic mineral mining permit requires a one time sampling event prior to permit renewal that includes:

a. Total Dissolved Solids.

b. Hardness.

c. Oil & Grease and surfactants.

d. Antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, selenium, silver, thallium, and zinc.

e. Aluminum, barium, boron, cobalt, iron, magnesium, manganese, molybdenum, total tin, and total aluminum

TABLE 1-3 ***ALTERNATIVE 3 Groundwater and Surface Water Quality***

ALTERNATIVE 3			
Sample ID	**Parameters**	**Frequency**	**Purpose**
P-1	Field Parameters: pH, temperature, dissolved oxygen Laboratory Parameters: acrylamide, diesel range organics (DRO), and gasoline range organics (GRO)	Quarterly: April, July, October	Created water feature in intial phases of mine. Downgradeint of plant site and end of season process water discharge. Monitor for parameters utilized at the facility.
S-1	Field Parameters: pH, temperature, dissolved oxygen Laboratiory Parameters: Acrylamide, Chlorides, hardness (Ca+Mg as $CaCO_3$), hydrogen sulfide as S, and total suspended solids (TSS)	Quarterly: April, July, October	Southern wetland complex and downgradient of end of season process water discharge. Monitor to verify that water quality is similar to expected natural concentrations and that existing uses will be maintainted and not be adversly affected.
RF-2	Field Parametrs: pH, temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO, GRO, Nitrate, as N and Nitrite as N	Quarterly: April, July, October	Renaisance Fesitival Water Supply Well downgradient of BRP plant site. Monitor for parameters utilized at the facility while RF remains on-site.
DW-1	Field Parameters: Flow, pH, temperature, dissolved oxygen Laboratory Parameters: Nitrate (as N), Nitrite (as N), Nitrogen (Kjeldahl, Total), Phospohorus, Total (as P), acrylamide, chloride, hardness (Ca+Mg as CaCO3), hydrogen sulfide (as S), and TSS[1]	Quarterly: April, July, October	Dewatering discharge to infiltration basin and as applicable to off-site surface water.
MW-7	Field Parameters: pH, temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO, and GRO	Quarterly: April, July, October for first year of mining	Background monitoring well. Monitor for parameters utilized at the facility.

[1] Additional monitoring of quarry dewatering discharge offsite will be performed as required under the NPDES permit in effect at the time.
Currently, prior to permit renewal, the General nonmetallic mineral mining permit requires a one time sampling event prior to permit renewal that includes:

a. Total Dissolved Solids.

b. Hardness.

c. Oil & Grease and surfactants.

d. Antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, selenium, silver, thallium, and zinc.

e. Aluminum, barium, boron, cobalt, iron, magnesium, manganese, molybdenum, total tin, and total aluminum.

TABLE 1-4 ***ALTERNATIVE 4 Groundwater and Surface Water Quality***

ALTERNATIVE 4			
Sample ID	**Parameters**	**Frequency**	**Purpose**
P-1	Field Parameters: pH, temperature, dissolved oxygen Laboratory Parameters: acrylamide, diesel range organics (DRO), and gasoline range organics (GRO)	Quarterly: April, July, October	Created water feature in intial phases of mine. Downgradeint of plant site and end of season process water discharge. Monitor for parameters utilized at the facility.
S-1	Field Parameters: pH, temperature, dissolved oxygen Laboratiory Parameters: Acrylamide, Chlorides, hardness (Ca+Mg as $CaCO_3$), hydrogen sulfide as S, and total suspended solids (TSS)	Quarterly: April, July, October	Southern wetland complex and downgradient of end of season process water discharge. Monitor to verify that water quality is similar to expected natural concentrations and that existing uses will be maintainted and not be adversly affected.
S-2	Field Parameters: pH, Temperature, dissolved oxygen Laboratory Parameters: Acrylamide	Quarterly: April, July, October	Stormwater pond prior to discharge to Gifford Lake downgradient of end of season process water discharge from MS-N plants site, water quality influenced by Mn River Flooding.
RF-2	Field Parametrs: pH, temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO, GRO, Nitrate, as N and Nitrite as N	Quarterly: April, July, October	Renaisance Fesitival Water Supply Well downgradient of BRP plant site. Monitor for parameters utilized at the facility while RF remains on-site.
MW-X	Field Parameters: pH, Temperature, dissolved oxygen Laboratory Parameters: Acrylamide	Quarterly: April, July, October	New monitoring well downgradient of end of season process water discharge from MS-S plant site, TBD based on final plant design.
DW-1	Field Parameters: Flow, pH, temperature, dissolved oxygen Laboratory Parameters: Nitrate (as N), Nitrite (as N), Nitrogen (Kjeldahl, Total), Phospohorus, Total (as P), acrylamide, chloride, hardness (Ca+Mg as CaCO3), hydrogen sulfide (as S), and TSS1	Quarterly: April, July, October	Dewatering discharge to infiltration basin and as applicable to off-site surface water.
MW-7	Field Parameters: pH, Temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO, and GRO	Quarterly: April, July, October for first year of mining	Background monitoring well. Monitor for parameters utilized at the facility.
W-114	Field Parameters: pH, Temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO, and GRO	Quarterly: April, July, October for first year of mining	Background monitoring well. Monitor for parameters utilized at the facility.
BR-04	Field Parameters: pH, Temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO, and GRO	Quarterly: April, July, October for first year of mining	Background monitoring well. Monitor for parameters utilized at the facility.

[1] Additional monitoring of quarry dewatering discharge offsite will be performed as required under the NPDES permit in effect at the time.

Currently, prior to permit renewal, the General nonmetallic mineral mining permit requires a one time sampling event prior to permit renewal that includes:

a. Total Dissolved Solids.

b. Hardness.

c. Oil & Grease and surfactants.

d. Antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, selenium, silver, thallium, and zinc.

e. Aluminum, barium, boron, cobalt, iron, magnesium, manganese, molybdenum, total tin, and total aluminum.

