Waupaca County groundwater testing and educational program final first year report, 4-15-91. [DNR-079a] 1991

Wilson, Thomas J.; Blonde, Greg

Madison, Wisconsin: Wisconsin Department of Natural Resources, 1991

WAUPACA COUNTY GROUNDWATER TESTING AND EDUCATIONAL PROGRAM
FINAL FIRST YEAR REPORT - 4-15-91

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ACKNOWLEDGEMENTS:

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WAUPACA COUNTY GROUNDWATER TESTING AND EDUCATIONAL PROGRAM

TOWNS OF LEBANON AND SCANDINAVIA

I. INTRODUCTION

A. WAUPACA COUNTY

Waupaca County is located in east-central Wisconsin encompassing a land area of nearly 488,000 acres. (Exhibit 1) Approximately 52% of all residents (45,000) live outside of cities and villages. The most populated city has less than 5,000 people (1988 population estimate). The population density is now 59 people per square mile, which is above average for a typical agricultural county.

Thirty five percent of the county is tillable farmland with corn, oats, and alfalfa are the primary agricultural corps. Some cash grain, canning crops, and potatoes are also grown. Six hundred twenty five dairy operations account for 66% of all farm receipts and is the predominant agricultural enterprise of the 1,450 farms in the county.

Thirty seven percent of the land area is forest, 18% is wetlands and 2% water. Only 4% of the county's surface area is considered developed or residential. (Exhibit 2)

Precambrian crystalline rock (granite), cambrian sandstone, and ordovician dolomite (commonly called limestone) are the major bedrock types found underlying Waupaca County.

Granite, which underlies nearly 80% of the county, outcrops near the communities of Big Falls, New London, and Waupaca. A layer of sandstone overlies most of the granite. A thin layer of limestone overlies the other bedrock in the extreme southeastern portion of the county.

The surface geology of the county is primarily a result of glacial activity and subsequent erosional forces. Common glacial features are steep sided moraines and drumlins. A glacial till with considerable amounts of dolomite constituents, covers the majority of the county's bedrock.

The soils are dominantly sandy and loamy having been formed under forest vegetation. As part of the Wolf River Basin, most of the county has a complex drainage pattern consisting of many streams that start in the wetlands of lakes fed by springs.

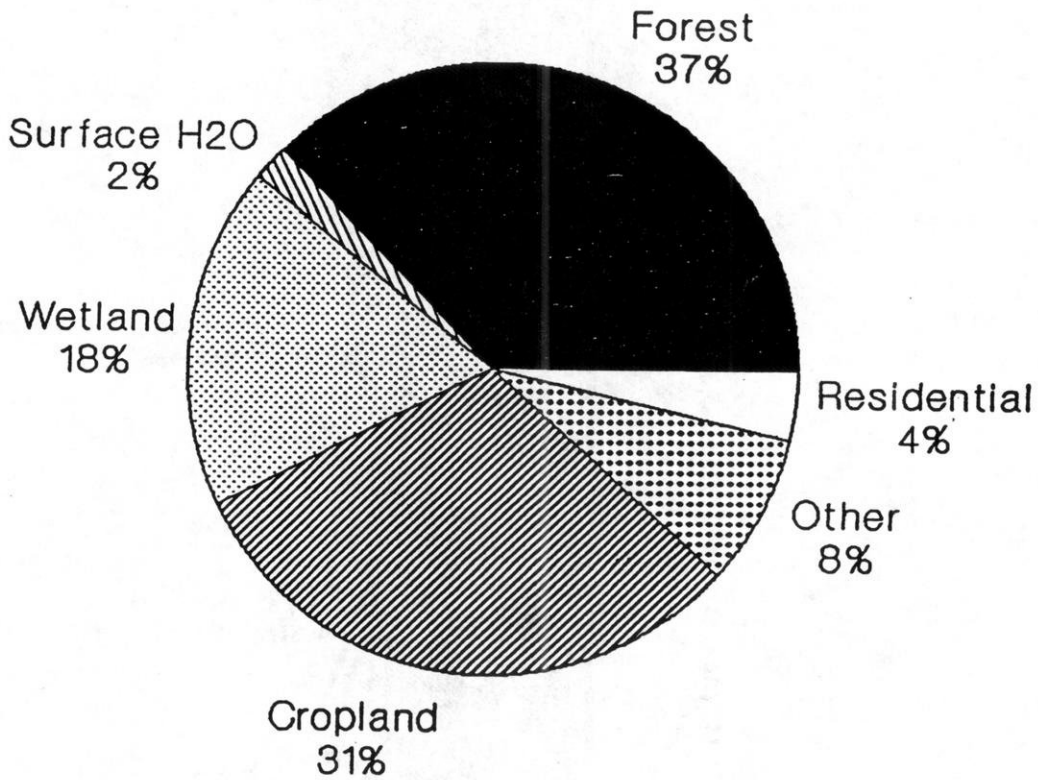
Generally, the water table is within 50 to 60 feet of the surface. Wells located in drumlin and moraine areas exceed 50 feet, but are usually no deeper than 120 feet. Except for isolated areas of granite bedrock, at the surface, western Waupaca County has ample groundwater with rapid recharge capability. (Exhibit 4) Wells in central regions of the county are slow to recharge with extremely variable and unpredictable yields. In the eastern portion of Waupaca County, the granite bedrock is much deeper and therefore the private wells installed within the granite are also considerably deeper. Well depths and well yields vary considerably in this portion of the county.

EXHIBIT 1


WISCONSIN
DOUGLAS
BAYFIELD
IRON
ASHLAND
VILAS
FLORENCE
BURNETT
WASHBURN
SAWYER
PRICE
ONEIDA
FOREST
POLK
BARRON
RUSK
LINCOLN
LANGLADE
MARINETTE
TAYLOR
ST CROIX
DUNN
CHIPPEWA
MENO-MINEE
OCONTO
DOOR
MARATHON
PIERCE
EAU CLAIRE
CLARK
SHAWANO
PEPIN
BUFFALO
TREMPEALEAU
JACKSON
WOOD
PORTAGE
WAUPACA
OUTAGAMIE
BROWN
KEWAU-NEE
ADAMS
WAUSHARA
WINNEBAGO
CALUMET
MANITOWOC
LA CROSSE
MONROE
MAR-QUETTE
GREEN LAKE
FOND DU LAC
SHEBOY GAN
JUNEAU
VERNON
SAUK
COLUMBIA
DODGE
WASH-INGTON
OZAUKEE
RICHLAND
CRAWFORD
DANE
IOWA
JEFFERSON
WAUKESHA
MILWAUKEE
GRANT
LAFAYETTE
GREEN
ROCK
WALWORTH
RACINE
KENOSHA

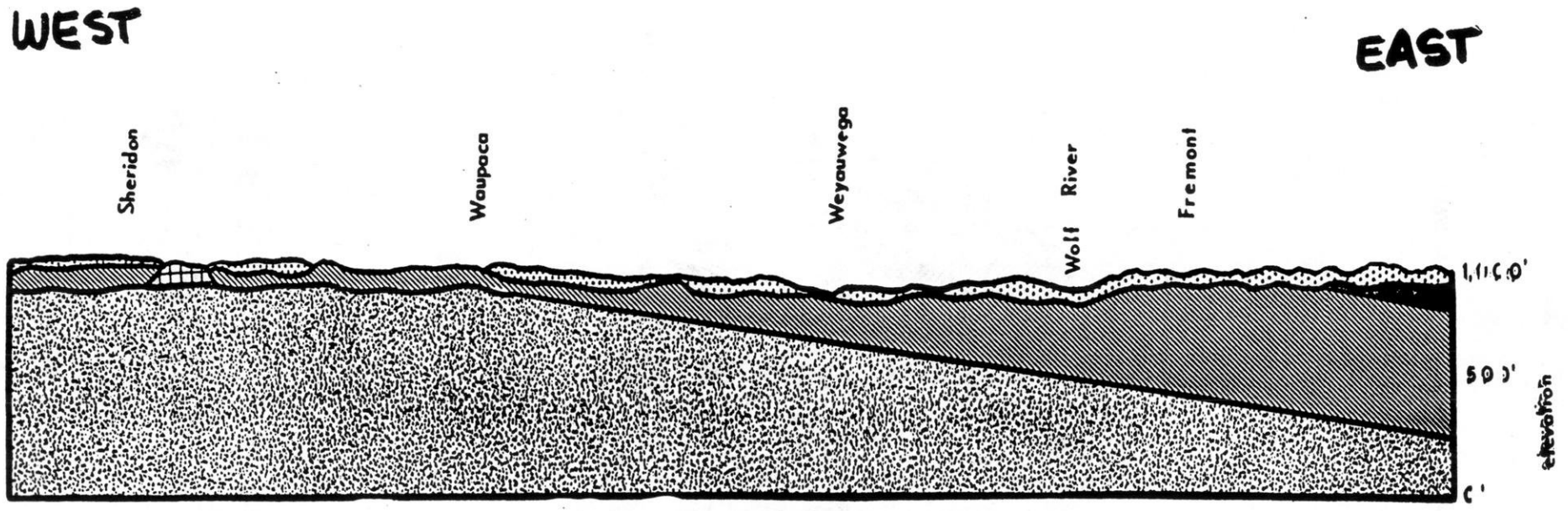
EXHIBIT 2

Waupaca County
Land Use Estimates



Source:WDATCP Ag Stat/WDNR Forest/ECWRPC -1988

EXHIBIT 3



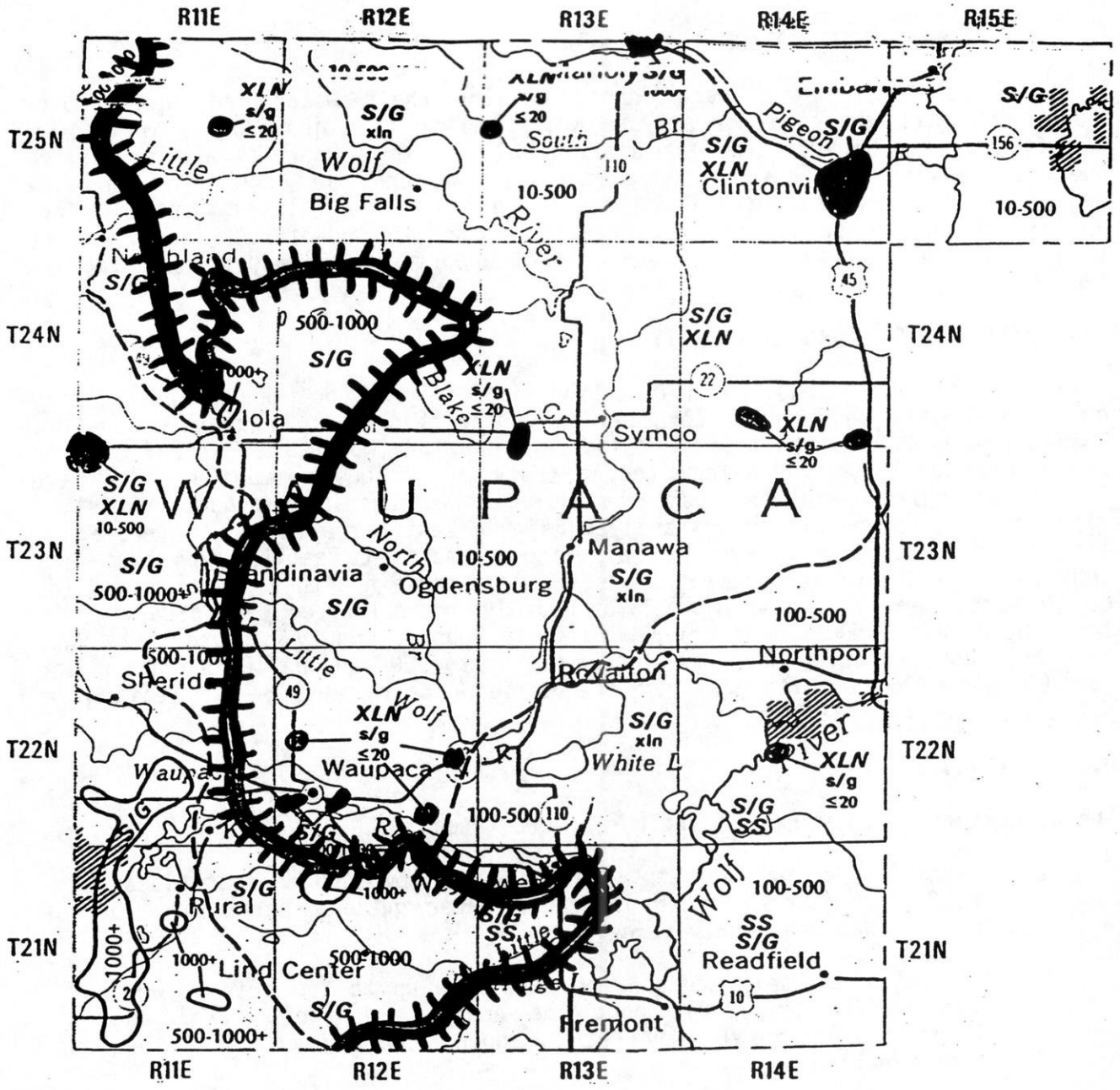
Key

- Precambrian granite
- Cambrian sandstone
- Ordovician dolomite
- Glacial till
- Cary end moraine

Fig. 3. Geologic section across southern Waupaca County

(after Weidman & Schultz, 1914)

EXHIBIT 4



EXPLANATION

.10-500 100-500 500-1000 500-1000+ .1000+	Maximum potential yields (in gallons per minute) expected from fully developed wells in area
+	Maximum potential yield unknown

Boundary between zones of aquifer potential, approximately located

Location of aquifer potential boundary

Federal/state lands

Data have not been field checked.

Major aquifer		Minor aquifer
SS	Sandstone	ss
S/G	Sand and Gravel	s/g
XLN	Crystalline (granite-like)	xln

0 10 Miles

0 10 Kilometers

Aquifer Potential of Waupaca County, Sept. 1981, by R.G. Hennings and I.D. Lippelt.

B. GROUNDWATER UTILIZATION

Virtually everyone in Waupaca County obtains their water from groundwater sources through municipal or private wells. Each year groundwater in Waupaca County provides an estimated 1.2 billion gallons for commercial and industrial use; 920 million gallons for human consumption, and 890 million gallons for agricultural purposes. (Exhibit 5) Furthermore, most lakes, streams, and rivers in Waupaca County are essentially exposed groundwater. These surface waters provide a great deal of recreational opportunity in addition to tourism revenue.

C. STATUS OF GROUNDWATER QUALITY

Current well water quality information is limited to the annual summary prepared for the past three years by the Central Wisconsin Groundwater Center. This averages 200 to 300 private wells per year. Although the current data on groundwater quality is limited, recent tests of various community wells have identified contamination from bacteria and volatile organic compounds (VOC's). In addition, homeowner samples analyzed at the Task Force Lab in Stevens Point and at the State Lab of Hygiene have shown some test results with bacterial contamination and nitrate levels exceeding acceptable health advisory standards of 10 parts per million (PPM). Unfortunately, very limited pesticide and VOC tests have been conducted on private wells in Waupaca County. Those tests that have been done to date, have been conducted by the DNR and DATCP as part of the special statewide efforts such as the Grade A dairy well water testing or potential problem locations.

D. OBJECTIVES

The objectives of this project include several areas:

1. Obtain additional private well water quality data on pesticides, VOC's and several other inorganic water quality parameters in several Waupaca County towns.

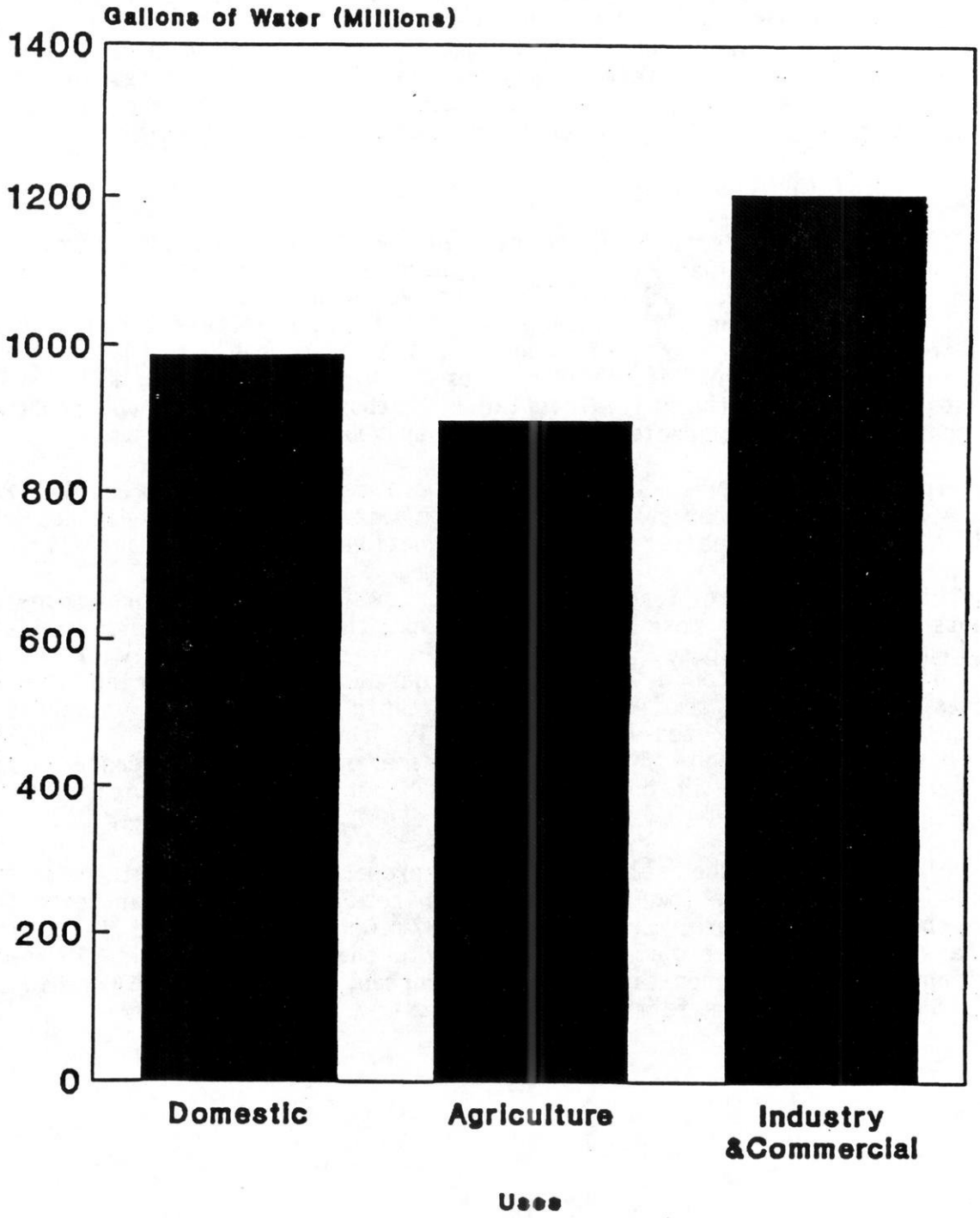
2. Inform, ultimately educate, and evaluate up to 150 private well owners (75 for 1990) about the quality of their water and identify potential ways to reduce the risk of future contamination.

3. Foremost, this project will identify knowledge gained about groundwater protection; have participants analyze their particular farmstead or rural homesite in terms of groundwater protection measures; and identify practices that have been changed to protect groundwater.

4. Provide an incentive for other rural residents to test their water quality and evaluate their management practices.

EXHIBIT 5

Waupaca County Water Usage 1979



Source: '79 U.S. Geological Survey

II. GROUNDWATER EDUCATION PROJECT

A. BACKGROUND

Eventually up to 150 private wells within four towns across central Waupaca County will be tested. Initially water quality will be tested in 75 wells in the Towns of Scandinavia and Lebanon. These towns provide a wide range in geological conditions, soil types, and water table conditions. These towns also have a variation of agricultural enterprises, farm concentrations and non-farm activities. Ultimately 75 additional wells will be tested in each of the Towns of Little Wolf and St. Lawrence in order to provide a cross section of groundwater quality in Waupaca county from east to west. (Exhibit 6)

B. INITIAL SELECTION PROCESS

During the summer of 1990 all of the residents with buildings and improvements in the Towns of Scandinavia and Lebanon were sent a letter explaining the program and asking them if they wish to volunteer to be a participant. (Exhibit 7). In Lebanon 372 property owners were sent letters along with two publications "You and Your Well" and "Well Abandonment" supplied by the Wisconsin Department of Natural Resources. Ninety (24%) of the Lebanon residents responded to the initial letter. Of those responding, 66% requested to be considered for the special well testing and educational program.

In the Town of Scandinavia, 395 property owners received letters and 97 (25%) responded. Sixty six percent of the Scandinavia respondents indicated they were interested in the special testing and educational program. (Table 1)

Our initial goal was to reach a 50/50 mix of farmers and rural non-farm residents. However, far more non-farm residents than active farmers indicated a willingness to participate. (Table 2) We chose to accept nearly all of the farmers that had indicated a willingness to participate and selected non-farm residents that indicated some knowledge about their well; those volunteers that had a well log were selected first. Initially, the distribution of wells was identified as a selection criteria, but became of less significance in the final selection process in order to get as many farmers participation as possible.

The final result was the selection of 38 property owners in the Town of Scandinavia and 35 in the Town of Lebanon. In Lebanon, of those participating, 57% of the residents were rural non-farm, 37% were farmers, and 7% did not indicate whether they were farm or non-farm. In the Town of Scandinavia 66% of participants were rural non-farm, 29% were currently farming, and 5% did not indicate whether they were farm or non-farm.

EXHIBIT 6

WAUPACA COUNTY

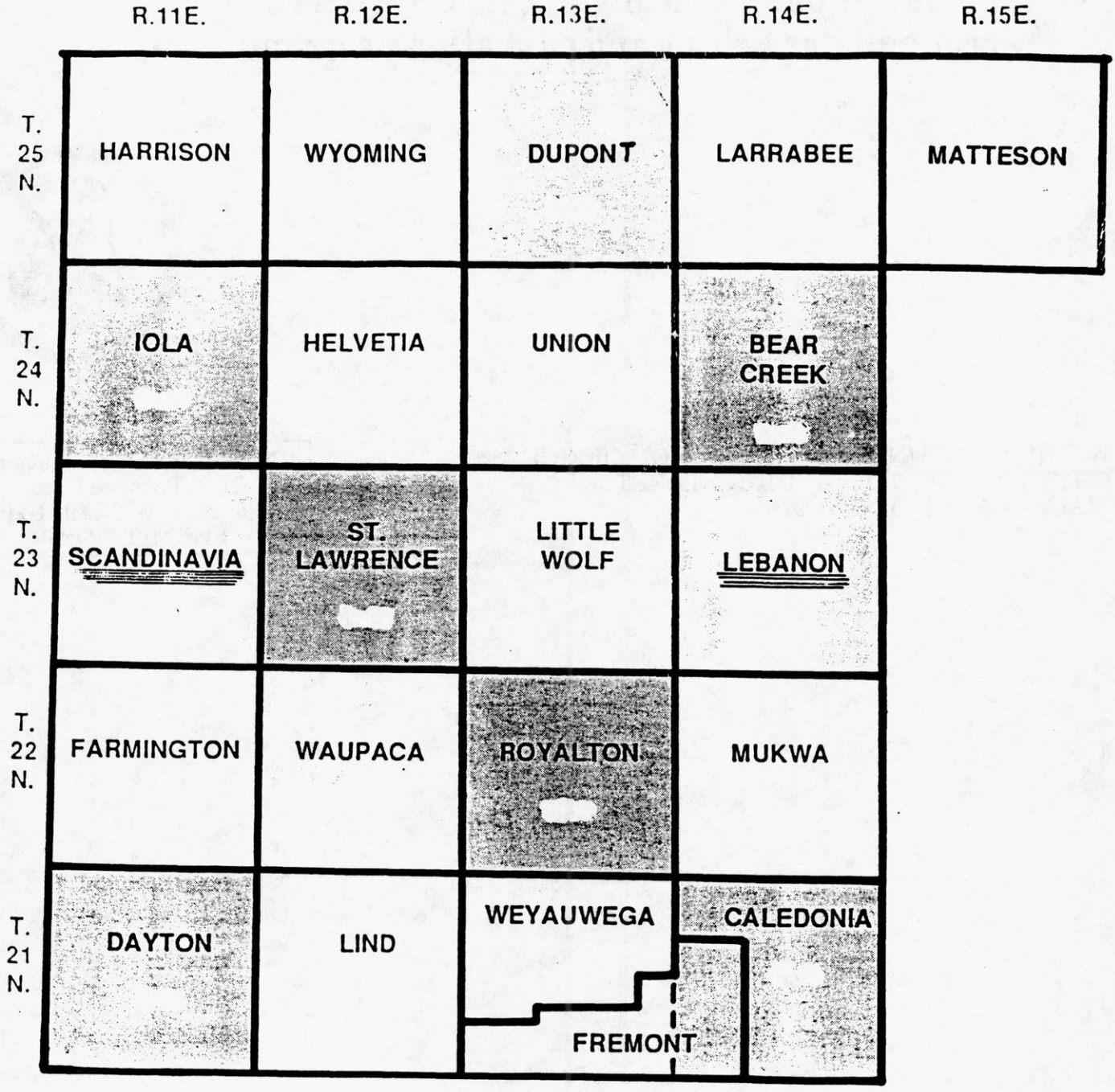


EXHIBIT 7

How's the Qualtiy of Your Drinking Water ?

Find out by participating in this UW–Extension groundwater testing and education program!

WAUPACA COUNTY UW-EXTENSION OFFICE
COURTHOUSE, 811 HARDING STREET
WAUPACA, WI 54981-2076

Non-Profit Organization
U.S. Postage Paid
Waupaca, WI 54981-2076
PERMIT NO. 50

UWEX COOPERATIVE EXTENSION SERVICE • UNIVERSITY OF WISCONSIN-EXTENSION

WAUPACA COUNTY EXTENSION OFFICE
Courthouse
811 Harding Street
Waupaca, WI 54981-2076
Phone 715 258-6230

July 10, 1990

DEAR TOWN OF SCANDINAVIA RESIDENT:

Quality drinking water is one of the most important resources we have. Since virtually all of our drinking water in Waupaca County comes from the ground, our groundwater resources determine the quality of our drinking water.

The Waupaca County University of Wisconsin Extension Office has received grants from the Golden Sands R. C. & D. (Resources, Conservation and Development Committee) and the Department of Natural Resources to conduct a special testing and groundwater education program. The Towns of Scandinavia and Lebanon have been selected for the first year of a proposed two year project. These towns have been selected because they provide a wide range of geological conditions, soil types, a variation of agricultural enterprises, farm concentrations, and nonfarm activities.

This educational project includes water testing for pesticides, volatile organic compounds (VOC's), and a typical homeowner test including: bacteria, pH, alkalinity, hardness, nitrate, chloride, and conductivity. The cost of the testing for pesticides and VOC's is $150.00 and **will be paid for through grant dollars.** The cost of the typical homeowner package is $15.00 and will be paid by the private well owner. The project summary and test results will be provided through educational programs in the fall of 1990 at a central location in each township.

The well testing effort will give you an indication of your own well water quality. Levels above drinking water standards will be referred to appropriate county or state agencies for assistance to help rectify the problem.

We anticipate selecting between 35 and 40 participants from each of the Towns of Scandinavia and Lebanon. Each participant will be expected to complete several surveys regarding the knowledge they have gained throughout the process and what practices they anticipate implementing to protect groundwater. Final selection will come from residents volunteering for the testing and educational program, as well as having a well construction report or some basic knowledge about their well.

We have enclosed a questionnaire on groundwater and well water, including a number of questions about your well. We are asking you to please fill out the questionnaire and return it to our office in the enclosed self-addressed envelope by **Friday, July 20, 1990. It is important that even if you choose not to participate in the special program, that you fill out the appropriate portion of the questionnaire and return it to our office.**

We have enclosed several publications for your review and reference. If you have questions or concerns, we encourage you to contact either Tom Wilson or Greg Blonde at the Waupaca County Extension Office.

Sincerely,

Thomas J. Wilson
Waupaca County UW-Extension
Resource Development Agent

Greg P. Blonde
Waupaca County Uw-Extension
Agricultural Agent

TJW:njh

1990 Waupaca County Groundwater Education Program

Please take the time to complete this questionnaire. Your responses will be helpful in developing educational programs related to groundwater in our county.

Are you interested in participating in this groundwater education/evaluation project? _____ yes _____ no

(If yes, please answer questions 1-17; if no, please answer questions 10-17)

Name _____ Phone _____

Address _____

(check one . . . _____ currently farming _____ rural nonfarm resident)

QUESTIONS 1 - 7 REFER TO THE WELL THAT PROVIDES YOUR HOUSEHOLD WATER

1) What year was your well constructed? 19 _____

2) Who was the owner when your well was constructed? _____

3) Who installed the well? _____

4) What type of well provides your household drinking water?

(check one . . . _____ driven _____ drilled _____ dug)

5) How deep is your well? _____ How many feet of casing? _____

6) How many feet below ground to the water level in your well? _____

7) What's the source of information for questions 1 - 6?

_____ well construction report
_____ well driller
_____ previous property owner
_____ personal measurements
_____ my best guess
_____ other, please specify _____

8) Do you have other wells on this property? _____ yes _____ no If yes, how many are:

_____ in use
_____ not in use, but not abandoned
_____ abandoned
_____ abandoned and filled in

9) Do you have a fuel storage tank on this property? _____ yes _____ no

FOR ALL RESPONDENTS

10) Groundwater in Waupaca County comes from . . .

_____ underground rivers or streams
_____ Canada/Lake Superior
_____ local precipitation
_____ don't know

11) Groundwater moves through the soil . . .

_____ generally from north to south
_____ generally from higher to lower areas
_____ without any specific direction
_____ don't know

12) Private well water should be tested . . .

_____ once each year
_____ once every ten years
_____ only if you notice a problem
_____ don't know

13) The most common health problems related to groundwater are caused by . . .

_____ pesticides
_____ nitrates
_____ bacteria
_____ don't know

14) Water with unsafe nitrate levels . . .

_____ is usually discolored
_____ usually looks and tastes fine
_____ has a salty taste
_____ don't know

15) List two major ways groundwater becomes contaminated:

_____

_____

16) If drinking water is unsafe . . .

_____ people drinking it will become ill within hours
_____ it will taste or smell bad
_____ only a laboratory may be able to detect it
_____ don't know

17) How knowledgeable do you feel about the cause and solution to potential groundwater contamination on your property?

_____ very well informed
_____ somewhat informed
_____ not informed at all

Thank you for your interest and help! Please cut this questionnaire from the introductory letter, place it in the enclosed stamped, self-addressed envelope and return by Friday, July 20, 1990.

Thomas J. Wilson
Waupaca County UW-Extension
Resource Development Agent

Greg P. Blonde
Waupaca County UW-Extension
Agricultural Agent

TABLE 1

INITIAL RESPONSE SUMMARY

(in number and percentage of response)

	Scandinavia	Lebanon	Total
Letters Sent	395	372	767
Responses	97 (25%)	90 (24%)	187 (24%)
Responses Wishing to Participate	65 (67%)	60 (67%)	125 (67%)
Responses Not Wishing to Participate	32 (33%)	30 (33%)	62 (33%)

Compiled by: Thomas J. Wilson
Waupaca County UW-Extension
Resource Development Agent

TABLE 2

FARMER NON-FARMER RESPONSE SUMMARY

(in numbers and percentage of responses)

	Scandinavia	Lebanon	Total
Farmers	14 (21%)	17 (28%)	31 (25%)
Rural Non-Farms	51 (79%)	43 (72%)	94 (75%)
Total Responses	65	60	125

Compiled by: Thomas J. Wilson
Waupaca County UW-Extension
Resource Development Agent

C. WATER SAMPLING PROCEDURES

During August of 1990, water samples were collected and delivered to the Environmental Task Force Lab at UW-Stevens Point for analysis. The tests were collected by the Waupaca County Conservation Crew (WCC) members. The wells selected were inventoried and given an unique well number by the Department of Natural Resources. (Exhibit 8 - located at back of document) The information has been collected in such a way that it can eventually be incorporated in the DNR Groundwater Information Network (GIN) System. The water test analysis included:

* EPA 507 for currently used pesticides
* EPA 608 for PCB's and older pesticides
* Volatile organic compounds (VOC's)
* Current Task Force Lab Homeowners Test (nitrate, bacteria, pH, chloride, conductivity, alkalinity, hardness and saturation index)

D. RECORDING RESULTS

Water quality results were recorded in such a way that they can potentially be linked to a computerized geographic information system. Criteria requested included the following: (Exhibits 7, 8, and 9 - located at the back of the document)

* Well location
* Year of well construction
* Owner of well at construction
* Well installer
* Type of well - dug, driven or drilled
* Depth of well
* Depth of casing
* Depth to water table
* Source of above information
* Other wells on the property
* Presence of fuel storage tanks

III. WATER QUALITY EDUCATION

A. AUDIENCE AND INFORMATION

The primary objective of this project is groundwater education with several key audiences:

* General public
* Residents of the Towns of Scandinavia and Lebanon
* Participants in the water quality testing
* Participants in the educational programs
* Participants desiring one-on-one follow-up
* Individuals, groups, and organizations or departments that are interested in the results of special groundwater projects

The general public was provided information via news releases, news articles, and radio about basic groundwater facts; an overview of the Waupaca County Well Water Quality Test Project; the cumulative results of the well test project; and the best management options to prevent groundwater contamination. (Exhibit 10 - located in the back of the document) The residents of the Towns of Scandinavia and Lebanon were sent correspondence (Exhibit 11 - located in back of document) in addition to the publications - "You and Your Well" and "Well Abandonment".

The respondents to the initial informational letter were asked a series of questions that reflect their current knowledge about various aspects of groundwater. These questions are illustrated in Exhibit 7, and summarized below:

* Where groundwater comes from
* How groundwater moves
* When wells should be tested
* Common health problems related to groundwater
* Nitrates
* How groundwater becomes contaminated
* Unsafe drinking water
* Existing knowledge about groundwater

B. EXISTING KNOWLEDGE ABOUT GROUNDWATER

Only 18% of the 175 usable responses indicated correctly that they knew that groundwater comes from local precipitation. Forty seven percent of the respondents indicated incorrectly that groundwater came from underground rivers and streams. Only 35% responded correctly to how groundwater moves through the soil - generally from higher to lower areas. Forty nine percent of the respondents indicted properly that private well water should be tested once each year. (Table 3)

When asked for the most common health problem related to groundwater the correct response of bacteria was identified by 28% of the respondents. Fifty four percent of the respondents identified that water with unsafe nitrate levels usually looks and tastes fine. Thirty eight percent of the respondents indicated that they did not know the answer to this question. Fifty five percent of the respondents were able to list at least two major ways groundwater becomes contaminated. Twenty six percent responded to this question with one correct answer, and 19% had no correct answer.

The vast majority (76%) responded with the correct answer, only a laboratory may be able to detect if drinking water is unsafe. Of all respondents, only 5% felt very knowledgeable about the actual causes of and solutions to potential groundwater contamination on their property. Sixty three percent of the respondents to the same question feel somewhat informed about their knowledge and 31% feel not informed at all.

When comparing the responses of all the respondents with those that requested to participate in the groundwater quality testing and educational program, responses showed some differences. In general those that requested to participate in the program had a slightly higher percentage of correct responses to the questions asked in the pretest. (Table 3)

TABLE 3

PRE-TEST RESPONDENT KNOWLEDGE LEVEL

Question Number	% of Correct Responses to Questions		
	* Total Respondents	** Requested Participation	*** Selected Participants
10. Where groundwater comes from	18%	17%	17%
11. How groundwater moves	35%	41%	31%
12. Frequency of testing wells	49%	51%	51%
13. Most common groundwater health problems	28%	30%	35%
14. Unsafe nitrates	54%	60%	66%
15. Two ways groundwater can be contaminated	55%	60%	68%
16. Unsafe drinking water	76%	77%	77%
17. Knowledge level - well informed	5%	5%	4%
- somewhat informed	63%	63%	67%
- not informed at all	31%	31%	28%

* 175 responses to pre-test (less than total number of responses)
** 125 requested participation in groundwater program
*** 73 participated

Compiled by: Thomas J. Wilson
Waupaca County UW-Extension
Resource Development Agent
January, 1991

The percentage of correct responses was again somewhat higher for those respondents invited to participate in the special program. This was especially the case in responses to the questions: most common groundwater health problem, nitrate, ways groundwater can be contaminated, and how to tell the safety of drinking water. (Table 3)

The respondents that participated in the groundwater quality testing and educational programs showed a significant increase in knowledge over all respondents. This same group showed as slightly higher level of knowledge over those that requested to participate, but were not selected. This result is likely due to the fact that if potential participants knew a great deal about their well, they probably knew more about groundwater in general; and those were the people that were selected to have their water quality tested.

C. EDUCATIONAL PROGRAMS

1. INITIAL PROGRAM

Two educational programs were offered. At the first program, participants learned about basic groundwater facts, the local geology of Waupaca County, and the aggregate summary of groundwater quality test results. Participants received their individual water quality test results. Sixty three or approximately 85 % of the well test participants attended this program.

As indicated earlier, 73 wells were tested in the two towns. The homeowners package summary of the well tests is illustrated in Table 4. Fourteen percent of the groundwater quality samples had bacterial problems. This percentage of bacterial contamination is about average for Waupaca County private wells based on tests done by the Environmental Task Force Lab over the past three years and is somewhat lower than the average for the state as whole. Participants wells with bacteria contamination were encouraged to retest the water and were provided verbal and written information on how to pursue the potential causes of the contamination.

According to participants reports, 52% of the wells had depths between 50 and 150 feet. All wells in that depth range were constructed since 1975. Those in the Town of Lebanon were somewhat deeper than the ones in Scandinavia. The average depth to the groundwater table was just over 50 feet. Twenty seven percent of the participants indicated that they had other wells on their property, seven of them artesian wells. Forty two percent of the participants indicated that they had a fuel storage tank on the property.

Participants reports indicated sixty four percent of the wells were drilled. Driven wells represented 10% of the wells and one percent represented dug wells. Twenty five percent of the participants indicated that they did not know the method of well installation or construction. Seventy percent of the respondents said they did not know when their water was last tested and another 15% indicated it was between 2 and 5 years since their water quality was last tested.

Eighty nine percent of the wells had nitrate levels less that the health advisory level - 10 ppm. Seven wells had nitrate levels between 10 and 20 ppm, and one well tested over 20 ppm nitrate. Ninety one percent of the wells tested had hardness values between 200 and 400 ppm of CaCo3, indicating the presence of limestone minerals in the aquifer.

