



**Iowa Department of Natural Resources**  
**Source Water Assessment and Protection (SWAP)**  
**Phase I Report for**  
**Dubuque (PWS#3126052) – Cambrian/Ordovician Aquifer**

#### **What is SWAP?**

The purpose of Iowa's Source Water Assessment and Protection (SWAP) Phase I report is to:

- define both the source water area and susceptibility of your water supply;
- locate, inventory, and rank potential contamination sources to your source water; and
- provide the results to the public for improved protection of your source water area.

#### **Introduction**

The Source Water Assessment and Protection (SWAP) Phase I report is meant to provide information and be used as a planning tool to help protect your drinking water. Within it you will find an inventory of your active wells, maps showing our best estimate of your source water area, and tables showing *potential* contamination sources within your source water area.

The source water area defined in this report is the region most directly linked to your water supply and where land use activities have the greatest influence on the quality of your drinking water. The method used for delineating your source area was chosen based on information available to the Iowa Department of Natural Resources Iowa Geological and Water Survey (IDNR-IGWS) concerning your wells, aquifers, and pumping rates.

The information given in this SWAP Phase I report is a starting point for your water supply, and by no means protects your drinking water. In order to protect your source water area, your system should start a Phase II, or implementation, of measures. Proactive measures are different for each system, but commonly include planning areas for future wells, cleaning up potential contaminants within your source water area, and converting source water area to prairies and wetlands. Further information on implementation of SWAP can be found at: [www.igsb.uiowa.edu/sourcewater](http://www.igsb.uiowa.edu/sourcewater).

#### **This report includes the following sections:**

1. Defining Your Source Water Area
2. Susceptibility of Your Source Water Area
3. Contaminant Sources within Your Source Water Area
4. Ranking Contaminant Sources
5. How to Protect Your Drinking Water
6. Consumer Confidence Report

#### **Section 1: Defining Your Source Water Area**

The first step of SWAP is to define the area that provides water to your wells. Accurate well and pumping information is critical to providing the best estimate of your source water area. According to our records, Dubuque has four active public wells (Wells #5, 6, 7 and 8) open in the sandstone of the Cambrian/Ordovician aquifer. Hydrologic and geologic data is available. The table below shows the well and aquifer information used for the defining your source water area.

W#	Local ID	Well Depth (ft)	Construct. date	Status	Aquifer	Aquifer thick. (ft)	SWL (ft)	PWL (ft)	Rate (gpm)
121	#5	1810	5/21/1924	Active	Cambrian/Ordovician	1606	27	66	680
2363	#8	1782	9/30/1946	Active	Cambrian/Ordovician	1537	28	152	1975
39379	#3	200	1/1/1956	Active	Alluvium	174	13	18	2496
39380	#4	190	6/1/1956	Active	Alluvium	165	13	14	2433
39381	#9	125	1/1/1969	Active	Alluvium	104	21	44	972
39382	#10	142	1/1/1981	Active	Alluvium	117	25	40	2083
39383	# OLD 1	1308	1/1/1899	unkn	Cambrian	unkn	35	116	unkn
39384	# OLD 2	1300	1/1/1899	unkn	Cambrian	unkn	36	119	unkn
39385	# OLD 3	1458	1/1/1919	unkn	Cambrian	unkn	36	105	unkn
39386	# OLD 4	1460	1/1/1919	unkn	Cambrian/Ordovician	unkn	34	105	unkn
7467	#1	136	12/1/1955	unkn	Alluvium	122	13	27	2333
7468	#2	196	1/1/1956	Active	Alluvium	171	13	27	2240
87	#6	1504	8/27/1935	Active	Cambrian/Ordovician	1287	34	253	1313
974	#7	1560	4/27/1939	Active	Cambrian/Ordovician	1345	22	140	2351

Additional information on your wells is available online on **GEOSAM**, Iowa's geologic database at: [www.igsb.uiowa.edu/geosam](http://www.igsb.uiowa.edu/geosam).

#### **SWAP Glossary**

**Aquifer:** An underground water-bearing layer of permeable material that will yield a usable quantity of water.

**Delineation:** An estimation of the area contributing water to your public wells.

**Capture zone:** A computer modeled delineation, typically using 2-5-and 10 year time of travel periods.

**Time of travel:** A duration of time specified to determine the distance and area that water will travel.

**Susceptibility:** A measure of an aquifer's potential to become contaminated. Does not imply either good or poor water quality.

