APPENDIX A

WISCONSIN ADMINISTRATIVE CODE, WELLHEAD PROTECTION PLAN

The Wisconsin Administrative Code, Chapter NR 811, Section 12(6) states:

(6) Well Head Protection Plan. A well head protection plan shall be provided for all new wells for municipal water systems. The owner of the municipal water system or its agent shall develop the plan. No new municipal well may be placed into service until the department has approved the well head protection plan. The plan shall include but is not limited to:

(a) Identification of the groundwater flow direction.

(b) Identification of the zone of influence for the well consisting of the distance to one foot of aquifer drawdown at the anticipated final pumping rate when pumpage of the well is assumed to be continuous without recharge for 30 days. The zone of influence shall be calculated using the Theis Method with or without groundwater modeling unless another method is approved by the department.

(c) Identification of the recharge area for the well. The recharge are shall be calculated using the Uniform Flow Equation or be computer modeled unless another method is approved by the department.

(d) Identification of the potential contamination sources within 0.5 mile of the well location and an assessment of the potential for the existing contamination sources within the recharge area of the well to negatively impact the well water quality. The potential contamination sources shall be summarized in a table or list including distance and direction from the well site and shall also be shown on a map surrounding the well site. The table or list shall include information obtained by checking the department's database of contaminated properties, established in accordance with ss. 292.12 (3), 292.31 (1), and 292.57, stats.

(e) Establishment of a well head protection area for the proposed well. The well head protection area shall encompass, at a minimum, that portion of the recharge area equivalent to a 5 year time of travel to the well. The well head protection area may be determined by a hydrogeologic investigation.

(f) A public education program for well head protection.

(g) A water conservation program.

(h) A contingency plan for providing safe water and protecting the well from contamination based on the inventory and assessment of potential contamination sources.

(i) A management plan, which assesses alternatives for addressing potential contamination sources, describes the local ordinances, zoning requirements, monitoring program, and other local initiatives proposed within the well head protection area established in par. (e), and addresses maintaining the minimum contamination source separation distances established by well siting in sub. (5) (d).

(j) The well head protection plan shall be labeled with the name and signature of the person who prepared the plan, the date that the plan was signed, and the name of the company or water system which the person represents. An owner approval letter shall be submitted when required in accordance with s. NR 811.10.

APPENDIX B

SURVEY PLAT - UNIT WELL 20

Vol 44, Page 42

1485798

HILL VIEW ADDITION TO MEADOWOOD

LOCATED IN THE NE 1/4 AND SE 1/4 OF SECTION 1, T6N, R8E, CITY OF MADISON, DANE COUNTY, WISCONSIN

CURVE TABLE

CURVE	LOT	RADIUS	CENT. ANGLE	CHORD	BEARING	TAN. BEARING
1-2		681.99'	18°52'24"	223.69'	S82°26'32"W	
	Lands	"	13°40'50"	164.23'	S84°59'29"W	S=S78°02'34"W
	1093	"	05°02'34"	60.00'	S75°31'17"W	
1-3		681.99'	13°40'50"	164.23'	S84°59'29"W	
4-5		800.00'	31°33'26"	435.07'	S79°45'17"W	
	1079	"	08°08'40"	113.62'	S84°00'54"W	
	1078	"	16°03'56"	223.58'	S76°07'12"W	
	Lands	"	07°20'50"	102.52'	S27°49'35"W	
6-5		800.00'	07°20'50"	102.52'	S27°49'35"W	6=S24°09'10"W
6-4		800.00'	24°12'56"	335.52'	S12°02'52"W	
7-8		25.00'	89°13'50"	35.12'	N44°33'30"E	
9-10		743.78'	16°10'26"	209.26'	N81°05'13"E	
	1085	"	03°04'16"	39.86'	N87°38'18"E	
	1086	"	06°33'06"	85.00'	N82°49'38"E	
	1087	"	06°33'06"	85.00'	N76°16'33"E	
2-3		681.99'	05°02'34"	60.00'	N75°31'17"E	3=N78°02'34"E
11-12		390.00'	88°39'50"	545.08'	N44°50'34"E	
	1064	"	05°17'26"	36.00'	N03°09'19"E	
	1065	"	13°27'02"	91.54'	N12°51'33"E	
	1066	"	21°32'56"	149.82'	N30°01'33"E	
	ST	"	13°48'00"	93.70'	N47°42'02"E	
	1052	"	19°45'48"	133.86'	N64°28'56"E	
	1053	"	14°48'36"	100.53'	N81°46'08"E	
11-13		390.00'	40°17'26"	268.63'	N20°39'19"E	13=N40°48'02"E
13-14		15.00'	94°11'58"	21.98'	N82°54'01"E	
15-16		260.00'	45°49'34"	202.45'	S69°54'49"E	
	1068	"	16°19'06"	73.80'	S53°09'33"E	
	1069	"	14°21'40"	65.00'	S68°29'56"E	
	1070	"	15°08'48"	68.53'	S83°15'10"E	
17-18		143.37'	29°00'00"	71.90'	S26°18'34"E	
	1075	"	26°12'15"	65.58'	S27°43'27"E	
	1076	"	02°47'46"	7.00'	S65°13'27"E	
19-20		25.00'	92°23'56"	36.08'	S15°38'05"E	20=S30°33'24"W
20-21		720.00'	00°56'56"	11.85'	S31°01'42"W	
22-23		450.00'	88°59'50"	628.93'	S44°50'34"W	24=S52°33'48"W
	1039	"	01°06'46"	8.73'	S88°37'03"W	30=S41°20'52"W
	1040	"	08°36'10"	67.50'	S83°45'35"W	
	1041	"	09°19'16"	73.12'	S74°47'52"W	
	1042	"	09°19'16"	73.12'	S65°28'36"W	
	1043	"	08°19'10"	64.76'	S56°41'23"W	
	ST	"	11°12'56"	87.95'	S46°57'20"W	
	1048	"	16°50'32"	131.85'	S32°55'26"W	
	1049	"	09°04'52"	71.25'	S19°57'34"W	
	1050	"	10°09'34"	79.69'	S10°20'21"W	
	1051	"	04°44'58"	37.29'	S02°53'05"W	
24-25		15.00'	76°25'38"	18.56'	N89°13'25"W	
26-27		50.00'	253°07'48"	89.44'	S12°25'52"W	
	1043	"	02°07'26"	1.85'	N52°04'17"W	

CURVE TABLE

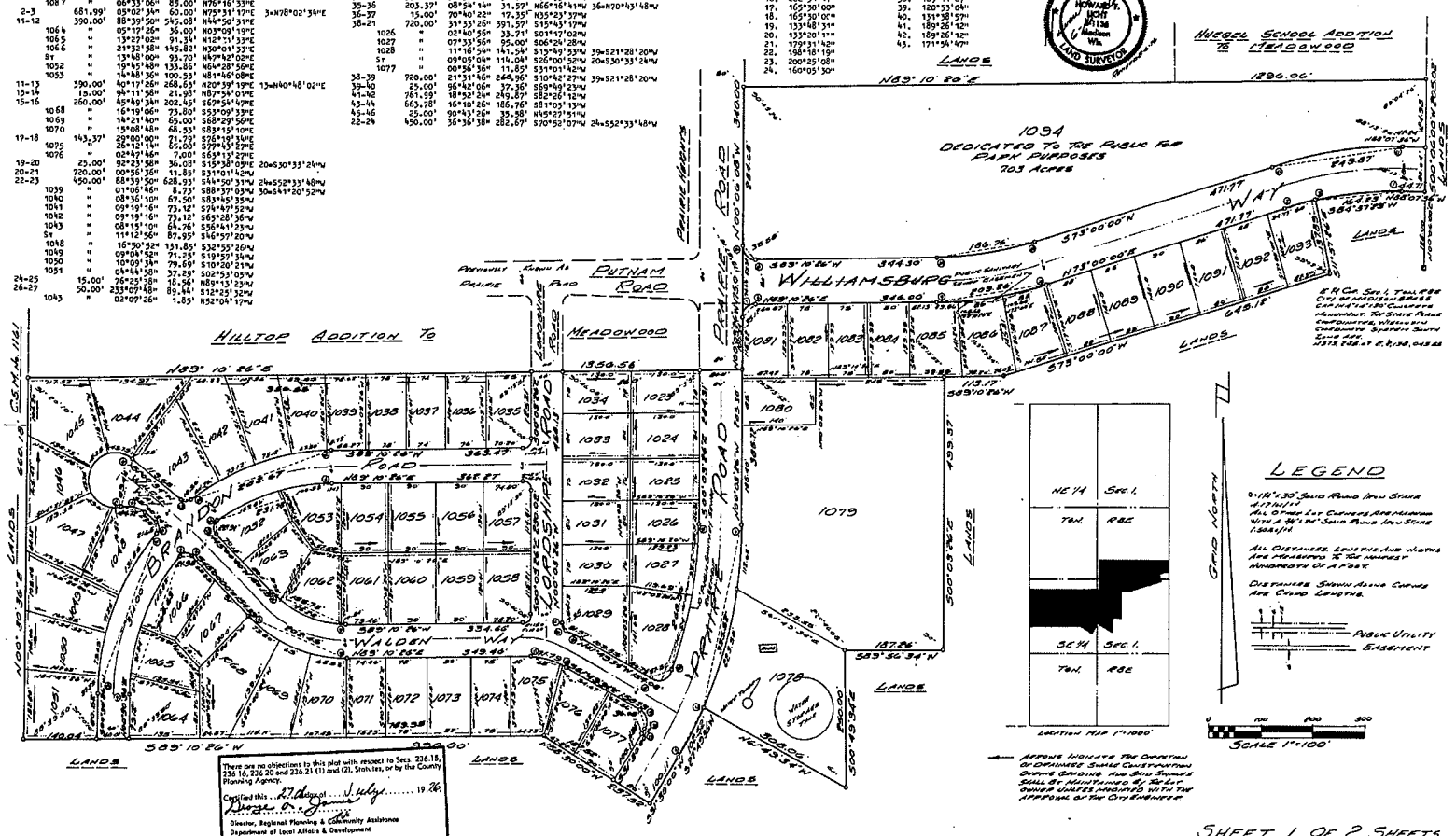
CURVE	LOT	RADIUS	CENT. ANGLE	CHORD	BEARING	TAN. BEARING
	1044	"	51°53'20"	43.75'	N79°04'40"W	
	1045	"	48°43'26"	41.25'	S50°36'57"W	
	1046	"	51°53'20"	43.75'	S00°18'34"W	
	1047	"	59°29'26"	49.61'	S55°22'49"E	
	1048	"	19°00'50"	16.32'	N85°22'03"E	27=N75°51'38"E
27-28		50.00'	53°07'48"	44.72'	S77°34'28"E	
29-30		15.00'	92°21'26"	21.65'	S04°49'51"E	30=S41°20'52"W
30-23		450.00'	40°50'16"	314.00'	S20°55'44"W	
31-32		200.00'	49°49'34"	195.21'	N67°54'49"W	
	1061	"	03°01'08"	10.54'	N89°19'00"W	
	1062	"	36°30'18"	125.28'	N69°33'17"W	
	1063	"	06°48'08"	21.99'	N88°09'04"W	
33-34		15.00'	99°36'02"	22.91'	N04°48'01"E	34=N54°36'02"E
34-12		390.00'	34°34'24"	231.78'	N71°53'14"E	
35-36		203.39'	08°54'14"	31.59'	N66°16'41"W	36=N70°43'48"W
36-37		15.00'	70°40'22"	17.35'	N35°23'37"W	
38-21		720.00'	31°33'26"	391.57'	S15°45'17"W	
	1026	"	02°40'36"	33.71'	S01°17'02"W	
	1027	"	07°33'56"	95.00'	S06°24'28"W	
	1028	"	11°16'54"	141.54'	S15°59'33"W	39=S21°28'20"W
	ST	"	09°05'04"	114.04'	S26°00'52"W	20=S30°33'24"W
	1077	"	00°56'56"	11.85'	S31°01'42"W	
38-39		720.00'	21°31'46"	268.96'	S10°42'27"W	39=S21°28'20"W
39-40		25.00'	98°42'06"	37.36'	S69°39'23"W	
41-42		761.99'	18°52'24"	249.87'	S82°26'32"W	
43-44		663.78'	16°10'26"	186.76'	S81°05'13"W	
45-46		25.00'	90°43'26"	35.58'	N45°27'51"W	
22-24		450.00'	36°36'38"	282.67'	S70°52'07"W	24=S52°33'48"W

INTERIOR BLOCK ANGLES

2.	177°28'43"	25.	141°47'11"	44.	171°58'47"
3.	89°28'43"	26.	296°33'58"	45.	134°58'17"
4.	192°06'18"	27.	270°00'00"	46.	134°58'17"
6.	106°07'54"	28.	153°26'06"		
7.	139°23'04"	29.	133°40'17"		
8.	139°23'04"	30.	154°14'28"		
9.	128°05'13"	31.	157°05'13"		
10.	128°05'13"	32.	157°05'13"		
11.	159°51'17"	33.	130°14'59"		
12.	162°42'48"	34.	112°54'47"		
13.	112°45'18"	35.	184°27'07"		
14.	132°54'03"	36.	149°06'56"		
15.	202°54'47"	37.	144°39'49"		
16.	202°54'47"	38.	169°14'07"		
17.	169°30'00"	39.	120°53'04"		
18.	169°30'00"	40.	131°58'57"		
19.	133°48'31"	41.	189°26'12"		
20.	133°20'17"	42.	189°26'12"		
21.	179°31'42"	43.	171°54'47"		
22.	198°18'19"				
23.	200°25'08"				
24.	160°05'30"				

INTERIOR PLAT ANGLES

1.	186°54'55"
3.	276°54'55"
6.	290°20'51"
5.	176°19'39"



There are no objections to this plat with respect to Secs. 236.15, 236.16, 236.20 and 236.21 (1) and (2), Statutes, or by the County Planning Agency.

Certified this 27th day of July 19 76.

Director, Regional Planning & Community Assistance
Department of Local Affairs & Development

SHEET 1 OF 2 SHEETS

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1485798

HILL VIEW ADDITION TO MEADOWOOD

SURVEYOR'S CERTIFICATE

I, Howard F. Licht, Registered Land Surveyor, hereby certify that in full compliance with the provisions of Chapter 236, Wisconsin Statutes, and the Subdivision Regulations of the City of Madison, and according to the instructions and descriptions furnished to me by the owners listed below, I have surveyed "Hill View Addition to Meadowood" and that such plat correctly represents all exterior boundaries and subdivision of the land surveyed and is located in the SE¼ of the NE¼ and in the NE¼ and NW¼ of the SE¼ of Section 1, 7 6N, R8E, City of Madison, Dane County, Wisconsin, to-wit:

Commencing at a concrete monument with Brass cap at the East ¼ corner of said Section 1; thence N00°05'00"E along the East line of the NE¼ of said Section 1, 135.00 feet to the point of beginning; thence N88°07'36"W, 44.71 feet to a point of curve; thence Westerly on a curve to the left which has a radius of 681.99 feet and a chord which bears S84°57'29"W, 164.23 feet; thence S11°52'26"E, 137.89 feet; thence S73°00'00"W, 645.32 feet; thence S89°10'26"W, 193.17 feet; thence S00°03'26"E, 499.37 feet; thence S89°56'34"W, 187.26 feet; thence S00°49'34"E, 250.00 feet; thence N51°49'34"W, 308.06 feet to a point on a curve; thence Southwesterly on a curve to the left which has a radius of 800.00 feet and a chord which bears S27°49'39"W, 102.52 feet to a point of tangency; thence S31°30'00"W, 100.19 feet; thence N58°30'00"W, 237.32 feet; thence S89°10'26"W, 990.00 feet to the North-South ¼ line; thence N00°30'36"E along said line 660.18 feet to the Southwest corner of the Plat of Hilltop Addition to Meadowood; thence N89°10'26"E along the South line of Hilltop Addition to Meadowood and said South line extended 1356.36 feet to the East Right of Way line of Prairie Road; thence N00°03'26"W along said East line 175.0 feet; thence N00°06'08"W along said East line 340.00 feet; thence N89°10'26"E, 1296.06 feet to the East line of the NE¼ of said Section 1; thence S00°06'00"W along said East line 205.02 feet to the point of beginning, excepting therefrom any areas previously dedicated to the public.

Dated this 16th day of June 1976.
Revised this 6th day of August 1976.

Howard F. Licht
Howard F. Licht
Registered Land Surveyor No. S-1136

CORPORATE OWNER'S CERTIFICATE OF DEDICATION

Midland Builders Incorporated, a corporation duly organized and existing under and by virtue of the laws of the State of Wisconsin, as owner, does hereby certify that said corporation caused the land described on this plat to be surveyed, divided, mapped and dedicated as represented on this plat.

Midland Builders Incorporated, does further certify that this plat is required by S.236.10 or S.236.12 to be submitted to the following for approval or objection:

Director, Regional Planning & Community Assistance, Department of Local Affairs & Development
Dane County Agriculture, Zoning, Planning and Water Resources Committee
The Common Council of the City of Madison

In witness whereof, the said Midland Builders Incorporated, has caused these presents to be signed by David Wm. Crocker, its President, and countersigned by Howard E. Mazur, its Treasurer, at Madison, Wisconsin, and its corporate seal to be hereunto affixed on this 2nd day of September, 1976.

In the presence of:
Eleanor C. Rogers
Barbara L. Carver

David Wm. Crocker
David Wm. Crocker, President
Howard E. Mazur
Howard E. Mazur, Treasurer

STATE OF WISCONSIN) S.S.
COUNTY OF DANE)

Personally came before me this 2nd day of September, 1976, David Wm. Crocker, President, and Howard E. Mazur, Treasurer, of the above named corporation, to me known to be the persons who executed the foregoing instrument, and to me known to be such President and Treasurer of said corporation, and acknowledged that they executed the foregoing instrument as such officers as the deed of said corporation, by its authority.

My commission expires Oct. 14, 1979.

Eleanor C. Rogers
Notary Public, Dane County, Wisconsin

Meadowood Baptist Church, Inc., a corporation duly organized and existing under and by virtue of the laws of the State of Wisconsin, as owner, does hereby certify that said corporation caused the land described on this plat to be surveyed, divided, mapped and dedicated as represented on this plat.

Meadowood Baptist Church, Inc., does further certify that this plat is required by S.236.10 or S.236.12 to be submitted to the following for approval or objection:

Director, Regional Planning & Community Assistance, Department of Local Affairs & Development
Dane County Agriculture, Zoning, Planning and Water Resources Committee
The Common Council of the City of Madison

In witness whereof, the said Meadowood Baptist Church, Inc., has caused these presents to be signed by Herbert F. Kietzke, its Chairman of the Board, and countersigned by Melvin Grinnell, Secretary, at Madison, Wisconsin, and its corporate seal to be hereunto affixed on this 2nd day of September, 1976.

In the presence of:
Barbara L. Carver

Herbert F. Kietzke
Herbert F. Kietzke, Chairman of the Board
Melvin Grinnell
Melvin Grinnell, Secretary

STATE OF WISCONSIN) S.S.
COUNTY OF DANE)

Personally came before me this 2nd day of September, 1976, Herbert F. Kietzke, Chairman of the Board, and Melvin Grinnell, Secretary, of the above named corporation, to me known to be the persons who executed the foregoing instrument, and to me known to be such Chairman of the Board and Secretary of said corporation, and acknowledged that they executed the foregoing instrument as such officers as the deed of said corporation, by its authority.

My commission expires Oct. 14, 1979.

Eleanor C. Rogers
Notary Public, Dane County, Wisconsin

CERTIFICATE OF COUNTY TREASURER

STATE OF WISCONSIN) S.S.
COUNTY OF DANE)

I, Martin T. Gunnulson, being the duly elected, qualified, and acting Treasurer of the County of Dane, do hereby certify that the records in my office show no unredeemed tax sales and no unpaid taxes or special assessments as of this 7th day of September, 1976, affecting the lands included in the plat of "Hill View Addition to Meadowood."

Martin T. Gunnulson
Martin T. Gunnulson, Treasurer
Dane County

MUNICIPAL OWNER'S CERTIFICATE

As owners, the City of Madison, a municipal corporation duly organized and existing under the laws of the State of Wisconsin, hereby certifies that it caused the land described on this plat to be surveyed, divided, mapped and dedicated as represented on this plat, and that this plat is required by S.236.10 or S.236.12 to be submitted to the following for approval or objections:

Director, Regional Planning and Community Assistance, Department of Local Affairs & Development
Dane County Agriculture, Zoning, Planning and Water Resources Committee
The Common Council of the City of Madison

In witness whereof, said City of Madison, has caused these presents to be signed by Paul R. Soglin, its Mayor, and Elson L. Hoel, its Clerk, and affixed with its corporate seal, at Madison, Wisconsin, this 2nd day of September, 1976.

In the presence of:
Shaun K. Winston
Sharon Kvalheim

City of Madison
Paul R. Soglin
Paul R. Soglin, Mayor
Elson L. Hoel
Elson L. Hoel, Clerk

STATE OF WISCONSIN) S.S.
COUNTY OF DANE)

Personally came before me this 2nd day of September, 1976, Paul R. Soglin, Mayor, and Elson L. Hoel, Clerk of the above named corporation, to me known to be such Mayor and Clerk of said corporation, and the persons who executed the foregoing instrument, and acknowledged that they executed the same as the deed of said corporation, by its authority.

My commission expires 8-30-79.

Sharon Kvalheim
Notary Public, Dane Co., Wisconsin

CERTIFICATE OF CITY TREASURER

STATE OF WISCONSIN) S.S.
COUNTY OF DANE)

I, Howard W. Gallagher, being the duly appointed Treasurer of the City of Madison, do hereby certify that in accordance with the records in my office, there are no unpaid taxes or unpaid special assessments as of this 2nd day of September, 1976, on any of the land included in the plat of "Hill View Addition to Meadowood."

Howard W. Gallagher
Howard W. Gallagher, Treasurer
City of Madison

COMMON COUNCIL RESOLUTION

"Resolved that a plat known as "Hill View Addition to Meadowood" which has been duly filed for approval of the Common Council of the City of Madison, Dane County, Wisconsin, be and the same is hereby approved as required by Chapter 236, Wisconsin Statutes."

I hereby certify that the above is a true and correct copy of a resolution adopted by the Common Council of the City of Madison on this 3rd day of August, 1976.

Elson L. Hoel
Elson L. Hoel, City Clerk

Received for recording this 3 day of Sept., 1976, at 8:30 o'clock, A.M., and recorded in Volume 44 of Plats, Page 42 & 43.

Harold W. Hill
Harold W. Hill, Dane County Register of Deeds

This instrument was drafted by Howard F. Licht
Held & Associates, Inc., Madison, Wisconsin

There are no objections to this plat with respect to Secs. 236.15, 236.16, 236.29 and 236.21 (1) and (2), Statutes, or by the County Planning Agency.
Certified this 27th day of August, 1976.
Director, Regional Planning & Community Assistance
Department of Local Affairs & Development

SHEET 2 OF 2 SHEETS

APPENDIX C

UNIT WELL 20 CONSTRUCTION REPORT AND FORMATION LOG

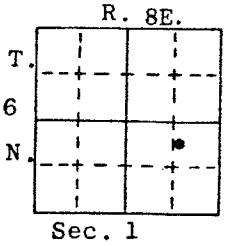
UNIVERSITY OF WISCONSIN GEOLOGICAL & NATURAL HISTORY SURVEY
1815 University Avenue, Madison, Wisconsin 53706

Log No. B98-Dn-1060
Sample Nos. All Retained

Well name Madison City Well #20
(L. A. Smith Station Well)

Owner.... City of Madison
Address.. 523 E. Main Street
Madison, WI 53703
Driller.. Layne-Northwest Co.
Engineer. Robert P. Fuller
Madison, Wisconsin

County: Dane
Completed... 10/72
Field check. WGS-RMP
Altitude.... 1108' ETM
Use..... Municipal
Static w.l.. 261.23'
Spec. cap... 18.9 GPM/ft



Quad. Madison West 7½'

Drill Hole						Casing & Liner Pipe or Curbing							
Dia.	from	to	Dia.	from	to	Dia.	Wgt.& Kind	from	to	Dia.	Wgt.& Kind	from	to
45"	0	415'	29"	415'	1068'	30"	½" wall API5LB new welded	+2'	415'				

Grout: Kind	from	to
Neat Cement	0	415'

Samples from 0 to 1130' Rec'd: 9/9/71, 12/7/71 Studied by: R. M. Peters M. Roshardt (300'-400') Issued: 3/6/85

Formations: Surface, Sinnipee Group, St. Peter Ss (Tonti & Readstown Mbrs), Jordan Fm, St. Lawrence Fm (Lodi & Black Earth Mbrs), Tunnel City Gp, Wonewoc Fm, Eau Claire Fm, Mt. Simon Ss.

Remarks: Well tested for 48 hours at 2400 GPM with 126.70' of drawdown.
Well back filled with cement from 1068' to 1131'. Dn-898 is the 400' deep test hole for this well. Well was drilled by reverse rotary method. WG&NHS resistivity, gamma and spontaneous potential logs run - 10/12/72.

LOG OF WELL:

	Depths	Graphic Section	Rock Type	Color	Grain Size Mode	Grain Size Range	Miscellaneous Characteristics
Sfc.	0-9		Sand & silt	Yl brown	M	VFn/VC	Much soil. Trace gravel.
SINNIPEE	9-15	BM / Pyro	Dolomite	Lt yl brown	Fn	Fn/M	Ltl quartz, pyrolusite coating. Tr drsy qtz, foss frags.
	15-20		"	Pl yellow	M	"	Mch "caved" snd & silt. Tr bn bk coating (pyrolusite?) "caved" grans, cht (caved?).
	20-25		"	"	Fn/M	"	Same but no chert.
	25-30		"	"	Fn	"	Mch cht ("caved"?), "caved" snd & silt. Tr pyrolusite coating,
	30-35		"	"	Fn/M	"	Mch "caved" snd&silt. Tr bn bk coating, cht, "caved" gravel.
	35-40		"	"	Fn	"	Mch "caved" snd&silt. Ltl cht("caved"?). Tr bn bk ctg, "cvd"
	40-45		"	"	Fn/M	"	Mch "cvd" snd&st. Tr cht("cvd"?)bn bk ctg, "cvd" gvl. grans.
10'	45-49		"	"	"	"	Mch"cvd" snd&st. Ltl cht ("cvd"). Tr bn bk ctg, "cvd" grans.
	49-55		Sandstone	V pl yl gy	Fn/M	VFn/C	Mch silica cement. Little limonite.
	55-60	Lim	"	Pl yl&rd yl	"	"	Same.
	60-65	Fe	"	Or yellow	"	Fn/C	Mch silica cement. Ltl Fe oxide coating. Tr limonite.
	65-70		"	"	"	"	Same.
TONTI	70-75	Fe	"	"	"	"	"
	75-80		"	"	"	"	"
	80-85		"	Lt or yl	"	VFn/C	Mch silica cement. Tr Fe oxide coating.
	85-90	Lim Lim	"	Lt or yl&v dk bn	Fn	"	Mch lim, silica cement. Tr Fe oxide coating.
	90-95		"	Lt or yl	Fn/M	"	Mch silica cement. Tr interstitial clay.
	95-100		"	"	Fn	"	Mch silica cement. Tr Fe oxide banding.
	100-105		"	"	"	"	Much silica cement.
	105-110		"	Lt or yl	M	VFn/C	Mch silica cement. Tr Fe oxide coating.
	110-115		"	"	"	Fn/C	Ltl silica cem. Tr lim, limonite cement.
	115-120	Lim	"	"	"	"	Ltl lim, sil cem. Tr lim cement.
	120-125		"	"	"	"	Mch sil cem. Tr lim&Fe oxide coating.
	125-130		"	Lt or yellow, yl bn & yl bn	"	VFn/C	Ltl sil cem. Tr lim coating, Fe oxide coating.
	130-135		"	Lt or yl & yl bn	Fn/M	"	Same.
	135-140		"	Lt or yl	"	"	Little silica cement.
	140-145		"	"	"	"	Ltl sil cem. Tr lim cem. Fe oxide banding.
	145-150		"	"	M	"	Ltl silica cement. Tr limonite coating.
09	150-158		"	"	"	"	Ltl silica cement.
Lodi	158-160		Sandstone&sh	Gy vi & white	VFn	VFn/C	Mch sts, hemic cem. Shale: hematitic, siliceous.

name: Madison City Well #20 (L. A. Smith Station Well)

	Depths	Graphic Section	Rock Type	Color	Grain Size Mode	Grain Size Range	Miscellaneous Characteristics
READSTOWN 52'	160-164	Hem Hem	Ss & shale	Gy vlcl wh	VFn	VFn/C	Mch sts, hematitic cement. Shale: hematitic siliceous.
	164-170	Lim	Sandstone	Gy vlcl wh	M	"	Mch sil cem. Ltl material like 158'-164' (cvd?), lim. Tr Fe oxide coating.
	170-175		"	Lt oryl&v lt gy	Fn/M	"	Mch sil cem, Tr Fe oxide coating, caved dolomite.
	175-180	Lim	Chert	Rd brn& wh	--	--	Soft. Very oolitic. Mch limonitic banding.
	180-185	Hem Hem	Shale	Wh, gy vi&rd bn	--	--	Very hematitic. Mch wh cht. Ltl lim cem ss, wh shale.
	185-190	Hem Hem	"	Rd & white	--	--	Very hematitic. Mch wh sh (decayed cht). Ltl sand. Tr hard wh cht.
	190-195		Sandstone	Wh, gy, vi&bn yl	M	VFn/C	Mch v hematitic sh, sil cem, cht (wh oolitic), wh shale.
	195-200	Hem Hem	"	Rd brn&bn yl	"	"	Mch hem&sil cem. Ltl hem sh, lt yl cht. Tr wh shale.
	200-205		Chert	Rd bn, yl brn&gy vi	--	--	Mch sil & hem cem ss. Ltl hematitic shale.
	205-210		"	Lt yl bn	--	--	Mch sil cem ss, drusy quartz. Tr Fe oxide cement.
JOR. 25'	210-215		Sandstone	"	Fn/M	VFn/C	Much silica cement, chert.
	215-220		"	V pl bn	"	"	Much silica cement.
	220-225		"	Bn yellow	"	VFn/M	Same.
	225-230		"	Bn yl& rd bn	"	VFn/C	Much silica cement. Tr Fe oxide coating.
	230-235		"	Bn yellow	"	VFn/M	Same.
Lodi 20'	235-240		Siltstone	Gy rd vlc	--	--	Much VFn/M sand. Little silica cement.
	240-245		Ss & sts	Pl yl&gy vi	M	VFn/C	Mch dolic cem (sts), silica cement (sandstone).
	245-250		Shale	V pl gy gn	--	--	Siliceous. Mch silt, VFn/C snd. Tr red bn hematitic shale.
	250-255	Hem	Siltstone	Rd bn & yl	--	--	Mch dolic cement. Ltl hematitic matrix. Ltl green shale.
Blk. E. 30'	255-260	G	Dolomite	Bn yellow	M	Fn/M	Trace VFn glauconite, pyrolusite.
	260-265	G	"	"	Fn	"	Same.
	265-270	G	"	Bn yl&gy vi	"	"	"
	270-275	G G	"	"	"	"	Ltl VFn glauconite. Tr pyrolusite, wh shale.
	275-280	G G	"	"	"	"	Ltl VFn/Fn glauconite. Tr pyrolusite, wh shale.
	280-285	G G	"	"	"	"	Same but no shale.
TUNNEL CITY Gp. 127'	285-290	G G G	Sandstone	Yl green	Fn	VFn/M	Mch VFn/M glauconite, shaly matrix. Tr dolomite cement.
	290-295	G G G	Shale	Yl, yl gn&rd bn	--	--	Mch VFn/M glauconite. Much silt, VFn/M sand.
	295-300	G G G	Sandstone	Bn yellow	Fn	VFn/M	Mch dol cem, VFn/M glauconite. Tr v pl yl shale.
	300-305	G G	Sandstone	Or yellow	Fn	VFn/M	Mch dol cem. Ltl Fn/M glauconite. Tr red & green shales.
	305-310	G	"	"	"	"	Same.
	310-315	G G	"	"	"	"	"
	315-320	G	"	"	"	"	Mch dol cem. Tr red & gn shales, fossil frags, glauconite.
	320-325		"	"	"	"	Same but no fossil fragments.
	325-330	G	"	"	"	"	Same.
	330-335	G G	"	"	"	"	Mch dol cem. Ltl Fn/M glauconite. Trace green shale.
	335-340	G	"	"	"	"	Mch dol cement. Tr glauconite.
	340-345		"	"	"	"	Same plus little green shale.
	345-350	G	"	"	"	"	Same.
	350-355	G G	"	"	"	"	Same but little glauconite.
	355-360	G	"	"	"	"	Same but trace glauconite.
	360-365		"	"	"	"	Same.
	365-370	G	"	Or brown	Fn/M	VFn/C	Mch dol cement. Tr Fn/C glauconite, red shale.
	370-375		"	"	M	"	Same.
	375-380	G	"	"	"	"	"
	380-385		"	Tan & gn	Fn	VFn/VC	Mch silica cement. Little green & red shales.
	385-390		"	"	"	"	Same.
	390-400		"	"	"	"	"
	400-405		"	"	M	VFn/C	Much silica cement. Little green shale.
	405-410		"	Yl gn &gn	Fn	"	Much silica&dolomite cement. Trace green shale.
	410-412		Siltstone	Red yellow	--	--	Much dolic shale matrix. Trace sand.
WONEWOC 63'	412-415		Sandstone	V pl bn&dk yl	C	VFn/VC	Little brown dolic shale, Tr silica cement.
	415-420		"	V pl bn	"	"	Tr bn dolic shale, dolic cement, white shale.
	420-425		"	Yellow	M	VFn/C	Much dolomite cement. Trace pyrolusite?
	425-430	Pyr	"	"	C	"	Much calcite cement. Little pyrolusite?
	430-435		"	"	M/C	VFn/VC	Much dol&calcite cem. Tr pyrolusite?, Fe oxide.
	435-440		"	White	M	"	Trace caved 430'-435', white shale.
	440-445		"	Yellow	M/C	"	Much calcite cement. Trace pyrolusite?
	445-450		"	V pl yl gy	Fn/M	VFn/C	Trace caved 440'-445', white shale.
	450-455		"	Yellow	M/C	VFn/VC	Mch calcite cement. Tr pyrolusite?, calcite crystals.
	455-460		"	V pl yl gy	Fn/M	"	Little pl green shale. Tr white shale.
	460-465		"	White	"	"	Trace pale green & white shales.
	465-470		"	V pl yl gy	"	"	Trace white shale.
	470-475		"	Pl yellow	"	VFn/C	Same.
E.C.	475-480		"	Yellow	Fn	VFn/M	Trace dolomite cement, white shale.
	480-485	G	"	Pl yellow	Fn/M	VFn/C	Little wh sh. Tr dol cem, glauc?, caved brown shale.
	485-490		"	Yellow	"	"	Mch dol cem. Tr wh shale, brown shaly matrix.

Name: Madison City Well #20 (L.A. Smith Station Well)

Depths	Graphic Section	Rock Type	Color	Grain Size		Miscellaneous Characteristics
				Mode	Range	
490-495		Sandstone	Yellow	Fn/M	Vfn/C	Ltl dol cem,pl gn pl bn,yl bn sh. Tr pyro?, white shale.
495-500		"	"	Fn	Vfn/C	Trace dol cement, bn shaly matrix, white shale.
500-505		"	"	Vfn/Fn	Vfn/M	Trace dolomite cement.
505-510		"	Or yellow	Fn/M	Vfn/C	Much dolomite cement, white & pink shale, pyrolusite?
510-515		"	Yellow	M	Vfn/C	Ltl dol cem,white,pl gn,& yl bn sh. Tr dendritic pyrolusite.
515-520		Siltstone	"	--	--	Moh dol cem,sand.Tr dend pyro. Tr white & pl gn shales.
520-525		Ss & Sts	Pl yl & pl gn	Fn/M	Vfn/VC	Moh pl gn shale, dol cem.Ltl wh sh. Tr dendritic pyrolusite.
525-530		Sandstone	Lt yl brn&gy	Fn/M	Vfn/C	Moh gry sh, dol, dol cem. Trace dendritic pyrolusite.
530-535		"	Lt pk gy	Fn	Vfn/M	Moh dol cem. Tr pale green shale, fossil fragments.
535-540	G	Sh & ss	Gn gy&ltgn gy	"	Vfn/C	Moh dol cement. Trace glauconite.
540-545		Shale	Green gray	--	--	Trace sandstone, pyrite.
545-550		"	"	--	--	Trace sand.
550-555	G G G	Dol & Sh	Gray green	Fn	Fn	Much glauconite. Trace gray shale, pyrite.
555-560	G G G	Dolomite	Green gray	"	Fn/M	Moh glauc, Fn/C dol-cem ss. Few fossil fragments.
560-565		Sandstone	V lt gy	M	Vfn/VC	Ltl gn gry cvd? glauc sh. Tr cvd dol,wh shale, dol cement.
565-570	G	"	Pink	"	Vfn/C	Moh dol cem. Tr white sh, cvd gry sh,rd spks,cvd? glauc.
570-575		"	V pl pk gy	"	Vfn/VC	Moh dol cem. Tr pl gn & yl bn shales.
575-580		"	V lt gy	M/C	"	Tr dol cem,pl gn& wh sh,cvd glauc dol,gn gry glauc shale.
580-585		"	V pl bn	M	Vfn/C	Much dolomite cement.
585-590		"	V pl pk gy	"	"	Same plus trace red speckling.
590-595	G	"	V pl bn	"	Vfn/VC	Tr dol cem, caved? glauconite, shaly matrix.
595-600		"	Lt pk gy	"	"	Moh dol cement. Tr caved? yl bn shale, white shale.
600-605		"	V lt pk gy	"	Vfn/C	Moh dol cement.Tr red speckling,cvd gn gy shale.
605-610		"	"	"	"	Moh dol cement. Tr gry & yl bn shale, white shale.
610-615		"	V lt pk gy & pl gn	"	"	Moh dol cem, pl gn & wh shaly matrix. Tr yl bn shale.
615-620		"	Lt pk gy & pl gn	"	"	Moh dol cem. Ltl pale gn & wh shaly matrix.
620-625		"	Lt pk gy	"	"	Moh dol cem. Trace white shale.
625-630		"	V lt gy	M/C	Vfn/VC	Ltl dol cement. Tr white & yellow brown shale.
630-635		"	Light gray	M	Vfn/C	Moh dol cement. Tr cvd gray shale, iron pyrites.
635-640		"	White	"	Vfn/VC	Ltl wh shale. Tr dol cement, v pl gn shaly matrix.
640-645		"	V lt gy	M/C	"	Tr dol cement, yellow bn shale, iron pyrites.
645-650		"	Lt pk gy	M	Vfn/C	Moh dol cement. Tr sndy dolomite, iron pyrites.
650-655		"	V lt gy	Fn/C	Vfn/VC	Ltl sandy dol. Tr dol cement, pl gn shaly matrix.
655-660		Ss & Dol	Lt pk gy	M & Fn	Vfn/C & Fn/M	Moh dol cement, sandy dolomite, dolomite rhombs.
660-665		"	"	"	"	Moh sndy dolomite, dolomite cement.Trace iron pyrites.
665-670		Sandstone	"	"	Vfn/C	Moh dolomite,dolomite cement. Trace iron pyrite.
670-675		Ss & Dol	"	M & Fn	Vfn/C & Fn/M	Moh floating sand, dolomite cement.
675-680		Sandstone	"	M	Vfn/C	Much dolomite cement. Little sandy dolomite.
680-685		"	V pl bn	Fn/M	"	Much sandy dolomite, dolomite cement.
685-690		Dolomite	Pink gray	Fn	Fn/M	Much floating sand. Much dolomite cemented sandstone.
690-695		Dol & Ss	"	Fn & M	Fn/M & Vfn/C	Moh floating sand, dol cement. Tr cvd? gray green shale.
695-700		"	"	"	Fn/M & Vfn/VC	Same but no shale.
700-705		Sandstone	Lt pk gy	M	Vfn/C	Moh dol cement. Ltl sandy dol. Trace v pl gn shale.
705-710		"	"	"	"	Moh dol cement. Trace red speckling.
710-715		"	Pl gn & lt pk gy	Fn/M	"	Moh pale green sandy shale, dolomite cement.
715-720		"	Lt pk gy	"	"	Much dolomite cement. Trace pl gn sandy shale.
720-725		"	Pink gray	M	"	Moh dolomite cement, sandy dol. Ltl pale green shaly matrix.
725-730		"	Lt gn gy	Fn	"	Moh pl gn sandy sh. Little dolomite cement.
730-735		"	Lt pk gy	Fn/M	"	Moh dol cement. Little sandy dolomite.
735-740		"	Lt gn gy	M	"	Moh dol cement. Ltl sandy dol, pl yl bn sh.Tr pl gn shales.
740-745		"	Lt gn gy	Fn	"	Moh pl gn shaly matrix. Tr sil cement, iron pyrites.
745-750		"	V pl bn	"	"	Moh dol cement. Trace pl yl bn shale.
750-755		"	"	"	"	Moh dol cement. Trace sandy dolomite.
755-760		"	"	Fn/M	"	Much dol cement. Trace pale gn & yl bn shales.
760-765		"	V lt bn gy	C	Vfn/VC	Tr grans,wh shale, pl gn shale, dolomite cement.
765-770		"	V pl bn	Fn	Vfn/C	Much dolomite cement.
770-775		"	Violet red	M	"	Same.
775-780		"	V pl bn	Fn	"	"
780-785	G	"	V lt bn gy	"	Vfn/VC	Ltl pl gn shaly matrix,Tr Fn glauc, yl bn shale, wh shales.
785-790		"	"	Fn&C	"	Trace pale green shaly matrix, white shale.
790-795	G	"	"	Fn	Vfn/C	Same plus trace yellow brown shale, glauconite?
795-800	G	"	"	Fn&C	Vfn/VC	Trace pale green sh matrix, white shale, Fn glauconite.
800-805		"	"	C	"	Ltl pl gn shaly matrix. Tr wh sh,yl bn sh,caved?gray shale.
805-810		"	"	C/VC	"	Ltl wh sh, Tr yl bn shale,green,dolomite & silica cements.
810-815		"	"	Fn&C	"	Tr yl bn shale,pale gn sh matrix, white shale,silica cement.
815-820		"	"	"	"	Ltl pl gn shaly matx.Tr yl bn shale,white sh,silica cement.