A neutral pH is 7 to 7.5. The average pH or acidity of the groundwater tests were 7.5 to 8.5. This indicates very alkaline groundwater, again reflective of the amount of limestone minerals in the aquifers. Most wells tested in Lebanon and Scandinavia had alkalinity levels in the range of 200 to 400 ppm of CaCo3. Alkalinity is due to the presence of the bicarbonate ion in water and is usually present in concentrations near that of hardness.

Natural chloride levels in Wisconsin's Groundwater are below 5 mg/l or ppm. Results indicated that most wells had chlorides between 1 and 10 ppm. Eleven percent of the samples had chloride levels above 25 ppm. Two samples had concentrations over 100 ppm chloride.

The homeowner sampling package also included testing from the parameters of conductivity and saturation index. The explanations for these parameters in addition to the others listed above are further explained in the "Guide to Interpreting Water Quality Data for Drinking Water" (Exhibit 12 - located in the back of document) This reference and a verbal explanation of the parameters and how to potentially resolve a problem were provided to all participants. Exhibit 13 (located in back of document) is a series of maps that illustrate where the tests were conducted and the water quality test results of each parameter.

The 73 wells were tested for nitrogen and phosphorus containing pesticides and volatile organic compounds (VOC's). Only two of the 73 wells (3%) of the wells tested positive for VOC's. One well indicated 1 ppb trichloroethylene, a solvent. The other detect was 1, 1, 1, Trichloroethane at a level of 1.3 ppm, also a solvent. Both participants with the VOC detects in their wells were provided an explanation of the material and a copy of the volatile organic compound report. (Exhibit 14) Both of these participants decided to do additional testing of their own wells.

Two of the wells indicated nitrogen and phosphorus containing pesticides and 2 additional wells indicated peaks on the gas cromatograph, but the pesticide could not be identified. (Exhibit 15) (The two samples with unidentified compounds have since been retested with no detects of any pesticides indicated.) One of the samples tested indicated the presence of simazine at 10.6 ppb; far below the health advisory level of 2.5 ppb. The other pesticide detect indicated a presence of metolachlor at 2.5 ppb. Its health advisory level is 15 ppb. This same sample test had atrazine at 7.9 ppb; over double the health advisory level of 3.5 ppb. The water quality is currently being retested in this particular well.

2. FINAL EDUCATIONAL PROGRAM

At the second program the participants were "coached" through the Farmstead Assessment System (Farm-A-Syst). This program was held on a Saturday and resulted in a six hour participant commitment. About fifty percent of the groundwater quality test participants attended this program. The assessment looked at the majority of the residential and farm activities that could potentially have a negative impact on the private well owners groundwater quality. Each aspect of the analysis was rated as to the level of potential risk to contaminate groundwater. The specific analysis and instructors for the Farm-A-Syst (Exhibit 16 - located in the back of document) were as follows:

1. Drinking water well condition - CRD Agent
2. Pesticide storage and handling - Crop Consultant

TABLE 4

Waupaca County UWEX Private Well Project Oct 1990

WATER SAMPLES:	73-	73
SOFTENERS:	38	52%
POSITIVE BACT:	10	14%

DEPTH:	AQUIF	WELL	WATER	CASE
Unknown	37%	22%	37%	36%
[1 - 25)	18%	1%	12%	0%
[25 - 50)	25%	8%	18%	5%
[50 -100)	12%	32%	22%	33%
[100-150)	5%	25%	10%	19%
[150-200)	1%	5%	0%	4%
[200 ...	1%	7%	1%	3%

OBSERVED PROBLEMS		
No Response	23	32%
None	50	68%
Color	0	0%
Taste	0	0%
Odor	0	0%
Health	0	0%
Corrosion	0	0%

NITRATE-NITRITE (ppm N)		
A NONE DETECTED	20	27%
B [0.2 - 2.0)	18	25%
C [2 - 5)	16	22%
D [5 - 10)	11	15%
E [10 - 20)	7	10%
F [20 ...	1	1%

TOTAL HARDNESS (ppm CaCO3)		
A NONE DETECTED	0	0%
B [2 - 25)	0	0%
C [25 - 50)	1	1%
D [50 - 150)	0	0%
E [150 - 200)	0	0%
F [200 - 300)	37	51%
G [300 - 400)	29	40%
H [400 - 500)	4	5%
I [500 ...	2	3%

pH		
A [... 5.0)	0	0%
B [5.0 - 5.5)	0	0%
C [5.5 - 6.0)	0	0%
D [6.0 - 6.5)	0	0%
E [6.5 - 7.0)	0	0%
F [7.0 - 7.5)	2	3%
G [7.5 - 8.0)	49	67%
H [8.0 - 8.5)	20	27%
I [8.5 ...	2	3%

WELL CONSTRUCTION METHOD		
No Response	18	25%
Driven	7	10%
Dug	1	1%
Drilled	47	64%

YEARS SINCE LAST WATER TEST		
Unknown	51	70%
Never	0	0%
[... 1)	0	0%
[1 - 2)	1	1%
[2 - 5)	11	15%
[5 - 10)	3	4%
[10 ...	7	10%

CONDUCTIVITY (umhos/cm)		
A [... 50)	0	0%
B [50 - 100)	0	0%
C [100 - 200)	0	0%
D [200 - 500)	30	41%
E [500 - 800)	38	52%
F [800 - 1000)	1	1%
G [1000 ...	4	5%

SI (Saturation index)		
A [... -3)	0	0%
B [-3 - -2)	0	0%
C [-2 - -1)	0	0%
D [-1 - 0)	0	0%
E [0 - 1)	68	93%
F [1 ...	5	7%

ALKALINITY (ppm CaCO3)		
A NONE DETECTED	0	0%
B [2 - 25)	0	0%
C [25 - 50)	0	0%
D [50 - 150)	2	3%
E [150 - 200)	1	1%
F [200 - 300)	51	70%
G [300 - 400)	15	21%
H [400 - 500)	4	5%
I [500 ...	0	0%

CHLORIDE (ppm)		
A NONE DETECTED	2	3%
B [1 - 10)	45	62%
C [10 - 25)	17	23%
D [25 - 50)	3	4%
E [50 - 100)	4	5%
F [100 - 200)	1	1%
G [200 ...	1	1%

TABLE 4 - Continued

Lebanon Township UWEX Private Well Project Oct 1990

WATER SAMPLES:	35-	35
SOFTENERS:	17	49%
POSITIVE BACT:	5	14%

DEPTH:	AQUIF	WELL	WATER	CASE
Unknown	23%	3%	23%	29%
[1 - 25)	17%	3%	14%	0%
[25 - 50)	26%	6%	20%	0%
[50 -100)	20%	34%	29%	40%
[100-150)	9%	34%	14%	20%
[150-200)	3%	11%	0%	9%
[200 ...	3%	9%	0%	3%

OBSERVED PROBLEMS		
No Response	19	54%
None	16	46%
Color	0	0%
Taste	0	0%
Odor	0	0%
Health	0	0%
Corrosion	0	0%

NITRATE-NITRITE (ppm N)		
A NONE DETECTED	10	29%
B [0.2 - 2.0)	9	26%
C [2 - 5)	5	14%
D [5 - 10)	6	17%
E [10 - 20)	4	11%
F [20 ...	1	3%

TOTAL HARDNESS (ppm CaCO3)		
A NONE DETECTED	0	0%
B [2 - 25)	0	0%
C [25 - 50)	1	3%
D [50 - 150)	0	0%
E [150 - 200)	0	0%
F [200 - 300)	12	34%
G [300 - 400)	16	46%
H [400 - 500)	4	11%
I [500 ...	2	6%

pH		
A [... 5.0)	0	0%
B [5.0 - 5.5)	0	0%
C [5.5 - 6.0)	0	0%
D [6.0 - 6.5)	0	0%
E [6.5 - 7.0)	0	0%
F [7.0 - 7.5)	1	3%
G [7.5 - 8.0)	29	83%
H [8.0 - 8.5)	4	11%
I [8.5 ...	1	3%

WELL CONSTRUCTION METHOD		
No Response	1	3%
Driven	5	14%
Dug	1	3%
Drilled	28	80%

YEARS SINCE LAST WATER TEST		
Unknown	21	60%
Never	0	0%
[... 1)	0	0%
[1 - 2)	1	3%
[2 - 5)	6	17%
[5 - 10)	2	6%
[10 ...	5	14%

CONDUCTIVITY (umhos/cm)		
A [... 50)	0	0%
B [50 - 100)	0	0%
C [100 - 200)	0	0%
D [200 - 500)	8	23%
E [500 - 800)	23	66%
F [800 - 1000)	1	3%
G [1000 ...	3	9%

SI (Saturation index)		
A [... -3)	0	0%
B [-3 - -2)	0	0%
C [-2 - -1)	0	0%
D [-1 - 0)	0	0%
E [0 - 1)	34	97%
F [1 ...	1	3%

ALKALINITY (ppm CaCO3)		
A NONE DETECTED	0	0%
B [2 - 25)	0	0%
C [25 - 50)	0	0%
D [50 - 150)	2	6%
E [150 - 200)	0	0%
F [200 - 300)	21	60%
G [300 - 400)	9	26%
H [400 - 500)	3	9%
I [500 ...	0	0%

CHLORIDE (ppm)		
A NONE DETECTED	2	6%
B [1 - 10)	20	57%
C [10 - 25)	8	23%
D [25 - 50)	2	6%
E [50 - 100)	2	6%
F [100 - 200)	1	3%
G [200 ...	0	0%

TABLE 4 - Continued

Scandinavia Township UWEX Private Well Project Oct 1990

WATER SAMPLES:	38-	38
SOFTENERS:	21	55%
POSITIVE BACT:	5	13%

DEPTH:	AQUIF	WELL	WATER	CASE
Unknown	50%	39%	50%	42%
[1 - 25)	18%	0%	11%	0%
[25 - 50)	24%	11%	16%	11%
[50 -100)	5%	29%	16%	26%
[100-150)	3%	16%	5%	18%
[150-200)	0%	0%	0%	0%
[200 ...	0%	5%	3%	3%

OBSERVED PROBLEMS		
No Response	4	11%
None	34	89%
Color	0	0%
Taste	0	0%
Odor	0	0%
Health	0	0%
Corrosion	0	0%

NITRATE-NITRITE (ppm N)		
A NONE DETECTED	10	26%
B [0.2 - 2.0)	9	24%
C [2 - 5)	11	29%
D [5 - 10)	5	13%
E [10 - 20)	3	8%
F [20 ...	0	0%

TOTAL HARDNESS (ppm CaCO3)		
A NONE DETECTED	0	0%
B [2 - 25)	0	0%
C [25 - 50)	0	0%
D [50 - 150)	0	0%
E [150 - 200)	0	0%
F [200 - 300)	25	66%
G [300 - 400)	13	34%
H [400 - 500)	0	0%
I [500 ...	0	0%

pH		
A [... 5.0)	0	0%
B [5.0 - 5.5)	0	0%
C [5.5 - 6.0)	0	0%
D [6.0 - 6.5)	0	0%
E [6.5 - 7.0)	0	0%
F [7.0 - 7.5)	1	3%
G [7.5 - 8.0)	20	53%
H [8.0 - 8.5)	16	42%
I [8.5 ...	1	3%

WELL CONSTRUCTION METHOD		
No Response	17	45%
Driven	2	5%
Dug	0	0%
Drilled	19	50%

YEARS SINCE LAST WATER TEST		
Unknown	30	79%
Never	0	0%
[... 1)	0	0%
[1 - 2)	0	0%
[2 - 5)	5	13%
[5 - 10)	1	3%
[10 ...	2	5%

CONDUCTIVITY (umhos/cm)		
A [... 50)	0	0%
B [50 - 100)	0	0%
C [100 - 200)	0	0%
D [200 - 500)	22	58%
E [500 - 800)	15	39%
F [800 - 1000)	0	0%
G [1000 ...	1	3%

SI (Saturation index)		
A [... -3)	0	0%
B [-3 - -2)	0	0%
C [-2 - -1)	0	0%
D [-1 - 0)	0	0%
E [0 - 1)	34	89%
F [1 ...	4	11%

ALKALINITY (ppm CaCO3)		
A NONE DETECTED	0	0%
B [2 - 25)	0	0%
C [25 - 50)	0	0%
D [50 - 150)	0	0%
E [150 - 200)	1	3%
F [200 - 300)	30	79%
G [300 - 400)	6	16%
H [400 - 500)	1	3%
I [500 ...	0	0%

CHLORIDE (ppm)		
A NONE DETECTED	0	0%
B [1 - 10)	25	66%
C [10 - 25)	9	24%
D [25 - 50)	1	3%
E [50 - 100)	2	5%
F [100 - 200)	0	0%
G [200 ...	1	3%

3. Fertilizer storage and handling - Crop Consultant
4. Petroleum product storage - Emergency Government
5. Hazardous waste management - Solid Waste Manager
6. Household Waste Water Treatment - Zoning Administrator
7. Livestock waste storage - Ag Agent
8. Livestock yard management - Ag Agent
9. Silage storage - Ag Agent
10. Milk house wastewater management - Ag Agent
11. Site evaluation - State UWEX Specialist
12. Overall assessment and prioritize - EPA Specialist

Aspects of the overall Farm-A-Syst were presented by the local county employee, or other appropriate person, whom could be contacted for additional assistance at a later date. The individual assessment will provide a comprehensive analysis of water quality related activities on the site that may potentially affect groundwater.

D. POST-TEST KNOWLEDGE ABOUT GROUNDWATER

One hundred forty two of a possible 175 follow-up survey responses were returned (refer to table 5). This represented an 81% response rate. Of these, 43 (30%) were from those residents of the Towns of Lebanon and Scandinavia who were not interested in participating in the project. Thirty six (25%) of the responses were from people who wished to participate, but were not selected. Nine (6%) were from participants that had their wells tested, but did not attend either of the educational programs. Fifty four (38%) of the responses came from those that attended the educational programs. Half of these (27) attended one meeting and the other half (27) attended both educational meetings. (Refer to Exhibit 17 located in back of document for sample questionnaire.)

In general, the more involvement participants had in the groundwater testing and educational programs, the greater the increase in their knowledge about groundwater and drinking water. Similarly, the more involvement in the program, the more groundwater protection practices that have been implemented or remain planned to be implemented.

Of the respondents that were not interested in the project from the start, only 16.3% indicated correctly that they knew that groundwater comes from local precipitation. In comparison, 55.6% of the respondents that attended both educational programs indicated the correct response. When asked how groundwater moves through the soil, 23.3% of the respondents that were not interested in the program and 47.2% of the respondents who wished to participate but were not selected, indicated the correct response - generally from higher to lower areas. Over fifty nine percent of the respondents that attended one educational program provided the correct response for this same question and 74.1% of the respondents that attended both educational programs listed the correct response.

When asked how knowledgeable each participant felt about the cause and solutions to potential groundwater contamination on their property, only 7% of the respondents that were not interested in the special program indicated that they were very well informed. Almost 30% of the respondents who attended one program indicated that they were very well informed and 40.7% of those who attended both educational programs felt that they were very well informed about the cause and solutions to potential groundwater contamination on their property.

When asked how knowledgeable each participant felt about the cause and solutions to potential groundwater contamination on their property, only 7% of the respondents that were not interested in the special program indicated that they were very well informed. Almost 30% of the respondents who attended one program indicated that they were very well informed and 40.7% of those who attended both educational programs felt they were very well informed about the causes and solutions to potential groundwater contamination on their property.

When asked if the participants have implemented practices that they feel will reduce the potential of groundwater contamination of their private well, only 18.6% of the respondents that chose not to participate in the program indicated they had done something to protect groundwater. Just over twenty two per cent of the respondents that requested to participate in the program but were not selected, indicated that they had implemented practices to reduce the potential groundwater contamination. Over 40% of the respondents that attended one of the educational programs and over 74% of the respondents that attended both educational programs indicated that they have implemented practices that will reduce the potential of groundwater contamination of their private wells.

Just over 11% of the respondents that were not interested in the program indicated even though they have not implemented any groundwater protection practices for their private well, they do plan to do so in the future. In comparison, 29.6% of those participants that attended one educational program responded that they would do **more** to protect their private well and 37% of the participants that attended both educational programs indicted that they plan to do **more** to protect their private well.

TABLE 5

POST-TEST RESPONDENT KNOWLEDGE LEVEL

Question	% of Correct Responses to Questions				
	*Group 1 **(43)	*Group 2 ** (36)	*Group 3 **(9)	*Group 4 **(27)	*Group 5 **(27)
Where groundwater comes from	16.3%	22.2%	44.4%	33.3%	55.6%
How groundwater moves	23.3%	47.2%	44.4%	59.3%	74.1%
Frequency of testing wells	58.1%	55.6%	55.6%	88.9%	92.6%
Most common groundwater health problems	30.2%	36.1%	11.1%	44.4%	29.6%
Unsafe nitrates	41.9%	61.7%	88.9%	74.1%	88.9%
Two ways groundwater can be contaminated	---	---	---	---	---
Unsafe drinking water	83.7%	75.0%	88.9%	88.9%	96.3%
Knowledge level - well informed	7.0%	16.7%	0 %	29.6%	40.7%
Practices implemented to protect groundwater	18.6%	22.2%	22.2%	40.7%	74.1%
Additional practices planned to protect groundwater	11.6%	33.3%	22.2%	29.6%	37.0%

* Group 1 = Those not interested in participating in the program
  Group 2 = Those who wanted to participate but were not selected
  Group 3 = Those participants who had well tested, but attended no educational programs
  Group 4 = Those participants who had well tested and attended one educational program
  Group 5 = Those participants who had well tested and attended both educational programs

** Number of responses

Compiled by: Thomas J. Wilson
Waupaca County UW-Extension
Resource Development Agent
July, 1991

IV. PROJECT CONTINUATION

YEAR - 1991 - 1992

The second year's efforts will be similar to the first years effort in order to provide uniform information of well water quality in private wells in Waupaca County. The Towns of St. Lawrence and Little Wolf are planned for water quality testing in the summer of 1991.

Most of the processes used in the initial phase of the project were very successful. However, efforts that will be revised during the second phase of this project include:

* Make additional efforts to test an equal number of actual farm operation wells as non-farm rural resident wells.

* Combine the two educational programs into one Saturday session and have information available for the participants to complete the Farm-A-Syst evaluation.

* Conduct the educational programs earlier in the fall of 1991.

V. CONCLUSIONS TO DATE

Following is a summary of the project conclusions to date:

* Rural residents, farm and non-farm, are interested in groundwater quality, but need a stimulant such as this special testing effort to actually get their water tested. It is unlikely that people will get their water quality tested for pesticides or VOC's without financial support.

* Additional testing for VOC's and pesticides is needed to better determine how Waupaca County private wells compare with the rest of the State of Wisconsin.

* Respondents have a basic knowledge of groundwater and groundwater contamination, but wish to learn a great deal more.

* The Farm-A-Syst can be equally relevant to the rural non-farm resident as it is to the farmer.

* Additional assistance is needed to help those farmers and rural non-farmer residents that have water quality problems, whether it be nitrate, bacteria, pesticides or VOC's.

* This type of project is essential to meet the needs of rural Waupaca County residents for water quality testing and groundwater education.

VI. EXPENSES TO DATE:

EXPENSES

$15,000	-	Wages (Local Agents and University)
10,950	-	Pesticide/VOC testing
300	-	Follow-up Testing
1,095	-	Homeowner Test Package
325	-	Mileage cost for sampling wells and transport to lab
500	-	Mailing lists, mailings, surveys, stamps, etc.
$28,170	-	Total

REVENUES

$15,000	-	Wages (in-kind salary payment)
1,095	-	Home owner test package
7,450	-	DNR groundwater monitoring program
5,000	-	Golden Sands RC&D Grant
$28,545		Total
$ 375	-	Funds unencumbered

EXHIBIT 8

Department of Natural Resources

GROUNDWATER MONITORING INVENTORY FORM
Form 3300-67 Rev. 3-90

File Maintenance Code:
A - Add (New Well)
C - Change (Existing Well Information)
D - Delete Well From Inventory

Form completed and sample collected by | Date 08/06/9(
M M D D Y

DM065

Also see directions on reverse side of this form

1. INVENTORY INFORMATION Mandatory Information (See Instructions)

Present name of establishment or facility (public system)

Facility I.D. or Check Here If New Facility ☐

Meyer, Bob

Name of owner or manager (last name first)

RT 3, Box 388A

Owner's address (street or route)

414 / 625-3297
Area code - Telephone number

New London | WI | 54961-
City | State | Zip code

Waupaca

County (of well) | Co. code | Township

Name of occupant (if different than owner)(last name first)

Occupant's address (street or route)

City | State | Zip code

Water System Type (check √ one)

Non-potable wells
☐ M Monitoring
☐ I Irrigation
☐ X Other

Potable wells
☐ M Community - municipal
☐ O Community - other than municipal
☐ N Non-community
☒ P Private

High cap. permanent well no. | Well no. | Parcel no

Govt. lot no. | OR | NW | SW | 3,4 | T23N | R14E
1/4 1/4 | 1/4 Sec. | Sec. | Town | Range

2. WELL DATA

☐ Unknown

Well construction report available? ☒ Yes ☐ No

Date well constructed	Constructed by	Casing depth	Depth to water	Depth to bedrock
Sept 20 85	MICHAL SCHAFER	66 ft.	16 ft.	ft

Casing diameter (inches)	Distance casing above or below grade (inches)(+ for above; - for below)	Total well depth	Water bearing formation
6	12 +	90 ft.	☐ S Sandstone ☐ H Shale ☐ L Limestone ☐ G Granite ☐ Q Quartzite ☐ U Unconsolidat

3. SOURCE OF WELL DATA

☒ Construction report
☐ Well driller
☐ Inspection form or sanitary survey
☐ Boring log
☐ Previous well owner
☐ Owner or occupant
☐ Data not available

4. WELL STATUS

☒ Active
☐ Inactive; not abandoned
☐ Permanently abandon
☐ Inactive; capped

5. ADDITIONAL COMMENTS (Directions to site, possible contaminant sources. See back.)

EXHIBIT 9

Environmental Task Force
Rm 220 College of Natural Resources
University of Wisconsin
Stevens Point, WI 54481
(715) 346-3209

PLEASE READ INSTRUCTIONS ON BACK CAREFULLY.

MAKE COMMENTS ON BACK IN SPACE PROVIDED.

Please note: The Homeowners package is $35.00 if form is not completed, $18.00 if form is completed to extent possible. Enter UN if data is unknown.

Occupant _____
WELL Address _____
City _____ Zip
Phone ( ) _____

Years of residence _____
Well Construction
Date _____
Well Driller _____
Address _____
Casing Diam _____ inches
Driven _____ Dug _____ Drilled _____
Depth
of Casing _____ feet
to Water _____ feet
of Well _____ feet
Distance to
Septic Tank _____ feet
Tile Field _____ feet
Seepage Pit _____ feet
Other _____ ft
(feedlot, fertilized field)

Owner _____
Address _____
City _____ Zip
Phone( ) _____

Years of ownership _____
Last Water Quality Test
Date _____
Lab _____
for _____
Well Location
County _____
Township _____
Legal Description
¼ ¼ S T R
1/4 1/4 (sect.) (town) (range)
Map Coord. _____

Water Source
Private ☐ Municipal ☐
Other _____

Mail to _____
Address _____
City _____ Zip
Phone ( ) _____

No. of wells at location _____
Sample Taken
Date _____
Time _____
Treatment Systems Owned
Softener? yes ☐ no ☐
Other _____
Tap Samples
Tap Location _____
Before Treatment? yes ☐ no ☐
Well Depth Changed? yes ☐ no ☐
Date of Change _____
Problems Observed
Color ☐ Taste ☐ Corrosion ☐
Odor ☐ Health ☐ None ☐
Other _____

Laboratory Results

Bacteria
Presumptive 24 hours
_____/5 _____
presumptive 48 hours
_____/5 _____
Confirmed Test _____
Coliform Group
_____/5 _____

Water Chemistry

pH	_____	Units
Conductivity	_____	umhos
Alkalinity	_____	mg/1
Hardness	_____	mg/1
Nitrate & Nitrite (N)	_____	mg/1
Chlorides	_____	mg/1
Iron	_____	mg/1
Corrosivity Index	_____	Units

Comments and Other Results

Name _____
Lab No. _____
Date Received _____
Date Reported _____

Laboratory Results

Bacteria
Presumptive 24 hours
_____/5 _____
Presumptive 48 hours
_____/5 _____
Confirmed Test _____
Coliform Group _____
_____/5 _____

Water Chemistry

pH	_____	Units
Conductivity	_____	umhos
Alkalinity	_____	mg/1
Hardness	_____	mg/1
Nitrate & Nitrite (N)	_____	mg/1
Chlorides	_____	mg/1
Iron	_____	mg/1
Corrosivity Index	_____	Units

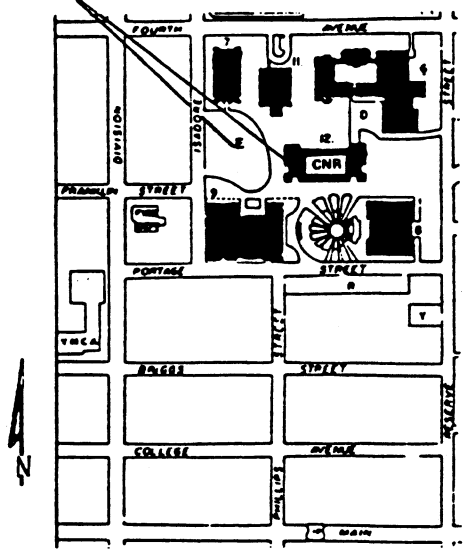
Comments and Other Results

Name _____
Lab No. _____
Date Received _____
Date Reported _____

Coliform Sampling Technique

1. Wash hands thoroughly with soap and water. Remove any faucet screens or other attachments.
2. Flame cold water faucet with a candle or torch. Heat tip of faucet until it is hot. Be sure only metal parts are contacted by flame.
3. Let water run for five minutes.
4. Carefully remove cover of sample bottle. Do not let fingers touch mouth or inside of cap. Cap may be placed top down on clean surface.
5. Run water into bottle and avoid splashing.
6. Leave one-half inch (½") air space at top and put on cap.
7. Sample must be turned into lab within 36 hours of time it was collected. Samples older than 48 hours will not be analyzed for bacteria. Samples older than 36 hours but less than 48 hours will be analyzed but results will be stamped "bacteria results are inconclusive."
8. Water samples will be accepted Monday through Wednesday (7:45 AM - 4:00 PM). Park in Lot E (in front of west entrance to CNR building). Be sure to leave auto flashers on. **IF YOU ARE MAILING IN SAMPLES,** we strongly suggest taking water sample on Monday just prior to mail pickup. This will help ensure that sample is received by Wednesday and before it is 36 hours old.
9. Results of test will be mailed within two (2) weeks of date received.
10. Make check payable to: UW-Stevens Point. Enclose with sample.

Parking
College of Natural Resources



Nitrate Sampling
A nitrate sample can be taken out of same bottle. If just a nitrate is requested, a clean, non-sterilized jar is adequate. Let water run 5 minutes before taking sample.

LIST TESTS YOU WISH RUN: _____

_____

ADDITIONAL COMMENTS:

_____

_____

_____

_____

_____

_____

Coliform Bacteria
Safety of water supplies is based on analysis of Coliform bacteria. These bacteria are present in large numbers in the soil and in the digestive tracts of humans and other animals. They do not usually cause disease but their presence in water is an indication that waste material may be contaminating the water, and suggests that pathogenic organisms may also be present. Such water is judged as unsafe for human consumption. Bacteria Safe means there is an absence of Coliform bacteria.

Nitrate
10 mg/1 NO_2 + NO_3 (N) (ten milligrams per lit nitrite and nitrate nitrogen) is the standard in th country. A disease called infantile methemoglobinem can be caused by concentrations greater than 10 i infants up to 6 months of age. Nitrite from reduce nitrate reacts with hemoglobin, the blood pigmer that carries oxygen from the lungs to the body tissue The methemoglobin cannot transfer oxygen so th infant suffers an oxygen shortage. Backgroun levels for NO_2 + NO_3(N) is generally 1mg/l or les Nitrates found in higher concentrations could b indicative of other contaminates in the ground wate

Ish Herald 12-90

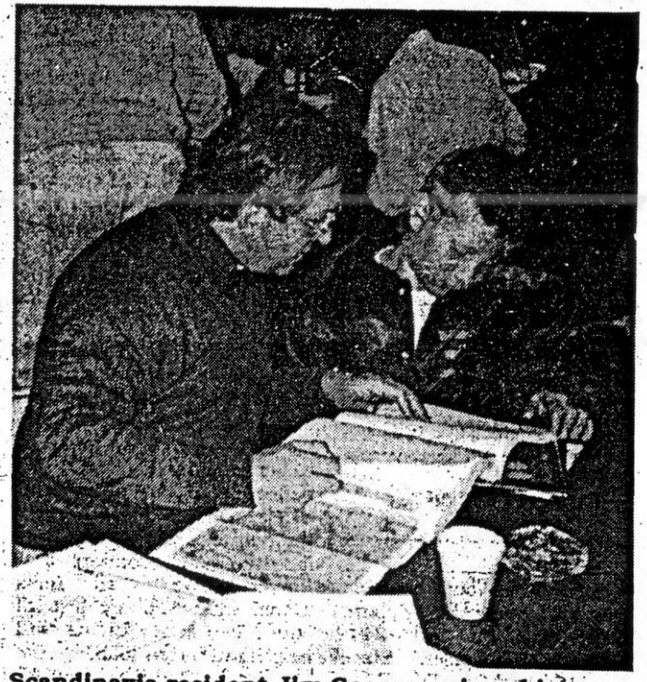
Rural landowners need assessment

BY TOM J. WILSON
UW EXTENSION
RESOURCE AGENT
WAUPACA COUNTY

The Waupaca County University of Wisconsin recently conducted a special groundwater testing and educational program for a selected number of volunteer rural residents in the town of Lebanon and Scandinavia.

The test results indicated that the general water quality of the approximately 75 wells tested had fewer contamination problems than similar tests for the state as a whole.

The Farmstead Assessment was initially designed for farmers to evaluate their farmstead in regard to potential groundwater contamination.



Scandinavia resident Jim Goeser reviews his homesite assessment with his son, Luke, at the UW-Extension's Groundwater Education Program.

If you would like more information about the special drinking water testing and educational program, please contact either Greg Blonde or Tom Wilson at the Waupaca County UW-Extension Office. Phone number is 715-258-6230.

EXHIBIT 10

Groundwater is everyone's responsibility

Dec 7, 1990 New London - Press Star

By Pat Fisher

The next ten years will certainly see some grand changes take place if everyone of us listens and learns about this fragile blue dot we live one. Groundwater is just one of the many things we have to change our attitudes about.

In Waupaca County virtually everyone gets their drinking water from underground sources. Human use and consumption amount to 921 million gallon each year. The county uses another 894 million gallons for agricultural purposes.

The rural property owners have private wells and the cities have municipal wells; the water found in these wells comes from an underground source. No matter who you are or where your live, we all share the same Wisconsin water. So when we pollute that source it affects a lot of people. It takes very small quantities of materials such as petroleum fuel, cleaning agents and chemicals to pollute groundwater to the point that it is unsafe for drinking. For example one gallon of gasoline can pollute one million gallons of groundwater.

Now each of us can protect our own wells and be very careful not to spill or dump things on our own property, but what about the person up the hill from you or down the road -- is he careful? We all are guilty of the way we discard our old paint cans, solvents, engine oil, and other products. Some bury it, dump it on that abandoned piece of back land and forget it. But now we have to think before continuing to use these methods.

Water runs from recharge to discharge points--for instance from higher to lower areas--so whatever the neighbors up the hill from you disposes of could end up in your well. If that person takes the garbage and dumps it next to a creek bed, naturally that run off goes to a lower point and gets carried in that water which, somewhere down the line, someone ends up drinking. No one person is at fault we all are at fault.

The type of soil that your property is on plays a great part in the filtering of that groundwater. Certain soils do a better job than others. In sandy soils water moves two to three feet per day, and in heavy clay, it moves two to three feet per year.

Groundwater does not move great distances from recharge to discharge. Groundwater comes from rain and snow melt that filter through the upper soil layers to soil or rock area that is saturated with water.

The most common sources of contamination are;

1) Leaking underground fuel tanks;

2) Chemical/pesticides on farmfields or spilled;

3) Poorly designed and managed landfills;

4) Mismanaged livestock, waste storage areas;

5) Industrial chemicals improperly disposed of;

6) Abandoned mining excavations;

7) Failing septic systems;

8) Junkyards.

Most pollution comes from a source very close to where that actual contamination shows up.

The health concerns surrounding groundwater contamination are:

1) Bacterial--These can cause diseases such a typhoid, dysentery, cholera, gastroenteritis, and tuberculosis;

2) High nitrates (over 10 PPM) can cause blue baby syndrome in infants under six months. This results from a restriction in the amount of oxygen the blood is able to carry to body tissues. Very high net rate levels can affect chemical levels especially in cows and sheep.

3) Volatile organic compound are known or suspected of causing eye and skin irritations, depression of nervous system functions, liver and kidney damage, genetic mutations and cancer.

4) Pesticides can cause liver and kidney damage, nervous system disorders and cancer.

Waupaca County has just completed a test survey of two townships -- Lebanon and

C[illegible] Dec 7 [illegible]

TOM WILSON, *left, gives local residents of Lebanon Township well assessments. The assessments were held Nov. 8 at St. Patrick's Church, Lebanon. (Staff photo by Pat Fisher).*

EXHIBIT 10 - Continued

- 33 -

New London - Press Star

December 7, 1990

Groundwater——

Continued from pg. 1

Scandinavia. Seventy three wells were tested for nitrates, bacteria, volatile organic compounds (VOC), pesticides, and several other chemicals. The survey was conducted by the University of Wisconsin-Stevens Point.

Of these 73 wells, two had a residue of pesticides and VOCs were found in two other wells. Fourteen percent of the wells initially tested unsafe due to bacterial contamination, and eleven percent had nitrates that were above the health advisory standard of ten parts per million.

Of the Waupaca County residents that participated in the special groundwater testing and educational effort, only a limited number of farmers attended the farmstead workshop. The property owners with no identified problems were interested in what they could do to reduce the potential of any groundwater contaminated in future years.

Each of the 73 property owners were given a day long program at the Edge of Town, Manawa, to go through what each could do to protect their wells and the wells of their neighbors.

Those people who attended learned about groundwater, where it comes from, how it moves, how it can be contaminated, and the basic characteristics of their own private well.

With this information each landowner can be aware and protect their own private well from contamination. Remember the water in your well is coming from another source other than your land area, so hopefully each and every one of us will protect our land use so that all of us will have good quality drinking water.

Anyone who would like more information on groundwater may contact Thomas Wilson, Waupaca County Courthouse, 811 Harding St., Waupaca, WI 54981 or call (715) 258-6230.

City of New London Wells

Residents of the city of New London share six wells within the city limits. These wells are tested daily for the same contaminants that the private wells are tested for. This time of year, the city of New London uses 170,000,000 gallons of water daily.

GROUNDWATER ASSESSMENT. *Dave Chapman, left, Coop Agronomist from New London, helped Goundwater Education participants with review of homesite assessment. (Submitted photo).*

Release: Immediate
Thomas J. Wilson, Waupaca County
UW-Extension Resource Agent
(715) 258-6230

PRIVATE WELLS - LIMITED PROBLEMS - GREAT PARTICIPATION

The special groundwater testing and educational program recently conducted by the University of Wisconsin Extension in the Towns of Scandinavia and Lebanon have proved several things.

First, water quality in those wells tested had less problems than the State of Wisconsin as a whole for similar testing; and second, private well owners have great concern for their drinking water source.

Seventy three wells in the Towns of Lebanon and Scandinavia were recently tested for nitrates, bacteria, volatile organic compounds (VOC's), pesticides, and several other chemicals. Of those tested, 14% initially tested unsafe due to bacterial contamination; and 11% had nitrates that are above the health advisory standard of 10 parts per million. These percentages reflect what has been the average for the volunteer tests that have been done in Waupaca County over the past year, but are lower than the averages for similar tests for the State of Wisconsin as a whole.

Of the 73 wells tested only two had a residue of pesticides detected and only two others had detects of volatile organic compounds. Two wells had detects, but the pesticides were unidentifiable. On a percentage basis, the pesticide detects is considerably less than a similar study on a state-wide basis.

- more -

Private Wells - Limited Problems - Great Participation - add one

Even though the percentages are low, those residents that have high nitrates, bacterial problems, pesticides, or volatile organic compounds, are concerned about where they may have come from and what they can do to rid them from their drinking water. Even those with no identified problems are interested in what they can do to reduce the potential of groundwater contamination in future years.

The special testing and educational program for rural property owners in the Towns of Lebanon and Scandinavia, whether it be as a farmer or a rural nonfarm resident, focused on ways to reduce potential groundwater contamination. These efforts start with learning about groundwater - where it comes from, how it moves, how it can be contaminated, and the basic characteristics of their private well. With this information, the private well owner can analyze their own farmstead or rural residence to see where contamination is likely to come from, and what they can do to protect Wisconsin's buried treasure - the source of their drinking water - groundwater.

The University of Wisconsin Extension in Waupaca County received special grant money to conduct the testing and educational program in the Towns of Lebanon and Scandinavia. They have also received a commitment from one funding source to do a similar program in other towns in Waupaca County next year. Since the cost of the special testing is in excess of $150.00 per test, only a limited number of tests can be conducted.

If you would like more information about the special testing and educational program, please contact Greg Blonde, Agricultural Agent, or Tom Wilson, Resource Development Agent, at the Waupaca County University of Wisconsin Extension Office. The office is located in the Courthouse in Waupaca and the phone number is 715 258-6230.

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Release: Immediate
Thomas J. Wilson, Waupaca County
UW-Extension Resource Agent
(715) 258-6230

FARMSTEAD ASSESSMENT APPROPRIATE FOR ALL RURAL LANDOWNERS

The Waupaca County University of Wisconsin recently conducted a special groundwater testing and educational program for a selected number of volunteer rural residents in the towns of Lebanon and Scandinavia. The test results indicated that the general water quality of the approximately 75 wells tested had fewer contamination problems than similar tests for the state as a whole.

The testing did however, indicate site specific problems for a number of the private well owners. Those residents are greatly concerned about what they can do to improve their drinking water quality. Others are concerned about how to protect their water quality in the future. Of those Waupaca County residents that participated in the special groundwater testing and educational effort, only a limited number of farmers actually attended the farmstead assessment workshop. At this all day workshop held on November 10, non-farm residents from Scandinavia and Lebanon indicated great interest and value in reviewing the very comprehensive farmstead assessment effort.