**Confining layer:** An underground layer of impermeable material which slows the movement of water.

Sufficient information was available concerning your wells, aquifer and pumping conditions to use a computer model to estimate your source water area. For your water supply, the source area was divided to show the areas we estimate groundwater to flow during 2-, 5-, and 10-year "time of travel" periods. These zones were estimated using a computer model developed by the U.S. Environmental Protection Agency for the purpose of delineating wellhead protection areas (WHPA). The model requires certain input data for your aquifer, wells, and pumping rate, listed below:

- Hydraulic gradient (0.001 ft/ft)
- Groundwater flow direction (unknown)
- Porosity (0.10) (sandstone)
- Transmissivity (3,996 ft<sup>2</sup>/day)
- Aquifer thickness (1,443 feet)
- Discharge (3,464,808 gpd)

#### **Section 2: Susceptibility of Your Source Water Area**

The second step of SWAP is assessing the susceptibility of your drinking water to surface contamination. Research by IDNR-IGWS has determined that thickness of confining layers such as till, clay, and shale between the aquifer and the land surface provide a good estimation to determine susceptibility. Aquifers overlain by thicker confining beds are less susceptible to contamination than aquifers overlain by thinner confining beds. The table below summarizes susceptibility by confining layer thickness.

Confining layer thickness	Susceptibility designation
<25 ft.	Highly susceptible
25 to 50 ft.	Susceptible
50 to 100 ft.	Slightly susceptible
>100 ft.	Low susceptibility

Based on our data, your wells have a cumulative confining layer thickness of 50 to 100 ft. Your aquifer was therefore determined to be **slightly susceptible** to surface contamination.

Another method for determining the susceptibility of your aquifer is by using nitrate concentrations to evaluate surface contamination to your drinking water. Wells that have higher nitrate values typically have less protection and are more at risk than wells with low or absent nitrate concentrations. The finished (treated) water at Dubuque has a seven-year (2004-2008) average nitrate-N concentration of 0.4 parts per million (ppm). The maximum concentration measured during this period was 0.5 ppm.

Nitrate concentrations in your public water supply are low. The concentrations measured much lower than the EPA maximum contamination level (MCL) of 10 ppm, indicating little contamination from nonpoint, fertilizer, or septic sources. Elevated nitrate concentrations can disrupt the electron transport system and cause methemoglobinemia, or blue baby syndrome, in infants and certain animals.

### Section 3: Contaminant Sources within Your Source Water Area

The third step of SWAP involves locating all potential contamination sources within your source water area. To identify potential contaminant sources we searched electronic databases for facilities and land uses that may be located within your source water area. The databases used for the inventory are described in Table 1 of the *Source Water Assessment and Protection Program and Implementation Strategy for the State of Iowa* (Iowa Source Water Protection plan). The contaminant source inventory includes facilities and land uses that have been known to contaminate groundwater.

Table 1 lists the potential contaminant sources we found in your source water area. Numbered symbols show locations of potential contaminant sources on the Contaminant Source Inventory map. The numbers correspond to the contaminant source list in Table 1. As noted previously, the potential contaminant sources are derived from databases and have varying degrees of locational accuracy, and therefore may be mapped in the wrong delineation. For this reason, locational accuracy is noted at the end of the table. You or other residents may be aware of additional contaminant sources that should be included. Feel free to modify this report to reflect your knowledge.

For many aquifers, particularly those overlain by thick confining layers, the greatest threat of contamination to the aquifer is through existing wells that penetrate through the confining layers. For this reason, Table 2 lists all known wells, owners, and locations identified in your source water area. A numbered symbol shown on the map at the end of this report identifies well locations.

In addition to the specific “point” sources listed in Table 1, nonpoint sources of contamination also exist in your source water area. In Iowa, a potentially significant nonpoint source of contamination is row crop agriculture. Land use information from 2007 was used to identify percentages and acreages of different land uses in your source water area. Land use percentages are presented in Table 3.

### Section 4: Ranking Contaminant Sources

The fourth and final step of SWAP is to rank the risk of potential contaminant sources to your drinking water. We have attempted to prioritize the relative risk based on a three component ranking system; 1) the location of the potential contaminant source in the source water area, 2) the susceptibility ranking of the aquifer to contamination 3) the type of contaminant source. Points are assigned for each category and a cumulative score calculated for each potential contaminant source using the scores for each of the three components. Higher numbers always correspond to higher risk in this report.

### 1) Location of potential contaminant sources

Your potential contaminant sources are ranked from 1-3 based on the delineation. Delineations were given greater weight based on proximity to the well. Fixed radius capture zones also received greater risk as they represent unknown or poorly known hydrogeologic conditions. The table below shows the risk score assigned to each delineation.