TABLE 1-5 ***ALTERNATIVE 5 Groundwater and Surface Water Quality***

ALTERNATIVE 5			
Sample ID	**Parameters**	**Frequency**	**Purpose**
P-1	Field Parameters: pH, temperature, dissolved oxygen Laboratory Parameters: acrylamide, diesel range organics (DRO), and gasoline range organics (GRO)	Quarterly: April, July, October	Created water feature in intial phases of mine. Downgradeint of plant site and end of season process water discharge. Monitor for parameters utilized at the facility.
S-1	Field Parameters: pH, temperature, dissolved oxygen Laboratiory Parameters: Acrylamide, Chlorides, hardness (Ca+Mg as $CaCO_3$), hydrogen sulfide as S, and total suspended solids (TSS)	Quarterly: April, July, October	Southern wetland complex and downgradient of end of season process water discharge. Monitor to verify that water quality is similar to expected natural concentrations and that existing uses will be maintainted and not be adversly affected.
MW-X	Field Parameters: pH, Temperature, dissolved oxygen Laboratory Parameters: Acrylamide	Quarterly: April, July, October	New monitoring well downgradient of end of season process water discharge from MS-S plant site, TBD based on final plant design.
RF-2	Field Parametrs: pH, temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO, GRO, Nitrate, as N and Nitrite as N	Quarterly: April, July, October	Renaisance Fesitival Water Supply Well downgradient of BRP plant site. Monitor for parameters utilized at the facility.
MW-6	Field Parametrs: pH, temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO and GRO	Quarterly: April, July, October	Monitoring well downgradient of MS-S plant site. Monitor for parameters used at the facility.
DW-1	Field Parameters: Flow, pH, temperature, dissolved oxygen Laboratory Parameters: Nitrate (as N), Nitrite (as N), Nitrogen (Kjeldahl, Total), Phospohorus, Total (as P), acrylamide, chloride, hardness (Ca+Mg as CaCO3), hydrogen sulfide (as S), and TSS1	Quarterly: April, July, October	Dewatering discharge to infiltration basin and as applicable to off-site surface water.
MW-7	Field Parameters: pH, Temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO, and GRO	Quarterly: April, July, October for first year of mining	Background monitoring well. Monitor for parameters utilized at the facility.
BR-04	Field Parameters: pH, Temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO, and GRO	Quarterly: April, July, October for first year of mining	Background monitoring well. Monitor for parameters utilized at the facility.

[1] Additional monitoring of quarry dewatering discharge offsite will be performed as required under the NPDES permit in effect at the time.

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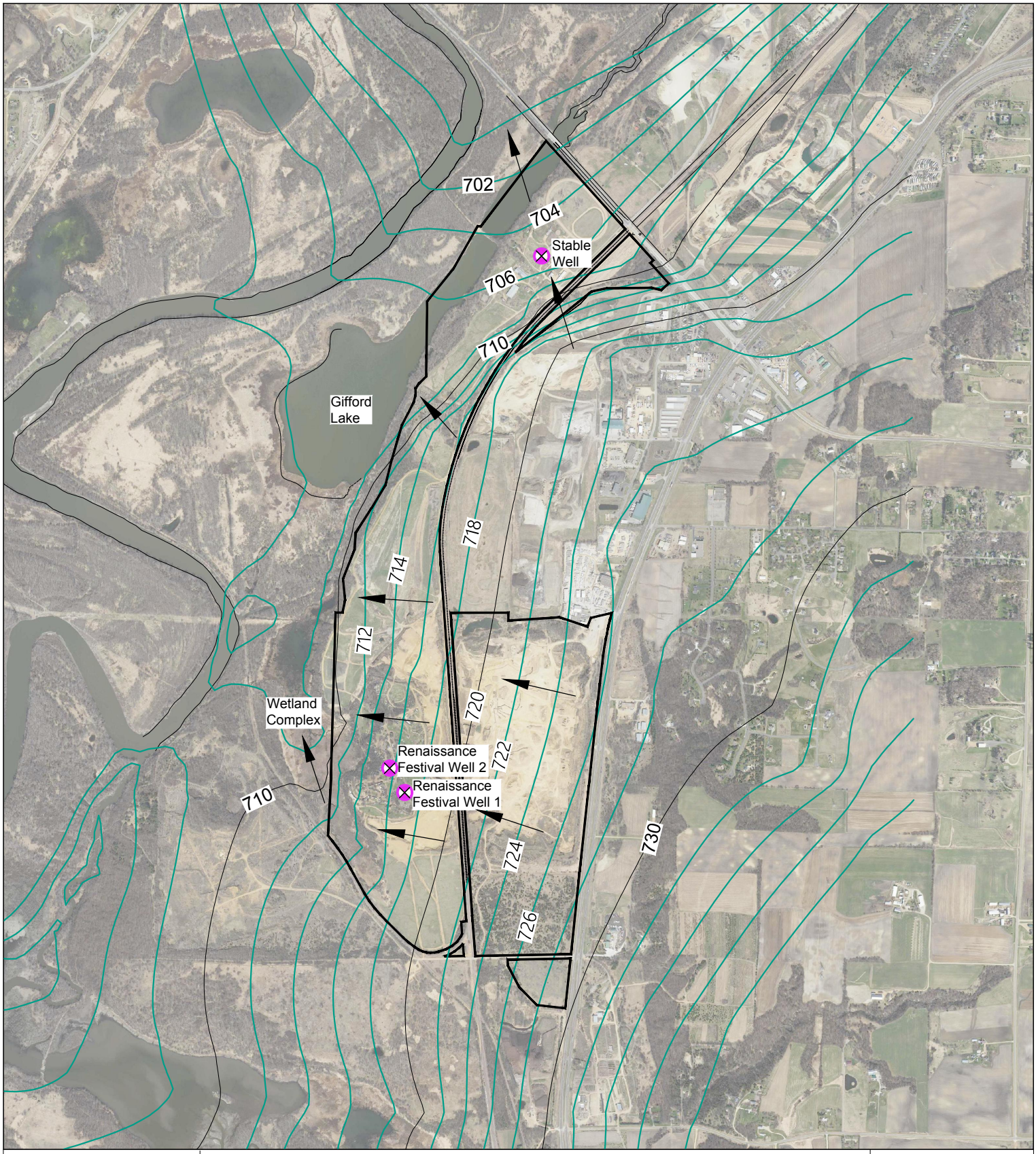
a. Total Dissolved Solids.
b. Hardness.
c. Oil & Grease and surfactants.
d. Antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, selenium, silver, thallium, and zinc.
e. Aluminum, barium, boron, cobalt, iron, magnesium, manganese, molybdenum, total tin, and total aluminum.