The Farmstead Assessment was initially designed for farmers to evaluate their farmstead in regard to potential groundwater contamination. The demonstration project conducted in Waupaca County proved to be equally valuable for the rural non-farm residents as well as those who are active farmers. Drinking water well condition, petroleum product storage, household waste management and household waste water treatment are important to a rural resident, whether he or she is a farmer or not. Some of the other farmstead practices such as pesticide storage and handling, livestock waste management, and silage storage can be of equal interest to the non-farmer as it is to the farmer.

- more -

Farmstead Assessment Appropriate for all Rural Landowners - add one

Rural non-farm residents desire to know how their neighbor farmer is addressing some of these management practices. They may wish to discuss options available to reduce potential contamination of groundwater for the both of them. Having an understanding of why a farmer manages his or her operation in a particular manner can also help the rural non-farm resident. Groundwater, free of contamination, is equally important to both of these rural dwellers.

The ultimate value of this type of effort is not only the increased awareness of groundwater - where it comes from and how it moves, or the fact that many local residents had their water tested for the first time in a very long time; but, what practices have been resumed or will be changed to reduce the potential contamination of groundwater. Since groundwater is the source of the drinking water for everyone in Waupaca County, we need to look at every option that is available to help protect it now - and long into the future.

If you would like more information about the special drinking water testing and educational program, please contact either Greg Blonde or Tom Wilson at the Waupaca County University of Wisconsin Extension Office. The Extension Office is located in the Courthouse in Waupaca and the phone number is 715 258-6230.

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UWEX COOPERATIVE EXTENSION SERVICE • UNIVERSITY OF WISCONSIN-EXTENSION

WAUPACA COUNTY EXTENSION OFFICE
Courthouse
811 Harding Street
Waupaca, WI 54981-2076
Phone 715 258-6230

Dear Groundwater Eduction Program Participant:

Congratulations! You have been selected as one of the thirty-five land owners from your township to receive the well test as a participant of the UW-Extension groundwater education program in Waupaca County.

We will be contacting you by telephone within the next ten days to arrange an appointment at your residence for collecting the water sample and well information. If you cannot be reached between 8:00 a.m. and 4:00 p.m. at the telephone number you provided on the enrollment form, please call us during your lunch hour (715-258-6230)to make arrangements for us to sample your well.

Sampling technique is extremely critical to insure accurate results. We appreciate your cooperation with the individuals collecting your water sample and well information. Also, at the time of sampling, we must collect your $15 check (payable to UW-Stevens Point) to cover the cost for testing of nitrates, bacteria, pH, alkalinity, hardness, chloride and conductivity. Our groundwater project grant will cover the remaining cost for your pesticide and volatile organic compound analysis.

After all water samples have been tested and the results analyzed, we will hold the first of two groundwater education meetings in your township to review the aggregate results (without identifying individual names or locations of well test participants) and general groundwater information. This meeting will be held early this fall. The second meeting will be held in late fall or early winter to provide you with individual test results from your well and discuss ways of reducing the risk of future groundwater contamination.

We appreciate your interest in this educational project and look forward to meeting with you in the future. If you have any questions, please contact either one of us in the UW-Extension Office at the courthouse in Waupaca.

Sincerely,

Greg Blonde
Waupaca Co. UWEX
Agriculture Agent

Thomas J. Wilson
Tom Wilson
Waupaca Co. UWEX
Resource Agent

UWEX COOPERATIVE EXTENSION SERVICE • UNIVERSITY OF WISCONSIN-EXTENSION

WAUPACA COUNTY EXTENSION OFFICE
Courthouse
811 Harding Street
Waupaca, WI 54981-2076
Phone 715 258-6230

Dear Friend,

On behalf of the Waupaca County UW-Extension Office, we appreciate your willingness to participate in our groundwater testing and education program. Unfortunately, we received more requests than our project funding would allow; therefore, we regret to inform you that we are unable to sample your well for volatile organic compounds (VOC's) and pesticides.

However, we still encourage you to test your well for nitrates, bacteria, pH, alkalinity, hardness, chloride, and conductivity. The water sample bottles for this test are available at our office located on first floor of the county courthouse in Waupaca. Cost is $15.00.

Although you have not been selected to participate in our special well testing program, you are invited to attend the educational program we will conduct in your township later this fall. If you are interested in attending, contact our office for more information.

Thanks again for your interest in our special groundwater evaluation and education program. If you have any questions please call us at (715) 258-6230.

Sincerely,

Greg Blonde
Waupaca Co. UWEX
Agriculture Agent

Thomas J. Wilson
Tom Wilson
Waupaca Co. UWEX
Resource Agent

UWEX COOPERATIVE EXTENSION SERVICE • UNIVERSITY OF WISCONSIN-EXTENSION

WAUPACA COUNTY EXTENSION OFFICE
Courthouse
811 Harding Street
Waupaca, WI 54981-2076
Phone 715 258-6230

September 20, 1990

Dear Lebanon Groundwater Education Program Participant:

We appreciate your interest and willingness to participate in our special testing and educational program. Sampling for the Town of Lebanon has been completed and the tests are being analyzed by the Environmental Task Force Lab at the University of Wisconsin - Stevens Point. We appreciate your cooperation for arranging to take the samples.

We have scheduled two groundwater education meetings. The first meeting will be held at the St. Patrick's Catholic Church on County Highway T and Church Road in the Town of Lebanon. The program will be held on **Thursday, November 8, 1990, beginning at 7:30 p.m. Please mark this date on your calendar.**

The second meeting will be held at the Edge of Town, Highway 22 on the south side of Manawa. The meeting will be on **Saturday, November 10, 1990, beginning at 10:00 a.m. and concluding about 3:00 p.m.** This meeting will be held jointly with the Town of Scandinavia residents and will include a noon meal paid for by University of Wisconsin Extension.

The first meeting will provide participants with some basic information about groundwater, the results and explanation of the testing, and some examples of what can be done to protect groundwater. The second program, at the Edge of Town in Manawa, will help you analyze your own rural residence or farmstead in regard to potential groundwater contamination and what specific steps could be taken to help you prevent problems from occurring in the future.

We appreciate your commitment to participate in this special educational program, and look forward to your attendance at the **November 8th and 10th meetings.** If you have some questions or wish more information prior to the meeting dates, please contact either Greg or Tom at the UWEX Office in Waupaca.

Sincerely,

Thomas J. Wilson
Waupaca County UW-Extension
Resource Development Agent

Greg P. Blonde
Waupaca County UW-Extension
Agriculture Agent

TJW:njh
cc. Chris Mechenich - UWEX
Byron Shaw - UWEX
Gary Jackson - UWEX

COOPERATIVE EXTENSION SERVICE • UNIVERSITY OF WISCONSIN-EXTENSION

WAUPACA COUNTY EXTENSION OFFICE
Courthouse
811 Harding Street
Waupaca, WI 54981-2076
Phone 715 258-6230

November 14, 1990

Dear Groundwater Test Participant:

We are sorry that you were unable to attend the educational meetings for the special private well testing program in the Towns of Scandinavia and Lebanon. Quality drinking water is one of the most important resources we have.

Enclosed are the test results for your well and a packet of information that explains a bit about groundwater. The well test will give you an idea of what your specific water quality is. If you have questions about your test results, or would like to analyze your farm or home site for groundwater contamination prevention, we encourage you to contact either of us at the Waupaca County University of Wisconsin Extension Office located in the Courthouse in Waupaca.

Sincerely,

Tom Wilson

Thomas J. Wilson
Waupaca County UW-Extension
Resource Development Agent

Greg Blonde

Greg P. Blonde
Waupaca County UW-Extension
Agriculture Agent

njh

Enclosure

UWEX COOPERATIVE EXTENSION SERVICE • UNIVERSITY OF WISCONSIN-EXTENSION

WAUPACA COUNTY EXTENSION OFFICE
Courthouse
811 Harding Street
Waupaca, WI 54981-2076
Phone 715 258-6230

To: Lori Bocher, Hoard's Dairyman
Al Morrow, Wisconsin Agriculturist
Dave Natzke, Agri-View
Scott Schultz, Country Today
Loren Sperry, Waupaca County Post & Wisconsin State Farmer
Dan Wilson, Appleton Post Cresent

From: Greg Blonde, Waupaca Co. UWEX Ag Agent Greg Blonde

Re: "Farmstead Assessment System" Pilot Program

I appreciate your interest in the "Farmstead Assessment System" (Farm-A-Syst) pilot program scheduled for Saturday, November 10th from 9:30 - 3:00 at the Edge of Town Bar and Hall in Manawa (south end of town on Hwy 22).

Enclosed you'll find the series of 12 worksheets (right side of folder) as well as the supplemental worksheet information (left side of folder) that make up the entire Farm-A-Syst packet. The Farmstead Assessment System was developed through cooperation of state agency and university specialists from Wisconsin, Minnesota and Region V of the U.S. Environmental Protection Agency. It is designed to help farmers and rural land owners identify and prioritize the impact of their practices, structures and facilities on drinking water supplies.

The intent of our pilot program is to have local resource people (i.e. Extension Agents, Crop Consultants, Zoning, Solid Waste and Land Conservation personnel) review each section related to their area of expertise and acquaint the 50-75 program participants with worksheet format and content. Participants will be encouraged to spend time at home completing all worksheets appropriate to their farmstead or rural homesite. The actual level of knowledge gained and resulting change in practices, structures or facilities will be measured through a follow-up survey in 1991.

I'll plan to have you stay for lunch as our guest. If you have any questions, or will not be able to attend, please call me at (715) 258-6230. Again, thanks for your interest and cooperation in this Farmstead Assessment System pilot project.

cc Gary Jackson
Sue Jones
Tom Wilson

EXHIBIT 11 - Continued

November 1, 1990

UNIVERSITY OF WISCONSIN-EXTENSION • COOPERATIVE EXTENSION

Dear Scandinavia Groundwater Education Program Participant:

Again, we are pleased that you chose to participate in the special groundwater testing and educational program. Remember to join us for your test results and the educational program on **Tuesday evening, November 6, 1990 at 7:30 p.m.** The program will be held at the **Scandinavia Lutheran Church**, located at 105 Church Street in Scandinavia.

The second educational program will be held at the Edge of Town in Manawa on Saturday, November 10, 1990 at 9:15 a.m.

We look forward to seeing you on November 6th.

Sincerely,

Thomas J. Wilson
Waupaca County UW-Extension
Resource Development Agent

Greg P. Blonde
Waupaca County UW-Extension
Agriculture Agent

University of Wisonsin-Extension • United States States Department of Agriculture
Wisconsin Counties Cooperating and Providing Equal Opportunities
in Employment and Programming

EXHIBIT 12

GUIDE TO INTERPRETING WATER QUALITY DATA FOR DRINKING WATER

Byron Shaw, Chris Mechenich - 1987

Alkalinity is due to the presence of the bicarbonate ion in water, which originates primarily from dissolving of limestone minerals in the aquifer. It is usually present in concentrations near that of hardness, as they originate from the same minerals. Low alkalinity water will usually have a low (acid) pH, while high alkalinity water will have a high (alkaline) pH (7-8.4). Low alkalinity water (less than 50 mg/l) is often corrosive, while high alkalinity water (greater than 150 mg/l) may result in scale buildup in plumbing.

Chlorides, in most areas of Wisconsin, are naturally below 5 mg/l. Increased concentrations indicate leachate from septic systems, road salt, fertilizer, animal waste, or other waste material. Chloride is very soluble in water and is, therefore, a good indicator of potential problems if it is found in increasing concentrations. It is not toxic, but can cause a salty taste if over 250 mg/l. High chlorides tend to speed up the corrosion rate of metals. Water with high chlorides, especially if from road salt, may also have a high sodium content.

Coliform Bacteria are single-celled, microscopic organisms found in soil and in the digestive tract of man and other animals. They do not usually cause disease, but their presence in water samples indicates that waste material may be contaminating the water and implies that pathogenic organisms may also be present. Any coliform bacteria present causes the water to be judged unsafe for human consumption.

In areas using fractured bedrock aquifers, coliform bacteria may contaminate the groundwater. More often, coliform problems are related to construction faults with the well, such as entrance of surface runoff into the well or improper location of the well relative to pollution sources. Wells contaminated with coliform bacteria should be carefully inspected for sanitary defects, disinfected with chlorine bleach, and then retested.

Conductivity is a measure of the ability of water to conduct an electric current and is directly related to the amount of total dissolved minerals in water. It is a quick analysis that can detect changes in mineral content but does not give an indication of which minerals are present. It is typically about twice the hardness of water, as hardness ions are a good indicator of total dissolved minerals in most natural waters. If it is much greater than 2 times the hardness, it indicates other unnatural minerals may be present. Rapid changes in conductivity can be used as an indicator of changing water quality.

Corrosivity index is calculated from the pH, alkalinity, calcium hardness and conductivity data. It is a measure of the tendency for calcium carbonate (lime) to precipitate in water. Lime precipitate provides the best natural means of preventing corrosion of plumbing. Too much lime, however, will result in partially plugging pipes and water heaters, decreasing their efficiency. Corrosivity indexes with negative numbers indicate corrosion is likely, while positive numbers indicate scale

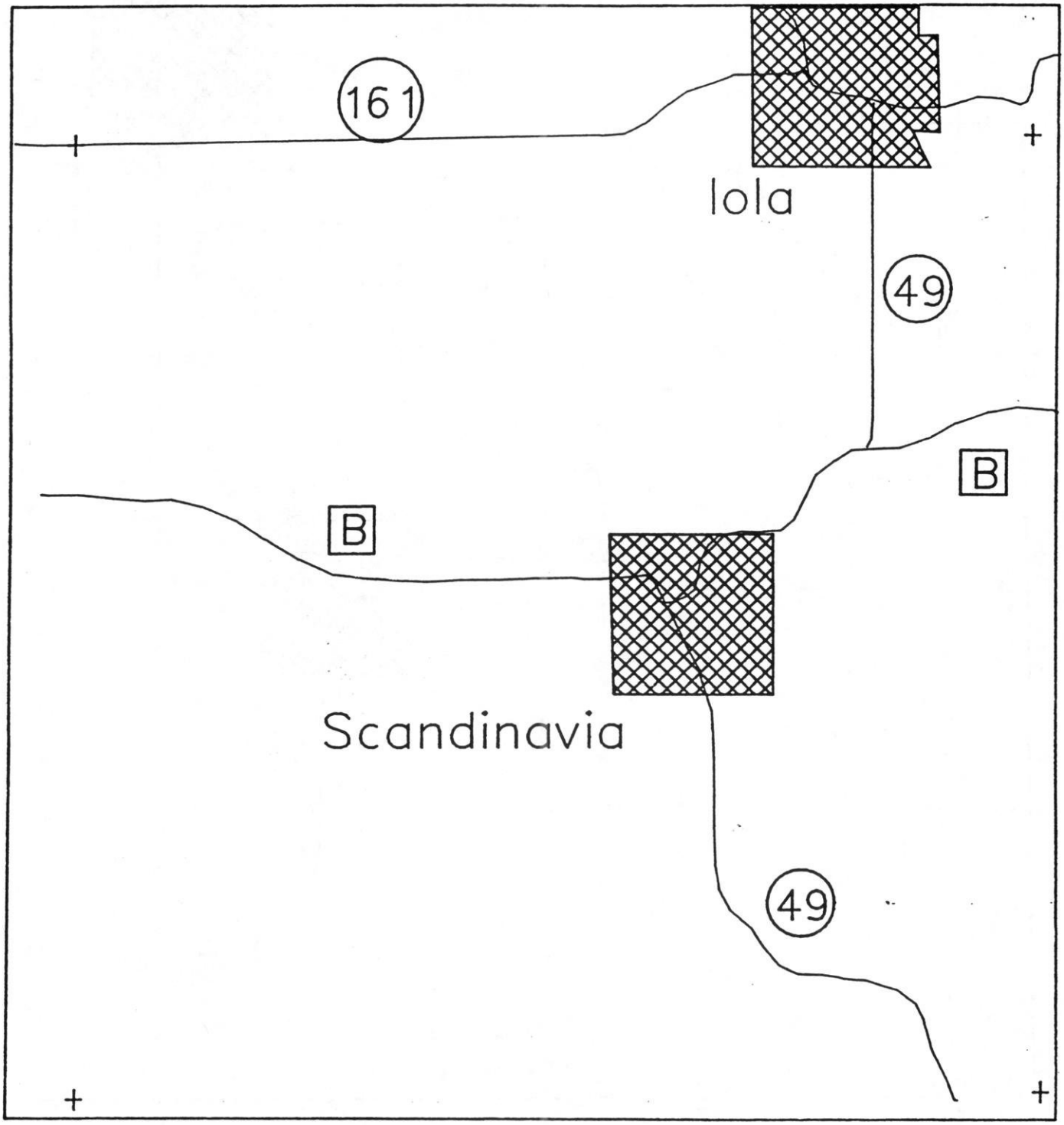
formation will occur. Values near zero or slightly positive are the most desirable.

Hardness in water is caused by calcium and magnesium, which are beneficial to health. High hardness (over 150 mg/l) can cause scale buildup in pipes and water heaters and cause increased use and decreased cleaning action of detergents and soaps, as hardness ions react with soap to form a "scum." Water from 0-100 mg/l hardness is considered soft. Water containing more than 250 mg/l is very hard and indicates the presence of limestone minerals in the aquifer. The water softening industry expresses hardness in grains per gallon: 1 grain/gallon = 17.1 mg/l.

Nitrate Nitrogen is a chemical that is formed in the decomposition of organic materials. It is also a fertilizer. Common sources include agricultural and lawn fertilizers, septic tank effluent, animal wastes, and landfills. The natural level of nitrate nitrogen in Wisconsin's groundwater is thought to be less than 2 mg/l.

The drinking water standard for nitrate nitrogen is 10 mg/l. Infants under 6 mounths of age are susceptible to a disease called methemoglobinemia (blue baby disease) when nitrate levels exceed the drinking water standard. Levels exceeding 2 mg/l are cause for concern because they indicate contamination of the water supply by human activity. Other contaminants not routinely tested for may also be present in water that shows elevated nitrate levels.

pH is the measure of the acidity of water. pH 7 is neutral. pHs below 7 are acid, above 7 are alkaline. Acid water, especially below pH 6.5, is often corrosive and may result in plumbing deterioration and the possible dissolution of toxic metals from the plumbing. Iron may also be present at problem levels in acid water, as it increases in its solubility as pH decreases. Lab pH values are often slightly higher than would be found in your well, as samples often lose some CO2 (carbonic acid) between sampling and lab analysis.

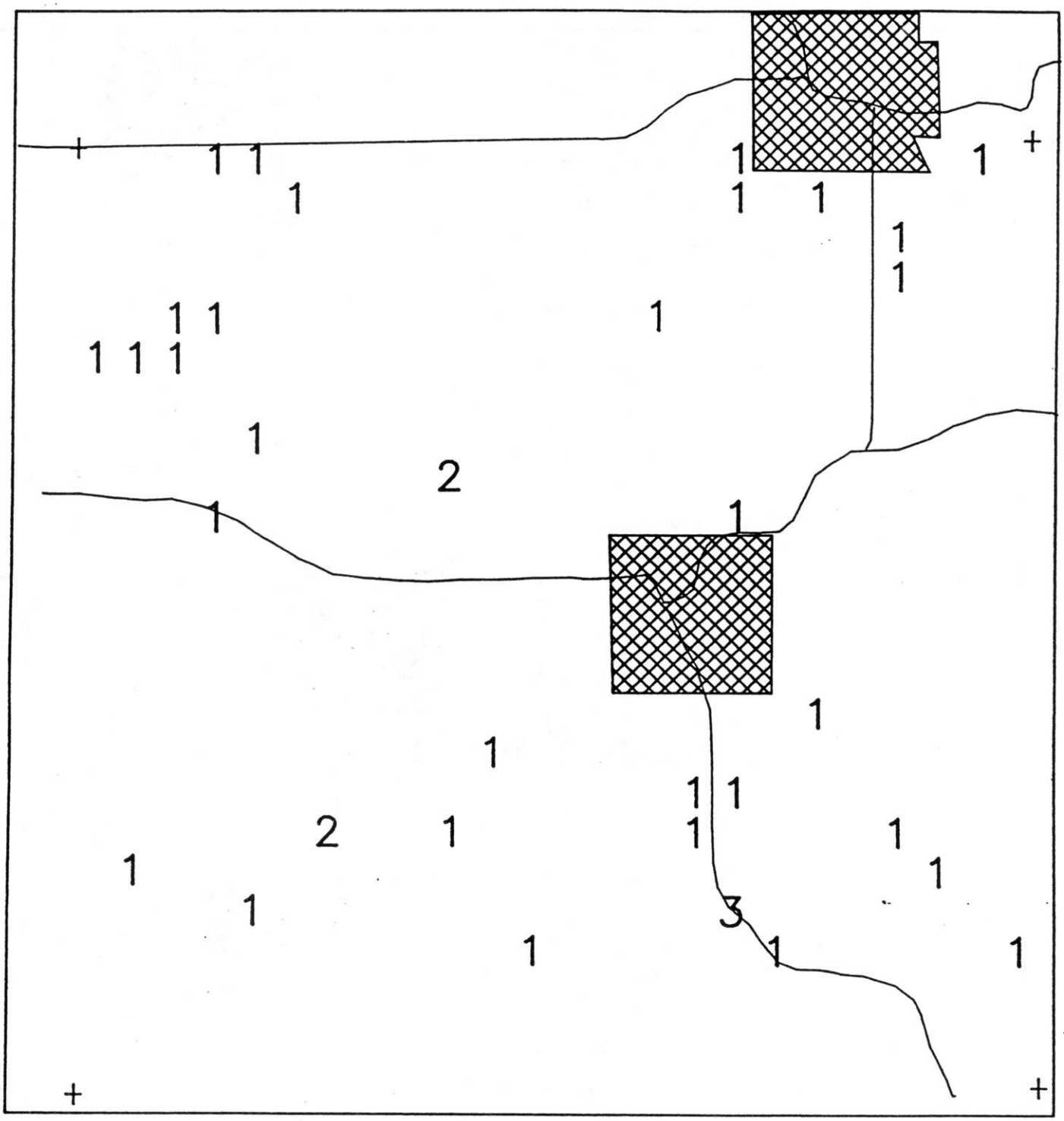


Waupaca Co

Scandinavia Township

1990

BASE MAP



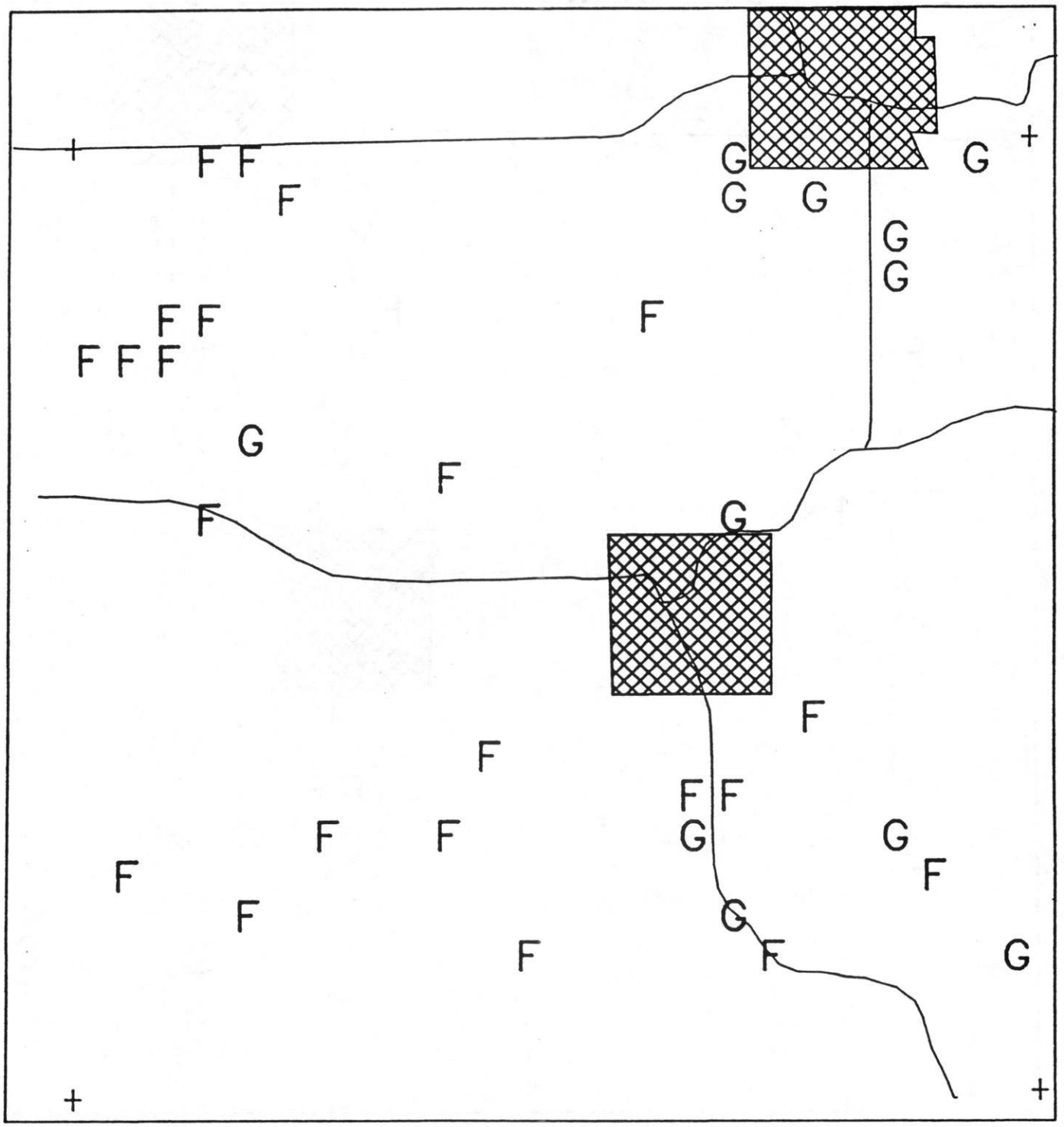
Waupaca Co

Scandinavia Township

1990

SAMPLE DISTRIBUTION

NUMBER SAMPLES/QQ SECTION



Waupaca Co

Scandinavia Township

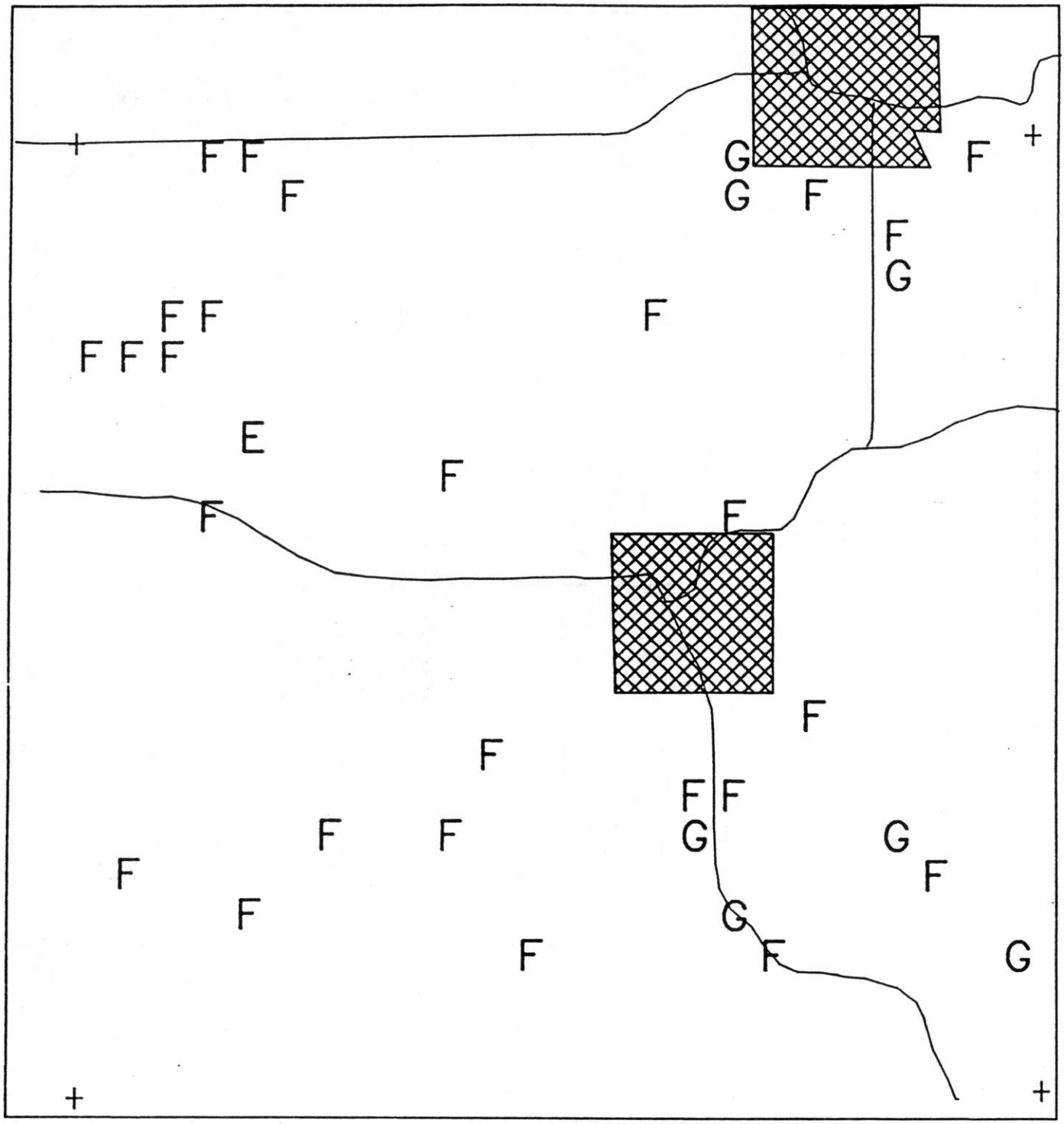
1990

TOTAL HARDNESS

NONE DETECTED	2	25	50	150	200	300	400	500
A	B	C	D	E	F	G	H	I

MAP LETTERS

66% 34%



Waupaca Co

Scandinavia Township

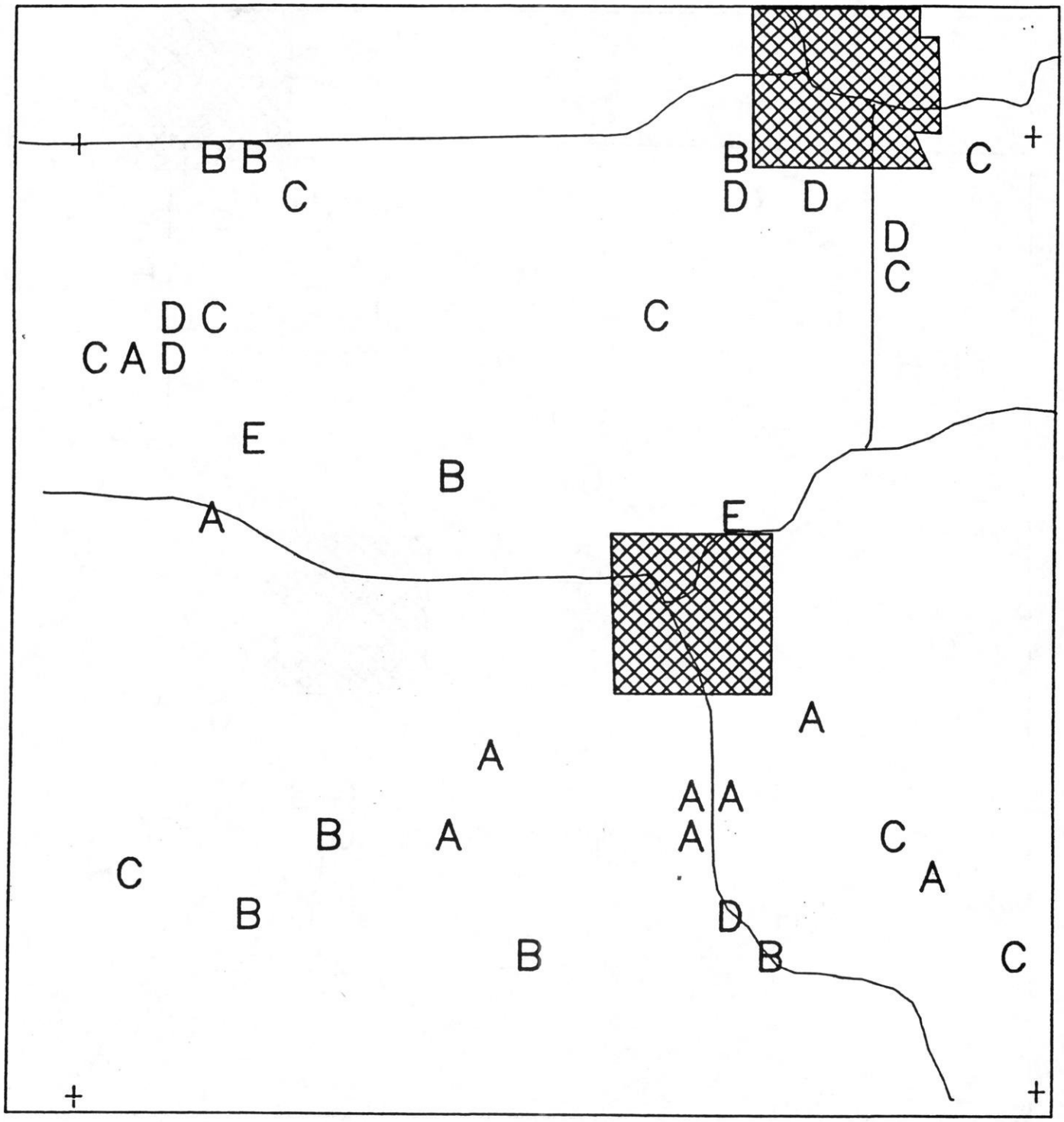
1990

ALKALINITY

NONE DETECTED	2	25	50	150	200	300	400	500
A	B	C	D	E	F	G	H	I

MAP LETTERS

3% 79% 16% 3%



Waupaca Co

Scandinavia Township

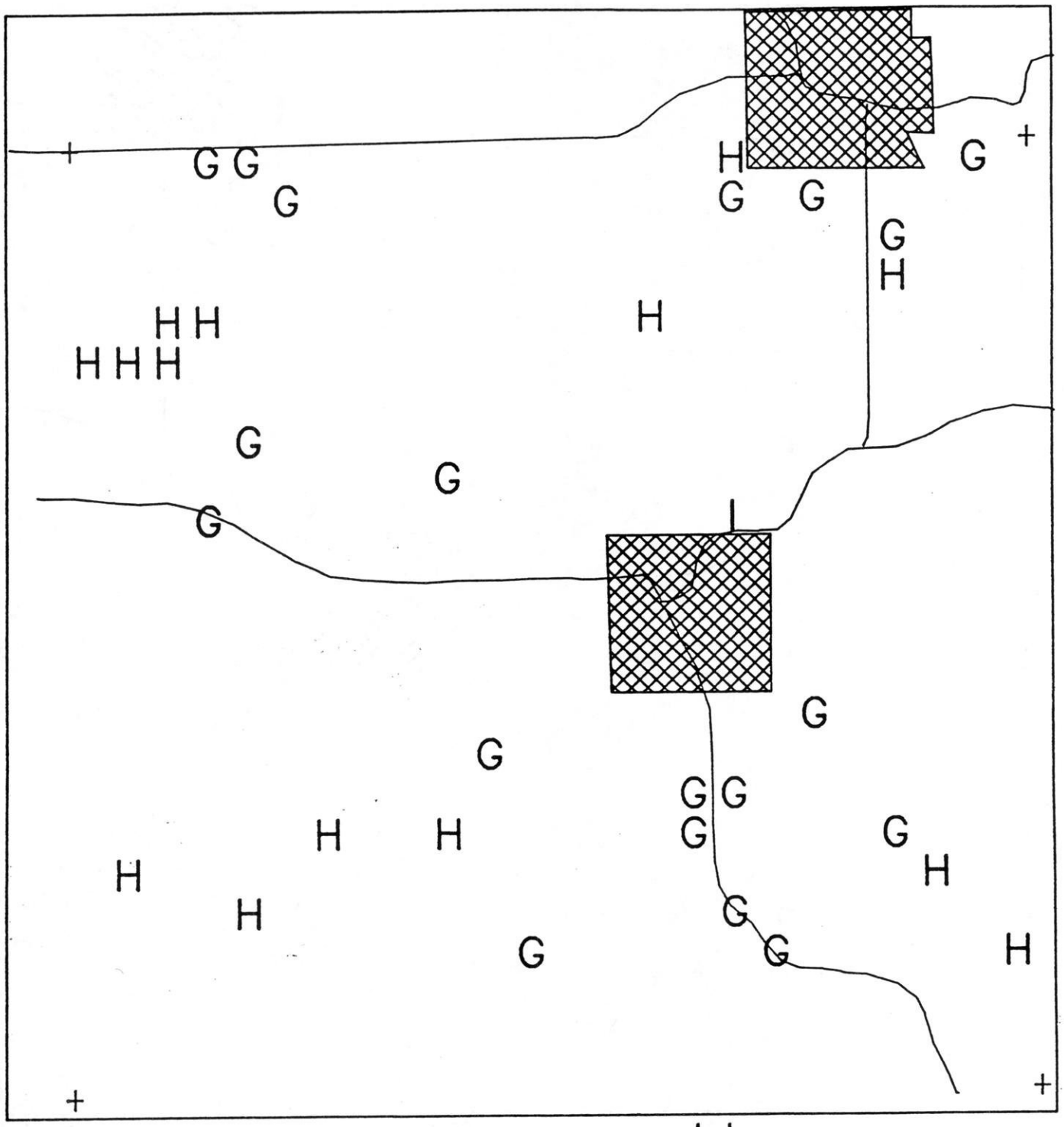
1990

NITRATE N (mg/l)