EAU CLAIRE 85'

MT. SIMON SANDSTONE

Log No.B98-Dn-1060
Sample Nos. All Retained

name: Madison City Well #20 (L.A. Smith Station Well)

MT. SIMON SANDSTONE

Depths	Graphic Section	Rock Type	Color	Grain Size Mode	Grain Size Range	Miscellaneous Characteristics
820-825		"	Lt rd bn	Fn/M	Vfn/C	Much dolomite cement.
825-830		"	Pl green	Fn	"	Mch pl gn sh matrix. Tr wh & yl brown shales, silica cem.cvd
830-835		"	"	"	"	Mch pl gn shaly matrix. Trace silica cement. 820'-825'
835-840		"	"	C	Vfn/VC	Mch pl gn sh matx. Tr cvd? sndy dol,si cem, yl brown shale.
840-845		"	"	M	Vfn/C	Mch pale gn shaly matrix. Little silica cement.
845-850		Shale	Lt yl bn	--	---	Much grout. Little like 840'-845'. Trace sand.
850-855		Sandstone	Pale green	M	Vfn/C	Much pale green shaly matrix. Ltl wood. Sample was 95% grout.
855-860		"	"	Fn	"	Much pale green shaly matrix. Trace white shale.
860-865		"	Pl gn&v lt bn gy	"	"	Much pale green shaly matrix.
865-870		"	V lt bn gy	C	Vfn/VC	---
870-875		"	"	"	"	Tr gray brown shaly matrix, white shale.
875-880		"	"	Fn	Vfn/C	Tr yl brown & pale green, shaly matrixes, white shale.
880-885		"	"	Fn/M	Vfn/VC	Same.
885-890		"	V lt gn gy	M/C	"	"
890-895		"	"	Fn	"	Ltl pl gn shaly matrix.Tr yl bn sh matr,wh shale,dol cement.
895-900		"	V lt bn gy	"	Vfn/C	Tr pale gn & yl bn shaly matrixes, white shale.
900-905		"	"	Fn/C	Vfn/VC	Same but no pl gn matrix.
905-910		"	"	M	"	Tr calcic cement, white shale.
910-915		"	"	Fn/M	Vfn/C	Tr pl gn & yl bn shaly matrixes,white shale,silica cement.
915-920		"	"	"	"	Same.
920-925		"	"	Fn/C	Vfn/VC	Ltl silica cem. Trace pale gn shaly matrix,wh shale,granules.
925-930	G	"	Lt bn gy	"	"	Same plus trace iron pyrites,glauc,pale yellowbrown shale.
930-935		Shale	Gray red	--	--	Siliceous. Little pale green. Trace silt, sand.
935-940		Sh & Ss	V lt brown,gray,gray red & pl green	M/C	Vfn/VC	Siliceous(shale). Tr white shale,granules, small pebbles.
940-945		Sandstone	V lt bn gy	Fn/C	"	Tr granules white, gray red, & pale green shales.
945-950	M	Sts & Sh	Lt ol gy	--	--	Mch silic cem(sts)Silic.Micac(sts).Tr snd, gray red shale.
950-955	M	Siltstone	"	--	--	Siliceous,Micaceous.Mch silic cem. Little shale, sandstone.
955-960		Sandstone	V lt bn gy	M/VC	Vfn/VC	Ltl dol cem,Many gran.Tr sm pebs,wh,dk gry & v lt gry shales.
960-965		"	"	M/C	"	Tr dol cem,granules, v lt bn gy shale, white shale.
965-970		"	"	Fn/C	"	Tr granules,wh shale, v lt bn shaly matrix.
970-975		"	"	C	"	Mny gran. Trace small pebbles,wh chert, v lt bn shaly matrix.
975-980		"	"	Fn/M	"	Mch sil cem. Ltl v lt bn shaly matrix, Tr gran, sm pebbles.
980-985		"	Bn yl &v lt bn gy	C/VC	"	Mch sil cem,v lt bn gy sh,Ltl dol cem,Tr pyr,iron oxide coat.
985-989 *		"	V lt bn gy	M/C	Fn/VC	Mch calcic cem,sh matrix,Few gran,Tr sm and medium pebbles.
989-995		Shale	V pl bn&gy red	--	--	Trace sand,granules, small pebbles, calcite.
995-1000 †		Sh & Ss	pl bn	C	Vfn/VC	Much calcic cement. Few granules. Trace small pebbles.
1000-1005		Shale	Lt brown	--	--	Ltl ss(calcite-cemented spheroids)Few gran,Tr sm pebbles.
1005-1010		Sandstone	V lt bn gy	C	Vfn/VC	Tr dark gry,white, and v lt bn shales, silica cement.
1010-1015‡		"	Lt red bn	Fn	"	Mch silica cement. Ltl v lt gy shale. Trace pyrite.
1015-1020		"	V lt bn gy	C	"	Ltl sil cem. Few granules.Tr wh shale, v lt bn gy shale.
1020-1025		"	"	Fn/M	"	Mch sil cem, v lt bn gy shale. Tr red brown shale, pyrite.
1025-1030		"	"	M	"	Mch sil cem. Many gran,small pebbles. Little pl brown shale.
1030-1035		"	"	"	"	Mch sil cem. Few gran., sm peb,Tr med peb,pl gn sh,pl bn sh,rounded
1035-1040		"	"	"	"	Mch sil cem.Tr gran, sm pebs,rnd Vfn/Fn opaque mineral. Vfn/Fn op min
1040-1045		"	V lt bn gy & pl bn	Fn/C	"	Ltl pl bn sh,sil cem.Mny gran,sm pebs.Tr plgn sh,rndVfn/Fn op min.
1045-1050		"	V pl bn	M	"	Ltl sil cem.Tr dol cem,wh,pl bn & yl shales,rnded Vfn/Fn op mineral.
1050-1055		"	"	C	"	Ltl wh & pl bn sh.Few gran. Trace gn gry shale, pyrite.
1055-1060		"	V pl bn & yellow	C/VC	Fn/VC	Mch calcic cem,v pl bn sh.Mny gran,sm pebs.Tr gry sh,pyrite.
1060-1065	G A G	"	V lt bn gy	M	Vfn/VC	Mch sil cem.Ltl glauc,wh sh,Tr rnd Vfn/Fn op min,sr,sm pebs.
1065-1070	Fe	"	Rd yl &v lt bn gy	"	"	Mch sil cem,v pl bn sh,ir ox ctg.Tr wh,pnk&lt gy shales,granules.
1070-1075		"	V pl brown	"	"	Mch sil cem.Ltl dk gy rd sh,wh sh,mic sts,Mny gran,sm pebs. Tr.
1075-1080 1		Conglomerate	Wh & Yl	Sm peb	Gran/M peb	Mch sil cem ss,Tr ir ox ctg.Ltl pl bn sh. iron oxide coating.
1080-1085 2		"	Yellow	Gr/SP	"	Ltl silica-cemented ss. Trace pl brown & white shales.
1085-1090		Sandstone	"	C/VC	Vfn/VC	Mny gran. Tr red brown hemic sh,pl gn sh, sm pebs,sil cem.
1090-1095		"	V pl bn	C	"	Tr sil cem, white,pl bn, & ol gn shales,granules,sm pebbles.
1095-1100 3		"	V pl bn & yellow	M/C	"	Mch silica cem.Mny sm pebs,grans.Ltl wh & pale brown shales.
1100-1105 4		Conglomerate	Yellow	Sm peb	Gran/M peb	Mch sil cem ss/rnded Fn op min.Ltl pl bn sh.Tr wh sh,rut quartz.
1105-1110 5		"	"	"	Gran/Sm peb	Mch sil cem ss. Ltl pl bn shale.Tr wh shale,pale green shale.
1110-1115 6		"	"	"	"	Little pale bn shale, silica-cemented ss.
1115-1120 7		Sandstone	V pl bn & yellow	M	Vfn/VC	Much silica cement.Many gran,sm pebs. Trace white shale.
1120-1125		Sh& Conglom	Pl bn & yl	Sm peb	Gran/M peb	Much silica-cemented sandstone, white shale.
570' 1125-1130		Sandstone	V pl bn	M	Vfn/VC	Mch white shale. Ltl sil cem. Tr gran, ol gn sh, pl bn sh.
			END OF LOG			

WISCONSIN GEOLOGICAL & NATURAL HISTORY SURVEY
University Avenue, Madison, Wisconsin 53706

Sample Nos. All Retained

Name: Madison City Well #20 (L.A. Smith Station Well)

Depths	Graphic Section	Rock Type	Color	Grain Size Mode	Grain Size Range	Miscellaneous Characteristics
						ADDITIONAL INFORMATION
						* Sample from 985-989 is composed of calcite-cemented spheroids of Fn/VC sandstone 4 mm in diameter and granule/medium pebble-sized rounded quartz grains. Spheroids and quartz grains are imbedded in a shaly matrix.
						† Sample from 996-1000 has many calcite-cemented spheroids approximately 5 mm in diameter.
						‡ Sample from 1010-1015 is a light red brown sandstone speckled with very dark red spots 1 mm in diameter. These spots seem to mark concentrations of pyrite grains.
						1 Sample from 1075-1080 contained 5 mm fragments of dark yellow brown quartzite.
						2 Sample from 1080-1085 contained 7 mm yellow quartz fragment of jasper? with pyrite, and 4 mm fragment of black quartzite.
						3 Sample from 1095-1100 contained two 5 mm fragments of white to reddish fragment of quartzite (Baraboo) and one 5 mm fragment of jasper?
						4 Sample from 1100-1105 contained 7 mm fragment of dark yellow brown dirty quartzite.
						5 Sample from 1105-1110 contained 6 mm fragment of yellow brown chert and 8 mm fragment of dark yellow brown quartzite.
						6 Sample from 1110-1115 contained 4 mm Baraboo quartzite fragment.
						7 Sample from 1115-1120 contained 7 mm fragment of red quartzite with quartz veinlet.

WISCONSIN UNIQUE WELL NUMBER **BF520**

Source: SWAP PROJECT KEYED

State of Wi-Private Water Systems-DG/2
Department Of Natural Resources, Box 7921
Madison, WI 53707

Form 3300-77A
(Rev 02/02)bw

Depth **1068** FT

Property Owner: MADISON, CITY OF		Telephone Number: 608 -266 -4656	
Mailing Address: 523 E MAIN ST			
City: MADISON	State: WI	Zip Code: 53703	
County of Well Location: 13 DANE	Co Well Permit No: W	Well Completion Date: October 1, 1972	

Well Constructor: LAYNE CHRISTENSEN COMPANY	License #: 582	Facility ID (Public): 113022470
Address: W229 N5005 DUPLAINVI		Public Well Plan Approval#: 70-0840
City: PEWAUKEE	State: WI / Zip Code: 53072	Date Of Approval: 10/26/1976
Hicap Permanent Well #: 77140	Common Well #: 020	Specific Capacity: 18.9 gpm/ft

1. Well Location

T=Town C=City V=Village: C of MADISON

Fire#:

Street Address or Road Name and Number: 2722 PRAIRIE RD #20

Subdivision Name: | Lot#: | Block #:

Gov't Lot **or** **NE** 1/4 of **SE** 1/4 of Section **1** T **6** N;R **8** **E**

Latitude Deg. Min.

Longitude Deg Min.

2. Well Type **1** (See item 12 below)

1=New 2=Replacement 3=Reconstruction

Lat/Long Method

of previous unique well # _____ constructed in **0**

Reason for replaced or reconstructed Well?

3. Well Serves **M** # of homes and or (eg: barn, restaurant, church, school, industry, etc.)

M=Munic O=OTM N=NonCom P=Private Z=Other X=NonPot A=Anode L=Loop H=Drillhole

High Capacity: Well? Property?

1 1=Drilled 2=Driven Point 3=Jetted 4=Other

4. Is the well located upslope or sideslope and not downslope from any contamination sources, including those on neighboring properties?

Well located in floodplain?

Distance in feet from well to nearest: (including proposed)

1. Landfill
2. Building Overhang
3. 1=Septic 2= Holding Tank
4. Sewage Absorption Unit
5. Nonconforming Pit
6. Buried Home Heating Oil Tank
7. Buried Petroleum Tank
8. 1=Shoreline 2= Swimming Pool
9. Downspout/ Yard Hydrant
10. Privy
11. Foundation Drain to Clearwater
12. Foundation Drain to Sewer
13. Building Drain 1=Cast Iron or Plastic 2=Other
14. Building Sewer 1=Gravity 2=Pressure 1=Cast Iron or Plastic 2=Other
15. Collector Sewer: ___ units ___ in . diam.
16. Clearwater Sump
17. Wastewater Sump
18. Paved Animal Barn Pen
19. Animal Yard or Shelter
20. Silo
21. Barn Gutter
22. Manure Pipe 1=Gravity 2=Pressure 1=Cast iron or Plastic 2=Other
23. Other manure Storage
24. Ditch
25. Other NR 812 Waste Source

5. Drillhole Dimensions and Construction Method Lower Open Bedrock

Upper Enlarged Drillhole

Dia.(in.)	From (ft)	To (ft)
45.0	surface	415
29.0	415	1068

-- 1. Rotary - Mud Circulation
-- 2. Rotary - Air
-- 3. Rotary - Air and Foam
-- 4. Drill-Through Casing Hammer
X -- 5. Reverse Rotary
-- 6. Cable-tool Bit _ n. dia
-- 7. Temp. Outer Casing _ in. dia. _____ depth ft. Removed ?

Other

6. Casing Liner Screen Material, Weight, Specification Manufacturer & Method of Assembly

Dia. (in.)		From (ft.)	To (ft.)
30.0	0 500 WALL API 5# NEW WELDED	surface	415

Dia.(in.)	Screen type, material & slot size	From	To

7. Grout or Other Sealing Material

Method / Kind of Sealing Material	From (ft.)	To (ft.)	# Sacks Cement
NEAT CEMENT	surface	415.0	

Geology Codes	8. Geology Type, Caving/Noncaving, Color, Hardness, etc	From (ft.)	To (ft.)
__SM	SAND @ SILT	0	9
Y_LR	DOLOMITE-SINNIPEE	9	49
__N_	SANDSTONE-TONTI	49	158
__NR	SS @ SHALE @ CHERT-READSTOWN	158	210
__N_	SANDSTONE-JORDAN	210	235
_HMN	SILTSTONE @ SS @ SHALE-LODI	235	255
__L_	DOLOMITE BLACK EARTH	255	285
__NH	SANDSTONE/SHALE/SILTSTONE-TUN	285	412
__N_	SANDSTONE-WONEWOC	412	475
__NM	SANDSTONE/SILTSTONE-EAU	475	535
E_HL	SHALE & DOLOMITE-EAU CLAIRE	535	560
__N_	SANDSTONE-MT SIMON	560	655

9. Static Water Level

261.2 feet **B** ground surface

A=Above B=Below

10. Pump Test

Pumping level **387.9** ft. below surface

Pumping at **2400.0** GP M **48.0** Hrs

11. Well Is: 0 in. Grade

A=Above B=Below

Developed?

Disinfected?

Capped?

12. Did you notify the owner of the need to permanently abandon and fill all unused wells on this property?

If no, explain

13. Initials of Well Constructor or Supervisory Driller Date Signed

Initials of Drill Rig Operator (Mandatory unless same as above) Date Signed

Additonal Comments?

Owner Sent Label? Y

Variance Issued?

More Geology?

Batch 551

Search

Home About A-Z Index Contact

DNR Drinking Water System: High Capacity Wells

HelpReports

High Capacity Well Number:	77140	**WI Unique Well No:**	BF520
DNR Region:	South Central	**County:**	Dane
Water Basin:	012 - Rock River (lower)	**DNR Facility ID:**	113022470
Operator's Well ID:	020	**Owner's Well Id:**	020
Well Town:	MADISON(CITY OF)	**Well Mailing City:**	
County Approval No:	0011	**File Ref. #:**	13-9-0011
Classification:	Municipal Water Supply	**Status:**	ACTIVE Formerly
Chief Aquifer:	Sandstone	**Approved Date:**	10/26/1970 **mm/dd/yyyy**
Completed Date:	**mm/dd/yyyy**	**Driller:**	LAYNE NORTHWEST CO
Driller License No:	582	**Normal pumpage:**	1448000 **gpd**
Maximum Pumpage:	2880000 **gpd**	**Pump Capacity:**	2000 **gpm**
Gravel Pack:		**Well Depth:**	1068 **feet**
Depth to Rock:	5 **feet**	**Type of Rock:**	Limestone or Dolomite
Multiple Aquifers:	N	**Drilling Method:**	
Enlarged Drillhole Depth:	415 **feet**	**Enlarged Drillhole Diameter:**	45 **inches**
Lower Drillhole Diameter:	29 **inches**	**Lower Drillhole Length:**	653 **feet**
More than 2 drillholes:	N	**Primary Casing Diameter:**	30 **inches**
Primary Casing Depth:	415 **feet**	**Liner Casing Diameter:**	**inches**
Liner Casing Length:	**feet**	**Liner Casing Depth:**	**feet**
Screen Diameter:	**inches**	**Screen Length:**	**feet**
Screen Type:		**Sealing Material Type:**	Cement Grout
Sealing Material Depth:	415 **feet**	**Yield Test Time:**	48 **Hours**
Yield Test Pump Rate:	2400 **gpm**	**Static Water Level:**	261.2 **feet**
Pumping Water Level:	387.9 **feet**	**Specific Capacity:**	18.9 **gpm/foot**
Image File Name:	DN4726.TIF		

Annual Well Pumpage (gallons)

Disclaimer: Please be advised that pumpage data may be measured or estimated. The method code provided by the owner/operator each year is displayed with the pumpage data. Because the pumpage data are submitted on paper forms, transcription errors may occur. Data for public water supply wells such as municipal wells will be available in the future. It is very important that the user of this data not make conclusions based on limited information such as one piece of data from one monitoring point. Instead, the data as a whole should be evaluated by a scientist or engineer who is experienced with such evaluations, considers changes over time, and takes into account the location of each well and changes in weather patterns. **Pumpage for private residential wells is not displayed.**

No Records returned

Method Code Descriptions

Use Code Descriptions

Download

- **Return Links**
  - Top Level

Last Revised: 11/02/2010

dnr.wi.gov

The Official Internet site for the Wisconsin Department of Natural Resources

101 S. Webster Street . PO Box 7921 . Madison, Wisconsin 53707-7921 . 608.266.2621

Well Construction Reports

WI Unique Well No:	BF520	**High Capacity Well No:**	77140
Hi Cap Well:		**Hi Cap Property:**	
County Well Location:		**DNR Region:**	South Central
County:	Dane	**Muni Type:**	C
Municipality:	MADISON	**Tax Parcel No:**	
Completion Date:	10/01/1972 **mm/dd/yyyy**	**DNR Received Date:**	
Status:	New Well	**Original Year:**	
Replacement Reason:		**Previous WI Well No:**	
Replacement WI Well No:		**Well Construction Type:**	Drilled
Other Const. Type:		**Category:**	Municipal/Community
Well Depth:	1068 **ft**	**# Services:**	
Facility Type:		**Highest Point on Property:**	
In Floodplain:		**Rotary - Mud Circulation:**	
Rotary - Air:		**Rotary - Foam:**	
Reverse Rotary:	Yes	**Cable Tool Bit:**	
Cable Bit Diameter:	**in**	**Temp Outer Casing:**	
Temp Casing Diameter:	**in**	**Temp Casing Removed:**	
Why not removed?:		**Other Drilling method:**	
Other Drilling Description:		**Screen Diameter:**	**inches**
Screen Description:		**Screen From:**	**feet**
Screen To:	**feet**	**Sealant Method:**	
Static Water level:	261.2 feet Below Ground	**Pumping level:**	387.9 **feet**
Pumping at:	2400	**Pumping units:**	Minutes
For:	48 **Hour(s)**	**Well Starting Depth:**	0 inches

Developed:		**Disinfected:**	
Capped:		**Proper Seal:**	
Seal Description:		**Contractor Signed on:**	
Rig Operator Signed on:		**Geologic Log Number:**	DN1060
Common Well Number:	020	**Calculated Specific Capacity:**	18.9
DNR Facility ID:	113022470	**Well Name:**	PRAIRIE ROAD WELL #20
Water Quality Comments:		**Water Quantity Comments:**	
Drilling Difficulty:		**Other Driller Comments:**	WELL WAS BACKFILLED WITH CEMENT FROM 1068' TO 1131'
Exception Area Comments:			

Distances in Feet to Nearest Objects

No Records returned

Download

Drillhole Dimensions

Diameter (in)	From Depth (ft.)	To Depth (ft.)
45	0	415
29	415	1068

Download

Casing & Liner

Diameter (inches)	Description	From Depth (ft.)	To Depth (ft.)
30	0 500 WALL API 5# NEW WELDED	0	415

Download

Grout or Other Sealant Materials

Kind of Sealing Material	From Depth (ft.)	To Depth (ft.)	Amount	Units
NEAT CEMENT	0	415		

Download

Geology

Geology	Geology Description	Driller's Description	USGS Code	From Depth (feet)	To Depth (feet)
--SM	Sand; Silty;	SAND @ SILT		0	9
Y-LR	Yellow; Limestone/Dolomite; w/Chert;	DOLOMITE-SINNIPEE		9	49
--N-	Sandstone;	SANDSTONE-TONTI		49	158
--NR	Sandstone; w/Chert;	SS @ SHALE @ CHERT-READSTOWN		158	210
--N-	Sandstone;	SANDSTONE-JORDAN		210	235
-HMN	Hard/Firm; Silt; w/Sandstone;	SILTSTONE @ SS @ SHALE-LODI		235	255
--L-	Limestone/Dolomite;	DOLOMITE BLACK EARTH		255	285
--NH	Sandstone; Shaley;	SANDSTONE/SHALE/SILTSTONE-TUNNEL CIT		285	412
--N-	Sandstone;	SANDSTONE-WONEWOC		412	475
--NM	Sandstone; Silty;	SANDSTONE/SILTSTONE-EAU CLAIRE		475	535
E-HL	Green; Shale; Limey or Dolomitic;	SHALE & DOLOMITE-EAU CLAIRE		535	560
--N-	Sandstone;	SANDSTONE-MT SIMON		560	655
P-LN	Pink; Limestone/Dolomite; w/Sandstone;	SANDSTONE/DOLOMITE-MT SIMON		655	700
--NH	Sandstone; Shaley;	SANDSTONE/SHALE/SILTSTONE-MT SIMON		700	1005
--N-	Sandstone;	SANDSTONE-MT SIMON		1005	1068

Download

Samples

Sample Date	Collected By	Description	Laboratory	Lab Sample ID
05/10/1993	CASTILLO	2720 PRAIRIE RD. BOOSTER PUMP DISCHARGE SAMPLE TAP	113133790	ID092931
04/29/1994	CASTILLO	2722 PRAIRIE RD BOOSTER PUMP SAMPLE TAP	113133790	IE024310

Records 1 to 2 of 2

Download

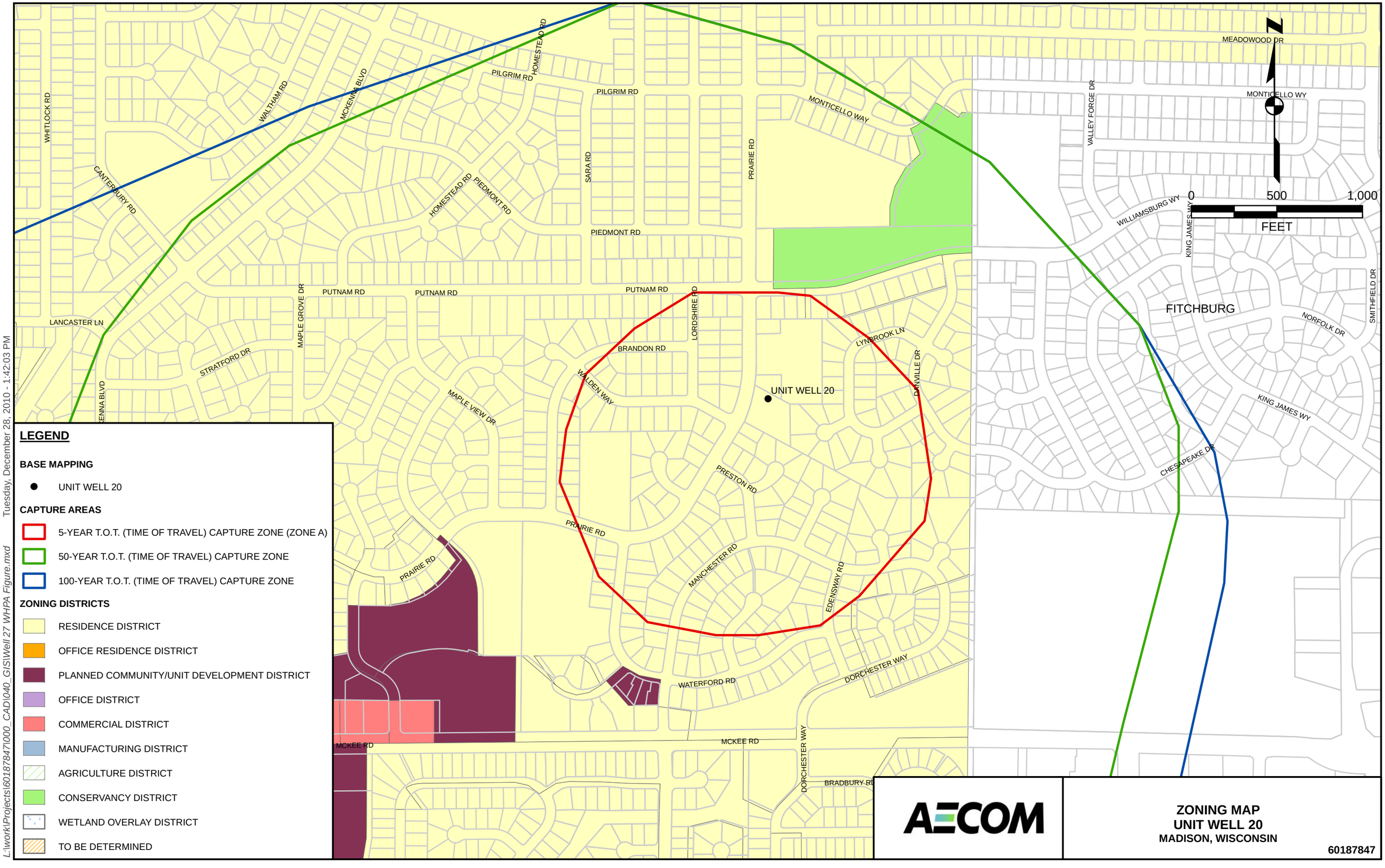
- Abandonment (0 Rows)

- Variances (0 Rows)
- Rehabilitation/Redevelopment (0 Rows)

Last Revised: 11/07/2010

APPENDIX D

CITY OF MADISON ZONING MAP



LEGEND

BASE MAPPING

- UNIT WELL 20

CAPTURE AREAS

- 5-YEAR T.O.T. (TIME OF TRAVEL) CAPTURE ZONE (ZONE A)
- 50-YEAR T.O.T. (TIME OF TRAVEL) CAPTURE ZONE
- 100-YEAR T.O.T. (TIME OF TRAVEL) CAPTURE ZONE

ZONING DISTRICTS

- RESIDENCE DISTRICT
- OFFICE RESIDENCE DISTRICT
- PLANNED COMMUNITY/UNIT DEVELOPMENT DISTRICT
- OFFICE DISTRICT
- COMMERCIAL DISTRICT
- MANUFACTURING DISTRICT
- AGRICULTURE DISTRICT
- CONSERVANCY DISTRICT
- WETLAND OVERLAY DISTRICT
- TO BE DETERMINED

AECOM

ZONING MAP
UNIT WELL 20
MADISON, WISCONSIN
60187847

Tuesday, December 28, 2010 - 1:42:03 PM
L:\work\Projects\60187847\000_CAD\040_GIS\Well 27 WHPA Figure.mxd

APPENDIX E

POTENTIOMETRIC SURFACE - LOWER BEDROCK (MOUNT SIMON) AQUIFER AND AREAS OF RECHARGE AND DISCHARGE

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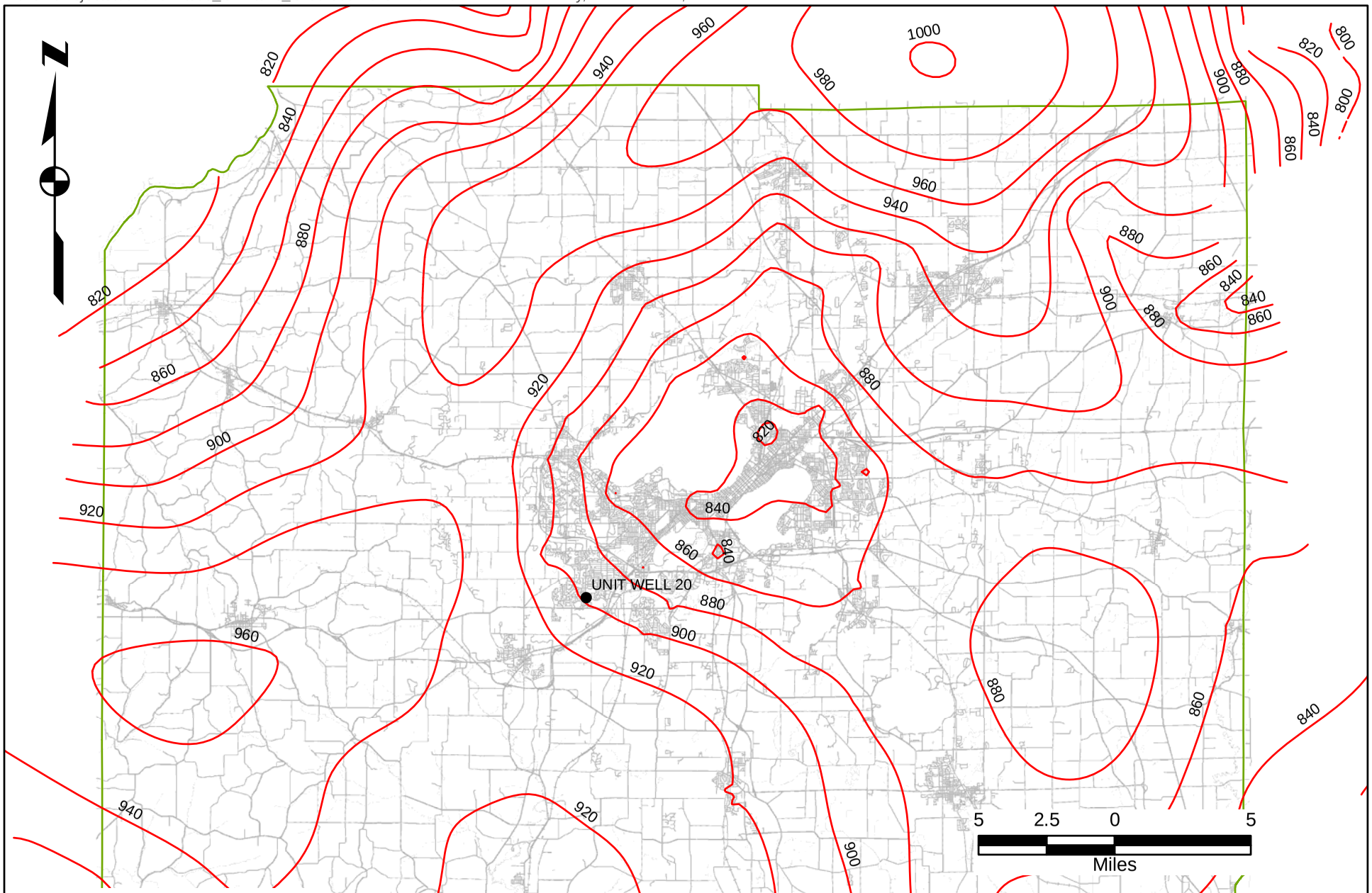
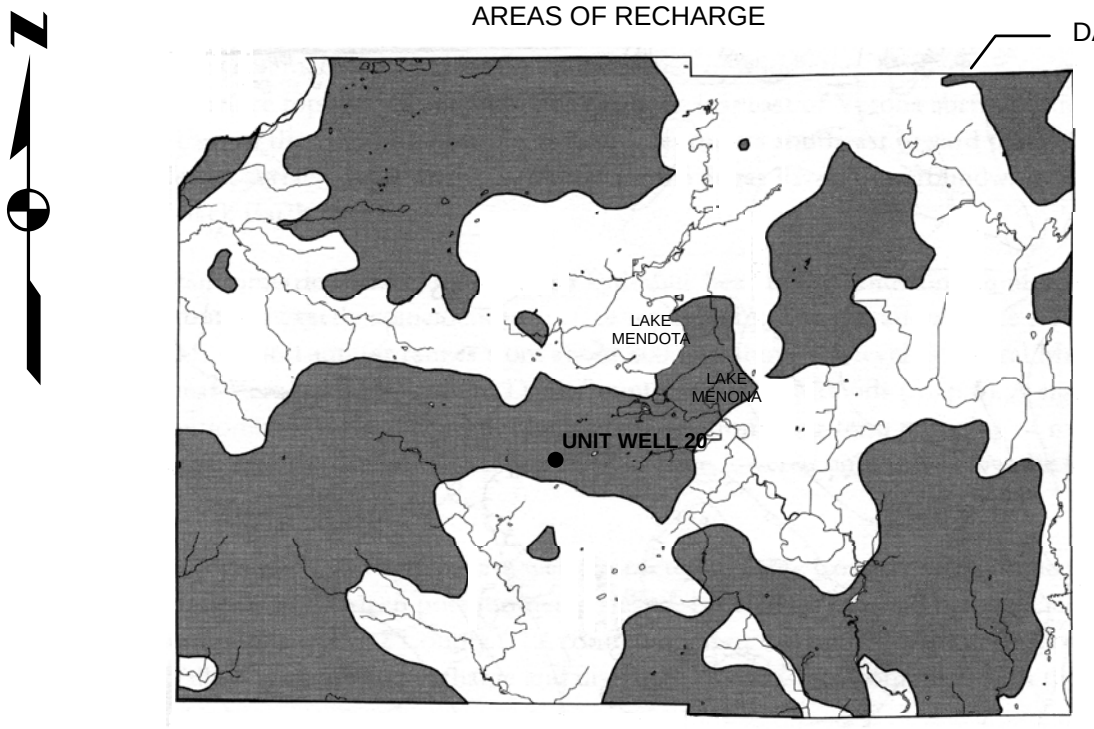


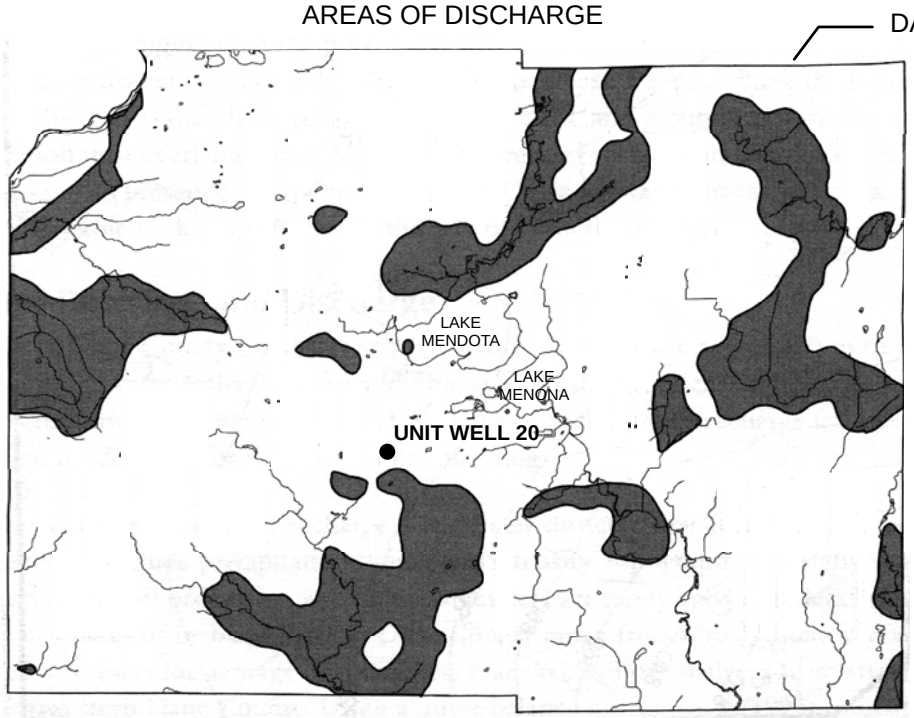
REFERENCE SOURCE:
DCRPC, 2004

CONTOURS SHOWN = FT
ABOVE MEAN SEA LEVEL

AECOM

FIGURE E-1
UNIT WELL 20
SIMULATED 2000 HEADS IN MT. SIMON AQUIFER
MADISON WATER UTILITY
MADISON, WISCONSIN **60187847**





REFERENCE SOURCE:
HYDROGEOLOGY OF DANE COUNTY,
BRADBURY, ET. AL., 1999

9 4.5 0 9
Miles

AECOM

FIGURE E-2
AREAS OF RECHARGE TO AND DISCHARGE FROM THE MT. SIMON AQUIFER
MADISON WATER UTILITY
MADISON, WISCONSIN **60187847**

L:\work\Projects\60187847\000_CAD\040_GIS\DischargeRechargeMS-UW20.mxd Wednesday, December 29, 2010 - 10:39:01 AM

APPENDIX F

POTENTIOMETRIC SURFACE - WATER TABLE ELEVATION

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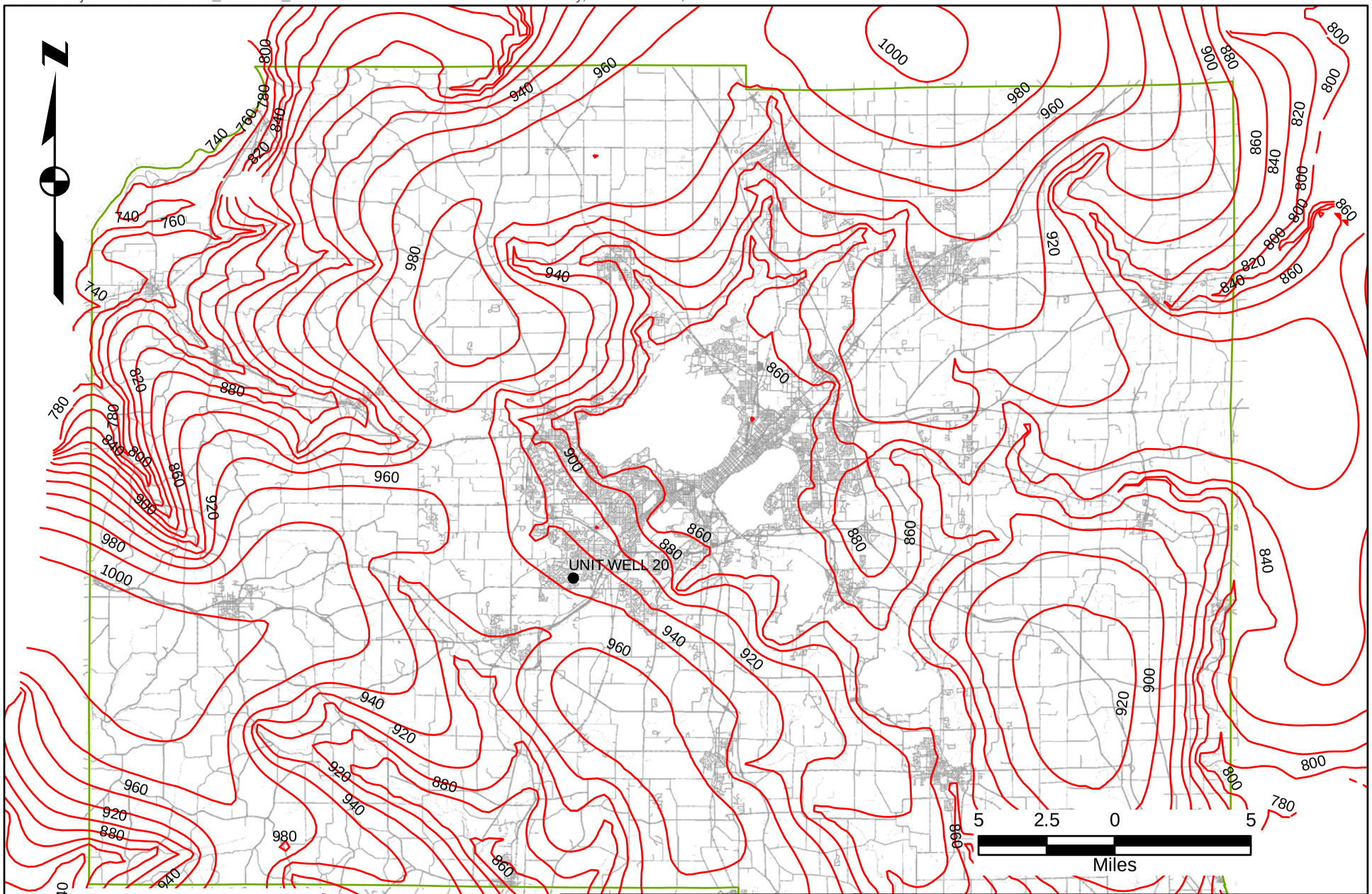


REFERENCE SOURCE:
DCRPC, 2004

CONTOURS SHOWN = FT
ABOVE MEAN SEA LEVEL

AECOM

FIGURE F-1
UNIT WELL 20
SIMULATED 2000 WATER TABLE
MADISON WATER UTILITY
MADISON, WISCONSIN **60187847**

APPENDIX G

DISTANCE-DRAWDOWN CALCULATION
(ZONE OF INFLUENCE)

Distance-Drawdown Calculations
Using Theis Equation
With Adjustment For Aquifer Dewatering (Water Table Condition)

Assumptions: **Well 20** **Madison**

Hydraulic Conductivity [K]	67.70	GPD/ft^2
Aquifer Thickness [B]	633	ft.
Storativity [S]	0.00030	
Pumping Rate [Q]	2100.00	gpm
Pumping Duration [TM]	30.000	Days

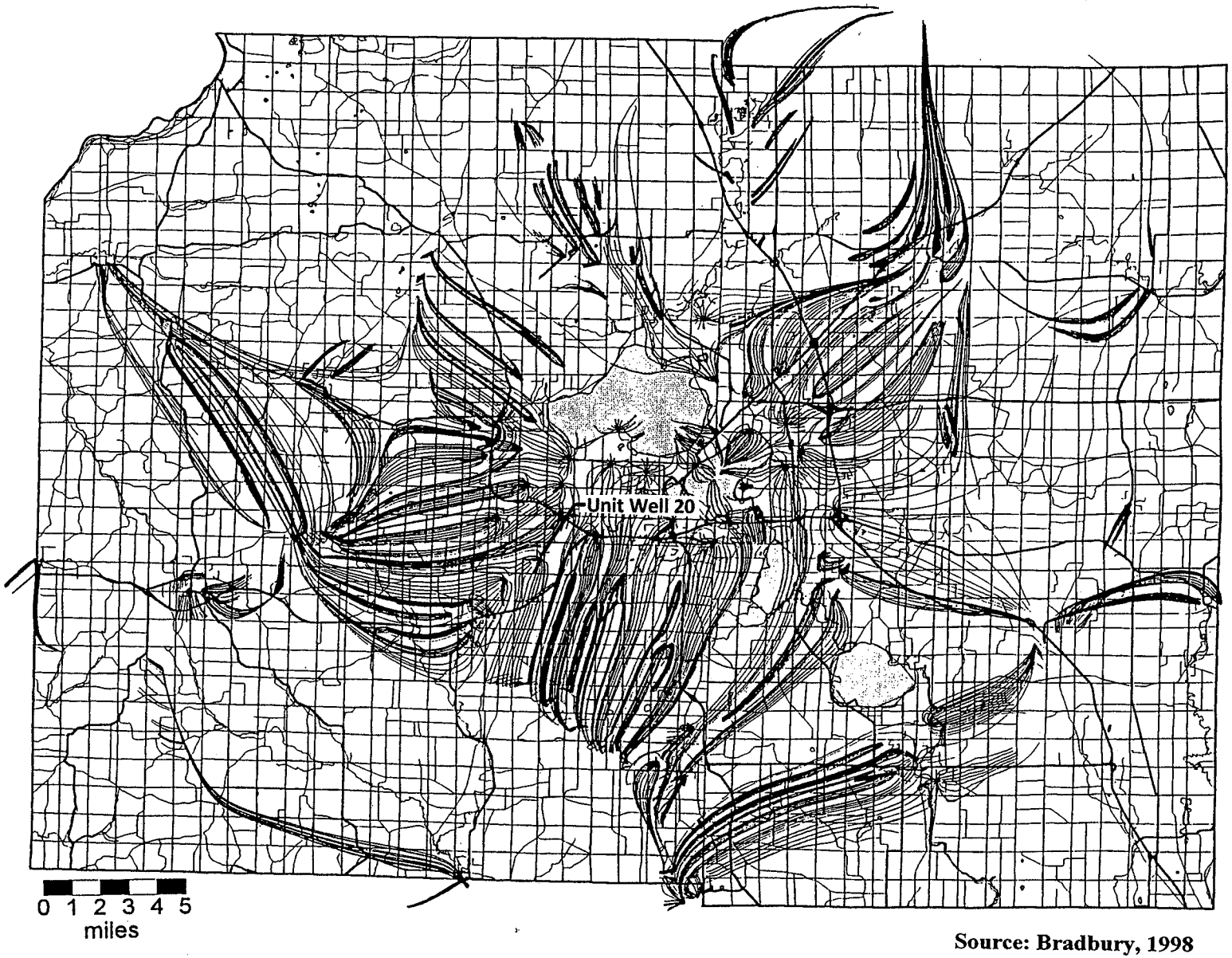
Results:

Radius From Well r (ft.)	Well Function W(u)	Apparent Drawdown s (ft.)	Drawdown Adjusted For Dewatering s' (ft.)
1.50	20.164398	113.23	125.71
5	17.756452	99.71	109.11
10	16.370158	91.92	99.79
20	14.983864	84.14	90.63
30	14.172934	79.59	85.34
40	13.597570	76.36	81.62
50	13.151283	73.85	78.75
75	12.340354	69.30	73.57
100	11.764992	66.06	69.93
200	10.378711	58.28	61.24
300	9.567802	53.73	56.22
400	8.992469	50.50	52.69
500	8.546221	47.99	49.96
750	7.735427	43.44	45.04
1000	7.160254	40.21	41.57
2000	5.775268	32.43	33.31
2000	5.775268	32.43	33.31
3000	4.966520	27.89	28.53
5000	3.951821	22.19	22.59
7500	3.154407	17.71	17.97
10000	2.597812	14.59	14.76
15000	1.839540	10.33	10.42
20000	1.335568	7.50	7.54
30000	0.714724	4.01	4.03
40000	0.375061	2.11	2.11
50800	0.178286	**1.00**	1.00
60000	0.090067	0.51	0.51
109400	0.000885	**0.00**	0.00

APPENDIX H

ULTIMATE ZOCS FOR MUNICIPAL WELLS IN DANE COUNTY

Fig. 2
Ultimate Zones of Contribution for Municipalities in Dane County, WI.



