

Estimating Water-Use Effects of In-Fill Growth versus Exurban Expansion Within the NE IL Water Planning Region

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CMAP, Chicago, Illinois

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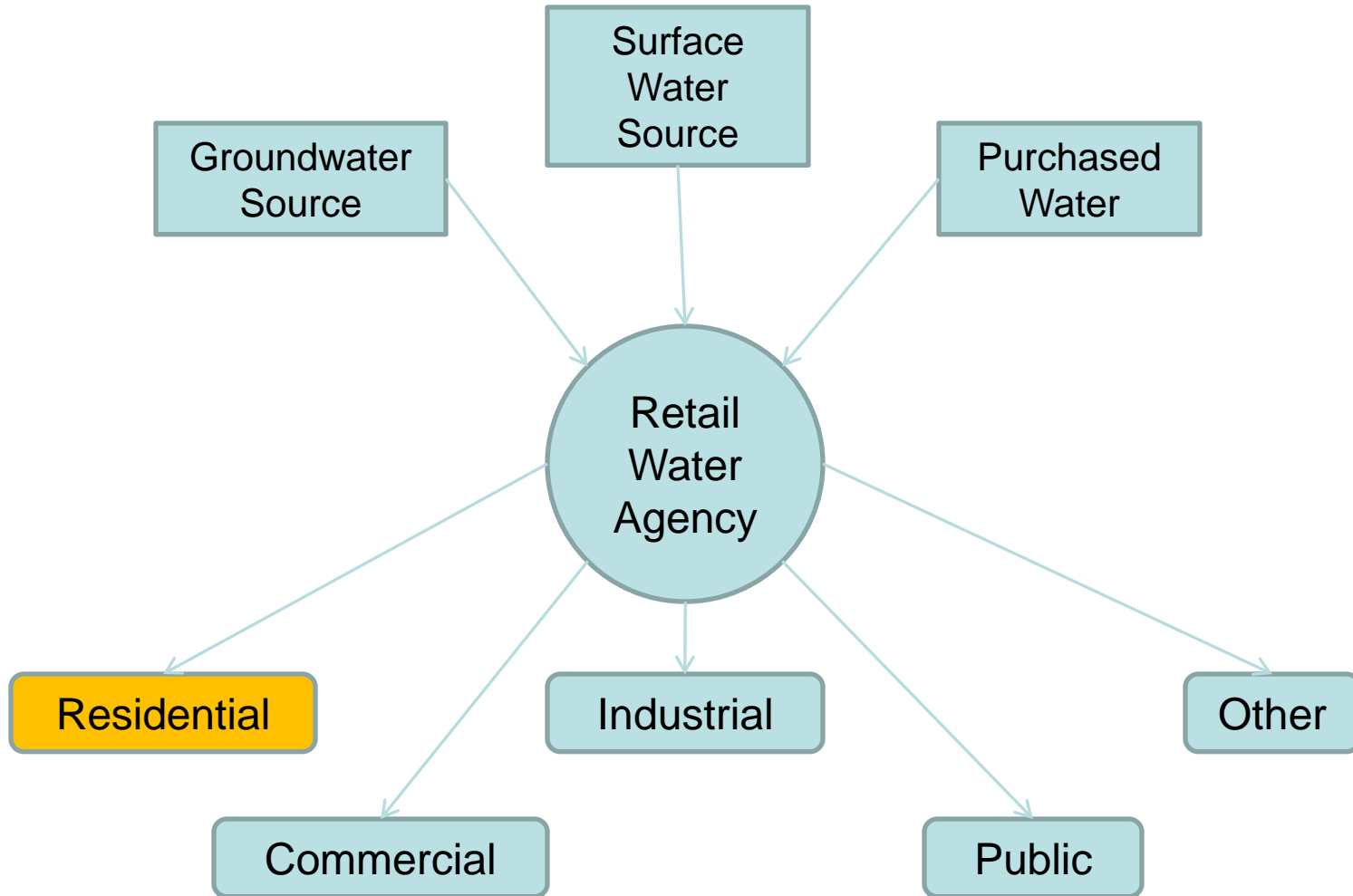
Outline

- Purpose of the study
- Data sources and limitations
- GPCD in ~300 municipalities and utilities
- Places with high and low GPCD
- GPCD in self-supplied residential areas
- Potential water savings
- Conclusions

Study Purpose

- Determine the effects of geographically differential patterns of population growth on total water use
- Differences in water use would result primarily from:
 - lower residential per capita water usage rates in multifamily dwellings in densely urbanized areas
 - higher per capita usage in single-family homes in low density suburban settings

Data: Residential Deliveries



Data Sources

- Illinois Water Information Program -IWIP
 - Annual "residential deliveries" (in gallons) by public water supply systems
 - Number of services (connections) and population served (inside and outside city)
- U.S. Census and other data sources:
 - Median household income, median home value, marginal price of water, housing units in structure (single family), gross housing density