NONE DETECTED	0.2	2	5	10	20	
A	B	C	D		E	F

MAP LETTERS

26% 24% 29% 13% 8%



Waupaca Co

Scandinavia Township

1990

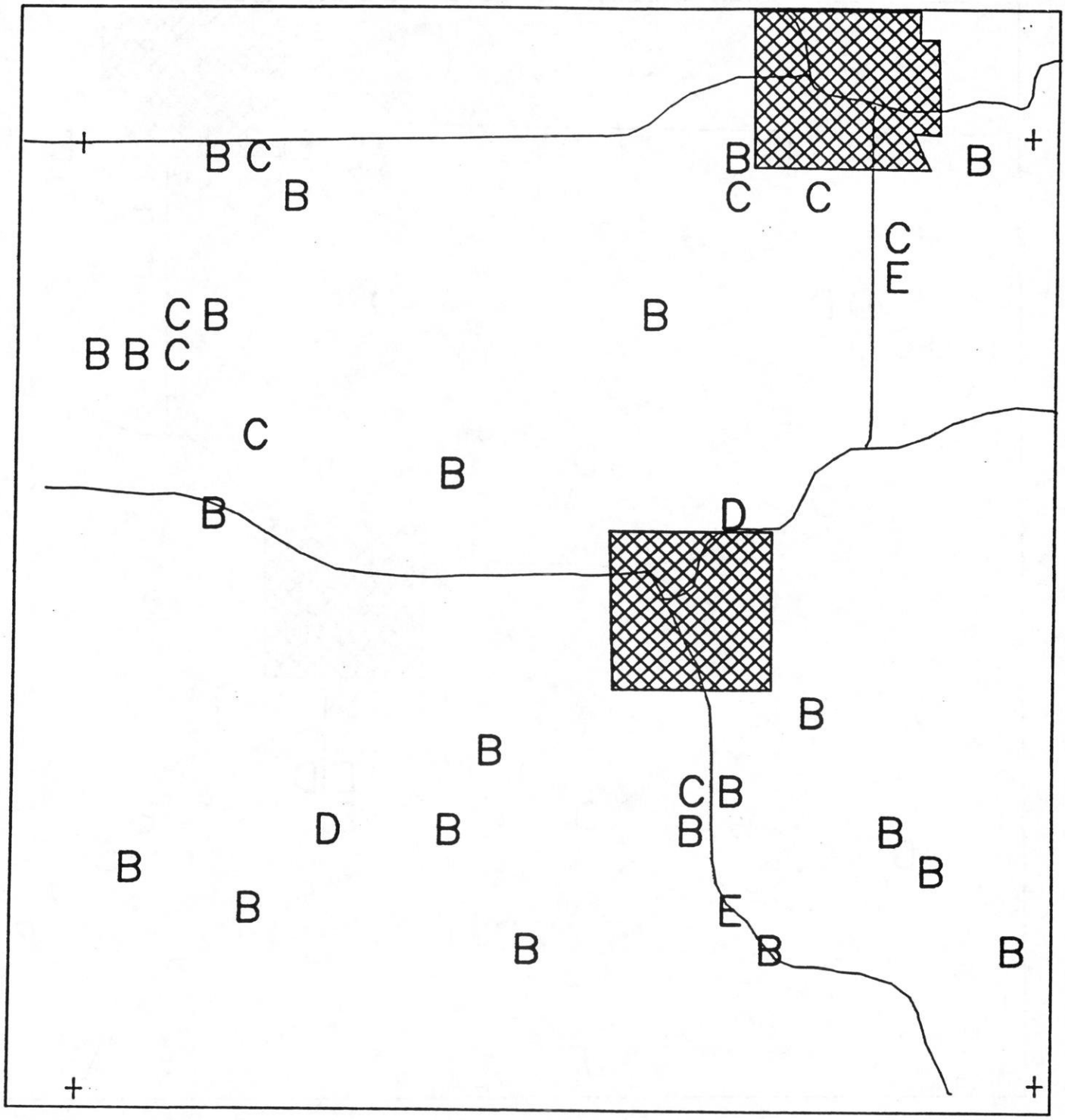
pH

5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5

A B C D E F G H I

MAP LETTERS

3% 53% 42% 3%



Waupaca Co

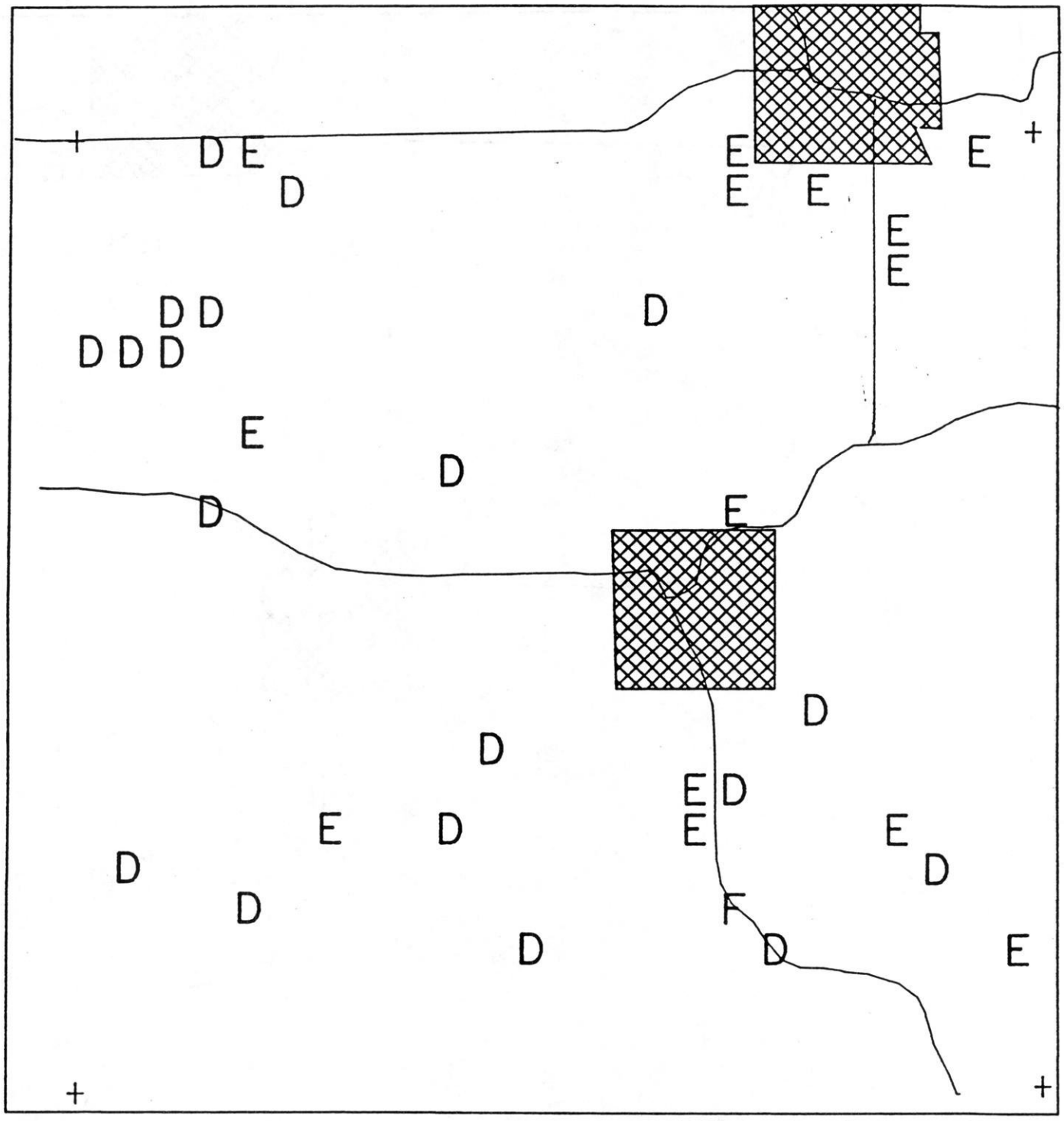
Scandinavia Township

1990

CHLORIDE (mg/l)

NONE DETECTED	1	10	25	50	100	200
A	B	C	D	E	F	G
	66%	24%	3%	5%		3%

MAP LETTERS



Waupaca Co

Scandinavia Township

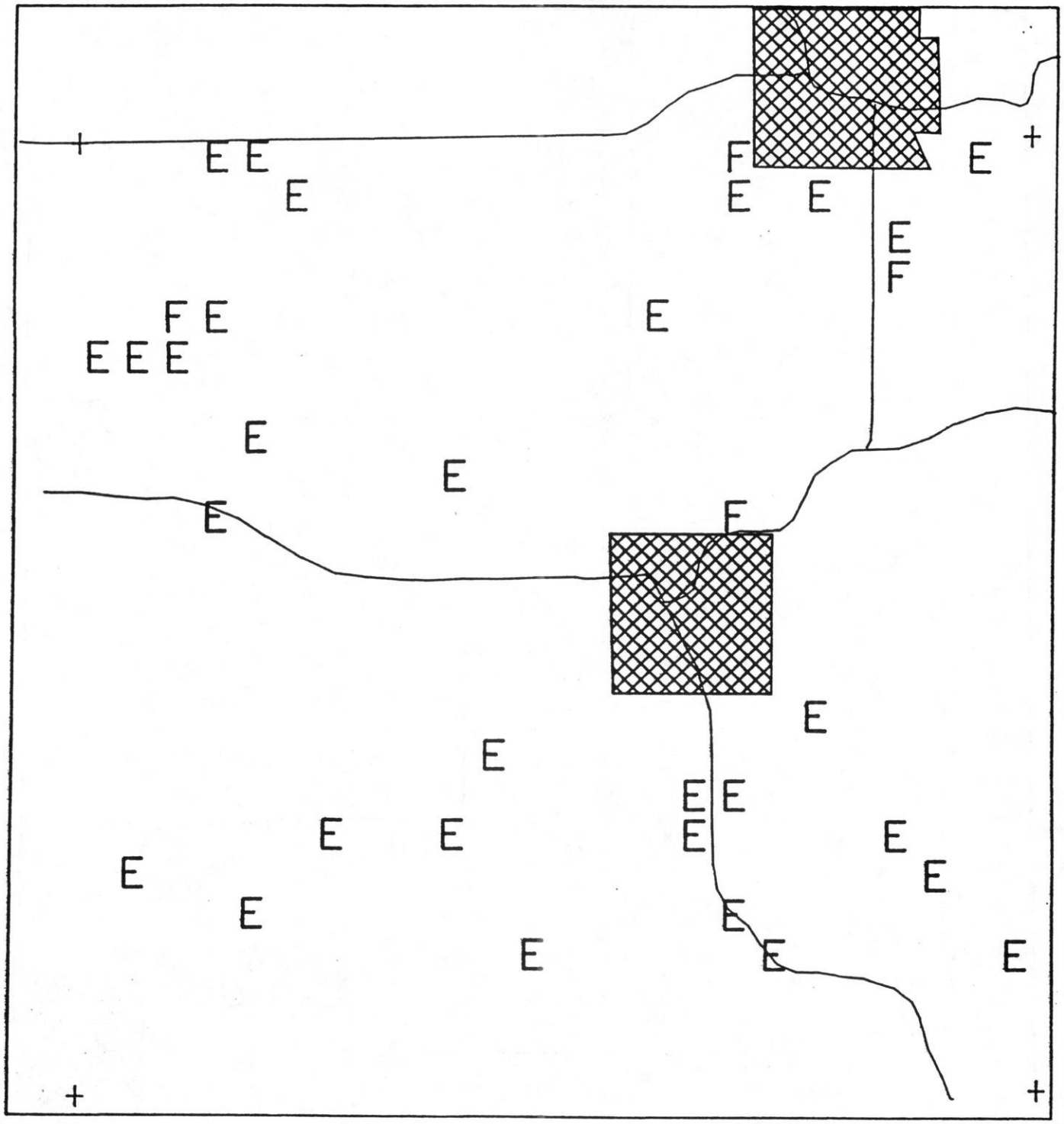
1990

CONDUCTIVITY

50	100	200	500	800	1000
A	B	C	D	E	F	G

MAP LETTERS

58% 39% 3%



Waupaca Co

Scandinavia Township

1990

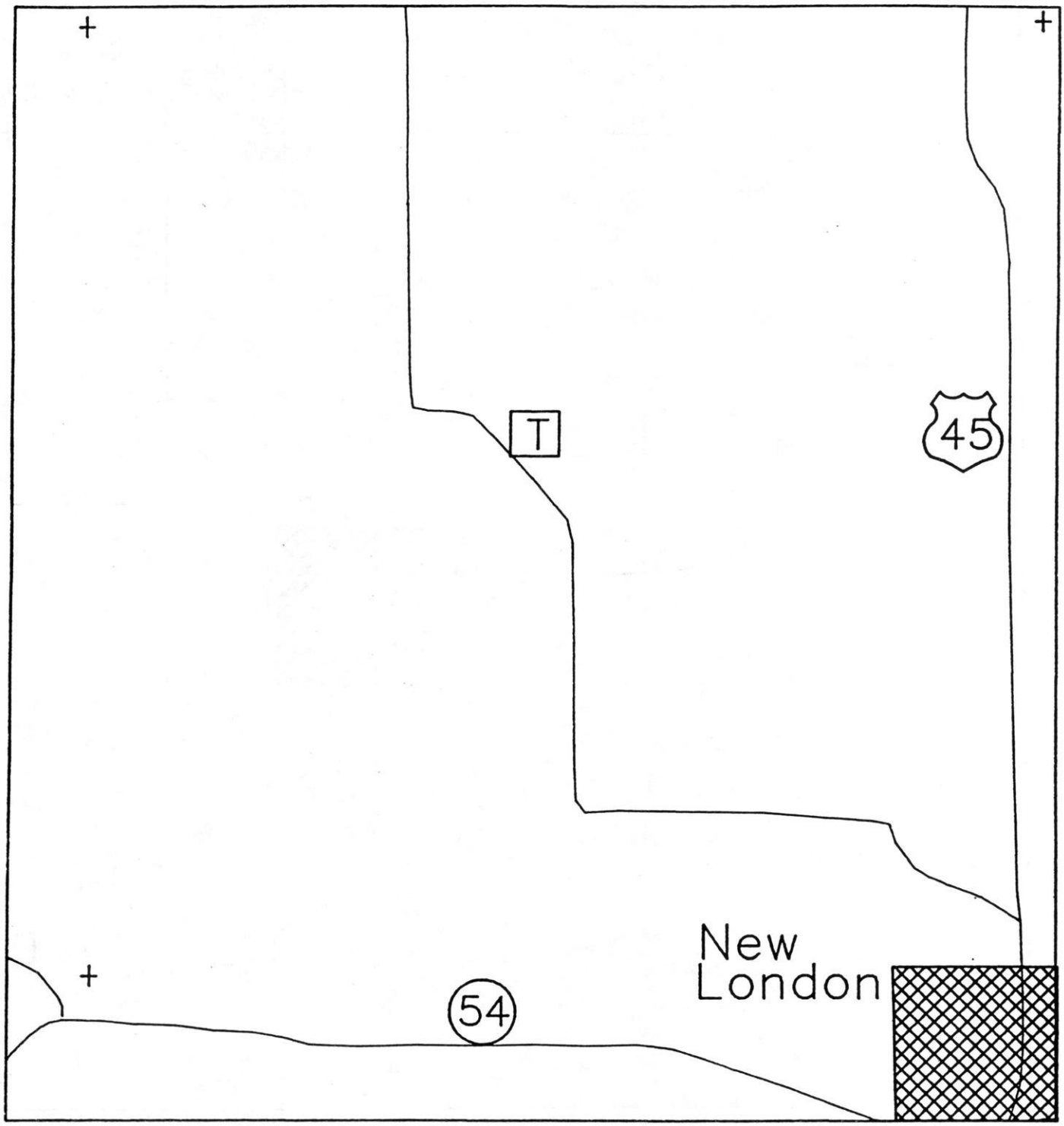
SATURATION INDEX

−3 −2 −1 0 1

A B C D E F

MAP LETTERS

89% 11%

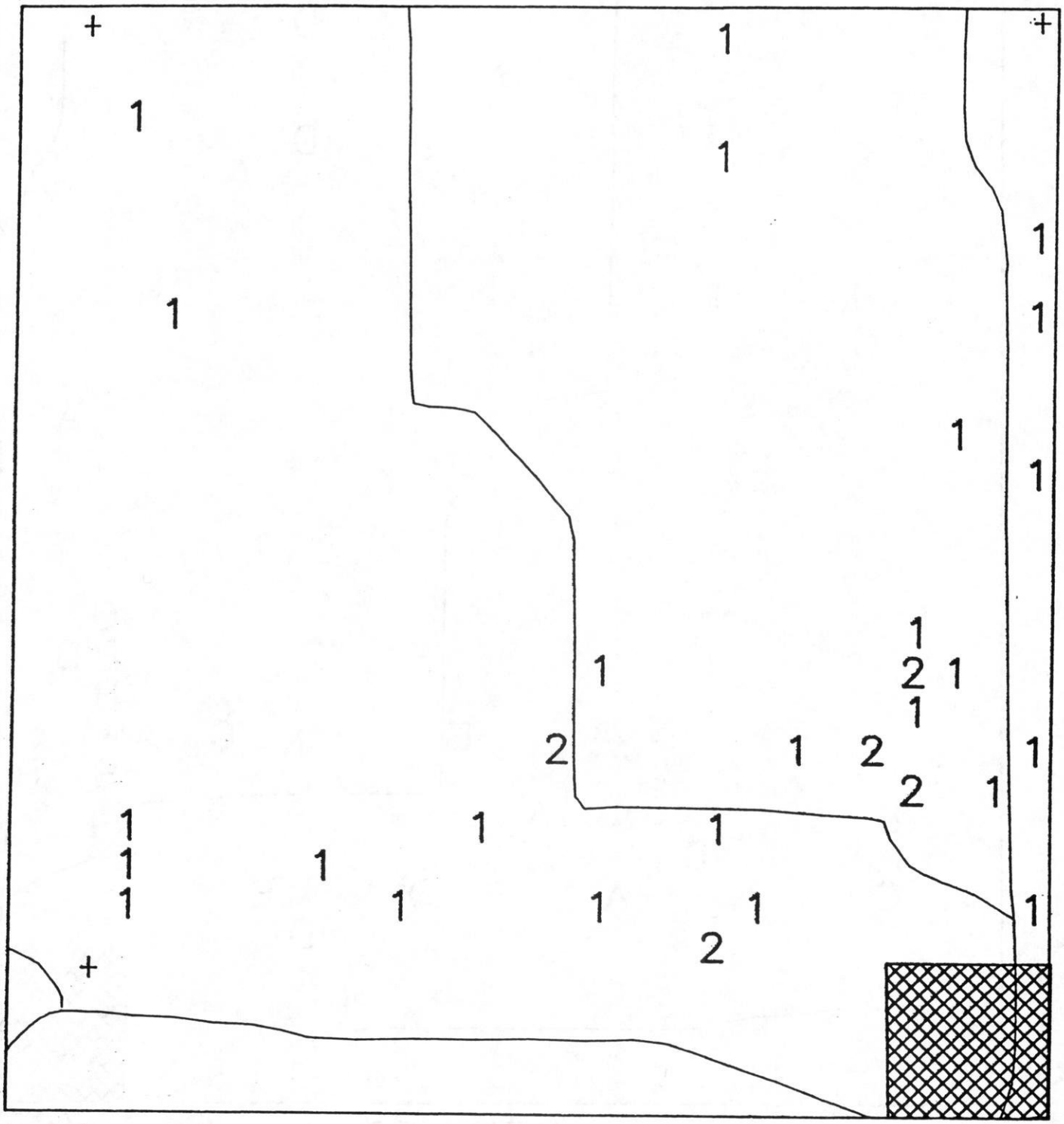


Waupaca Co

Lebanon
Township

1990

BASE MAP

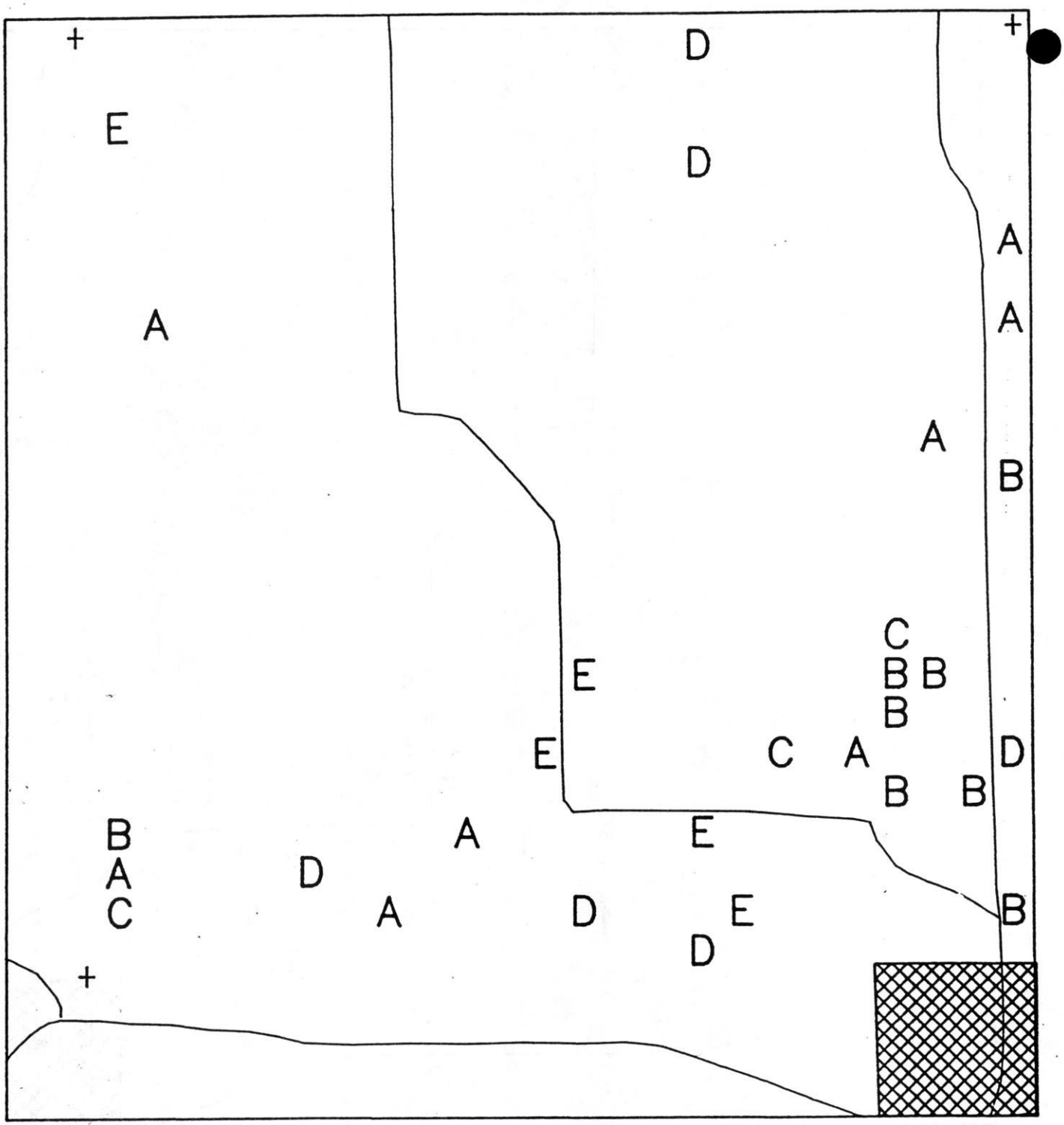


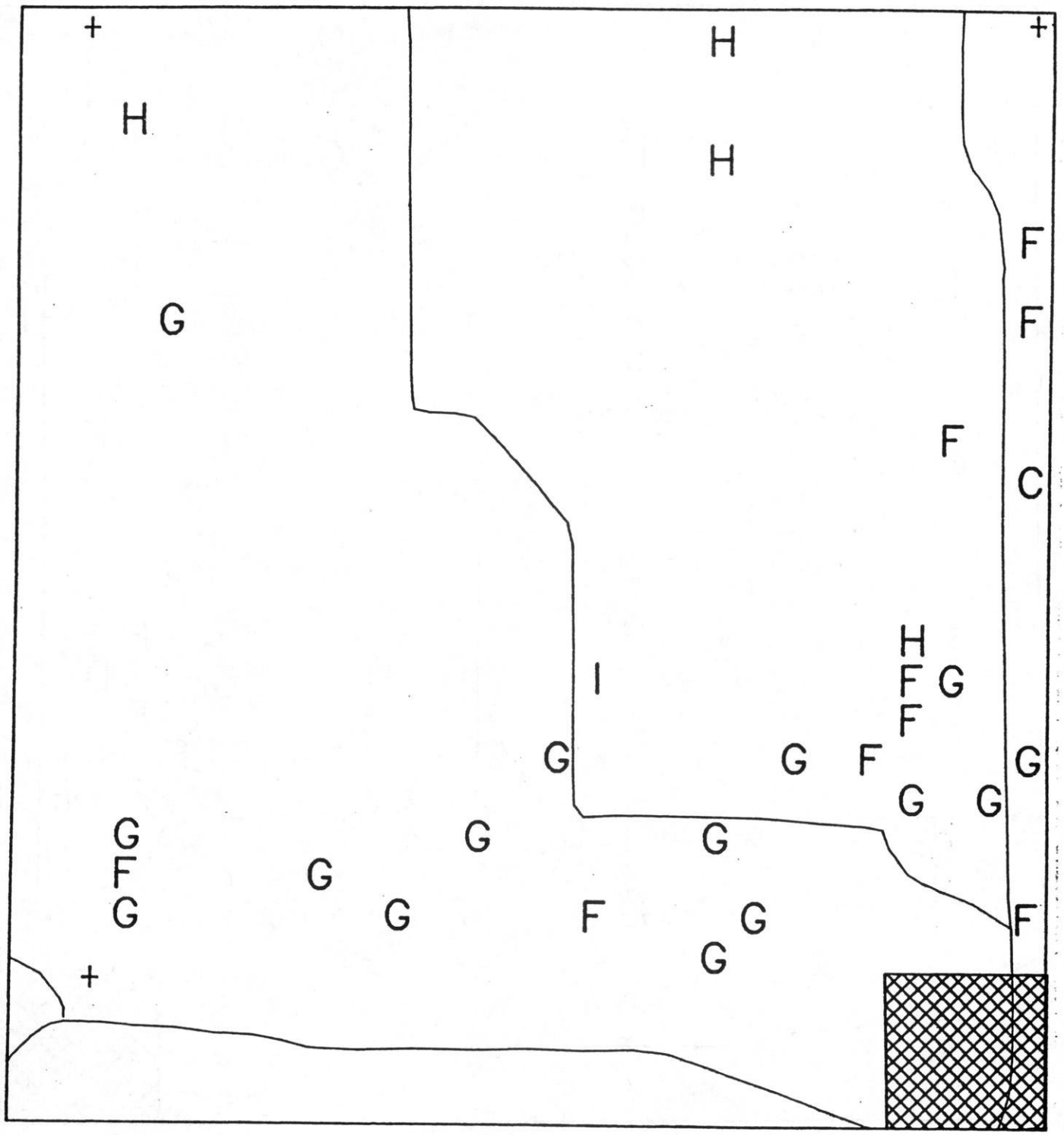
Waupaca Co

Lebanon Township

1990

SAMPLE DISTRIBUTION
NUMBER SAMPLES/QQ SECTION


Waupaca Co
NITRATE N (mg/l)
Lebanon Township
1990
NONE DETECTED
0.2
2
5
10
20
A
B
C
D
E
F
MAP LETTERS
29%
26%
14%
17%
11%
3%



Waupaca Co

Lebanon Township

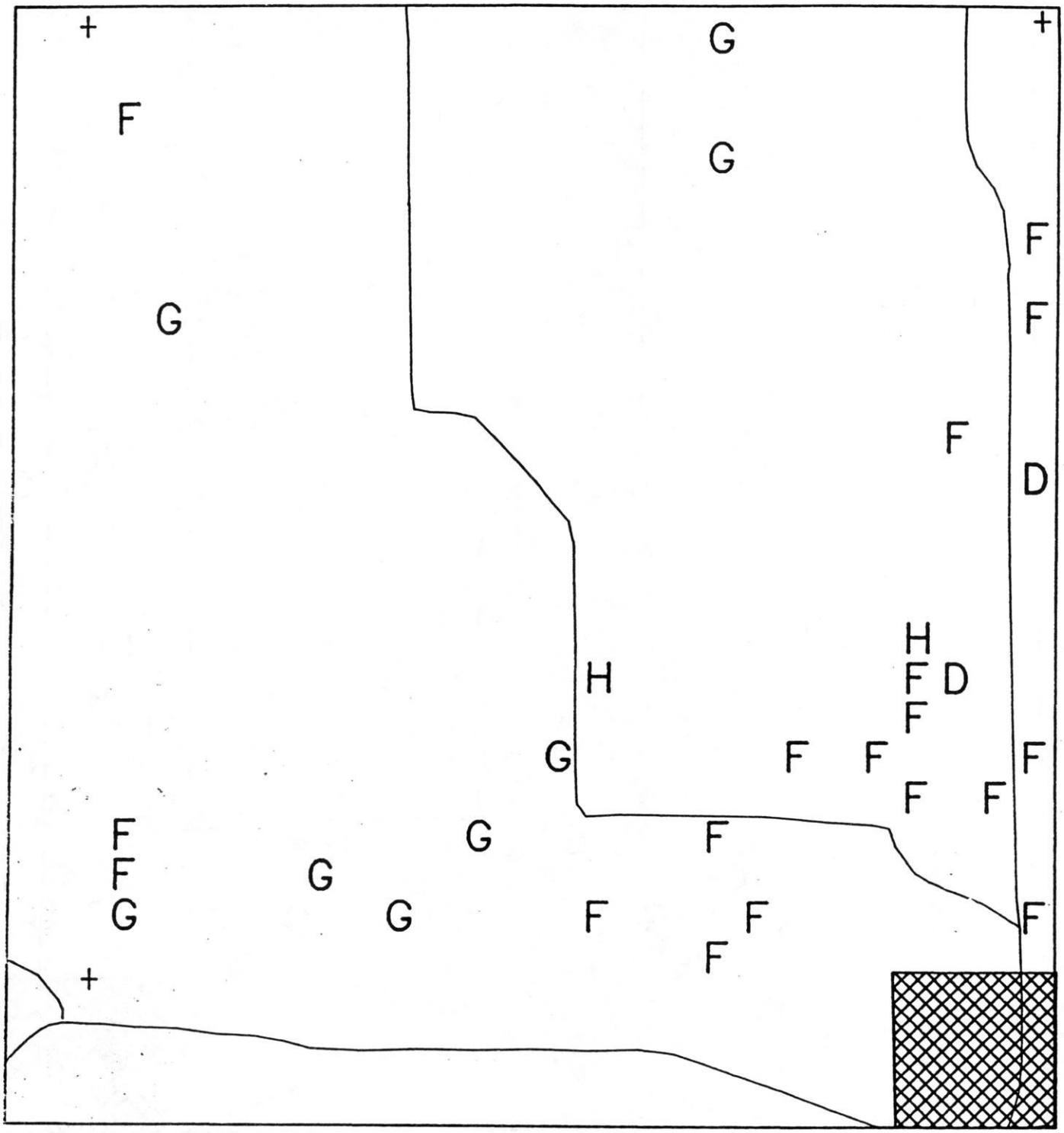
1990

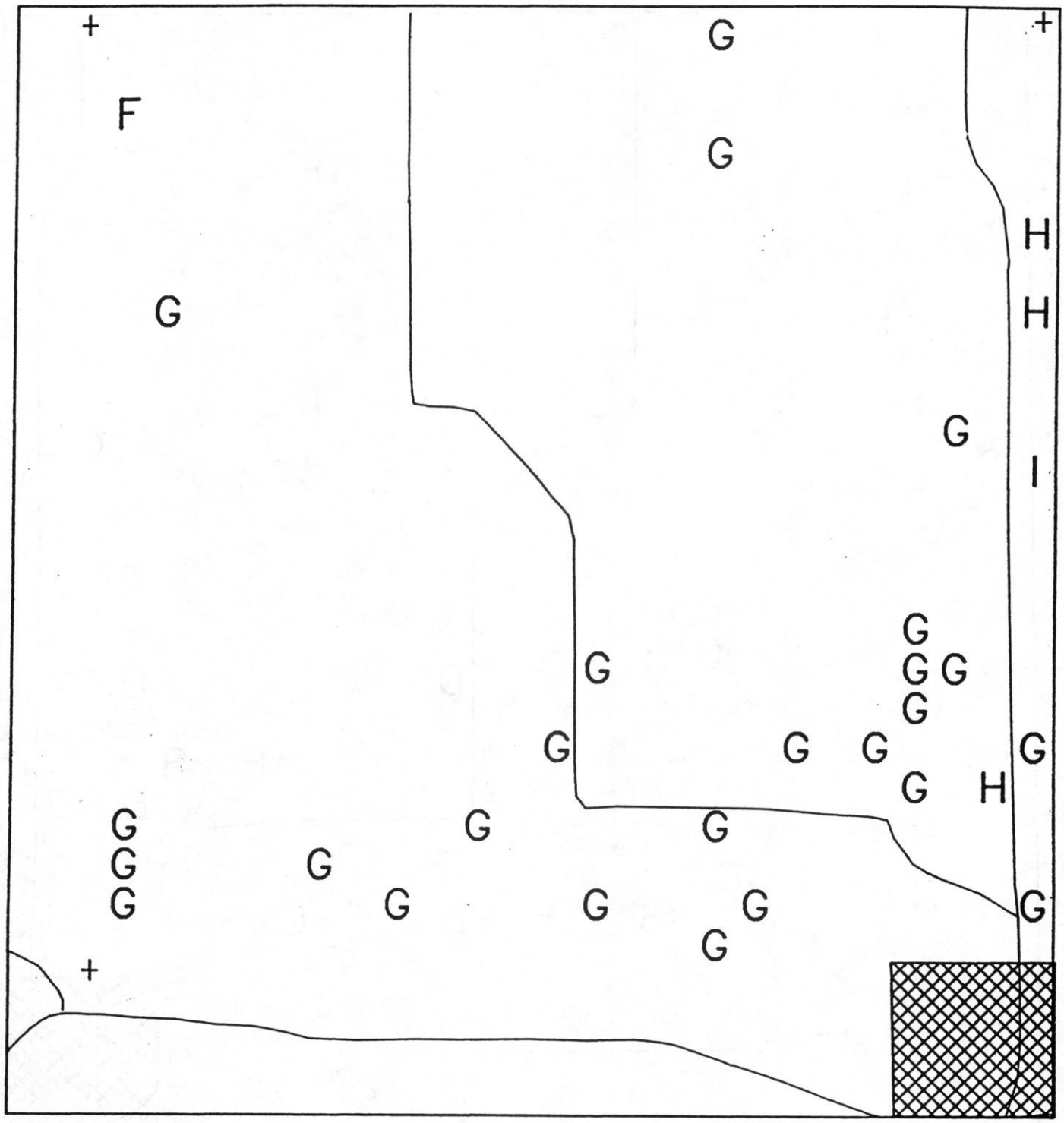
TOTAL HARDNESS

NONE DETECTED	2	25	50	150	200	300	400	500
A	B	C	D	E	F	G	H	I

MAP LETTERS

3%	34%	46%	11%	6%


Waupaca Co
Lebanon
Township
1990
ALKALINITY
NONE DETECTED
2 25 50 150 200 300 400 500
A B C D E F G H I
MAP LETTERS
6% 60% 26% 9%