Source: Bradbury, 1998

APPENDIX I

SUMMARY OF PRIVATE WELLS IN THE UNIT WELL 20 AREA

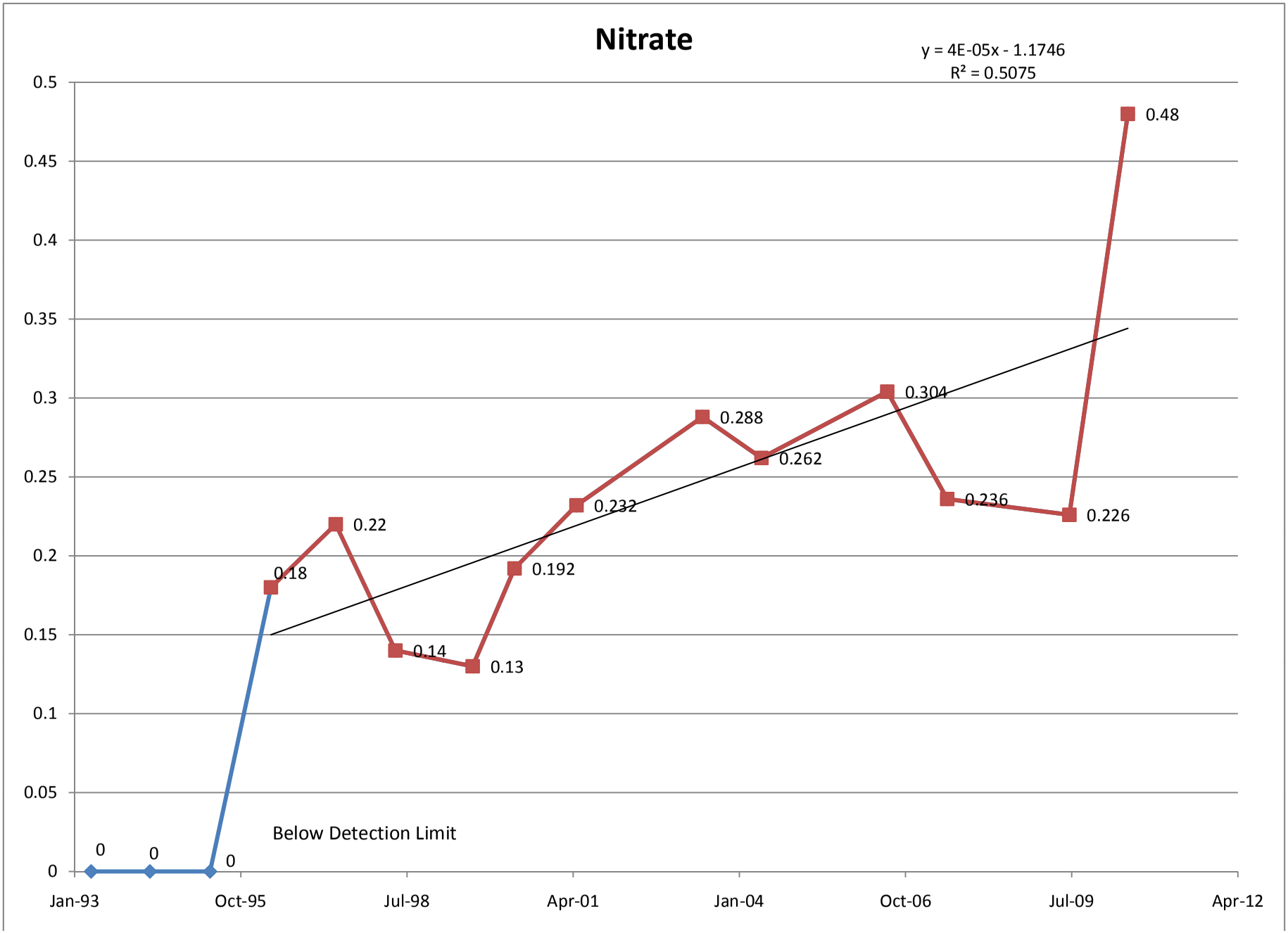
Summary of private wells located within, or approximately within the area encompassed by the 100 year TOT ZOC for Unit Well 20.

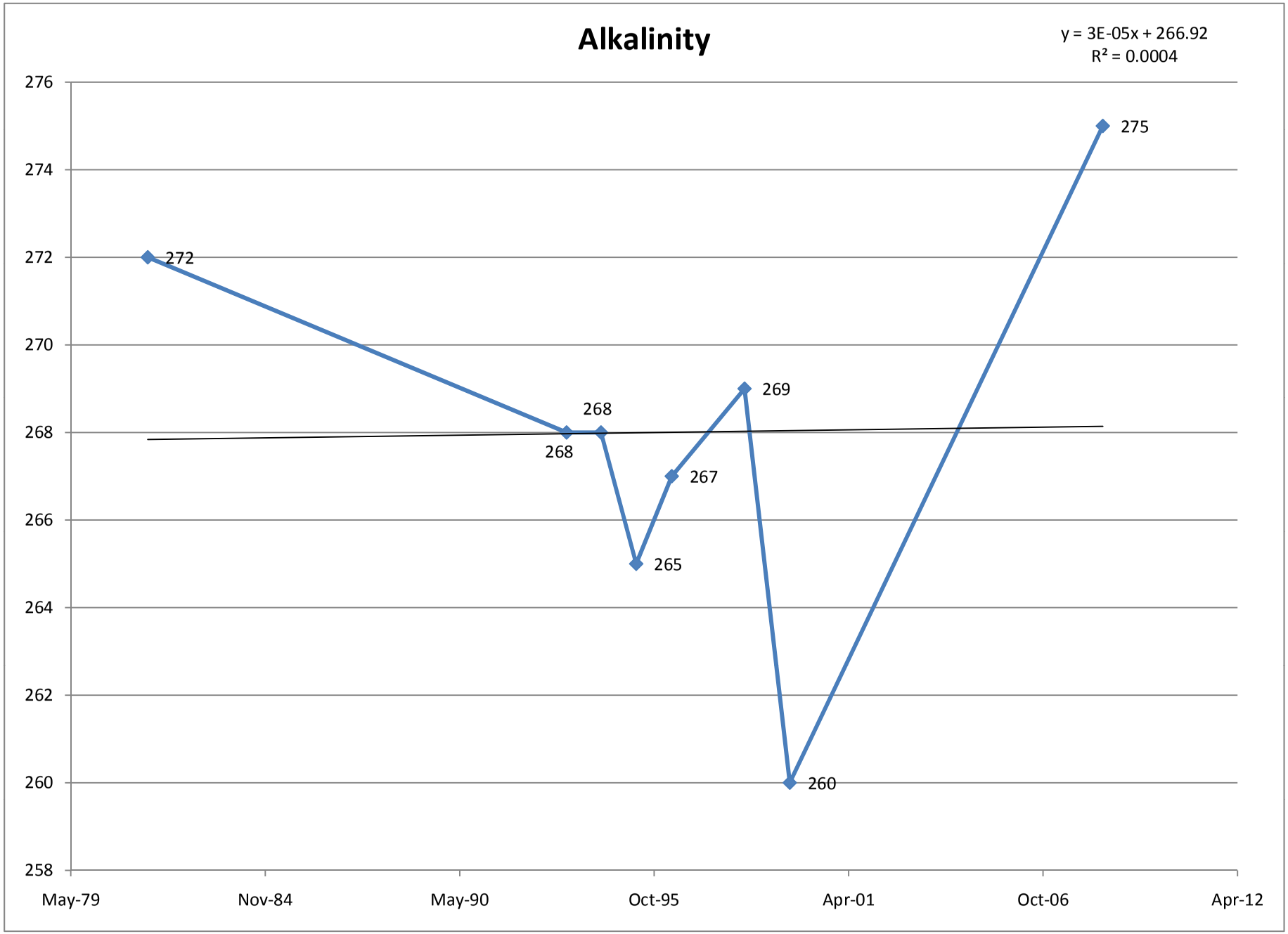
FIGURE 4-1 NO.	OWNER	WELL ADDRESS	WELL DEPTH (Feet)
101	Mike Moubry	6501 Putnam Road	NR-Abandoned
102	Riley & Melinda O'Brian	3149 Maple Grove Drive	NR-Abandonment Scheduled
103	Capitolland Christian Center	3651 Maple Grove Drive	140
104	Dale Maurer	3231 Maple Grove Drive	NR
105	Gerald Maurer	3240 Maple grove Drive	NR
106	John Schmitz	6402 Nesbitt Road	150
107	James Weber	6444 Nesbitt Road	NR
108	Walter Zweifel	6572 Nesbitt Road	NR
108	Dane County Landfill #1 Walter Zweifel	6572 Nesbitt Road	NR
108	Dean Nesbitt	6566 Nesbitt Road	NR
108	Dane County Landfill #1 (Sharon Nesbitt)	6566 Nesbitt Road	NR
109	Barnes Inc	6433 Nesbitt Road	155
110	Waupun Ready Mix	6399 Nesbitt Road	201
111	Harland Klipstein	2789 Fitchrona Road	140
112	Felly's Greenhouse	6353 Nesbitt Road	NR
113	Quenton Thompson	2808 Allegheny Drive	160
114	Stephen Dresen	2805 Allegheny Drive	152
115	Doug Wipperfurth	2830 Allegheny Drive	296
116	Doris Botten	2801 Allegheny Trail	NR
117	Wingra	County Road PD	378

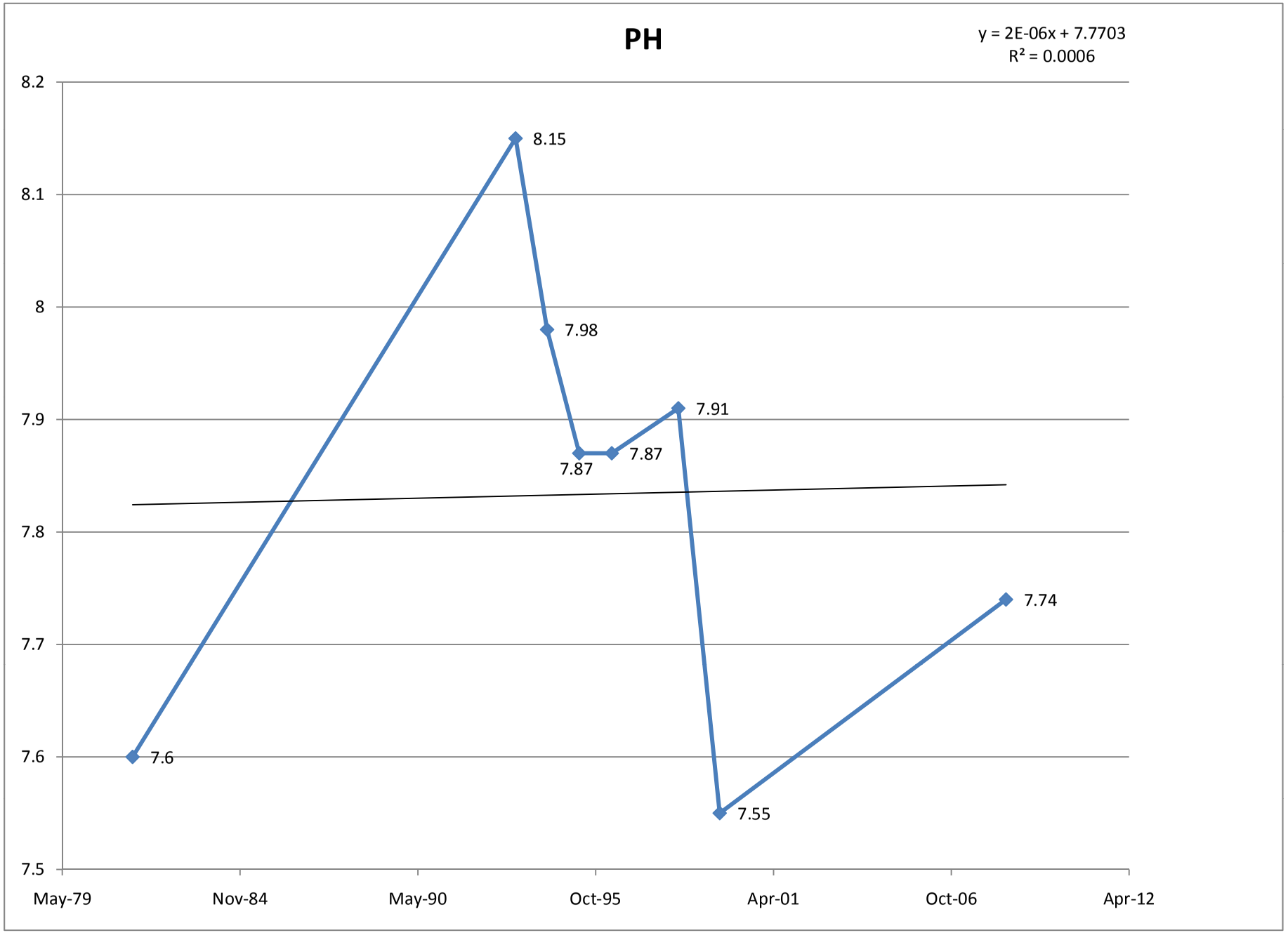
NR = Not Reported

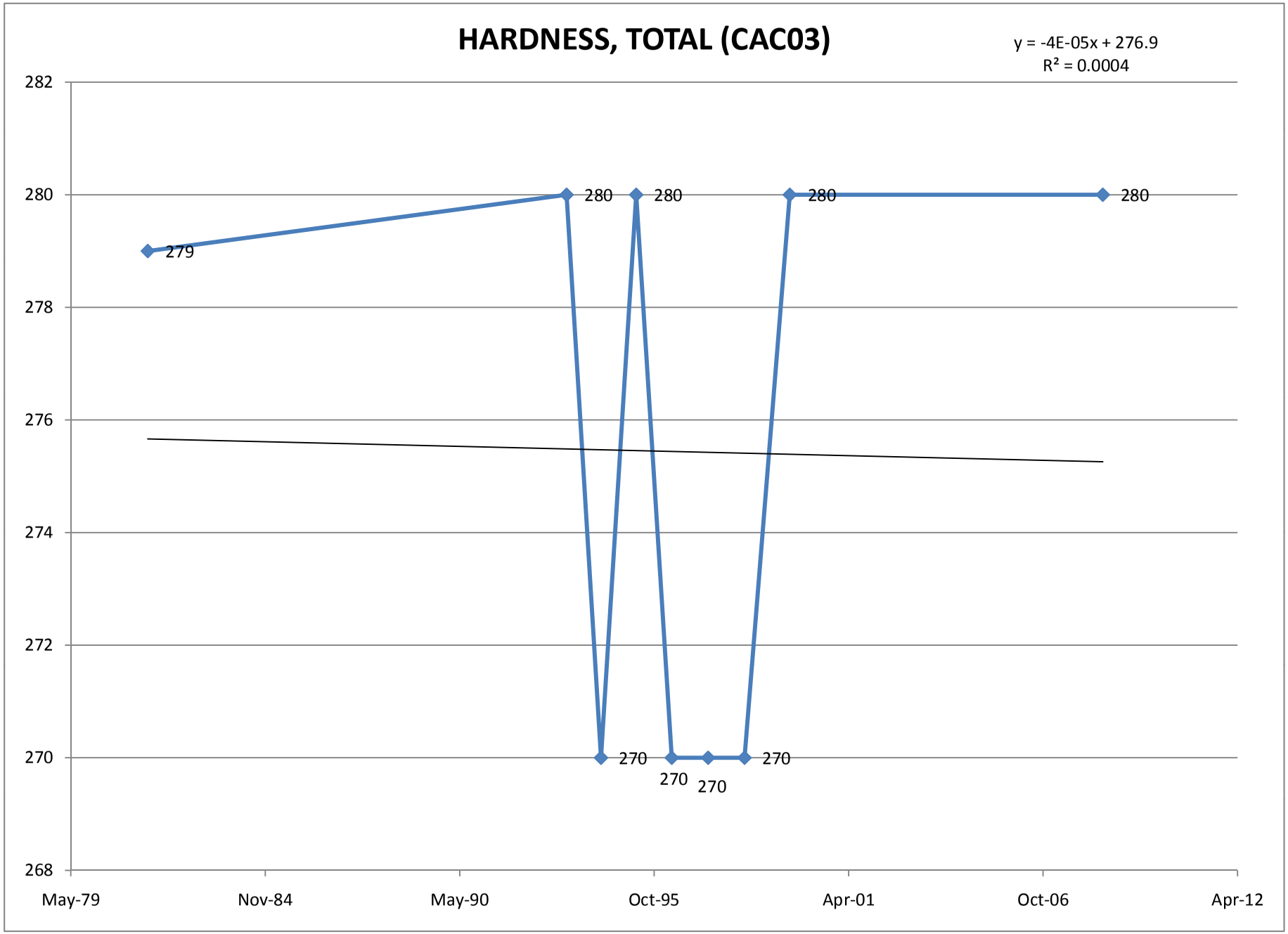
APPENDIX J

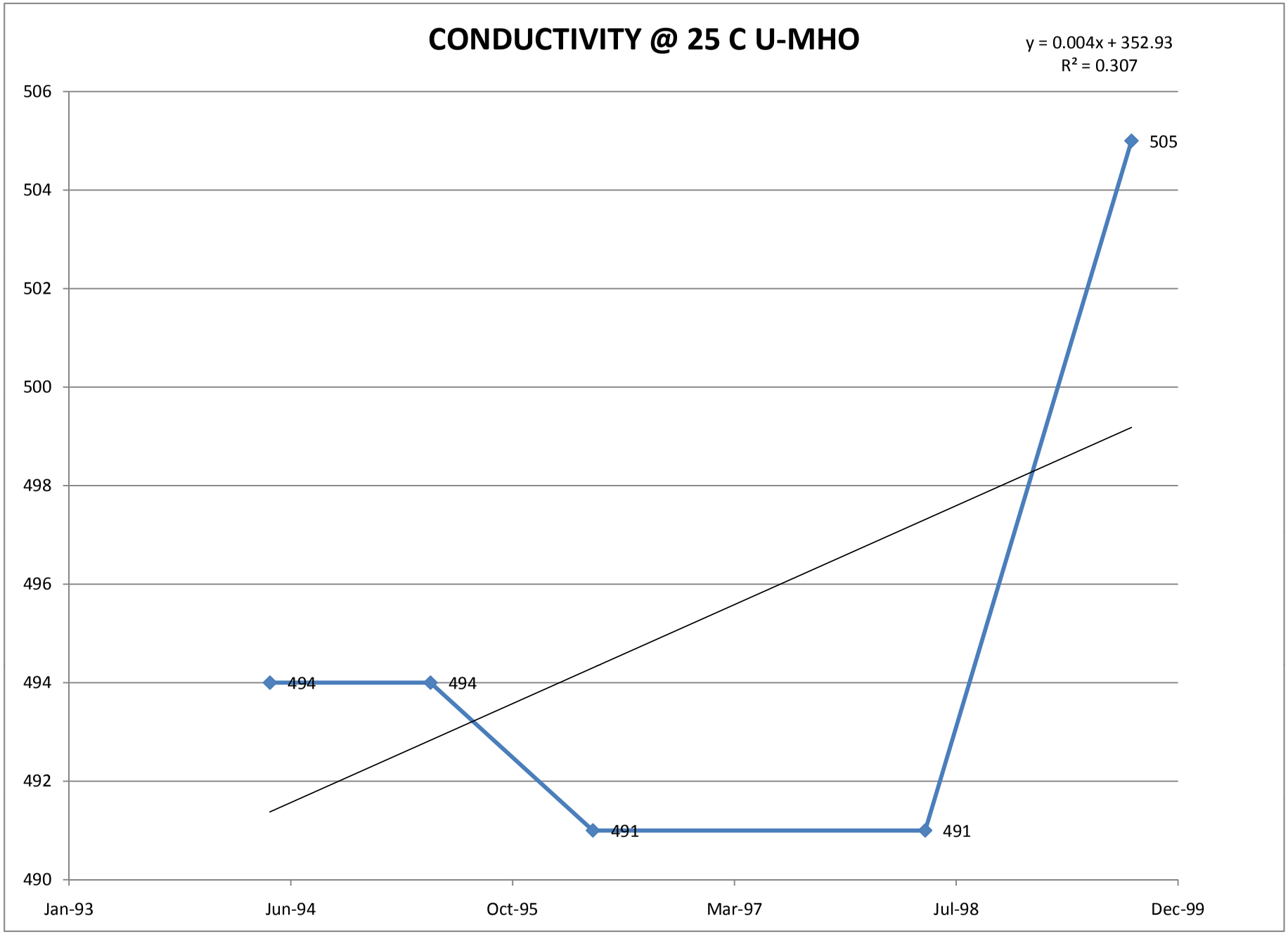
UNIT WELL 20 HISTORICAL WATER QUALITY DATA

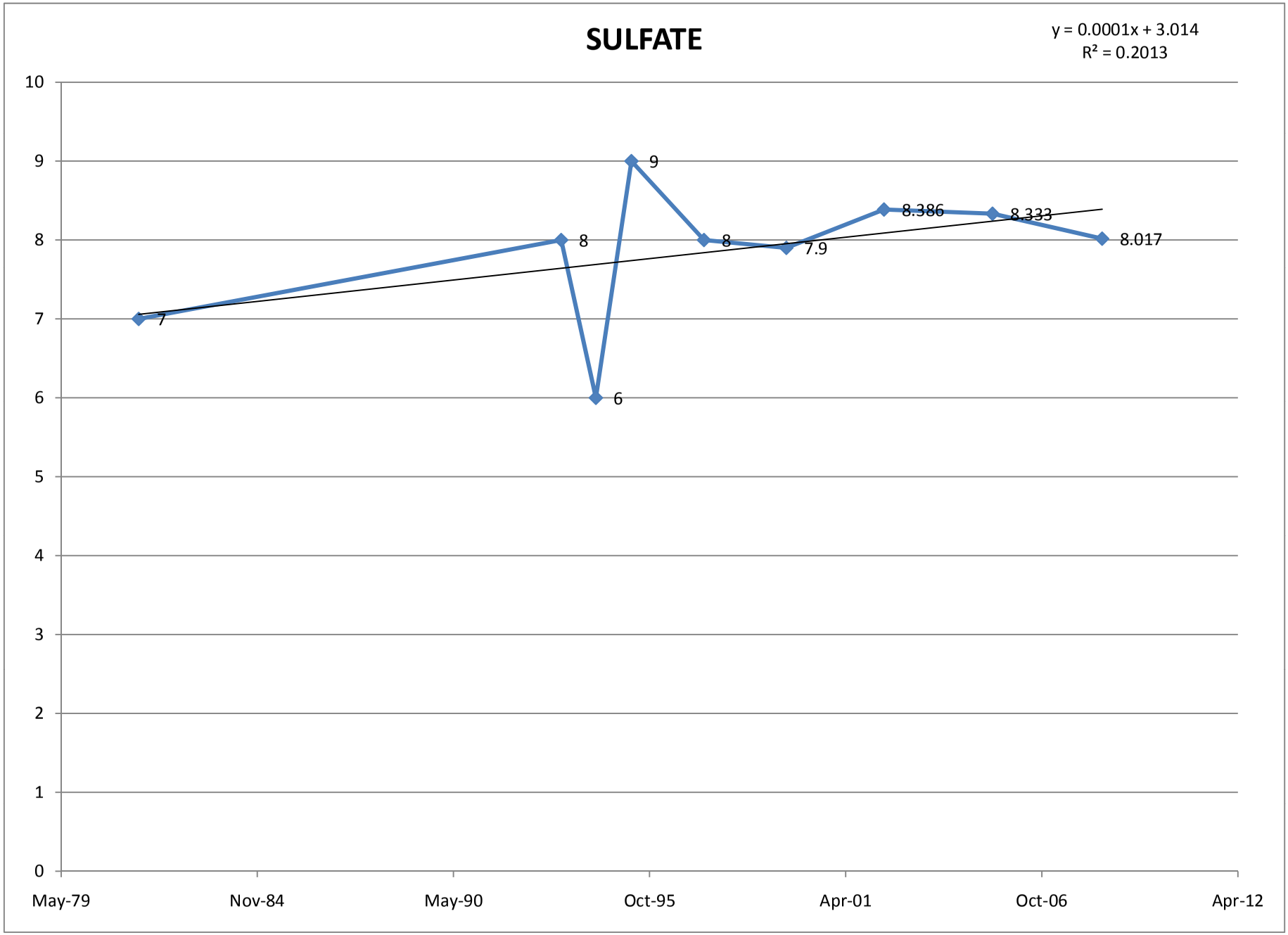

Nitrate
y = 4E-05x - 1.1746
R² = 0.5075
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Jan-93
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
0
0
0
0.18
0.22
0.14
0.13
0.192
0.232
0.288
0.262
0.304
0.236
0.226
0.48
Below Detection Limit

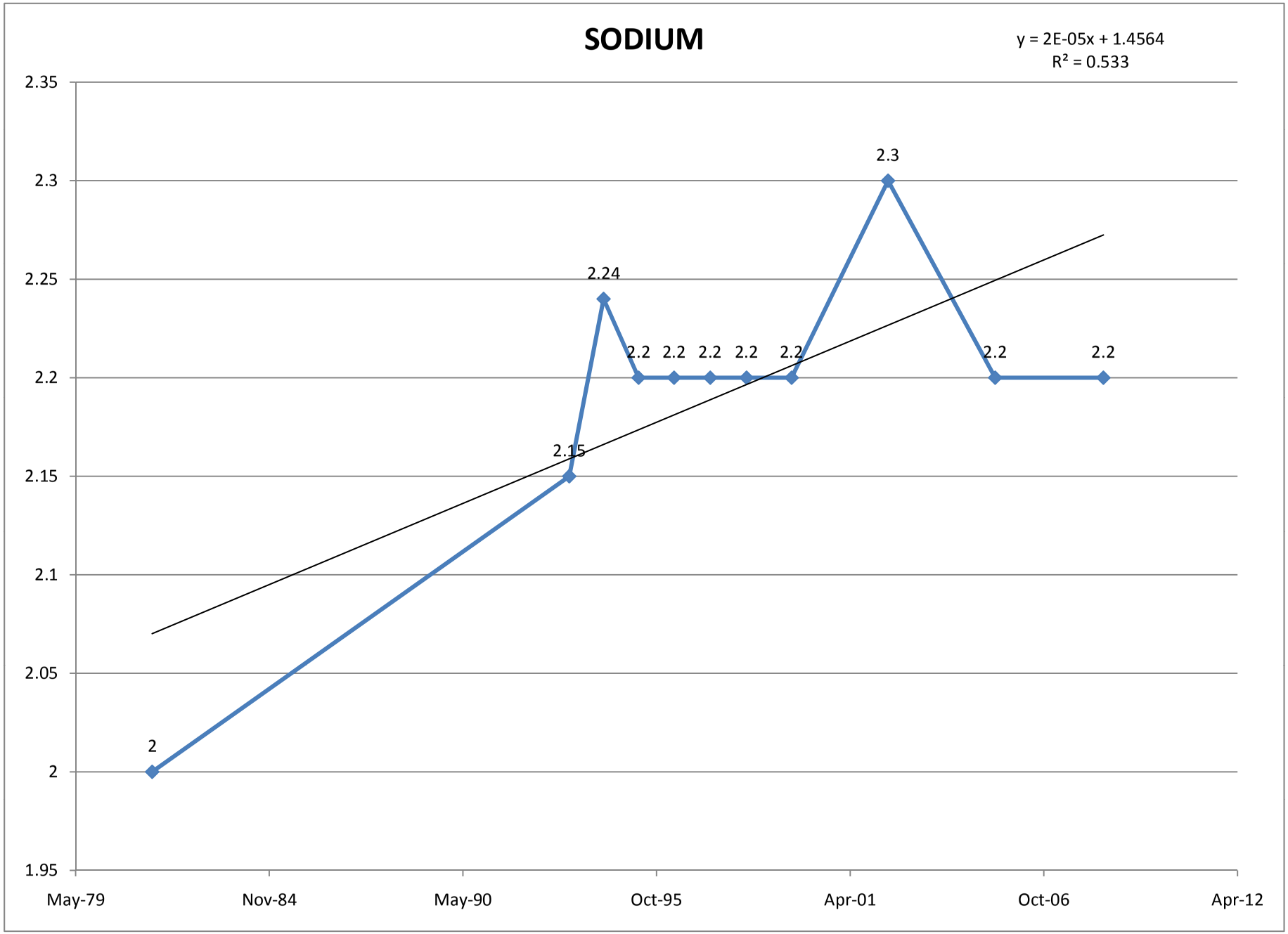

Alkalinity
y = 3E-05x + 266.92
R² = 0.0004
276
274
272
270
268
266
264
262
260
258
May-79
Nov-84
May-90
Oct-95
Apr-01
Oct-06
Apr-12
272
268
268
265
267
269
260
275


PH
y = 2E-06x + 7.7703
R² = 0.0006
8.2
8.1
8
7.9
7.8
7.7
7.6
7.5
8.15
7.98
7.91
7.87
7.87
7.74
7.6
7.55
May-79
Nov-84
May-90
Oct-95
Apr-01
Oct-06
Apr-12


HARDNESS, TOTAL (CAC03)
y = -4E-05x + 276.9
R² = 0.0004
282
280
278
276
274
272
270
268
279
280
280
280
280
270
270
270
270
May-79
Nov-84
May-90
Oct-95
Apr-01
Oct-06
Apr-12


CONDUCTIVITY @ 25 C U-MHO
y = 0.004x + 352.93
R² = 0.307
506
504
502
500
498
496
494
492
490
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
494
494
491
491
505


SULFATE
y = 0.0001x + 3.014
R² = 0.2013
10
9
8
7
6
5
4
3
2
1
0
7
8
6
9
8
7.9
8.386
8.333
8.017
May-79
Nov-84
May-90
Oct-95
Apr-01
Oct-06
Apr-12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2.3
2.25
2.2
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2.1
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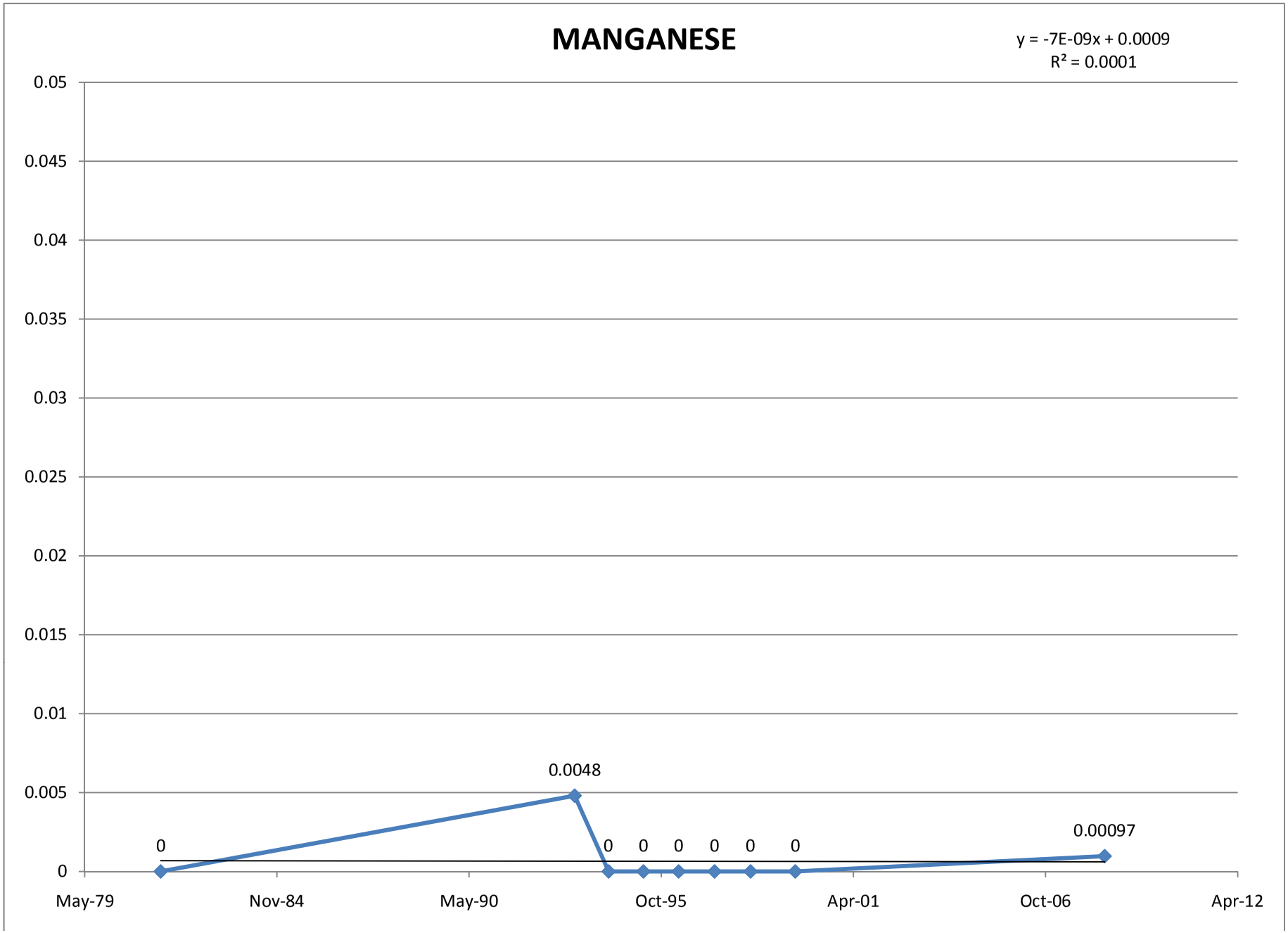
2
1.95
2
2.15
2.24
2.2
2.2
2.2
2.2
2.2
2.3
2.2
2.2
May-79
Nov-84
May-90
Oct-95
Apr-01
Oct-06
Apr-12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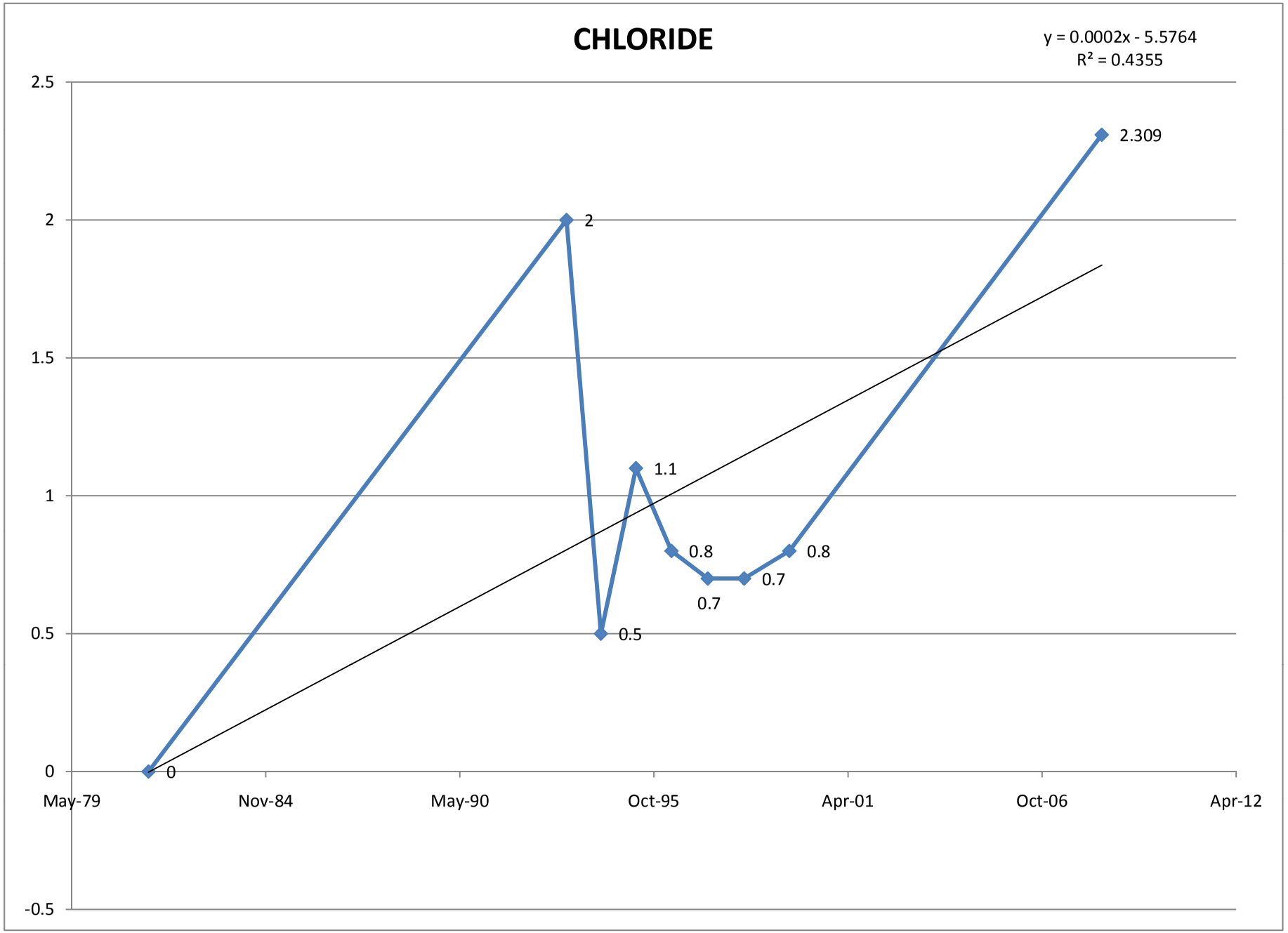
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0.0048
0.00097
0 0 0 0 0 0 0
May-79
Nov-84
May-90
Oct-95
Apr-01
Oct-06
Apr-12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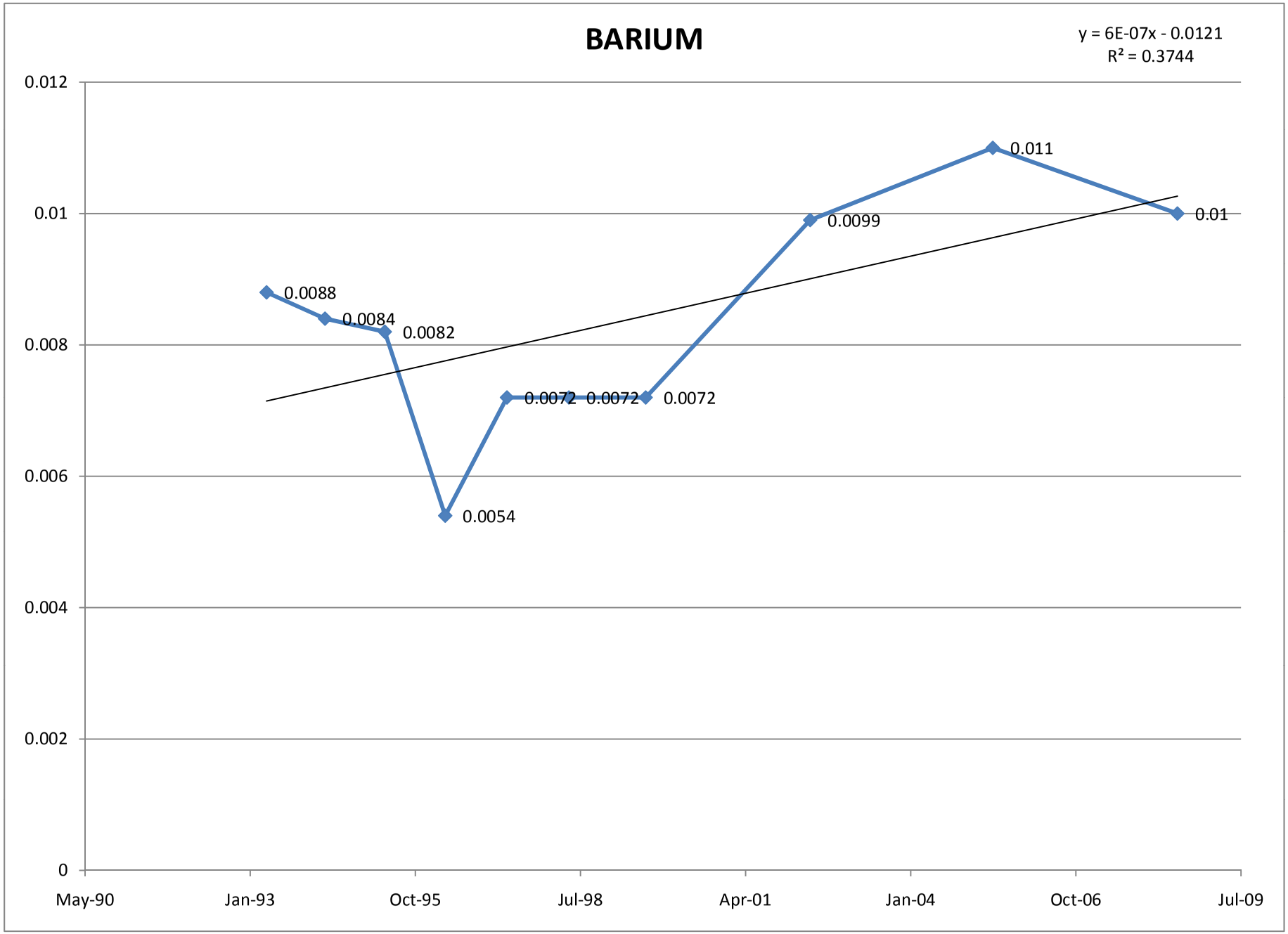
2
1.5
1
0.5
0
-0.5
May-79
Nov-84
May-90
Oct-95
Apr-01
Oct-06
Apr-12
0
2
0.5
1.1
0.8
0.7
0.7
0.8
2.309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0.008
0.006
0.004
0.002
0
0.0088
0.0084
0.0082
0.0054
0.0072
0.0072
0.0072
0.0099
0.011
0.01
May-90
Jan-93
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09

APPENDIX K

PROHIBITED LAND USES IN WHPAs,
POTENTIAL SOURCES OF GROUNDWATER CONTAMINATION AND LAND USES
AND THEIR RELATIVE RISK TO GROUNDWATER

TABLE K-1
RECOMMENDED PROHIBITED LAND USES
UNIT WELL 20 WELLHEAD PROTECTION ZONES
MADISON, WISCONSIN

ZONE A - PROHIBITED USES

Commercial animal confinement facilities
Animal waste facilities
Asphalt products manufacturing
Auto body repair businesses
Auto sales and service
Auto salvage yards (junk yards)
Bus or truck terminals
Commercial bulk fertilizer and/or pesticide facilities (storage, mixing and/or loading)
Cemeteries
Dry cleaning businesses/facilities
Electroplating businesses/facilities
Exterminating businesses/facilities
Fuel storage tanks (heating oil)
Furniture manufacturing and refinishing
Garage and vehicular towing
Hazardous and/or toxic materials storage
Hazardous and/or toxic waste facilities
Industrial businesses that use hazardous chemicals as defined by the EPA
Industrial pipelines
Landfills or waste disposal facilities
Machine shops
Paint and coating manufacturing
Photo processing
Plastics manufacturing
Printing and duplicating businesses that use hazardous chemicals as defined by the EPA
Public and municipal maintenance garages
Radioactive waste facilities
Recycling facilities
Research laboratories
Retail liquid motor fuel dispensing facilities
Salt storage
Septage and/or sewage sludge spreading
Spray wastewater facilities
Stormwater impoundments/retention areas
Underground and aboveground petroleum and chemical product storage tanks
Unsewered residential, commercial, or industrial development
Vehicle repair shops
Wastewater treatment or disposal facilities

TABLE K-1 (cont.)