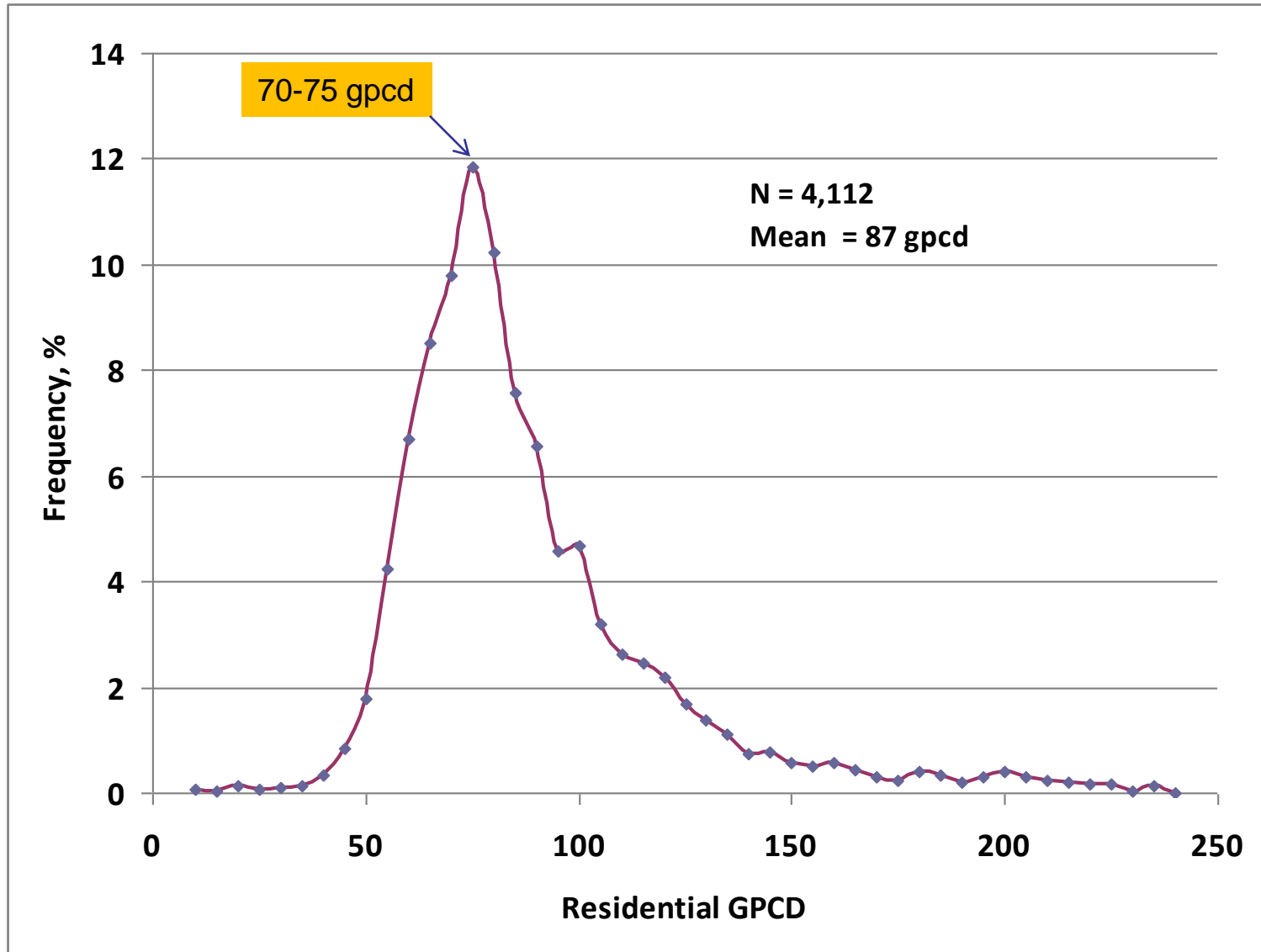
Data Limitations

- Residential deliveries reported to IWIP are not always accurate:
 - Ideally estimates should be based on the summation of all metered quantities for all residential accounts
 - But often they are estimated indirectly (by subtracting consumption for large meters or summing only small meter sizes)
 - Apartments are sometimes classified as commercial users

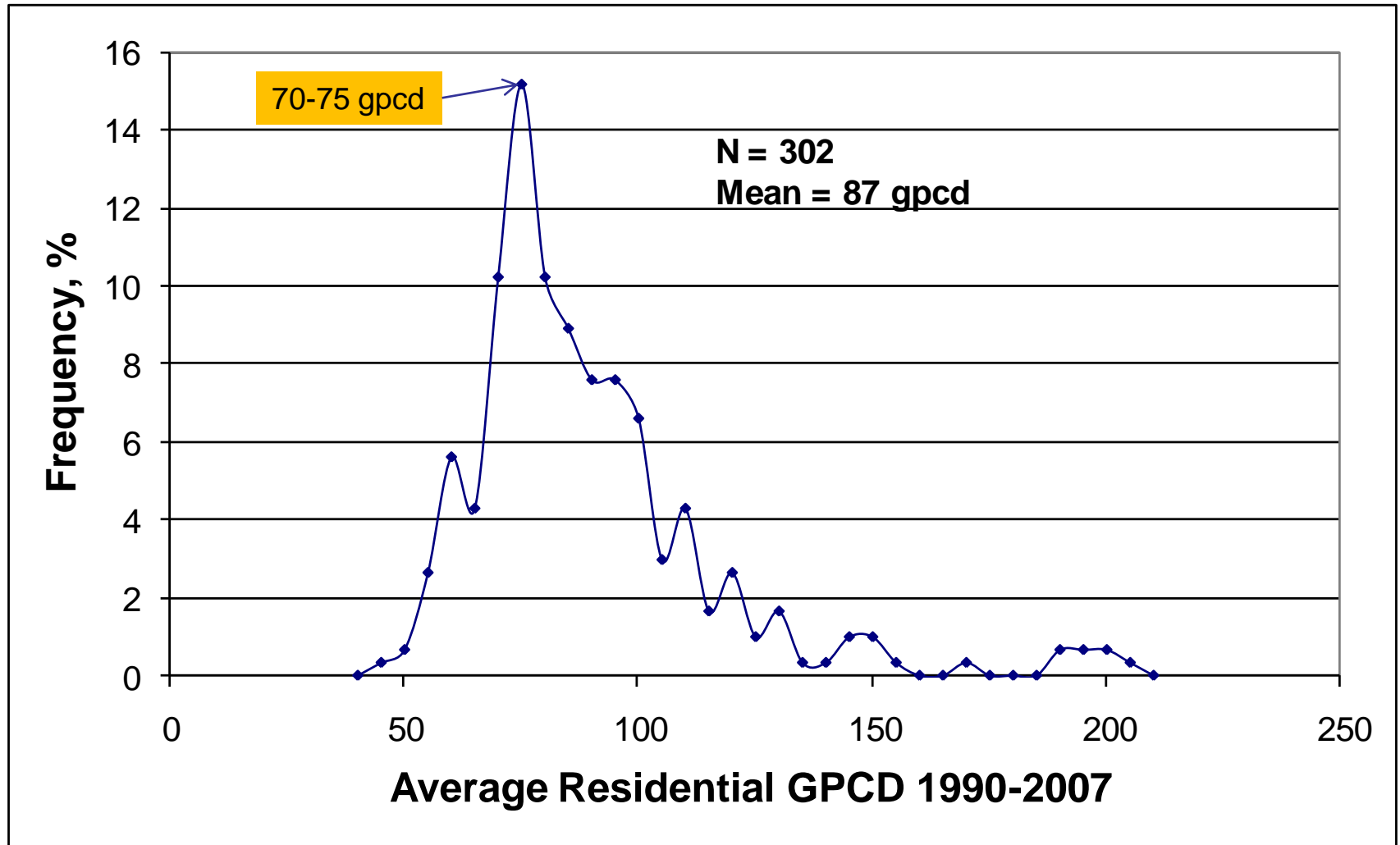
Data Limitations, cont.