Waupaca Co

Lebanon Township

1990

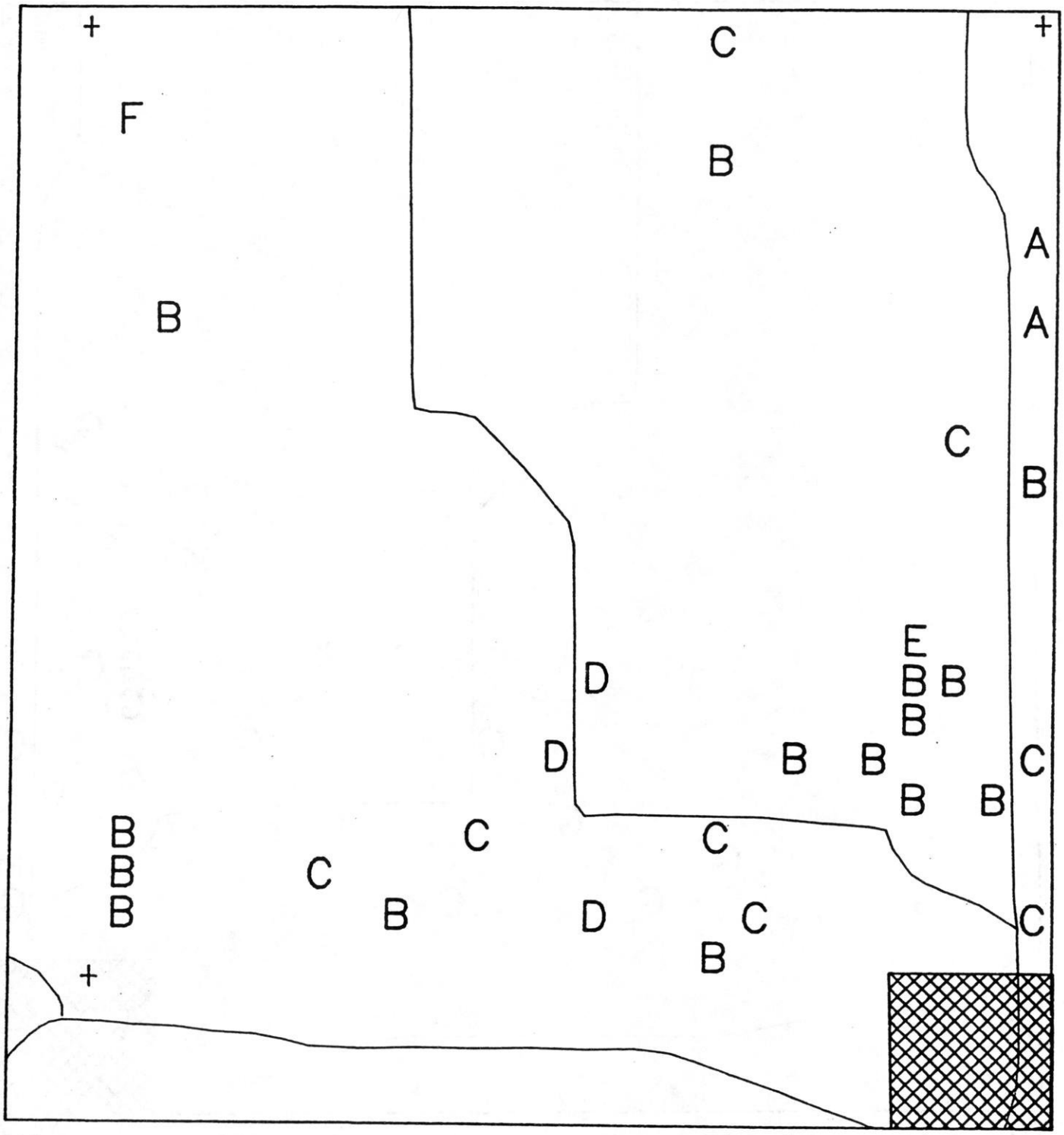
pH

5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5

A B C D E F G H I

MAP LETTERS

3% 83% 11% 3%



Waupaca Co

Lebanon Township

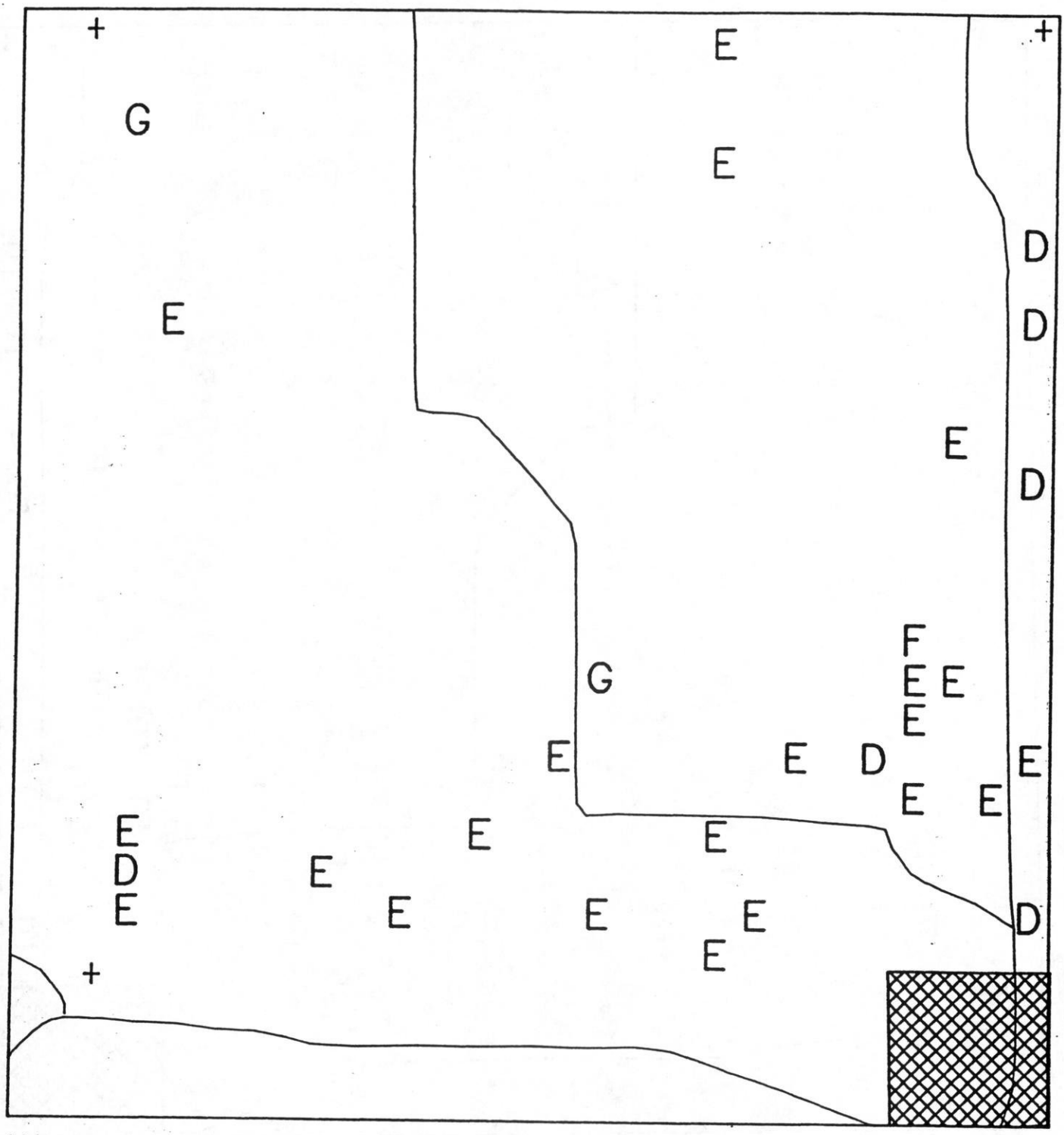
1990

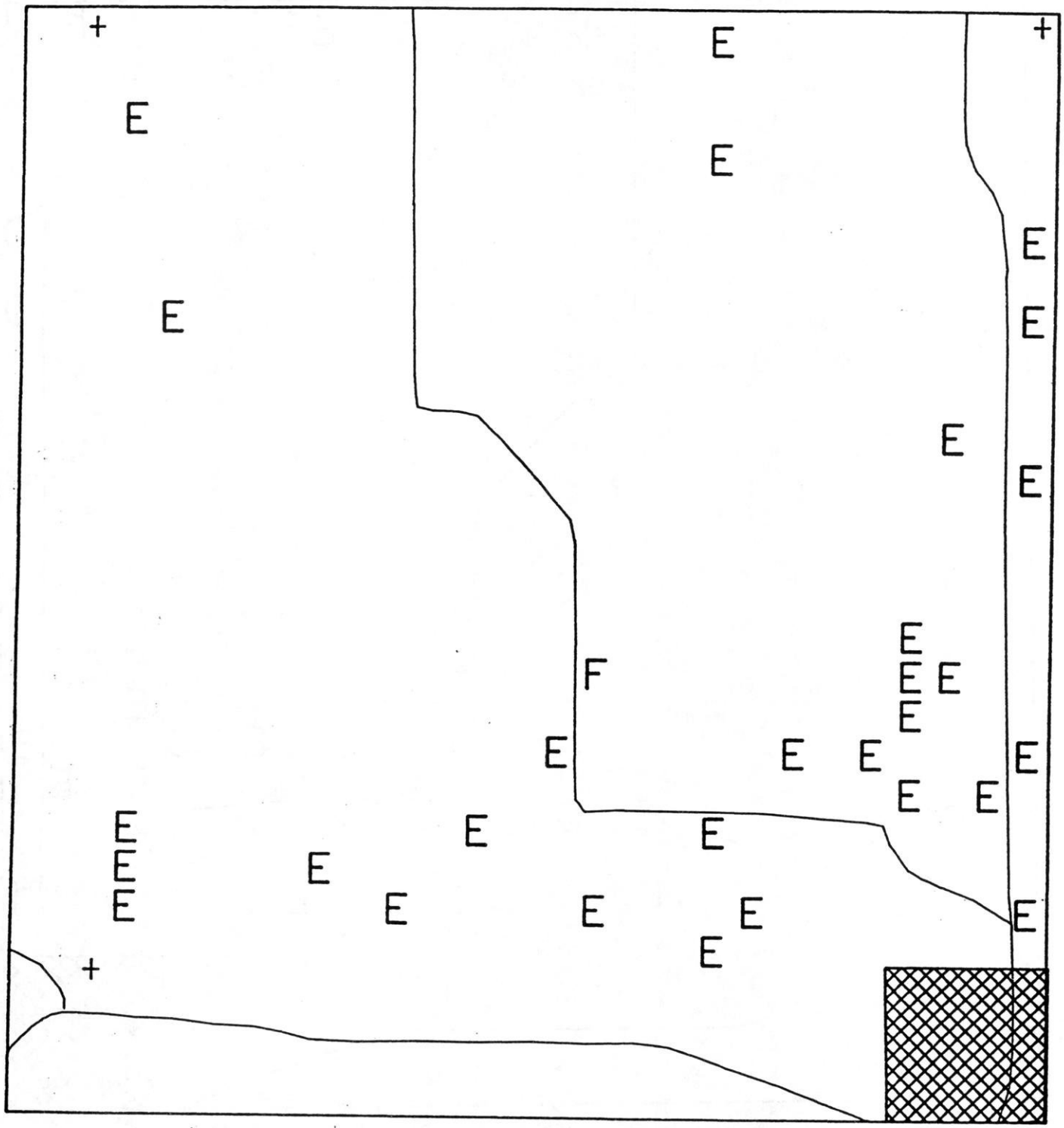
CHLORIDE (mg/l)

NONE DETECTED	1	10	25	50	100	200
A	B	C	D	E	F	G

MAP LETTERS

6% 57% 23% 6% 6% 3%


Waupaca Co
Lebanon
Township
1990
CONDUCTIVITY
50 100 200 500 800 1000
A B C D E F G
MAP LETTERS
23% 66% 3% 9%



Waupaca Co

Lebanon Township

1990

SATURATION INDEX

−3 −2 −1 0 1

A B C D E F

MAP LETTERS

97% 3%

EXHIBIT 14

ENVIRONMENTAL TASK FORCE LABORATORY - UWSP
VOLATILE ORGANIC COMPOUND REPORT
Waupaca County Water Testing Project

Volatile organic chemicals (VOC's) are a class of compounds that include solvents such as cleaners and degreasers, fuels, paint thinners and strippers, and dry cleaning fluids. The most likely sources of VOC contamination in rural areas are leaking underground storage tanks. If you detect an unusual chemical smell in your drinking water, and it is more evident in hot water than in cold water, you may have VOC contamination in your water. However, many of the VOC's are a health hazard at levels which you cannot smell.

EPA METHOD 601/602 — SAMPLE #335-90-6
SAMPLE SOURCE Waupaca County — DATE SAMPLE RECEIVED 8-15-90
SAMPLE NAME DM 220 [redacted] — DATE SAMPLE ANALYZED 8-22-90

Detection limits (ppb) are indicated in brackets [].	Concentration (ppb)
Benzene[0.5]	Not detected
Bromodichloromethane[0.7]	Not detected
Bromoform[1.8]	Not detected
Carbon Tetrachloride[0.9]	Not detected
Chlorobenzene[0.2]	Not detected
2-Chloroethylvinyl Ether	Not detected
Chloroform[0.6]	Not detected
Dibromochloromethane[1.0]	Not detected
1,1-Dichloroethane[0.7]	Not detected
1,2-Dichloroethane[0.9]	Not detected
1,1-Dichloroethylene[1.9]	Not detected
trans-1,2-Dichloroethylene[0.5]	Not detected
1,2-Dichloropropane[0.7]	Not detected
cis-1,3-Dichloropropene[0.4]	Not detected
trans-1,3-Dichloropropene[0.4]	Not detected
Ethylbenzene[0.5]	Not detected
1,1,2,2-Tetrachloroethane[1.6]	Not detected
Tetrachloroethylene[0.5]	Not detected
Toluene[0.3]	Not detected
1,1,1-Trichloroethane[1.0]	Not detected
1,1,2-Trichloroethane[1.1]	Not detected
Trichloroethylene[0.6]	1.0
Trichlorofluoromethane[3.0]	Not detected
m + p-Xylene[0.2]	Not detected
o-Xylene[0.1]	Not detected
Isopropylbenzene[0.1]	Not detected
2-Chlorotoluene[0.1]	Not detected
N-Propylbenzene [0.1]	Not detected
4-Chlorotoluene[0.1]	Not detected
tert-Butylbenzene[0.1]	Not detected
sec-Butylbenzene[0.1]	Not detected
1,4-Dichlorobenzene[0.1]	Not detected
1,2-Dichlorobenzene[0.1]	Not detected

ppb = parts per billion. A part per billion is equivalent to one drop of pesticide in a billion drops of water. For comparison, this is equivalent in concentration to 8 drops of water in an Olympic-size swimming pool. Such small amounts may seem insignificant, but may still have important health implications.

Comments: _____

State of Wisconsin DNR Certified Laboratory 750040280

ENVIRONMENTAL TASK FORCE LABORATORY - UWSP
VOLATILE ORGANIC COMPOUND REPORT
Waupaca County Water Testing Project

Volatile organic chemicals (VOC's) are a class of compounds that include solvents such as cleaners and degreasers, fuels, paint thinners and strippers, and dry cleaning fluids. The most likely sources of VOC contamination in rural areas are leaking underground storage tanks. If you detect an unusual chemical smell in your drinking water, and it is more evident in hot water than in cold water, you may have VOC contamination in your water. However, many of the VOC's are a health hazard at levels which you cannot smell.

EPA METHOD 601/602 — SAMPLE #303-90-11
SAMPLE SOURCE Waupaca County — DATE SAMPLE RECEIVED 8-1-90
SAMPLE NAME DM 053 [redacted] — DATE SAMPLE ANALYZED 8-6-90

Detection limits (ppb) are indicated in brackets [ ].	Concentration (ppb)
Benzene[0.5]	Not detected
Bromodichloromethane[0.7]	Not detected
Bromoform[1.8]	Not detected
Carbon Tetrachloride[0.9]	Not detected
Chlorobenzene[0.2]	Not detected
2-Chloroethylvinyl Ether	Not detected
Chloroform[0.6]	Not detected
Dibromochloromethane[1.0]	Not detected
1,1-Dichloroethane[0.7]	Not detected
1,2-Dichloroethane[0.9]	Not detected
1,1-Dichloroethylene[1.9]	Not detected
trans-1,2-Dichloroethylene[0.5]	Not detected
1,2-Dichloropropane[0.7]	Not detected
cis-1,3-Dichloropropene[0.4]	Not detected
trans-1,3-Dichloropropene[0.4]	Not detected
Ethylbenzene[0.5]	Not detected
1,1,2,2-Tetrachloroethane[1.6]	Not detected
Tetrachloroethylene[0.5]	Not detected
Toluene[0.3]	Not detected
1,1,1-Trichloroethane[1.0]	1.3
1,1,2-Trichloroethane[1.1]	Not detected
Trichloroethylene[0.6]	Not detected
Trichlorofluoromethane[3.0]	Not detected
m + p-Xylene[0.2]	Not detected
o-Xylene[0.1]	Not detected
Isopropylbenzene[0.1]	Not detected
2-Chlorotoluene[0.1]	Not detected
N-Propylbenzene [0.1]	Not detected
4-Chlorotoluene[0.1]	Not detected
tert-Butylbenzene[0.1]	Not detected
sec-Butylbenzene[0.1]	Not detected
1,4-Dichlorobenzene[0.1]	Not detected
1,2-Dichlorobenzene[0.1]	Not detected

ppb = parts per billion. A part per billion is equivalent to one drop of pesticide in a billion drops of water. For comparison, this is equivalent in concentration to 8 drops of water in an Olympic-size swimming pool. Such small amounts may seem insignificant, but may still have important health implications.

Comments: _____

State of Wisconsin DNR Certified Laboratory 750040280

EXHIBIT 15

A Brief Description of Commonly Used Nitrogen and Phosphorus Containing Pesticides in Waupaca County

ALACHLOR...an active ingredient in herbicide compounds/mixtures for control of annual grass and broadleaf weeds in corn and soybeans. Commercial products with alachlor include: Lasso(*), Lariat(*), Bronco(*), Bullet(*), Cropstar, and Freedom(*).

ATRAZINE...an active ingredient in herbicide compounds/mixtures for control of annual broadleaf and grass weeds in corn. Commercial products with atrazine include: AAtrex(*); Bicep(*); Extrazine II(*); Lariat(*); Marksman(*); and, Sutazine+(*).

BENEFLURALIN...the active ingredient in Balan, a herbicide compound for control of annual broadleaf and grass weeds when establishing alfalfa without a cover crop. Also, used to control crabgrass and other annual grass weeds in home lawns and golf courses.

BUTYLATE...an active ingredient in herbicide compounds/mixtures for control of annual weeds in corn. Commercial products with butylate include: Sutan+, and Sutazine+(*).

CYANAZINE...an active ingredient in herbicide compounds/mixtures for control of annual grass and broadleaf weeds in corn. Commercial products with cyanazine include: Bladex(*), and Extrazine II(*).

DIAZINON...the active ingredient and commercial name of a soil and foliage insecticide for control of armyworms, a variety of garden insects and other general nuisance insects outside the home.

EPTC...an active ingredient in herbicide compounds/mixtures for control of annual grass weeds during the establishment year of alfalfa, birdsfoot trefoil and clover without a cover crop, as well as control of annual grass and broadleaf weeds in corn. Commercial products with EPTC include: Eptam; Eradicane, and Eradicane Extra.

HEXAZINONE...the active ingredient in Velpar, a herbicide compound for selective weed and brush control in christmas tree plantations and reforestation areas. Velpar is also labled for control of annual broadleaf weeds and certain grasses in established dormant alfalfa.

EXHIBIT 15 - Continued

ENVIRONMENTAL TASK FORCE LABORATORY-UWSP
NITROGEN AND PHOSPHORUS CONTAINING PESTICIDE REPORT
Waupaca County Water Testing Project

Nitrogen and Phosphorus Containing Pesticides are some of the more commonly used herbicides (weed killers) and insecticides (insect poisons) in Wisconsin. Herbicides such as Atrazine and Lasso have been found in ground water in other parts of the state.

EPA METHOD 507
SAMPLE SOURCE Waupaca County
SAMPLE NAME [redacted] DM 173

SAMPLE # 318-90-3
DATE SAMPLE EXTRACTED 8/13/90
DATE OF REPORT 10/30/90

COMMON NAME	CHEMICAL NAME	CONCENTRATION (ppb)	WISCONSIN HEALTH ADVISORY LEVEL (ppb)
VERNAM	VERNOLATE	Not detected	N/A
	*PROPACHLOR	Not detected	N/A
*BALAN	BENFLURALIN	Not detected	N/A
PRINCEP	SIMAZINE**	Not detected	2,150
	PROPAZINE	Not detected	N/A
*TOLBAN	PROFLURALIN	Mot detected	N/A
DUAL (W)	METOLACHLOR**	2.5	15
*PROWL	PENDIMETHALIN**	Not detected	N/A
	*OXADIAZON	Not detected	N/A
EPTAM (W)	EPTC**	Not detected	N/A
SUTAN	BUTYLATE	Not detected	67
TILLAM	PEBULATE	Not detected	N/A
ORDRAM	MOLINATE	Not detected	N/A
RO-NEET	CYCLOATE	Not detected	N/A
*TREFLAN	TRIFLURALIN	Not detected	25
AATREX (W)	ATRAZINE**	7.9	3.5
	TERBACIL	Not detected	N/A
SENCOR	METRIBUZIN	Not detected	250
	BROMACIL	Not detected	N/A
*PAARLAN	ISOPROPALIN	Not detected	N/A
*GOAL	OXYFLUORFEN	Not detected	N/A
VELPAR	HEXAZINONE	Not detected	N/A
	DIAZINON (W)**	Not detected	N/A
LASSO (W)	ALACHLOR**	Not detected	0.5
*BLADEX (W)	CYANAZINE**	Not detected	12.5

* means this pesticide is detected by EPA Method 507 but not officially included in the method.

(W) means this pesticide is commonly used in Waupaca County.
N/A means no standard has been established for this pesticide.
ND means this pesticide was not detected in your sample.
** means further information about this pesticide is on the reverse side.

ppb = parts per billion. A part per billion is equivalent to one drop of pesticide in a billion drops of water. For comparison, this is equivalent in concentration to 8 drops of water in an Olympic-size swimming pool. Such small amounts may seem insignificant, but may still have important health implications.

Comments: _____

State of Wisconsin DNR Certified Laboratory 750040280

EXHIBIT 15 - Continued

ENVIRONMENTAL TASK FORCE LABORATORY-UWSP
NITROGEN AND PHOSPHORUS CONTAINING PESTICIDE REPORT
Waupaca County Water Testing Project

Nitrogen and Phosphorus Containing Pesticides are some of the more commonly used herbicides (weed killers) and insecticides (insect poisons) in Wisconsin. Herbicides such as Atrazine and Lasso have been found in ground water in other parts of the state.

EPA METHOD 507
SAMPLE SOURCE Waupaca County
SAMPLE NAME [redacted] DM 210

SAMPLE # 335-90-5
DATE SAMPLE EXTRACTED 8/21/90
DATE OF REPORT 10/30/90

COMMON NAME	CHEMICAL NAME	CONCENTRATION (ppb)	WISCONSIN HEALTH ADVISORY LEVEL (ppb)
VERNAM	VERNOLATE	Not detected	N/A
	*PROPACHLOR	Not detected	N/A
*BALAN	BENFLURALIN	Not detected	N/A
PRINCEP	SIMAZINE**	10.6	2,150
	PROPAZINE	Not detected	N/A
*TOLBAN	PROFLURALIN	Mot detected	N/A
DUAL (W)	METOLACHLOR**	Not detected	15
*PROWL	PENDIMETHALIN**	Not detected	N/A
	*OXADIAZON	Not detected	N/A
EPTAM (W)	EPTC**	Not detected	N/A
SUTAN	BUTYLATE	Not detected	67
TILLAM	PEBULATE	Not detected	N/A
ORDRAM	MOLINATE	Not detected	N/A
RO-NEET	CYCLOATE	Not detected	N/A
*TREFLAN	TRIFLURALIN	Not detected	25
AATREX (W)	ATRAZINE**	Not detected	3.5
	TERBACIL	Not detected	N/A
SENCOR	METRIBUZIN	Not detected	250
	BROMACIL	Not detected	N/A
*PAARLAN	ISOPROPALIN	Not detected	N/A
*GOAL	OXYFLUORFEN	Not detected	N/A
VELPAR	HEXAZINONE	Not detected	N/A
	DIAZINON (W)**	Not detected	N/A
LASSO (W)	ALACHLOR**	Not detected	0.5
*BLADEX (W)	CYANAZINE**	Not detected	12.5

* means this pesticide is detected by EPA Method 507 but not officially included in the method.

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Comments: _____

_____

State of Wisconsin DNR Certified Laboratory 750040280

EXHIBIT 15 - Continued

ENVIRONMENTAL TASK FORCE LABORATORY-UWSP
NITROGEN AND PHOSPHORUS CONTAINING PESTICIDE REPORT
Waupaca County Water Testing Project

Nitrogen and Phosphorus Containing Pesticides are some of the more commonly used herbicides (weed killers) and insecticides (insect poisons) in Wisconsin. Herbicides such as Atrazine and Lasso have been found in ground water in other parts of the state.

EPA METHOD 507
SAMPLE SOURCE WAUPACA COUNTY
SAMPLE NAME DM 054 [redacted]

SAMPLE # 303-90-9
DATE SAMPLE EXTRACTED —
DATE OF REPORT 10-30-90

COMMON NAME	CHEMICAL NAME	CONCENTRATION (ppb)	WISCONSIN HEALTH ADVISORY LEVEL (ppb)
VERNAM	VERNOLATE	Not detected	N/A
	*PROPACHLOR	Not detected	N/A
*BALAN	BENFLURALIN	Not detected	N/A
PRINCEP	SIMAZINE**	Not detected	2,150
	PROPAZINE	Not detected	N/A
*TOLBAN	PROFLURALIN	Not detected	N/A
DUAL (W)	METOLACHLOR**	Not detected	15
*PROWL	PENDIMETHALIN**	Not detected	N/A
	*OXADIAZON	Not detected	N/A
EPTAM (W)	EPTC**	Not detected	N/A
SUTAN	BUTYLATE	Not detected	67
TILLAM	PEBULATE	Not detected	N/A
ORDRAM	MOLINATE	Not detected	N/A
RO-NEET	CYCLOATE	Not detected	N/A
*TREFLAN	TRIFLURALIN	Not detected	25
AATREX (W)	ATRAZINE**	Not detected	3.5
	TERBACIL	Not detected	N/A
SENCOR	METRIBUZIN	Not detected	250
	BROMACIL	Not detected	N/A
*PAARLAN	ISOPROPALIN	Not detected	N/A
*GOAL	OXYFLUORFEN	Not detected	N/A
VELPAR	HEXAZINONE	Not detected	N/A
	DIAZINON (W)**	Not detected	N/A
LASSO (W)	ALACHLOR**	Not detected	0.5
*BLADEX (W)	CYANAZINE**	Not detected	12.5

* means this pesticide is detected by EPA Method 507 but not officially included in the method.

(W) means this pesticide is commonly used in Waupaca County.
N/A means no standard has been established for this pesticide.
ND means this pesticide was not detected in your sample.
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ppb = parts per billion. A part per billion is equivalent to one drop of pesticide in a billion drops of water. For comparison, this is equivalent in concentration to 8 drops of water in an Olympic-size swimming pool. Such small amounts may seem insignificant, but may still have important health implications.

Comments: ONE UNIDENTIFIED COMPOUND

State of Wisconsin DNR Certified Laboratory 750040280

EXHIBIT 15 - Continued

ENVIRONMENTAL TASK FORCE LABORATORY-UWSP
NITROGEN AND PHOSPHORUS CONTAINING PESTICIDE REPORT
Waupaca County Water Testing Project

Nitrogen and Phosphorus Containing Pesticides are some of the more commonly used herbicides (weed killers) and insecticides (insect poisons) in Wisconsin. Herbicides such as Atrazine and Lasso have been found in ground water in other parts of the state.

EPA METHOD 507
SAMPLE SOURCE WAUPACA COUNTY
SAMPLE NAME DM@61 [redacted]

SAMPLE # 303-90-7
DATE SAMPLE EXTRACTED —
DATE OF REPORT 10-30-90

COMMON NAME	CHEMICAL NAME	CONCENTRATION (ppb)	WISCONSIN HEALTH ADVISORY LEVEL (ppb)
VERNAM	VERNOLATE	Not detected	N/A
	*PROPACHLOR	Not detected	N/A
*BALAN	BENFLURALIN	Not detected	N/A
PRINCEP	SIMAZINE**	Not detected	2,150
	PROPAZINE	Not detected	N/A
*TOLBAN	PROFLURALIN	Mot detected	N/A
DUAL (W)	METOLACHLOR**	Not detected	15
*PROWL	PENDIMETHALIN**	Not detected	N/A
	*OXADIAZON	Not detected	N/A
EPTAM (W)	EPTC**	Not detected	N/A
SUTAN	BUTYLATE	Not detected	67
TILLAM	PEBULATE	Not detected	N/A
ORDRAM	MOLINATE	Not detected	N/A
RO-NEET	CYCLOATE	Not detected	N/A
*TREFLAN	TRIFLURALIN	Not detected	25
AATREX (W)	ATRAZINE**	Not detected	3.5
	TERBACIL	Not detected	N/A
SENCOR	METRIBUZIN	Not detected	250
	BROMACIL	Not detected	N/A
*PAARLAN	ISOPROPALIN	Not detected	N/A
*GOAL	OXYFLUORFEN	Not detected	N/A
VELPAR	HEXAZINONE	Not detected	N/A
	DIAZINON (W)**	Not detected	N/A
LASSO (W)	ALACHLOR**	Not detected	0.5
*BLADEX (W)	CYANAZINE**	Not detected	12.5

* means this pesticide is detected by EPA Method 507 but not officially included in the method.

(W) means this pesticide is commonly used in Waupaca County.
N/A means no standard has been established for this pesticide.
ND means this pesticide was not detected in your sample.
** means further information about this pesticide is on the reverse side.

ppb = parts per billion. A part per billion is equivalent to one drop of pesticide in a billion drops of water. For comparison, this is equivalent in concentration to 8 drops of water in an Olympic-size swimming pool. Such small amounts may seem insignificant, but may still have important health implications.

Comments: 4 UNIDENTIFIED COMPOUNDS

State of Wisconsin DNR Certified Laboratory 750040280

PILOT VERSION

FARM•A•SYST
Farmstead Assessment System

Worksheet #1

Drinking Water Well Condition

Why should I be concerned?

About 95 percent of this country's rural residents depend on groundwater to supply their drinking water and farmstead needs. Wells are designed to provide clean water, but if improperly constructed and maintained, they can allow bacteria, pesticides or oil products to comtaminate groundwater. These contaminants can put family and livestock health at risk.

There are documented cases of well contamination from farmstead activities near the drinking water well. The condition of your well and its proximity to contamination sources determine how much of a risk it poses to the water you drink. For example, a spill of pesticides being mixed and loaded right near the well could result in the contamination of your family's drinking water supply. Feedlots, animal yards and waste storage areas could release nitrates at an accelerated rate, and they could contaminate your well. Bacteria, nitrates, oil and pesticides can enter through a cracked casing.

Preventing the contamination of your well is very important. Once the groundwater supplying your well is contaminated, it is very difficult to clean up, and the only options may be to treat the water, drill a new well, or obtain water from another source. A contaminated well can also affect your neighbors' wells and can pose a serious health threat to your family and neighbors.

The goal of Farm•A•Syst is to help you protect the groundwater that supplies your drinking water.

How will this worksheet help me protect my drinking water?

- It will take you step by step through your drinking water well condition and management practices.
- It will rank your activities according to how they might affect the groundwater that provides your drinking water supplies.
- It will provide you with easy-to-understand rankings that will help you analyze the "risk level" of your drinking water well condition and management practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require some modification to better protect your drinking water.

How do I complete the worksheet?

Follow the directions at the top of the chart on the next page. It should take you about 15-30 minutes to complete this worksheet and figure out your ranking.

Drinking Water Well Condition: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your farmstead, read across to the right and circle the statement that best describes conditions on your farmstead. (Skip and leave blank any categories that don't apply to your farmstead.)
3. Then look above the description you circled to find your "rank number" (4, 3, 2 or 1) and enter that number in the blank under "your rank."
4. Directions on overall scoring appear at the end of the worksheet.
5. Allow about 15-30 minutes to complete the worksheet and figure out your risk ranking for pesticide storage and handling practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
LOCATION					
Slope to pollution sources	Uphill from all pollution sources. No surface water runoff reaches well. Surface water diverted from well.	Uphill from pollution sources. No surface water runoff reaches well.	Downhill from most pollution sources. Some surface water runoff may reach well.	Settling or depression near casing. Surface water runoff from barnyard, pesticide mixing area, fuel storage or farm dump reaches well.	____
Separation distances between well and farmstead contamination sources*	Meets or exceeds all state minimum required separation distances.	Meets most minimum separation distances.	Meets minimum separation distances only for sources required to be at least 100 feet from well.	Does not meet all minimum separation distances for sources required to be at least 100 feet from well.	____
Soil and/or subsurface potential to protect groundwater**	Best (soils rank best or good)	Good (soils rank marginal/good)	Marginal	Poor	____
CONDITION					
Condition of casing and well cap (seal)	No holes or cracks visible. Cap tightly secured.	_____	No holes or cracks visible. Cap loose.	Holes or cracks visible. Cap loose or missing. Can hear water running.	____
Casing depth	Cased more than 50 feet below water table.	Cased 31–50 feet below water table.	Cased 10–30 feet below water table.	Cased less than 10 feet below water table.	____

*See page 2 of "Improving Drinking Water Well Management."
**See page 9 of Worksheet #11 for this ranking.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
Casing height above land surface	More than 12 inches above grade.	8–12 inches above grade.	At grade or up to 8 inches above.	Below grade or in pit or basement.	____
Well age	Less than 20 years old.	21–50 years old.	51–70 years old.	More than 70 years old.	____
Well type	_____	Drilled	Driven-point (sand point)	Dug well	____
MANAGEMENT					
Backflow prevention	Anti-backflow devices installed on all faucets with hose connections. No cross-connections between water supplies.	Anti-backflow devices installed on some faucets with hose connections.	No anti-backflow devices. Air gap maintained.	No anti-backflow devices. Air gap not maintained. Cross-connections between water supplies.	____
Unused well	No unused wells.	No unused, unsealed wells.	Unused, unsealed well in field.	Unused, unsealed well in farmstead.	____
Water testing	Consistent water quality. Bacteria, nitrate and other tests meet standards.	Occasional deviation from standards with bacteria, nitrate and other tests.	Bacteria, nitrate and other tests mostly do not meet standards.	No water tests done. Water discolored after rainstorms or during spring melt. Noticeable changes in color, clarity, odor or taste.	____
				TOTAL	

What do I do with these rankings?

Step 1: Begin by determining your overall well management risk ranking. Total the rankings for the categories you completed and divide by the number of categories you ranked:

_____ divided by _____ equals	
total of rankings / # of categories ranked	risk ranking*

*Carry your answer out to one decimal place.

4=low risk 3=low to moderate risk 2=moderate to high risk 1=high risk

This ranking gives you an idea of how your well management practices as a whole might be affecting your drinking water. This ranking should serve only as a very general guide, not a precise diagnosis. Because it represents an averaging of many individual rankings, it can mask any individual rankings (such as 1's or 2's) that should be of concern. (Step 2 will focus on individually ranked activities of concern.)

Enter your boxed well management risk ranking in the appropriate place on page 2 of worksheet #12. Later you will compare this risk ranking with other farmstead management rankings. Worksheet #11 will help you determine your farmstead's site conditions (soil type, soil depth and bedrock characteristics), and worksheet #12 will show you how these site conditions affect your risk rankings.

Step 2: Look over your rankings for individual activities. First take note of any 4's and 3's:

- **Low-risk** practices (4's): ideal; should be your goal despite cost and effort
- **Low-to-moderate-risk** practices (3's): provide reasonable groundwater protection

Now pay particular attention to any 2's or 1's:

- **Moderate-to-high-risk** practices (2's): inadequate protection in many circumstances
- **High-risk** practices (1's): inadequate; pose a high risk of polluting groundwater

Regardless of your overall risk ranking, any individual rankings of "1" require immediate attention. Some concerns you can take care of right away; others could be major—or costly—projects, requiring planning and prioritizing before you take action.

Find any activities that you identified as 1's and list them under "High-Risk Activities" on pages 6-7 of worksheet #12.

Step 3: Read "Improving Drinking Water Well Condition and Management," and give some thought to how you might modify your farmstead practices to better protect your drinking water.

FARM•A•SYST
Farmstead Assessment System

The Farmstead Assessment System is a cooperative project of the University of Wisconsin-Extension, Cooperative Extension; Minnesota Extension Service; and the U.S. Environmental Protection Agency Region V.

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FARM•A•SYST team members: **Gary Jackson**, University of Wisconsin-Extension, and **Jim Anderson**, Minnesota Extension Service, directors; **Susan Jones**, U.S. EPA Region V, Water Division, and University of Wisconsin-Extension, project manager; **Kim Cates**, Wisconsin Geological and Natural History Survey; and **Fred Madison**, Wisconsin Geological and Natural History Survey and University of Wisconsin-Madison. Special thanks to **Nick Houtman**.

Written by Susan Jones, U. S. EPA Region V, Water Division, and University of Wisconsin-Extension, Cooperative Extension.

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PILOT VERSION

FARM•A•SYST
Farmstead Assessment System

Worksheet #2

Pesticide Storage and Handling

Why should I be concerned?

Pesticides are showing up where they're not wanted—in our drinking water. If pesticides are not handled carefully around the farmstead, they can seep through the ground after a leak or spill, or they can enter a well directly during mixing and loading.

Pesticides play an important role in agriculture. They have increased farm production, and they have enabled farmers to manage more acres with less labor. Taking voluntary action to prevent pesticide contamination of groundwater will help assure their continued availability for responsible use by farmers.

Pesticides work by interfering with the life processes of plants and insects. Pesticides are also toxic to people. If pesticides enter a water supply in large quantities—as can happen with spills or back-siphonage accidents—**acute health effects** (toxic effects apparent after only a short period of exposure) can range from moderate to severe, depending on the toxicity of the pesticide and the amount of exposure. Contaminated groundwater used for drinking water supplies may result in **chronic exposure** (prolonged or repeated exposure to low doses of toxic substances), which may be hazardous to people and livestock.

When found in water supplies, pesticides normally are not present in high-enough concentrations to cause acute health effects, which can include chemical burns, nausea and convulsions. Instead, they typically occur in trace levels, and the concern is primarily for their potential for causing chronic health problems.

The goal of Farm•A•Syst is to help you protect the groundwater that supplies your drinking water.

How will this worksheet help me protect my drinking water?

- It will take you step by step through your pesticide handling, storage and disposal practices.
- It will rank your activities according to how they might affect the groundwater that provides your drinking water supplies.
- It will provide you with easy-to-understand rankings that will help you analyze the "risk level" of your pesticide handling, storage and disposal practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require some modification to better protect your drinking water.

How do I complete the worksheet?

Follow the directions at the top of the chart on the next page. It should take you about 15-30 minutes to complete this worksheet and figure out your ranking.

Worksheet #2

Pesticide Storage and Handling: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your farmstead, read across to the right and circle the statement that best describes conditions on your farmstead. (Skip and leave blank any categories that don't apply to your farmstead.)
3. Then look above the description you circled to find your "rank number" (4, 3, 2 or 1) and enter that number in the blank under "your rank."
4. Directions on overall scoring appear at the end of the worksheet.
5. Allow about 15-30 minutes to complete the worksheet and figure out your risk ranking for pesticide storage and handling practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
PESTICIDE STORAGE					
Amount stored	No pesticides stored.	Less than 1 gallon or less than 10 pounds of each pesticide.	More than 1 gallon or more than 10 pounds of each pesticide.	More than 55 gallons or more than 550 pounds of each pesticide.	____
Types stored:					
Leachability*	No chemicals used.	Chemicals classified by SCS as having a low leaching potential.	Chemicals classified as having medium leaching potential.	Chemicals classified as having high leaching potential.	____
Liquid or dry formulation	No liquids. All dry.	Some liquids. Mostly dry.	Mostly liquids. Some dry.	All liquids.	____
Spill or leak control	Impermeable surface (such as concrete) does not allow spills to soak into soil. Curb installed on floor to contain leaks and spills.	Impermeable surface with curb installed has some cracks, allowing spills to get to soil. OR impermeable surface without cracks has no curb installed.	Permeable surface (wooden floor) has some cracks. Spills could contaminate wood or soil.	Permeable surface (gravel or dirt floor). Spills could contaminate floor.	____
Containers	Original containers clearly labeled. No holes, tears or weak seams.	Original containers old. Labels partially missing or hard to read.	Containers old but patched. Metal containers show signs of rusting.	Containers have holes or tears that allow chemicals to leak. No labels. (X)	____

*See attached Pesticide Leachability Chart.

(X) Besides representing a higher-risk choice, this practice also violates Wisconsin law.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
PESTICIDE STORAGE (continued)					
Security	Fenced or locked area separate from all other activities.	Fenced area separate from most other activities.	Open to activities that could damage containers or spill chemicals.	Open access to theft, vandalism and children.	____
MIXING AND LOADING PRACTICES					
Distance to well from mixing/ loading area with no curbed and paved containment area	100 feet or more downslope from well.	50-100 feet downslope from well. (X)	10-50 feet downslope from well, (X) or 100-500 feet upslope.	Within 10 feet downslope or within 100 feet upslope from well. (X)	____
Spill containment	Concrete pad with curb keeps all spills contained. Drain to sump and piped to storage.	Concrete pad with curb keeps all spills contained. No sump.	Concrete pad with some cracks keeps most spills contained. No curb or sump.	No containment at all. Spills soak into ground or drain toward well.	____
Backflow prevention on water supply	Anti-backflow device installed and/or 6-inch air gap maintained.	Anti-backflow device installed. Hose in tank above waterline.	No anti-backflow device. Hose in tank above waterline.	No anti-backflow device. Hose in tank below water line. (X)	____
Water source	Separate water tank with pump.	Hydrant away from well.	Hydrant near well.	Water directly from well or surface water.	____
Filling supervision	Constant	____	Frequent	Seldom	____

(X) Besides representing a higher-risk choice, this practice also violates Wisconsin law.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
MIXING AND LOADING PRACTICES (continued)					
Handling system	Closed system for all liquid and dry product transfers.	Closed system for most liquids. Some liquid and dry product hand poured. Sprayer fill port easy to reach.	All liquids and dry product hand poured. Sprayer fill port easy to reach.	All liquids and dry product hand poured. Sprayer fill port hard to reach.	____
Sprayer cleaning and rinse water disposal	Sprayer washed out in field. Rinsate (rinse water) used in next load and applied to labeled crop.	Sprayer washed out on pad at farmstead. Rinsate used in next load and applied to labeled crop.	Sprayer washed out at farmstead. Rinsate sprayed less than 100 feet from well.	Sprayer washed out at farmstead. Rinsate dumped at farmstead or in field. (X)	____
CONTAINER DISPOSAL					
Disposal location	Return all triple-rinsed containers to dealers. Take all bags to landfill or designated collection site.	Return most triple-rinsed containers and bags to landfill or designated collection site.	Take contaminated containers to landfill or designated collection site.	Pile uncleaned containers on open ground near well or on exposed bedrock, sandy soils or sinkholes. Dispose on farm by burning. (X)	____
				TOTAL	

(X) Besides representing a higher-risk choice, this practice also violates Wisconsin law.