ZONE B - PROHIBITED USES

Commercial animal confinement facilities
Animal waste facilities
Asphalt products manufacturing
Auto body repair businesses
Auto salvage yards (junk yards)
Bus or truck terminals
Commercial bulk fertilizer and/or pesticide facilities (storage, mixing and/or loading)
Dry cleaning businesses/facilities
Electroplating businesses/facilities
Exterminating businesses/facilities
Garage and vehicular towing
Hazardous and/or toxic materials storage
Hazardous and/or toxic waste facilities
Industrial businesses that use hazardous chemicals as defined by the EPA
Landfills or waste disposal facilities
Manufacturing businesses that use hazardous chemicals as defined by the EPA
Paint and coating manufacturing
Printing and duplicating businesses that use hazardous chemicals as defined by the EPA
Public and municipal maintenance garages
Radioactive waste facilities
Recycling facilities
Retail liquid motor fuel dispensing facilities
Salt storage
Septage and/or sewage sludge spreading
Spray wastewater facilities
Underground and aboveground petroleum and chemical product storage tanks (less than 600 feet from well)
Unsewered residential, commercial, or industrial development (if sewage system receives 8,000 gallons per day or more)
Vehicle repair shops
Wastewater treatment or disposal facilities

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Source: USEPA, 1993. Wellhead Protection: A Guide for Small Communities. Seminar Publication EPA/625/R-93/002, Washington, DC

Table 4-4. Potential Sources of Ground Water Contamination

Source	Health, Environmental, or Aesthetic Contaminant[1,2,3]
NATURALLY OCCURRING SOURCES	
Rocks and soils	*Aesthetic Contaminants:* Iron and iron bacteria; manganese; calcium and magnesium (hardness) *Health and Environmental Contaminants:* Arsenic; asbestos; metals; chlorides; fluorides; sulfates; sulfate-reducing bacteria and other microorganisms
Contaminated water	Excessive sodium; bacteria; viruses; low pH (acid) water
Decaying organic matter	Bacteria
Geological radioactive gas	Radionuclides (radon, etc.)
Natural hydrogeological events and formations	Salt-water/brackish water intrusion (or intrusion of other poor quality water); contamination by a variety of substances through sink-hole infiltration in limestone terrains
AGRICULTURAL SOURCES	
Animal feedlots and burial areas	Livestock sewage wastes; nitrates; phosphates; chloride; chemical sprays and dips for controlling insect, bacterial, viral, and fungal pests on livestock; coliform[4] and noncoliform bacteria; viruses
Manure spreading areas and storage pits	Livestock sewage wastes; nitrates
Livestock waste disposal areas	Livestock sewage wastes; nitrates
Crop areas and irrigation sites	Pesticides;[5] fertilizers;[6] gasoline and motor oils from chemical applicators
Chemical storage areas and containers	Pesticide[5] and fertilizer[6] residues
Farm machinery areas	Automotive wastes;[7] welding wastes
Agricultural drainage wells and canals	Pesticides;[5] fertilizers;[6] bacteria; salt water (in areas where the fresh-saltwater interface lies at shallow depths and where the water table is lowered by channelization, pumping, or other causes)
RESIDENTIAL SOURCES	
Common household maintenance and hobbies	*Common Household Products:*[8] Household cleaners; oven cleaners; drain cleaners; toilet cleaners; disinfectants; metal polishes; jewelry cleaners; shoe polishes; synthetic detergents; bleach; laundry soil and stain removers; spot removers and dry cleaning fluid; solvents; lye or caustic soda; household pesticides;[9] photochemicals; printing ink; other common products *Wall and Furniture Treatments:* Paints; varnishes; stains; dyes; wood preservatives (creosote); paint and lacquer thinners; paint and varnish removers and deglossers; paint brush cleaners; floor and furniture strippers *Mechanical Repair and Other Maintenance Products:* Automotive wastes;[7] waste oils; diesel fuel; kerosene; #2 heating oil; grease; degreasers for driveways and garages; metal degreasers; asphalt and roofing tar; tar removers; lubricants; rustproofers; car wash detergents; car waxes and polishes; rock salt; refrigerants
Lawns and gardens	Fertilizers;[5] herbicides and other pesticides used for lawn and garden maintenance[10]
Swimming pools	Swimming pool maintenance chemicals[11]
Septic systems, cesspools, and sewer lines	Septage; coliform and noncoliform bacteria;[4] viruses; nitrates; heavy metals; synthetic detergents; cooking and motor oils; bleach; pesticides;[9,10] paints; paint thinner; photographic chemicals; swimming pool chemicals;[11] septic tank/cesspool cleaner chemicals;[12] elevated levels of chloride, sulfate, calcium, magnesium, potassium, and phosphate
Underground storage tanks	Home heating oil
Apartments and condominiums	Swimming pool maintenance chemicals;[11] pesticides for lawn and garden maintenance and cockroach, termite, ant, rodent, and other pest control;[9,10] wastes from onsite sewage treatment plants; household hazardous wastes[8]

Table 4-4. Potential Sources of Ground Water Contamination (continued)

Source	Health, Environmental, or Aesthetic Contaminant[1,2,3]
MUNICIPAL SOURCES	
Schools and government offices and grounds	Solvents; pesticides;[9,10] acids; alkalis; waste oils; machinery/vehicle servicing wastes; gasoline and heating oil from storage tanks; general building wastes[13]
Park lands	Fertilizers;[6] herbicides;[10] insecticides[9]
Public and residential areas infested with mosquitoes, gypsy moths, ticks, ants, or other pests	Pesticides[5,9]
Highways, road maintenance depots, and deicing operations	Herbicides in highway rights-of-way;[5,10] road salt (sodium and calcium chloride); road salt anticaking additives (ferric ferrocyanide, sodium ferrocyanide); road salt anticorrosives (phosphate and chromate); automotive wastes[7]
Municipal sewage treatment plants and sewer lines	Municipal wastewater; sludge;14 treatment chemicals[15]
Storage, treatment, and disposal ponds, lagoons, and other surface impoundments	Sewage wastewater; nitrates; other liquid wastes; microbiological contaminants
Land areas applied with wastewater or wastewater byproducts	Organic matter; nitrate; inorganic salts; heavy metals; coliform and noncoliform bacteria;[4] viruses; nitrates; sludge;[14] nonhazardous wastes[16]
Storm water drains and basins	Urban runoff; gasoline; oil; other petroleum products; road salt; microbiological contaminants
Combined sewer overflows (municipal sewers and storm water drains)	Municipal wastewater; sludge;[14] treatment chemicals;[15] urban runoff; gasoline; oil; other petroleum products; road salt; microbial contaminants
Recycling/reduction facilities	Residential and commercial solid waste residues
Municipal waste landfills	Leachate; organic and inorganic chemical contaminants; wastes from households[8] and businesses;[13] nitrates; oils; metals
Open dumping and burning sites, closed dumps	Organic and inorganic chemicals; metals; oils; wastes from households[8] and businesses[13]
Municipal incinerators	Heavy metals; hydrocarbons; formaldehyde; methane; ethane; ethylene; acetylene; sulfur and nitrogen compounds
Water supply wells, monitoring wells, older wells, domestic and livestock wells, unsealed and abandoned wells, and test hole wells	Surface runoff; effluents from barnyards, feedlots, septic tanks, or cesspools; gasoline; used motor oil; road salt
Sumps and dry wells	Storm water runoff; spilled liquids; used oil; antifreeze; gasoline; other petroleum products; road salt; pesticides;[5] and a wide variety of other substances
Drainage wells	Pesticides;[9,10] bacteria
Well pumping that causes inter-aquifer leakage, induced filtration, landward migration of sea water in coastal areas; etc.	Saltwater; excessively mineralized water
Artificial ground water recharge	Storm water runoff; excess irrigation water; stream flow; cooling water; treated sewage effluent; other substances that may contain contaminants, such as nitrates, metals, detergents, synthetic organic compounds, bacteria, and viruses
COMMERCIAL SOURCES	
Airports, abandoned airfields	Jet fuels; deicers; diesel fuel; chlorinated solvents; automotive wastes;[7] heating oil; building wastes[13]
Auto repair shops	Waste oils; solvents; acids; paints; automotive wastes;[7] miscellaneous cutting oils
Barber and beauty shops	Perm solutions; dyes; miscellaneous chemicals contained in hair rinses
Boat yards and marinas	Diesel fuels; oil; septage from boat waste disposal areas; wood preservative and treatment chemicals; paints; waxes; varnishes; automotive wastes[7]

Table 4-4. Potential Sources of Ground Water Contamination (continued)

Source	Health, Environmental, or Aesthetic Contaminant[1,2,3]
Bowling alleys	Epoxy; urethane-based floor finish
Car dealerships (especially those with service departments)	Automotive wastes;[7] waste oils; solvents; miscellaneous wastes
Car washes	Soaps; detergents; waxes; miscellaneous chemicals
Camp grounds	Septage; gasoline; diesel fuel from boats; pesticides for controlling mosquitoes, ants, ticks, gypsy moths, and other pests;[5,9] household hazardous wastes from recreational vehicles (RVs)[8]
Carpet stores	Glues and other adhesives; fuel from storage tanks if forklifts are used
Cemeteries	Leachate; lawn and garden maintenance chemicals[10]
Construction trade areas and materials (plumbing, heating and air conditioning, painting, paper hanging, decorating, drywall and plastering, acoustical insulation, carpentry, flooring, roofing and sheet metal, wrecking and demolition, etc.)	Solvents; asbestos; paints; glues and other adhesives; waste insulation; lacquers; tars; sealants; epoxy waste; miscellaneous chemical wastes
Country clubs	Fertilizers;[6] herbicides;[5,10] pesticides for controlling mosquitoes, ticks, ants, gypsy moths, and other pests;[9] swimming pool chemicals;[11] automotive wastes
Dry cleaners	Solvents (perchloroethylene, petroleum solvents, Freon); spotting chemicals (trichloroethane, methylchloroform, ammonia, peroxides, hydrochloric acid, rust removers, amyl acetate)
Funeral services and crematories	Formaldehyde; wetting agents; fumigants; solvents
Furniture repair and finishing shops	Paints; solvents; degreasing and solvent recovery sludges
Gasoline services stations	Oils; solvents; miscellaneous wastes
Golf courses	Fertilizers;[6] herbicides;[5,10] pesticides for controlling mosquitoes, ticks, ants, gypsy moths, and other pests[9]
Hardware/lumber/parts stores	Hazardous chemical products in inventories; heating oil and fork lift fuel from storage tanks; wood-staining and treating products such as creosote
Heating oil companies, underground storage tanks	Heating oil; wastes from truck maintenance areas[7]
Horticultural practices, garden nurseries, florists	Herbicides, insecticides, fungicides, and other pesticides[10]
Jewelry/metal plating shops	Sodium and hydrogen cyanide; metallic salts; hydrochloric acid; sulfuric acid; chromic acid
Laundromats	Detergents; bleaches; fabric dyes
Medical institutions	X-ray developers and fixers;[17] infectious wastes; radiological wastes; biological wastes; disinfectants; asbestos; beryllium; dental acids; miscellaneous chemicals
Office buildings and office complexes	Building wastes;[13] lawn and garden maintenance chemicals;[10] gasoline; motor oil
Paint stores	Paints; paint thinners; lacquers; varnishes; other wood treatments
Pharmacies	Spilled and returned products
Photography shops, photo processing laboratories	Biosludges; silver sludges; cyanides; miscellaneous sludges
Print shops	Solvents; inks; dyes; oils; photographic chemicals
Railroad tracks and yards	Diesel fuel; herbicides for rights-of-way; creosote for preserving wood ties
Research laboratories	X-ray developers and fixers;[17] infectious wastes; radiological wastes; biological wastes; disinfectants; asbestos; beryllium; solvents; infectious materials; drugs; disinfectants (quaternary ammonia, hexachlorophene, peroxides, chlornexade, bleach); miscellaneous chemicals

Table 4-4. Potential Sources of Ground Water Contamination (continued)

Source	Health, Environmental, or Aesthetic Contaminant[1,2,3]
COMMERCIAL SOURCES (continued)	
Scrap and junk yards	Any wastes from businesses[13] and households;[8] oils
Sports and hobby shops	Gunpowder and ammunition; rocket engine fuel; model airplane glue
Above-ground and underground storage tanks	Heating oil; diesel fuel; gasoline; other petroleum products; other commercially used chemicals
Transportation services for passenger transit (local and interurban)	Waste oil; solvents; gasoline and diesel fuel from vehicles and storage tanks; fuel oil; other automotive wastes[7]
Veterinary services	Solvents; infectious materials; vaccines; drugs; disinfectants (quaternary ammonia, hexachlorophene, peroxides, chlornexade, bleach); x-ray developers and fixers[17]
INDUSTRIAL SOURCES	
Material stockpiles (coal, metallic ores, phosphates, gypsum)	Acid drainage; other hazardous and nonhazardous wastes[16]
Waste tailing ponds (commonly for the disposal of mining wastes)	Acids; metals; dissolved solids; radioactive ores; other hazardous and nonhazardous wastes[15]
Transport and transfer stations (trucking terminals and rail yards)	Fuel tanks; repair shop wastes;[7] other hazardous and nonhazardous wastes[15]
Above-ground and underground storage tanks and containers	Heating oil; diesel and gasoline fuel; other petroleum products; hazardous and nonhazardous materials and wastes[16]
Storage, treatment, and disposal ponds, lagoons, and other surface impoundments	Hazardous and nonhazardous liquid wastes;[16] septage; sludge[14]
Chemical landfills	Leachate; hazardous and nonhazardous wastes;[16] nitrates
Radioactive waste disposal sites	Radioactive wastes from medical facilities, power plants, and defense operations; radionuclides (uranium, plutonium)
Unattended wet and dry excavation sites (unregulated dumps)	A wide range of substances; solid and liquid wastes; oil-field brines; spent acids from steel mill operations; snow removal piles containing large amounts of salt
Operating and abandoned production and exploratory wells (for gas, oil, coal, geothermal, and heat recovery); test hole wells; monitoring and excavation wells	Metals; acids; minerals; sulfides; other hazardous and nonhazardous chemicals[16]
Dry wells	Saline water from wells pumped to keep them dry
Injection wells	Highly toxic wastes; hazardous and nonhazardous industrial wastes;[16] oil-field brines
Well drilling operations	Brines associated with oil and gas operations
INDUSTRIAL PROCESSES (PRESENTLY OPERATED OR TORN-DOWN FACILITIES)[18]	
Asphalt plants	Petroleum derivatives
Communications equipment manufacturers	Nitric, hydrochloric, and sulfuric acid wastes; heavy metal sludges; copper-contaminated etchant (e.g., ammonium persulfate); cutting oil and degreasing solvent (trichloroethane, Freon, or trichloroethylene); waste oils; corrosive soldering flux; paint sludge; waste plating solution
Electric and electronic equipment manufacturers and storage facilities	Cyanides; metal sludges; caustics (chromic acid); solvents; oils; alkalis; acids; paints and paint sludges; calcium fluoride sludges; methylene chloride; perchloroethylene; trichloroethane; acetone; methanol; toluene; PCBs
Electroplaters	Boric, hydrochloric, hydrofluoric, and sulfuric acids; sodium and potassium hydroxide; chromic acid; sodium and hydrogen cyanide; metallic salts
Foundries and metal fabricators	Paint wastes; acids; heavy metals; metal sludges; plating wastes; oils; solvents; explosive wastes

Table 4-4. Potential Sources of Ground Water Contamination (continued)

Source	Health, Environmental, or Aesthetic Contaminant[1,2,3]
Furniture and fixtures manufacturers	Paints; solvents; degreasing sludges; solvent recovery sludges
Machine and metalworking shops	Solvents; metals; miscellaneous organics; sludges; oily metal shavings; lubricant and cutting oils; degreasers (tetrachlorethylene); metal marking fluids; mold-release agents
Mining operations (surface and underground), underground storage mines	Mine spoils or tailings that often contain metals; acids; highly corrosive mineralized waters; metal sulfides
Unsealed abandoned mines used as waste pits	Metals; acids; minerals; sulfides; other hazardous and nonhazardous chemicals[16]
Paper mills	Metals; acids; minerals; sulfides; other hazardous and nonhazardous chemicals;[16] organic sludges; sodium hydroxide; chlorine; hypochlorite; chlorine dioxide; hydrogen peroxide
Petroleum production and storage companies, secondary recovery of petroleum	Hydrocarbons; oil-field brines (highly mineralized salt solutions)
Industrial pipelines	Corrosive fluids; hydrocarbons; other hazardous and nonhazardous materials and wastes[16]
Photo processing laboratories	Cyanides; biosludges; silver sludges; miscellaneous sludges
Plastics materials and synthetics producers	Solvents; oils; miscellaneous organics and inorganics (phenols, resins); paint wastes; cyanides; acids; alkalis; wastewater treatment sludges; cellulose esters; surfactant; glycols; phenols; formaldehyde; peroxides; etc.
Primary metal industries (blast furnaces, steel works, and rolling mills)	Heavy metal wastewater treatment sludge; pickling liquor; waste oil; ammonia scrubber liquor; acid tar sludge; alkaline cleaners; degreasing solvents; slag; metal dust
Publishers, printers, and allied industries	Solvents; inks; dyes; oils; miscellaneous organics; photographic chemicals
Public utilities (phone, electric power, gas)	PCBs from transformers and capacitors; oils; solvents; sludges; acid solution; metal plating solutions (chromium, nickel, cadmium); herbicides from utility rights-of-way
Sawmills and planers	Treated wood residue (copper quinolate, mercury, sodium bazide); tanner gas; paint sludges; solvents; creosote; coating and gluing wastes
Stone, clay, and glass manufacturers	Solvents; oils and grease; alkalis; acetic wastes; asbestos; heavy metal sludges; phenolic solids or sludges; metal-finishing sludge
Welders	Oxygen, acetylene
Wood preserving facilities	Wood preservatives; creosote

[1]In general, ground water contamination stems from the *misuse and improper disposal* of liquid and solid wastes; the *illegal dumping or abandonment* of household, commercial, or industrial chemicals; the *accidental spilling* of chemicals from trucks, railways, aircraft, handling facilities, and storage tanks; or the *improper siting, design, construction, operation, or maintenance* of agricultural, residential, municipal, commercial, and industrial drinking water wells and liquid and solid waste disposal facilities. Contaminants also can stem from *atmospheric pollutants*, such as airborne sulfur and nitrogen compounds, which are created by smoke, flue dust, aerosols, and automobile emissions, fall as acid rain, and percolate through the soil. When the sources listed in this table are used and managed properly, ground water contamination is not likely to occur.

[2]Contaminants can reach ground water from activities occurring on the land surface, such as industrial waste storage; from sources below the land surface but above the water table, such as septic systems; from structures beneath the water table, such as wells; or from contaminated recharge water.

[3]This table lists the most common wastes, but not all potential wastes. For example, it is not possible to list all potential contaminants contained in storm water runoff or research laboratory wastes.

[4]Coliform bacteria can indicate the presence of pathogenic (disease-causing) microorganisms that may be transmitted in human feces. Diseases such as typhoid fever, hepatitis, diarrhea, and dysentery can result from sewage contamination of water supplies.

[5]Pesticides include herbicides, insecticides, rodenticides, fungicides, and avicides. EPA has registered approximately 50,000 different pesticide products for use in the United States. Many are highly toxic and quite mobile in the subsurface. An EPA survey found that the most common pesticides found in drinking water wells were DCPA (dacthal) and atrazine, which EPA classifies as *moderately toxic* (class 3) and *slightly toxic* (class 4) materials, respectively.

[6]The EPA National Pesticides Survey found that the use of fertilizers correlates to nitrate contamination of ground water supplies.

[7]Automotive wastes can include gasoline; antifreeze; automatic transmission fluid; battery acid; engine and radiator flushes; engine and metal degreasers; hydraulic (brake) fluid; and motor oils.

[8]Toxic or hazardous components of common household products are noted in Table 3-2.

[9]Common household pesticides for controlling pests such as ants, termites, bees, wasps, flies, cockroaches, silverfish, mites, ticks, fleas, worms, rats, and mice can contain active ingredients including napthalene, phosphorus, xylene, chloroform, heavy metals, chlorinated hydrocarbons, arsenic, strychnine, kerosene, nitrosamines, and dioxin.

[10]Common pesticides used for lawn and garden maintenance (i.e., weed killers, and mite, grub, and aphid controls) include such chemicals as 2,4-D; chlorpyrifos; diazinon; benomyl; captan; dicofol; and methoxychlor.

[11]Swimming pool chemicals can contain free and combined chlorine; bromine; iodine; mercury-based, copper-based, and quaternary algicides; cyanuric acid; calcium or sodium hypochlorite; muriatic acid; sodium carbonate.

[12]Septic tank/cesspool cleaners include synthetic organic chemicals such as 1,1,1 trichloroethane, tetrachloroethylene, carbon tetrachloride, and methylene chloride.

[13]Common wastes from public and commercial buildings include automotive wastes; rock salt; and residues from cleaning products that may contain chemicals such as xylenols, glycol esters, isopropanol, 1,1,1-trichloroethane, sulfonates, chlorinated phenolys, and cresols.

[14]Municipal wastewater treatment sludge can contain organic matter; nitrates; inorganic salts; heavy metals; coliform and noncoliform bacteria; and viruses.

[15]Municipal wastewater treatment chemicals include calcium oxide; alum; activated alum, carbon, and silica; polymers; ion exchange resins; sodium hydroxide; chlorine; ozone; and corrosion inhibitors.

[16]The Resource Conservation and Recovery Act (RCRA) defines a hazardous waste as a solid waste that may cause an increase in mortality or serious illness or pose a substantial threat to human health and the environment when improperly treated, stored, transported, disposed of, or otherwise managed. A waste is hazardous if it exhibits characteristics of ignitability, corrosivity, reactivity, and/or toxicity. Not covered by RCRA regulations are domestic sewage; irrigation waters or industrial discharges allowed by the Clean Water Act; certain nuclear and mining wastes; household wastes; agricultural wastes (excluding some pesticides); and small quantity hazardous wastes (i.e., less than 220 pounds per month) generated by businesses.

[17]X-ray developers and fixers may contain reclaimable silver, glutaldehyde, hydroquinone, phenedone, potassium bromide, sodium sulfite, sodium carbonate, thiosulfates, and potassium alum.

[18]This table lists potential ground water contaminants from many common industries, but it does not address all industries.

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Table 4-5. Land Uses and Their Relative Risk to Ground Water

LEAST RISK	A.	1. Land surrounding a well or reservoir, owned by a water company. 2. Permanent open space dedicated to passive recreation. 3. Federal, state, municipal, and private parks. 4. Woodlands managed for forest products. 5. Permanent open space dedicated to active recreation.
	B.	1. Field crops: pasture, hay, grains, vegetables. 2. Low density residential: lots larger than 2 acres. 3. Churches, municipal offices.
	C.	1. Agricultural production: dairy, livestock, poultry, nurseries, orchards, berries. 2. Golf course, quarries. 3. Medium density residential: lots from 1/2 to 1 acre.
	D.	1. Institutional uses: schools, hospitals, nursing homes, prisons, garages, salt storage, sewage treatment facilities. 2. High density housing: lots smaller than 1/2 acre. 3. Commercial uses: limited hazardous material storage and only sewage disposal.
	E.	1. Retail commercial: gasoline, farm equipment, automotive, sales and services; dry cleaners; photo processor; medical arts; furniture strippers; machine shops; radiator repair; printers; fuel oil distributors. 2. Industrial: all forms of manufacturing and processing, research facilities. 3. Underground storage of chemicals, petroleum.
GREATEST RISK		4. Waste disposal: pits, ponds, lagoons, injection wells used for waste disposal; bulky waste and domestic garbage landfills; hazardous waste treatment, storage and disposal sites.

Source: Adapted from U.S. EPA, 1989a.

APPENDIX L

CLEAN SWEEP COLLECTION PROGRAM

Household Hazardous Waste Program

Clean Sweep provides an opportunity for residents of Madison and Dane County to safely dispose of hazardous waste, free of charge.

We are now closed for the 2010 collection season and will reopen on May 3rd 2011.

2011 Collection Season

Clean Sweep will reopen open on May 3rd, 2011 and run through October 29th, 2011. We'll be open every Tuesday, Wednesday, Friday, and Saturday from 7:30 A.M. to 2:00 P.M. Our facility is located in Madison at 2302 Fish Hatchery Road (on the north end of the Dane County Highway Garage property).
View a map to CleanSweep site.

Guidelines for Materials Brought to Clean Sweep

When you bring materials, they should be packaged to keep them from spilling or breaking on the way. Leave materials in their original containers. DO NOT MIX like or unlike materials together. Leaking containers may be placed, as is, in another container. Be sure to label the outside container.

Disposal options for common items

Although we do our best to accept as much household hazardous waste as possible, there are some things we cannot take off your hands. Click on the items below to display information regarding their disposal.

Note: If an item is in this list, it does not necessarily mean that Clean Sweep will accept it.

Please click on the item of interest to learn about its proper disposal.

For a printable version of the disposal options for the most common household items, please click here.

Please note that the drop-down list above is more comprehensive and contains many useful links to help answer your material disposal questions.

Clean Sweep does not accept tires, paper or cardboard products, yard waste, construction, debris, rubbish, glass, solid metals, solid waste, appliances, etc. Contact your local official, trash hauler, or private recycler for details.

Small Business

Clean Sweep is currently closed.

The Small Business Hazardous Waste Disposal Program

The small business program allows farms and businesses to dispose of agricultural chemicals or other hazardous materials and waste in a convenient and cost-effective manner. Very Small Quantity Generator (VSQG) wastes are accepted by appointment only during our May – October season.

Appointment Scheduling

Small business chemicals are accepted by appointment only during our May – October season. Appointments are normally scheduled on Thursday mornings. See the "Make an Appointment" section below.

Appointments for the 2011 season will be available on Thursdays from May 5th until October 14th, 2011.

Reduced costs

The small business program, as an add-on to the Household Hazardous Waste Program, is able to take advantage of its economies of scale and provide significant cost savings. State law requires that all Wisconsin businesses producing hazardous waste manage and dispose of their materials and wastes properly. Buisnesses generating large quantities of waste must hire a chemical contractor to sort, package, and transport the waste to a licensed facility. This option proves very costly for generators of small quantities of waste, especially if they have different waste streams (e.g. solvents and paints). This makes the reduced costs offered by Clean Sweep particularly attractive to small businesses.

Reduced Regulations

Under normal regulations, the procedures and paperwork for small businesses can be confusing and complicated. However, the Wisconsin DNR has designed a program to assist generators of small quantities of waste to effectively dispose of their hazardous materials in a simplified manner, which allows Dane County Clean Sweep, to waive manifest requirements and authorize us to accept business waste.

Proper Treatment

As a VSQG, you can be assured that your waste will be properly managed by the Clean Sweep program. Clean Sweep makes sure that the facilities to which this waste is sent are audited regularly. We

also help to minimize liability, by assuring that these materials are displosed of through a hierarchy of disposal: Reuse, Recycle, Treatment, or Incineration. This hierarchy of disposal makes sure that wastes are disposed of in the most cost-efficient and environmentally-conscious manner.

How to Transport Materials to Clean Sweep

Products and materials should be packaged to keep them from spilling or breaking on the way to Clean Sweep. Leave materials in their original containers. DO NOT MIX like or unlike materials together. Leaking containers may be placed, as is, in another container. Please make sure to properly label the outside container.

Make an Appointment

Appointments for the 2011 season will be available on Thursdays from May 5th until October 14th, 2011.

You have two options to set up an appointment to bring in your hazardous waste:

- online pre-registration form
- small business program brochure and application (print and mail)

If you have questions about the program or if you are unsure whether you qualify, you may contact Dave Radisewitz at 608-243-0347 (voice), 608-267-3105 (fax), or email him at dradisewitz@publichealthmdc.com.

Agriculture

Due to a lack of DATCP grant funding for 2010, no subsidies will be available for agricultural related businesses (Agricultural VSQGs) for the 2010 season. Agricultural VSQGs are welcome to use the program; however, agri-businesses will be charged the full price for disposal, same as our other non-agricultural business customers. Dane County will provide a 100% subsidy for Dane County farmers for 2010.

2010 Appointment Scheduling

Agricultural chemicals are accepted by appointment only during our May – October season. Appointments are normally scheduled on Thursday mornings. See the "Make an Appointment" section below.

Appointments for the 2010 season will be available on Thursdays from May 6th until October 14th, 2010.

The Agricultural Hazardous Waste Disposal Program

Due to the lack of DATCP subsidies other agri-businesses will be charged the full small business charge.

Collection Dates

Agricultural Clean Sweeps will be held every Thursday morning by appointment between May 6 and October 14. Please note that pre-registration is required. The exact time and date for your drop-off will be assigned upon registration.

Items acceptable under the Agricultural Clean SweepItems acceptable under the Agricultural Clean Sweep

- Unused, damaged, cancelled, banned, or otherwise unwanted agricultural chemicals, including herbicides, insecticides, fungicides, rodenticides, and wood preservatives.
- Common pesticides such as 2,4-D, captan, malathion, DDT, parathion, toxaphene, chlordane, heptachlor, lindane, 2,4,5-T, and pentachlorophenol.
- Other agricultural chemicals including veterinary supplies, lead paint, acid washes, wood finishes, solvents, and engine cleaners.

Unacceptable chemicals

- Explosives, including detonators and blasting caps
- Radioactives, including smoke alarms

- Infectious and biological wastes
- Propane cylinders. Certain compressed gas cylinder will be accepted; however, you must pre-register to determine whether or not your particular cylinder is acceptable. There are no exceptions to this rule.

How to Transport Materials to Clean Sweep

Products and materials should be packaged to keep them from spilling or breaking on the way to Clean Sweep. Leave materials in their original containers. DO NOT MIX like or unlike materials together. Leaking containers may be placed, as is, in another container. Label the outside container.

Make an Appointment

Appointments for the 2010 season will be available on Thursdays from May 6th until October 14th, 2010.

If you'd like to set up an appointment to bring in your agricultural hazardous waste, please fill out our online preregistration form. If you have questions about the program or if you are unsure whether you qualify, you can find answers in the preregistration form or by contacting Dave Radisewitz at 608-243-0347 (phone), 608-267-3105 (fax), or email him at dradisewitz@publichealthmdc.com.

Product Exchange Program

This program allows you to bring in chemicals that are still useable, including paint, thinners, solvents, and pesticides. We make these products available free to the public at our on-site product exchange store. Please note that in accordance with Dane County ordinance Chapter 80 and City of Madison ordinance MGO 7.48, Clean Sweep cannot provide phosphorus containing lawn fertilizer in the Product Exchange. If you're looking for any other free materials that Clean Sweep has on its shelves, stop by and see what may be useful to you.

The City of Madison/Dane County Clean Sweep Facility cannot, and does not, guarantee the integrity, safety, usability, or effectiveness of the products taken from the Product Exchange. When you take products from this facility, you do so at your own risk. Every product is provided “as is”, and there are no express or implied warranties, including but not limited to warranties of merchantability and fitness for particular purpose.

Madison Freecycle

Madison Freecycle is an email list and Yahoo! group whose purpose is to "reduce waste by providing an alternative to sending unneeded, but still usable items to the landfill." Check them out if you've got something of use that you don't want to throw away or if you're looking for free items.

Madison Stuff Exchange

The Madison Stuff Exchange "provides area residents and businesses with a convenient way to exchange, re-use, or sell items they no longer need or want." The difference between the Stuff Exchange and the Freecycle is that some items on the Stuff Exchange may be sold for up to $99.

Paint Disposal

Leftover paint accounts for nearly 85% of all the waste material received by the Dane County Clean Sweep program on an annual basis. Over 1/2 of all the waste material received annually is latex paint, and management of this non-hazardous material consumes nearly 1/3 of the Clean Sweep annual budget. In order to sustain our program amidst rising disposal costs and dwindling public funds, it is necessary that we place an increased emphasis on latex paint management at the point of consumption. By following the latex paint management tips listed below, you will help to lower our operating costs and keep our program and services free to our customers.

Taking your latex paint to Clean Sweep for disposal should be your option of last resort. If you find you absolutely cannot solidify and dispose of latex paint waste on your own, Clean Sweep will still accept it, subject to the following conditions:

- Latex paint must still be in a liquid state
- Cans must be at least ½ full

Paint Re-use Option

If you have nearly full cans of latex paint in good condition, don't waste them! Clean Sweep will accept them for placement into our product exchange!

Minimize your waste

- Buy only what you need to get the job done. Store retailers can help you calculate the right amount (or check out one of the paint calculators on the right side of this page) or check coverage rates of various products. In general, one gallon of paint will provide one coat of coverage for 300 square feet.
- Use it up - apply another coat.
- Give it away to someone who can use it: friends, relatives, neighbors, churches, theatrical groups, high schools, recreation departments or community organizations. Only give away paint that is in good condition and is in its original container with an intact label.
- Store paint properly between uses:
    - Protect from freezing
    - Place a piece of kitchen plastic wrap on the surface of the paint to keep it from drying out or forming a skin
    - Put the lid back on the can and tap firmly into place

Tips for proper disposal of paint

First check the label to determine what type of paint you have. Latex paints are non-hazardous and soluble in water - look on the label for

the words “latex” or “acrylic” and directions that specify to clean up or thin with water. Oil or solvent-based paints and stains are combustible and present particular hazards – look on the label for the words “oil” or “alkyd” and directions that specify to clean up or thin with mineral spirits or paint thinner. Left-over oil or solvent-based paints, whether liquid or solid, should be taken to the Dane County Clean Sweep Facility at 2302 Fish Hatchery Road for proper disposal. Never dispose of oil- or solvent-based paints and stains in your trash.

Because latex paint is non-hazardous, it can be disposed of with your regular trash, provided that it is completely solidified. Never dispose of liquid paints in your trash. Several methods to properly solidify latex paint are listed below:

- Remove the lid and let the paint dry out in the can; protect from freezing and rain as well as curious children and animals. This only works when an inch or less of paint is left in the can and is most effective in warmer months.
- Mix latex paint with an equal amount of cat litter, stir in completely and allow to dry.
- Mix latex paint with a latex paint hardener; stir and allow to harden. Paint hardener can be purchased at your local hardware store. Follow the directions on the package.
- For larger volumes of latex paint, line a cardboard box with a plastic bag. Add an absorbing agent such as kitty litter, sawdust or shredded newspaper to the box. Pour the paint into the box so that it forms a thin layer (about 1 inch deep) and allow the paint to harden. Repeat this process until all of the paint has hardened.

Once the latex paint has hardened or solidified, it can be disposed of with your regular trash. However, make sure the lids are removed from the paint cans when you set them at your curb, or place them in your Trash Cart if you have automated trash pickup. If you live in the City of Madison, then dried latex materials can be brought to the Streets Department east or west full-service drop-off sites for disposal.

Painting Resources on the web

- MIStupid Paint Calculator
- Improvenet Paint calculator
- Should I use latex or oil-based paint?
- Tips on cleaning up after painting

APPENDIX M

CITY OF MADISON WELL ABANDONMENT ORDINANCE - DANE COUNTY ORDINANCE RELATING TO PRIVATE WATER SYSTEMS

13.20 TAMPERING WITH WATER METERS PROHIBITED.

(1) No person shall modify, tamper with or in any manner interfere with, or make any connection to a water meter installed by the Madison Water Utility or to said meter's electrical and mechanical connections or apparatuses or water pipes leading to said meters without the written authorization of the Water Utility General Manager or unless authorized by law.

(2) Any person violating this section may be subject to a forfeiture of not less than one-hundred dollars ($100) nor more than one-thousand dollars ($1,000).

(Cr. by Ord. 7848, 11-5-82)

(Sec. 13.20 Am. by Ord. 12,357, Adopted 3-16-99)

13.205 TAMPERING WITH WATER UTILITY MAINS AND PROPERTY.

(1) No person shall modify, tamper with or in any manner interfere with, or make any connection to any Madison Water Utility pipe, service, or owned facility or any other appurtenance without the authorization of the Water Utility Manager or his or her agent unless authorized by law.

(2) No person shall turn any valve or corporation cock without the authorization of the Water Utility Manager or his or her agent unless authorized by law.

(3) Any person violating this section may be subject to a forfeiture of not less than two hundred dollars ($200) nor more than two thousand dollars ($2000) each day or portion thereof shall be considered a separate violation.

(Sec. 13.205 Cr. by ORD-08-00117, 10-24-08)

13.21 WELL ABANDONMENT.

(1) Purpose. To prevent contamination of groundwater and to protect public health, safety and welfare by assuring that unused, unsafe or noncomplying wells, wells which may serve as conduits for contamination or wells which may be illegally cross-connected to the Madison Water Utility are properly abandoned. Improperly abandoned wells represent potential direct pathways for groundwater contamination to enter the municipal drinking water supply. (Am. by ORD-09-00124, Pub. 8-20-09, Eff. 1-1-10)

(2) Applicability. This ordinance applies to all wells located in the City of Madison or on premises served by the Madison Water Utility.

(3) Definitions.

Noncomplying means a well or pump installation which does not comply with the provisions of Wis. Admin. Code ch. NR 812, in effect at the time the well was constructed, a contamination source was installed, the pump was installed or work was done on either the well or pump installation.

Pump installation means the pump and related equipment used for withdrawing water from a well including the discharge piping, the underground connections, pitless adapters, pressure tanks, pits, sampling faucets and well seals or caps.

Unsafe means a well or pump installation which produces water which is bacteriologically contaminated or contaminated with substances in excess of the standards of Wis. Admin. Code chs. NR 809 or 140, or for which a Health Advisory has been issued by the Department of Natural Resources.

Unused means a well or pump installation which is not in use or does not have a functional pumping system.

Well means an excavation or opening into the ground made by digging, boring, drilling, driving, or other methods for the purpose of obtaining groundwater for consumption or other use. Wells for the express purpose of monitoring the quality of ground water and/or gases and/or soil characteristics are exempt from this Ordinance.

Well abandonment means the filling and sealing of a well according to the provisions of Wis. Admin. Code ch. NR 812.

(4) Abandonment Required. All wells located in the City of Madison or on premises served by the Madison Water Utility shall be abandoned if no valid well operation permit has been obtained from the Madison Water Utility or if so required under Wis. Admin. Code § NR 812.26(2). An application for a well operation permit shall be made within ninety (90) days of the date of any abandonment notice from the Madison Water Utility. (Am. by Ord. 12,567, 5-3-00)

(5) Well Operation Permit. No person may operate a well without having obtained a well operation permit. The Madison Water Utility may grant a permit to a private well owner to operate a well for a period not to exceed five (5) years providing the conditions of this section are met. An owner may request renewal of a well operation permit by submitting information verifying that the conditions of this section are met. The Madison Water Utility, or its agent, may conduct inspections or have water quality tests conducted at the applicant's expense to obtain or verify information necessary for consideration of a permit application or renewal. Permit applications and renewals shall be made on forms provided by the Madison Water Utility. A permit fee of one hundred dollars ($100) shall accompany the application. This fee shall include the cost of conducting bacterial examinations of water samples obtained from the well. The Madison Water Utility may require abandonment of a well for failure to renew a permit or to pay renewal fee within ninety (90) days of the date of any abandonment notice from the Madison Water Utility; otherwise, abandonment shall be required. The following conditions must be met for issuance or renewal of a well operation permit:

(a) The well and pump installation meet or are upgraded to meet the requirements of Wis. Admin. Code ch. NR 812.

(b) The well construction and pump installation have a history of producing bacteriologically safe water as evidenced by at least two (2) samplings taken a minimum of two (2) weeks apart. No exception to this condition may be made for unsafe wells, unless the Department of Natural Resources approves, in writing, the continued use of the well.

(c) There are no cross-connections between the well and pump installation and the Madison Water Utility.

(Am. by Ord. 12,567, 5-3-00)

(6) Required Inspection. Whenever real property with a well on the premises is conveyed pursuant to Wis. Stat. ch. 706, the seller shall contact the Madison Water Utility at least fourteen (14) days prior to the transfer of property. Upon proper notice, the Madison Water Utility may conduct an inspection to determine whether the well should be permitted or abandoned under this section.

(7) A representative of the Madison Water Utility shall have the power and authority at all reasonable times, for any proper purpose, to enter upon any property in the City of Madison and make inspection thereof. If entry is refused, such representative may obtain a special inspection warrant under Wis. Stat. § 66.0119. Upon request by a representative of the Madison Water Utility, the owner, lessee or occupant of any property so served shall furnish to the inspection agency any pertinent information regarding the well on such property if such information is known to such owner, lessee or occupant. (Am. by Ord. 12,567, 5-3-00)

(8) Abandonment Procedures.