TABLE 6 ***ALTERNATIVE 6 Groundwater and Surface Water Quality***

ALTERNATIVE 6			
Sample ID	**Parameters**	**Frequency**	**Purpose**
P-1	Field Parameters: pH, temperature, dissolved oxygen Laboratory Parameters: acrylamide, diesel range organics (DRO), and gasoline range organics (GRO)	Quarterly: April, July, October	Created water feature in intial phases of mine. Downgradeint of plant site and end of season process water discharge. Monitor for parameters utilized at the facility.
S-1	Field Parameters: pH, temperature, dissolved oxygen Laboratiory Parameters: Acrylamide, Chlorides, hardness (Ca+Mg as $CaCO_3$), hydrogen sulfide as S, and total suspended solids (TSS)	Quarterly: April, July, October	Southern wetland complex and downgradient of end of season process water discharge. Monitor to verify that water quality is similar to expected natural concentrations and that existing uses will be maintainted and not be adversly affected.
RF-2	Field Parametrs: pH, temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO, GRO, Nitrate, as N and Nitrite as N	Quarterly: April, July, October	Renaisance Fesitival Water Supply Well downgradient of BRP plant site. Monitor for parameters utilized at the facility while RF remains on-site.
DW-1	Field Parameters: Flow, pH, temperature, dissolved oxygen Laboratory Parameters: Nitrate (as N), Nitrite (as N), Nitrogen (Kjeldahl, Total), Phospohorus, Total (as P), acrylamide, chloride, hardness (Ca+Mg as CaCO3), hydrogen sulfide (as S), and TSS1	Quarterly: April, July, October	Dewatering discharge to infiltration basin and as applicable to off-site surface water.
MW-7	Field Parameters: pH, Temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO, and GRO	Quarterly: April, July, October for first year of mining	Background monitoring well. Monitor for parameters utilized at the facility.
MW-9	Field Parameters: pH, Temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO, and GRO	Quarterly: April, July, October for first year of mining	downgtradient BRP upgradient MS . Monitor for parameters utilized at the facility.
BR-04	Field Parameters: pH, Temperature, dissolved oxygen Laboratory Parameters: Acrylamide, DRO, and GRO	Quarterly: April, July, October for first year of mining	Background monitoring well. Monitor for parameters utilized at the facility.

[1] Additional monitoring of quarry dewatering discharge offsite will be performed as required under the NPDES permit in effect at the time. Currently, prior to permit renewal, the General nonmetallic mineral mining permit requires a one time sampling event prior to permit renewal that includes:

a. Total Dissolved Solids.
b. Hardness.
c. Oil & Grease and surfactants.
d. Antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, selenium, silver, thallium, and zinc.
e. Aluminum, barium, boron, cobalt, iron, magnesium, manganese, molybdenum, total tin, and total aluminun