- "Population served" is not known precisely and may not be updated on annual basis
- Extensive data checking and verification were necessary:
 - Values were corrected where possible
 - "Out-of-range" values were removed
- Caveat: GPCD estimates for some systems (or some years) may be in error

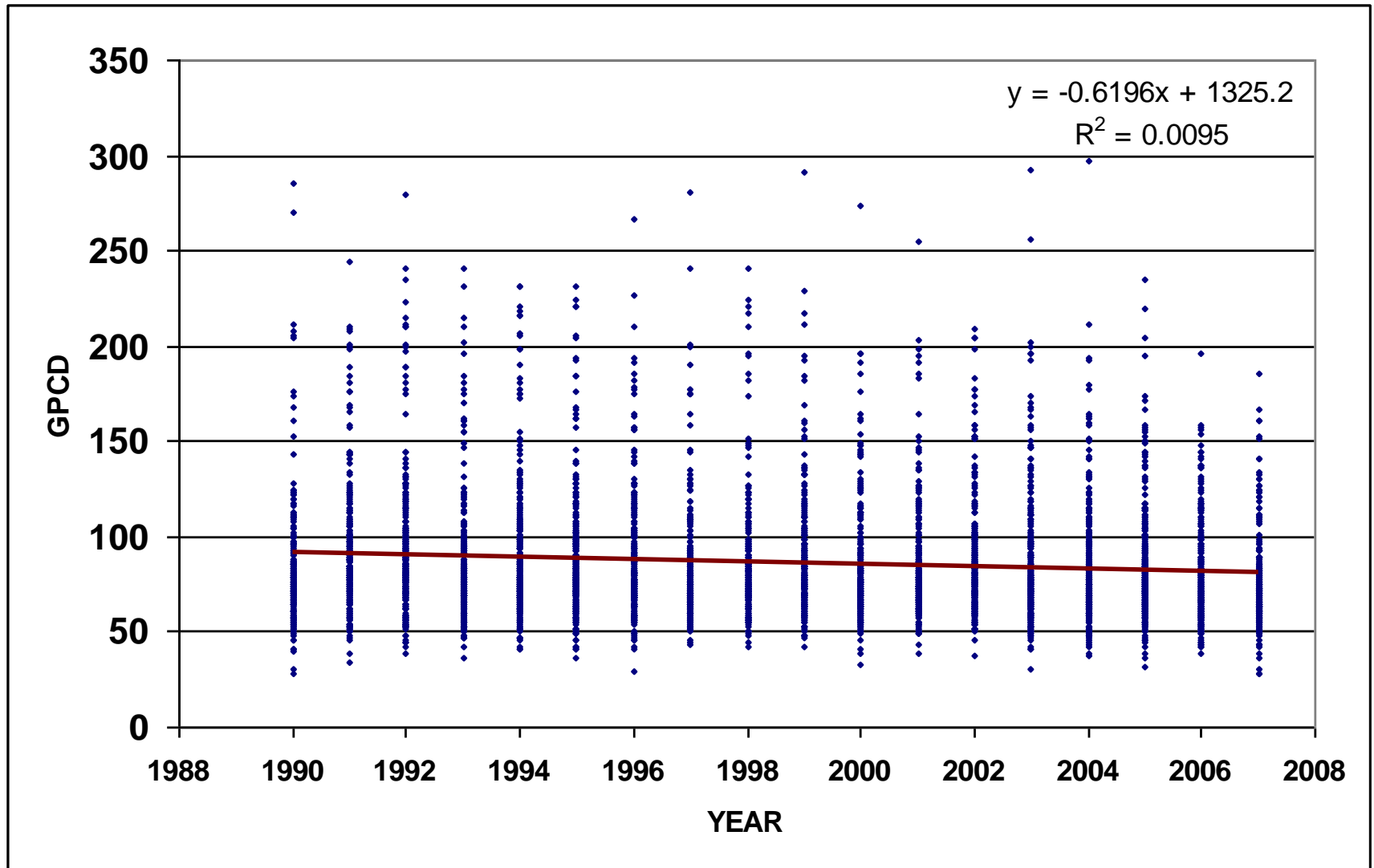
Distribution of Annual Per Capita Rates



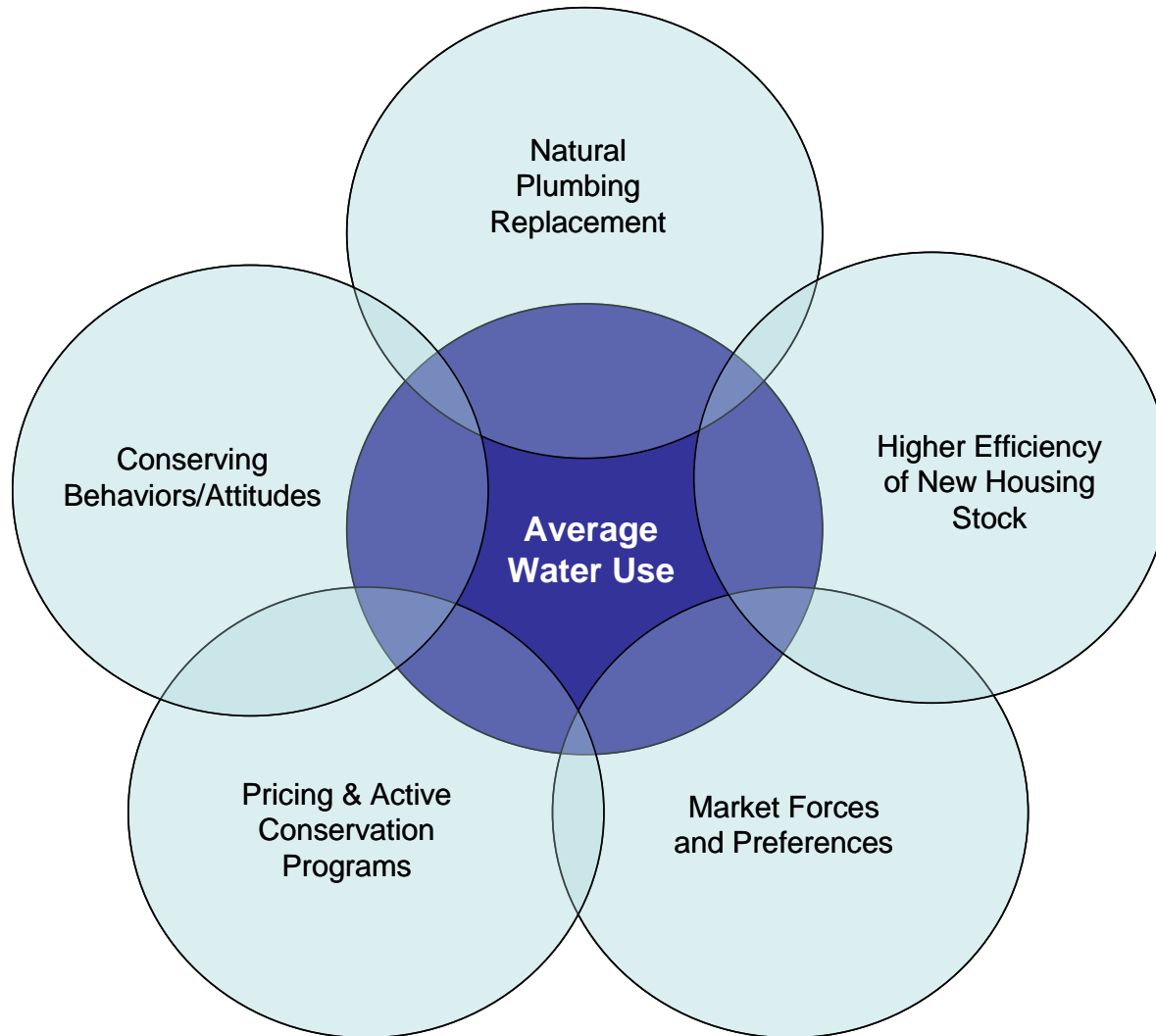
Distribution of Average Per Capita Rates