(a) All wells abandoned under the jurisdiction of this ordinance or rule shall be abandoned according to the procedures and methods of Wis. Admin. Code § NR 812. All debris, pump, piping, unsealed liners and any other obstructions which may interfere with sealing operations shall be removed prior to abandonment.

(b) The owner of the well, or the owner's agent, shall notify the Madison Water Utility at least forty-eight (48) hours prior to commencement of any well abandonment activities. The abandonment of the well may be observed by the Madison Water Utility.

(c) An abandonment report form, supplied by the Department of Natural Resources, shall be submitted by the well owner to the Madison Water Utility and the Department of Natural Resources within ten (10) days of the completion of the well abandonment.

(d) The Madison Water Utility may require any person who has abandoned a well not in compliance with Subdivision (a) to return and take corrective action so that the well is abandoned by him or her in a complying manner. (Cr. by Ord. 12,567, 5-3-00)

(9) Well Abandonment Rebate. Upon the proper abandonment of a well pursuant to this section, the City Engineer, in consultation with the Water Utility General Manager and the Public Health Director, is authorized to issue a rebate to the owner of a property located in the City of Madison or that is served by the Madison Water Utility of up to fifty percent (50%) of the cost to the owner of the abandonment of the well, up to a maximum rebate of one thousand dollars ($1000.00). In determining the amount of the rebate, any contributions made by Dane County under Dane County Ordinance 46.42 shall not be considered, provided that the rebate issued by the City under this Subsection, when combined with any contribution made by Dane County, shall not exceed the total cost to the owner of abandoning the well. No rebate shall be issued to the owner of a property against whom the City has either issued a citation or made a written referral to the City Attorney for non-compliance with the requirements of this section. Rebates issued under this subsection shall be funded out of the landfill remediation fee as set forth in Section 32.025, MGO. (Cr. by ORD-09-00124, Pub. 8-20-09, Eff. 1-1-10)

(10) This law does not supersede the State Plumbing Code, Wis. Admin. Code § NR 811 or Chapter 18 of the Madison General Ordinances entitled "Plumbing Code" but is supplementary to them. (Renum. by ORD-09-00124, Pub. 8-20-09, Eff. 1-1-10)

(11) Penalties. The penalty for violation of this section may be not less than twenty-five dollars ($25) nor more than one thousand dollars ($1,000) and the cost of prosecution. Each day of violation is a separate offense. If any person fails to comply with this ordinance for more than ten (10) days after receiving written notice of the violation, the City may impose a penalty and cause the well abandonment to be performed and the expense may be levied as a special charge against the property. (Am. by ORD-08-00095, 8-23-08; Renum. by ORD-09-00124, Pub. 8-20-09, Eff. 1-1-10)

(Sec. 13.21 Cr. by Ord. 10,136, 11-14-90; Am. by Ord. 12,345, 3-12-99; Am. by Ord. 12,567, 5-3-00; Ord. 13,500, 1-23-04)

13.22 WELLHEAD PROTECTION.

(1) To prevent contamination of wells supplying municipal water systems, the Water Utility General Manager or his/her designee shall review all proposed uses on zoning lots in Zones A and B in Wellhead Protection Districts.

(2) Review will be based on the presence, use, or storage on the lot of hazardous chemicals, as defined by the Environmental Protection Agency. Consideration will be given to factors including but not limited to the following: whether the zoning lot is in Zone A or Zone B, effective storage or containment of particular hazardous chemicals, and the magnitude and/or frequency of use of the hazardous chemicals. Approval of the use may be contingent on specific conditions being met. A current list of hazardous chemicals, as defined by the Environmental Protection Agency, shall be maintained. (Cr. by Ord. 13,106, 7-23-02)

13.23 PENALTY. Any person violating any provision of this chapter for which a separate penalty has not been imposed shall be punished by a fine of not less than fifty dollars ($50) nor more than one thousand dollars ($1,000). Each day or portion thereof such violation continues shall be considered a separate offense

The word "fine" as used in this chapter shall be synonymous with the term "forfeiture".

(Am. by Ord. 12,357, Adopted 3-16-99; Renumbered to Sec. 13.23 by Ord. 13,106, 7-23-02; Am. by ORD-06-00135, 10-6-06)

TITLE 9
HEALTH AND SANITATION

CHAPTER 45
RELATING TO PRIVATE WATER SYSTEMS

45.01 AUTHORITY AND ADOPTION. (1) This ordinance is adopted under the authority of ss. 59.067 and 162.07, Wis. Stats., and Ch. NR 845, Wis. Admin. Code.
(2) This ordinance is subject to the provisions of ss. 59.067 and 162.07, Wis. Stats., and all rules promulgated thereunder regulating private water systems.
(3) This ordinance may not be more lenient nor more stringent than the rules promulgated pursuant to ch. 162, Stats.
(4) Failure to comply with any of the provisions of such regulations shall constitute a violation of this ordinance, actionable according to the penalties provided herein.
(5) This ordinance applies to the entire county and includes cities, towns, villages and sanitary districts in the county.

45.02 JURISDICTION. The provisions of this ordinance shall apply to all private water systems within Dane County.

45.03 PURPOSE. The purpose of this ordinance is to protect the drinking water and groundwater resources of the county by governing access to groundwater through regulating (1) private well location and (2) existing private water systems.

45.04 INTENT. The intent of this ordinance is to regulate (1) the locations of wells and (2) existing water systems and to provide for the administration and enforcement of this ordinance.

45.05 EFFECTIVE DATE. (1) This ordinance shall be effective July 1, 1987 for well location.
[HISTORY: (2) rep., OA 29, 1995-96, pub. 12/06/95.]

45.06 SEVERABILITY AND NON-LIABILITY. If any section, provision or portion of this ordinance is adjudged unconstitutional or invalid by a court of competent jurisdiction, the remainder of this ordinance shall not be affected. The county asserts that there is no liability on the part of the board of supervisors, its agencies or employees for any health hazards or damages that may occur as a result of reliance upon, and compliance with, this ordinance.

45.07 REPEAL. All other county ordinances or parts of ordinances inconsistent or conflicting with this ordinance, to the extent of the inconsistency only, are repealed.

45.08 DEFINITIONS. As used in this ordinance, the following words and phrases have the meanings indicated:
(1) *Administrator* means the county employee designated by the county executive to issue permits for private well location and to administer ch. NR 812, Wis. Admin. Code, in the county as authorized by the department. The administrator is hereby empowered to delegate his or her authority under this ordinance to any or all of the certified well inspectors employed by the community support and health services department of the County of Dane.

(2) *Central office* means the department's bureau of water supply, located in Madison, which functions as the coordinating authority for the statewide water supply program.
(3) *Community water system* has the meaning designated in s. NR 811.02(7), Wis. Admin. Code.
(4) *County* means the County of Dane.
(5) *County office staff* means county office personnel trained to answer general well location questions and to accept permit applications.
(6) *Delegation level* means the program level, as set forth in s. NR 845.05, Wis. Admin. Code, at which a county is authorized to administer and enforce ch. NR 812, Wis. Admin. Code.
(7) *Department* means the Department of Natural Resources of the State of Wisconsin.
(8) *District office* means the department's office located in Madison, Wisconsin.
(10) *Existing installations* has the meaning designated in ch. NR 812, Wis. Admin. Code.
(11) *Health hazard* means a condition which constitutes:
(a) A violation of ch. NR 812, Wis. Admin. Code, regarding the installation, construction, operation or maintenance of a private well; or
(b) Confirmed bacteriologically unsafe well water quality.
(11m) *Large parcel* means, for the purpose of this ordinance, a parcel having dimensions such that all boundary lines cannot be shown on a sheet of paper not to exceed 8½ inches by 11 inches for a plan diagram that has a scale of 1 inch equals 100 feet or smaller.
(12) *Noncommunity water system* means a public water supply system that serves at least 25 people at least 60 days each year. A noncommunity water system commonly serves a transient population rather than permanent year-round residents. This is typically an individual well serving a restaurant, industry, service station, tavern, motel, campground or church.
(13) *Noncomplying well* means a private water system not in compliance with all provisions of ch. NR 812, Wis. Admin. Code, in effect at the time the well was constructed.
(14) *Person* means an individual, corporation, company, association, cooperative, trust, institution, partnership, state, public utility, sanitary district, municipality or federal agency.
(15) *Personal interest* means having a financial interest in a property or being related by marriage or birth to a person having a financial interest in a property.
(16) *Primary drinking water standards* means those maximum contaminant levels which represent minimum public health standards set forth in ch. NR 809, Wis. Admin. Code.
(17) *Private water system* means the water collection, storage and treatment facilities and all structures, piping and appurtenances by which water is provided for human consumption by other than community water systems. For the purpose of this ordinance, it includes non-community water systems.
(18) *Private water systems ordinance* means a county ordinance, approved by the department, regulating private water systems at the county's authorized delegation level.
(19) *Private well* means, for the purpose of this ordinance, any drilled, driven point, dug, bored or jetted well constructed for the purpose of obtaining groundwater for potable use, including wells constructed in special well casing depth areas, wells constructed to potable well standards regardless of the intended use of the well and noncommunity wells. It does not include springs, or private or public wells that require written plan approval from the department.
(20) *Public water system* has the meaning designated in ch. NR 812, Wis. Admin. Code.
(21) *Reconstruction* means modifying the original construction of a private well. It includes, but is not limited to, deepening, lining, installing or replacing a screen, underreaming, hydrofracturing and blasting.
(22) *Variance* means an approval issued by the department under ch. NR 812, Wis. Admin. Code, allowing a private water system to vary from ch. NR 812, Wis. Admin. Code, requirements if department approved conditions are met.
(23) *Water system* means the water collection, storage, treatment facilities and all structures, piping and appurtenances by which water is provided.
(24) *Well* has the meaning designated in ch. 162, Wis. Stats.
(25) *Well construction* means the procedures, methods, materials and equipment used during the construction or reconstruction of a private well.
(25m) *Well constructor* means any person who constructs a well.
(26) *Well location permit* means a permit, or comparable registration system, issued by the county which allows the construction or reconstruction of a private well.
[HISTORY: (1) am., Sub. 1 to OA 43, 1987-88, pub. 06/18/88; (9) rep., (12) am. and (25m) cr., OA 29, 1995-96, pub. 12/06/95; (11m) cr. and (19) am., OA 21, 2002-03, pub. 03/04/03.]

[45.09 - 45.10 reserved.]

45.11 COUNTY RESPONSIBILITIES; PRIVATE WELL LOCATION PERMITS. In accepting Level 1 and Level 5 responsibility from the department, the county hereby agrees to:

(1) Issue permits authorizing the location of new and replacement private wells, including drilled, driven point, dug, bored or jetted wells, or the reconstruction or rehabilitation of existing private wells.

(2) Conduct inspections of wells for which well location permits are required as soon as possible after the well is constructed.

(3) Determine whether the casing height of a permitted well complies with ch. NR 812, Wis. Admin. Code, and that there is a cap or seal on the upper terminus of the well.

(4) Require the abandonment of wells not in service, or that will be taken out of service, if the well is unused, noncomplying or bacteriologically unsafe. The county may require abandonment of a well or drillhole as per s. NR 812.26, Wis. Admin. Code, or which has other chemical compounds, including inorganic and organic compounds, for which state health advisory limits have been issued, after consultation with and approval by the department.

(5) Require upgrading of all inspected private wells that are not in compliance with the minimum private well locational distances in ch. NR 812, Wis. Admin. Code.

[**HISTORY:** (intro.) am., OA 29, 1995-96, pub. 12/06/95; (4) am., OA 21, 2002-03, pub. 03/04/03; (4) am., OA 10, 2003-04, pub. 09/12/03.]

45.12 COUNTY RESPONSIBILITIES; EXISTING PRIVATE WATER SYSTEMS. (1) On the request of a property owner or a lending institution, the administrator will conduct an evaluation of the well and collect a water sample for coliform bacteria analysis and, if also requested, collect a nitrate-nitrogen sample from the private water supply.

(2) The administrator will conduct a private water system evaluation whenever any water sample is collected as part of a complaint or problem follow-up, unless directed not to do so by the department.

(3) The administrator shall require upgrading of all inspected private water systems that are not in compliance with the minimum private well location standards of ch. NR 812, Wis. Admin. Code.

[**HISTORY:** 45.12 am., OA 29, 1995-96, pub. 12/06/95.]

45.13 COOPERATION WITH OTHER UNITS. The administrator shall cooperate with all other governmental units and agencies in the enforcement of all state and local laws and regulations pertaining to matters in this ordinance.

45.14 ADMINISTRATOR. (1) The county director of environmental health shall act as the Dane County administrator and is assigned the duties of administering the private water system program in accordance with department rules.

(2) The administrator shall have the power and duty to enforce the provisions of this ordinance and all other ordinances, laws and orders of the county and of the State of Wisconsin which relate to the construction, alteration or installation of all private water systems within the county, at the county's authorized delegation level.

45.15 QUALIFICATIONS OF ADMINISTRATOR. (1) The administrator shall be informed on the principles and practices of private well construction. If the administrator has a personal interest in the construction or modification of any well subject to the provisions of ch. 162, Wis. Stats., ch. NR 812, Wis. Admin. Code, or county ordinance, the county executive shall, after consultation with the department, designate another knowledgeable person to examine the application to issue the required permit(s) and to make the necessary inspections.

45.16 POWERS OF ADMINISTRATOR. The administrator shall have all the powers necessary to enforce the provisions of this ordinance commensurate with the level or levels of the county's delegated authority, including the following:

(1) In the discharge of his or her duties, the administrator or an authorized assistant may enter any building or property upon presentation of the proper credential, during reasonable hours for the purpose of inspecting the private water system and may request the owner or operator to produce the private well location required under this ordinance. No person may interfere with the administrator or an authorized assistant in the performance of his or her duties. Any person interfering shall be in violation of this ordinance and subject to penalty as provided by this ordinance. If consent to enter property for inspection purposes is denied, the administrator may obtain a special inspection warrant under ss. 66.122 and 66.123, Wis. Stats.

(2) Order any person owning, operating or installing a private water system to abandon, repair or place it in a complying safe or sanitary condition if the system is found to be unused, bacteriologically unsafe or not in compliance with ch. NR 812, Wis. Admin. Code, or this ordinance.
(3) Prohibit the use of any new well which is found to be installed, located, constructed, operated or maintained so as to be a health hazard to the users, neighbors or community.
(4) Appoint assistants to aid in processing applications for well location permits.
(5) Enforce any or all ordinances applicable to private water systems in accordance with department rules.
(6) If the administrator of the private water systems ordinance or an authorized assistant determines that the location or construction of a private well does not comply with this ordinance, the administrator or assistant shall post, in a conspicuous place upon the site, a suspension of work order demanding cessation of work. The administrator shall notify the well constructor and property owner in writing of the noncompliance and the nature of the work to be discontinued and corrected, identifying the location and the name of the person issuing the order. It shall be a violation of this ordinance to engage in work at conflict with the terms of an order or to make an unauthorized removal of a posted order. Work may resume on the site only under the direction of the administrator.
[**HISTORY:** (3) am., OA 29, 1995-96, pub. 12/06/95.]

45.17 DUTIES OF ADMINISTRATOR. It shall be the duty of the administrator to enforce the provisions of this ordinance and perform the following duties commensurate with the level or levels of the county's delegated authority:
(1) Record all permits, fees, inspections and other official actions and make an annual report thereon to the county board of supervisors.
(2) Provide the department with copies of all permits and correspondence as required by ch. NR 845, Wis. Admin. Code.
(3) Inspect the location of new private water systems upon completion.
(5) Investigate and record all private water system complaints.
(6) Investigate cases of noncompliance with this ordinance, ch. NR 812, Wis. Admin. Code, and ch. 162, Wis. Stats., issue orders to abate the noncompliance and submit complaints to the corporation counsel for enforcement.
(7) Refer complaints and cases of noncompliance believed to be or known to be beyond the scope of the county's delegation level to the department.
(8) Cooperate with all other governmental units and agencies in the enforcement of all state and local laws and regulations of matters related to this ordinance.
(9) Assist the department as specified in ch. NR 845, Wis. Admin. Code.
(10) Refer variance requests and actions which require department approval to the department.
(11) Advise owners not to drink or use water from private water systems under conditions specified in ch. NR 845, Wis. Admin. Code.
(12) The administrator, a trained county inspector or county office staff shall be available at the administrator's office for answering questions regarding permit applications and for accepting applications for well location for a minimum of four regularly scheduled hours each working day.
[**HISTORY:** (4) rep., OA 29, 1995-96, pub. 12/06/95.]

[45.18 - 45.20 reserved.]

45.21 REQUIREMENTS AND PERMITS. (1) No person may install a private well or water system unless the owner of the property on which the private water system is to be installed holds a valid well location permit issued by the county or has made arrangements to acquire a permit by notifying the administrator prior to construction. Notification shall include providing the administrator with the property owner's name and address, property legal description, proposed starting date and identification of the person who will be obtaining the permit. Unless other arrangements are made in advance, the permit shall be applied for on the first workday following initial construction.
(2) No private water system may be located, installed or operated within the jurisdictional limits of the county without the appropriate permit being obtained in compliance with sub. (1) above and without being in full compliance with the provisions of this ordinance and all other applicable state and local laws and regulations. Permit applications for the location of a well shall be made by the property owner or the property owner's designated agent. Permits shall be issued from the office of the administrator.
(3) The permit application shall be on forms provided by the administrator, and shall include the following:
(a) A site plan diagram. The plan diagram shall be submitted on paper not less than 8½ by 11 inches and shall include the location of all

structures, septic tanks, septic absorption fields, underground fuel storage tanks, animal yards and other sources of contamination; at least one property line, the property access road and nearest public road. Distances shall be provided by dimension or to scale. For large parcels the plan must include a small scale diagram showing all property lines and adjacent roads in addition to the large scale diagram showing site details.

(b) A copy of any variance granted by the department including proof that the variance has been properly recorded.

(4) Well location permit applications shall be signed by the property owner or the property owner's designated agent. Well location permit applications shall be submitted to the administrator at least 2 working days prior to construction if the property owner or well constructor is interested in receiving information about potential contamination sources such as landfills, underground storage tanks, primary and replacement on-site sewage disposal system areas on the development site and on adjacent properties, and special casing areas. When a well permit application is submitted less than 2 working days prior to construction, the well constructor shall be responsible for maintaining full compliance with all provisions of ch. NR 812, Wis. Admin. Code. The permit application may be submitted by the property owner or the property owner's designated agent and shall be issued to the property owner.

(5)(a) The administrator shall assist applicants by answering questions and providing forms, reviewing applications and approve, disapprove or notify an applicant of the need to seek a variance or special approval from the department or return the permit application due to incompleteness for all private water systems to be constructed or modified in the county, within 2 working days following submission of the permit application. The administrator may reserve final approval or disapproval of a permit which requires department action until the variance or special approval request has been acted on by the department.

(b) If a permit is disapproved because an applicant submits an incomplete or inaccurate application, one-half of the application fee shall be retained by the county. Any reapplication shall require the same fee as a new application.

(7) The administrator shall issue written notice to each applicant whose permit application is disapproved. An application shall be disapproved if the well construction would result in noncompliance with ch. NR 812, Wis. Admin. Code, or if a well construction variance or special approval request was denied by the department. Each notice shall:

(a) State the specific reason for denial.

(b) Inform the applicant of the right to request a special approval or a variance from the department and the procedures for making such a request.

(8) When construction occurs on a weekend or holiday, notification shall be provided to the administrator on the first workday following the weekend or holiday in the same manner as described in sub. 4 above. Unless other arrangements are made with the administrator, the permit application shall be obtained on the first workday following the weekend or holiday. The well constructor shall be responsible for maintaining full compliance with all provisions of ch. NR 812, Wis. Admin. Code.

(10) A permit transfer application shall be submitted to the county when there is a change of property owner after the application is submitted but before well construction is completed. Failure to submit a transfer application to the county shall invalidate a previously issued permit. The application shall be on a form made available by the administrator.

(11) As soon as the well location permit is received it shall be displayed conspicuously at the well site during construction, for a minimum of seven (7) days following completion of construction or until the well has been inspected by county staff, whichever occurs first.

(12) A well location permit shall be valid for a period of one year or until construction is completed, whichever comes first. If the permit expires, a new application shall be submitted to the administrator. Reapplications shall be evaluated so that construction will comply with the provisions of ch. NR 812, Wis. Admin. Code, in effect at the time of the reapplication. The administrator may require additional inspection and fees for reapplications.

(13) A well location permit is not required nor shall be issued by the county for private water systems requiring written plan approval from the department.

(14) Any permit issued under this section shall be void if any false or inaccurate statement is made or if any inaccuracy is shown on any application for a permit.

(15) No permit may be issued to any property owner or designated agent of the property owner who is in violation of this ordinance, until the

violation has been corrected, unless the permit is to allow correction of the violation.
[**HISTORY:** (5)(a) and (b) am., Sub. 1 to OA 43, 1987-88, pub. 06/18/88; (1), (2), (4), (5), (7), (8), (10), (11) and (15) am. and (6) and (9) rep., OA 29, 1995-96, pub. 12/06/95; (3) am., OA 21, 2002-03, pub. 03/04/03; (3)(a) am., OA 10, 2003-04, pub. 09/12/03.]

45.22 APPEALS. Persons seeking to appeal a decision of the administrator under this ordinance shall file written letters of appeal with the administrator. The administrator shall place the appeal on the agenda of the county board of health and the appeal shall be given a due process proceeding in accord with s. 46.17. The board shall decide whether to uphold, uphold with modifications or reverse the administrator's decision based upon the terms and intent of this ordinance and of relevant state laws and administrative rules. No appellate decision of the committee shall have the effect of approving an existing or proposed condition that would violate this ordinance or state law or administrative rule. Appeals that may only be approved by the granting of a variance to ch. NR 812, Wis. Admin. Code, shall be referred to the department pursuant to ch. NR 845, Wis. Admin. Code. Board appellate decisions shall be made in writing and shall be filed in the administrator's office. Appeals of decisions made by authorized agents on behalf of the administrator shall be made first to the administrator and then be appealable as provided herein.

45.23 VIOLATIONS. The administrator shall investigate violations of this ordinance and ch. NR 812, Wis. Admin. Code, at the county's authorized delegation level(s), issue orders to abate the violations and submit orders to the corporation counsel for enforcement.

45.24 ADMINISTRATIVE DIRECTIVES AND ORDERS. **(1)** The administrator, after investigation and a determination that a violation exists, may issue a written field directive. This field directive may consist of a hand written note on an inspection report, or similar paper, identifying the violation that has occurred and assigning a date by which the violation must be corrected, and shall include the inspector's telephone number and office address.
(2) A formal letter may be issued which states the violation, the ordinance, administrative rule or statutory section violated, the date the violation was noted, the name of the inspector who noted the violation and the date by which the correction must be made.
(3) Upon discovery and after documentation of a violation, the administrator may issue a correction order. The administrator may use a stepped enforcement procedure by issuing a directive before an order or may proceed directly to issuing a correction order. An order shall include the following:
(a) The location of the violation (site).
(b) The name of the parties: owner, permittee, well constructor.
(c) The section of the ordinance and Wisconsin Administrative Code violated.
(d) The date of inspection of the site where the violation occurred.
(e) The name of the person who conducted the inspection which revealed the violation.
(f) The date by which the correction must be completed.
(g) The name of the person who must be contacted regarding subsequent inspection of the site.
(h) A statement that if the order is not complied with, the administrator will refer the violation to the corporation counsel with a recommendation to seek injunctive relief or forfeitures, or both, from the circuit court of Dane County. Orders must be signed by the administrator.
(i) Orders shall be served on the owner or well constructor by certified mail. Where appropriate, the administrator may request the sheriff to serve any particular order. The administrator shall report all orders that have not been complied with to the corporation counsel for enforcement.
[**HISTORY:** (3)(i) am., Sub. 1 to OA 43, 1987-88, pub. 06/18/88.]

45.25 ENFORCEMENT ACTIONS. **(1)** An enforcement action may be brought by the corporation counsel against a person or persons for any of the following violations:
(a) Failure to comply with any provision of this ordinance;
(b) Failure to comply with any permit specification or requirement;
(c) Failure to comply with any directive or order issued by the county administrator;
(d) Resisting, obstructing or interfering with the county administrator's or an authorized assistant's actions undertaken pursuant to this ordinance.
(2) The county corporation counsel may, for any violation, seek injunctive relief or forfeitures of not less than $50.00 nor more than $200.00, or both, for each violation.

(3) Each day a violation exists is a separate offense.
(4) Any person who has the ability to pay any forfeiture entered against him or her under this ordinance but refuses to do so may be confined in the county jail until such forfeiture is paid, but in no event to exceed thirty (30) days. In determining whether an individual has the ability to pay a forfeiture imposed under this section, all items of income and all assets may be considered regardless of whether or not the income or assets are subject to garnishment, lien or attachment by judgment creditors under the laws of this state.
[**HISTORY:** (2) am., OA 16, 2000-01, pub. 02/05/01.]

[45.26 - 45.50 reserved.]

45.51 FEE SCHEDULES. (1) The fee for a well siting permit shall be $95.00.
(2) The fee for a transfer of a well siting permit shall be $40.00.
(3) The fee for a re-inspection of a well site shall be $30.00.
[**HISTORY**: (1) and (2) am., and (4) rep., OA 21, 2002-03, pub. 03/04/03; (1) – (3) am., OA 37, 2003-04, pub. 04/28/04; am., OA 25, 2006-07, pub. 12/29/06, eff. 01/01/07; (1) am., OA 31, 2009-10, pub. 11/25/09, eff. 01/01/10.]

[45.52 – 45.99 reserved.]

END OF CHAPTER

[**HISTORY:** Ch. 45 cr., OA 4, 1987-88, pub. 09/14/87; references throughout chap. 45 to NR 11.03(2), NR 109, NR 112, NR 145 and NR 145.05 were changed to, respectively, NR 811.02(7), NR 809, NR 812, NR 845 and NR 845.05, OA 29, 1995-96, pub. 12/06/95.]

APPENDIX N

PRIVATE WELLS AND WELL ABANDONMENT INFORMATION

YOU & YOUR WELL

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

For more information, request the following brochures: Well Abandonment (PUB-DG-016), Bacteriological Contamination of Drinking Water (PUB-DG 003), Driven-Point (Sand-Point) Wells (PUB-DG-022 92)

PUB-DG-002 2007

Is there a new well in your future? Perhaps you are building a new home, or are simply considering replacing or upgrading an existing water supply. Whatever the case, here is some information that can help you.

Who regulates water wells?

Wisconsin has had well regulations since 1936, and today is recognized as a national leader in well protection. NR 812, (formerly NR 112), Wis. Adm. Code, is administered by the Department of Natural Resources (DNR). The Well Code is based on the sound premise that if a well and water system is properly located, constructed, installed and maintained the well should provide safe water continuously without the need for treatment. Most county zoning and public health offices have a copy of the Well Code. For information about the code, contact a DNR regional water supply staff person or a licensed well driller or pump installer. Consult with licensed individuals or neighbors for background information on water quality.

When is an approval required prior to construction?

A DNR Notification Number is required prior to construction. You may obtain a DNR Notification Number online at: **dnr.wi.gov**. Under "Online Services" click on Well Construction Notification and answer the questions. Be sure to print a copy for your records. A second option is that you may also visit one of the 1500 locations throughout Wisconsin where hunting & fishing licenses are sold. You will receive a receipt for your records which displays a DNR Notification Number. Also, some DNR approved county ordinances require that a "well permit" be obtained prior to construction. Check with your county health department or zoning office.

State statutes require that any owner who constructs and/or operates a well or combination of wells on one property that are capable of producing 70 or more gallons per minute, in aggregate, must obtain an approval from the DNR prior to construction.

Approvals are also required for constructing school water systems, wastewater treatment plant water systems and community water systems governed under chapter NR 811 and for the installation of some types of water treatment.

Who can construct wells? Who can install pumps?

Well Driller—Only those persons holding a current well drilling license from the Department of Natural Resources may construct or reconstruct (deepen or install a liner or screen) potable wells.

Pump Installer—Only those persons holding a current pump installer license from the Department of Natural Resources may install and replace pumps, pitless adapters and accessory piping and pressure tanks on both drilled and driven point potable wells.

Exceptions—A well drilling license is not required for constructing driven point wells.

A license is not required for a person constructing a well or installing a pump on property owned and occupied by him or her. State law requires, however, that no matter who does the work, it must comply with the State Private Well Code (ch. NR 812), and a Well Construction Report must be submitted to DNR.

A license is not required for an individual constructing a nonpotable well or installing a pump in a nonpotable well, however the installation must comply with the well code.

What are the responsibilities of a well constructor to the owner?

The well must be constructed or reconstructed in compliance with ch. NR 812, and upon completion of a well construction or reconstruction, a well driller or point driver is required to:

1. Test pump and flush the well.
2. Disinfect the well.
3. Collect a water sample for a bacteriological test; submit the sample to a laboratory certified for bacteriological testing; and provide a report of the results to the owner within 10 days of receiving the water test results. (The DNR recommends that the water also be tested for nitrates.)
4. Provide the owner or his agent with a copy of a Well Construction Report, that describes how the well was constructed, within 30 days of completion of the well. The report assigns a unique number to the well.

The water sample test results and well construction report must also be sent to the Department.

What are the responsibilities of a pump installer to the owner?

A pump installer must install the pump, the pitless adapter, pressure tank and sample faucet in compliance with the Well Code, disinfect the pump and distribution system after installation, flush it, take a water sample for bacteriological analysis (as described in #3 above) and report the results to the owner.

The pump installer may delegate the sample collection to the owner or another agent, by leaving the sample bottle, instructions and form, but the pump installer is still responsible for the sample collection.

Some private well location requirements (from NR 812)

Always ensure that your well is located upslope and as far as possible from potential sources of contamination, but at least:

- 8 feet from an approved gravity building sewer pipe or 25 feet from building sewers made of other non-approved materials or a pressurized building sewer.
- 8 feet from a swimming pool.
- 100 feet from any buried petroleum tank, except that only 25 feet of separation is required for a buried fuel oil tank if the tank is used only for private residential heating.
- 25 feet from a septic or holding tank, or from a laundry or wastewater sump.
- 25 feet from the high water mark of a lake, pond or stream.
- 50 feet from a privy, dry well, soil absorption system ("drainfield") or mound system.
- 50 feet from a municipal collector sewer.
- 50 feet from an animal yard or animal shelter
- 250 feet from a sludge disposal area, a salvage yard or a salt storage area.
- 250 feet from an absorption, storage, retention or treatment pond; ridge and furrow system; or spray irrigation waste disposal site.
- 1,200 feet from any existing, proposed or abandoned landfill site.

NOTE: *This list is not complete. Consult NR 812 or the DNR for specific requirements. Figures A and B show well location requirements.*

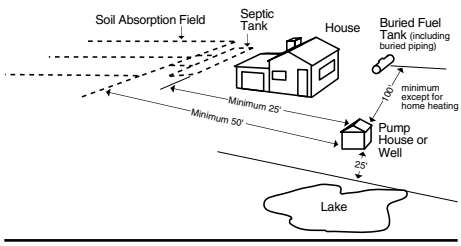


Figure A Common separation distances on residential lots

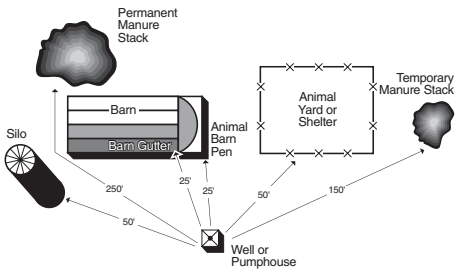


Figure B Common separation distances on farms

Some general DOs and DON'Ts

DO Make certain the well constructor extends the well casing pipe at least 12 inches above the finished ground surface and two feet above a floodplain. (Future landscaping must be taken into account.)

DO Properly install a vermin-proof well cap and electrical conduit to prevent entrance of insects into the well.

DO Make certain any underground connection to the well is made with an approved pitless adapter or unit. Properly installed, this will provide a water tight connection to the well and allow easy pump repair or well cleaning.

DO Completely fill and seal any unused wells (a DNR brochure on well abandonment is available).

DO Collect a water sample for bacteriological analysis at least once each year and anytime you notice a change in taste, odor, color or appearance. Also sample for nitrate if the water is to be used for an infant or a pregnant woman.

DO Construct your driven point well to a depth of at least 25 feet (not including the screen), or, 10 feet below the static water level, whichever is the greater depth.

DO Install an accessible downward-facing, non-threaded sampling faucet between the pump and the pressure tank at least 12 inches above the floor to allow for sampling water directly from the well.

DO Use only code-complying well casing pipe. (see NR 812.17).

DON'T Install a well in the basement or in a crawl space of your home. (The well would not be accessible for repair.) If the basement is of the walk-out type, installation is permissible. (Offset pumps may be installed in dry basements.)

DON'T Construct a well, pump, or pressure tank pit. A well may not terminate in a pit or an alcove. The DNR *does not* allow pits because of the potential for flooding and subsequent contamination of the water supply. (Pitless adapters have made pits obsolete.)

DON'T Install unprotected buried suction line between a well and a pump or pressure tank in a basement. If the pipe were to develop a hole or crack, it could allow surface water to get into the water supply. Instead use a pitless adapter or unit with a pressurized piping arrangement. Do not install a non-pressure conduit to enclose the suction piping between a well and a basement.

DON'T Use a well for disposal or drainage of solid wastes, sewage, surface water or wastewater. This can contaminate an aquifer.

DON'T Develop a spring as a drinking water source without obtaining advance approval from DNR. The DNR does *not* recommend the use of a spring as a source of water for drinking.

Types of acceptable pump installations

Offset Pump Installations (pump usually installed offset from the well in basement of house) with a seal-cross fitting or a flange adapter and pressurized, concentric discharge. Connections should be made below frost depth to eliminate the potential for freezing.

1. Offset shallow-well pump for driven point well (Figure C)
2. Packer jet assembly for offset for driven point well pump (Figure D)

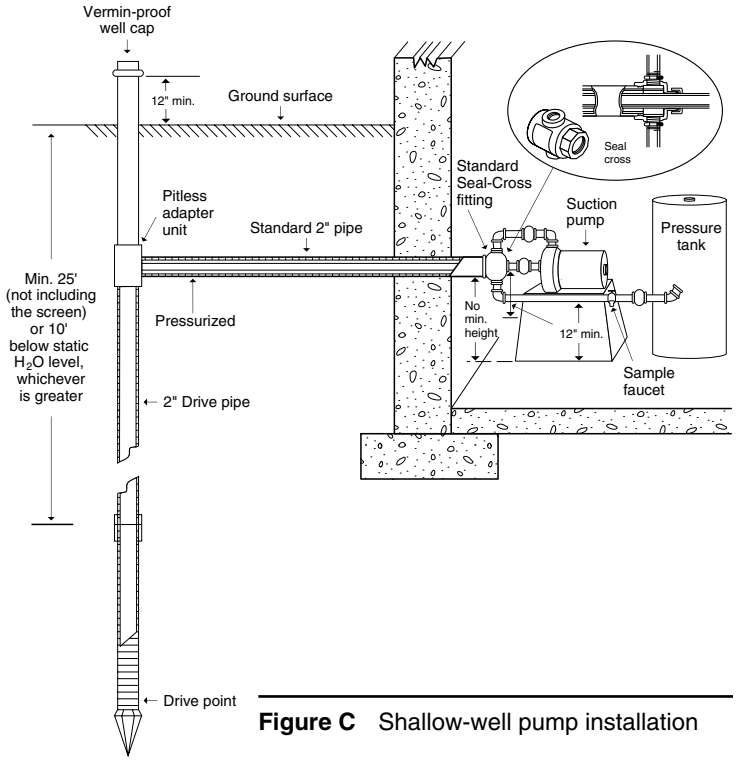


Figure C Shallow-well pump installation

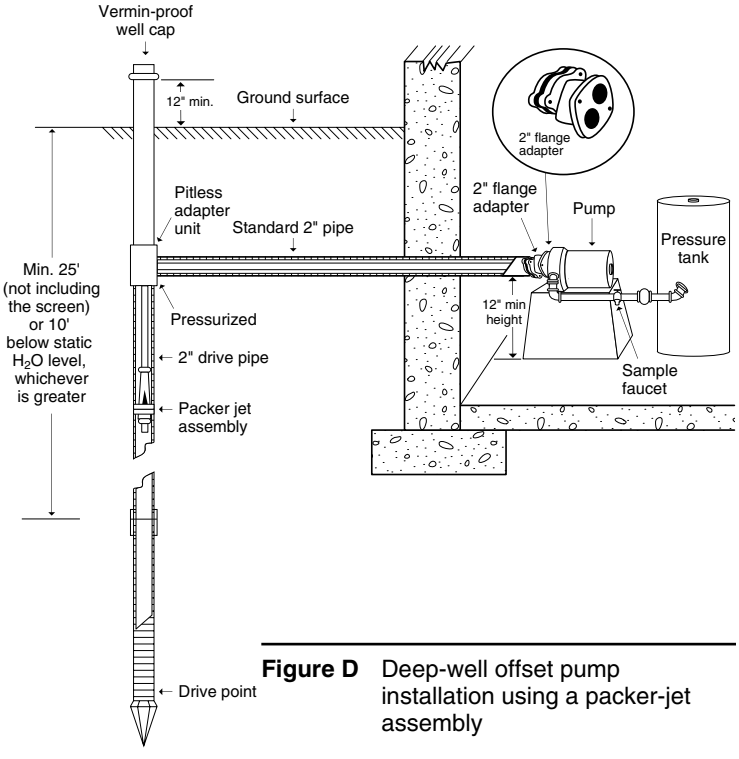


Figure D Deep-well offset pump installation using a packer-jet assembly

Submersible Pumps installed within well, below water level with:

1. An above-ground discharge pipe enclosed in a heated shelter (Figure E); or
2. Approved above-ground discharge unit, directed to an inside pressure tank (Figure F); or
3. A below-ground discharge with approved pitless adapter or pitless unit (Figure G); or
4. A buried pitless receiver tank (Figure H).

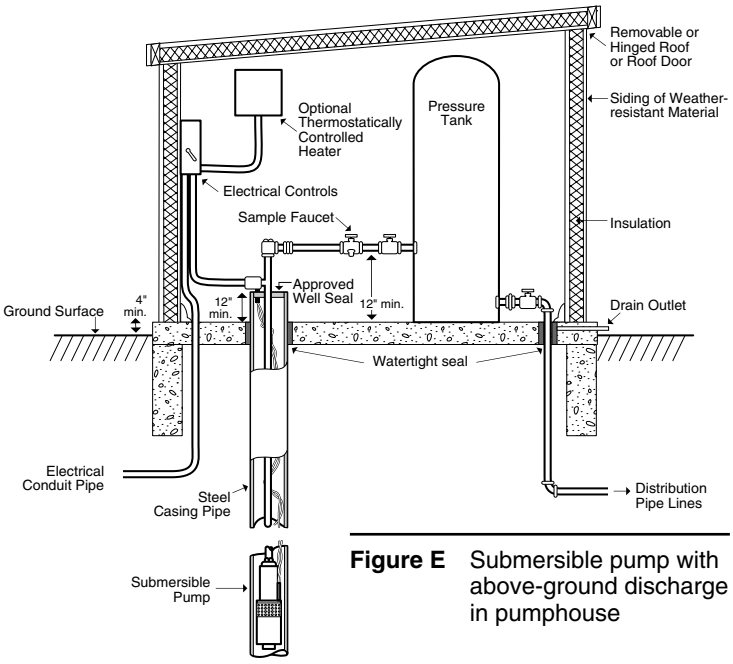


Figure E Submersible pump with above-ground discharge in pumphouse

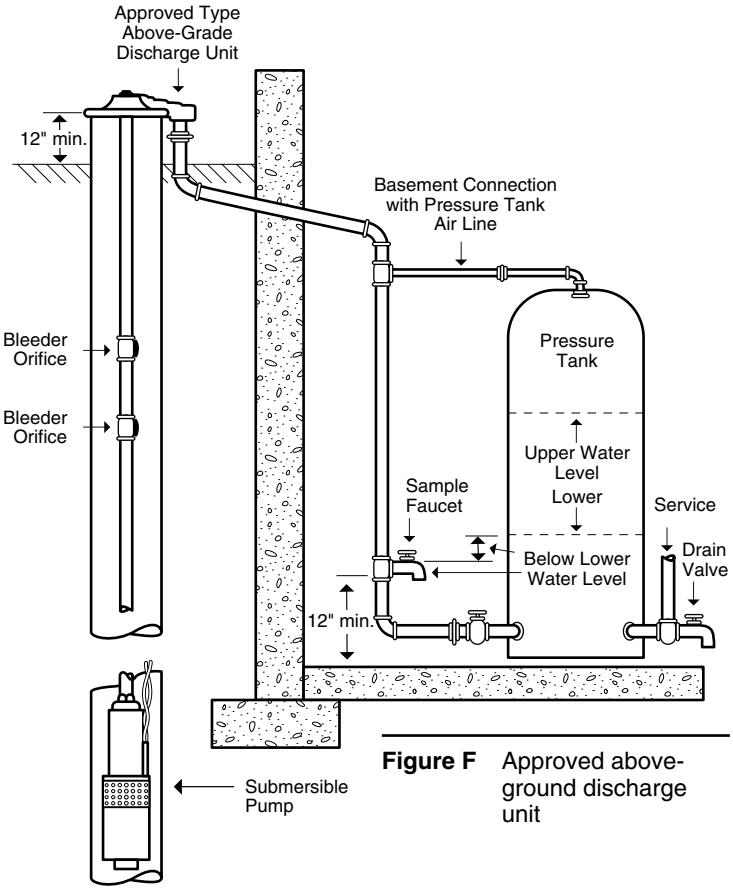


Figure F Approved above-ground discharge unit

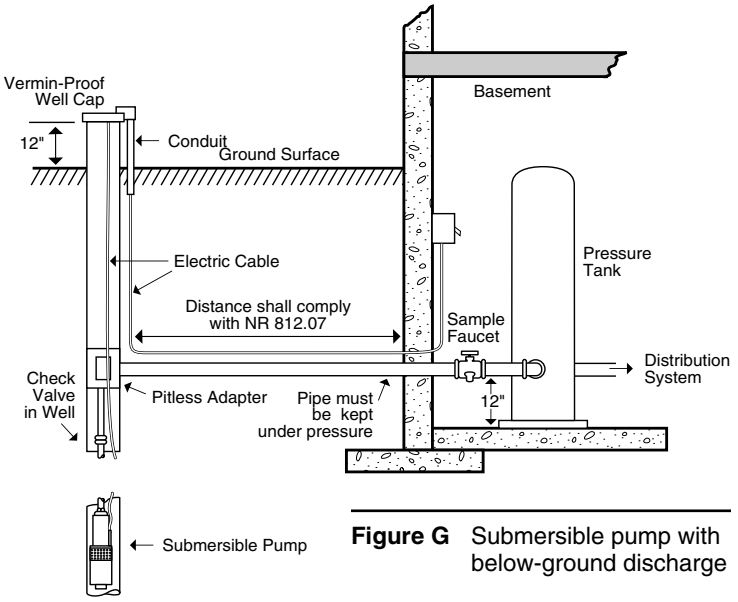


Figure G Submersible pump with below-ground discharge

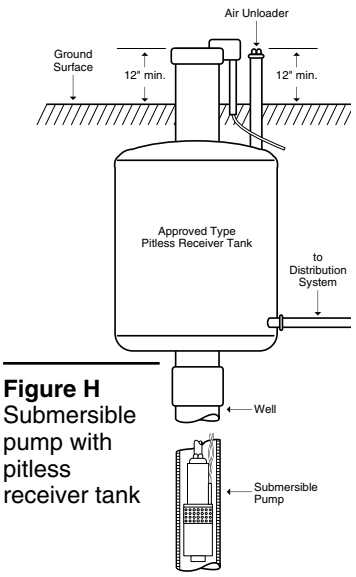


Figure H Submersible pump with pitless receiver tank

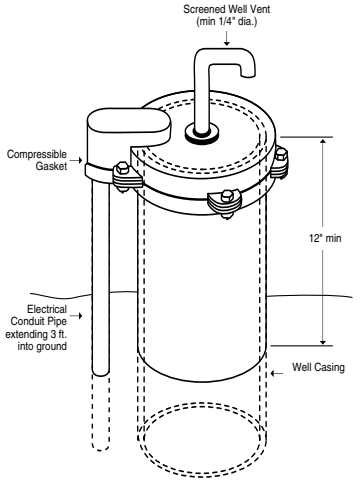


Figure I Example of a vermin-proof cap

Well Code requirements have been simplified for this pamphlet.