<b>Delineation</b>	<b>Risk score</b>
2-year time of travel	3
5-year time of travel	2
10-year time of travel	1
Hydrologic boundary	3
Surface runoff area, 2-year, 5-year	1
2,500-foot fixed radius	3
One-mile fixed radius	3

### 2) Aquifer susceptibility to contamination

Susceptibility rankings were given scores to give more priority to aquifers with less confining layers. Aquifer susceptibilities were given ranks of 1-4, from low susceptibility to highly susceptible. If your well depth or confining layer thickness is unknown, the delineation was automatically designated “highly susceptible” and ranked 4.

### 3) Land-use type

The land-use type combines the potential for different facility classes or land uses to release contaminants with an estimate of the toxicity of the contaminants that may be released. A list of land-use types is shown on Table 3 in the Iowa Source Water Protection plan. Land-use risks are assigned values from 1 to 5 (least to greatest risk).

The final “Risk Score” for the source water area is the result of summing the three components of relative risk. For additional information regarding the ranking classification, please refer to the Iowa Source Water plan.

The goal for ranking potential contaminants is to provide your system with a list to help prioritize potential risks. These risks can only be addressed through local initiatives and strategies started by your community. For implementation, or Phase II of a SWAP plan, it is up to your local community to decide which potential contaminant sources carry the most risk, and to proactively engage problems you might find to your drinking water. The risk rankings provided in this report are only a guide; the final decision on the priority of potential contaminant sources rests with your local source water protection team.

## **Section 5: How to Protect Your Drinking Water**

This SWAP Phase I report only provides information to help your community start protecting its drinking water. Remember that your community is responsible for taking the necessary steps to ensure you have clean drinking water for future generations. The Source Water Program strongly encourages you to add your local knowledge of history, land uses, and potential contaminant sites to make your own changes to this report. Below are a couple of examples of what your community could do to better understand and protect your source water area

### 1) Refining your source water area

Your source water area is an estimate based on the best information available to IDNR-IGWS. In all likelihood your source water area could be further refined if additional hydrogeologic information becomes available. This information includes better estimates of aquifer properties, groundwater gradients, flow directions, and boundary conditions. This information could be obtained by performing pump tests, installation of monitoring wells, and detailed water level measurements. Additionally, drilling

new wells, hooking to rural water systems, or changing pumping rates can have a profound effect on your source water area. If you feel the source water area is wrong or needs refining feel free to contact the Iowa Geological and Water Survey staff at 319-335-1575.

## **2) Refining potential contaminant sources**

It must be recognized that this SWAP Phase I report has not identified all potential contaminant sources in your source water area, nor does it likely include fully accurate locations. Therefore, some potential sources may be located inaccurately or not included in the inventory at all. The Iowa Source Water Protection Plan ([www.iowadnr.gov/water/watershed/swp\\_strategy.html](http://www.iowadnr.gov/water/watershed/swp_strategy.html)) provides listings of additional types of facilities and land uses that may result in contamination, and describes how community-based inventories can be successfully implemented. We encourage you to review the attached materials and consider using your knowledge of the community to improve the contaminant source inventory. It may be appropriate in some cases to retain outside services to assist you in implementing your source water plan.

## **3) Protecting your drinking water**

If your community is interested in protecting your drinking water, there are plenty of free resources available to help guide you through this process. The Source Water Protection website ([www.iowadnr.gov/water/watershed/sourcewater.html](http://www.iowadnr.gov/water/watershed/sourcewater.html)) has many online resources available. Please feel free to contact Chad Fields (319-335-2083) or Becky Ohrtman of the Source Water Program (515-281-0932) for further information.

## **Section 6: Consumer Confidence Report**

As the agency responsible for conducting drinking water programs in the state of Iowa, IDNR must provide each public water supply with language to be included in their Consumer Confidence Report regarding source water protection. The following language, at a minimum, must be included in each Consumer Confidence Report you produce from now on:

“The Dubuque water supply obtains a portion of its water from the sandstone of the Cambrian/Ordovician aquifer. The Cambrian/Ordovician aquifer was determined to be slightly susceptible to contamination because the characteristics of the aquifer and overlying materials may allow the access of contaminants to the aquifer. Dubuque wells will be slightly susceptible to contamination from poorly maintained or abandoned wells reaching the Cambrian/Ordovician aquifer in the source water delineation. A detailed evaluation of your source water was completed by the Iowa Department of Natural Resources, and is available from the City at 563-589-4291.”

You may modify this language or include additional information if you so desire, but you must identify the source of your system’s drinking water and identify known sources of potential contamination.

Table 1. Inventory and assessment of potential contaminant sources.