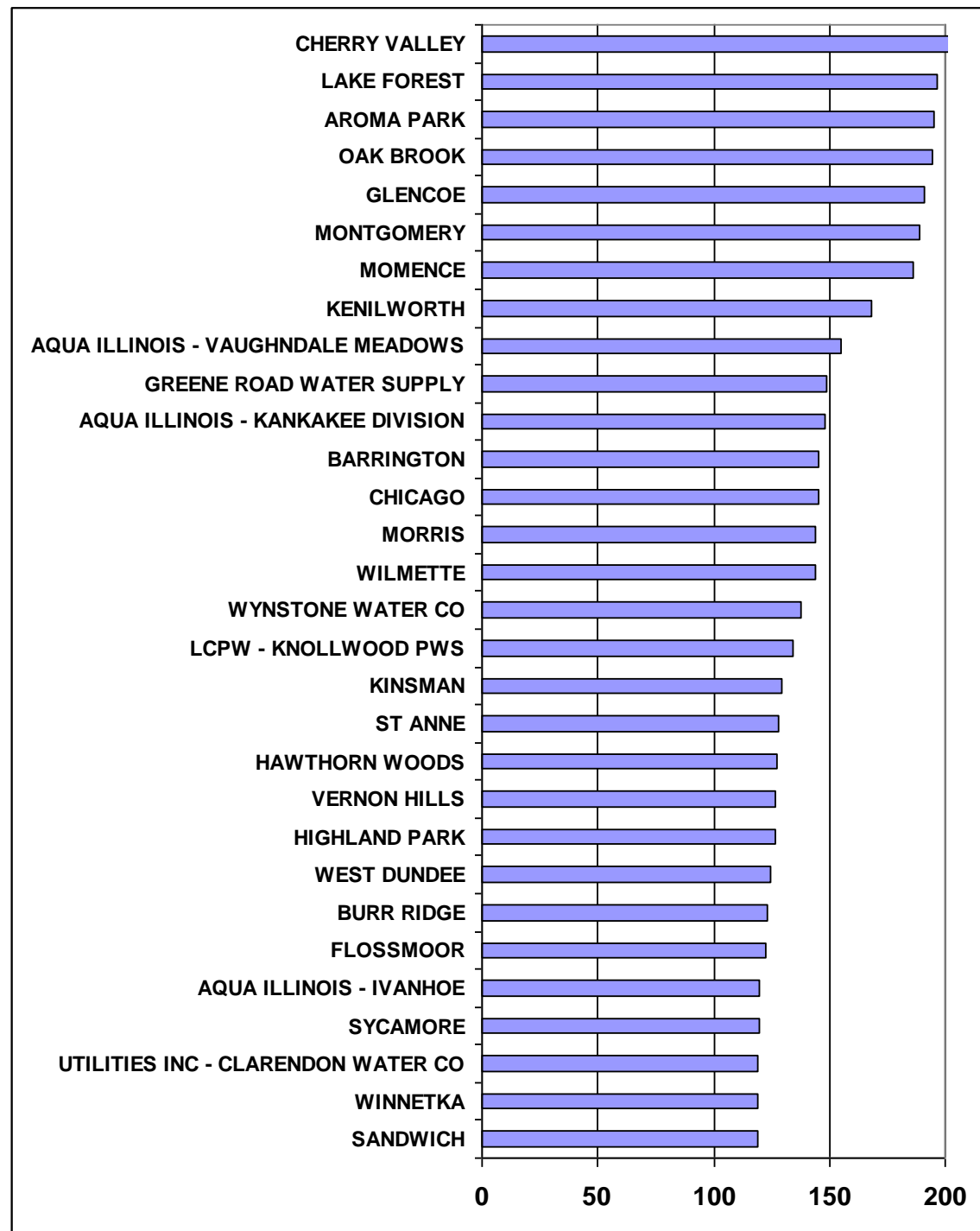
Historical GPCD Use and Annual Trend



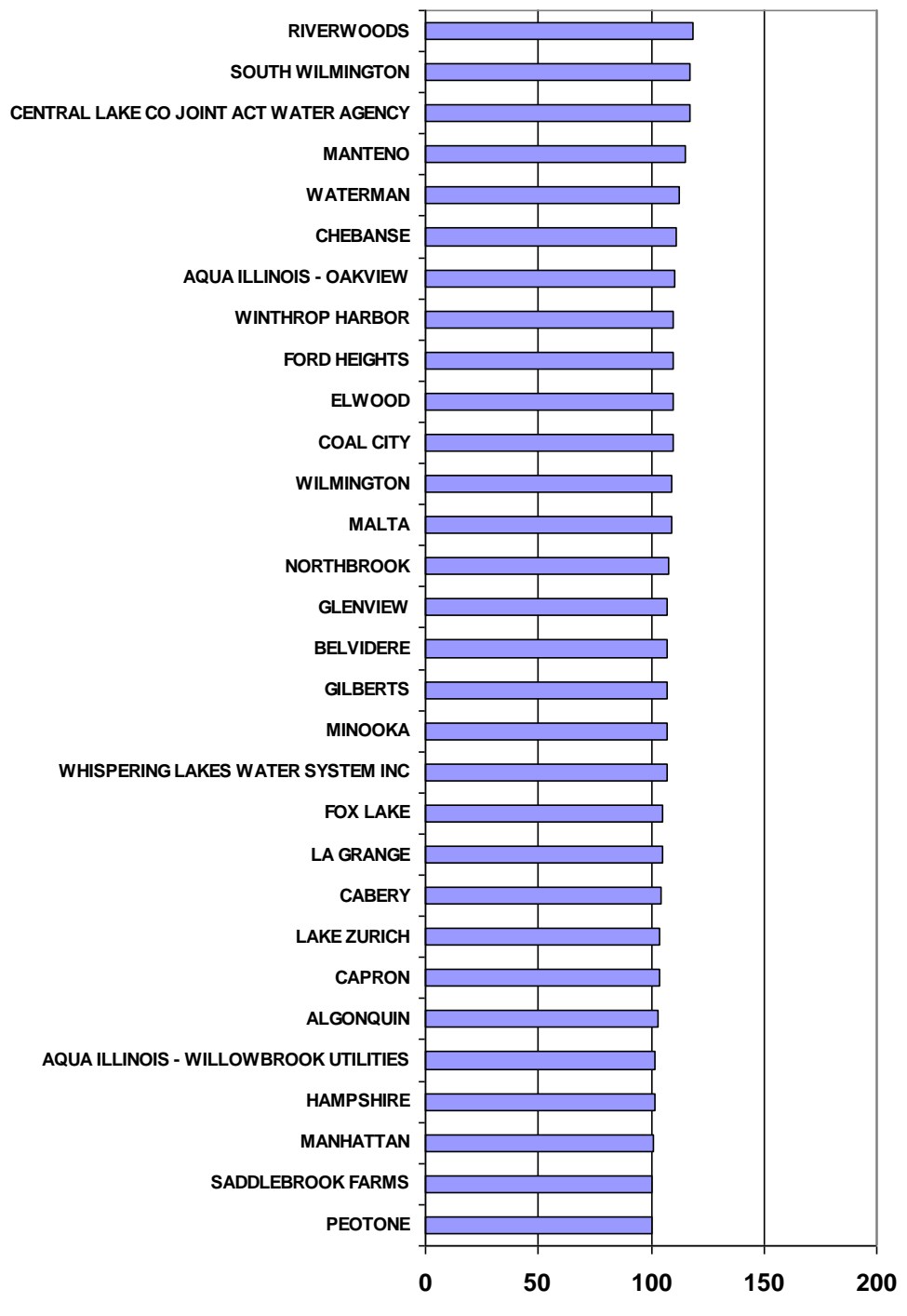
GPCDs Vary Because Many Factors Influence Water Use