PESTICIDE LEACHABILITY CHART

The pesticides listed on this chart are identified by brand name, common name and rating for movement by leaching (low, medium or high). Identify the pesticides stored on your farmstead from the listing below. Note the "leachability factor" for each pesticide you store. Then give yourself an overall "leachability ranking" (low, medium or high), based on which ranking best represents the pesticides you store. Then use this ranking to complete the "Leachability" section on the assessment worksheet.

HERBICIDES

Alanap	naptalam	-
Ally	metsulfuron-methyl	-
Amiben	chloramben	-
Amitrol T	amitrole	Med
Antor	diethatyl-ethyl	Low
Arsenal	imazapyr acid	High
Arsenal	imazapyr amine	High
Assert	imazethabenz	High
Assure	quizalofop-ethyl	Low*
Atrazine	atrazine	High
Avenge	difenzoquat	Low
Balan	benefin	Low
Banvel	dicamba	High
Basagran	bentazon	High
Betamix	phenmedipham &	Low
	desmedipham	Low
Betanex	desmedipham	Low
Bicep	metolachlor &	Med
	atrazine	High
Bladex	cyanazine	Med
Blazer	acifluorfen	Med
Bronate	bromoxynil &	Low
	MCPA ester	Low
Bronco	glyphosate &	Low
	alachlor	Med
Buckle	triallate &	Low
	trifluralin	Low
Buctril	bromoxynil	Low
Buctril-Atrazine	bromoxynil & atrazine	Low High
Butyrac 200	2,4-DB amine	Med*
Butyrac	2,4-DB ester	Low*
Cannon	alachlor &	Med
	trifluralin	Low
Carbyne	barban	-
Casoron	dichlobenil	High
Classic	chlorimuron	-
Cobra	lactofen	-
Command	clomazone	Med
Commence	trifluralin &	Low
	clomazone	Med
Crossbow	triclopyr &	Med
	2,4-D ester	Low*
Curtail	clopyralid &	High
	2,4-D amine	Med
Curtail M	clopyralid &	High
	MCPA ester	Low
Dacthal	DCPA	Low
Dowpon	dalapon	High
Dual	metolachlor	Med
Eptam	EPTC	Med
Eradicane	EPTC	Med
Eradicane Extra	EPTC	Med
Evik	ametryn	Med
Extrazine II	atrazine &	High
	cyanazine	Med
Far-Go	triallate	Low
Fusilade 2000	fluazifop	Low
Galaxie	bentazon &	High
	aciflourfen	Med
Genate Plus	butylate	Med
Genep	EPTC	Med
Glean	chlorsulfuron	-
Goal	oxyfluorfen	Low*
Gramoxone Extra	paraquat	Low
Harmony	DPX-M6316 &	-
	Extra DPX-L5300	-
Herbicide 273	endothall	Low
Hoelon	diclofop	Low
Kerb	pronamide	Low
Krenite	fosamine	Low
Laddock	atrazine &	High
	bentazon	High
Lariat	alachlor &	Med
	atrazine	High
Lasso EC	alachlor	Med
Lasso Micro Tech	alachlor	-
Lasso II	alachlor	Med
Lasso-Atrazine	alachlor & atrazine	Med High
Lexone	metribuzin	High
Lorox	linuron	Med
Lorox Plus	linuron &	Med
	chlorimuron	-
Marksman	dicamba &	High
	atrazine	High
MCPA Amine	MCPA amine	-
MCPA Ester	MCPA ester	Low
Nortron	ethofumesate	High
Option	fenoxaprop	Low
Pinnacle	DPX-M6316	-
Poast	sethoxydim	-
Pramitol	prometon	High
Preview	metribuzin &	High
	chlorimuron	-

Princep	simazine	High
Prowl	pendimethalin	Low
Prozine	pendimethalin & atrazine	Low High
Pursuit	imazethapyr	-
Pursuit Plus	imazethapyr & pendimethalin	- Low
Pyramin	pyrazon	High
Ramrod	propachlor	Low
Ramrod-Atrazine	propachlor & atrazine	Low High
Ranger	glyphosate	Low
Reflex	fomesafen	High
Rescue	naptalam & 2,4-DB	- Med*
Rhino	butylate & atrazine	Med High
Ro-Neet	cycloate	Med
Roundup	glyphosate	Low
Salute	metribuzin & trifluralin	High Low
Scepter	imazaquin	-
Sencor	metribuzin	High
Sinbar	terbacil	High
Sonalan	ethalfluralin	Low
Spike	tebuthiuron	High
Stampede	propanil &	Low
CM	MCPA ester	Low
Stinger	clopyralid	High
Storm	bentazon & acifluorfen	High Med
Surflan	oryzalin	Low
Sutan+	butylate	Med
Sutazine+	butylate & atrazine	Med High
2,4-D Amine	2,4-D amine	Med
2,4-D Ester	2,4-D ester	Low*
Tandem	tridiphane	Low
Thistrol	MCPB	-
Tillam	pebulate	Med
Tordon	picloram	High
Treflan	trifluralin	Low
Turbo	metolachlor & metribuzin	Med High
Velpar	hexazinone	High
Vernam	vernolate	Low
Weedar	MCPA amine	-
Weedmaster	dicamba & 2,4-D amine	High Med
Weedone-2,4-DP	dichlorprop -ester	Low*
Whip	fenoxaprop	Low

INSECTICIDES

Ambush	permithrin	Low
Aqua 8-Parathion	parathion	Low
Asana XL	esfenvalerate	Low
Bolstar	sulprofos	Low
Broot	trimethacarb	Low**
Carzol	formetanate	Low
Counter	terbufos	Low
Cygon	dimethoate	Med
Cythion	malathion	Low
Diazinon	diazinon	Med*
Dimilin	diflubenzuron	Low
DiSyston	disulfoton	Low
Dyfonate	fonofos	Med
Dyfonate II	fonofos	Med
Dylox	trichlorfon	High
Endocide	endosulfon	Low
Endocide Plus	endosulfon & parathion	High Low*
Force	tefluthrin	-
Furadan	carbofuran	High
Guthion	azinphos-methyl	Low
Imidan	phosmet	Low
Knox-Out	diazinon	Med*
Lannate	methomyl	High
Larvadex	cyromazine	High *
Larvin	thiodicarb	Low
Lindane	lindane	Med
Lorsban	chlorpyrifos	Low
Malathion	malathion	Low
Malathion/ methoxychlor	malathion & methoxychlor	Low -
Mavrik	fluvalinate	Low
Metasystox-R	demeton-s-methyl	High**
Methoxychlor	methoxychlor	-
Mitac	amitraz	Low**
Mocap	ethoprop	High
Monitor	methamidophos	High
Nudrin	methomyl	High
Orthene	acephate	Low
Parathion	parathion	Low*
Penncap-M	methyl parathion	Low
Phosdrin	mevinphos	Med
Phoskil	parathion	Low*
Pounce	permethrin	Low
Pydrin	fenvalerate	Low
Rampart	phorate	Low
Scout-Xtra	tralomethrin	-
Sevin	carbaryl	Low
Somanil	methidathion	Med
Supracide	methidathion	Med
Swat	phosphamidon	-
Temik	aldicarb	High
Thimet	phorate	Low
Thiodan	endosulfan	Low
Trigard	cyromazine	High*
Vydate	oxamyl	Low

FUNGICIDES

Agsco TN-IV	tin	-
Agsco MN F	maneb & zinc	Low** -
Bayleton	triadimefon	Med

Benlate	benomyl	High
Blitex	maneb & triphenyl tin	Low** -
Botran	dicloran	Low**
Bravo	chlorothalonil	Low
Captan	captan	Low
Carbamate	ferbam	Med
Champion	copper-fixed	-
Crotothane	dinocap	Low**
Cyprex	dodine acetate	Low**
Daconil	chlorothalonil	Low
Dithane	mancozeb	Low
Duter	tin	-
Dyrene	anilazine	Low
Karathane	dinocap	Low**
Kelthane	dicofol	Low**
Kocide	copper hydroxide	-
Magnetic 6	sulfur	-
Maneb	maneb	Low**
Maneb & Zinc	maneb & zinc	Low** -
Manzate	mancozeb	Low
Merteck	thiabendazole	-
Orbit	propiconazole	Med**
Penncozeb	mancozeb	Low
Polyram	metiram	Low**
Protex	maneb triphenyl tin	Low** -
Ridomil	metalaxyl	High
Ronilan	vinclozalin	Low**
Rovral	iprodione	Low*
Rubigan	fenarimol	High
Super Six	sulfur	-
Super Tin	tin	-
Telone II	dichloropropene	Med
Terrachlor	PCNB	Low*
Tersan	benomyl	High
That F	sulfur	-
Thiolux	sulfur	-
Tilt	propiconazole	Med**
Top Cop	basic copper sulfate	-
Topsin	thiophanate methyl	Low**
Triphenyl Tin Hydroxide	triphenyltin hydroxide	-
Triple Tin	triphenyltin hydroxide	- -
Vitavax	carboxin	Low
Vorlex	dichloropropene & methyl-isothiocyanate	Med Med

* The rating is an estimate, but reasonably accurate compared to estimated ratings footnoted **.
** The rating is a guess, and subject to a higher degree of error than estimates footnoted *.

Adapted from Becker, R.L., et al. 1990, **Pesticides: Surface Runoff, Leaching, and Exposure Concerns.** Minnesota Extension Service. Data were derived from U.S. Dept. of Agriculture SCS/ARS Pesticides Properties Data Base, Version 1.9, August 1989, developed by R.D. Wauchope, and ratings derived by D.W. Goss.

EXHIBIT 16 - Continued

What do I do with these rankings?

Step 1: Begin by determining your overall pesticide management risk ranking. Total the rankings for the categories you completed and divide by the number of categories you ranked:

_____ (total of rankings) divided by _____ (# of categories ranked) equals ☐* (risk ranking)

*Carry your answer out to one decimal place.

4=low risk 3=low to moderate risk 2=moderate to high risk 1=high risk

This ranking gives you an idea of how your pesticide management practices as a whole might be affecting your drinking water. This ranking should serve only as a very general guide, not a precise diagnosis. Because it represents an averaging of many individual rankings, it can mask any individual rankings (such as 1's or 2's) that should be of concern. (Step 2 will focus on individually ranked activities of concern.)

Enter your boxed pesticide management risk ranking in the appropriate place on page 2 of worksheet #12. Later you will compare this risk ranking with other farmstead management rankings. Worksheet #11 will help you determine your farmstead's site conditions (soil type, soil depth and bedrock characteristics), and worksheet #12 will show you how these site conditions affect your risk rankings.

Step 2: Look over your rankings for individual activities. First take note of any 4's and 3's:
- **Low-risk** practices (4's): ideal; should be your goal despite cost and effort
- **Low-to-moderate-risk** practices (3's): provide reasonable groundwater protection

Now pay particular attention to any 2's or 1's:
- **Moderate-to-high-risk** practices (2's): inadequate protection in many circumstances
- **High-risk** practices (1's): inadequate; pose a high risk of polluting groundwater

Regardless of your overall risk ranking, any individual rankings of "1" require immediate attention. Some concerns you can take care of right away; others could be major—or costly—projects, requiring planning and prioritizing before you take action.

Find any activities that you identified as 1's and list them under "High-Risk Activities" on pages 6-7 of worksheet #12.

Step 3: Read "Improving Pesticide Storage and Handling," and give some thought to how you might modify your farmstead practices to better protect your drinking water.

FARM•A•SYST
Farmstead Assessment System

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PILOT VERSION

FARM•A•SYST
Farmstead Assessment System

Worksheet #3

Fertilizer Storage and Handling

Why should I be concerned?

Fertilizers play a vital role in agriculture. Over the years, they have increased farm production dramatically. Commercial fertilizer is, however, a major source of nitrate. Nitrate levels exceeding the public health standard of 10 ppm (parts per million) nitrate-nitrogen have been found to occur in many drinking water wells.

Nitrate levels in drinking water above federal and state drinking water standards of 10 ppm nitrate-nitrogen can pose a risk to some infants. Infants under 6 months of age are particularly susceptible to health problems from high nitrate-N levels, including the condition known as methemoglobinemia (blue baby syndrome). Nitrate can also affect adults, but the evidence is much less certain.

Young livestock are also particularly susceptible to health problems from high nitrate-N levels. While livestock may be able to tolerate several times the 10 ppm nitrate-nitrogen level, levels of 20-40 ppm may prove harmful, especially in combination with high levels (1,000 ppm) of nitrate from feed sources.

Farmstead handling of fertilizers can affect groundwater by allowing materials containing nitrogen to seep through the ground after a leak or spill. Other potential farmstead sources of nitrate are septic systems, livestock yards, livestock waste storage facilities and silage storage.

The goal of Farm•A•Syst is to help you protect the groundwater that supplies your drinking water.

How will this worksheet help me protect my drinking water?

- It will take you step by step through your fertilizer handling, storage and disposal practices.
- It will rank your activities according to how they might affect the groundwater that provides your drinking water supplies.
- It will provide you with easy-to-understand rankings that will help you analyze the "risk level" of your fertilizer handling, storage and disposal practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require some modification to better protect your drinking water.

How do I complete the worksheet?

Follow the directions at the top of the chart on the next page. It should take you about 15-30 minutes to complete this worksheet and figure out your ranking.

Worksheet #3

Fertilizer Storage and Handling: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your farmstead, read across to the right and circle the statement that best describes conditions on your farmstead. (Skip and leave blank any categories that don't apply to your farmstead.)
3. Then look above the description you circled to find your "rank number" (4, 3, 2 or 1) and enter that number in the blank under "your rank."
4. Directions on overall scoring appear at the end of the worksheet.
5. Allow about 15-30 minutes to complete the worksheet and figure out your risk ranking for fertilizer storage and handling practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
FERTILIZER STORAGE					
Dry formulation					
Amount stored	None stored	Less than 1 ton.	Between 1 and 20 tons.	More than 20 tons.	____
Type of storage	Covered on impermeable surface (such as concrete or asphalt). Spills can be collected easily.	Partial cover on clay soil. Spills can be collected.	Partial cover on loamy soils. Spills not collected.	No cover on sandy soils. Spills not collected.	____
Liquid formulation					
Amount stored	None stored.	Less than 55 gallons.	Between 55 and 1500 gallons.	More than 1500 gallons.	____
Type of storage	Concrete or other impermeable secondary containment does not allow spill to contaminate soil.	Clay-lined secondary containment. Most of spill can be recovered.	Somewhat permeable soils (loam). No secondary containment. Most of spill cannot be recovered.	Permeable soil (sand). No secondary containment. Spills contaminate soil.	____
Containers	Original containers clearly labeled. No holes, tears or weak seams. Lids tight.	Original containers old. Labels partially missing or hard to read.	Containers old but patched. Metal containers showing signs of rusting.	Containers have holes or tears that allow fertilizers to leak. No labels.	____

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
FERTILIZER STORAGE (continued)					
Security	Fenced or locked area separate from all other activities, or locks on valves.	Fenced area separate from most other activities.	Open to activities that could damage containers or spill fertilizer.	Open access to theft, vandalism and children.	____
MIXING AND LOADING PRACTICES					
Distance to well from mixing and loading area with no containment (curbed and impermeable surface)	100 or more feet downslope from well.	50 to 100 feet downslope.*	10 to 50 feet downslope,* or 100 to 500 feet upslope.	Within 10 feet downslope * or 100 feet upslope.	____
ADDITIONAL MIXING AND LOADING PRACTICES FOR LIQUID FERTILIZER					
Mixing and loading pad (spill containment)	Concrete mixing/ loading pad with curb keeps all spills contained. Sump allows collection and transfer to storage.	Concrete pad with some cracks keeps most spills contained. No curb or sump.	No mixing/loading pad. Somewhat impermeable surface(such as clay). Spills contaminate soil.	No mixing/loading pad. Permeable soil (sand). Spills soak into ground.	____
Water source	Separate water tank with pump.	Hydrant away from well.	Hydrant near well.	Water directly from well or surface water.	____
Backflow prevention on water supply	Anti-backflow device installed and/or 6-inch air gap maintained.	Anti-backflow device installed. Hose in tank above waterline.	No anti-backflow device. Hose in tank above waterline.	No anti-backflow device. Hose in tank below water line. *	____
Filling supervision	Constant	_____	Frequent	Seldom	____

* Although these practices are legal for fertilizers in Wisconsin, they are illegal for pesticides. Therefore, if the same area is used for both pesticide and fertilizer handling, these conditions are illegal.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
ADDITIONAL MIXING AND LOADING PRACTICES FOR LIQUID FERTILIZER (continued)					
Handling system	Closed system for all liquid product transfers.	Closed system for most liquids. Some liquids hand poured. Sprayer fill port easy to reach.	All liquids hand poured. Sprayer fill port easy to reach.	All liquids hand poured. Sprayer fill port hard to reach.	____
CLEANUP AND DISPOSAL PRACTICES					
Sprayer cleaning and rinsate disposal	Sprayer washed out in field. Rinsate used in next load and applied to labeled crop.	Sprayer washed out on pad at farmstead. Rinsate used in next load and applied to labeled crop.	Sprayer washed out at farmstead. Rinsate sprayed less than 100 feet from well.	Sprayer washed out at farmstead. Rinsate dumped at farmstead or in field. *	____
				TOTAL	

* Although these practices are legal for fertilizers in Wisconsin, they are illegal for pesticides. Therefore, if the same area is used for both pesticide and fertilizer handling, these conditions are illegal.

What do I do with these rankings?

Step 1: Begin by determining your overall fertilizer management risk ranking. Total the rankings for the categories you completed and divide by the number of categories you ranked:

_____ divided by _____ equals [ ]*
total of rankings # of categories ranked risk ranking

*Carry your answer out to one decimal place.

4=low risk 3=low to moderate risk 2=moderate to high risk 1=high risk

This ranking gives you an idea of how your fertilizer management practices as a whole might be affecting your drinking water. This ranking should serve only as a very general guide, not a precise diagnosis. Because it represents an averaging of many individual rankings, it can mask any individual rankings (such as 1's or 2's) that should be of concern. (Step 2 will focus on individually ranked activities of concern.)

Enter your boxed fertilizer management risk ranking in the appropriate place on page 2 of worksheet #12. Later you will compare this risk ranking with other farmstead management rankings. Worksheet #11 will help you determine your farmstead's site conditions (soil type, soil depth and bedrock characteristics), and worksheet #12 will show you how these site conditions affect your risk rankings.

Step 2: Look over your rankings for individual activities. First take note of any 4's and 3's:
- **Low-risk** practices (4's): ideal; should be your goal despite cost and effort
- **Low-to-moderate-risk** practices (3's): provide reasonable groundwater protection

Now pay particular attention to any 2's or 1's:
- **Moderate-to-high-risk** practices (2's): inadequate protection in many circumstances
- **High-risk** practices (1's): inadequate; pose a high risk of polluting groundwater

Regardless of your overall risk ranking, any individual rankings of "1" require immediate attention. Some concerns you can take care of right away; others could be major—or costly—projects, requiring planning and prioritizing before you take action.

Find any activities that you identified as 1's and list them under "High-Risk Activities" on pages 6-7 of worksheet #12.

Step 3: Read "Improving Fertilizer Storage and Handling," and give some thought to how you might modify your farmstead practices to better protect your drinking water.

FARM•A•SYST
Farmstead Assessment System

The Farmstead Assessment System is a cooperative project of the University of Wisconsin-Extension, Cooperative Extension; Minnesota Extension Service; and the U.S. Environmental Protection Agency Region V.

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FARM•A•SYST team members: **Gary Jackson**, University of Wisconsin-Extension, and **Jim Anderson**, Minnesota Extension Service, directors; **Susan Jones**, U.S. EPA Region V, Water Division, and University of Wisconsin-Extension, project manager; **Kim Cates**, Wisconsin Geological and Natural History Survey; and **Fred Madison**, Wisconsin Geological and Natural History Survey and University of Wisconsin-Madison. Special thanks to **Nick Houtman**.

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PILOT VERSION

FARM•A•SYST
Farmstead Assessment System

Worksheet #4

Petroleum Product Storage

Why should I be concerned?

Above-ground and underground storage of fuel presents a threat to public health and the environment. Nearly one out of every four underground storage tanks in the United States may now be leaking, according to the U.S. Environmental Protection Agency. If an underground petroleum tank is more than 20 years old, especially if it's not protected against corrosion, the potential for leaking increases dramatically. Newer tanks and piping can leak, too, especially if they weren't installed properly.

Even a small gasoline leak of one drop per second can result in the release of about 400 gallons of gasoline into the groundwater in one year. Even a few quarts of gasoline in the groundwater may be enough to severely pollute a farmstead's drinking water. At low levels of contamination, fuel contaminants in water cannot be detected by smell or taste, yet the seemingly pure water may be contaminated to the point of affecting human health.

Preventing tank spills and leaks is especially important because of how rapidly gasoline, diesel and fuel oil can move through surface layers and into groundwater. Also, vapors from an underground leak that collect in basements, sumps or other underground structures have the potential to explode.

Petroleum fuels contain a number of potentially toxic compounds, including common solvents, such as benzene, toluene and xylene, and additives, such as ethylene dibromide (EDB) and organic lead compounds. EDB is a carcinogen (cancer-causer) in laboratory animals, and benzene is considered a human carcinogen.

The goal of Farm•A•Syst is to help you protect the groundwater that supplies your drinking water.

How will this worksheet help me protect my drinking water?

- It will take you step by step through your petroleum product storage practices.
- It will rank your activities according to how they might affect the groundwater that provides your drinking water supplies.
- It will provide you with easy-to-understand rankings that will help you analyze the "risk level" of your petroleum product storage practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require some modification to better protect your drinking water.

How do I complete the worksheet?

Follow the directions at the top of the chart on the next page. It should take you about 15-30 minutes to complete this worksheet and figure out your ranking.

Petroleum Product Storage: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your farmstead, read across to the right and circle the statement that best describes conditions on your farmstead. (Skip and leave blank any categories that don't apply to your farmstead.)
3. Then look above the description you circled to find your "rank number" (4, 3, 2 or 1) and enter that number in the blank under "your rank."
4. Directions on overall scoring appear at the end of the worksheet.
5. Allow about 15-30 minutes to complete the worksheet and figure out your risk ranking for petroleum product storage practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
LOCATION (all tanks)					
Distance of tank from well	Tank downhill more than 100 feet from well in tight soil.	Tank at grade or uphill more than 100 feet from well in tight soil.	Tank downhill more than 100 feet from well in sandy soil.	Tank at grade or uphill less than 100 feet from well in sandy soil.	____
Tank location and local land use (leakage potential)	Well-drained soils. Water table always beneath tank. Above-ground tank more than 50 feet from buildings.	Moderately well-drained soils. Only occasionally high water table.	Located more than 50 feet from buildings. Silty or clayey soils saturated seasonally.	Located near buildings and in area with clayey soils often saturated.	____
DESIGN AND INSTALLATION (all tanks)					
Type and age of tank/cathodic protection	Synthetic tank or tank protected from rust by electrolysis (cathodic protection).	Steel tank less than 15 years old, coated with paint or asphalt.	Coated steel tank 15 or more years old. OR bare steel tank less than 15 years old.	Bare steel tank 15 or more years old.	____
Spill and overfill protection	Catch basin plus automatic shut off.	Catch basin plus overfill alarm.	Catch basin or concrete catch pad.	No protection.	____
Piping	Piping protected from rust by electrolysis (cathodic protection) and insulated from tank, sloped back to tank. Check valve at pump (not at tank).	Piping galvanized but not insulated from tank. Pipe drains back to tank. Check valve at pump.	Pipe galvanized, not insulated or bare. Piping sloped back to tank, but check valve is located at tank (foot valve).	Piping and tank insulated and of dissimilar materials. Uninsulated pipe bare, cannot drain freely to the tank. All pressure pipe systems.	____
Tank installation	Installed by experienced installer.	Installed according to industry recommendations.	No information on installation.	Installed without backfill, anchors and other prescribed protections.	____

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
DESIGN AND INSTALLATION (above-ground tanks only)					
Tank enclosure	Tank surrounded by 6-foot tall noncombustible building or fence with lock. Building well-ventillated. 4-hour firewall.	Tank surrounded by low fence with lock. 4-hour fire wall.	Tank surrounded by low fence. No lock. No firewall.	No enclosure.	____
Secondary containment	Tank placed within concrete or synthetic dike with pad able to hold 125% of tank capacity.	Tank placed within dike and pad made or low permeability soils, able to hold 125% of tank capacity.	Tank placed on pad.	No secondary containment.	____
MONITORING (all tanks)					
Tank integrity testing and leak protection monitoring	Regular leak monitoring. Daily inventory control. Tank tightness testing.	Regular tank tightness testing and daily inventory control.	Static tightness testing only.	No inventory control, testing or monitoring.	____
TANK CLOSURE (underground tanks)					
Abandoned or unused tank	Tank taken from ground. Soil checked for evidence of contamination.	Tank filled with inert material and soil checked for evidence of leaking.	Tank removed or filled with inert material. Soil not checked for contamination.	Tank left in ground.	____
				TOTAL	

What do I do with these rankings?

Step 1: Begin by determining your overall petroleum product storage risk ranking. Total the rankings for the categories you completed and divide by the number of categories you ranked:

_____ divided by _____ equals		*
total of rankings	# of categories ranked	risk ranking

*Carry your answer out to one decimal place.

4=low risk 3=low to moderate risk 2=moderate to high risk 1=high risk

This ranking gives you an idea of how your petroleum product storage as a whole might be affecting your drinking water. This ranking should serve only as a very general guide, not a precise diagnosis. Because it represents an averaging of many individual rankings, it can mask any individual rankings (such as 1's or 2's) that should be of concern. (Step 2 will focus on individually ranked activities of concern.)

Enter your boxed petroleum product storage risk ranking in the appropriate place on page 2 of worksheet #12. Later you will compare this risk ranking with other farmstead management rankings. Worksheet #11 will help you determine your farmstead's site conditions (soil type, soil depth and bedrock characteristics), and worksheet #12 will show you how these site conditions affect your risk rankings.

Step 2: Look over your rankings for individual activities. First take note of any 4's and 3's:

- **Low-risk** practices (4's): ideal; should be your goal despite cost and effort
- **Low-to-moderate-risk** practices (3's): provide reasonable groundwater protection

Now pay particular attention to any 2's or 1's:

- **Moderate-to-high-risk** practices (2's): inadequate protection in many circumstances
- **High-risk** practices (1's): inadequate; pose a high risk of polluting groundwater

Regardless of your overall risk ranking, any individual rankings of "1" require immediate attention. Some concerns you can take care of right away; others could be major—or costly—projects, requiring planning and prioritizing before you take action.

Find any activities that you identified as 1's and list them under "High-Risk Activities" on pages 6-7 of worksheet #12.

Step 3: Read "Improving Petroleum Product Storage," and give some thought to how you might modify your farmstead practices to better protect your drinking water.

FARM•A•SYST
Farmstead Assessment System

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PILOT VERSION

FARM•A•SYST
Farmstead Assessment System

Worksheet #5

Hazardous Waste Management

Why should I be concerned?

Consider the variety of products commonly used in households and on farms: paints, solvents, oils, cleaners, wood preservatives, batteries, adhesives and pesticides. In addition, some common disposal practices not only threaten groundwater but also may be illegal.

Small, unusable amounts often wind up spilled, buried, dumped or flushed onto farm property. Minimizing the amounts of these substances used on the farm, along with practicing proper disposal practices, can reduce both health risks and the potential for groundwater contamination. Farmers and their families are generally familiar with the hazards of pesticides commonly used in the farm operation, but they may be less aware of thehazards of other chemicals that make many tasks around the home and farm easier or more efficient.

Improper use of hazardous products may cause toxic health effects. Improper storage may allow chemicals to leak, causing potentially dangerous chemical reactions, toxic health effects or groundwater contamination. Improper disposal allows these dangerous chemicals to enter directly into drinking water through surface water or groundwater. *(For more specific information on potential health effects of toxic contaminants, refer to the chart titled "Health Effects of Sample Contaminants.")*

The goal of Farm•A•Syst is to help you protect the groundwater that supplies your drinking water.

How will this worksheet help me protect my drinking water?

- It will take you step by step through your hazardous waste management practices.
- It will rank your activities according to how they might affect the groundwater that provides your drinking water supplies.
- It will provide you with easy-to-understand rankings that will help you analyze the "risk level" of your hazardous waste management practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require some modification to better protect your drinking water.

How do I complete the worksheet?

Follow the directions at the top of the chart on the next page. It should take you about 15-30 minutes to complete this worksheet and figure out your ranking.

Information derived from Farm•A•Syst worksheets is intended only to provide general information and recommendations to farmers regarding their own farmstead practices. It is not the intent of this educational program to keep records of individual results.

Hazardous Waste Management: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your farmstead, read across to the right and circle the statement that best describes conditions on your farmstead. (Skip and leave blank any categories that don't apply to your farmstead.)
3. Then look above the description you circled to find your "rank number" (4, 3, 2 or 1) and enter that number in the blank under "your rank."
4. Directions on overall scoring appear at the end of the worksheet.
5. Allow about 15-30 minutes to complete the worksheet and figure out your risk ranking for hazardous waste disposal practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
ASH DISPOSAL					
From farm burn-barrel or incinerator	Collect and dispose of at engineered landfill.	Disposal of ash *from dry combustibles only*, on farm or at dump, or spread on fields.	Disposal of ash from mixed trash at dump.	On-farm disposal of ash from mixed trash in consistent location near well. *	____
BUILDING/WOOD MAINTENANCE PRODUCTS					
Adhesives, such as caulk and solvent-based glues	Use up or share with someone else. Use hazardous waste contractor collection service.	Evaporate liquid in open air. Take sludge to engineered landfill.	Take product to engineered landfill or municipal incinerator.	On-farm disposal. *	____
Brush or spray gun	Clean in contained, ventilated area. Use solvent recycler collection service.	Clean in contained, ventilated area. Filter and reuse clean liquid. Or evaporate in open air.	Clean in uncontained, ventilated area.	Disposal of used solvents in on-farm dump or in landfill. *	____
Paint or stain	Use up or share with someone else. Use hazardous waste contractor.	Evaporate liquid in open air. Take sludge to engineered landfill.	Take latex paint to engineered landfill.	Disposal of oil-based paints or stains on farm or at dump.	____

* Not legal for products used in the farm business. Household quantities are exempt from regulation.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
BUILDING/WOOD MAINTENANCE PRODUCTS (continued)					
Stripper for paint or finish and paint thinner	Contain spills. Use up unused product. Use hazardous waste contractor collection service.	Evaporate liquid in open air. Take sludge to engineered landfill.	Take to engineered landfill or municipal incinerator. *	On-farm disposal. *	____
Lead-based paint	Use hazardous waste contractor collection service.	____	Evaporate liquid in open air. Take sludge to engineered landfill.	On-farm disposal. Liquid or sludge disposal in dump. Liquid disposal in engineered landfill.	____
Solvent-based surface cleaners	Use up or share with someone else. Use hazardous waste contractor collection service.	Evaporate liquid in open air. Take sludge to engineered landfill.	Take to engineered landfill or municipal incinerator. *	On-farm disposal. *	____
EMPTY CONTAINER DISPOSAL					
Paper/cardboard pesticide container	____	Take empty to engineered landfill or municipal incinerator.	Take empty to town dump or on-farm disposal.	Partially full container disposal on farm.	____
Plastic pesticide container	Triple rinse. Return container to retail store for reuse. Apply rinsate to appropriate crop.	Take triple-rinsed container to engineered landfill.	Take unrinsed container to engineered landfill.	Take unrinsed container to dump or on-farm disposal.	____
Full plastic container for oil or other vehicle product	No low-risk disposal practice. Recycle container.	Evaporate any remaining ingredients in safe conditions. Take empty to engineered landfill or municipal incinerator.	Take empty to town dump. *	Partially filled container disposal on farm.	____

* Not legal for products used in the farm business. Household quantities are exempt from regulation.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
EMPTY CONTAINER DISPOSAL (continued)					
Plastic container for household product (such as cleaning product)	Take to recycling facility or reuse for similar product.	Take empty to engineered landfill or municipal incinerator.	Take empty to town dump. * Or on-farm disposal.	Partially filled container disposal on farm.	____
PESTICIDES					
Unwanted or banned pesticides	Participate in EPA banned pesticide buy-back program if available. Return unused pesticides to place of purchase. Use hazardous waste contractor collection service.	Use up pesticides sold for restricted or general use.	All other practices represent a moderate to high risk.	All other practices represent a moderate to high risk.	____
VEHICLE/METAL EQUIPMENT MAINTENANCE PRODUCTS					
Used antifreeze	Save and take to antifreeze recycling facility. Or filter and reuse as water in other radiators.	Collect and dispose at municipal sewage treatment drain with permission of municipality.	Take to engineered landfill, municipal incinerator or town dump. Dispose on farm (including in septic system).	Dump near well.	____
Waste oil and grease	Take to used oil collection tank for recycling.	Reuse for lubrication. Burn for heat in a DNR-approved incinerator.	Infrequent on-farm disposal of very small amounts.*	Frequent disposal on farm. *	____
Waste oil sludge (left over after burning)	Use hazardous waste contractor services.	Collect and dispose of at engineered landfill.	Occasional disposal of small amounts in a town dump.	Frequent disposal on farm.	____

* Not legal for products used in the farm business. Household quantities are exempt from regulation.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
VEHICLE/METAL EQUIPMENT MAINTENANCE PRODUCTS (continued)					
Spent organic solvent/parts cleaner	Collect. Use solvent recycler collection service (works for parts cleaning but not for other solvent uses).	Filter in ventilated area. Reuse clean liquid. Take sludge to engineered landfill or hazardous waste contractor.	Take sludge to engineered landfill or municipal incinerator. *	Town dump or on-farm disposal. *	____
Rust-removal products	Use up or share with someone else. Use hazardous waste contractor services.	Take to engineered landfill or municipal incinerator.	Dump or on-farm disposal. *	____	____
Lead acid battery	Take to battery recycler or battery store.	Take to engineered landfill. Store used batteries away from well.	Store used batteries near well.	Dump or on-farm disposal near well. *	____
Vehicle maintenance drips and spills	Contain on paved area with sawdust. Evaporate and dispose of sludge at engineered landfill.	Infrequent flushing onto farm property.	Occasional flushing onto farm property near well.	On-farm disposal. Frequent flushing onto farm property near well.	____
WOOD PRESERVING					
Application	Contain drips and spills. Label and retain leftovers for future use. Use hazardous waste contractor collection service.	Aplication with containment. Dispose in engineered landfill.	Application without containment more than 100 feet from well.	Application without containment within 100 feet of well.	____
Disposal of unused preservatives	Use up or share with someone else. Use hazardous waste contractor collection service.	One-time disposal of small amount away from well.	Occasional disposal of small amount away from well.	All other disposal practices present high risk.	____

TOTAL ☐

* Not legal for products used in the farm business. Household quantities are exempt from regulation.

What do I do with these rankings?

Step 1: Begin by determining your overall hazardous waste risk ranking. Total the rankings for the categories you completed and divide by the number of categories you ranked:

_____ divided by _____ equals	
total of rankings / # of categories ranked	risk ranking*

*Carry your answer out to one decimal place.

4=low risk 3=low to moderate risk 2=moderate to high risk 1=high risk

This ranking gives you an idea of how your hazardous waste practices **as a whole** might be affecting your drinking water. This ranking should serve only as a **very general guide, not a precise diagnosis.** Because it represents an **averaging** of many individual rankings, it can mask any **individual** rankings (such as 1's or 2's) that should be of concern. (Step 2 will focus on individually ranked activities of concern.)

Enter your boxed hazardous waste risk ranking in the appropriate place on page 3 of worksheet #12. Later you will compare this risk ranking with other farmstead management rankings. Worksheet #11 will help you determine your farmstead's site conditions (soil type, soil depth and bedrock characteristics), and worksheet #12 will show you how these site conditions affect your risk rankings.

Step 2: Look over your rankings for individual activities. First take note of any 4's and 3's:
- **Low-risk** practices (4's): ideal; should be your goal despite cost and effort
- **Low-to-moderate-risk** practices (3's): provide reasonable groundwater protection

Now pay particular attention to any 2's or 1's:
- **Moderate-to-high-risk** practices (2's): inadequate protection in many circumstances
- **High-risk** practices (1's): inadequate; pose a high risk of polluting groundwater

Regardless of your overall risk ranking, any individual rankings of "1" require immediate attention. Some concerns you can take care of right away; others could be major—or costly—projects, requiring planning and prioritizing before you take action.

Find any activities that you identified as 1's and list them under "High-Risk Activities" on pages 6-7 of worksheet #12.

Step 3: Read "Improving Hazardous Waste Management," and give some thought to how you might modify your farmstead practices to better protect your drinking water.

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Technical review provided by:

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PILOT VERSION

FARM•A•SYST
Farmstead Assessment System

Worksheet #6

Household Wastewater Treatment

Why should I be concerned?

Virtually all farms use a septic system or similar on-site wastewater treatment system. While these systems are generally economical and safe, household wastewater can contain contaminants that degrade water quality for such uses as drinking, stock watering, food preparation and cleaning.

Potential contaminants in household wastewater include disease-causing bacteria, infectious viruses, household chemicals, and excess nutrients, such as nitrate. Viruses can infect the liver, causing hepatitis. They can also infect the lining of the intestine, causing gastroenteritis (vomiting and diarrhea). If coliform organisms (a group of indicator bacteria) are found in your well water, they show that the water is potentially dangerous for drinking and food preparation. Your septic system is one potential source, along with livestock yards and others.

The quantity of wastewater can also present an environmental concern. Too much water entering the home treatment system reduces the efficiency of the treatment and can shorten its life.

The goal of Farm•A•Syst is to help you protect the groundwater that supplies your drinking water.

How will this worksheet help me protect my drinking water?