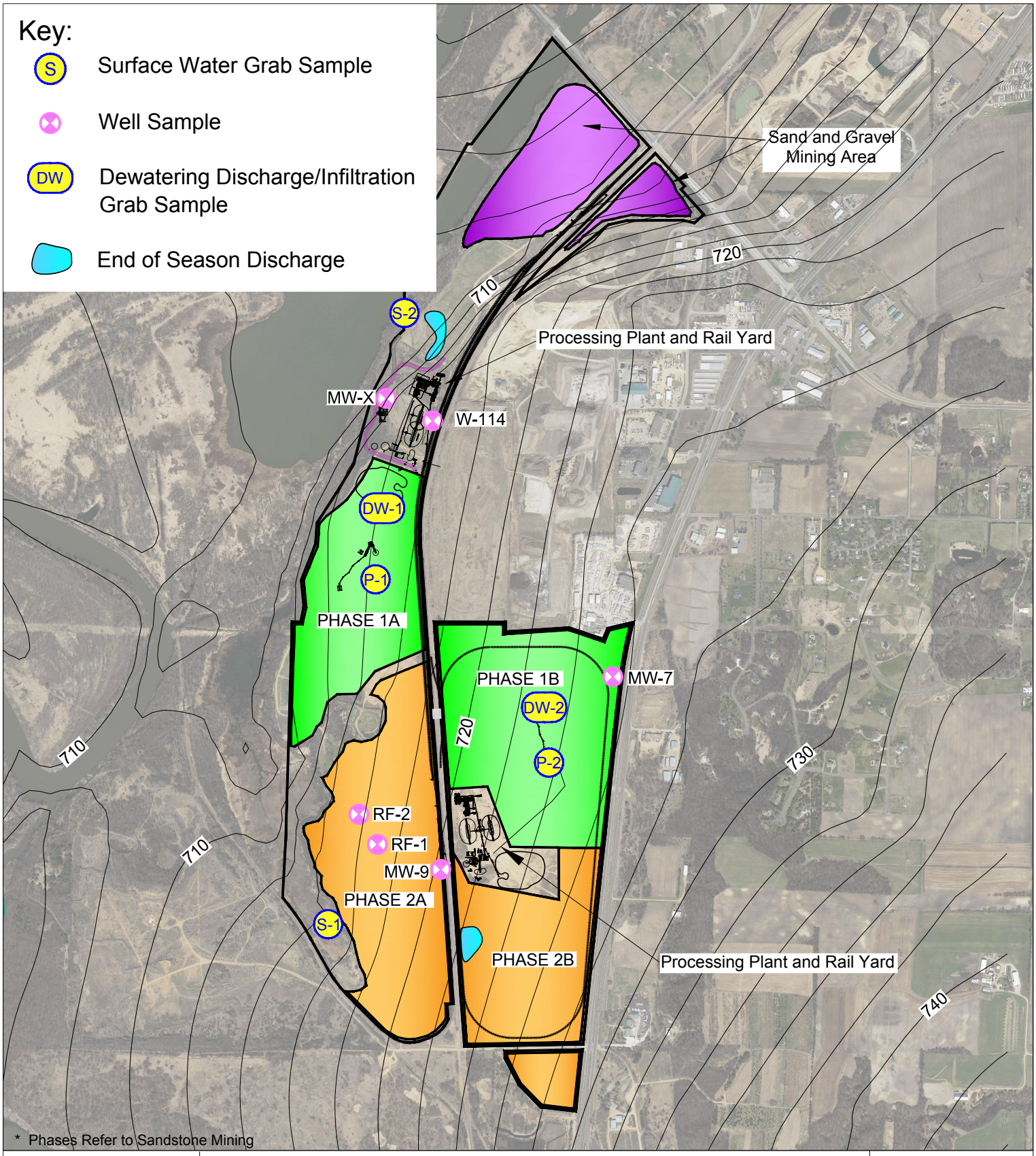


N

0 1000 2000
SCALE IN FEET

Figure 1
Downgradient Drinking Water Supply Wells and Surface Water Receptors
Water Quality Monitoring Plan
Merriam Junction Sands

Sunde Engineering, PLLC.

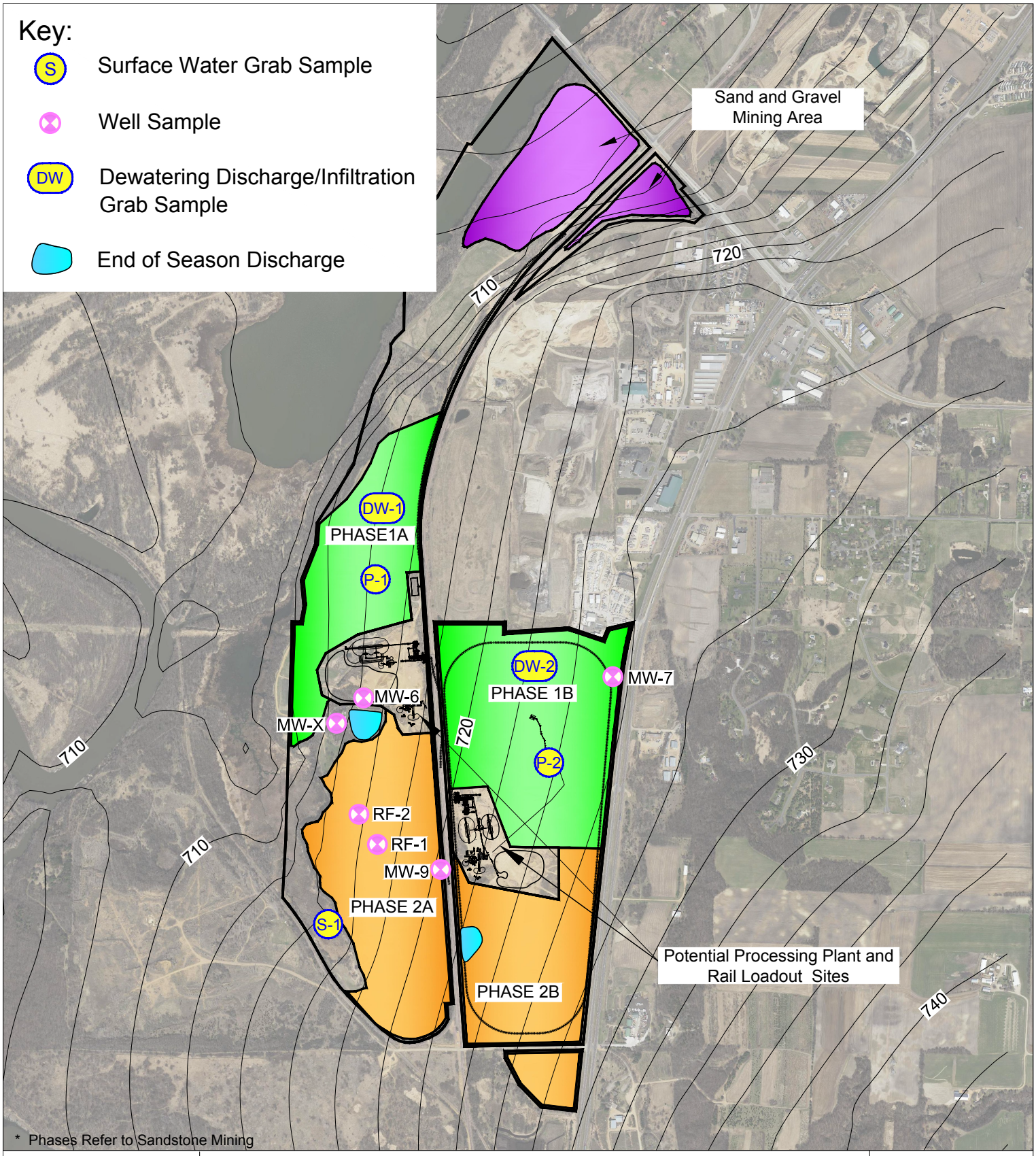


N

Not to Scale

Figure 2
Alternative 1 Groundwater/Surface Water Monitoring Network
Merriam Junction Sands

Sunde Engineering, PLLC.