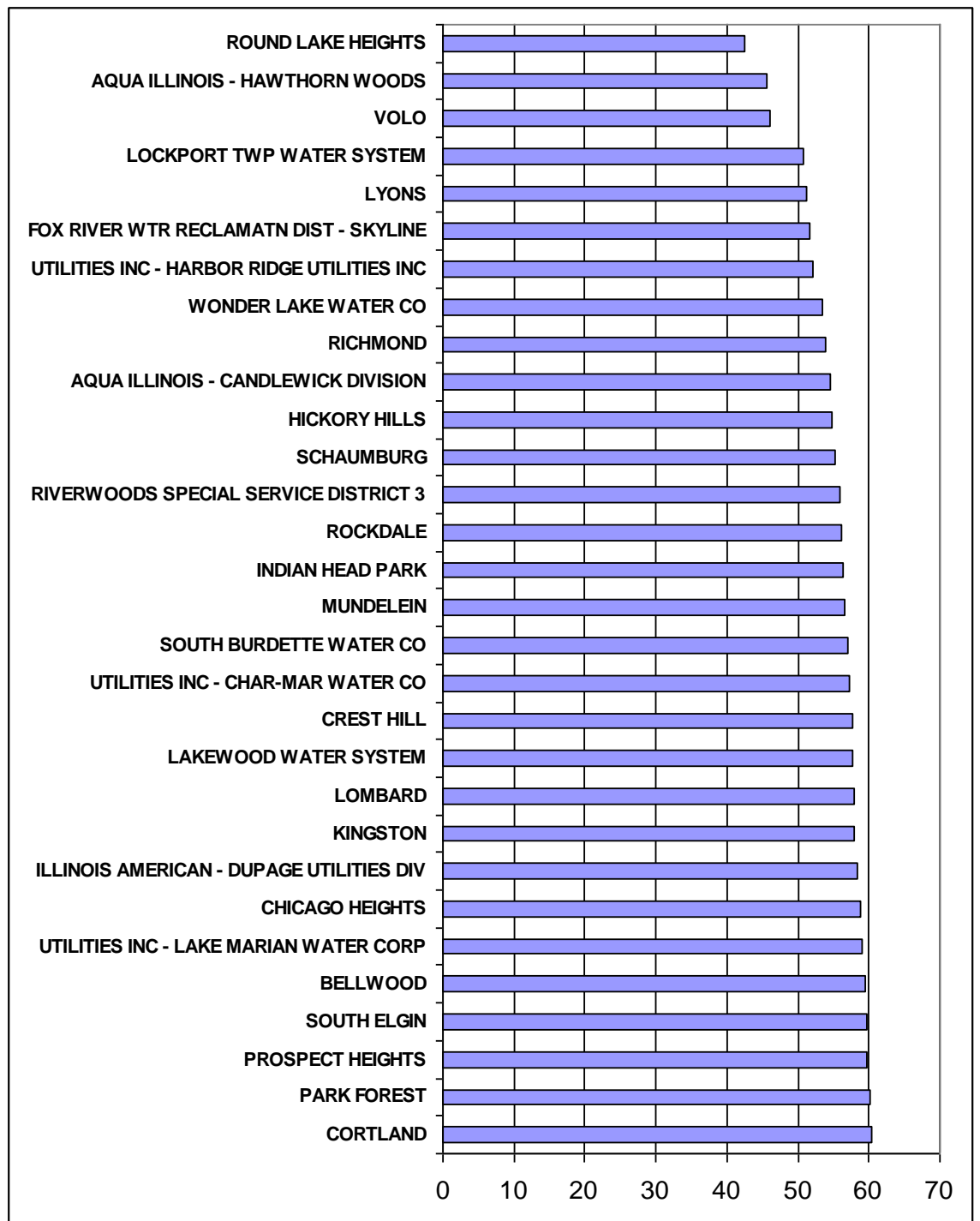
GPCD values for
top 30 communities
and systems
(top 10 percentile)