For specific details on the Wisconsin Well Code (NR 812), look on our website at: **dnr.wi.gov/org/water/dwg/code.htm**. If you have questions on the specifics of NR 812, please contact staff at one of the following offices.

Northern Region
810 W. Maple Street
Spooner, WI 54801
(715) 635-2101
or
107 Sutliff Avenue
Rhinelander, WI 54501
(715) 365-8900

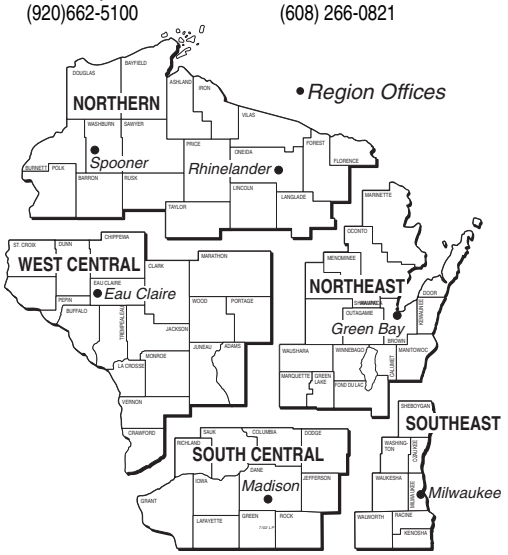
South Central Region
3911 Fish Hatchery Road
Fitchburg, WI 53711
(608) 275-3266

West Central Region
1300 W. Clairemont
PO Box 4001
Eau Claire, WI 54702-4001
(715) 839-3700

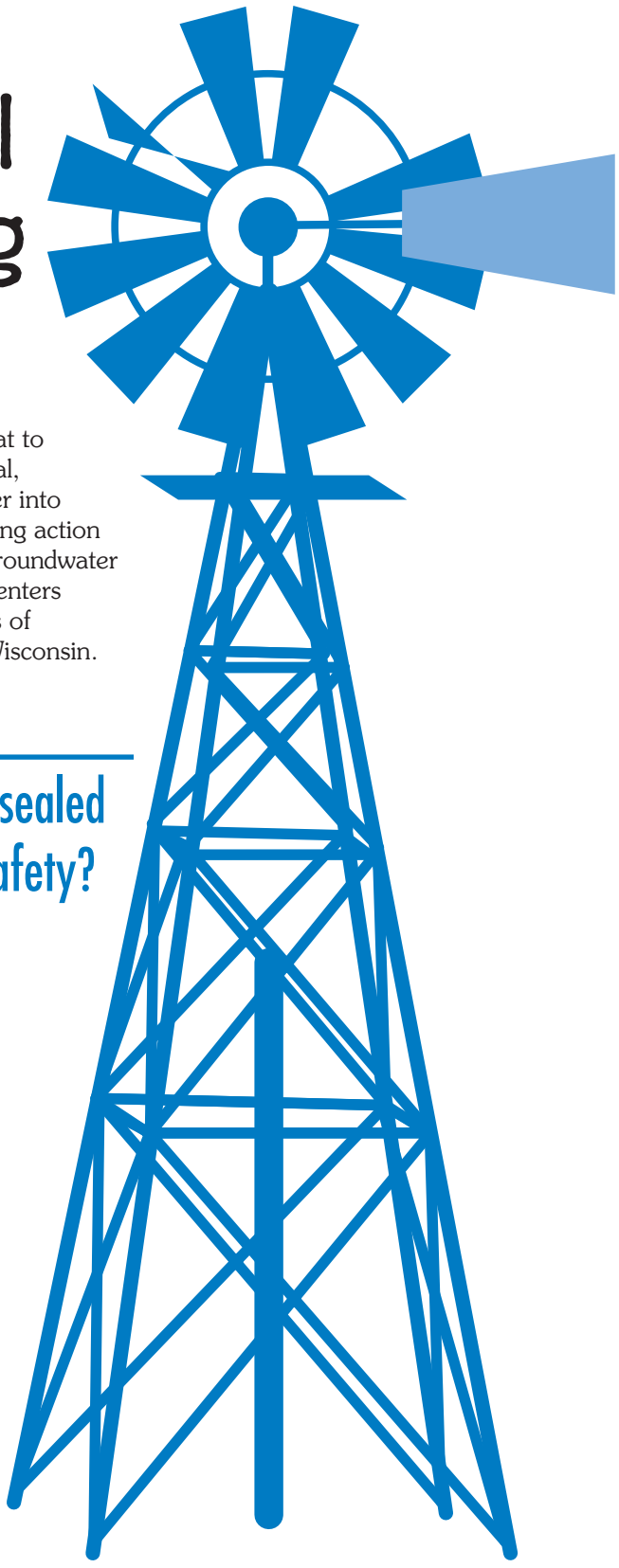
Southeast Region
2300 N. Dr. Martin Luther King, Jr. Drive
Milwaukee, WI 53212
(414) 263-8500

Northeast Region
2984 Shawano Avenue
P.O. Box 10448
Green Bay, WI 54307-0448
(920)662-5100

Central Office
101 S. Webster
P.O. Box 7921
Madison, WI 53707-7921
(608) 266-0821



Answers to Your Questions on Well Filling and Sealing



Why are unused and improperly filled and sealed wells threats to groundwater?

Unused and improperly filled and sealed wells are a significant threat to groundwater quality. If not properly filled with impermeable material, unused wells can directly channel contaminated surface or soil water into groundwater. Water that gets into unused wells bypasses the purifying action that normally takes place in the upper layers of the soil. Because groundwater flows in soil and bedrock formations (aquifers), contamination that enters old wells can move to nearby drinking water wells. Many thousands of improperly filled and sealed wells are threatening groundwater in Wisconsin. Whenever you see an old deteriorating windmill in the countryside, there is likely an improperly filled and sealed well underneath.

How can unused and improperly filled and sealed wells threaten groundwater and personal safety?

- Contaminated surface water can enter a well if the casing pipe does not extend high enough above the ground surface and the well cap has been broken or removed; or if there are cracks or holes in the casing due to damage or deterioration with age.
- Contaminated surface water can seep down along the casing pipe of an improperly constructed well.
- Wells in low areas are sometimes illegally left open to drain surface water from heavy rainfall or snowmelt.
- Open wells offer tempting disposal receptacles for liquid and solid wastes. The disposal of any pollutant or wastewater in a well is prohibited by State codes.
- Large-diameter open wells, especially old dug wells, pose safety hazards for small children and animals. In recent years, there have been instances in Italy, Missouri and Kansas where children have fallen into wells. Although such occurrences are infrequent, they should never be allowed to happen.
- Improperly filled and sealed flowing wells can be a nuisance and may lower artesian pressure in neighboring wells.

When should wells be properly filled and sealed?

Wells must be properly filled when they are removed from service. Wells are removed from service for a number of reasons, including construction of a replacement well, destruction of the building being served, failure of the well to produce safe water, failure of the well to meet the State Well Code (NR812) standards, or when a community water system is extended into an area formerly served by individual private wells.

After wells are removed from service they are seldom used. They often get forgotten after a property transfer and, in time, may get covered by a parking lot or a building. Sometimes in this way all traces of old wells disappear. Such wells can cause groundwater contamination. In one recent case in Wisconsin, a house burned down over an improperly filled and sealed well located in the basement. The well provided a point of entrance into the aquifer and allowed ash-laden water to contaminate the neighbor's well.

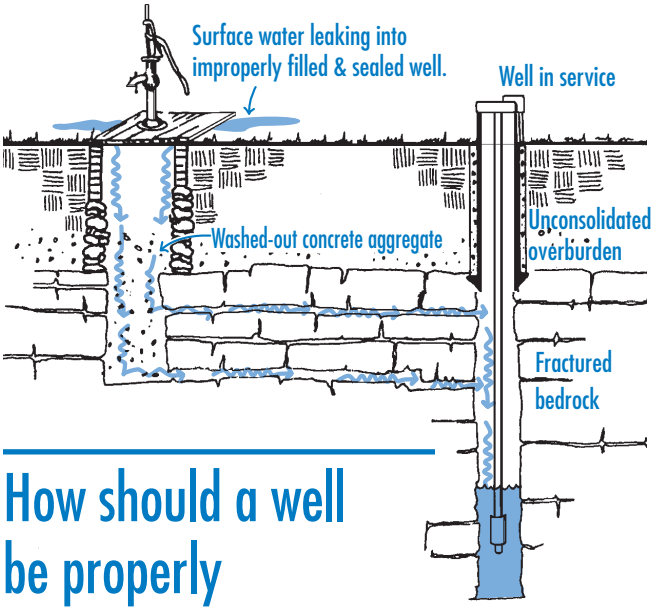
In another case, a buried well having only a stone set on the top of the open casing caused severe contamination of the drinking water pumped from another well on the same property. The unused well was near both an animal yard and a sewage absorption field and thus provided direct access for the entrance of contamination into the groundwater.

After a well gets covered, it is very difficult, if not impossible, to find it and determine if it's causing contamination. When new wells are constructed in an area with improperly filled and sealed wells, they may have to be cased much deeper or to alternate aquifers to provide safe water. These problems can be avoided by the proper filling and sealing of unused wells. Chapters NR811 and NR812, Wis. Adm. Codes, require proper permanent filling and sealing of unused wells.

Who can perform proper well filling and sealing work?

As of June 1, 2008, only licensed well drillers and pump installers may be hired to fill and seal wells. These contractors are familiar with correct filling and sealing materials and procedures, are knowledgeable about wells, and have access to the necessary equipment. It's usually more economical to fill and seal an old unused well at the same time the well driller is at the site constructing a new well.

Improperly filled and sealed well



How should a well be properly filled and sealed?

First determine the construction and condition of the well

The first step in proper well filling and sealing is to obtain information on the construction and condition of the well. Construction information is best obtained from the Well Construction Report on file with the Wisconsin Geological and Natural History Survey (WGNHS) or on DNR's website at dnr.wi.gov. Search for 'Well Construction Reports.' The records date back to 1936.

IMPORTANT INFORMATION TO KNOW WHEN REQUESTING A WELL CONSTRUCTION REPORT:

To request a report, you must furnish a legal description in terms of ¼ - ¼ Section, ¼ - Section, Section, Township and Range designations of the property where the well is located. It's also helpful if you can obtain the name of the well driller, the property owner or agent at the time of drilling, the approximate date of construction and the street address or lot #. The chances of finding the report are greater with more information. Order forms and other information about well construction reports are available on the WGNHS (Wisconsin Geological & Natural History Survey) uwex.edu/wgnhs/well.htm.

Specific forms include:

- To request a Well Construction Report for a specific well uwex.edu/wgnhs/pdfs/wcrpdf/wellord.pdf.
- To request a Well Construction Report for an area uwex.edu/wgnhs/pdfs/wcrpdf/wellord2.pdf.

A site inspection will help you locate the well and see what condition it is in. You should determine if the well is easily accessible in the yard; or if it is in a pit or a basement. It's possible the top of the well is buried in the yard, in which case you may be able to find it using a metal detector.

During your inspection you can also check to see if the pump has been removed.

Clearing, filling and sealing the well

Before the well is filled and sealed, the pump and its associated piping, any ungrouted liner pipe, or other obstacles must be removed from the well. If debris has been thrown in the well, a well driller may have to first drill it out. After the well is cleared, it must be filled from the bottom up with neat cement grout, sand-cement grout, concrete or approved bentonite chips. Well drillers and pump installers are familiar with these materials and know how to calculate and place the proper volume of material.

The filling material must be placed through a conductor (tremie) pipe extending to the bottom of the well except when approved bentonite chips are used according to DNR instructions (see pages 4 and 5). Use of a conductor pipe will assure that the filling material won't be diluted by the water in the well and will not plug in the well part-way down. The bottom of the conductor pipe must be kept submerged in the material during filling, but may be pulled as the well is being filled.

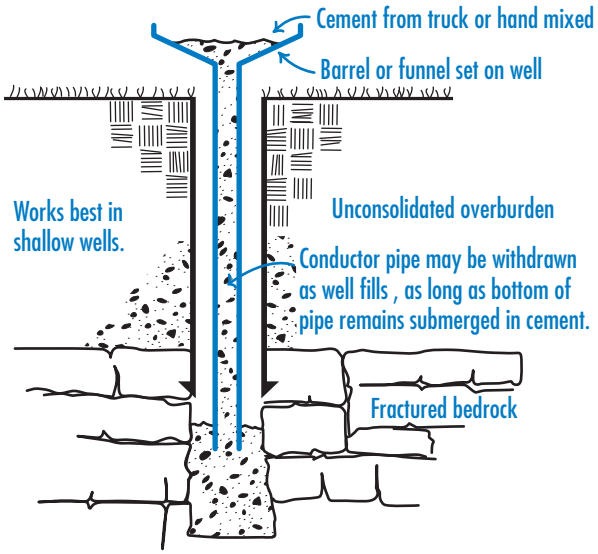
Except when using bentonite chips, a well driller or pump installer may not just pour or dump the filling material into the well without the use of a conductor pipe because this could cause the filling material to become diluted or bridge in the well part-way down. If dilution occurs, the fill material will not be impermeable. If bridging occurs, the well will only get partially filled. An improperly filled and sealed well can be as much a threat to groundwater quality as an open well.

After properly filling and sealing the well from the bottom up, the filling material may terminate a few feet below the ground surface to allow the top of the casing to be cut off, if preferred. The casing may also be left in place. If the well discharged through a non-pressure conduit, the end of this conduit (in the basement) must be sealed watertight with a steel plate.

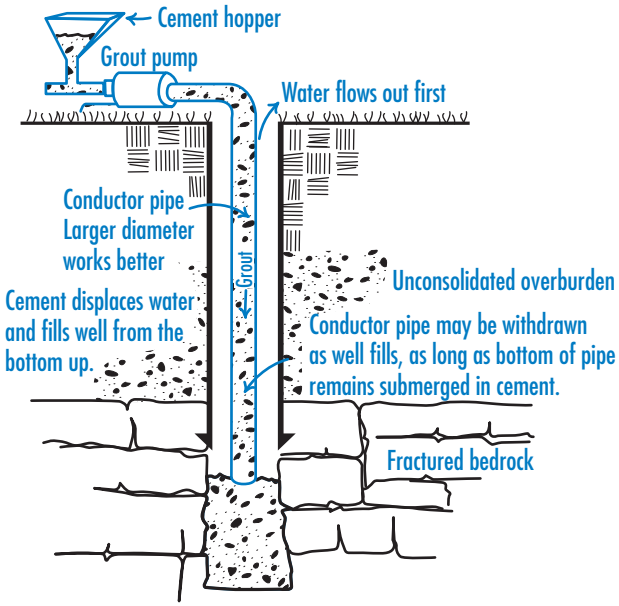
Flowing wells

Flowing artesian wells that flow at high rates may require special techniques to reduce the flow before the well is filled and sealed.

Gravity method for well filling and sealing



Pumped method for well filling and sealing



Driven-point (sand-point) wells

Driven-point or jetted wells 2 inches or less in diameter must be filled with neat cement grout. Only licensed well drillers and pump installers are allowed to fill and seal driven point wells. Grout may be poured down the casing or pumped down through a conducter pipe. The drive pipe and screen may be pulled before the grout is poured if the well is 25-feet deep or less. Bentonite chips may **not** be used for these wells because the chips can too easily bridge in the casing pipe.

Many driven-point wells terminate in pits or in the basements of buildings. Since April 10, 1953 such well locations have been prohibited by the State Well Code.

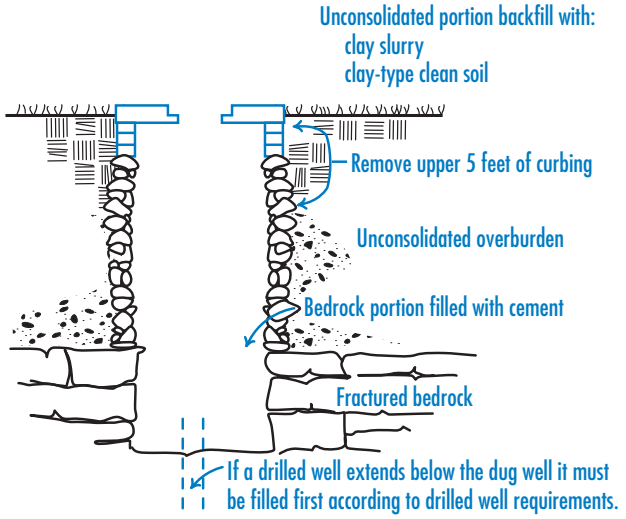
If your well was constructed after this date, the well does not comply and must be properly filled and sealed except when the DNR approves its continued use.

Dug wells

To properly fill and seal a dug well, a well driller or pump installer must first remove the well cover and remove any piping or debris before filling the well. (If a drilled well extends below the dug well it must be filled first.) The dug well must be filled and sealed with clean clay, silt, clean native clay or silt-type soil free of organic material (if compacted), concrete, sand-cement grout or bentonite chips. If the dug well penetrates partially or completely into bedrock, the well must be filled with concrete or sand-cement grout to a point at least two feet above the top of the bedrock. The top 5 feet of curbing of the dug well must be removed to allow for a good contact between the filling material and the soil. The curbing may be caved into the dug well while the well is being filled if it's done in a manner to prevent plugging of the filling material part-way down; or this step may also be done near the end of the filling and sealing procedure.

If the dug well is less than 18 inches in diameter, a conductor (tremie) pipe must be used to place the filling material, except when bentonite chips are used. For very deep or large diameter dug wells, alternate materials may be allowed.

Dug well filling and sealing



Well pits

When a pit well is unused, the pit structure must also be filled and sealed. To properly fill and seal a well pit, perforate or knock in at least one wall, break up or perforate the floor, and then fill the pit with clean native clay, silt, or clean native soil. If the pit is a subsurface pump room (alcove) connected to the building foundation, the pit does not have to be filled.

Well filling and sealing using bentonite chips

In Wisconsin approved bentonite chips may be used to fill wells and drillholes. The chips may be used for both sand and gravel formation wells and bedrock wells. They may only be used for wells & drillholes meeting the following specifications.

- 4 inches or larger in diameter.
- Not more than 500 feet deep.
- Not more than 350 feet of water standing in the well or drillhole.

*(Note: Bentonite chips may **not** be used to fill wells or drillholes filled with drilling mud or clay slurry and may **not** be used for small diameter driven point wells.)*

Bentonite chips may also be used for the following:

- To fill dug wells.
- As an alternative to concrete in the top 5 feet when clay slurry is used to fill a well or drillhole from the bottom up to the 5-foot depth.

(Note: Bentonite chips come in two basic size ranges (¼" - ⅜" and ½" - ¾" chips). The ¼" - ⅜" chips should be used for 4-inch diameter wells. Bentonite chips are irregularly shaped pieces of sodium bentonite clay that look very much like crushed limestone. They should not be confused with pellets or tablets which are not allowed).

Well drillers and pump installers must follow these procedures when using bentonite chips:

1. Determine the construction details of the well or drillhole including at least the:
   a. Well or drillhole diameter, by simply measuring the inside diameter of the well casing pipe or drillhole; and
   b. Well or drillhole depth, by lowering a weighted line down to the bottom. (Make sure the weight is securely attached).
2. Remove the pump, pump piping and any other material obstructions or debris in the well or drillhole that could prevent complete filling and sealing.
3. Calculate the volume of the well or drillhole to determine the number of bags of chips that will be required by using:
   a. The attached Table I page 5; OR
   b. The formula:

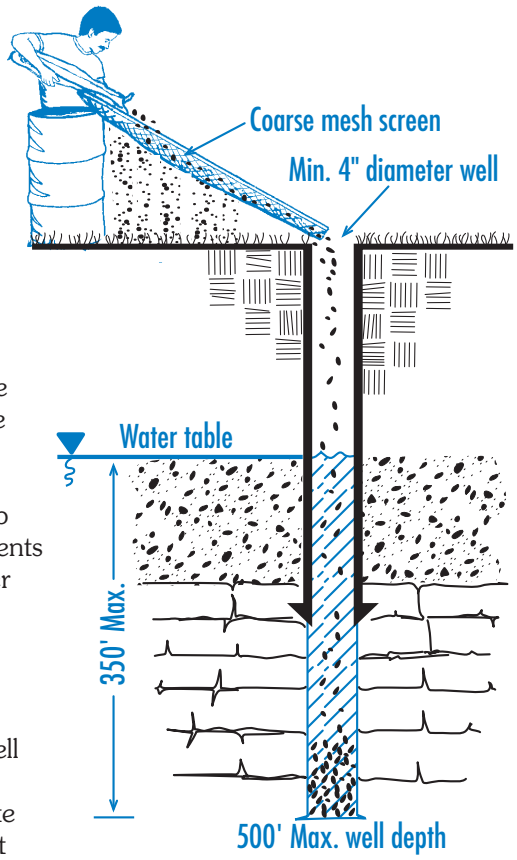
$$\frac{\pi r^2 h}{0.69\ ft^3/bag}$$

π = pi = 3.14
r = well radius (in feet)
h = well depth (in feet)

0.69 = number of ft^3 filled by one 50 lb. bag

(Remember: Divide the well radius (in inches) by 12 to get the radius in feet.)

4. Fine particles and dust contained in the bags of bentonite chips must not be allowed to enter the well. This is prevented by pouring the bentonite chips out of the bag such that they tumble under their own weight down across a coarse-mesh screen 2 to 3 feet in length. This allows the dust to fall through the screen onto the ground. The screen should be formed into a U-shape like a rain gutter. One end of the screen should be placed on the top of the well casing while the other end is supported at a steep angle. Removal of the dust prevents bridging of the chips at the water table. Do not push or pull the chips down across the screen as this will only create more dust.
5. Pour the bentonite chips across the screen into the top of the well at a rate not faster than about 3 minutes per bag. Pour at this rate so bridging of the chips does not occur – the chips must fall all the way to the bottom of the well. (Do not use a conductor-tremie pipe). Check well periodically with weighted line for possible bridging of chips.



6. Make sure the well "accepts" the entire number of bags calculated to fill it. If it doesn't, bridging may have occurred. The point of bridging must be broken so the bentonite chips will fall to the bottom. If the bridge cannot be broken, the well may have to be drilled out and re-filled with neat cement grout.
7. If the standing water in the well does not rise to the surface during the filling procedure, clean, uncontaminated water must be poured down into the well (through the chips) until water rises up to the top of the well and stays there. The chips will then swell and create an impermeable plug in the well.

Table I - Method for determining the number of 50 lb. bags of bentonite chips to fill a well

Hole size and volume table

Hole diameter inches	Hole volume (ft3/foot)	Pounds bentonite chips to fill 1 ft	Feet filled by one bag bentonite chips	Bags bentonite chips to fill 100 Ft
4	0.087	6.3	7.9	12.6
4-½	0.110	7.9	6.3	15.8
5	0.136	9.8	5.1	19.6
5-½	0.165	11.9	4.2	23.8
6	0.196	14.1	3.5	28.2
6-½	0.230	16.6	3.0	33.2
7	0.267	19.2	2.6	38.4
7-½	0.307	22.1	2.3	44.2
8	0.349	25.1	2.0	50.2
8-½	0.394	28.4	1.8	56.8
9	0.442	31.8	1.6	63.6
9-½	0.492	35.4	1.4	70.8
10	0.545	39.2	1.3	78.4
11	0.660	47.5	1.1	95.0
12	0.785	56.5	0.89	113.0
15	1.227	88.3	0.57	176.6
18	1.767	127.2	0.39	254.4
20	2.182	157.1	0.32	314.2
25	3.409	245.4	0.20	490.8
30	4.909	353.4	0.14	706.8

Table C - Acceptable materials and methods for well filling and sealing

	Well type	Materials							Methods
		Clean clay or silt or clean native soil	Approved bentonite chips ◆	Neat cement grout ■	Concrete ▲	Sand-cement grout	Bentonite-sand slurry w/min. mud wt. 11 lbs/gal	Chlorinated, sand-free pea gravel	
Unconsolidated formation wells	Driven-Point (sand-point) wells ↓ & drillholes ≤ 2 ½" diameter	No	No	Yes	No	No	No	No	Cement grout may be poured without using a conductor ◉ pipe
	Wells & drillholes > 2 ½" diameter	No	Yes, provided well is 4" minimum diameter & 500' maximum depth	Yes	Yes	Yes	Yes, provided top 5' filled with neat cement grout, sand-cement grout or concrete	● Yes, but in depths below 250'	Conductor ◉ pipe required except when bentonite chips or pea gravel is used
	Dug wells ◦	Yes (top 5' of curbing must be removed following filling)	Yes	Yes	Yes	Yes	No	No	Conductor ◉ pipe not required unless well is ≤+18" diameter
Bedrock wells	Bedrock wells not extending through Maquoketa Shale	No	Yes, provided 4" minimum diameter & 500' maximum depth	Yes	Yes	Yes	No	● Yes, but in depths below 250'	Conductor ◉ pipe required except when bentonite chips or pea gravel is used
	Bedrock wells extending through Maquoketa Shale	No	Yes in top 500' & for 40' plugs at top & bottom of Maquoketa Shale contact surfaces	Yes	Yes	Yes	No	● Yes, in depths below 250', but not at Maquoketa Shale contact surfaces	Conductor ◉ pipe required except when bentonite chips or pea gravel is used
	Dug wells ◦	Yes, but only in unconsolidated portion of well	Yes	Yes	Yes	Yes	No	No	Conductor pipe required only for placement of grout or concrete; or if well is ≤+18" diameter
	Well pits	Yes	Yes	Yes	Yes	Yes	No	No	Must perforate floor & 1 wall of pit

◆ *Bentonite chips may only be used for wells **not** deeper than 500 feet and having **not** more than 350 feet of standing water in them. The chips must be poured across a coarse mesh screen such that excess dust does not enter the well. Pour rate should not be faster than 3 min. per 50 lb. bag to prevent bridging.*

■ *Neat cement grout and sand-cement grout must have a density of at least 15.2 lbs per gallon*

▲ *When concrete is used, the gravel size may not exceed ⅓ the inside diameter of the conductor pipe used.*

↓ *Driven-Point (Sand-Point) Wells may be pulled prior to filling the hole if the well is 25' deep or less.*

◉ *The terms conductor pipe and tremie pipe are synonymous. The bottom of the pipe must remain submerged in the grout throughout the filling procedure. Conductor pipe must be metal pipe, thermoplastic pipe rated for at least 100 psi or rubber-covered hose reinforced with braided fiber or steel and rated for at least 300 psi.*

● *40' Impermeable plugs shall be provided at each bedrock formation change. [See s. NR 812.26(7)(a)]*

◦ *The top 5 feet of dug well curbing must be knocked out to provide a soil contact with the filling material.*

"Clean clay or silt or clean native soil" means low permeability soil material, free of organic humus or any other contamination.

"Clay or Bentonite-sand slurry" means a mixture having the minimum ratio of 50 pounds of native clay or approved bentonite mixed with 100 gallons of water (from a known safe and uncontaminated source) and 10-25% sand by volume of the slurry such that a mud weight of at least 11 lbs./gal. is achieved.

"Neat Cement Grout" means a mixture of cement and water in the proportion of one bag of Portland cement (94 lbs.) meeting ASTM C 150, Type I or API-10A, Class A standard; and 5 to 5.5 gallons of water from a known safe and uncontaminated source. Powdered bentonite may be added up to ratio of 5 pounds per 94-pound bag of cement provided 1.3 gallons of water are added for each 2 pounds of bentonite added.

"Concrete (sand-cement) grout" means a mixture of cement, sand and water in the proportion of one bag of Portland cement (as described above), a cubic foot of dry sand and 5 to 5.5 gallons of clean water from a known safe and uncontaminated source.

"Concrete" means a mixture of cement, water, sand and gravel in the proportion of one bag of Portland cement (as described above), an equal measure of gravel (by weight or by volume) and not more than 5.5 gallons of water from a known safe and uncontaminated source. A commercially-prepared mix may be used provided the mix has at least 6 bags of cement per cubic yard.

"Approved chipped bentonite products" are as follows:

ABI Plug ..... ABI, Inc.

Bentonite Plug..... Loresco (medium: ¼ - ⅜ and coarse ½ - ¾")

Black Hills Bentonite Plug...Black Hills Bentonite, LLC

CETCO Chip..... CETCO (medium: ¼ - ⅜" & coarse: ⅜ - ¾")

Cowboy Brand ..... Cowboy Mining Co. (Fine, Medium & Coarse)

Econoplug ..... Economy Mud Products Co. (both medium chips: ¼" to ⅜" and coarse chips: ½" to ¾")(mfg. by Wyo-Ben, Inc.)

Enviroplug ..... Wyo-Ben, Inc. (both medium chips: ¼" to ⅜" and coarse chips: ½" to ¾")

Federal Plug ..... M-1 Drilling Fluids (Federal) – 100% of chipped sodium bentonite (both medium chips: ¼" to ⅜" and coarse chips: ½" to ¾")

Holeplug ..... Baroid Industrial Drilling Products (⅜" and ¾" chips)

Kwik Plug ..... Federal Summit (⅜" and ¾" chips)

Naturapel ..... Wyo-Ben, Inc. (chips)

Opti Seal ..... Bentonite Corp. (⅜" and ¾" chips)

PdsCo Plug ..... PdsCo. (Polymer Drilling Systems)(medium and coarse chips)

Permaplug ..... Cathodic Engineering Equipment Co. (both coarse chips: ¾" and medium chips: ⅜")

Pure Gold Chips..... CETCO (both medium ¼" to ⅜" and coarse ⅜" to ¾" chips)

Tower Plug ..... Black Hills Bentonite, LLC (⅜" and ¾" chips)

Well-Plug ..... Fluidril Mud Systems (from Black Hills Bentonite) 100% chipped bentonite (⅜" and ¾" chips)

Conductor (tremie) pipe used for well filling and sealing shall be any of the following:

1. Metal pipe,
2. Rubber-covered hose reinforced with braided fiber or steel and rated for at least 300 psi, or
3. Thermoplastic pipe rated for at least 100 psi including:
    a. polyvinyl chloride (PVC),
    b. chlorinated polyvinyl chloride (CPVC),
    c. polyethylene (PE),
    d. polybutylene (PB), and
    e. acrylonitrile butadiene styrene (ABS)

Must I report the well filling and sealing to the DNR?

Yes. When groundwater contamination investigations are undertaken, it's important to know the location of active, unused and former wells. Further, this information is important documentation for property transfers. Well Filling and Sealing Reports (Form #3300-005) are available to licensed well drillers and pump installers from DNR central office. Well Filling and Sealing Reports must be used to report how the well was filled and sealed and document that the well no longer exists. The form must be completed, signed, and sent to DNR central office by the licensed person performing the well filling and sealing work. The second copy is the owner's copy.

What administrative rules cover well filling and sealing?

NR 812.26 governs proper abandonment of private water supply wells. The filling requirements are also printed on the back of the well abandonment form. NR141, Wis. Adm. Code, governs the proper abandonment of monitoring wells. NR 811.17, has rules for abandonment of community wells.

Where can I obtain additional information?

For further information on drinking water supplies and groundwater quality check the DNR website at dnr.wi.gov/org/water/dwg/index.htm.
Also check the UW Extension website at:
learningstore.uwex.edu/Drinking-Water-C120.aspx

This brochure was revised by the Wisconsin Department of Natural Resources with assistance from the Education Subcommittee of the Groundwater Coordinating Council.

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call Madison Water Utility at (608) 266-4665

Office Hours:
Monday-Friday: 7:30am - 4:00pm

PRIVATE WELL PROGRAM

In November 1990, the Common Council adopted the Well Abandonment Ordinance (MGO Section 13.21) to prevent groundwater contamination from unused, unsafe, or non-complying wells. The ordinance requires that a private well shall be properly abandoned or a permit obtained to operate the well. The requirement applies to wells located in the City of Madison or on premises served by the Madison Water Utility.

Well operation permits may be obtained by submitting an application and permit fee to the Water Utility. By ordinance, permits are valid for a period not to exceed five years. Before a permit will be issued, the well must satisfy each of the following three criteria:

1. The well and pump installation must comply with provisions of Chapter NR 812 of the Wisconsin Administrative Code,
2. The well must produce safe water, as determined by bacteriological analysis, and
3. There must be no cross connections between the well and the municipal water system.

After the application and permit fee have been received, the Water Utility will schedule an appointment to inspect the well and ensure that the installation satisfies the above criteria and to collect the first of two water samples. City ordinance requires that two consecutive samples, taken a minimum of two weeks apart, must be bacteriologically safe, that is, free of coliform bacteria.

If the minimum requirements are not met, the private well must be abandoned or corrections must be made to bring the well into compliance before a permit will be issued.

A list of licensed well drillers and pump installers is available on the Department of Natural Resources website.

WELL ABANDONMENT

Domestic wells represent potential conduits or direct pathways for surface contaminants to reach the groundwater supply. For example, holes in the basement floor can easily be mistaken as drains for the sewer system. The proper abandonment of an unused well avoids the possibility of contamination by closing and sealing the connection between the land surface and the groundwater below our feet. As of June 1, 2008, only licensed well drillers and pump installers can fill and seal wells under Wisconsin law. These licensed professionals must follow the regulations codified in Wisconsin Administrative Code, Chapter NR 812.

WELL ABANDONMENT REIMBURSEMENT PROGRAM

Program Description

Effective January 2010, the City of Madison will offer partial reimbursement of the cost to abandon a private domestic well. Generally, the city and water utility are authorized to reimburse up to fifty percent of the cost to abandon a well, up to a maximum of $1000. Reimbursements are limited to actual realized costs to fill and seal the well, and do not include the cost to connect to City water service. Funds are limited and some restrictions may apply.

Proper abandonment involves pulling the pumping equipment and filling the well with an approved, impermeable material. According to state code and city ordinance, the work must be completed by a licensed well driller or pump installer, and the Madison Water Utility must be given a minimum of 48 hours notice to schedule staff to witness the abandonment.

The following requirements must be met before any payment will be disbursed:

- Notification to the Water Utility at least 48 hours prior to the abandonment
- Completed and signed **application**
- Original paid receipt from a licensed well driller or pump installer, including an itemized list of the costs
- Submit to the Madison Water Utility a copy of the **well abandonment form**; the original form must be submitted to the DNR within 10 days of the abandonment.

Frequently Asked Questions (FAQ)

Additional Resources for Private Well Owners

Department of Natural Resources website
- **General Information**
- **Well Abandonment Grant Program**

Water Systems Council brochure –
Closing an Abandoned Well

For more information or if you have questions, please contact the Water Utility at 266-4654 or **water@cityofmadison.com**.

City of Madison – Private Well Abandonment Reimbursement Program

The purpose of the Well Abandonment ordinance, Madison General Ordinance Section 13.21, is to prevent groundwater contamination of the aquifer supplying City of Madison drinking water wells from unsafe, unused, or non-complying private wells. Effective January 1, 2010, the City of Madison will offer partial reimbursement of the costs to abandon a private domestic well. Generally, the city and water utility are authorized to reimburse up to fifty percent of the cost to abandon a well, to a maximum of $1000. Reimbursements are limited to actual realized costs to fill and seal the well, and do not include the cost to connect to City water service, if applicable. Funds are limited and some restrictions may apply.

According to city ordinance, owners of private domestic wells must obtain, through the Madison Water Utility, a well operation permit in order to operate a private well located within the City of Madison or the Madison Water Utility service area. In the absence of a valid permit, operation of the private well must cease and the well shall be properly abandoned according to state code. Proper abandonment involves pulling the pumping equipment and filling the well/borehole with an approved, impermeable material. According to state code and city ordinance, the work must be completed by a licensed well driller or pump installer, and the Madison Water Utility must be given a minimum of 48 hours notice to schedule staff to witness the abandonment.

Periodically, an unused or improperly abandoned well is identified during a home inspection. Inspections of this nature often precede the transfer of real estate ownership but may also be initiated by the Madison Water Utility. Any unused or improperly abandoned well, regardless of how it was identified, must be properly abandoned according to the provisions in Wisconsin Administrative Code, Chapter NR 812. Furthermore, any private well which has not been used in the preceding twelve months must also be abandoned.

The following requirements must be met before any payment will be disbursed:

- Notification to the Water Utility, at least 48 hours prior to the abandonment, in order to allow staff to witness the abandonment
- Completed and signed application
- Original paid receipt from a licensed well driller or pump installer that indicates the location where the work was completed and an itemized list of the costs
- Submit to the Madison Water Utility a copy of the well abandonment form (DNR Form #3300-005: Well / Drillhole / Borehole Filling & Sealing). The original form must be submitted to the DNR within 10 days of the abandonment.

Please mail the completed application, original dated receipt, and any required paperwork to:

Madison Water Utility
c/o Private Well Abandonment
119 East Olin Avenue
Madison, WI 53713

APPENDIX O

CITY OF MADISON WELLHEAD PROTECTION ORDINANCE

(d) The Madison Water Utility may require any person who has abandoned a well not in compliance with Subdivision (a) to return and take corrective action so that the well is abandoned by him or her in a complying manner. (Cr. by Ord. 12,567, 5-3-00)

(9) Well Abandonment Rebate. Upon the proper abandonment of a well pursuant to this section, the City Engineer, in consultation with the Water Utility General Manager and the Public Health Director, is authorized to issue a rebate to the owner of a property located in the City of Madison or that is served by the Madison Water Utility of up to fifty percent (50%) of the cost to the owner of the abandonment of the well, up to a maximum rebate of one thousand dollars ($1000.00). In determining the amount of the rebate, any contributions made by Dane County under Dane County Ordinance 46.42 shall not be considered, provided that the rebate issued by the City under this Subsection, when combined with any contribution made by Dane County, shall not exceed the total cost to the owner of abandoning the well. No rebate shall be issued to the owner of a property against whom the City has either issued a citation or made a written referral to the City Attorney for non-compliance with the requirements of this section. Rebates issued under this subsection shall be funded out of the landfill remediation fee as set forth in Section 32.025, MGO. (Cr. by ORD-09-00124, Pub. 8-20-09, Eff. 1-1-10)

(10) This law does not supersede the State Plumbing Code, Wis. Admin. Code § NR 811 or Chapter 18 of the Madison General Ordinances entitled "Plumbing Code" but is supplementary to them. (Renum. by ORD-09-00124, Pub. 8-20-09, Eff. 1-1-10)

(11) Penalties. The penalty for violation of this section may be not less than twenty-five dollars ($25) nor more than one thousand dollars ($1,000) and the cost of prosecution. Each day of violation is a separate offense. If any person fails to comply with this ordinance for more than ten (10) days after receiving written notice of the violation, the City may impose a penalty and cause the well abandonment to be performed and the expense may be levied as a special charge against the property. (Am. by ORD-08-00095, 8-23-08; Renum. by ORD-09-00124, Pub. 8-20-09, Eff. 1-1-10)

(Sec. 13.21 Cr. by Ord. 10,136, 11-14-90; Am. by Ord. 12,345, 3-12-99; Am. by Ord. 12,567, 5-3-00; Ord. 13,500, 1-23-04)

13.22 WELLHEAD PROTECTION.

(1) To prevent contamination of wells supplying municipal water systems, the Water Utility General Manager or his/her designee shall review all proposed uses on zoning lots in Zones A and B in Wellhead Protection Districts.

(2) Review will be based on the presence, use, or storage on the lot of hazardous chemicals, as defined by the Environmental Protection Agency. Consideration will be given to factors including but not limited to the following: whether the zoning lot is in Zone A or Zone B, effective storage or containment of particular hazardous chemicals, and the magnitude and/or frequency of use of the hazardous chemicals. Approval of the use may be contingent on specific conditions being met. A current list of hazardous chemicals, as defined by the Environmental Protection Agency, shall be maintained. (Cr. by Ord. 13,106, 7-23-02)

13.23 PENALTY. Any person violating any provision of this chapter for which a separate penalty has not been imposed shall be punished by a fine of not less than fifty dollars ($50) nor more than one thousand dollars ($1,000). Each day or portion thereof such violation continues shall be considered a separate offense

The word "fine" as used in this chapter shall be synonymous with the term "forfeiture".

(Am. by Ord. 12,357, Adopted 3-16-99; Renumbered to Sec. 13.23 by Ord. 13,106, 7-23-02; Am. by ORD-06-00135, 10-6-06)

28.107 WELLHEAD PROTECTION DISTRICTS.

(1) Statement of Purpose. The Common Council of the City of Madison finds that certain uses can seriously threaten or degrade groundwater quality. To promote the public health, safety, and general welfare of the City of Madison, the Wellhead Protection Districts are created to protect municipal water supplies.

(2) Applicability. The requirements of the Wellhead Protection Districts shall apply to all zoning lots located in such districts in addition to all requirements in the Madison General Ordinances that apply to the principal zoning district classification of said zoning lots.

(3) Protection Zones. Each wellhead shall have two (2) zones of protection around it.

(a) Zone A shall be the area around the well in which it has been determined that groundwater and potential contaminants will take five (5) years or less to reach the pumping well.

(b) Zone B shall be the smaller of the area around the well in which it has been determined that groundwater and potential contaminants will take one hundred (100) years or less to reach the pumping well, or the area within a twelve hundred (1,200) foot radius around the well, except for the area in Zone A.

(4) Uses. All uses in Zones A and B of any Wellhead Protection District shall be approved by the Water Utility General Manger or his/her designee. A use may be approved with conditions. Approval by the Water Utility General Manager or his/her designee shall be in addition to all other approvals required for the proposed use.

(a) Permitted Uses In Zones A and B. Any use allowed as permitted in the principal zoning district, except those uses not approved pursuant to Sec. 13.22.

(b) Conditional Uses In Zones A and B. Any use allowed as a conditional use in the principal zoning district except those uses not approved pursuant to Sec. 13.22. All conditional uses are subject to the provisions of Sec. 28.12(11).

(5) Existing Uses. Any lawful use existing at the time of the creation of a Wellhead Protection District may be continued, however, no expansion or enlargement of such use is allowed without approval pursuant to Sec. 13.22 by the Water Utility General Manager or his/her designee.