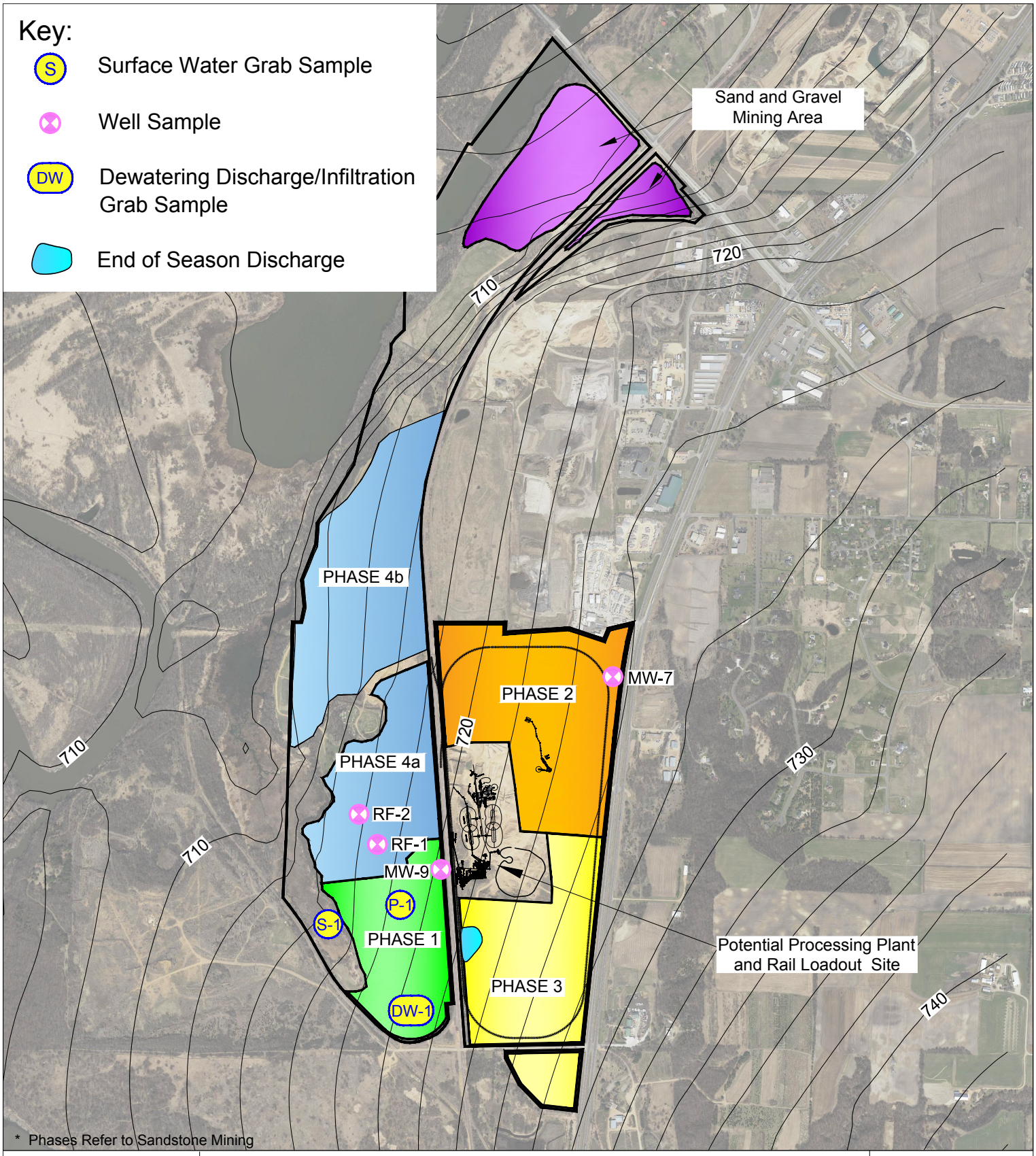


N

Not to Scale

Figure 3
Alternative 2 Groundwater/Surface Water Monitoring Network
Merriam Junction Sands

Sunde Engineering, PLLC.