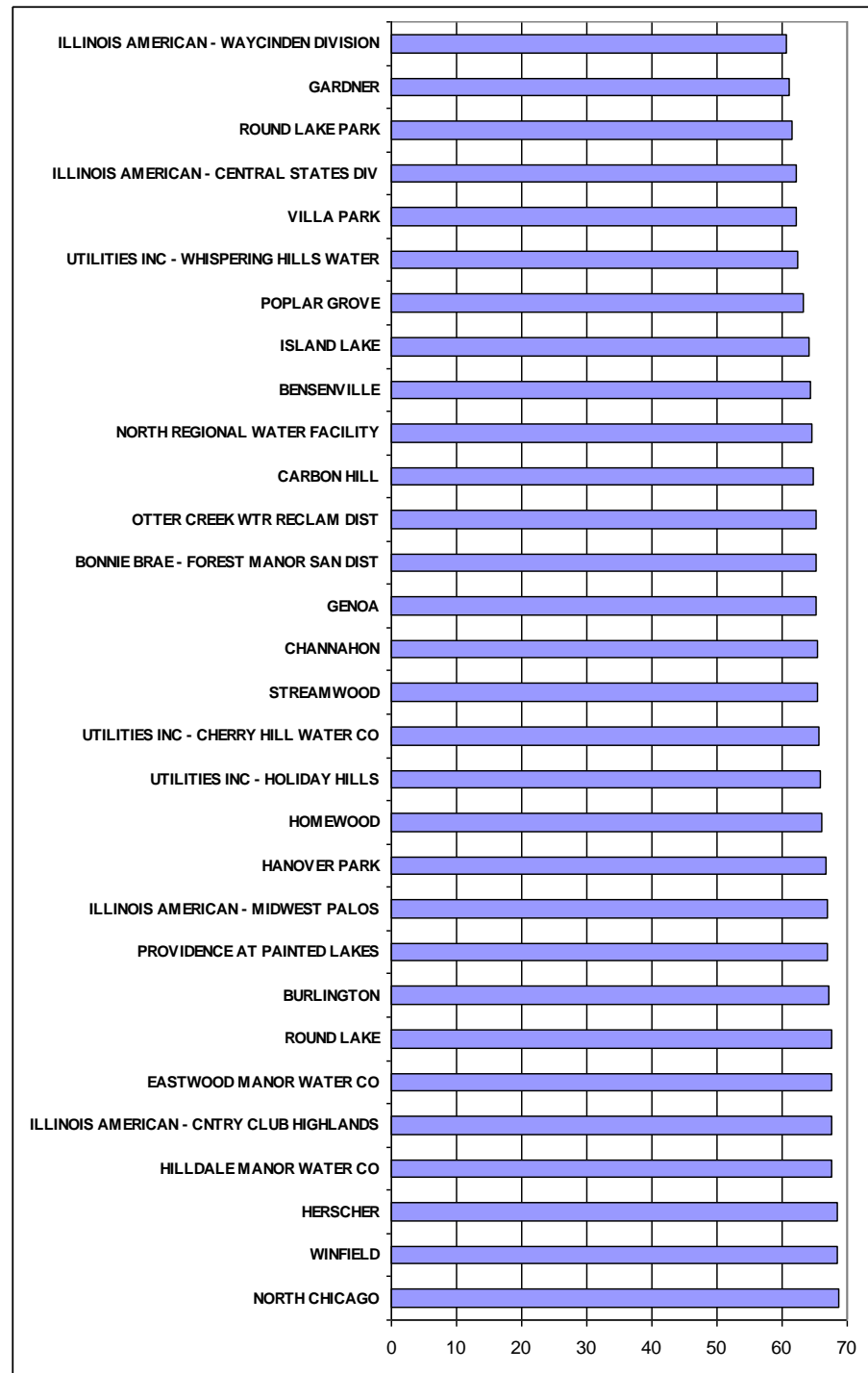
GPCD values for
top 31-60 communities
and systems
(next top 10 percentile)



GPCD values for
bottom 30 communities
and systems
(bottom 10 percentile)



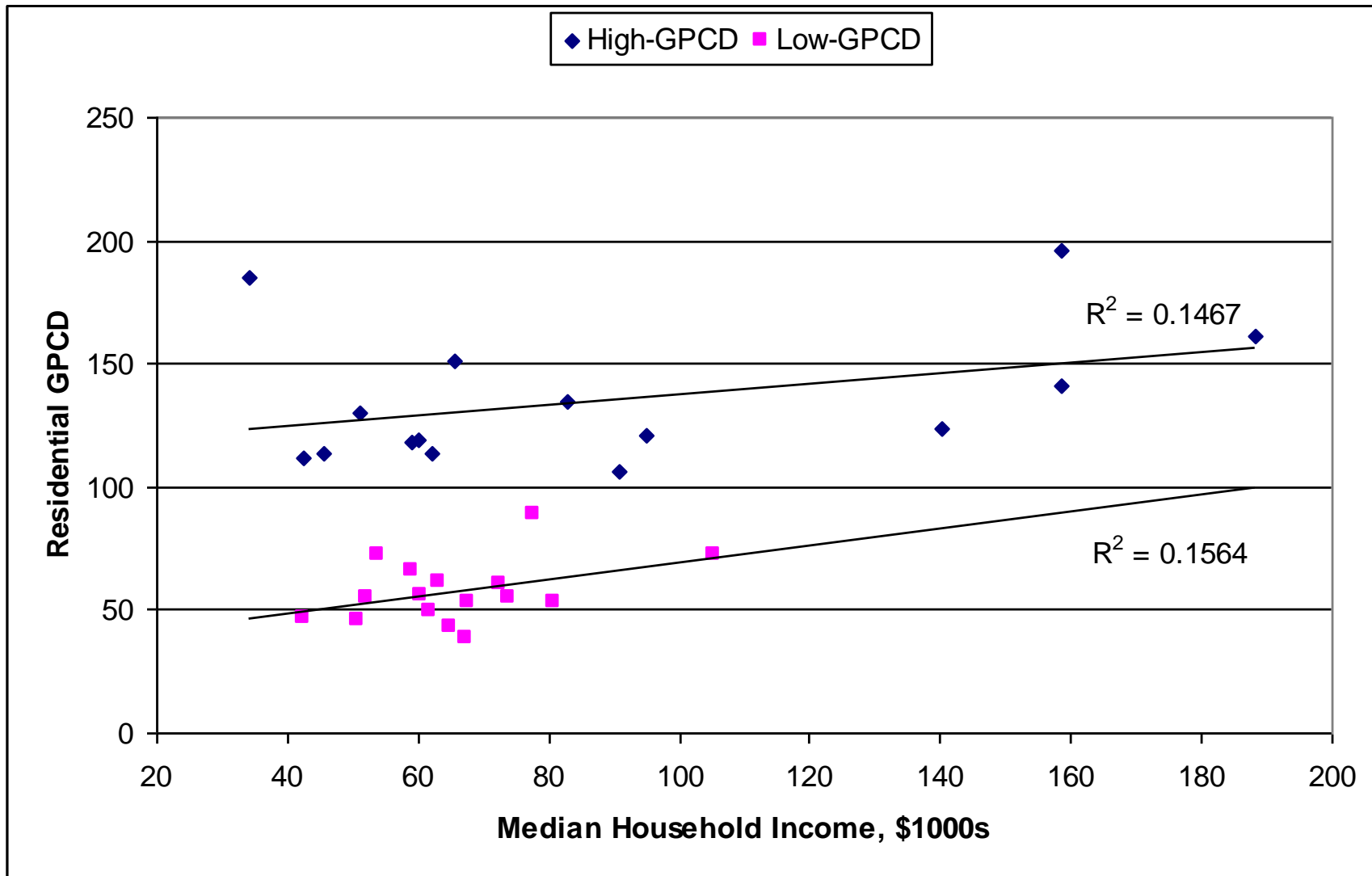
GPCD values for
bottom 31-60 communities
and systems
(bottom 10-20 percentile)