APPENDIX P

WATER CONSERVATION PLAN

City of Madison

Water Utility

Water Conservation and Sustainability Plan

Table of Contents

"When the well's dry, we know the worth of water."
—Benjamin Franklin

Water is absolutely critical to successful, growing communities where residents can enjoy a high quality of life. Madison and Dane County are fortunate to have abundant supplies of water that if protected and used in a sustainable manner will last long into the future. Recent news about the water shortages in Atlanta, Georgia and elsewhere in the southeast, continuing concerns about the ability of communities in the southwestern United States to grow when water supplies are scarce, and the uncertainty caused by climate change, drive home the point that communities are not necessarily guaranteed a water supply. With proper management, planning and conservation now, Madison can help ensure clean and abundant water supplies far into the future.

It may seem counterintuitive for a utility that derives its income from selling water to plan for conservation, as more water sold means more income for the utility, on a unit by unit basis. But if the utility has to meet rising customer demand every year, it has to continually increase its pumping and delivery capacity, and it may eventually have to find additional sources of water if its primary source is overwhelmed. Each increase in capacity and supply costs the utility money to develop and operate, and it is actually cheaper for both the utility and its customers to invest in water efficiency rather than increased supply. Additional benefits of water conservation include improved water quality; a reduced burden on surface water quality, as less wastewater is generated; reduced greenhouse gas emissions due to reduced energy spent on water pumping; and increased spring, stream, and river flows, as less of the groundwater that feeds them is withdrawn.

Conservation Goal
Maintain the current annual rate of groundwater pumping, based on an average of five years (2002-2006), while reducing residential per capita water use by 20% below current levels by the year 2020.

BACKGROUND

GROUNDWATER RESOURCES

Below Wisconsin's surface is an estimated 1.2 *quadrillion* (1,200,000,000,000,000) gallons of groundwater which, if above ground, would flood the entire state to 100 feet deep. That fact may beg the question of why water resources are a concern at all in our state (Kassulke & Chern, 2006). A key point to understand initially is that groundwater moves much more slowly than surface water. This fact makes planning for drinking water quantity and quality a challenge. When water is not replaced or recharged at the same rate at which it is pumped out of the ground, shortages can occur. Though we receive about 32 inches of rainfall each year, only 18-30% of that soaks into the ground. The rest either

runs off to the nearest water body or evaporates (UW-ASC, 2007). The amount of infiltration is controlled by a number of factors, including the intensity of each rain event and the soil type, but one of the primary influences in an urban area such as Madison is the ground cover. While natural areas, such as forests and prairies usually have high infiltration rates, urban surfaces, such as roofs and pavement, allow almost no infiltration at all. Thus, maintaining a sustainable infiltration rate in an urban area poses a particularly difficult challenge.

An additional challenge in maintaining quality groundwater for drinking water supply is preventing contamination. Industrial and other potential groundwater contaminants are abundant in urban areas, and keeping them out of the aquifer requires widespread acceptance of water quality protection plans. When groundwater becomes contaminated, it can become unusable as a drinking water source for many years. With over 70% of Wisconsinites using groundwater for their water supply and various industries relying on it for their livelihood, it is imperative that we keep this resource plentiful and free of anthropogenic contaminants (GCC, 2006).

Dane County sits atop two aquifers that are separated by an aquitard (collectively called the Cambrian Eau Claire Formation). The aquitard, a mostly-impermeable shale layer, occurs at around 200 feet below the surface and is up to 60 feet thick in some areas. The upper aquifer is a source of water for many private wells, while the lower aquifer, called the Mount Simon Formation, is the main water source for all Dane County municipalities, and is up to 700 feet thick (Bradbury et al., 2007). The 23 Madison municipal wells range from 500 feet to 1,175 feet deep. Figure 1 below shows a cross-section of the major aquifers in southern Wisconsin. Figure 2 is a profile of Dane County's aquifer formations.

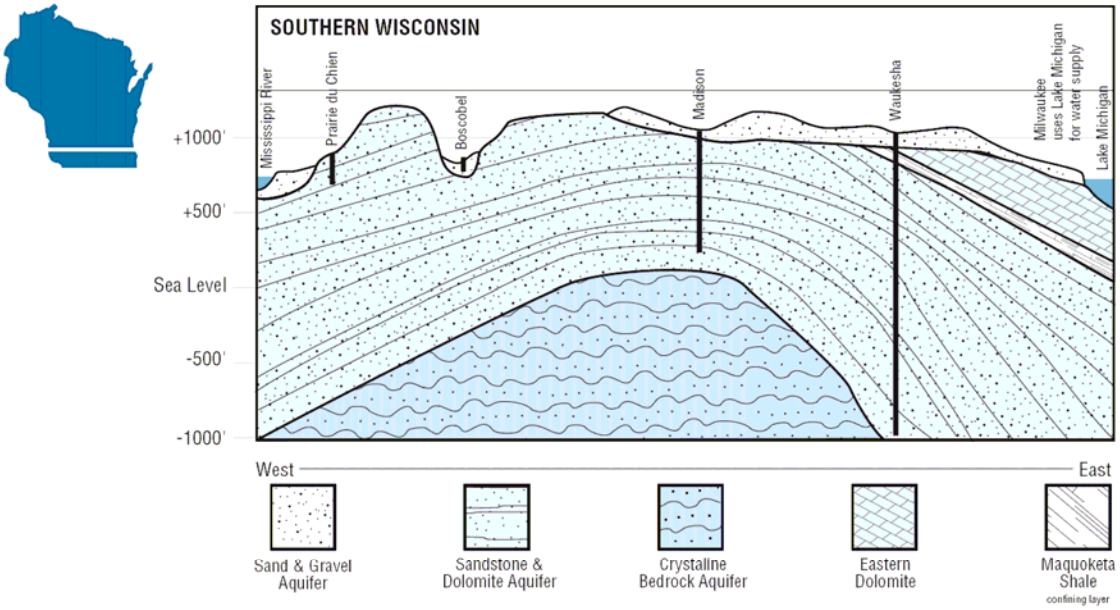

Figure 1: From Wisconsin's Buried Treasure: Groundwater Study Guide (WDNR, 2006)

GROUNDWATER LEVELS

The amount of available groundwater varies by season and region. Water flows slowly underground, its speed varying with the hydraulic conductivity of each type of bedrock material. When traveling through coarse sand, water can reach speeds of up to several feet per day. In very clay-rich areas water may only move inches in a year. Levels of groundwater can vary naturally throughout the year without human intervention. Some snowmelt will infiltrate each spring, allowing groundwater to rise. There is often a drop in levels during the summer months due to plant uptake, decreased rainfall, increased evaporation, and discharge to surface water bodies. When the plants become dormant in the fall, levels often rise again. When the ground is frozen in the winter, with little to no infiltration, the levels usually fall. From year to year, the level varies due to changes in precipitation (Hunt, 2003).

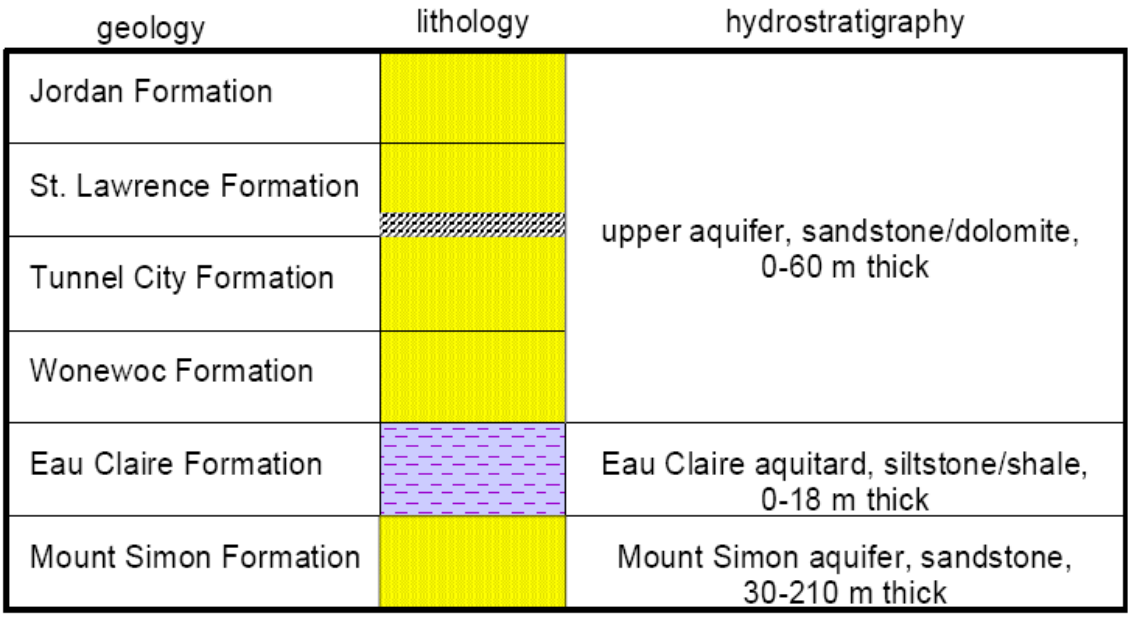

Figure 2: Cambrian stratigraphy of Dane County, Wisconsin (Bradbury et al., 2007)

[1 meter = 3.28 ft]

Human Impact

Madison citizens use, on average, about 73 gallons of water per day (based on the five-year average of 2002 to 2006). To supply these needs, the City of Madison pumps between 20 million and 54 million gallons per day (City of Madison Water Utility Data, 2007). Dane County pumps around 50 million gallons per day (Hunt et al., 2001), while the state pumps over a billion gallons each day to supply the drinking, industrial, commercial, livestock, irrigation, and other needs of its citizens.

With the introduction of high-efficiency toilets, low-flow showerheads, faucet aerators, and other conservation measures, groundwater use per capita has generally stabilized nationwide (Hunt, 2003). However, an increasing population continues to create a demand for groundwater. In some areas around the state, such as the Fox River Valley, southeastern Wisconsin, and Dane County, the groundwater levels have already been significantly drawn down (WGAC , 2006).

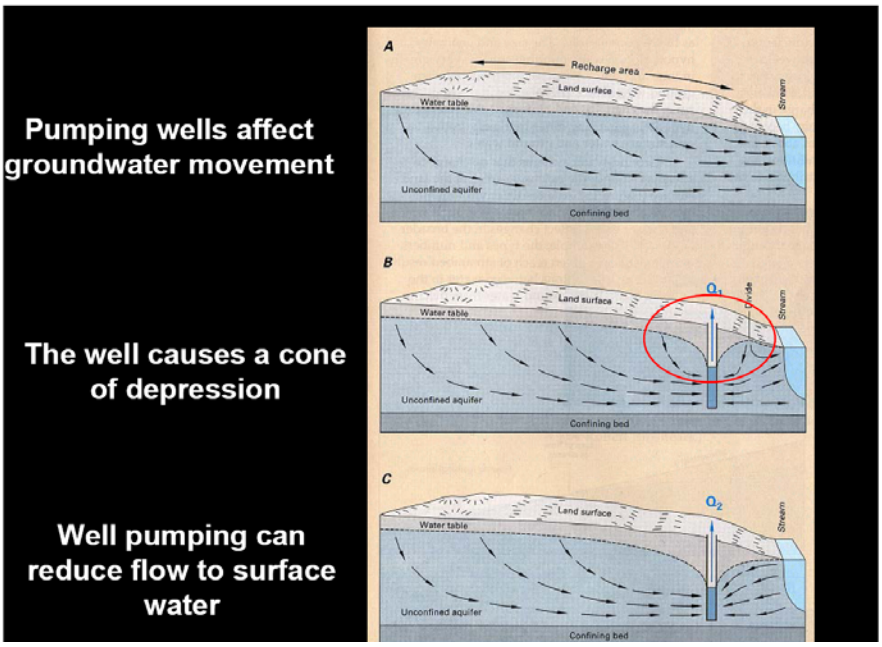

Figure 3: Groundwater Drawdown (from K. Bradbury presentation, September 14, 2006)

In addition to direct pumping of groundwater, humans have also impacted aquifers by decreasing the surface area available for recharge. Land development increases the amount of impervious surfaces, such as roofs and pavement, which causes more runoff and less infiltration of precipitation and snowmelt. In addition to the problems this trend causes for the aquifer, it can also contribute to flooding and surface water pollution, as stormwater carries dirt and oil from parking lots and streets to the nearest water body. In undeveloped areas, a higher percentage of rainwater stays where it lands, sinking into the ground and eventually becoming groundwater (WDNR, 1997).

GROUNDWATER DRAWDOWN

Because groundwater moves slowly, when a well is pumped for a long period of time, a cone of depression in the water table is formed surrounding that well (the water level is lowered significantly adjacent to the well, and less farther away, creating a cone shape). If pumping stops, the cone eventually disappears. When groundwater is pumped at a higher rate than it is recharged, drawdown occurs. When too many wells are placed near one another, their cones of depression merge and drawdown can be severe. Severe drawdown in a deep aquifer may pull water out of shallow aquifers, which in turn can affect springs and surface water bodies as well.

Streams, lakes, and wetlands can all be affected by groundwater drawdown. Some streams rely entirely on groundwater for their baseflow during dry periods, and without enough groundwater input they may run dry, compromising wildlife habitat. Many wetlands rely on groundwater for up to 70% of water input. Groundwater drawdown can greatly impact these sensitive areas (WDNR, 1997). In Dane County, there is a cone of depression of about 30 feet in the deep aquifer (Mount Simon Formation), caused by municipal water use. This drawdown affects the surface water by drawing down the shallow aquifer *at least* 40 feet in localized areas (Bradbury, 2006).

Because of this substantial drawdown, the Wisconsin Groundwater Advisory Committee has warned it could designate Dane County as a Groundwater Management Area. The governor and State Senate and Assembly leaders appointed the members of this committee. Their charge, as directed by 2003 Wisconsin Act 310, is to identify areas with groundwater quantity issues. Two areas of the state were immediately identified as Groundwater Management Areas: the southeast area (all or parts of the Milwaukee, Waukesha, Washington, Ozaukee, Walworth, Kenosha, and Racine counties) and the Lower Fox River Valley (all of Brown and parts of Calumet and Outagamie Counties). These two areas have experienced drawdown of more than 150 feet. Identifying locations as Groundwater Management Areas triggers a requirement to create a regional groundwater management plan with assistance from the Department of Natural Resources. It also gives the DNR more authority over the approval process for high capacity wells (WGAC, 2006).

In its 2006 report, the Groundwater Advisory Committee recommended that Dane County be listed as a Groundwater Attention Area, which is one step below a Groundwater Management Area. An Attention Area is considered a warning that the groundwater conditions are such that a coordinated management plan should be put into place to prevent further drawdown. General managers from Dane County water utilities have been meeting since early 2007 to discuss regional groundwater issues.

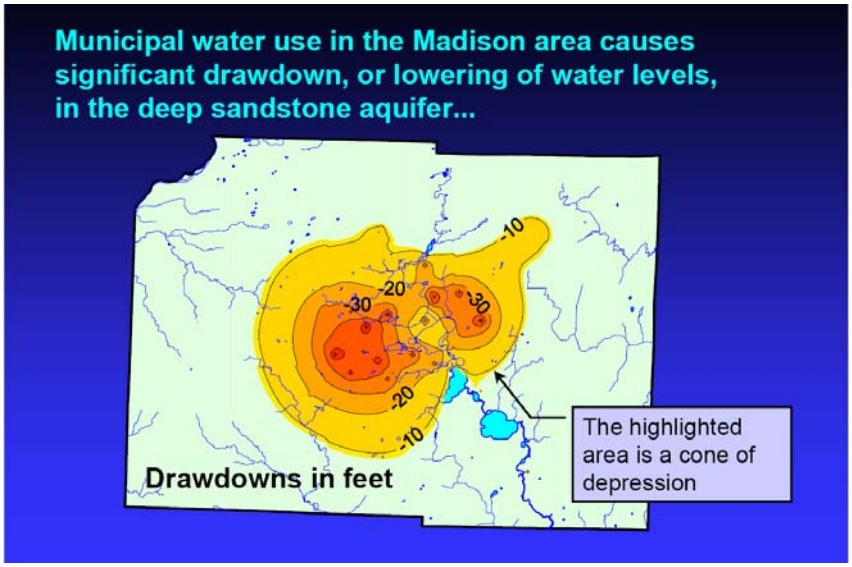

Figure 4: Groundwater Drawdown (from K. Bradbury presentation, September 14, 2006)

One cause of groundwater drawdown in the Dane County area is the fact that the Madison Metropolitan Sewerage District (MMSD) discharges most of its effluent to Badfish Creek, which is outside the originating watershed of the city's drinking water. The groundwater is

pumped from one watershed and discharged into another one. An exception to the MMSD's handling of wastewater is the case of the City of Verona, whose effluent is returned to its originating watershed in Badger Mill Creek. However, the effluent does not necessarily address groundwater recharge.

The drawdown has caused a decrease in baseflow for many of Madison's streams and shallow springs, especially around Starkweather Creek and Lake Wingra. Prior to groundwater pumping, it is believed that groundwater flowed into the Madison area lakes, but in some locations it now appears that this flow has reversed, drawing lake water into the groundwater (WDNR, 1997). Research by Baumann and colleagues (1974) indicated that at least 28 springs in the Lake Wingra watershed have dried up.

Concerns about the drawdown spurred a multi-departmental collaboration in 1992 called the Regional Hydrologic Modeling and Management Program to look more closely at groundwater issues. The group continues to update a regional groundwater-modeling program. The model is able to show current conditions as well as predicted conditions based on various pumping rates (DCRPC, 2004).

Mitigation Projects

Concerns about threats to groundwater quantity have spurred several area mitigation projects. One such project resulted from the construction of the new West Campus Cogeneration Facility on the UW campus. Since spring 2005, the facility has used water from Lake Mendota in its operations. While the amount withdrawn has minimal effects on the lake itself, it could potentially lead to problems downstream in the Yahara River during droughts. To mitigate any adverse effects from pumping, a group of public and governmental entities worked together to create a mitigation plan.

After about 20 site evaluations, the Odana Hills Golf Course was chosen as the best location to infiltrate treated stormwater. Stormwater draining to the Odana Ponds is treated onsite and pumped to an underground infiltration field located in the golf course. The water quality and quantity is monitored extensively before infiltration. Completed in 2006, the Ponds' infiltrated water will eventually feed shallow springs that flow into Lake Wingra, with minimal impacts to the existing pond. While it will take about 30 years for the infiltrated stormwater to reach the springs, an effect is likely to be seen much sooner, due to an increase in head pressure in the upper aquifer. The goal of this project is to infiltrate 80 million gallons per year. (MGE, 2007). See Figure 5 for a map of this project.

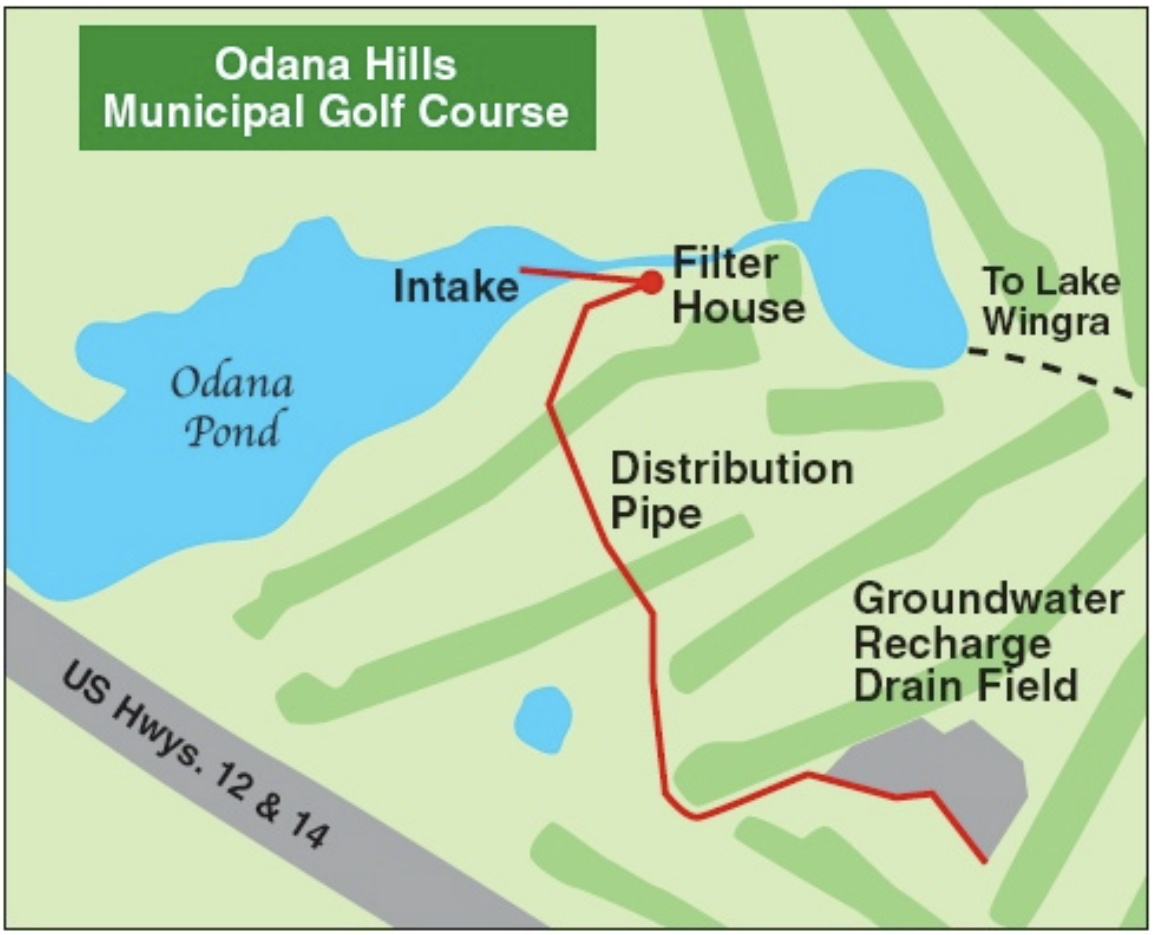

Figure 5: Map of the Odana Hills Golf Course stormwater infiltration project (MGE, 2007)

GROUNDWATER QUALITY

Certain areas around the state are fairly susceptible to groundwater contamination and shortages. For example, areas with bedrock very close to the surface have limited available water and are prone to contamination because percolating water receives only minimal filtration. Other areas have very sandy soils that allow water to flow through faster than it can be filtered and so are prone to problems with contamination from fertilizers and pesticides (WDNR, 1997). In southeastern Wisconsin and the Fox River Valley, increasing levels of radium are encountered due to groundwater drawdown. Some of these areas are now faced with the need for new water sources.

Because groundwater moves slowly relative to surface water, contamination below ground can have an impact for many, many years. Depending on soil conditions, residue from a spill might be detectable for hundreds or even thousands of years. The relatively slow movement of groundwater has significant implications for water quantity as well as quality (Bradbury et al, 1985; Alley et al, 1999).

Wellhead Protection Plans

In 1986, the federal government, through amendments to the federal Safe Drinking Water Act, required statewide wellhead protection programs. In 1993, the EPA approved a state program overseen by the Wisconsin Department of Natural Resources. In turn, the DNR requires a wellhead protection plan for any municipal well constructed after May 1992. There is a second, voluntary state program for wells developed prior to 1992. Wellhead protection is intended to protect public water supply wells from contaminants that could enter the public water supply by managing land use activities in areas that contribute water to the wells. Sixteen of the 34 Dane County municipal water systems have at least one wellhead protection plan in place. Fourteen systems have wellhead protection ordinances. The City of Madison has completed wellhead protection plans for 11 wells thus far and has a wellhead protection ordinance in place.

Madison's General Ordinance 28.107 established Wellhead Protection Districts. Each well district has two zones. Zone A is defined as "the area around the well in which it has been determined that groundwater and potential contaminants will take five (5) years or less to reach the pumping well." Zone B is the area in which it would take contaminants 100 years to reach the well or within 1,200 feet of the well. The Water Utility reviews proposed uses that fall within either of the zones before construction plans can be approved. Existing uses are allowed, but expansion of those uses must be approved. Proposed uses are considered on a case-by-case basis. The City of Madison's General Ordinance Chapter 13.22 Wellhead Protection states the following:

> To prevent contamination of wells supplying municipal water systems, the Water Utility General Manager or his/her designee shall review all proposed uses on zoning lots in Zones A and B in Wellhead Protection Districts.
>
> Review will be based on the presence, use, or storage on the lot of hazardous chemicals, as defined by the Environmental Protection Agency. Consideration will be given to factors including but not limited to the following: whether the zoning lot is in Zone A or Zone B, effective storage or containment of particular hazardous chemicals, and the magnitude and/or frequency of use of the hazardous chemicals. Approval of the use may be contingent on specific conditions being met. A current list of hazardous chemicals, as defined by the Environmental Protection Agency, shall be maintained.

Water Utility staff are currently working on creating a wellhead protection plan for each municipal well in the city by 2010. Changes to the ordinance are currently under consideration that would establish wellhead protection areas around each of the 23 wells, even before the wellhead protection plans are completed.

DRINKING WATER

In 1880, a petition to the Madison Common Council requested that a municipal water service be constructed for its 10,324 citizens. The Madison Water Utility now provides service to more than 62,000 locations in the City of Madison, Town of Madison,

Shorewood Hills, Maple Bluff, Blooming Grove, and Town of Burke. Despite being adjacent to Lakes Mendota and Monona, the City developed its water supply system using deep wells.

Overall, Wisconsin has high quality drinking water, though some areas are more susceptible to well contamination than others. In recent years, complaints of colored water, a result of elevated levels of Manganese (Mn) and Iron (Fe), have shaken public confidence in the safety of Madison's public water supply. While the colored water is not a public health problem, it is considered a water quality problem. The Water Utility has proposed to treat four wells that have had levels of Mn and Fe that exceed the EPA's Secondary Standards for water quality.

Economic and Environmental Costs of Water Use

In 2007 MWU pumped 11.392 billion gallons of water and used 22.287 million kilowatt hours (kWh) of electricity to pump that water. In 2007 it took an average of 1,956 kWh to pump 1 million gallons of water.

	Per Million Gallons of Water Pumped
2007 Electricity Usage	
Average kWh	1,956
Average kWh cost	.088
Electricity cost	$172.10
2007 Chemical Usage	
Average cost of Chlorine	2.17
Average cost of Fluoride	13.51
Total Cost to Pump and Treat	$187.79
CO2 produced @ 2.216 lbs per kWh	4,334.50 lbs
CO2 in tons	2.1673 tons

A Focus on Energy Report from May 2004 provides statewide emissions factors of 2.216 pounds of CO2 produced per kWh. That equates to 4,334.5 pounds of CO2 produced for every million gallons of water pumped. Madison Water Utility is enrolled in the Green Power Tomorrow program with MG&E and is purchasing 2,265,900 kWh of Green Power Tomorrow electricity. This purchase will offset electricity use at an annual cost of $22,659. The annual offset of CO2 will be 5,021,234 pounds.

Conservation benefits attributed to this topic would be that for every 1million gallons of water that the utility avoids pumping, the result would be a savings of $187.79 in 2007 dollars, and the prevention of 4,334.50 pounds of CO2 being put into the air.

WATER CONSERVATION PLAN

This plan has been compiled for the City of Madison Water Utility as a guidance document to **maintain the current annual rate of groundwater pumping**, excepting growth in new areas, provided that the recharge rates in new areas are sustainable. In the City of Madison, annual pumping has remained steady at about 11.3 billion gallons per year for the past 10 years. The introduction of water-saving appliances has assisted in conserving water at every level. The loss of high water demand industries has also contributed to the reduction in the growth of consumption. The University of Wisconsin and Oscar Mayer have also implemented aggressive conservation plans.

In order to maintain the current pumping level, however, certain measures will need to be put in place to further reduce the per capita use. Consequently, a secondary objective is to **reduce the residential per capita water use by 20% by the year 2020.** The current average for residential water use is about 73 gallons per day (5-year average, 2002-2006). In order to meet the 20% goal, each person would need to decrease their daily water use by about 15 gallons, which corresponds to a residential goal of **58 gallons per day**.

Because the Madison Water Utility has different types of customers who use water in very different ways, the conservation steps outlined in this plan are broken into sections corresponding to each of these groups. Included are sections for residential, commercial, industrial, and municipal/government accounts, as well as the University of Wisconsin.

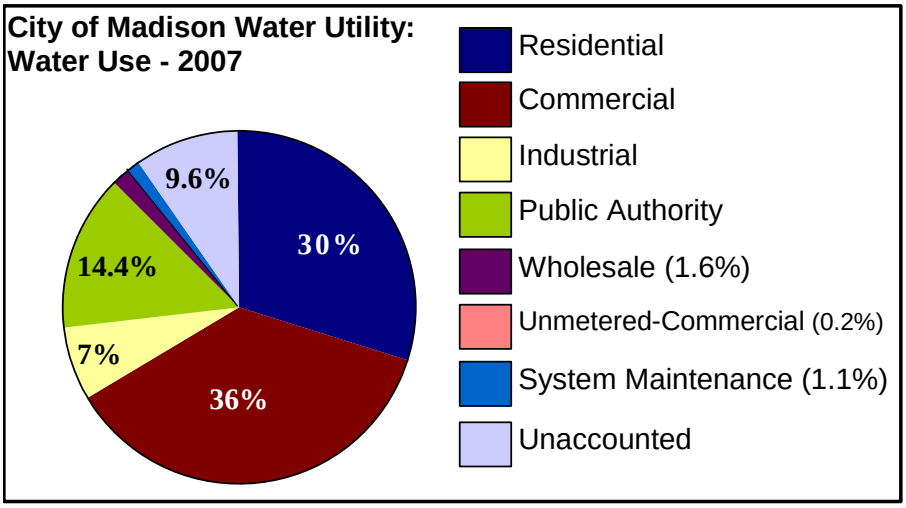

Figure 6: Percent Annual Water Use by Water Utility Customers, 2007

RESIDENTIAL

Goal: To reduce per capita residential use of water by 20% by 2020.

The 55,000 residential accounts in the City of Madison far exceed the number of commercial, industrial and municipal accounts, though representing only 41% of metered sales.

Water Use Statistics

Nationwide, daily **indoor** water use per capita is 69.3 gallons. By installing all high-efficiency fixtures, this daily use drops by about 35% to 45.3 gallons. The breakdown by activity follows:

Table 1: Indoor Water Use (Vickers, 2002)

Use	Gallons Per Capita Per Day– Typical	Gallons Per Capita Per Day-Conservation
Showers	11.6	8.8
Clothes Washers	15.0	10.0
Dishwashers	1.0	0.7
Toilets	18.5	8.2
Baths	1.2	1.2
Leaks	9.5	4.0
Faucets	10.9	10.8
Other Domestic Uses	1.6	1.6
TOTAL	**69.3**	**45.3**

In the City of Madison, the residential average daily use per capita (indoor and outdoor) is about 73 gallons per day. By 2020, the City of Madison is expected to have over 245,000 residents, assuming a growth rate of 1.1%. Reducing per capita residential water use by 20% by 2020 would keep total residential water usage approximately equal to, or perhaps slightly less than current rates. The daily average use would need to be about **58 gallons per person**. This is the foundation for being able to maintain the current annual pumping rates, which is the overall goal. Progress toward this goal shall be measured using a rolling 5-year average in order to minimize fluctuations due to weather variations.

Water Utility staff recently compared average water use of an established, older neighborhood and a new neighborhood to see if higher-efficient appliances/fixtures in the newer homes have an impact on average water use. Data was derived from a cross-section of 1,029 customers in seven different billing routes, some of which were in the older neighborhoods and some in newer. The results, surprisingly, indicated a near-identical water use between the two neighborhoods. It does not appear that the newer homes exhibit any greater water efficiency than the older homes. It is difficult to determine how much water use can be attributed to irrigation in the larger lot sizes (pervious area) because there seems to be a greater correlation with home size

(impervious area), which would no doubt relate to more people in the home consuming water for all household purposes.

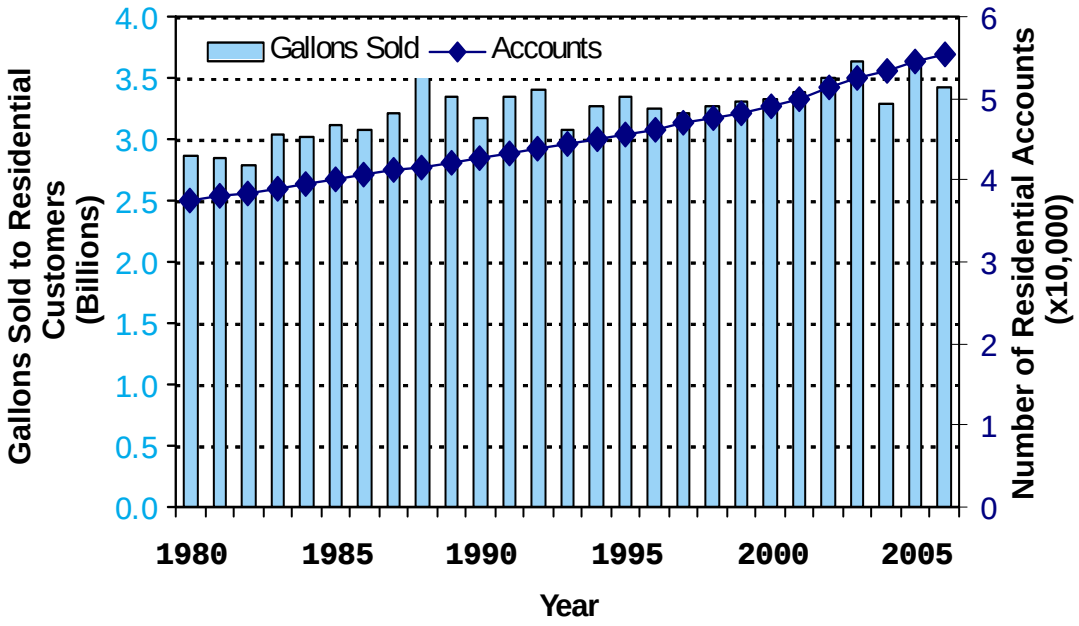

Figure 7: Gallons of water pumped by City of Madison Water Utility and the number of customers served (1980-2006) (data from Madison Water Utility)

Seasonal Water Use

For many residents, water use increases significantly in the summer due to outdoor activities such as car washing, lawn care, and swimming pool use. According to the EPA, lawn care makes up about ⅓ of all outdoor water use nationwide. Also, when using a hose to wash off sidewalks and driveways, about 50 gallons of water is used every 5 minutes.

In some municipalities, ordinances related to outdoor use are put in place to control the increased demand for water in the summer. According to the University of Wisconsin Extension office, an established lawn requires only about 1 inch of water each week, and it is best to water just once per week to encourage vigorous root growth. In addition, watering during the middle of the day causes most of the water to be lost to evaporation before it has a chance to infiltrate. However, many homeowners can be seen watering their lawns nearly every day and often during the hottest time of the day.

While encouraging indoor water conservation will continue to be an important aspect of groundwater sustainability, water-efficient appliances make this a fairly easy step for many homeowners. Outdoor water conservation will likely have the biggest impact from

the residential sector. A recent analysis of one residential billing group showed a 25% increase in summer over winter use.

The Utility has a 6-month billing system, and residents fall into one of six billing cycles. This can make it difficult for the Utility to estimate monthly residential use as well as for homeowners to track their prior use. The amount of water *pumped* is tracked monthly, though this does not necessarily reflect the amount of water that is *sold* each month as the Utility needs to pump more water than it sells. Figure 9 shows the total monthly pumping rates in 2007 for all classes.

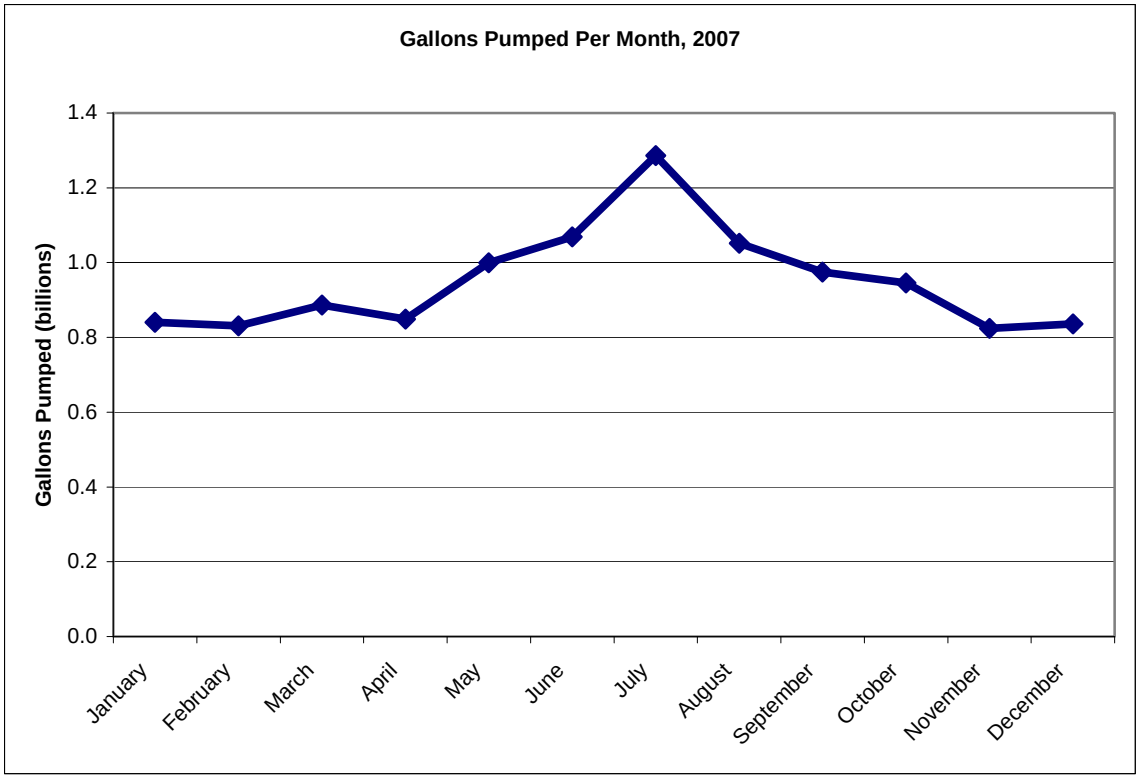

Figure 8: Gallons of water pumped per month by City of Madison Water Utility in 2007

Water Rates

Basic economic principles dictate that higher prices will decrease demand for nearly any good, and water is no exception. Conservation rate structures create a higher rate charge when water use exceeds a predetermined level. Rate structure may also have multiple tiers with increasing rate associated with each subsequent tier. Western Resource Advocates, a non-profit environmental law and policy organization, recently evaluated thirteen Colorado utilities on their water conservation strategies. One component of their analysis was the rate structure. Ten of the thirteen Colorado utilities employed an inclining block rate structure in which a higher per unit charge is imposed when a threshold is exceeded.

Moving to a system of rates that actively promotes conservation needs to be done carefully to minimize impacts on low-income residents while also maintaining an adequate revenue stream. Changes to billing frequency and incorporation of new software need to be addressed, both of which generate additional costs. Despite these added costs, communities across the country are implementing conservation rate structures. Madison Water Utility is committed to doing what is best for customers and the long-term sustainability of our water resources, and so shall analyze the costs and benefits of making such a switch.

Currently, the Water Utility uses a declining block rate structure for all classes of customers. Only the biggest water users benefit from the declining rate structure. The **average residential customer (a 2.5 person household) uses 45 CCF every six months or 184 gallons per day.** The Madison Water Utility should consider a conservation rate structure in its 2009 rate case.

Table 2 provides examples of inclining rates for Ann Arbor, MI, Boulder, CO, Tucson, AZ, and Waukesha, WI. Boulder and Tucson are arid, and water resources have been an historic issue. Waukesha has well contamination problems and is undertaking water conservation strategies to assist the City's interest in tapping Lake Michigan's surface water.

As indicated in Table 2, both Ann Arbor and Tucson have used a low rate price point around 15 CCF (61 gallons/day), which is similar to the City of Madison's 20th percentile ranking (20% of all residential customers use 15 CCF or less). This could be described as "subsistence water use level." Waukesha purports to have a conservation rate structure but has set its second rate step so high that few residential customers would be affected.

The staff of the Wisconsin Public Service Commission have informed the Water Utility that the commission has reservations about a conservation rate structure for communities that bill less frequently than four times per year. The Water Utility has projected in its 2010 and 2011 budget years funding for an automatic reading system (AMR) that would enable the utility to bill on a quarterly or monthly basis. This would then meet the PSC's requirement to implement a conservation rate structure.

With these issues in mind, a sustainable rate structure has been proposed in Table 2 for Madison. Inclining rates were calculated based on four different levels of water use. The lowest water users fall into the 20th percentile of current use rates, "the subsistence level." The next level is what a Madison family would use if the 20% reduction goal were met, "the conserving level." The third level is what the current average Madison family uses, the "median level," and the final level shows the 80th percentile of water use (highest water users).

Table 2 also proposes a rate structure for 2009 for illustrative purposes. (The actual rate structure proposed will be determined based upon the PSC procedures.) The proposed

rate structure would not increase for the lowest level of usage. To address the issue of the semi-annual bill, the Water Utility should point out that the cost differences at the various rate steps are reasonably in accord with the current rate structure and the fact that the City could bill quarterly in five to six years.

Table 2: Examples of Conservation Rate Structures

Muncipality	Billing Cycle	Base Meter Rate - 6 Months	Rate Per CCF (748 Gallons) Rate Steps		Rate/CCF	Semi-Annual Cost for Madison Residential Customer 20th Percentile	Conserving	Median	80th Percentile
Semi-Annual Consumption (CCF)						15	36	45	55
Average Daily Use (Gallons)						61	148	184	225
Ann Arbor, MI	Quarterly	$ 22.50	0.0	14.0	$ 1.07				
			14.0	56.0	$ 2.25	$ 39.73	$ 86.98	$ 107.23	$ 129.73
			56.0	90.0	$ 3.61				
			>90.0		$ 4.95				
Boulder, CO	Quarterly	$ 51.30	0.0	33.7	$ 1.41	$ 72.45			
			33.7	56.2	$ 1.87		$ 103.12	$ 119.95	$ 138.65
			56.2	84.2	$ 3.78				
			84.2	112.3	$ 5.61				
			>112.3		$ 9.35				
Tucson, AZ	Monthly	$ 32.52	0.0	15.0	$ 1.17	$ 50.07			
			15.0	30.0	$ 4.09				
			30.0	45.0	$ 5.78		$ 232.80	$ 284.82	
			>45		$ 8.03				$ 365.12
Waukesha, WI	Quarterly	$ 39.00	0.0	80.2	$ 1.95	$ 68.25	$ 138.45	$ 156.00	$ 175.50
			80.2	107.0	$ 2.20				
			>107		$ 2.70				
Madison, WI	Semi-Annual	$ 25.50	0.0	500.0	$ 1.20	$ 43.50	$ 68.70	$ 79.50	$ 91.50
			>500		$ 0.86				
Madison, WI A Proposed Sustainable Rate Structure for Residential Customers.	Semi-Annual	$ 27.50	0.0	15.0	$ 1.20	$ 45.50			
			15.0	40.0	$ 1.30		$ 72.72		
			40.0	55.0	$ 1.32			$ 84.50	$ 97.70
			>55		$ 1.38				

Toilet rebate program

By federal law, manufacturers may not make a toilet that uses more than 1.6 gallons per flush (residential and commercial). A model that uses 1.6 gallons per flush (GPF) is considered a "low-flow" toilet, whereas a high-efficiency toilet (HET) uses no more than 1.28 GPF. The Water Utility proposes to create a new program that would offer incentives to replace old, inefficient toilets with high-efficiency models, similar to the lead pipe replacement program that the utility offered in past years. Pending Public Service Commission approval, the city would work with local plumbers and retail outlets to offer a rebate for the installation of a high-efficiency toilet. In order to receive the rebates, residents would have to prove that older toilets were actually replaced, and each household would be eligible for a rebate on only one toilet. Final details of the program are yet to be determined.