- It will take you step by step through your household wastewater treatment practices.
- It will rank your activities according to how they might affect the groundwater that provides your drinking water supplies.
- It will provide you with easy-to-understand rankings that will help you analyze the "risk level" of your household wastewater treatment practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require some modification to better protect your drinking water.

How do I complete the worksheet?

Follow the directions at the top of the chart on the next page. It should take you about 15-30 minutes to complete this worksheet and figure out your ranking.

Household Wastewater Treatment: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your farmstead, read across to the right and circle the statement that best describes conditions on your farmstead. (Skip and leave blank any categories that don't apply to your farmstead.)
3. Then look above the description you circled to find your "rank number" (4, 3, 2 or 1) and enter that number in the blank under "your rank."
4. Directions on overall scoring appear at the end of the worksheet.
5. Allow about 15-30 minutes to complete the worksheet and figure out your risk ranking for household wastewater treatment practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
Quantity of wastewater	Conservative water use (less than 20 gallons per person per day). Good maintenance. Water-conserving fixtures.	Moderate water use (20-60 gallons per person per day). Fair maintenance of fixtures. Water softener recharges twice a week or less.	High water use (60-120 gallons per person per day). Poor maintenance of fixtures. Water softener recharges more than twice a week.	Excessive water use (greater than 120 gallons per person per day). Leaking fixtures. Fixtures with no volume controls.	____
Quality of wastewater					
Settleable solids	No garbage disposal unit.	Minimal use of garbage disposal unit (1-2 times per week).	Moderate use of garbage disposal unit (3-5 times per week).	Daily use of garbage disposal unit.	____
Dissolved solids	Minimal use of household chemicals. No disposal of solvents and cleaning agents. No water softener, or not recharged on site.	Careful use of household chemicals (cups per week). Minimal disposal of solvents and cleaning agents. Use water softener, recharged on site.	Moderate use of household chemicals (quarts per week). Moderate disposal of solvents and cleaning agents.	Extensive use of household chemicals (gallons per week). Extensive disposal of solvents and cleaning agents.	____
Floatable solids	No disposal of grease or oils into sewer. Domestic wastes only.	Minimal disposal of grease or oils. Oil and grease wiped from cooking utensils before washing.	Moderate disposal of grease or oils. No attempt to reduce disposal of grease and oil from household, but little generated.	Extensive disposal of grease or oils.	____

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
Collection of wastewater	All wastewater collected. No clear water collected. No leakage losses. No settling of soil near tank or collection system. More than 50 feet from well.	All wastewater collected. Some clear water collected. No leakage losses.	Some wastewater diverted, or some leakage and infiltration.	Clear water infiltration. Leakage losses. Less than 25 feet from well.	____
Pretreatment system:					
Cesspool *	____	____	____	Any cesspool or direct discharge of water.	____
OR					**OR**
Septic tank	____	Serial tanks or added solids retention system. No leakage. Pumped at less than 3-year intervals. Baffles checked.	Single tank. Pumped at 5-6 year intervals.	Leakage losses. Seldom pumped out. Less than 25 feet from well. Less than 3 feet from saturation or bedrock.	____
OR					**OR**
Packaged aerobic system	Maintenance program followed. Loaded at less than design capacity.	No mechanical failures. Loaded near design capacity.	Occasional failures.	Frequent system failure. Load exceeds design capacity.	____
OR					**OR**
Holding tank	Excess capacity for pumping interval. More than 50 feet downslope from well. No leakage.	Excess capacity for pumping interval. More than 50 feet upslope from well. No leakage.	Occasional overflow or leakage.	Less than 25 feet from well. Leakage losses. Upslope from well.	____

* Also known as dry well or seepage pit

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
Additional treatment (all systems)	Aeration, denitrification, filtration, disinfection.	Aeration.	Filtration and/or disinfection.	No additional treatment.	____
Disposal of wastewater					
Surface distribution	Offsite disposal.	Sufficient storage to accommodate best application. Incorporated.	Frequent spreading. No incorporation.	Bed or pit, agricultural field or silo drainage system.	____
OR					**OR**
Surface distribution	Offsite disposal.	Pressure distribution to trench system.	"Gravity" distribution to trench system.	Bed or pit, agricultural field or silo drainage system.	____
Horizontal separation from water supply	Offsite disposal.	Downslope more than 50 feet from well.	Downslope less than 50 feet from well.	Upslope from well.	____
Vertical separation from water supply	Offsite disposal.	More than 6 feet to saturated soil or bedrock.	More than 3 feet to saturated soil or bedrock.	Less than 3 feet to saturated soil or bedrock.	____
Surface discharge rate	Offsite disposal.	Less than 1/2 gallon per square foot per year. Vegetation harvested.	More than 1/2 gallon per square foot per year. No vegetation harvesting.	____	____
OR					**OR**
Subsurface discharge rate	Offsite disposal.	____	Below design capacity.	At or above design capacity.	____

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
Disposal of waste-water (continued)					
Soils	Offsite disposal.	Loams or finer.	Sands.	Coarse sand or coarser.	____
Disposal of septage or sludge					
Surface distribution	Offsite disposal.	Sufficient storage to accommodate best application time. Incorporated. Approved disposal site.	Frequent spreading. No incorporation. Approved disposal site.	Non-approved site.	____
Horizontal separation from water supply	Offsite disposal.	Downslope more than 50 feet.	Downslope less than 50 feet.	Upslope from water supply.	____
Horizontal separation from water supply	Offsite disposal.	____	More than 3 feet to saturated soil or bedrock.	Less than 3 feet to saturated soil or bedrock.	____
Soils	Offsite disposal.	Loams or finer.	Sands.	Coarse sand or coarser.	____
Surface discharge rate	Offsite disposal.	Less than 1/10 gallon per square foot per year. Vegetation harvested.	Less than 1 gallon per square foot per year. No vegetation harvesting.	More than 1 gallon per square foot per year.	____
				TOTAL	

What do I do with these rankings?

Step 1: Begin by determining your overall household wastewater risk ranking. Total the rankings for the categories you completed and divide by the number of categories you ranked:

_____ divided by _____ equals	*
total of rankings / # of categories ranked	risk ranking

*Carry your answer out to one decimal place.

4=low risk 3=low to moderate risk 2=moderate to high risk 1=high risk

This ranking gives you an idea of how your household wastewater practices **as a whole** might be affecting your drinking water. This ranking should serve only as a **very general guide, not a precise diagnosis.** Because it represents an **averaging** of many individual rankings, it can mask any **individual** rankings (such as 1's or 2's) that should be of concern. (Step 2 will focus on individually ranked activities of concern.)

Enter your boxed household wastewater risk ranking in the appropriate place on page 3 of worksheet #12. Later you will compare this risk ranking with other farmstead management rankings. Worksheet #11 will help you determine your farmstead's site conditions (soil type, soil depth and bedrock characteristics), and worksheet #12 will show you how these site conditions affect your risk rankings.

Step 2: Look over your rankings for individual activities. First take note of any 4's and 3's:

- **Low-risk** practices (4's): ideal; should be your goal despite cost and effort
- **Low-to-moderate-risk** practices (3's): provide reasonable groundwater protection

Now pay particular attention to any 2's or 1's:

- **Moderate-to-high-risk** practices (2's): inadequate protection in many circumstances
- **High-risk** practices (1's): inadequate; pose a high risk of polluting groundwater

Regardless of your overall risk ranking, any individual rankings of "1" require immediate attention. Some concerns you can take care of right away; others could be major—or costly—projects, requiring planning and prioritizing before you take action.

Find any activities that you identified as 1's and list them under "High-Risk Activities" on pages 6-7 of worksheet #12.

Step 3: Read "Improving Household Wastewater Treatment," and give some thought to how you might modify your farmstead practices to better protect your drinking water.

FARM•A•SYST
Farmstead Assessment System

The Farmstead Assessment System is a cooperative project of the University of Wisconsin-Extension, Cooperative Extension; Minnesota Extension Service; and the U.S. Environmental Protection Agency Region V.

Funding provided by the North Central Regional Center for Rural Development, U.S. EPA Region V, the U.S. EPA Great Lakes National Program Office, the Wisconsin Department of Natural Resources and the Minnesota Pollution Control Agency.

FARM•A•SYST team members: Gary Jackson, University of Wisconsin-Extension, and Jim Anderson, Minnesota Extension Service, directors; Susan Jones, U.S. EPA Region V, Water Division, and University of Wisconsin-Extension, project manager; Kim Cates, Wisconsin Geological and Natural History Survey; and Fred Madison, Wisconsin Geological and Natural History Survey and University of Wisconsin-Madison. Special thanks to Nick Houtman.

Written by Jim O. Peterson, Environmental Resources Center, University of Wisconsin-Extension, Cooperative Extension; and James C. Converse, Department of Agricultural Engineering, and E. Jerry Tyler, Department of Soil Science, University of Wisconsin-Madison.

Technical review provided by:

Editorial assistance provided by Bruce Webendorfer, University of Wisconsin-Extension, and Linda Schroeder, Schroeder Communications. Special thanks to Christine Kohler.

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PILOT VERSION

FARM•A•SYST
Farmstead Assessment System

Worksheet #7

Livestock Waste Storage

Why should I be concerned?

Storing livestock waste allows farmers to spread manure when conditions are right for nutrient use by crops. Accumulating manure in a concentrated area, however, can be risky to the environment and to human and animal health.

Facilities for manure stored in liquid form on the farmstead sometimes leak or burst, releasing large volumes of pollutants. Manure in earthen pits can form a semi-impervious seal of organic matter that does limit leaching potential, but seasonal filling and emptying can cause the seal to break down. Short-term solid manure storage and abandoned storage areas can also be sources of groundwater contamination by nitrates. Manure can contribute nutrients and disease-causing organisms to both surface water and groundwater.

Nitrate levels in drinking water above federal and state drinking water standards of 10 parts per million (ppm) nitrate-nitrogen can pose health problems for infants under 6 months of age, including the condition known as methemoglobinemia (blue baby syndrom can also affect adults, but the evidence is much less certain.

Young livestock are also susceptible to health problems from high nitrate-N levels. Levels of 20-40 ppm may prove harmful, especially in combination with high levels (1,000 ppm) of nitrate from feed sources.

Fecal and coliform bacteria in livestock waste can contaminate groundwater, causing such infectious diseases as dysentery, typhoid and hepatitis. Organic materials that lend an undesirable taste and odor to drinking water are not known to be dangerous to health, but their presence does suggest that other contaminants are flowing into groundwater.

The goal of Farm•A•Syst is to help you protect the groundwater that supplies your drinking water.

How will this worksheet help me protect my drinking water?

- It will take you step by step through your livestock waste storage practices.
- It will rank your activities according to how they might affect the groundwater that provides your drinking water supplies.
- It will provide you with easy-to-understand rankings that will help you analyze the "risk level" of your livestock waste storage practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require some modification to better protect your drinking water.

How do I complete the worksheet?

Follow the directions at the top of the chart on the next page. It should take you about 15-30 minutes to complete this worksheet and figure out your ranking.

Livestock Waste Storage: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your farmstead, read across to the right and circle the statement that best describes conditions on your farmstead. (Skip and leave blank any categories that don't apply to your farmstead.)
3. Then look above the description you circled to find your "rank number" (4, 3, 2 or 1) and enter that number in the blank under "your rank."
4. Directions on overall scoring appear at the end of the worksheet.
5. Allow about 15-30 minutes to complete the worksheet and figure out your risk ranking for livestock waste storage practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
LONG-TERM STORAGE (180 days or more)					
Steel, glass-lined (liquid-tight, above ground)	Properly installed and maintained.	_____	Leaking tank on medium-textured soils (loams).	Leaking tank on coarse-textured soils (sand).	_____
Concrete stave (liquid-tight)	Designed and installed according to accepted standards and specifications. Properly maintained.	Designed and installed according to accepted standards and specifications. Not maintained.	Concrete cracked, medium-textured soils (loams). Water table deeper than 20 feet.	Concrete cracked, coarse-textured soils (sands). Water table or fractured bedrock shallower than 20 feet.	_____
Poured concrete (liquid-tight)	Designed and installed according to accepted standards and specifications. Properly maintained.	Designed and installed according to accepted standards and specifications. Not maintained.	Concrete cracked, medium-textured soils (loams). Water table deeper than 20 feet.	Concrete cracked, coarse-textured soils (sands). Water table or fractured bedrock shallower than 20 feet.	_____
Earthen-lined	_____	Designed and installed according to accepted standards and specifications.	Not designed to standards. Constructed in medium- or fine-textured dense materials (loams, silts). Water table deeper than 20 feet.	Not designed to standards. Constructed in coarse-textured materials (sands). Fractured bedrock or water table shallower than 20 feet. More than 10 years old.	_____

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
SHORT-TERM STORAGE (usually 30-90 days; in some cases, up to 180 days)					
Stacked in field (on soil base)	———	———	Stacked on high ground. Medium- or fine-textured soils (loams, silts). Water table is deeper than 20 feet.	Stacked on high ground. Coarse-textured soils (sands). Fractured bedrock or water table shallower than 20 feet.	———
Stacked in yard	———	Concrete yard with curbs and gutters. Grass filter strips installed and maintained.	Earthen yard with medium- or fine-textured soils (loams, silts). Water table deeper than 20 feet.	Earthen yard with coarse-textured soils (sands). Fractured bedrock or water table shallower than 20 feet.	———
Water-tight structure designed to accepted standards and specifications	Designed and installed according to standards. Covered with roof.	Designed and installed according to standards on medium- and fine-textured soils (loams, silts). Water table deeper than 20 feet.	Designed and installed according to standards on coarse-textured soils (sands). Water table or fractured bedrock shallower than 20 feet.	Designed and installed according to standards. Not properly maintained. Water treatment and diversion and terrace structures allowed to deteriorate.	
Stacked in open housing	Building has concrete floor, protected from surface water runoff. Adequate bedding provided.	Building has earthen floor on medium- or fine- textured soils (loams, silts), protected from surface water runoff. Water table deeper than 20 feet.	Building has earthen or concrete floor on medium- or fine-textured soils (loams, silts), subject to surface water runoff. Water table or fractured bedrock shallower than 20 feet.	Building has earthen floor on coarse-textured soils (sands), subject to surface water runoff. Water table or fractured bedrock shallower than 20 feet.	———
				TOTAL	

What do I do with these rankings?

Step 1: Begin by determining your overall livestock waste risk ranking. Total the rankings for the categories you completed and divide by the number of categories you ranked:

_____ divided by _____ equals	
total of rankings / # of categories ranked	risk ranking*

*Carry your answer out to one decimal place.

4=low risk 3=low to moderate risk 2=moderate to high risk 1=high risk

This ranking gives you an idea of how your livestock waste practices as a whole might be affecting your drinking water. This ranking should serve only as a very general guide, not a precise diagnosis. Because it represents an averaging of many individual rankings, it can mask any individual rankings (such as 1's or 2's) that should be of concern. (Step 2 will focus on individually ranked activities of concern.)

Enter your boxed livestock waste risk ranking in the appropriate place on page 3 of worksheet #12. Later you will compare this risk ranking with other farmstead management rankings. Worksheet #11 will help you determine your farmstead's site conditions (soil type, soil depth and bedrock characteristics), and worksheet #12 will show you how these site conditions affect your risk rankings.

Step 2: Look over your rankings for individual activities. First take note of any 4's and 3's:

- **Low-risk practices (4's):** ideal; should be your goal despite cost and effort
- **Low-to-moderate-risk practices (3's):** provide reasonable groundwater protection

Now pay particular attention to any 2's or 1's:

- **Moderate-to-high-risk practices (2's):** inadequate protection in many circumstances
- **High-risk practices (1's):** inadequate; pose a high risk of polluting groundwater

Regardless of your overall risk ranking, any individual rankings of "1" require immediate attention. Some concerns you can take care of right away; others could be major—or costly—projects, requiring planning and prioritizing before you take action.

Find any activities that you identified as 1's and list them under "High-Risk Activities" on pages 6-7 of worksheet #12.

Step 3: Read "Improving Livestock Waste Storage," and give some thought to how you might modify your farmstead practices to better protect your drinking water.

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Written by Fred Madison, Wisconsin Geological and Natural History Survey and Department of Soil Science, University of Wisconsin-Madison.

Technical review provided by:

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PILOT VERSION

FARM•A•SYST
Farmstead Assessment System

Worksheet #8

Livestock Yards Management

Why should I be concerned?

Livestock yards, such as barnyards, holding areas and feedlots, are areas of concentrated livestock wastes, which can be a source of nitrate and bacteria contamination of groundwater. This is especially true if there is no system to divert clean water flow from the livestock yard or to collect polluted runoff from the yard for diversion to an area where its effect on surface water or groundwater is minimal. The potential for livestock yards to affect groundwater is greatest if the yard is located over coarse-textured permeable soils, if the water table is at or near the surface, if bedrock is within a few feet of the surface, or when polluted water is discharged to permeable soils and bedrock.

Nitrate levels in drinking water above federal and state drinking water standards of 10 parts per million (ppm) nitrate-nitrogen can pose health problems for infants under 6 months of age, including the condition known as methemoglobinemia (blue baby syndrome). Nitrate can also affect adults, but the evidence is much less certain.

Young livestock are also susceptible to health problems from high nitrate-N levels. Levels of 20-40 ppm may prove harmful, especially in combination with high levels (1,000 ppm) of nitrate from feed sources.

Fecal and coliform bacteria in livestock waste can contaminate groundwater if waste seeps into nearby wells, causing such infectious diseases as dysentery, typhoid and hepatitis. Organic materials, which may lend an undesirable taste and odor to drinking water, are not known to be dangerous to health, but their presence does suggest that other contaminants are flowing directly into groundwater.

The goal of Farm•A•Syst is to help you protect the groundwater that supplies your drinking water.

How will this worksheet help me protect my drinking water?

- It will take you step by step through your livestock yards management practices.
- It will rank your activities according to how they might affect the groundwater that provides your drinking water supplies.
- It will provide you with easy-to-understand rankings that will help you analyze the "risk level" of your livestock yards management practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require some modification to better protect your drinking water.

How do I complete the worksheet?

Follow the directions at the top of the chart on the next page. It should take you about 15-30 minutes to complete this worksheet and figure out your ranking.

Livestock Yards Management: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your farmstead, read across to the right and circle the statement that best describes conditions on your farmstead. (Skip and leave blank any categories that don't apply to your farmstead.)
3. Then look above the description you circled to find your "rank number" (4, 3, 2 or 1) and enter that number in the blank under "your rank."
4. Directions on overall scoring appear at the end of the worksheet.
5. Allow about 15-30 minutes to complete the worksheet and figure out your risk ranking for livestock yards management.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
LOCATION					
Distance from drinking water well	More than 200 feet.	100-200 feet.	50-100 feet.	Less than 50 feet.	____
SITE CHARACTERISTICS					
Soil depth and permeability	Well-drained loam, silt loam, sandy clay loam, silt. With low permeability (silt and clay). More than 40 inches deep.	Well-drained or moderately well-drained clay, silty clay, clay loam, silty clay loam, sandy clay. 30-40 inches deep with moderate permeability (loamy).	Shallow (20-30 inches) and/or high permeability (sandy). Moderately well-drained (loamy very fine sand, very fine sandy loam, loamy fine sand, fine sandy loam).	Very shallow (less than 20 inches) and/or very high permeability (coarse sand) and/or excessively well-drained soil (sand to gravel) and/or somewhat poorly drained soil to poorly drained soils.	____
DESIGN AND MANAGEMENT					
Surface water diversion	All upslope and roof water diverted.	Most upslope surface and roof water diverted.	No surface water diverted. Some roof water collected and redirected.	All water (surface and roof water) runs through the yard.	____
Lot runoff control system	No yard runoff--neither barn nor roofed area.	All runoff collected from curbed lot. Solids separated. Water directed onto filter strip.	Most of lot runoff collected. Some solids removed. No filter strip.	Lot runoff uncontrolled.	____
Yard cleaning and scraping practice	No yard (animals confined).	Once per week.	Once per month.	Rarely.	____

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
CONCENTRATION OF ANIMALS ON YARD [square feet per animal (sf/a)]*					
Dairy cows	No yard. Confined to barn or roofed yard.	75 sf/a or more on fenced, curbed concrete pad and/or 400 sf/a on graded earthen surface. More than 1800 sf/a in exercise area.	50 sf/a or more on concrete and/or 200-300 sf/a on earthen surface. More than 1200 sf/a in exercise area.	Some concrete (less than 50 sf/a) and earth (less than 100 sf/a).	____
Dairy replacements	No yard. Confined to barn or roofed yard.	More than 40 sf/a on fenced, curbed concrete pad and/or 150-200 sf/a on earthen yard.	More than 20 sf/a on concrete and/or more than 75 sf/a on earthen surface.	Less than 75 sf/a on earth.	____
Beef feeders	No yard. Confined to barn with slotted floor.	Barn and/or paved lot more than 50 sf/a. Earthen lot with mound more than 300 sf/a, or without mound more than 500 sf/a.	No shelter and paved lot 40-50 sf/a. Earthen with mound more than 150 sf/a or earthen without mound less than 250 sf/a.	Paved less than 30 sf/a, or earthen less than 150 sf/a.	____
Beef cows/heifers	Option not available: barn or roofed lot too expensive.	Barn with paved lot more than 60 sf/a. Earthen with mound more than 400 sf/a. Earthen without mound more than 600 sf/a.	Paved lot more than 30 sf/a. Earthen with mound more than 200 sf/a. Earthen without mound more than 300 sf/a.	Earthen without mound less than 200 sf/a.	____
Sheep/ewes	No yard. Confined to barn or roofed yard.	Barn and paved lot more than 20 sf/a. Earthen more than 40 sf/a.	Barn and paved lot less than 15 sf/a. Earthen less than 25 sf/a.	Earthen less than 10 sf/a.	____
Feeder lambs	No yard. Confined to barn.	Barn and paved lot more than 10 sf/a. Earthen more than 25 sf/a.	Barn and paved lot more than 5 sf/a. Earthen more than 10 sf/a.	Earthen less than 10 sf/a.	____

*Animal concentrations derived from Midwest Plan Service publications and other sources.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
CONCENTRATION OF ANIMALS ON YARD [square feet per animal (sf/a)]*					
Hogs/sows	No yard. Confined to barn.	Shed and paved lot more than 30 sf/a.	Shed and earthen lot less than 15 sf/a.	Shed and earthen lot less than 10 sf/a.	____
Pigs: growing/ finishing	No yard. Confined to barn.	Shed and paved lot more than 15 sf/a.	Shed and earthen lot more than 15 sf/a.	Shed and earthen lot less than 10 sf/a.	____
Horses	No yard. Confined to barn or on pasture.	Earthen exercise lot more than 2500 sf/a. No pasture.	Earthen lot more than 1500 sf/a. No pasture.	Earthen lot less then 1000 sf/a. No pasture.	____
Chickens:					
Broilers	No lot. In building.	Earthen lot of 2 sf/a or more.	Earthen lot of 1-2 sf/a.	Earthen lot of less than 1 sf/a.	____
Layers	No lot. In building.	Earthen lot of 4 sf/a or more.	Earthen lot of 2-4 sf/a.	Earthen lot of less than 2 sf/a.	____
Turkeys	No lot. Building or roofed area. On range.	Earthen lot of 8 sf/a or more.	Earthen lot of 4 sf/a or more.	Earthen lot of less than 4 sf/a.	____
Ducks	No lot. In building.	Earthen lot of 4 sf/a or more.	Earthen lot of 2 sf/a or more.	Earthen lot of less than 2 sf/a.	____
				TOTAL	

*Animal concentrations derived from Midwest Plan Service publications and other sources.

What do I do with these rankings?

Step 1: Begin by determining your overall livestock yards risk ranking. Total the rankings for the categories you completed and divide by the number of categories you ranked:

_____ (total of rankings) divided by _____ (# of categories ranked) equals ☐ (risk ranking)*

*Carry your answer out to one decimal place.

4=low risk 3=low to moderate risk 2=moderate to high risk 1=high risk

This ranking gives you an idea of how your livestock yards practices as a whole might be affecting your drinking water. This ranking should serve only as a very general guide, not a precise diagnosis. Because it represents an averaging of many individual rankings, it can mask any individual rankings (such as 1's or 2's) that should be of concern. (Step 2 will focus on individually ranked activities of concern.)

Enter your boxed livestock yards risk ranking in the appropriate place on page 3 of worksheet #12. Later you will compare this risk ranking with other farmstead management rankings. Worksheet #11 will help you determine your farmstead's site conditions (soil type, soil depth and bedrock characteristics), and worksheet #12 will show you how these site conditions affect your risk rankings.

Step 2: Look over your rankings for individual activities. First take note of any 4's and 3's:

- **Low-risk** practices (4's): ideal; should be your goal despite cost and effort
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Now pay particular attention to any 2's or 1's:

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- **High-risk** practices (1's): inadequate; pose a high risk of polluting groundwater

Regardless of your overall risk ranking, any individual rankings of "1" require immediate attention. Some concerns you can take care of right away; others could be major—or costly—projects, requiring planning and prioritizing before you take action.

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Step 3: Read "Improving Livestock Yards Management," and give some thought to how you might modify your farmstead practices to better protect your drinking water.

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PILOT VERSION

FARM•A•SYST
Farmstead Assessment System

Worksheet #9

Silage Storage

Why should I be concerned?

Silage is an essential feed for livestock-based agriculture. When properly harvested and stored, silage poses little or no pollution threat, but improper handling can lead to a significant flow of silage juices (or leachate) from the silo. Leachate is an organic liquid that results from pressure in the silo or from extra water entering the silo. It is usually a problem only when silage is fresh, or just after storage. This loss of leachate represents a major loss of nutrient value from the silage.

This liquid is often highly acidic and can be corrosive to concrete and steel. If it enters a stream, its high organic content feeds bacteria that rob the water of oxygen. Groundwater contaminated with silage juices has a disagreeable odor and shows increased levels of acidity, ammonia, nitrates and iron.

Silage leachate can contain such groundwater contaminants as bacteria and minerals. Along with the pollutants found in silage leachate, an even greater potential threat is that the low pH created by the presence of acids in silage leachate can free up and release naturally occurring metals in the soil and aquifer, which can increase their concentrations in groundwater. Leachate from 300 tons of high-moisture silage has been compared to the sewage generated daily by a city of 80,000 people.

Nitrate is the most important potential contaminant to consider. Levels of 20-40 parts per million (ppm) can cause livestock problems, especially if feed contains more than 1,000 ppm. Water with levels over 100 ppm should not be used for livestock. Water with over 10 ppm should not be used for infants under 6 months of age.

The goal of Farm•A•Syst is to help you protect the groundwater that supplies your drinking water.

How will this worksheet help me protect my drinking water?

- It will take you step by step through your silage storage practices.
- It will rank your activities according to how they might affect the groundwater that provides your drinking water supplies.
- It will provide you with easy-to-understand rankings that will help you analyze the "risk level" of your silage storage practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require some modification to better protect your drinking water.

How do I complete the worksheet?

Follow the directions at the top of the chart on the next page. It should take you about 15-30 minutes to complete this worksheet and figure out your ranking.

Worksheet #9

Silage Storage: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your farmstead, read across to the right and circle the statement that best describes conditions on your farmstead. (Skip and leave blank any categories that don't apply to your farmstead.)
3. Then look above the description you circled to find your "rank number" (4, 3, 2 or 1) and enter that number in the blank under "your rank."
4. Directions on overall scoring appear at the end of the worksheet.
5. Allow about 15-30 minutes to complete the worksheet and figure out your risk ranking for silage storage practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
Silage moisture content	Below 65%	Between 65% and 70%	Between 70% and 85%	Over 85%	___
Silo location	At least 100 feet downslope from well. Water drains away from silo to field or pasture.	At least 50 feet downslope from well. Water drains to field or pasture.	Within 100 feet upslope of well. Water pools or stands near silo.	Within 50 feet upslope of well. Water pools on soil surface.	___
Silo floor condition	Concrete or asphalt. No cracks.	Concrete or asphalt surface has some cracks.	Some permeable soils (loam) but has some cracks.	Permeable soil (sand), not compacted.	___
Silo cap condition	Cap tight fitting. No leaks.	Cap tight fitting. Minor leaks.	Cap, but many large leaks.	No cap.	___
Silo lining	New or relined in last 5 years.	Relined 5 to 25 years ago.	Relined 25 to 40 years ago.	Relined more than 40 years ago.	___
Leachate collection system	Designed system in place and maintained.	Designed system in place but not maintained.	No system in place. Leachate moves to waterway.	No system in place. Leachate collects in low area.	___

TOTAL ☐

What do I do with these rankings?

Step 1: Begin by determining your overall silage storage risk ranking. Total the rankings for the categories you completed and divide by the number of categories you ranked:

_____ divided by _____ equals	
total of rankings	# of categories ranked

risk ranking*

*Carry your answer out to one decimal place.

4=low risk 3=low to moderate risk 2=moderate to high risk 1=high risk

This ranking gives you an idea of how your silage storage practices as a whole might be affecting your drinking water. This ranking should serve only as a very general guide, not a precise diagnosis. Because it represents an averaging of many individual rankings, it can mask any individual rankings (such as 1's or 2's) that should be of concern. (Step 2 will focus on individually ranked activities of concern.)

Enter your boxed silage storage risk ranking in the appropriate place on page 4 of worksheet #12. Later you will compare this risk ranking with other farmstead management rankings. Worksheet #11 will help you determine your farmstead's site conditions (soil type, soil depth and bedrock characteristics), and worksheet #12 will show you how these site conditions affect your risk rankings.

Step 2: Look over your rankings for individual activities. First take note of any 4's and 3's:

- **Low-risk** practices (4's): ideal; should be your goal despite cost and effort
- **Low-to-moderate-risk** practices (3's): provide reasonable groundwater protection

Now pay particular attention to any 2's or 1's:

- **Moderate-to-high-risk** practices (2's): inadequate protection in many circumstances
- **High-risk** practices (1's): inadequate; pose a high risk of polluting groundwater

Regardless of your overall risk ranking, any individual rankings of "1" require immediate attention. Some concerns you can take care of right away; others could be major—or costly—projects, requiring planning and prioritizing before you take action.

Find any activities that you identified as 1's and list them under "High-Risk Activities" on pages 6-7 of worksheet #12.

Step 3: Read "Improving Silage Storage and Handling," and give some thought to how you might modify your farmstead practices to better protect your drinking water.

FARM•A•SYST
Farmstead Assessment System

The Farmstead Assessment System is a cooperative project of the University of Wisconsin-Extension, Cooperative Extension; Minnesota Extension Service; and the U.S. Environmental Protection Agency Region V.

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FARM•A•SYST team members: **Gary Jackson**, University of Wisconsin-Extension, and **Jim Anderson**, Minnesota Extension Service, directors; **Susan Jones**, U.S. EPA Region V, Water Division, and University of Wisconsin-Extension, project manager; **Kim Cates**, Wisconsin Geological and Natural History Survey; and **Fred Madison**, Wisconsin Geological and Natural History Survey and University of Wisconsin-Madison. Special thanks to **Nick Houtman**.

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PILOT VERSION

FARM•A•SYST
Farmstead Assessment System

Worksheet #10

Milking Center Wastewater Treatment

Why should I be concerned?

Dairy wastewater is usually considered a dairy sanitation problem. If not carefully managed, however, dairy wastewater can contaminate both groundwater and surface water.

The amount of wastewater generated varies with milking preparation, equipment used and the number of cows. A typical 100-cow free-stall operation uses an estimated 835 to 1335 gallons of water per day in the milking center alone.

Milking center wastewater is contaminated with organic matter, nutrients, chemicals, grit and microorganisms. Poorly designed or mismanaged waste disposal systems can contaminate water with ammonia, nitrate, phosphorus, detergents and disease-causing organisms. Groundwater movement varies widely, from inches per year to feet per day, and under some conditions these wastes can be carried directly to a well. Surface water can also be affected by manure, milk solids, ammonia, phosphorus and detergents.

The goal of Farm•A•Syst is to help you protect the groundwater that supplies your drinking water.

How will this worksheet help me protect my drinking water?

- It will take you step by step through your milking center wastewater treatment practices.
- It will rank your activities according to how they might affect the groundwater that provides your drinking water supplies.
- It will provide you with easy-to-understand rankings that will help you analyze the "risk level" of your milking center wastewater treatment practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require some modification to better protect your drinking water.

How do I complete the worksheet?

Follow the directions at the top of the chart on the next page. It should take you about 15-30 minutes to complete this worksheet and figure out your ranking.

Milking Center Wastewater Treatment: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your farmstead, read across to the right and circle the statement that best describes conditions on your farmstead. (Skip and leave blank any categories that don't apply to your farmstead.)
3. Then look above the description you circled to find your "rank number" (4, 3, 2 or 1) and enter that number in the blank under "your rank."
4. Directions on overall scoring appear at the end of the worksheet.
5. Allow about 15-30 minutes to complete the worksheet and figure out your risk ranking for milking center wastewater treatment practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
NO DISCHARGE METHODS					
All wastewater to manure storage with waste applied to fields *	Wastewater delivered directly to liquid manure storage. No discharge expected.	———	———	Wastewater delivered to leaky manure storage.	___
* If using this practice, do not complete the rest of this worksheet. Put ranking for above section in the "total" box at the end of this chart.					
PRETREATMENT (before discharge to soil absorption bed/field)					
Milking cleanup practices	First pipeline rinse captured and fed to calves or added to barn manure. Waste milk never poured down drain. Manure and excess feed removed from parlor before wash-down.	Waste milk poured down drain 10% of the time. Manure and excess feed usually removed before wash-down.	Waste milk poured down drain 50% of the time. Manure and excess feed often washed down drain.	All waste milk poured down drain. Manure and excess feed frequently washed down drain.	___
Storage/settling tank liner	Concrete or plastic lined.	Clay lined.	Cracked or porous liner.	No liner to prevent seepage.	___
Settling tank cleanout	Tank cleaned as needed or every 3-4 months.	Tank cleaned every 6 months.	Annual cleaning.	Tank never cleaned.	___
Liquid storage period following settling	9-12 months.	1 week to 9 months.	Less than 1 week.	No storage/settling. Wastewater discharged directly to soil as generated.	___

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
DISCHARGE METHODS					
Below-ground absorption field	No low-risk practice. System has at least a moderate risk of nitrate pollution.	Located on loam at least 3 feet thick. Soil dries out every few weeks.	Located on sand more than 5 feet thick. Soil stays wet year around. No air enters subsoil.	Located on loam or sand close to water table or creviced bedrock. No air allowed to enter subsurface.	____
Rapid surface infiltration	_____	_____	Combine with high-level pretreatment. Sandy loam or loamy sand soil 5 or more feet thick. Vegetation removed regularly.	No treatment. Sandy loam or loamy sand soil less than 5 feet thick. Vegetation not removed.	____
Slow surface infiltration	Combine with high-level pretreatment. Silt or clay loam soil more than 10 feet to water table or bedrock. Extended rest period between loadings. Vegetation removed.	Combine with high-level pretreatment. Silt or clay loam soil more than 3 feet to water table or bedrock. Extended rest period between loadings. Vegetation removed.	Some pretreatment. Silt or clay soil more than 2 to 3 feet over bedrock or high water table. Vegetation not removed.	No pretreatment. 1 foot of silt or clay soil above bedrock or high water table. Vegetation not removed.	____
Field application	Applied to growing crops at 1 inch or less per week. Vegetation removed regularly.	Applied to uncropped fields at less than 1 inch per week. Vegetation removed occasionally.	Applied to cropped or uncropped fields at 1-2 inches per week. Vegetation never removed.	Applied to same area at more than 2 inches per week. Vegetation never removed.	____
Surface flow*	Applied in sheet to slowly permeable soil. Vegetation regularly removed.	Applied in sheet to slowly permeable soil. Vegetation sometimes removed.	Applied in sheet to slowly permeable soil. Vegetation not removed.	Applied in sheet to moderately or highly permeable soil. Vegetation not removed.	____
				TOTAL	

*Regular discharge to ditch or stream may require state discharge permit.

What do I do with these rankings?

Step 1: Begin by determining your overall milking wastewater risk ranking. Total the rankings for the categories you completed and divide by the number of categories you ranked:

total of rankings	divided by # of categories ranked	equals	risk ranking*

*Carry your answer out to one decimal place.

4=low risk 3=low to moderate risk 2=moderate to high risk 1=high risk

This ranking gives you an idea of how your milking center practices **as a whole** might be affecting your drinking water. This ranking should serve only as a **very general guide, not a precise diagnosis.** Because it represents an **averaging** of many individual rankings, it can mask any **individual** rankings (such as 1's or 2's) that should be of concern. (Step 2 will focus on individually ranked activities of concern.)

Enter your boxed milking wastewater risk ranking in the appropriate place on page 4 of worksheet #12. Later you will compare this risk ranking with other farmstead management rankings. Worksheet #11 will help you determine your farmstead's site conditions (soil type, soil depth and bedrock characteristics), and worksheet #12 will show you how these site conditions affect your risk rankings.

Step 2: Look over your rankings for individual activities. First take note of any 4's and 3's:

- **Low-risk** practices (4's): ideal; should be your goal despite cost and effort
- **Low-to-moderate-risk** practices (3's): provide reasonable groundwater protection

Now pay particular attention to any 2's or 1's:

- **Moderate-to-high-risk** practices (2's): inadequate protection in many circumstances
- **High-risk** practices (1's): inadequate; pose a high risk of polluting groundwater

Regardless of your overall risk ranking, any individual rankings of "1" require immediate attention. Some concerns you can take care of right away; others could be major—or costly—projects, requiring planning and prioritizing before you take action.

Find any activities that you identified as 1's and list them under "High-Risk Activities" on pages 6-7 of worksheet #12.

Step 3: Read "Improving Milking Center Wastewater Treatment," and consider how you might modify your farmstead practices to better protect your drinking water.

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Farmstead Assessment System

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PILOT VERSION

FARM•A•SYST
Farmstead Assessment System

Worksheet #11

Site Evaluation

Why is the site evaluation important?

How such farmstead practices as pesticide handling or manure management affect groundwater depends in part on the physical characteristics of your farmstead site: soil type, bedrock characteristics and depth to groundwater. That's why evaluating the soils and geologic characteristics of your farmstead is such an important step in protecting the groundwater you drink.

What's involved in completing this evaluation?

This evaluation has four parts:

Part 1: Evaluating your soil type and depth
Part 2: Evaluating subsurface and geologic materials, along with depth to groundwater
Part 3: Determining your overall site evaluation ranking (combining parts 1 and 2)
Part 4: Doing a farmstead diagram (optional)

Getting the information to complete parts 1 and 2 will require assistance from outside sources, such as your county SCS or Extension office. How long this takes will vary depending on the availability of the information in your county. Once you have the information in hand, though, it should take about an hour to complete the first three parts of worksheet #11 (the farmstead diagram will take additional time).

If some of the information you need isn't readily available, the worksheet contains instructions on how to proceed. The more information you can get, the better; but some information is better than no information.