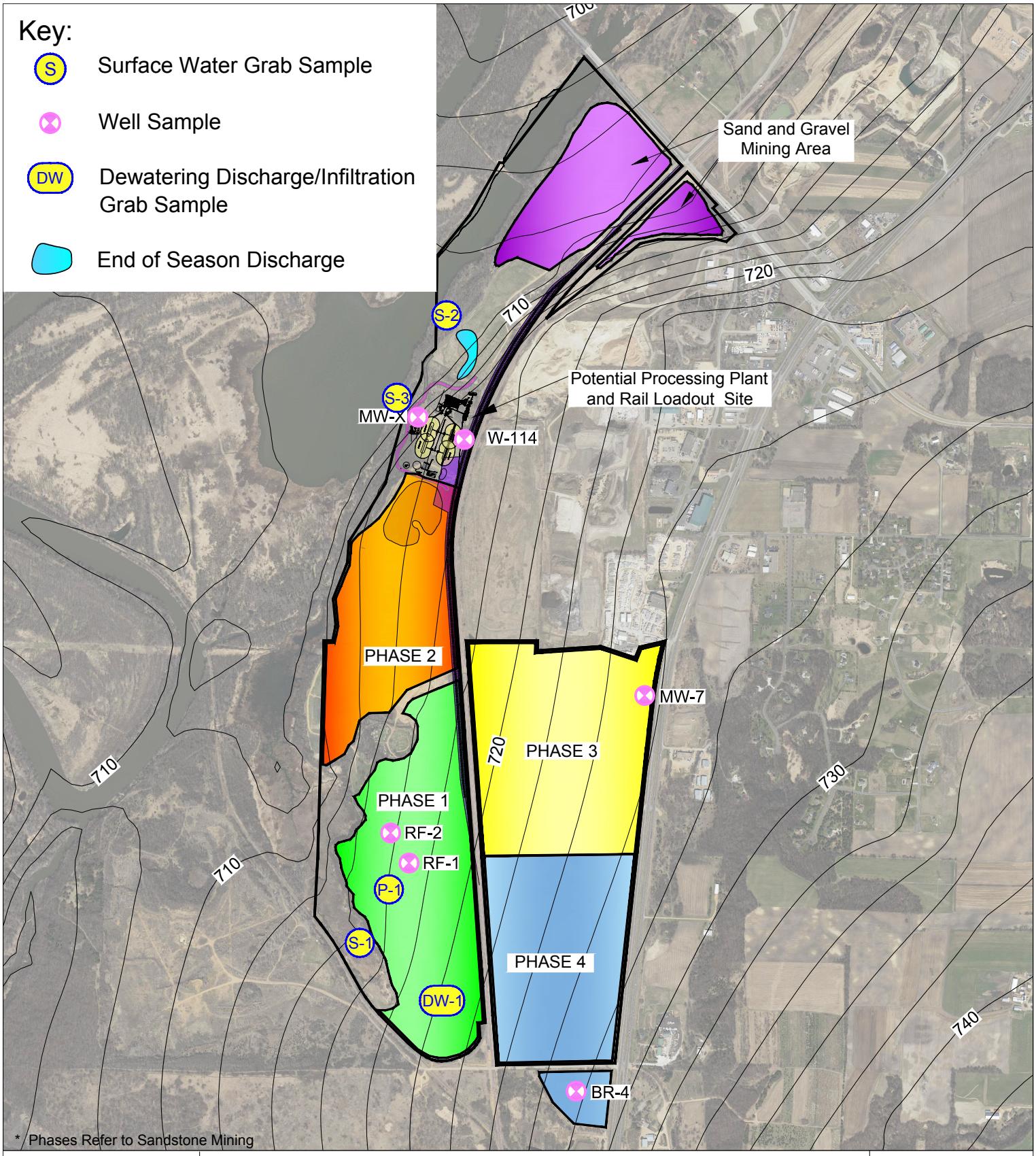


N

Not to Scale

Figure 4
Alternative 3 Groundwater/Surface Water Monitoring Network
Merriam Junction Sands

Sunde Engineering, PLLC.

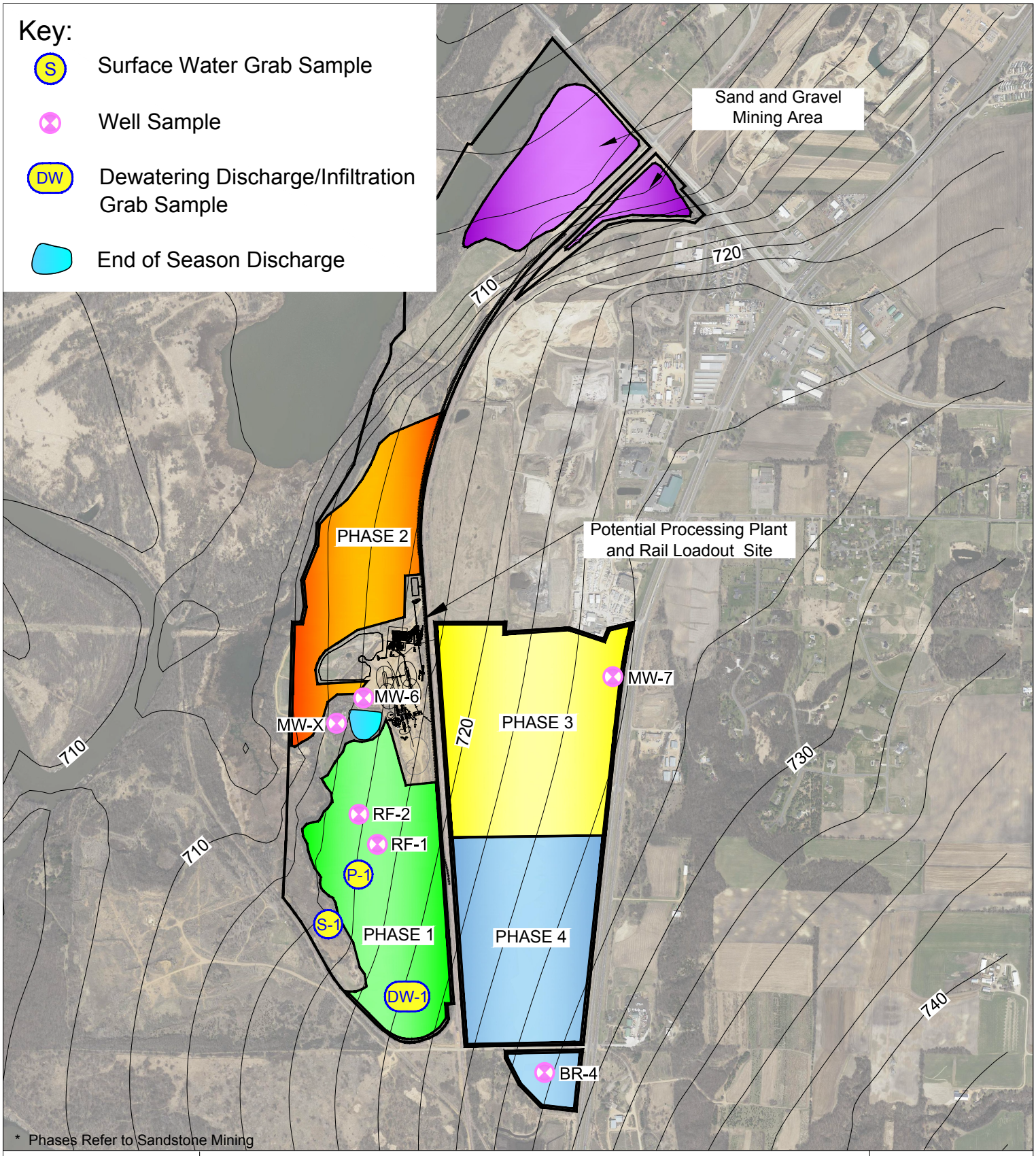


N

Not to Scale

Figure 5
Alternative 4 Groundwater/Surface Water Monitoring Network
Merriam Junction Sands

Sunde Engineering, PLLC.