Residential water audit

Most residents simply do not realize how much water they use at home or what they can do to reduce their consumption. The water utility could offer audits of home water use in which utility employees would analyze all water-using appliances and systems. The homeowners would be informed about cost effective ways to reduce their in-home water consumption. Given the staffing burden this could potentially pose to the utility, there would need to be a charge for the service, but it is anticipated that a rebate might be able to cover the cost of the audit if additional steps are taken as a result of the audit, such as replacing toilets, faucets, washers, etc.

Currently, if a customer has an unusually high water bill, water utility staff will send a letter and set up an in-home audit for leak detection. The Water Utility does about 150 audits each year.

Landscaping

Many non-native plants that are used for landscaping purposes require much more water than native species. Using native plants that are adapted to local climate conditions and can withstand seasonal droughts will be encouraged and promoted by the utility and other city departments.

Several cities across the U.S. have already created landscape ordinances for new development that encourage water efficiency. The City of Santa Cruz (CA) enacted a municipal ordinance to promote water conservation in order to control the peak summer water demand. They require a landscape and irrigation plan for new commercial, multi-family, and single-family lots over ½ acre as well as for current customers who are required to modify their landscape in conjunction with a land use approval process. A city water conservation office approves the plans. Requirements include a separate water

meter for irrigation purposes, a landscape water budget, and an irrigation /landscape design.

Education and outreach

The Water Utility will work with SustainDane to publicize and promote the water conservation kits and rain barrels that they provide. They will also continue to provide support and speakers as requested to schools and community organizations to promote education about the importance of water conservation. During times of high water use (hot, dry periods), the utility will continue to run public service announcements reminding residents of the importance of reducing water use and how to do so.

The Utility and City will actively promote the EPA's WaterSense labeling program for toilets, washers, showerheads and irrigation sprinkler systems and will lead by example by choosing WaterSense labeled products for city facilities.

The Water Utility is also getting involved and making a financial commitment to locally promoting 'Green*Plumbers*'. This is a national accreditation program that educates plumbers on new, water-saving techniques and general water conservation. The program's goal is to reach 40,000 plumbers nationwide.

Bottom Line

The five most important actions residents can take to conserve water are:

1. Fix leaks
2. Replace old toilets (largest water user in the home)
3. Replace clothes washer (second largest water user)
4. Plant the right plants
5. Water only what lawn/gardens need

COMMERCIAL

Goal: Promote water conservation through rebate promotions and education

For billing purposes, commercial accounts refer to businesses as well as multi-family housing (more than 3 units). Conservation strategies for this customer class, including targeted rebates, education, ordinances, and a certification program, are briefly described below. The strategies described represent a suite of options available to the utility for consideration.

Multi-family/commercial property high-efficiency toilet rebate

Apartment property owners/managers could be eligible for a rebate for replacing a 3.5-gallons per flush (GPF) or higher toilets with a new, higher efficiency toilets that use 1.6 GPF or less. Other utilities offer rebates of $25-$250, where the size of the rebate depends on the efficiency of the replacement toilet.

Denver Water offers a $25 rebate for replacement of an older toilet with a qualifying. low-flow unit that uses 1.6 GPF or less. Commercial customers are eligible for a $125 rebate when they replace an older toilet with a high-efficiency model that uses 1 GPF or less. Denver also offers a rebate of $200 per unit for the replacement of urinals with models that use 0.5 GPF or less. Similarly, Marin Municipal Water District (CA) offers a $250 rebate and the Contra Costa Water District (CA) offers a $175 rebate for the replacement of a 3.5-GPF toilet with one rated at 1.28-GPF or less.

Water utilities in the cities of Sioux Falls (SD), Seattle (WA), and Aurora (CO) offer owners of multifamily housing and commercial establishments rebates that range from $50-$100 for the replacement of older, less efficient toilets. Seattle offers a free high-efficiency toilet (rated at 1.28-GPF) or $80 rebate to replace toilets installed before 1994. Some communities such as Boulder, CO, allow unlimited high-efficiency toilet rebates, while others impose a cap. The city of Aurora limits the rebate to $10,000 per property.

There do not appear to be many programs offering rebates for installing high-efficiency toilets in newly constructed buildings, likely because new toilets are all 1.6 GPF or less. Most programs do not provide recycling or disposal of old toilets. The Santa Clara Valley Water District provides a list of toilet recyclers and their fees, for informational purposes.

The high-efficiency toilet rebate program could also include waterless urinals, which use no water and have no flush. They use a liquid-filled trap in the drain of the unit to allow liquids to flow through while blocking sewer odors. The Dedham-Westwood Water District (MA) offers rebates of $100 for installation of waterless urinals in new construction and $200 for the replacement of conventional urinals.

Commercial laundry equipment rebate

Commercial accounts would be eligible for a rebate, based on the number of gallons saved per year over the previous machine. Before implementing this rebate program, the

utility should survey existing laundry facilities to determine the extent to which these establishments are already using water-efficient washers. In addition, the utility would need to establish whether the rebate was dependent on the type of equipment replaced, i.e. coin-operated top/front loading equipment or larger industrial units used by linen/diaper service companies, hospitals, and hotels. Denver (CO) offers a $150 rebate for each domestic-size, coin-operated laundry machine that replaces an older, inefficient one. Commercial accounts in Boulder (CO) are eligible for $100 per machine rebates for qualifying water-efficient washing machines; there are no limits on the number of eligible rebates per account.

The Contra Costa Water District (CA) offers a rebate of up to $220 for the purchase or lease of a high-efficiency commercial washer, coupled with a $130 rebate from Pacific Gas and Electric Company. There is no requirement that the efficient washers replace older models. However, washers must be installed in commercial laundries or multifamily developments. Seattle (WA) offers rebates up to $100 for the purchase of high-efficiency commercial or shared washing machines. The exact amount of the rebate depends on the efficiency of the machine.

Commercial dishwasher rebate

Commercial accounts could be eligible for a dishwasher rebate whose value is based on the number of gallons saved per year over the previous machine. For example, Marin Municipal Water District (CA) offers a rebate of up to $500 for the five-year lease of a water-efficient commercial dishwasher.

Targeted education and outreach to promote water conservation

Specific commercial enterprises that could be targeted for education/outreach include the hospitality industry, nursing home/retirement communities, hospitals/medical centers, carwashes, business parks, laundromats/linen service, and landscaping. Specific educational materials would be provided in conjunction with any rebate or incentive program. Examples of some proposed outreach activities are provided below.

1. Encourage/provide incentives (rebates) for replacement of older, less-efficient washing machines in

    - Hospitality Industry
    - Laundromats
    - Linen/Diaper Service
    - Hospitals
    - Nursing Homes

2. Encourage/provide incentives (rebates) for replacement of 3.5-GPF or higher toilets with high efficiency toilets in all commercial and multi-family buildings.

3. Provide/promote use of "Request linen washing" cards to the hospitality industry.

4. Promote landscaping/xeriscaping with native plants that minimizes need for watering due to their natural suitability to the existing climate. Landscaping companies would be the primary audience; however, owners of all commercial properties including business parks, retirement communities, nursing homes, shopping centers, and medical clinics with extensive green spaces would also be targeted. In addition to promoting native landscaping, information on plant watering requirements, ideal times for watering, and water-conserving irrigation/watering systems will also be provided. Seminars or workshops on native landscaping also would be planned.

5. Recommend water audits or leak detection surveys to reduce water waste from leaky toilets, faucets, and showers in

   - Multi-family housing
   - Hotels/motels
   - Restaurants
   - Shopping centers/malls
   - Office/business parks

6. Provide best management practice information to car washes and provide certification to those car washes implementing water conservation techniques.

Proposed ordinances

New ordinances that should be considered for implementation are as follows

1. *Water sprinkling ordinance*
   Many communities in water-scarce areas such as Southern California and the arid Southwest impose water-sprinkling restrictions that limit the times of day and/or days of the week when watering may occur. In 2006, Waukesha Water Utility imposed restrictions that limiting watering to two days per week. The ordinance also requires that watering takes place before 9 a.m. and after 5 p.m. The decision to impose water restrictions was driven by water quality issues at a number of city wells, specifically radium levels that exceeded federal drinking water guidelines.

   Currently, the Madison Water Utility General Manager has the authority to impose mandatory or voluntary outdoor water use restrictions. This authority is described in Madison General Ordinance 13.04. Although the utility has the authority, it has not been exercised in the past. Previous general managers have preferred education and public service announcements promoting water

conservation rather than imposing mandatory restrictions. It is our goal to implement a sprinkling ordinance by 2010.

2. *Replacement of all 3.5-GPF or higher toilets*
   Similar to the lead service replacement program for residential customers, all multi-family housing units and other commercial customers would be encouraged to replace all 3.5-GPF or higher toilets with a more efficient (1.6-GPF or less) toilet during a ten-year window. The City of Madison Water Utility would share the cost by offering a rebate available once it was shown that a less efficient toilet was actually replaced by a more efficient one.

3. *Landscape ordinance*
   Examples of directives included in a landscape ordinance could include downspouts directed to turf instead of pavement and requiring a 'water-friendly' landscape plan with new or major reconstruction.

   One component of LEED™ (Leadership in Energy and Environmental Design) certification is the use of water efficient landscaping. More communities are starting to require or encourage LEED™ certification, and so water efficiency will naturally become more important in building design.

4. Car wash reclamation ordinance
   New automatic car washes or existing car washes that upgrade/enlarge their service facility must recycle at least 50% of the water used.

5. *Revise credit meter program and costs*
   Currently, residential and commercial users frequently install 'sewer deduct' meters as there is no initial cost to install from the Water Utility. Installation cost charged by plumbers depends upon the complexity of the plumbing. Once installed, the meter base charge is determined by the size of the meter.

Certification program for businesses that are "water efficient"

Working with partners in the business community, the Water Utility would establish a program for certifying businesses that are "water-efficient." Water efficiency could be demonstrated by evaluation of historic water use at a facility, conservation/water efficiency practices/programs implemented, and the results of a water audit for the facility. Partners would collaborate with the Water Utility to establish the standards, a monitoring program, and promotion of the certification program. Alternatively, the business community could develop a certification program independent of the Water Utility, which could serve as a technical advisor to the program.

Water efficiency is already a part of the Wisconsin Department of Tourism's existing "Travel Green Wisconsin" program, which certifies businesses in the restaurant and hospitality industries on a voluntary basis. The standards do not contain many specific

targets, however; they simply ask businesses if they engage in water efficient practices. These standards could be updated with specific targets.

INDUSTRIAL

Goal: To have a water conservation plan in place for each industrial customer

There are 23 industrial customers in the City of Madison, and they account for 10% of the total water use. Although this is a small number of customers, the opportunity for water savings in this area is significant. Water conservation generally falls into three categories: reducing water usage, reducing water loss, and reusing water that is currently being discarded.

Industrial Customer Water Conservation Plan

Step one in preparing an individualized plan is to prepare and gather pertinent information from company and utility records. This information is gathered using a pre-audit checklist, which would include the following:

1. People who are familiar with the industrial customer's daily operations
2. Building and location information, facility floor plans, plumbing schematics and drawings, operating schedules, number of employees, location maps identifying each water supply meter, and all sub-meters
3. Inventory of plumbing fixtures and all water-using equipment
4. Outdoor water use data, utility records that show water and sewer use, and any prior water and energy audits

Step two would be to perform a site audit of each industrial customer. An initial onsite water audit of all water-using equipment and processes would be used to identify water use. This includes a detailed examination of where and how much water enters the system, and where and how much water leaves the system. Water system audits assess current water use, provide data needed to reduce water and revenue losses, and forecast future demand. With this information, system improvements can be identified where conservation efforts are most needed. Follow-up audits would be conducted twice per year to check on each customer's water conservation progress, inform industrial customers of new water conservation practices, answer customer questions, and educate employees. In order for a water conservation program to succeed, it is important that a good record-keeping system be established to monitor operation and maintenance costs, revenues, and water use.

Step three is preparing an audit report. After the completion of the physical inspection of the facility, in which each water-use area is carefully examined, and water-use data is recorded, it is important to develop a final audit report. This report will provide a baseline for water conservation efforts.

Step four is to identify water conservation opportunities and to develop a site-specific water conservation action plan for the industrial customer. Based on the information

gathered, potential opportunities for reducing water usage, reducing water loss, and reusing water are identified. The following systems should be evaluated for efficiency and water conservation opportunities: cooling towers, boilers, flow meters and sub meters, automated controls, landscaping, irrigation, single-pass cooling, gray water, and reverse osmosis or de-ionized water. In some cases, water-using equipment can be replaced. In other cases, retrofitting existing equipment will be appropriate.

Similarly, a review of opportunities for improvements in equipment maintenance and repair should be completed. The following areas should be reviewed: plumbing fixtures, recirculation pumps, leaks, reused or recycled water systems, proper cleaning and sanitation of equipment, instrumentation-pH meters, total dissolved solids measuring devices, monitoring equipment for correct rinsing process, flow valves, flow restrictors, shut-off valves, reducing valves, solenoid timers, and water meters. Procedural changes can often result in substantial water savings. Furthermore, water conservation measures often pay for themselves by reducing energy costs. Once water conservation opportunities have been identified, a water conservation action plan is developed.

Step five is educating employees and involving them in water conservation efforts. Employees can have a major effect on the success of a water conservation program. It is important to educate and train key employees to make conservation efforts the most effective. Employees must be informed about the program and be made an integral part of the water reduction effort. An important part of this process is the formation of a water conservation and energy team within the organization, though the facility's water conservation goals should be shared with all employees. Industrial customers should educate employees about costs for water, sewer and electrical. These costs should be logged periodically. It is important for the industrial customer to stress to employees that even small projects can produce large savings in water consumption and to publicize water conservation successes--internally and externally. The Water Utility would provide educational materials specific to each customer's need, based on the site audit and water conservation plan.

Water Conservation Award

The Water Utility should consider an awards program to reward and honor industrial customers for their water conservation successes. The Water Utility would present a suitable plaque or certificate of achievement to the chosen industrial customers.

Winners could be selected based on the results of their water conservation efforts in the following areas: landscape and irrigation, plumbing fixture retrofits, quality and effectiveness of the water conservation plan, water leak detection, water recycling or reuse, innovative water conservation measures and methods, overall reduction of water use, and implementation of public education and community relations programs.

Funding for Public Water Conservation Education Programs

In order to make the water conservation effort as successful as possible, a public water conservation education program is essential. Industrial customers may be willing to help fund educational materials for water conservation youth programs or retrofits in low-

income homes. They could also work with Focus On Energy to assist customers in attaining available rebates. Rebate information would be published as part of the educational materials in the public water conservation education program.

MUNICIPAL

Goal: Governmental buildings shall enact water saving programs that support the main goal of maintaining sustainable pumping levels

The municipal division comprises the governmental entities of the City of Madison, Dane County, State of Wisconsin, and Federal government. All buildings that are serviced by the City of Madison Water Utility of these government entities will be included in the Water Conservation Program.

City of Madison Water Utility

The most important section of the City of Madison is the Water Utility itself. The enacting of water conservation measures within the Water Utility can serve as a model for other governmental buildings as well as the public at large. Before conservation measures are implemented, an audit shall be performed of all Water Utility buildings, and toilets, showerheads, and sink aerators will be checked for compliance with current water conservation standards for new construction. The amount of water that is dumped from reservoirs into the storm drains will also be investigated. The flushing program implemented to reduce manganese from the water supply will be inspected. The placement of water meters at the wells and other peripheral buildings will be explored for feasibility. All new Water Utility buildings will be built with water conservation measures in mind.

The following are water saving programs that could be instituted at the Water Utility:

Emphasize and expand the leak detection program
Many leaks in the water distribution system go undetected. By purchasing more leak detection equipment and devoting work-hours, we can reduce leaks. Older pipes and those in areas prone to main leaks will be checked on a systematic basis. The El Paso Water Utility has enacted a leak detection program using devices called “loggers” placed on valves that in three years of use have saved 725 million gallons of water (Buehrer, 2008).

Install low-flush toilets, low-flow showerheads, and sink aerators
Following the internal audit, old toilets shall be replaced with high-efficiency models, showerheads changed to low-flow, and aerators placed on sinks without them.

Quantify water use by utility through better record keeping
Increase the amount of data gathered on Water Utility water use activities and centralize data for ease of accessibility and comparability. New data gathered includes amount of water used during hydrant flushing, amount of water lost when reservoirs are dumped, and amount of water lost from a main break. Gather data from the Fire Department about

amount of water used to extinguish a fire. This new data could be compared to the amounts of water that are unaccounted for when compiling the annual audit of water pumped. A new central computer system could be implemented to ease the ability of pulling up data and comparing water use against various variables.

Installation of meters in wells
Water Utility wells currently do not have meters for the water that is used inside a well, i.e., for toilets and sinks. The feasibility of placing meters in the wells will be investigated. By having meters in the wells, the Water Utility can better monitor how much water is being used and if leaks occur.

Hydrant flushing
Historically, the Water Utility has employed conventional flushing twice a year to remove mineral sediment from water mains. Unidirectional flushing was begun in 2005 as a better technique to scour the water mains and remove sediment. The utility will continue to evaluate its flushing program to minimize the amount of water needed to clean the pipes. Ongoing research at the utility is expected to provide guidance on the frequency needed for flushing.

Well operation and maintenance
The operation and maintenance of a municipal well occasionally requires pumping the water to a sanitary or storm water sewer. The Water Utility should maintain better record keeping for how often these events occur and how much water is pumped to waste. Periodic review of this data should identify potential water conserving strategies for well operations and maintenance.

Use of rain barrels/ rain gardens
Rain barrels can be used at all Water Utility buildings to catch rainwater and reuse the water for lawn/flower watering. Rain gardens may be used to reduce runoff where appropriate. In the building of the new Operations Center, the use of rain barrels and rain gardens should be included.

Other Governmental Buildings (City, County, State, and Federal)

Audits will be performed of all other governmental buildings served by the Water Utility. Individuals in charge of the buildings may perform the audits. A questionnaire would be provided to assist individuals in auditing their own buildings, and further information will be provided to explain potential water saving programs. Ordinances and/or other legislation could be put in place to bring governmental buildings under a predetermined "Green" standard. Information about water saving programs will be made available on the Water Utility website.

Water conservation measures may include replacing old toilets, installing sink aerators, and installing rain gardens and rain barrels. The Madison Common Council recently adopted a Green Building Resolution proposed by Alder Satya Rhodes-Conway that will require any new or substantially renovated city-owned building to be certified under the

LEED© standard. This standard ensures new city buildings will be as energy-and water-efficient as possible.

UNIVERSITY OF WISCONSIN

The University started a water conservation program in 2002 (Dave Bonfield, UW Plumbing Shop Supervisor, Personal Communication). The plan included replacing old toilets with high-efficiency models and installing sink aerators and low-flow showerheads, and removing urinal flush tanks. Due to new construction and major remodeling, he estimates that 90% of the toilets on campus are now high-efficiency. While the showerheads have been accepted by users, the sink aerators were not very popular, and so some may have been altered. Since the inception of the water conservation program, daily water use has decreased by about 30%.

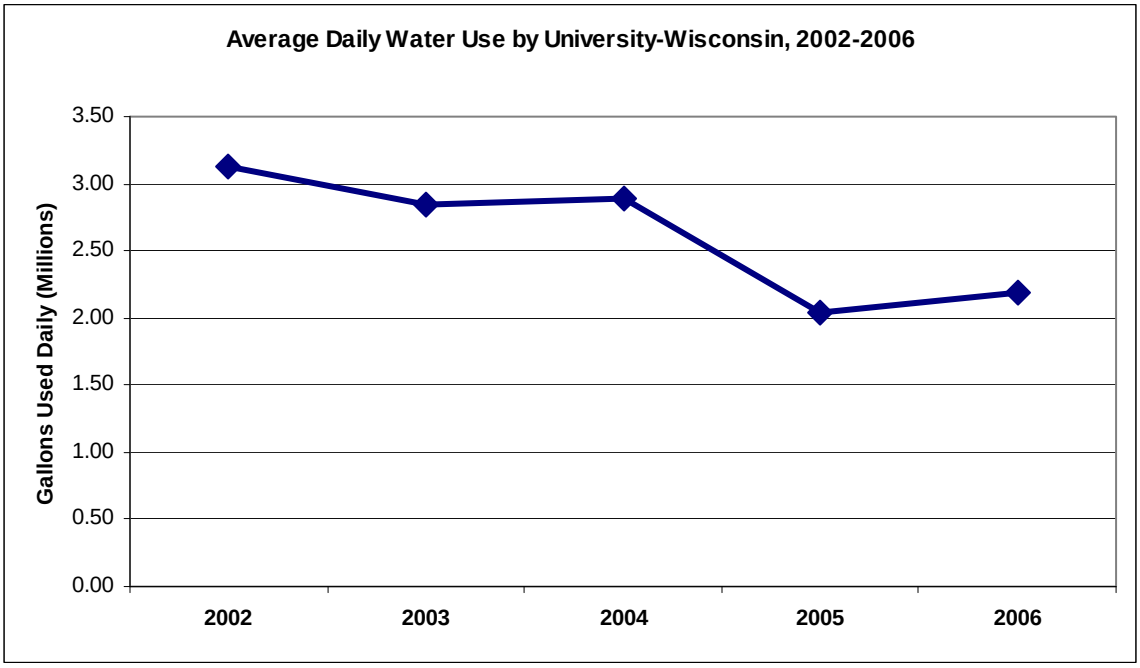

Figure 9: Average Daily Water Use at UW; data does not include dorms on Johnson Street or buildings south of University Ave or East of Randall Ave.

SUMMARY OF EDUCATIONAL COMPONENTS

RESIDENTIAL

- The promotion of the (future) **toilet-rebate program** will be an important educational opportunity for water conservation
- **Rain barrels** may be installed at some MWU facilities for demonstration purposes to allow the public to see their operational features. **Rain gardens** may

be used to reduce runoff where appropriate. MWU will incorporate the use of rain barrels and rain gardens in the renovation of the Operations Center Vehicle Maintenance Facility

- The Water Utility will continue to **provide support and speakers**, as requested, to schools and community organizations to promote education about the importance of water conservation.
- During times of high water use (hot, dry periods), the utility will continue to run **public service announcements** reminding residents of the importance of reducing water use and how to do so.
- The Utility and City will actively **promote the EPA's WaterSense** labeling program for toilets, washers, showerheads and irrigation sprinkler systems, and will lead by example by choosing WaterSense labeled products for city facilities.
- The Water Utility is getting involved in and will be making a financial commitment to locally promoting '**Green*Plumbers.***' This is a national accreditation program that educates plumbers on new, water-saving techniques and general water conservation. The program's goal is to reach 40,000 plumbers nationwide.

COMMERCIAL

- **Targeted education/outreach** to promote water conservation by commercial users is an important component of any educational program.
- **Offer educational information for clothes washers or dishwashers**, which would serve as an important educational component to several sectors of the commercial industry, specifically, the hospitality industry, nursing home/retirement communities, hospitals/medical centers, laundromats/linen service.
- Other incentive/rebate programs could include:
    - Commercial/multi-family **toilet rebate program**
    - Promotion of **"Request linen washing" cards** to the hospitality industry
    - Promotion of **xeriscaping**/landscaping with native plants that require minimal water once established
        - While landscaping companies would be the primary audience, owners of all commercial properties with extensive green spaces (business parks, retirement communities, nursing homes, shopping centers, and medical clinics) would also be targeted. In addition to promoting native landscaping, information on watering requirements, ideal times for watering, and water-conserving irrigation/watering systems will also be provided. Seminars or workshops on native landscaping could also be planned.
    - Recommendation of **water audits** or leak detection surveys to reduce water waste from leaky toilets, faucets, and showers in
        - Multi-family housing
        - Hotels/motels
        - Restaurants

        - Shopping centers/malls
        - Office/business parks
    - Provide best management practice **information to car washes** and provide certification to those car washes implementing water conservation techniques.

INDUSTRIAL

After developing **individual facility plans**, the final step is educating employees and involving them in water conservation efforts. Employees can have a major effect on the success of a water conservation program. It is important to educate and train key employees to make conservation efforts the most effective. Employees must be informed about the program and be made an integral part of the water reduction effort. An important part of this process is the formation of a water conservation and energy team within the organization, though the facility's water conservation goals should be shared with all employees. Industrial customers should educate employees about costs for water, sewer and electrical. These costs should be logged periodically. It is important for the industrial customer to stress to employees that even small projects can produce large savings in water consumption and to publicize water conservation successes--internally and externally. The Water Utility would provide educational materials specific to each customer's need, based on the site audit and water conservation plan.

- The Water Utility should consider an **awards program** to reward and honor industrial customers for their water conservation successes. The Water Utility would present a suitable plaque or certificate of achievement to the chosen industrial customers.

SUMMARY OF CONSERVATION GOALS

The following list is a summary of recommendations put forth in this plan. The goals within each category are listed in order of suggested priority.

	Objective: Maintain Current Pumping Levels			
	Recommendations	**Implementation**	**Timeline**	**Cost**
RESIDENTIAL	**Reduce per capita water use by 20% by year 2020.**	Concerted effort by customers, Water Board, Common Council, & Water Utility Staff	2020	
	Establish a toilet rebate program. Using the figures of the AWWA, Table 1, high efficiency toilets could reduce the daily water use by 10.3 gallons per capita or about 2,301,000 gallons per day or about the output of one well. This represents two-thirds of goal to reduce residential water use by 20% by 2020. A rebate of $100 per dwelling unit is considered a sufficient inducement to encourage the replacement of existing fixtures with high efficiency toilets. It is estimated that the total cost to the customer, using a licensed plumber would be approximately $350 per fixture. It is anticipated that a number of residents would undertake the work themselves. The sum of $250,000 representing 2,500 toilet replacements per year at $100 per dwelling unit has been requested as a part of the annual rate structure. This rebate program would be administered in much the same manner as the Water Utility's successful lead service replacement program, which is drawing to a close. As in the lead service replacement program, the Water Utility proposes to partner with the plumbing construction firms to undertake the work. Consideration will be given to the aspect of recycling the metal from the replaced toilets. The ceramic portion of the fixtures may not lend itself to recycling. Other communities have adopted more ambitious rebate programs including rebates for dishwaters and washing machines. However, the actual reduction of water consumption is harder to document than toilets and not affordable for the Madison Water Utility, at this time.	Water Utility Staff with Assistance from the Recycling Coordinator of the Street Division.	October 2008 (Subject to Rate Structure Approval)	$250,000 annually
	Provide customers with current consumption data The Madison Water Utility issues its bills twice per year to its customers. This does pose a challenge to customers who wish to monitor their water use. However, each customer does have a remote register that measures water use. Generally these registers are located on the side of the dwelling unit and measure consumption in cubic feet. This initiative would provide instruction to customers to track their water use on a monthly basis. Each customer will be mailed a card stock form, which can be used to determine their water use and convert the usage to gallons. In addition, a digital water use tabulator shall be developed so that the customer can load their usage on their computer along with the date and number of residents. The water use tabulator can calculate usage and compare that usage with typical customers. The estimated cost should be on the magnitude of $10,000, with programming. An additional $15,000 would have to be expended for public information.	Water Utility Staff with Vendor Programming Assistance.	January 2009	$25,000

	Enact inclining rate structure A modest rate structure has been proposed to the PSC (Wisconsin Public Service Commission). The rate request was 18%, reflective of the Utility's straitened financial situation. The concept of the proposed inclining rate structure was a rate structure for: 1. The lowest 20th percentile of usage at 61 gallons per day. 2. A Conserving Level at 148 gallons per day. 3. A median level at 184 gallons per day. 4. The 80th percentile at 225 gallons per day. A more aggressive rate structure may be proposed at such time as more frequent bills can be issued or that customers are able to tract their usage with practice.	Water Utility Staff and Wisconsin Public Service Commission	October 2008 (Subject to Rate Structure Approval.)	
	Investigate the Conversion of Water Meters to Provide for Quarterly Billing and the Potential of Monthly Billing (To make a switch from semi-annual to quarterly billing using a non-AMR system would be $417,000 in semi-annual operating costs.)	Water Utility Staff	2011	Capital cost of $5,370,000 in 2010, $5,370,000 in 2011.
	Enact Outdoor Water Usage Restrictions to Maintain Pumpage Below a Preset Daily Amount Section 13.04 of the Madison General Ordinances provides for Voluntary and Mandatory Restrictions for outdoor water usage, which is generally irrigation of turfed areas. In 2007, there were 29 days where pumpage exceeded 40 MGD, 11 days in which pumpage exceeded 45 MGD, and 3 days where pumpage exceeded 50 MGD. This goal would provide that voluntary restrictions be imposed whenever pumpage exceeded 45 MGD for 3 continuous days and manatory restrictions whenever pumpage exceeds 50 MGD for 2 continuous days. While not directly tied to water conservation, the enactment of water usage restrictions would save on electricity during high use days and inform the customer regarding the limitations of the system.	Water Utility Board, and Water Utility Staff	July 2008	$0
	Expand residential water audits from the current high-bill leak detection to include individual requests for onsite inspection/ personalized recommendations	Customer Service/ PIO/ Conservation Manager	Long Term	

	Offer appliance upgrade program for washing machines/ dishwashers	PIO/ Conservation Manager	Long Term	

	Recommendations	Implementation	Timeline	Cost
COMMERCIAL	**Target high-use customers with education/outreach to promote water conservation**		Short Term	
	Enact landscaping ordinance for new development/major redevelopment	General Manager	Intermediate	
	Offer appliance upgrade program (e.g., for laundromats)	PIO/ Conservation Manager	Long Term	
	Enact a certification program for water-efficient buildings	PIO/ Conservation Manager	Long Term	
	Enact a car wash reclamation ordinance	General Manager	Long Term	
INDUSTRIAL	**Perform individual audits for customers**	PIO/ Conservation Manager	Short Term	
MUNICIPAL	**Quantify water use by Water Utility with better record keeping**	Supply/ Operations	Short Term	
	Continue to minimize reservoir dumping	Supply	Short Term	
	Emphasize and expand the leak-detection program Requires purchase of new equipment and devoted work-hours	Operations	Short Term	
	Upgrade Water Utility bill with new software	Customer Service	Short Term	
	Install use meters in well buildings	General Manager	Intermediate	
	Audit other government buildings for water use	PIO/ Conservation Manager/ Facilities Manager	Intermediate	
	Reduce hydrant flushing as well filters are installed (when appropriate)	Engineering	Intermediate	

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APPENDIX Q

WATER CONSERVATION INFORMATION

Tom Heikkinen
General Manager

Administrative Office
119 East Olin Avenue
Madison WI 53713
Main: (608) 266-4651
Fax: (608) 266-4426
TTY: (866) 704-2315
Email: **Water Utility**

To report an emergency, 24/7 call Madison Water Utility at (608) 266-4665

Office Hours:
Monday-Friday: 7:30am - 4:00pm

SUSTAINABILITY

- Home Conservation
- Lawn & Garden
- Toilet Rebate
- Water Conservation
- Businesses (PDF)

Home Conservation

Madison Water Utility is leading an effort to develop a comprehensive water conservation program for the city. Completed in 2008, the Water Utility Water Conservation and Sustainability Plan looks at a variety of things that can be done by the city and its residents and businesses to reduce our impact on the water resources that help make Madison such a great place to live, work and play. View the plan here.

Is There a Leak?

Any water-using device or pipe connection can leak. There is usually some evidence of such problems, but the evidence isn't always obvious: A toilet leak can be noisy but it can also be rather quiet; a dripping faucet can be overlooked. Checking the water meter can be a good way of finding out if there is a water leak:

- The meter in the basement may have a small (1/4-inch) "leak detector" dial, a blue gear-like fitting visible on the face of the meter with no numbers or markings. If there is any movement of that dial when water isn't in use, there is likely to be a leak. (Be sure the water softener isn't cycling and no other water-using appliances are operating when you check this.)
- The meter in the basement shows movement of water through the meter, registering on a digital display, including tenths and hundredths, and often on a one-cubic-foot dial showing the precise amount of water being used. Checking the meter for any change in the display or movement on the dial after a period of time when no water has been used will reveal whether any water is being lost.
- The register on the outside of the house shows a digital display to tenths of cubic foot (7.48 gallons) and can also be checked for any registration when no water has been in active use.

Repair Leaky Faucets

At one drop a second, a leaky faucet can waste more than 3000 gallons of water in a year. Most leaks are easily

Resources

- Water Sense Efficiency Program, *U.S. EPA*
- Do's and Don'ts Around the Home, *U.S. EPA*
- H2OUSE
- EnergyStar water use information
- EnAct program (includes an extensive practical online guide)
- Sustain Dane's Rain Barrel Program

repaired with basic know-how and simple tools. Good reference books and articles are available, hardware store and home center staff can be very helpful--and the cost of a plumber may be minor compared to the costs of damage. View Drip Calculator, *American Water Works Association*.

Toilet Leaks

Listen and watch for toilet leaks. To test for "flapper" leaks, put a coloring agent--food coloring, egg dye or other water-soluble color--in the toilet tank, and check to see whether any of the color leaks into the toilet bowl within ten minutes. Flapper replacement is the most common remedy for such leaks. Check float ball assemblies for corrosion of metal components that may prevent the shutoff of water refilling the tank so that it runs over into the overflow pipe; such leaks won't show in a dye test but can cause great water loss.

Backflow Prevention Devices

Install backflow prevention devices on outdoor faucets, sprinkler system, and laundry tubs, or any other threaded faucet. The devices, available in most hardware stores, prevent possible contamination by reverse flow of products used in the home or garden into the water distribution system.

Good Practices

- Install water-saving devices: Aerators for kitchen and bath taps, flow regulators for shower heads and toilet tanks, and high-efficiency toilets to reduce the amount of water used in every flush.
- Use automatic shutoff attachments on hoses, and don't let the water run unnecessarily while washing the car or for other outdoor uses.
- Use the most efficient settings for dishwashers and clothes washing machines. Full loads are often the most efficient. When it's time to replace appliances, consider water efficiency in your choice.
- Use nontoxic and biodegradable soaps and cleansers, or try environmentally friendly options: Baking soda provides abrasive nontoxic cleaning; vinegar's acidity makes it a good cleaning option when mixed with water; borax is an effective laundry cleaning agent as well as abrasive.

- Turn off the tap when not actively rinsing (toothbrush or razor as well as in the kitchen) or washing hands.
- Think of practices and habits that might be changed to make a difference. Can showers be shorter? Sidewalk and driveway swept rather than hosed?
- Electrical energy is needed to pump water from the well and send it to our homes and work places. Conserving energy and water is critical during electrical power shortages, and makes very good sense all of the time.
- Activities that use significant amounts of water--both indoors and outdoors--can be timed to help manage periods of high demand for electricity.
- **When it's time to replace appliances, purchase more energy-efficient and water-efficient ones.** Initial costs may take some time to be offset by water savings, but savings for electricity use are often very quick, rebates are sometimes offered, and there are often other features on the newer appliances that help compensate for the aggravation, expense, and use of resources involved with replacing the earlier model.
- Household toxic wastes? Flushing or pouring toxic substances down the drain and into the sanitary sewer system isn't a good practice for disposing of them. Toxic materials may end up in our water supply, or someone else's.
- How about that garbage disposal? Instead of grinding up food wastes and sending them into the sanitary sewer system, use them for making compost --or grind them up into pretty-near compost in the food processor or blender to speed things along.

Lawn & Garden

Good Fertilizing Practices

- When using fertilizer and applying it with a spreader, clean it after each use—over a grassy area well away from the storm sewer.
- Fall fertilizing is best for healthy lawn growth.
- Test the soil to see whether fertilizer is needed and apply only what's needed.

Good Lawn Practices

- Grow the mix of grass varieties for our area—fescues, perennial ryegrass and Kentucky bluegrass, in descending order of quantity.
- Mow to two-and-a-half to three-and-a-half inches.
- Sharpen mower blades frequently, and avoid cutting more than 1/3 the length of the grass at one mowing.
- Leave grass clippings on the lawn, spreading out clumps; the clippings will disappear after giving up their moisture and nitrogen.
- Try lawn weed control measures based on good mowing, watering and nutrient-monitoring practices. If hand digging and other efforts—including tolerance—have failed, pursue the least-toxic practices and remedies.
- Lawn watering guide

Good Planting Practices

- Plant native plants. Native plants are tolerant to variations in local climate and generally need little watering, fertilizer, pesticides or mowing. To learn more, visit UW Extension, Landscape Plants of the Upper Midwest.
- Group plants that have similar cultural needs to make the most of resources and your time.

Collect rain water in a rain barrel

- Water that runs off hard surfaces such as the roof can be collected and reused to water plants. Rain

Resources

- Water Sense Efficiency Program, *U.S. EPA*
- Do's and Don'ts Around the Home, *U.S. EPA*
- H2OUSE
- EnergyStar water use information
- EnAct program (includes an extensive practical online guide)
- Sustain Dane's Rain Barrel Program
- DNR Pharmaceutical Waste information

water is “soft,” without groundwater minerals or added chlorine or fluoride, so it is more plant-friendly than tap water. Capturing water from gutters and downspouts in a well-designed rain barrel conserves the municipal supply while providing the best water for lawn and garden. To learn more, go to Sustain Dane’s Rain Barrel Program.

Insects and Pests

- Know which insects are beneficial, which are actually damaging plants and which are just passing through; again, pursue the least-persistent and least-toxic remedies. Have you tried hand (or glove) picking? Insecticidal soap? Dish soap and oil in water sprayed on shelled insects? isopropyl alcohol on aphids? a 1:9 milk:water solution to kill plant mildew?

RAIN GARDENS

- City of Madison Engineering, Water Quality Initiatives, Rain Garden

Residential Customer Toilet Rebate

(If you meant to go to the Apartment Building Toilet Rebate page, click here.)

NOTICE: As of October 6, our high-efficiency toilet rebate program is OUT OF FUNDS for 2010. Applications may still be submitted and will be put on a waiting list for 2011 rebates.

Program Overview

The Madison Water Utility is offering rebates of up to $100 for residential customers who replace their high water using toilets with EPA WaterSense-rated High Efficiency Toilet (HET) models. The program is part of the utility's Water Conservation and Sustainability Plan to reduce per capita water usage 20 percent by the year 2020, with the goal of protecting the quality and quantity of the deep-well aquifer that supplies the Madison area.

Toilets eligible for rebate must be HETs (which use an average of 1.28 gallons per flush) and must be on the Environmental Protection Agency's (EPA) WaterSense list. Any toilet that meets the criteria and is purchased after January 1, 2009, will be eligible. Rebates will be in the form of checks sent to the customer's residence of record; the check amount will not exceed the purchase price of the toilet.

To apply for the rebate, you must submit two items: the original, dated sales receipt for the toilet showing the manufacturer's model name and number and the completed application form (PDF). (You should keep a photocopy of your receipt.) These items must be mailed to the following address:

Madison Water Utility
Toilet Rebate Program
119 East Olin Avenue
Madison, WI 53713

Eligibility

Participants in the program must be residential customers of the Madison Water Utility, and the installation address must be in the customer service area of the utility. Qualified customers are those who live in single-family homes, condos, or apartments in buildings no larger than four units. Rebates are for replacement of existing larger-capacity toilets, and are not for new construction. Rebates are first-come, first-served, until funding is exhausted. The program is for only one rebate per household. Eligible replacement toilets must be HETs listed on the EPA WaterSense website (Click on the Product Category toilets, then click on the brand name, then on the model name, and then on the SEARCH button to find the model number--which will appear at the bottom of the WaterSense page).

Installation

Homeowners may install the toilets themselves, or they may hire a plumber or contractor to do the job. Owners are responsible for proper installation and associated costs. Installation may be subject to verification by water utility personnel. Toilets may be purchased at any supplier as long as they are on the WaterSense list of HETs.

Rebates

Rebate checks of up to $100 (not to exceed actual purchase price) will be sent to the customerâ€™s address after applications are processed. Please allow four to six weeks. Rebates are not available for the costs of installation.

Disposal of Old Toilets

Replaced toilets should be placed at the curb for pick-up by the City Streets and Recycling Department.

For more information, call the Madison Water Utility at (608) 266-9129.

Download the Toilet Rebate Application Form (PDF)

To view the Toilet Rebate Video, download Adobe FlashPlayer.

The Madison Water Utility has led an effort to develop a comprehensive water conservation program for the city. The Water Conservation and Sustainability Plan of 2008 (PDF) looks at a variety of things that can be done by the city and its residents and businesses to reduce our impact on the water resources that help make Madison such a great place to live, work and play. Read a message from the design team that developed the plan (PDF)

Good Outdoor Watering Practices

- Water lawn and garden, not pavement: Position sprinklers so that water lands on plantings and isn't lost to evaporation or the storm drain.
- Check weather reports or buy a rain gauge to monitor whether watering in addition to rain is needed; most established lawn and garden plantings do well on an inch of water per week.
- During drought, turf grass plants need only 1/4 inch of water a month to survive. If lawn and garden do need water, limit loss to evaporation.
- Water before 8:00 a.m. when it isn't windy, position a sprinkler to avoid losing water on driveways or sidewalks, and water slowly so the soil can absorb the water.
- Water the lawn only when needed. Step on the grass; if it springs back up when you move your foot, it does not need water.
- Water less frequently and thoroughly. A good soaking is better than watering frequently and will allow the roots to grow to greater depths and help make turf more drought tolerant. Lawns need about 1 inch per week. Hint: Place 3-5 empty tuna or cat food cans at varied distances from the sprinkler. The time it takes to fill the cans is about how long you should water your lawn.
- Consider alternate-side use in hot, dry conditions when many people may be watering. In addition to the recommendations above, if your house has an even-number address, limit outdoor use to even-numbered calendar days; if it has an odd-number address choose odd-numbered calendar days.
- The University of Wisconsin-Extension publishes an excellent lawn watering guide (pdf).

Resources

- Sustain Dane
- My Fair Lakes.com
- Dane County Office of Lakes and Watersheds Rain Garden Information
- UW Extension Home & Garden
- EnAct Program
- Wisconsin DNR Water Protection Milestones
- City of Madison Engineering Division Water Quality Initiatives
- Special drug disposal collection days, City Streets Division and Dane County MedDrop
- EPA WaterSense

Collect rain water in a rain barrel or cistern

Water that runs off hard surfaces such as roofs can be collected and put to use in the garden. Rain water is "soft," without groundwater minerals or chlorine, so it's more plant-friendly than tap water. Capturing water from gutters and downspouts in a well-designed rain barrel conserves the municipal supply while providing the best water for lawn and garden. To learn more, visit Sustain Dane's rain barrel program.

Only Rain In The Storm Drain!

Everything from our streets drains to surface waters and someone's ground water, so we need to try to keep plant material, toxins (fertilizer, pesticide, herbicide) and debris out of the storm sewers—and we need to avoid wasting ground water by sending it down the storm drain.

Rain gardens

Manage rainfall on your property as much as possible, using the contour of the area and plantings to slow the flow of water, use it and offer it back to the atmosphere. To learn more, visit City of Madison Engineering, Water Quality Initiatives, Rain Gardens