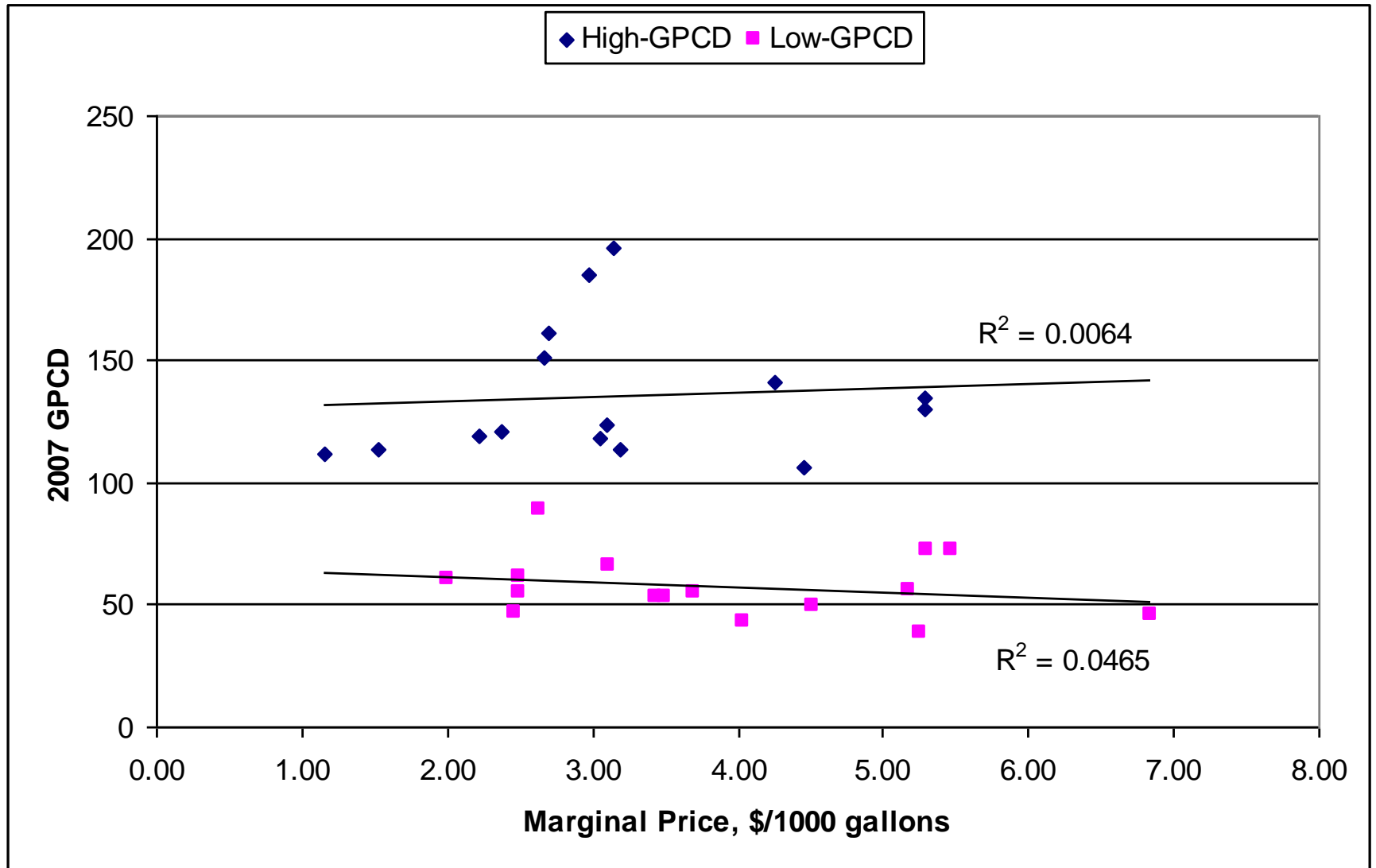
Municipality/System	County	2007 GPCD	1990-07 GPCD	2007 MHI	MP- Current	2007 MHV	SF% (1d+1a)	Housing Density
Oak Brook	Du Page	196	195	158.592	3.15	1,020.257	87	399
Aqua Illinois - Kankakee	Kankakee	185	148	34.054	2.98	105.205	63	893
Glencoe	Cook	161	191	188.215	2.69	1,173.223	91	851
Cherry Valley	Boone	151	204	65.621	2.67	183.150	79	236
Lake Forest	Lake	141	197	158.592	4.25	1,035.883	85	415
Vernon Hills	Lake	134	178	82.859	5.29	318.646	67	1,052
Morris	Grundy	130	144	51.088	5.28	209.720	68	739
Burr Ridge	Du Page	124	123	140.167	3.10	795.634	90	573
Barrington	Cook	121	145	95.102	2.37	597.569	82	849
Sandwich	DeKalb	119	119	60.149	2.22	196.426	71	821
Montgomery	Kane	118	189	58.880	3.05	211.374	79	346
Chicago	Cook	114	145	45.505	1.53	286.800	28	5,076
Sycamore	DeKalb	113	120	62.192	3.19	196.426	69	898
Momence	Kankakee	112	186	42.356	1.15	139.109	80	893
Central Lake Co. JAWA	Lake	106	117	90.966	4.45	343.803	79	904
Average High GPCD		135	160	88.956	3.16	454.215	75	996

Municipality/System	County	2007 GPCD	1990- 07 GPCD	2007 MHI	MP- Current	2007 MHV	SF% (1d+1a)	Housing Density
South Elgin	Kane	89	60	77.683	2.64	240.119	71	900
Herscher	Kankakee	73	69	53.926	5.30	157.589	85	321
Sleepy Hollow	Kane	72	72	105.325	5.47	392.575	91	600
Richmond	McHenry	66	54	59.194	3.12	223.270	82	324
Cortland	DeKalb	61	60	63.185	2.50	206.072	74	412
Poplar Grove	Boone	60	63	72.637	2.00	202.769	90	107
Villa Park	Du Page	56	62	60.289	5.18	270.762	78	1,699
Crest Hill	Will	55	58	51.972	2.50	172.429	63	671
Island Lake	McHenry	55	64	73.745	3.70	235.782	96	1,014
Mundelein	Lake	54	46	80.946	3.43	263.349	81	1,179
Wonder Lake Water Co.	McHenry	53	54	67.505	3.50	225.306	99	619
Schaumburg	Cook	50	55	61.818	4.51	272.600	57	1,742
Chicago Heights	Cook	47	59	42.303	2.47	171.673	65	1,196
Lyons	Cook	46	51	50.714	6.85	237.603	57	1,912
Lombard	Du Page	43	58	64.952	4.04	282.730	67	1,757
Round Lake Heights	Lake	39	42	67.465	5.25	223.782	94	740
Average Low GPCD		57	58	65.854	3.90	236.151	78	949