How do soils affect the potential for groundwater contamination?

Soil characteristics are very important in determining how a contaminant breaks down to harmless compounds and whether it leaches into groundwater. Because most breakdown occurs in the soil, there is a greater potential for groundwater contamination in areas where contaminants move quickly through the soil.

- Sandy soils have large "pore" spaces between individual particles, and the particles provide relatively little surface area for "sorption," or physical attachment of most contaminants. Large amounts of rainfall or excessive irrigation water can percolate through these soils, and dissolved contaminants can move rapidly down through the soil and into groundwater.

- Clay soils, on the other hand, are made up of extremely small particles that slow the movement of water and dissolved contaminants through the soil. Contaminants also stick tightly to clay surfaces.

While held securely to soil particles, contaminants are broken down by bacteria and reactions with minerals and natural chemicals in the soil. Most of this chemical and biological breakdown takes place in the loose, cultivated surface layers, where the soil tends to be warm, moist, high in organic matter and well-aerated.

Finally, soil organic matter is important in holding contaminants, and soils high in organic matter provide an excellent environment for chemical and biological breakdown of these contaminants—before they reach groundwater.

The natural purification capability of the soil is, however, limited. Under certain conditions, such as heavy rainfall, chemical spills and sandy soil, contaminants may leach below the soil. In such cases, the subsurface geologic material and the distance a contaminant must travel to groundwater are important factors in determining whether a contaminant actually reaches the groundwater.

How do subsurface and geologic materials affect the potential for groundwater contamination?

Wisconsin soils were formed over sediments consisting of glacial till and outwash, weathered and disintegrated bedrock materials, and bedrock. The depth of these surficial deposits ranges from zero to hundreds of feet.

Depth to groundwater is important primarily because it determines not only the depth of material through which a contaminant must travel before reaching an aquifer but also the time during which a contaminant is in contact with the soil. As a result, where soil and surficial deposits are fairly deep, contaminants are less likely to reach groundwater.

Bedrock geology influences groundwater pollution when the water table is below the bedrock surface. Sedimentary rocks have a wide range of permeability—from highly permeable fractured dolomite to nearly impermeable shales and crystalline formations. Movement of pollutants in fractured limestone or dolomite is unpredictable, and pollutants can readily spread over large areas. Where bedrock material contains significant cracks and fractures, the depth and characteristics of soil and surficial geologic deposits largely determine the potential for groundwater contamination.

A word of caution

As with the results of the previous 10 assesment worksheets, use the rankings from this worksheet cautiously. Many factors affect whether or not a contaminant will leach to groundwater. There is no guarantee that a "low-risk" site will be uncontaminated—or that groundwater will become contaminated at a a "high-risk" site. The type of contaminant involved, how you handle and store potential contaminants (such as pesticides and manure), the location and maintenance of your well, and many other factors can affect the potential for groundwater contamination.

Part 1: Evaluating the Soil on Your Farmstead

To complete your soil evaluation, you will need a copy of your county's soil survey report. This report is available at county offices of Extension Service, Soil Conservation Service (SCS) or Land Conservation Department (LCD).

Step 1: Start by locating your farmstead on the aerial photos in the soil survey, note the soil category indicated on the photo, and look up information related to that soil in the written sections of the soil survey report.

Don't skip any parts of the worksheet. If you are not familiar with using soil surveys, you may need help completing Part 1. Ask your county Extension agent or your SCS or LCD specialist to help you find the following information:

- Location of your farmstead on the map and aerial photographs provided in the soil survey report.
- The soil mapping unit and soil series from the legend provided in the soil survey report.
- The soil series and/or soil mapping unit, including the profile description as well as any other information in the report regarding depth to bedrock, depth to water, organic matter or organic carbon content.
- The classification of the soil series, including family, subgroup and order. Soil surveys published before 1965 will not include the soil classification. You'll have to get this information from your county Soil Conservation Service office.

Step 2: With this information in hand, you are ready to rank your soil according to seven characteristics. For each of the seven characteristics in the left column, find information about your soil in the soil survey. Then, match your soil description to the description in the middle column to determine your score. (For example, if the soil survey tells you that the texture of your soil is a clay loam, your score for that category would be 8.) Enter your score in the space indicated.

SOIL CHARACTERISTICS		Score
1. Texture of surface (A horizon)	loam, silt loam, sandy clay loam, silt	9
	clay, silty clay, clay loam, silty clay loam, sandy clay	8
	loamy very fine sand, very fine sandy loam, loamy fine sand, fine sandy loam	4
	sand, loamy sand, sandy loam, organic materials, and all textural classes with coarse fragment class modifiers (such as "gravelly loam")	1

Your score _____

		Score
2. Texture of subsoil (B horizon)	clay, silty clay, sandy clay, silt	10
	sandy clay loam, loam, silt loam, clay loam, silty clay loam	7
	loamy very fine sand, very fine sandy loam, loamy fine sand, fine sandy loam	4
	sand, loamy sand, sandy loam, organic materials, and all textural classes with coarse fragment modifiers (such as "gravelly loam")	1

Your score _____

3. Organic matter content (Ap horizon) or 0-6" depth from surface

If your soil series is classified in the soil survey as Histosols; Aquic suborder; and Lithic, Aquollic and Aquic subgroup, use the ranking to the right (1). (These are organic soils, wet soils, or soils with less than 20 inches of material over bedrock. See a county specialist if you think your soil falls into one of these categories.) 1

OR

If your soil does not fall into the above groups, obtain the following information from a soil test report for your farm or from your county SCS office:

Organic matter (%)	OR	Organic Carbon	
high (4-10%)		2.32-5.8	10
medium (2-4%)		1.16-2.32	7
moderately low (1-2%)		0.58-1.16	5
low (0.5-1%)		0.29-0.58	3
very low (less than 0.5%)		less than 0.29	1

(Lower your score by one level if the soil mapping unit description in the soil survey indicates erosion, unless you take organic matter or carbon from soil test results.)

Your score _____

		Score
4. pH-Surface (A) horizon	6.6 or greater	6
	less than 6.6	4

Your score _____

5. Depth of soil solum (depth of A and B horizons, minus inches of erosion from surface layer noted in soil survey description)	greater than 60 in.	10
	40-60 in.	8
	30-40 in.	5
	less than 30 in.	1

(Lower your score one level when rock is present at 30-40 inches below the soil surface. Consult the profile description in the soil survey report to learn about depth to rock, then subtract the inches of surface erosion from the depth to bedrock.)

Your score _____

6. Permeability of subsoil horizon (Use most permeable particle-size class at the family level of the soil classification system in the soil survey. If your soil survey was published before 1965, see your SCS specialist.)	moderately low, low to very low (fine, very fine, clayey, clayey skeletal)	10
	moderate (fine loamy, fine silty, coarse silty, loamy skeletal)	8
	high (sandy, sandy skeletal, coarse loamy, or when bedrock is present at 20-40 inches	3
	very high (coarse sand, fragmental, sandy; or psammentic suborder)	1

Your score _____

7. Soil drainage class	well drained	10
	well to moderately well drained	7
	moderately well drained	4
	somewhat poorly, poorly, and very poorly drained; excessively drained	1

Your score _____

Step 3: Add your seven scores together. TOTAL _____

Step 4: In the box below, find your score in the listed ranges in the left column. Then identify your soil's "potential to protect groundwater" and find the rank number assigned to your score.

Total Score	Soil's Potential To Protect Groundwater	Rank
51+	Best	5
41-50	Good	4
31-40	Marginal/Good	3
21-30	Marginal	2
0-20	Poor	1

Step 5: Enter this rank number here: SOILS RANK ☐

Step 6: Understand your soils ranking.

A soil with more than 50 points (ranking #5) probably is a deep, medium- or fine-textured, well-drained soil which contains 4-10% organic matter. Potential contaminants move slowly through the soil, allowing them to become attached to soil particles. Sunlight, air and microorganisms then have time to break down the contaminant into harmless compounds. The groundwater contamination risk level is low.

A soil with a score less than 20 (ranking #1) is probably a coarse, sandy, extremely well-drained soil with less than 1% organic matter. Such a soil would enable most contaminants to move rapidly down toward the water table.

Overall, the higher your ranking number, the more likely that your soil conditions will help to reduce the risk of groundwater contamination from farmstead practices.

Part 2: Evaluating Subsurface and Geologic Materials on Your Farmstead

This part looks at the subsurface and geologic materials beneath your farmstead's soils. Completing the worksheet will give you a much clearer picture of your site's potential for keeping pollutants out of groundwater.

For example, the soil evaluation might have indicated a moderate potential for protecting groundwater. However, if the soils are fairly shallow and lie over fractured bedrock, the potential for groundwater contamination at the site is probably higher than indicated by the soil evaluation alone.

This part requires only two items of information: your site's subsurface geologic material and depth to groundwater. Unfortunately, information on subsurface geologic material, as well as depth to water, is often difficult to obtain:

- It is sometimes available from the soil survey report, although this differs from county to county.
- You can also obtain this information from your well constructor report. If the well installer filled out the report correctly, and submitted it to the DNR, it is on file at the Wisconsin Geological and Natural History Survey (3817 Mineral Point Road, Madison, Wisconsin 53705; telephone 608-262-1705).
- You can find additional information from other well constructor reports in your area, hydrogeological reports and groundwater flow maps for some counties, which are also available from the Geological Survey. These are generalized maps, though, and may not accurately reflect the depth to groundwater or direction of flow at your farmstead.
- Published geological reports for your county may show the type of geologic material in your area.

Try not to skip any steps in this part. Ask your county extension agent or your SCS or LCD specialist to help you gather the information and provide assistance in completing Part 2.

If the information for this part is not available, though, you may skip to Part 3 on page 9. The instructions will tell you how to proceed without it.

Step 1: Find the information you need—from the soil survey, well construction reports or Geological Survey reports—to identify 1) the geologic materials beneath your farmstead; and 2) depth to groundwater.

Step 2: Match the information on your site's geology to one of the descriptions in the left column below. (You will be choosing **only one description** from the entire table that follows.)

Step 3: When you have chosen the description that best matches your site's geology, read across to the right until you get to the appropriate "depth to groundwater" for your site and circle that score for your farmstead.

For example, you may determine from your well constructor's report that geologic material beneath your farmstead consists of 30 feet of coarse-textured, unconsolidated material over fractured limestone bedrock, and that depth to groundwater is 15 feet. Looking down the left column to find your category, and then going across to the right, you see that your rank is "2."

Geological Material (more than 5 feet below ground)	**Depth to Groundwater (in feet)**			
	0-10'	11-30'	31-50'	More than 50'
silt or clay	3	3	4	4
shale	3	3	4	4

EXHIBIT 16 - Continued

Geological Material (more than 5 feet below ground)	Depth to Groundwater (in feet)			
	0-10'	11-30'	31-50'	More than 50'
dense or fine-textured till (unsorted)	3	3	4	4
medium or coarse-textured till (unsorted)	2	2	3	4
unweathered or unfractured metamorphic or igneous rock, massive limestone	2	2	3	4
33-45 feet of medium- to fine-textured unconsolidated materials over fractured bedrock (limestone, sandstone, igneous or metamorphic rock)	2	2	3	3
20-32 feet of medium- to fine-textured unconsolidated materials over fractured bedrock (limestone, sandstone, igneous or metamorphic rock)	1	1	2	2
33-45 feet of coarse textured, unconsolidated materials over fractured bedrock (limestone, sandstone, igneous or metamorphic rock)	1	2	3	2
20-32 feet of coarse-textured, unconsolidated materials over fractured bedrock (limestone, sandstone, igneous or metamorphic rock)	1	1	2	1
sand and gravel with more than 12% silt or clay (sorted)	1	1	2	2
6-20 feet of medium- to fine-textured, unconsolidated materials over fractured bedrock (limestone, sandstone, igneous or metamorphic rock)	1	1	2	2
0-5 feet of medium- to fine-textured, unconsolidated materials over fractured bedrock (limestone, sandstone, igneous or metamorphic rock)	1	1	1	1
0-20 feet of coarse textured, unconsolidated materials over fractured bedrock (limestone, sandstone, igneous or metamorphic rock)	1	1	1	1
sand and gravel with less than 12% silt or clay (sorted)	1	1	1	1
karst, highly fractured rock or highly permeable rock	1	1	1	1

Step 4: Enter your circled number here: SUBSURFACE RANK ☐

Step 5: Understand your subsurface and geology ranking. The table below shows what your rank means.

Rank	Subsurface Potential To Protect Groundwater	Level of Risk
4	Best	Low
3	Good	Low/moderate
2	Marginal	High/moderate
1	Poor	High

A ranking of "4" shows that the subsurface material has small pore spaces, groundwater is at least 10 feet from the soil surface, and the risk of groundwater contamination is low.

A ranking of "1" indicates a material with large pore spaces that allow contaminants to move downward easily, increasing the risk of groundwater contamination. In highly fractured rock or in very coarse-textured, unconsolidated materials, the depth to groundwater doesn't seem to matter, because some contaminants will flow through the pore spaces with very little slowdown.

Overall, the higher your ranking number, the more likely that your farmstead's geologic conditions and depth to groundwater **will help to reduce** the risk of groundwater contamination from farmstead practices.

Part 3: Combining Your Farmstead's Soil and Subsurface/Geologic Rankings

Combining the rankings from parts 1 and 2 will provide you with a good overall ranking of your farmstead site's potential to keep pollutants from moving down to groundwater.

Step 1: Transfer your boxed rankings from the soil evaluation (Part 1, page 6) and the subsurface/geologic evaluation (Part 2, above) to the two boxes below:

Soils Rank ☐ Subsurface Rank ☐

Step 2: The table below shows the overall level of groundwater contamination risk associated with your farmstead site conditions. Find your two numbers written in the correct sequence (soils rank-subsurface rank) and circle the sequence.

LEVEL OF RISK			
Low Risk (Rank 4)	Low-Moderate Risk (Rank 3)	High-Moderate Risk (Rank 2)	High Risk (Rank 1)
1-4	2-3	1-3	1-1
2-4	4-2	3-2	1-2
3-3		5-1	2-1
3-4			2-2
4-3			3-1
4-4			4-1
5-3			

Step 3: Look above the sequence you circled to find your risk level and your ranking. (For example, if your numbers are 2-3, your site is in the low-moderate risk column and your ranking is 3.)

Step 4: Enter your combined ranking here: COMBINED RANKING ☐

Step 5: Understand your combined ranking.

In general, a site with a combined ranking of 4 (low groundwater pollution risk) will have a soil with a good capacity to hold and break down contaminants. Its subsurface conditions will also keep contaminants from reaching the water table. Under certain conditions, however, such as spills, poor management and heavy rainfall, contaminants may reach groundwater.

On the other hand, if you carefully manage a site with a combined ranking of 1 (high groundwater pollution risk), you may not affect your drinking water. Both site characteristics and your management practices are of equal importance.

Your three site ranking numbers (soils ranking, subsurface ranking and combined ranking) will be used again in worksheet #12. They will be combined with your risk rankings for specific activities from the 10 assessments (such as pesticide handling) to give you a more accurate assessment of potential groundwater contamination on your farmstead.

You may now proceed with Part 4 of this worksheet, or you may go directly to Worksheet #12.

Part 4: Learning More About your Site

Sketching a diagram of your farmstead can provide useful information to help you understand how the physical layout and site characteristics of your farmstead may contribute to—or lessen—the effects of possible contaminants reaching your drinking water.

The diagram can show the location of wells, septic drainfields, manure storage areas, direction of groundwater flow, surface water, buildings, and other activities that may contribute potential contaminants. Along with the soil and subsurface evaluations, the diagram will help point out aspects of your farmstead that may present a hazard to your drinking water.

Step 1: Begin by looking at the sample diagram on page 12.

Step 2: Then diagram your farmstead on the blank grid provided on page 13. Include all of thefollowing that apply to your farmstead:

- all buildings and other structures (home, barn, machine shed)
- wells and abandoned wells
- septic system (tank, dry well, absorption field and/or ditch)
- cowyard/barnyard
- manure storage (temporary and permanent)
- underground petroleum storage tank
- above ground petroleum storage tank
- pesticide and fertilizer storage, handling and mixing areas
- silage storage
- milkhouse waste disposal system (tank, field and/or ditch)
- farm dumps
- vehicle maintenance areas
- liquid disposal areas

You can use the same diagram to indicate surface water (ponds and streams), direction of landslope, groundwater flow, and the different soil types found around your farmstead. Generally, groundwater follows surface topography and moves downhill towards surface water.

Step 3: Use your diagram to note which activities or structures on your farmstead have a greater likelihood of allowing contaminants to reach groundwater. This information should help prepare you to make better decisions about your farmstead activities and structures and how they might be affecting your drinking water.

When you've completed the diagram of your farmstead, go on to worksheet #12.

EXAMPLE FARMSTEAD DIAGRAM

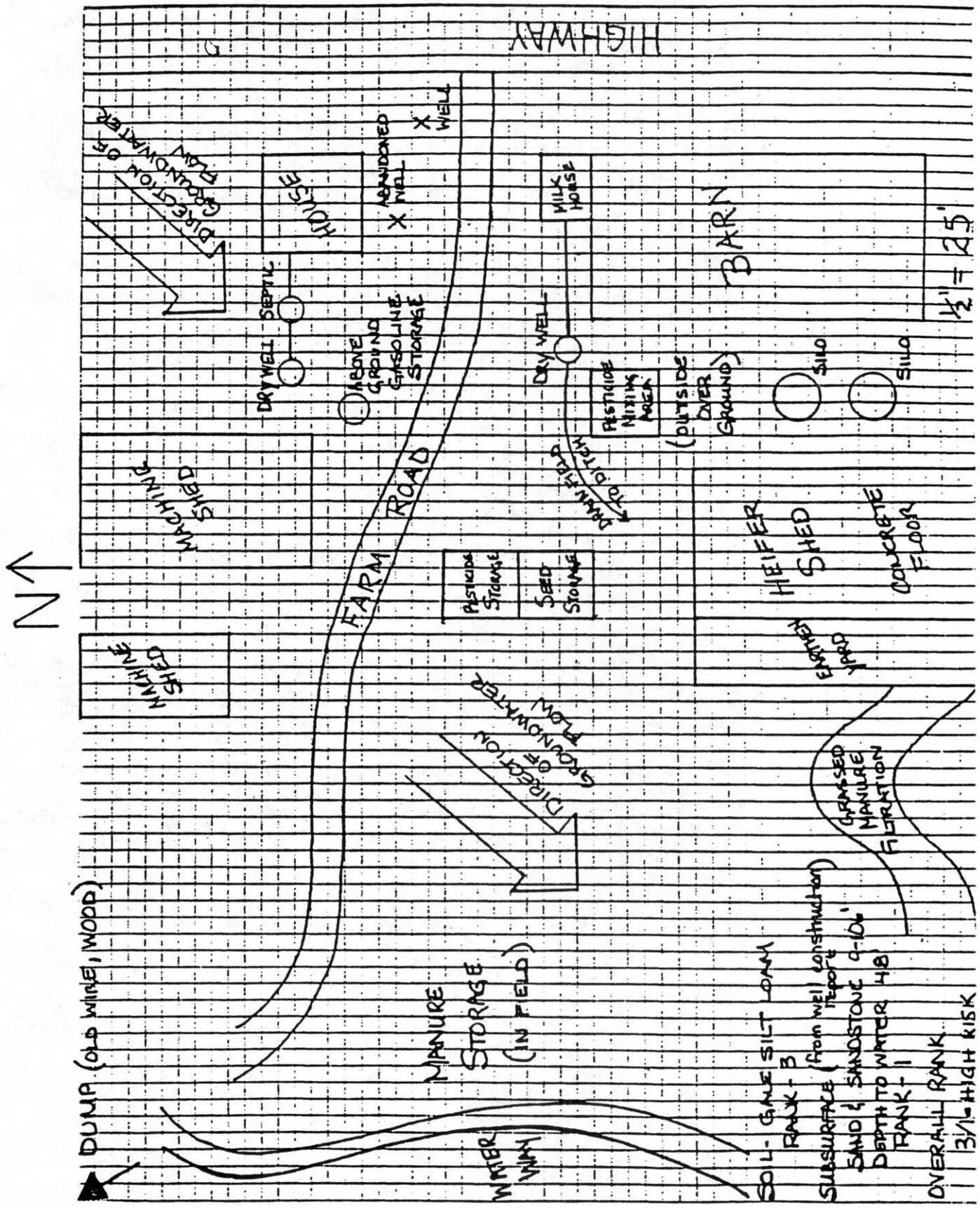
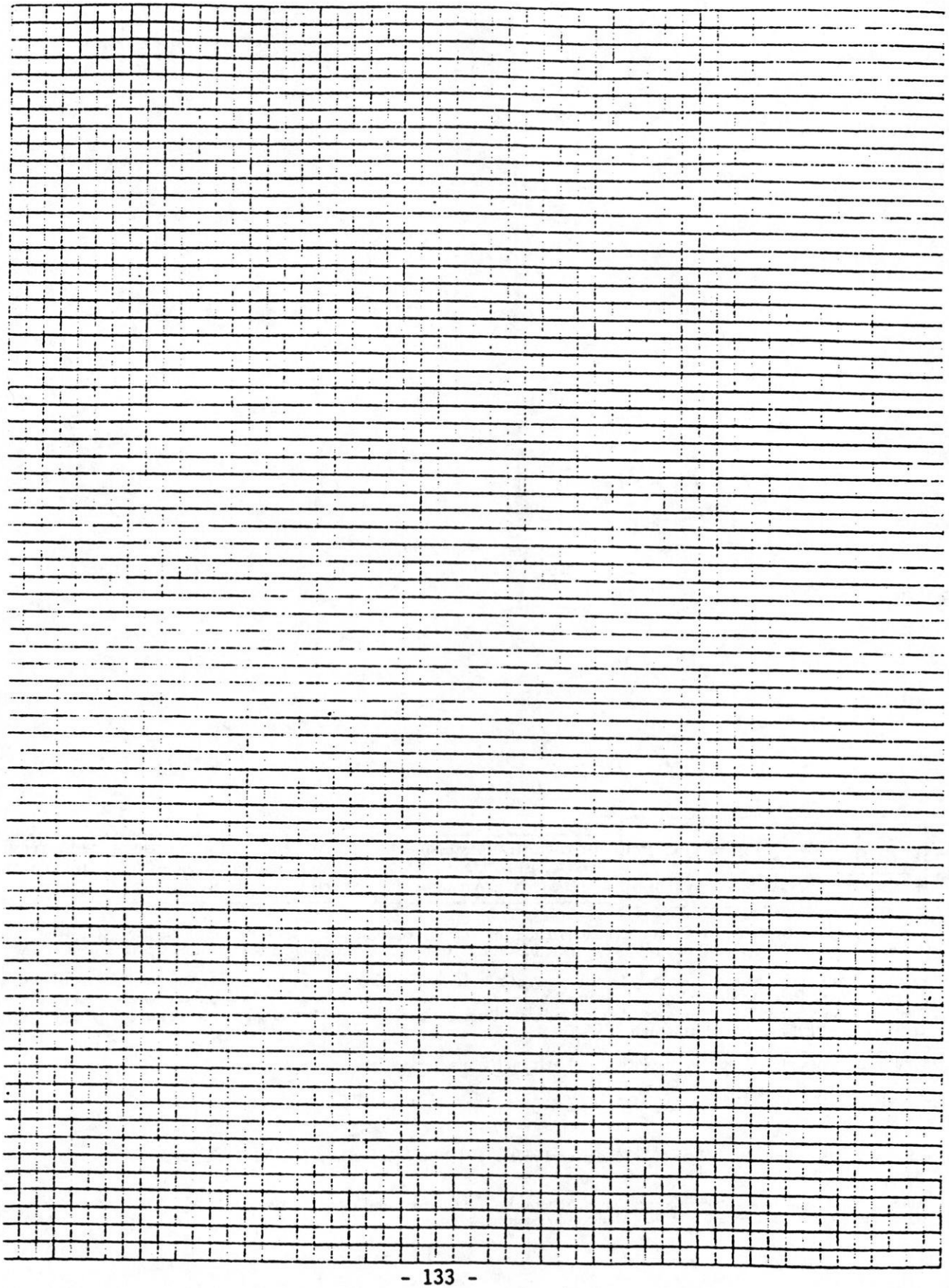


EXHIBIT 16 - Continued

YOUR FARMSTEAD DIAGRAM



FARM•A•SYST
Farmstead Assessment System

The Farmstead Assessment System is a cooperative project of the University of Wisconsin-Extension, Cooperative Extension; Minnesota Extension Service; and the U. S. Environmental Protection Agency RegionV.

Funding provided by the North Central Regional Center for Rural Development. U.S. EPA Region V, the U.S. EPA Great Lakes National Program Office, the Wisconsin Department of Natural Resources and the Minnesota Pollution Control Agency.

FARM•A•SYST team members: Gary Jackson, University of Wisconsin-Extension, and Jim Anderson, Minnesota Extension Service, directors; Susan Jones, U.S. EPA Region V, Water Division, and University of Wisconsin-Extension, project manager; Kim Cates, Wisconsin Geological and Natural History Survey; and Fred Madison, Wisconsin Geological and Natural History Survey and University of Wisconsin-Madison. Special thanks to Nick Houtman.

Written by Kim Cates, Wisconsin Geological and Natural History Survey.

Technical review provided by:

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PILOT VERSION

FARM•A•SYST
Farmstead Assessment System

Worksheet #12

Overall Farmstead Assessment

As an overall summary of the work you've already done to assess your farmstead structures and activities, this worksheet has two parts:

Part 1: Your first step will be to combine the individual risk rankings for various farmstead structures and activities (from worksheets 1-10) with your soils ranking and subsurface geologic ranking from worksheet #11. Combining these rankings will give you a much more accurate picture of the groundwater contamination risk of your various farmstead practices as they are affected—for better or worse—by your particular site conditions.

Part 2: Your second step will be to list any individual farmstead activities from your 10 worksheets that you ranked with 1's (high risk). You've probably been adding to this list as you've completed each worksheet. In this part, you will be looking at individual concerns, giving you very specific information about the groundwater contamination risk of particular farmstead practices.

Getting Started

If you have not already done so, take the boxed risk rankings from the top of the scoring sheet of each of the 10 worksheets you completed and transfer them into the box below. (For the worksheets you did not complete, leave the boxes blank.)

Then take your three site evaluation rankings from worksheet #11 (soils ranking, subsurface ranking and combined ranking) and transfer them into the box below, too. (If you have fewer than three rankings, just record the ones you have and leave the others blank.) **The figures in this box are all you need to complete parts 1 and 2 of this worksheet.**

FARMSTEAD RISK RANKINGS (from worksheets 1-10)		SITE RANKINGS (from worksheet #11)	
#1: Well condition	____	Soils ranking	____
#2: Pesticide handling	____		
#3: Fertilizer handling	____	Subsurface ranking	____
#4: Petroleum storage	____		
#5: Hazardous waste management	____	Combined ranking	____
#6: Household waste-water treatment	____		
#7: Livestock waste	____		
#8: Livestock yards	____		
#9: Silage storage	____		
#10: Milking center waste	____		

Part 1: Combining Risk Rankings with Site Rankings

Step 1: To calculate overall risk rankings in the chart below for each of the 10 worksheets you completed, take your farmstead risk rankings from the box on page 1, add them to the appropriate lines below, and calculate the average of the two numbers.

In some cases, you will use the combined site evaluation rank. In other cases, you will use only the subsurface ranking (for example, when you are calculating the risk associated with a septic system's soil absorption field or an inground manure storage pit).

If you don't have a combined site or subsurface rank for your farmstead, use the soil rank. Although the subsurface information, either by itself or in a combined site rank, gives a more accurate picture of your site's ability to hold and break down contaminant, the soil rank is an acceptable substitute if the subsurface information for your site is unavailable.

#1: DRINKING WATER WELL CONDITION

Rank from Worksheet #1 _____ = _____ Overall Drinking Water Well Risk Ranking
(Do not use a site rank.)

#2: PESTICIDE STORAGE AND HANDLING

Rank from Worksheet #2 _____
Combined Site Rank _____
TOTAL _____ divided by 2 = _____ Overall Pesticide Risk Ranking

#3: FERTILIZER STORAGE AND HANDLING

Rank from Worksheet #3 _____
Combined Site Rank _____
TOTAL _____ divided by 2 = _____ Overall Fertilizer Risk Ranking

#4: PETROLEUM PRODUCT STORAGE
(Select **one or both** categories below, as appropriate to your site.)

ABOVE-GROUND STORAGE
Rank from Worksheet #4 _____
Combined Site Rank _____
TOTAL _____ divided by 2 = _____ Overall Above-Ground Storage Risk Ranking

BELOW-GROUND STORAGE
Rank from Worksheet #4 _____
Subsurface Site Rank _____
TOTAL _____ divided by 2 = _____ Overall Below-Ground Storage Risk Ranking

#5: HAZARDOUS WASTE MANAGEMENT AND DISPOSAL

Rank from Worksheet #5 _____
Combined Site Rank _____
TOTAL _____ divided by 2 = _____ Overall Hazardous Waste Risk Ranking

#6: HOUSEHOLD WASTEWATER TREATMENT
(Select **one or both** categories below, as appropriate to your site.)

SURFACE APPLICATION
Rank from Worksheet #6 _____
Combined Site Rank _____
TOTAL _____ divided by 2 = _____ Overall Surface Household Wastewater Risk Ranking

SOIL ABSORPTION FIELD
Rank from Worksheet #6 _____
Subsurface Site Rank _____
TOTAL _____ divided by 2 = _____ Overall Subsurface Household Wastewater Risk Ranking

#7: LIVESTOCK WASTE STORAGE
(Select **one or both** categories below, as appropriate to your site.)

ABOVE-GROUND STORAGE
Rank from Worksheet #7 _____
Combined Site Rank _____
TOTAL _____ divided by 2 = _____ Overall Above-Ground Livestock Waste Storage Risk Ranking

BELOW-GROUND STORAGE
Rank from Worksheet #7 _____
Subsurface Site Rank _____
TOTAL _____ divided by 2 = _____ Overall Below-Ground Livestock Waste Storage Risk Ranking

#8: LIVESTOCK YARD MANAGEMENT

Rank from Worksheet #8 _____
Combined Site Rank _____
TOTAL _____ divided by 2 = _____ Overall Livestock Yard Management Risk Ranking

#9: SILAGE STORAGE
(Select **one or both** categories below, as appropriate to your site.)

ABOVE-GROUND STORAGE
Rank from Worksheet #9 _____
Combined Site Rank _____
TOTAL _____ divided by 2 = _____ Overall Above-Ground Silage Storage Risk Ranking

BELOW-GROUND STORAGE
Rank from Worksheet #9 _____
Combined Site Rank _____
TOTAL _____ divided by 2 = _____ Overall Below-Ground Silage Storage Risk Ranking

#10: MILKING CENTER WASTEWATER TREATMENT
(Select **one or both** categories below, as appropriate to your site.)

ABOVE-GROUND DISPOSAL
Rank from Worksheet #10 _____
Combined Site Rank _____
TOTAL _____ divided by 2 = _____ Overall Above-Ground Milking Center Wastewater Treatment Risk Ranking

BELOW-GROUND DISPOSAL
Rank from Worksheet #10 _____
Subsurface Site Rank _____
TOTAL _____ divided by 2 = _____ Overall Below-Ground Milking Center Wastewater Treatment Risk Ranking

Step 2: Interpret your overall risk rankings. For each of the rankings in the blanks above, use the box below to assess your overall groundwater contamination risk from that area of activity on your farmstead. This information should give you a general idea of areas of concern that need addressing.

INTERPRETING YOUR SCORES

Ranking	Groundwater Contamination Risk
3.0–4 and above	Low
2.0–2.9	Low-Moderate
1.0–1.9	Moderate-High
0.9 and below	High

Keep in mind, however, that each of these rankings is based on an averaging of many individual activities and structures—such as all of your specific pesticide storage and handling practices in worksheet #2. Don't use these overall rankings to assess or predict the amount—if any—of actual groundwater contamination on your farmstead. An actual determination of groundwater contamination requires an intensive onsite investigation.

The rankings do provide an overall assessment of the risk level of various farmstead activities and how site conditions affect these levels of risk. Part 2 focuses on specific activities or structures that you ranked as 1's on your individual worksheets.

Part 2: Identifying Specific High-Risk Activities

Step 1: If you haven't already done so, go back to each of the 10 worksheets you completed and identify any individual activities or structures that you ranked as 1's (high risk). You may have already done this as you completed each worksheet.

Step 2: List each activity of concern on the chart on pages 6 and 7. Begin by filling in the first three blanks (to the left of the double vertical line on the chart). Do this for each of the 10 worksheets you completed.

Step 3: Then, for each activity that you listed, fill in the "response options" and "taking action" sections to the right of the double vertical line on the chart.

- **Response options:** Check one of the two boxes: either "immediate action possible" or "further planning required." This should be a quick assessment of whether a change in practice requires major effort and money (like relocating a well or building a pesticide storage facility) or whether it "just" requires a change in practice (like cleaning a livestock yard more often or being sure that stored pesticides are clearly labeled).

- **Taking action:** Decide right now on a possible first step to take to begin to address each concern listed. It might be patching old pesticide containers, or cleaning your milking center settling tank right away, or making a first phone call to get information about relocating and redesigning your pesticide storage area.

The first step for a concern that you identified as "immediate action possible" should, of course, be easier than a first step for a major or costly project. But, whatever the area of concern, what's an initial step you can take to begin to address each of the high-risk concerns you have listed?

Step 4: Keep this list handy and refer to it often. It provides important information for you as you plan how to begin to more effectively protect the groundwater that provides drinking water to you and your family.

High-Risk Activities

A listing of individual activities or structures that ranked "1" on your farmstead assessment charts

After completing each of the 10 assessments appropriate to your farmstead, list any individual activities or structures that you ranked as "1" (high risk). Fill in the worksheet number, the worksheet name and the individual activity of concern. Don't fill in the blanks to the right of the double line. You'll do that later, when you're completing worksheet #12.

Work-sheet number	Worksheet name	Individual activity identified as being high risk (1)	Response Options (check one)		Taking Action (proposed first step to address concern)
			Immediate action possible (change in practice only; cost not a factor)	Further planning required (requires major structural improvement or relocation; involves major effort or high cost)	

Work-sheet number	Worksheet name	Individual activity identified as being high risk (1)	Response Options (check one)		Taking Action (proposed first step to address concern)
			Immediate action possible (change in practice only; cost not a factor)	Further planning required (requires major structural improvement or relocation; involves major effort or high cost)	

EXHIBIT 16 - Continued

A Few Final Words

After doing all you can to reduce the riskof groundwater contamination on your farmstead, you may still have well test results showing high levels of some contaminants.

- One factor could be activities away from the farmstead. Nitrates could be leaching from your fields, for example.

- Problems could originate in more distant areas, too. Depending on the geology of an area, activities miles away can result in groundwater contamination that flows slowly toward your property and the groundwater you drink. It may take years for a spill on someone else's land to show up in your well. Leaking petroleum tanks, farm dumps and waste pits away from your property all have the potential to affect your drinking water quality—**just as activities on your farmstead have the potential to affect the drinking water of your neighbors and even others living miles away from you.**

- You may want to keep track of potential sources of groundwater contamination beyond your farmstead. You may also want to encourage your neighbors to use this farmstead assessment.

On the other hand, despite the fact that results of your farm well water quality tests are quite good, your worksheet results may show the need for numerous changes. Your well may be upslope from your farmstead, so the water drawn from that area is not affected by your activities on the ground. That doesn't mean, however, that contaminants are not entering the groundwater system and affecting someone else's drinking water. You need to be as careful as you can about farmstead management, especially if your farmstead is on land vulnerable to groundwater contamination.

You may have quite a few "high-risk" pollution potential rankings. You may also be concerned about your well water quality test results and want to know more about how your farmstead activities might have influenced them. If so, after completing the Farmstead Assessment System, you may want to ask an expert to conduct a detailed site analysis and look more closely at potential sources to determine the causes of the contamination.

For further information about potential sources of groundwater contamination on your farmstead, contact your county Extension, Soil Conservation Service, or Land Conservation Department office.

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Written by Susan Jones, U.S. EPA Region V, Water Division, and University of Wisconsin-Extension, Cooperative Extension.

Technical review provided by:

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WAUPACA COUNTY FOLLOW-UP GROUNDWATER TESTING AND EDUCATIONAL PROGRAM QUESTIONNAIRE

EXHIBIT 17

Please take the time to complete this questionnaire. Your responses will be helpful in developing educational programs related to groundwater in our county.

1) Groundwater in Waupaca County comes from . . . (please check one)

_____ underground rivers or streams
_____ Canada/Lake Superior
_____ local precipitation
_____ don't know

2) Groundwater moves through the soil . . . (please check one)

_____ generally from north to south
_____ generally from higher to lower areas
_____ without any specific direction
_____ don't know

3) Private well water should be tested . . .

_____ once each year
_____ once every ten years
_____ only if you notice a problem
_____ don't know

4) The most common health problems related to groundwater are caused by . . . (please check one)

_____ pesticides
_____ nitrates
_____ bacteria
_____ don't know

5) Water with unsafe nitrate levels . . . (please check one)

_____ is usually discolored
_____ usually looks and tastes fine
_____ has a salty taste
_____ don't know

6) List two major ways groundwater becomes contaminated . . . (please list two)

_____

_____

7) If drinking water is unsafe . . . (please check one)

_____ people drinking it will become ill within hours
_____ it will taste or smell bad
_____ only a laboratory may be able to detect it
_____ don't know

8) How knowledgeable do you feel about the cause and solution to potential groundwater contamination on your property . . . (please check one)

_____ very well informed
_____ somewhat informed
_____ not informed at all

9) Since last summer, have you implemented practices that you feel will reduce the potential of groundwater contamination of your private well? (please check one)

_____ yes
_____ no

If your response is yes, please list below those things that you feel will lessen the potential of groundwater contamination. (Please list as many as you wish)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

10. If you have not implemented any groundwater protection practices for your private well, do you plan to do so in the future? (Please check one)

_____ yes
_____ no

Again, if your response is yes, please list below those things that you plan to do to reduce the potential of groundwater contamination of your private well. (please list as many as you wish)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

11) Would you like additional information or assistance in evaluating your well site and establishing a priority list of measures to reduce the potential of groundwater contamination? (please check one)

_____ yes
_____ no

If yes, please list your name, address and phone number to allow someone from our office to contact you to arrange a visit to your well site.

Name: _____

Address: _____

_____

Phone Number: _____

Thank you for your interest and help! Please place this questionnaire in the enclosed stamped, self-addressed envelope and return by Friday, March 1, 1991.

Thomas J. Wilson
Waupaca County UW-Extension
Resource Development Agent

Greg P. Blonde
Waupaca County UW-Extension
Agricultural Agent