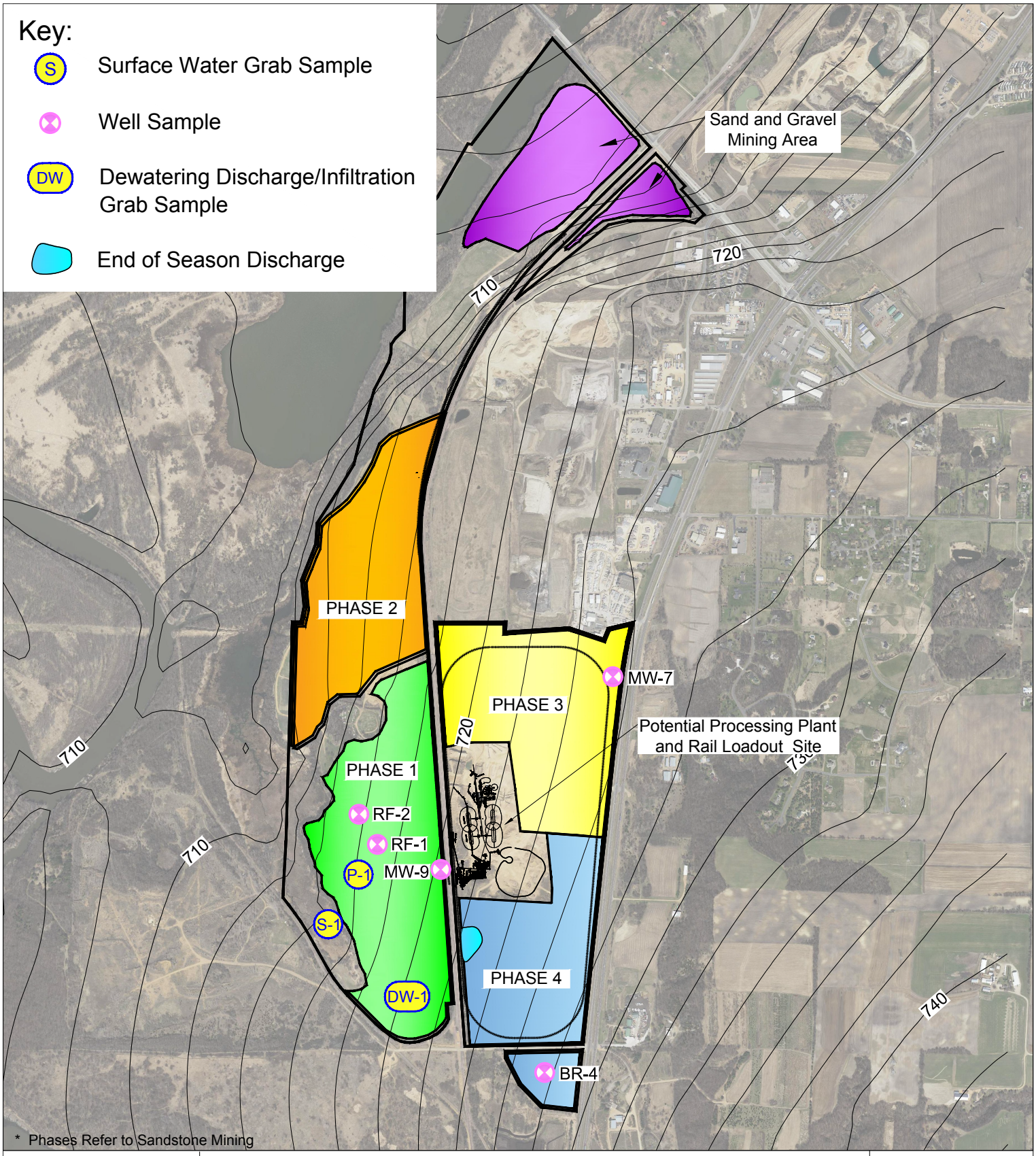


N

Not to Scale

Figure 6
Alternative 5 Groundwater/Surface Water Monitoring Network
Merriam Junction Sands

Sunde Engineering, PLLC.



N

Not to Scale

Figure 7
Alternative 6 Groundwater/Surface Water Monitoring Network
Merriam Junction Sands

Sunde Engineering, PLLC.

Attachment 1

Well Logs:
Downgradient Drinking Water Supply Wells

Minnesota Unique Well Number

248000

County Scott
Quad Jordan East
Quad ID 90A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 02/23/1989
Update Date 02/14/2014
Received Date

Well Name	Township	Range	Dir	Section	Subsection
MN	115	23	W	21	CCDADC

Elevation 775 ft. **Elev. Method** 7.5 minute topographic map (+/- 5 feet)

Address

C/W 3630 145TH ST W SHAKOPEE MN 55379

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
DIRT OVERBURDEN	0	2	BLACK	
ROCK SHAKOPEE	2	50		HARD
SANDSTONE &	50	155		
ROCK	155	200	PNK/GRN	HARD

Remarks

Well Depth 200 ft. **Depth Completed** 200 ft. **Date Well Completed** 06/09/1977

Drill Method **Drill Fluid**

Use commercial **Status** Active

Well Hydrofractured? **Yes** ☐ **No** ☐ **From** **To**

Casing Type Single casing **Joint**
Drive Shoe? **Yes** ☐ **No** ☐ **Above/Below** 0 ft.

Casing Diameter **Weight** **Hole Diameter**
4 in. To 161 ft. lbs./ft. 8 in. To 160 ft.

Open Hole From 161 ft. To 200 ft.