**Dubuque Public Water Supply (3126052)**  
**Phase I - Contaminant Source Inventory and Assessment**

**Aquifer: Cambrian-Ordovician      Slightly susceptible (risk factor = 2)**

Map No.	Potential Contaminant Source Name	Potential Contaminant Source Type	Program ID	Alternate ID	Potential Contaminant Source Address	Loc'n Accuracy	Land Use Risk	Risk Score
---------	-----------------------------------	-----------------------------------	------------	--------------	--------------------------------------	----------------	---------------	------------

**Capture zone: 2-year time of travel (risk factor = 3)**

1	Tullys Dubuque Lumber	Leaking USTs	7LTI35	310608921	2655 Lincoln Ave, Dubuque, IA 52001	good	5	<b>10</b>
2	Park Maintenance Bldg	Underground storage tanks	198607132	310482578	2241 Lincoln Ave., Dubuque, IA 52001	poor	4	<b>9</b>
3	Dubuque Water Works	Risk management plan	#####	100000049627	1902 Hawthorne St., Dubuque, IA 52001	poor	5	<b>10</b>
4	Frank Reihle Building	Unspecified hazardous waste gen.	#####	IAD051001097	1901 Hawthorne, Dubuque, IA 52001	good	5	<b>10</b>
5	Leisure Services Dept	Small quan. hazardous waste gen.	#####	IAD984593608	2241 Lincoln Ave, Dubuque, IA 52001	poor	4	<b>9</b>
6	Cmsp and P	Railroads	nde	nde	no address available	unkn	1	<b>6</b>
7	Ia-924	Interstate, US, and State Hwys.	nde	nde	no address available	poor	1	<b>6</b>

**Capture zone: 5-year time of travel (risk factor = 2)**

8	Public Wks Water Div City Of Dubuque	Leaking USTs	8LTU98	310535529	1800 Hawthorne St., Dubuque, IA 52001	good	5	<b>9</b>
9	Mulgrew Oil	Underground storage tanks	198604782	310507127	2501 Rhomberg Ave, Dubuque, IA 52001	poor	4	<b>8</b>
10	Barnstead International	Toxic release inventory	#####	52001BRNST2555K	2555 Kerper Blvd., Dubuque, IA 52001	good	5	<b>9</b>
11	Barnstead International	Small quan. hazardous waste gen.	#####	IAD005268347	2555 Kerper Blvd., Dubuque, IA 52001	good	4	<b>8</b>
12	Cmsp and P	Railroads	nde	nde	no address available	unkn	1	<b>5</b>
13	Ia-924	Interstate, US, and State Hwys.	nde	nde	no address available	poor	1	<b>5</b>

**Capture zone: 10-year time of travel (risk factor = 1)**

14	Carpenter Company	Toxic release inventory	#####	52001RCRPN2525K	2525 Kerper Blvd., Dubuque, IA 52001	poor	5	<b>8</b>
15	Cmsp and P	Railroads	nde	nde	no address available	unkn	1	<b>4</b>
16	Ia-924	Interstate, US, and State Hwys.	nde	nde	no address available	poor	1	<b>4</b>

<sup>1</sup>Score range: 1 to 5, see Table 3 of the Iowa Source Water Protection and Assessment plan

<sup>4</sup>Sum of land use, capture zone, and aquifer susceptibility risk factors

Table 2. Inventory of water wells not used in delineation.

**Dubuque Public Water Supply (3126052)**  
**Phase I - Inventory of wells not used for delineation**

**Aquifer: Cambrian-Ordovician      Slightly susceptible (*risk factor = 2*)**

No. on map	Well ID	Well Owner	Well ID Source	Well Depth (ft.)	Date Drilled/permited	Well Location	Locational Accuracy
------------	---------	------------	----------------	------------------	-----------------------	---------------	---------------------

**Capture zone: 5-year time of travel (*risk factor = 2*)**

1	2097044	Lilleskov, Dean	Private well tracking system	unkn	unkn	T. 89 N., R. 3 E., Sec. 7, SE SW NE SE SW	good
---	---------	-----------------	------------------------------	------	------	---	------

Table 3. Land cover type summary.

**Dubuque (3126052) - Cambrian-Ordovician aquifer      Slightly susceptible**

**Summary of land cover types (2007) by acreage**

Capture zone	Grassland	Water	Developed areas	Forested areas	No data	Total acres
2-year	2.3	3.1	61.2	5.4	0.0	72.1
5-year	3.1	17.1	50.4	24.8	0.0	95.3
10-year	1.6	17.1	55.0	24.0	21.7	119.4

**Summary of land cover types (2007) by percentage of total**

Capture zone	Grassland	Water	Developed areas	Forested areas	No data	Total
2-year	3.2	4.3	84.9	7.5	0.0	100.0
5-year	3.3	17.9	52.9	26.0	0.0	100.0
10-year	1.3	14.3	46.1	20.1	18.2	100.0

## Dubuque - Cambrian-Ordovician aquifer

Source Water Protection Area