Screen? ☐ **Type** **Make**

Static Water Level
60 ft. land surface Measure 06/09/1977

Pumping Level (below land surface)

Wellhead Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☐ Yes ☐ No ☒ Not Specified

Nearest Known Source of Contamination
feet Direction Type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☐ Not Installed Date Installed
Manufacturer's name
Model Number HP 0 Volt
Length of drop pipe ft Capacity g.p. Typ

Abandoned
Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance
Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous
First Bedrock Prairie Du Chien Group Aquifer St.Lawrence
Last Strat St.Lawrence Formation Depth to Bedrock 2 ft
Located by Minnesota Geological Survey
Locate Method Digitized - scale 1:24,000 or larger (Digitizing Table)
System UTM - NAD83, Zone 15, Meters X 452689 Y 4955179
Unique Number Verification Input Date 03/25/1996

Angled Drill Hole

Well Contractor
Associated Well Co. 27259
Licensee Business Lic. or Reg. No. Name of Driller

Minnesota Unique Well Number

206810

County Scott
Quad Shakopee
Quad ID 105D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 06/15/1990
Update Date 08/18/2014
Received Date

Well Name	Township	Range	Dir	Section	Subsection
MALKERSON	115	23	W	16	ACCDCB

Elevation 761 ft. **Elev. Method** Calc from DEM (USGS 7.5 min or equiv.)

Address

C/W 12360 CHESTNUT BL SHAKOPEE MN 55379

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
COURSE GRAVEL &	0	150	BROWN	
SAND	150	187	BROWN	
SHALE	187	325	GRN/WHT	
SANDSTONE	325	345	WHITE	

Remarks

BATHROOM
KITCHEN SINK
MIKES HOUSE
OUTSIDE FAUCET
WHITE BARN

Well Depth 345 ft. **Depth Completed** 345 ft. **Date Well Completed** 09/14/1970

Drill Method **Drill Fluid**

Use public supply/non-comm.-transient **Status** Active

Well Hydrofractured? **Yes** ☐ **No** ☐ **From** **To**

Casing Type Single casing **Joint**
Drive Shoe? **Yes** ☐ **No** ☐ **Above/Below** 0 ft.

Casing Diameter **Weight**
5 in. To 188 ft. lbs./ft.

Open Hole From 188 ft. To 345 ft.

Screen? ☐ **Type** **Make**

Static Water Level
0 ft. land surface Measure 09/14/1970

Pumping Level (below land surface)
0 ft. hrs. Pumping at 75 g.p.m.

Wellhead Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☐ Yes ☐ No ☒ Not Specified

Nearest Known Source of Contamination
feet Direction Type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☐ Not Installed Date Installed
Manufacturer's name AEROMOTOR
Model Number HP 2 Volt
Length of drop pipe ft Capacity g.p. Typ Submersible

Abandoned
Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance
Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous
First Bedrock St.Lawrence-Tunnel City Aquifer St.Lawrence-
Last Strat Tunnel CIty/Lone Rock Fm Depth to Bedrock 187 ft
Located by Minnesota Department of Health
Locate Method Digitization (Screen) - Map (1:12,000)
System UTM - Mad83, Zone 15, Meters X 453346 Y 4957552
Unique Number Verification Inpute Date 04/17/2001

Angled Drill Hole

Well Contractor
Leuthner Well Co. 10125
Licensee Business Lic. or Reg. No. Name of Driller

Minnesota Unique Well Number

404657

County Scott
Quad Jordan East
Quad ID 90A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 06/15/1990
Update Date
Received Date 04/16/2015

Well Name	Township	Range	Dir	Section	Subsection
RENAISSANCE	115	23	W	28	BBAA

Elevation 777 ft. **Elev. Method** Calc from DEM (USGS 7.5 min or equiv.)

Address

C/W 3525 145TH ST W SHAKOPEE MN 55379

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
SHAKOPEE LIMESTONE	0	80	BROWN	HARD
JORDAN SANDROCK	80	189	WHITE	SOFT
ST. LAWRENCE SHALE	189	236	GREEN	HARD
FRANCONIA SHALE	236	371	GREEN	HARD
GALESVILLE	371	450	WHITE	MEDIUM
EAU CLAIRE SHALE	450	455	GREEN	HARD

Remarks

*1 - BIG WELL.
*2 - SMALL WELL.
600 WELL
BAKERY HILL WELL
BIG WELL
TOTAL PLATE COUNT TNTC 8-25-77

Well Depth 455 ft. **Depth Completed** 455 ft. **Date Well Completed** 10/14/1983

Drill Method Non-specified Rotary **Drill Fluid**

Use public supply/non-comm.-transient **Status** Active

Well Hydrofractured? **Yes** ☐ **No** ☐ **From** **To**

Casing Type Single casing **Joint** Welded
Drive Shoe? **Yes** ☒ **No** ☐ **Above/Below**

Casing Diameter	Weight	Hole Diameter
8 in. To 256 ft.	28.5 lbs./ft.	14 in. To 256 ft.
		8 in. To 445 ft.

Open Hole From 256 ft. To 455 ft.

Screen? ☐ **Type** **Make**

Static Water Level
61 ft. Land surface Measure 11/10/1983

Pumping Level (below land surface)
110 ft. 1 hrs. Pumping at 100 g.p.m.

Wellhead Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☒ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount		From	To
Neat Cement	6.5	Cubic yards	2 ft.	256 ft.

Nearest Known Source of Contamination
600 feet North Direction Type
Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 05/10/1984
Manufacturer's name PIONEER
Model Number P - 300 HP 20 Volt 220
Length of drop pipe 161 ft Capacity 250 g.p. Typ Submersible

Abandoned
Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance
Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous
First Bedrock Prairie Du Chien Group Aquifer Tunnel City-Eau
Last Strat Eau Claire Formation Depth to Bedrock 0 ft
Located by Minnesota Department of Health
Locate Method GPS SA Off (averaged)
System UTM - Mad83, Zone 15, Meters X 452672 Y 4955007
Unique Number Verification Info/GPS from data Inpute Date 06/06/2005

Angled Drill Hole

Well Contractor

Licensee Business	Lic. or Reg. No.	Name of Driller
Hartmann Well Co.	40174	JAECKELS, R.