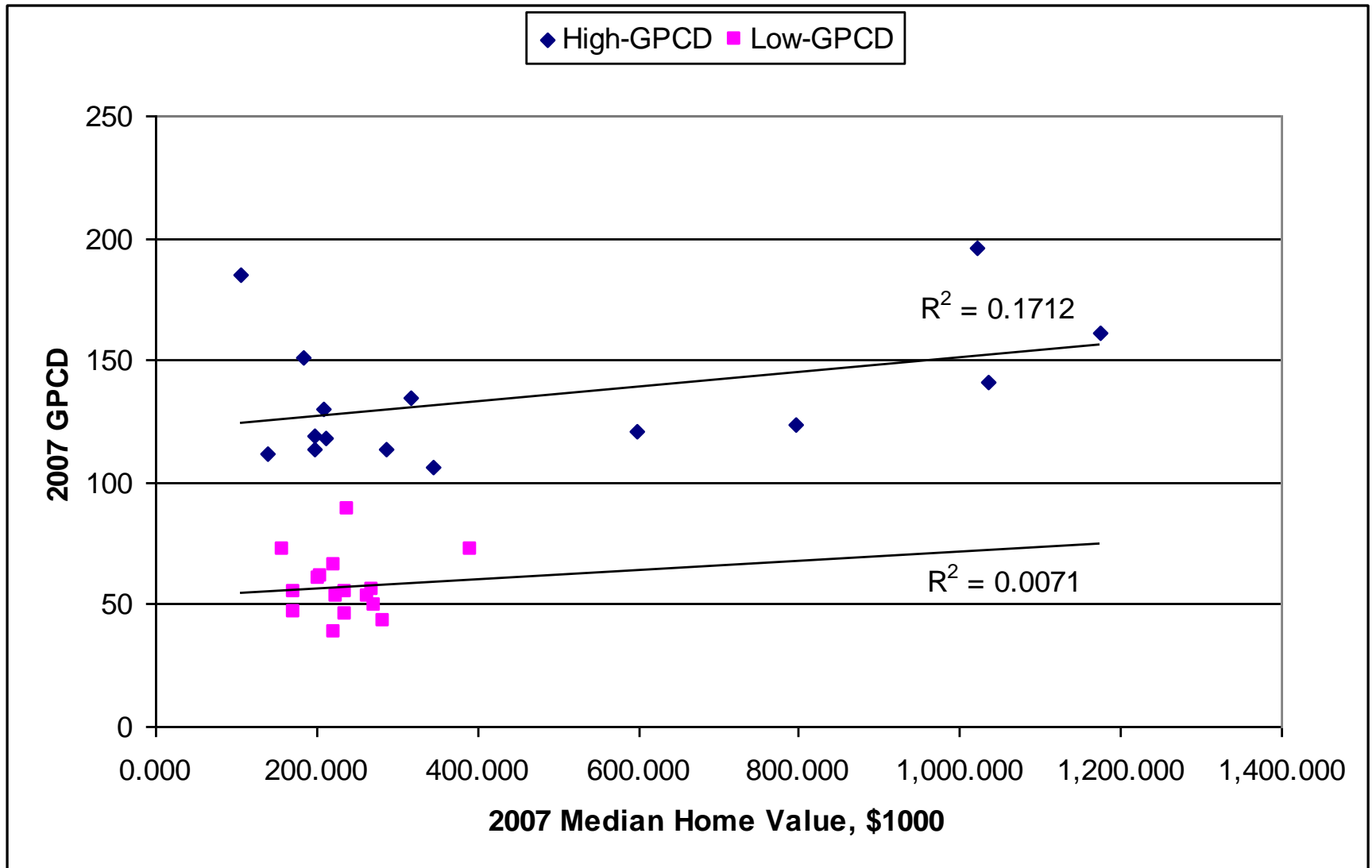
High and Low GPCD Rates Vs. Median Household Income



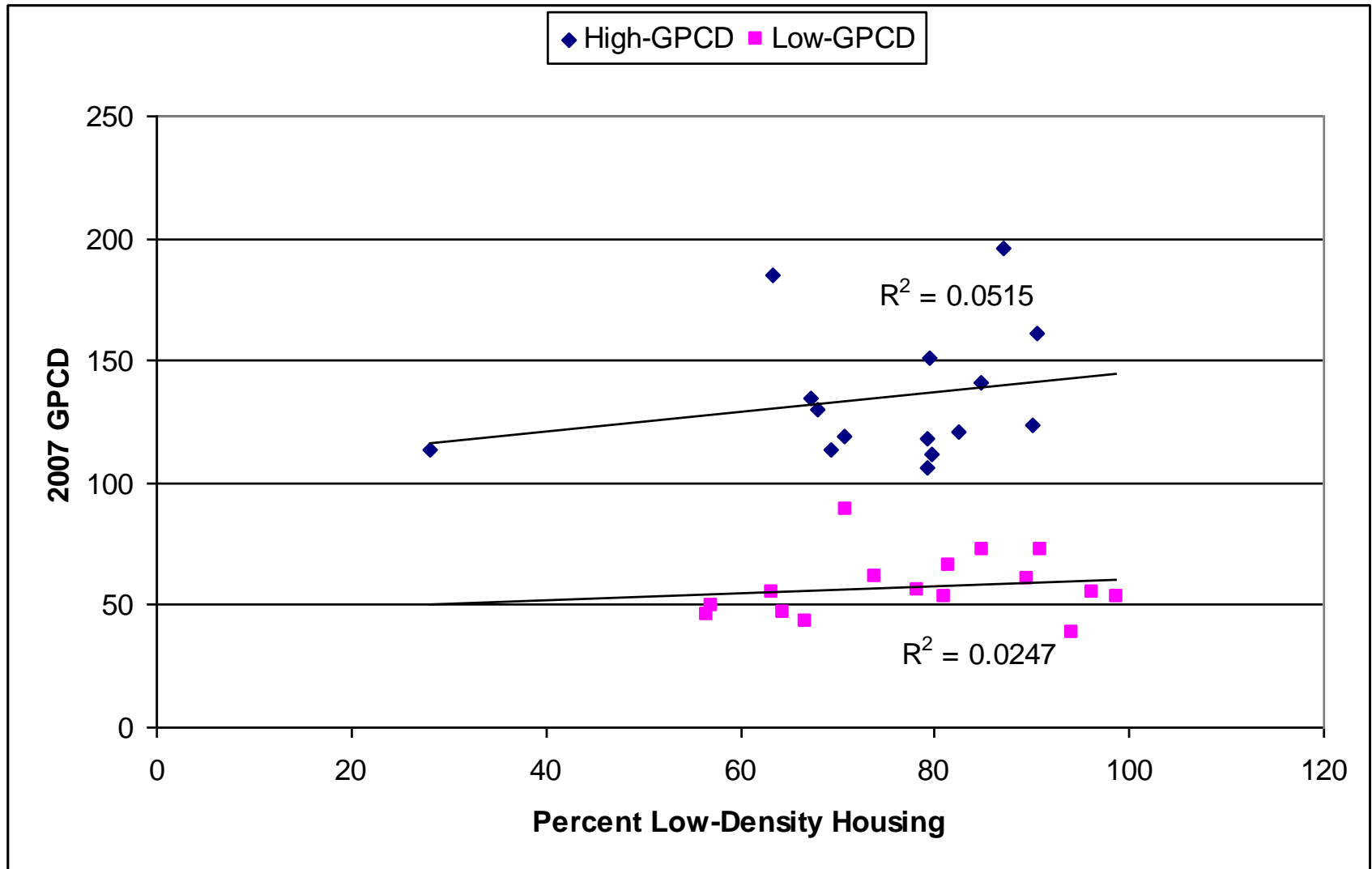
High and Low GPCD Rates Vs. Marginal Price of Water



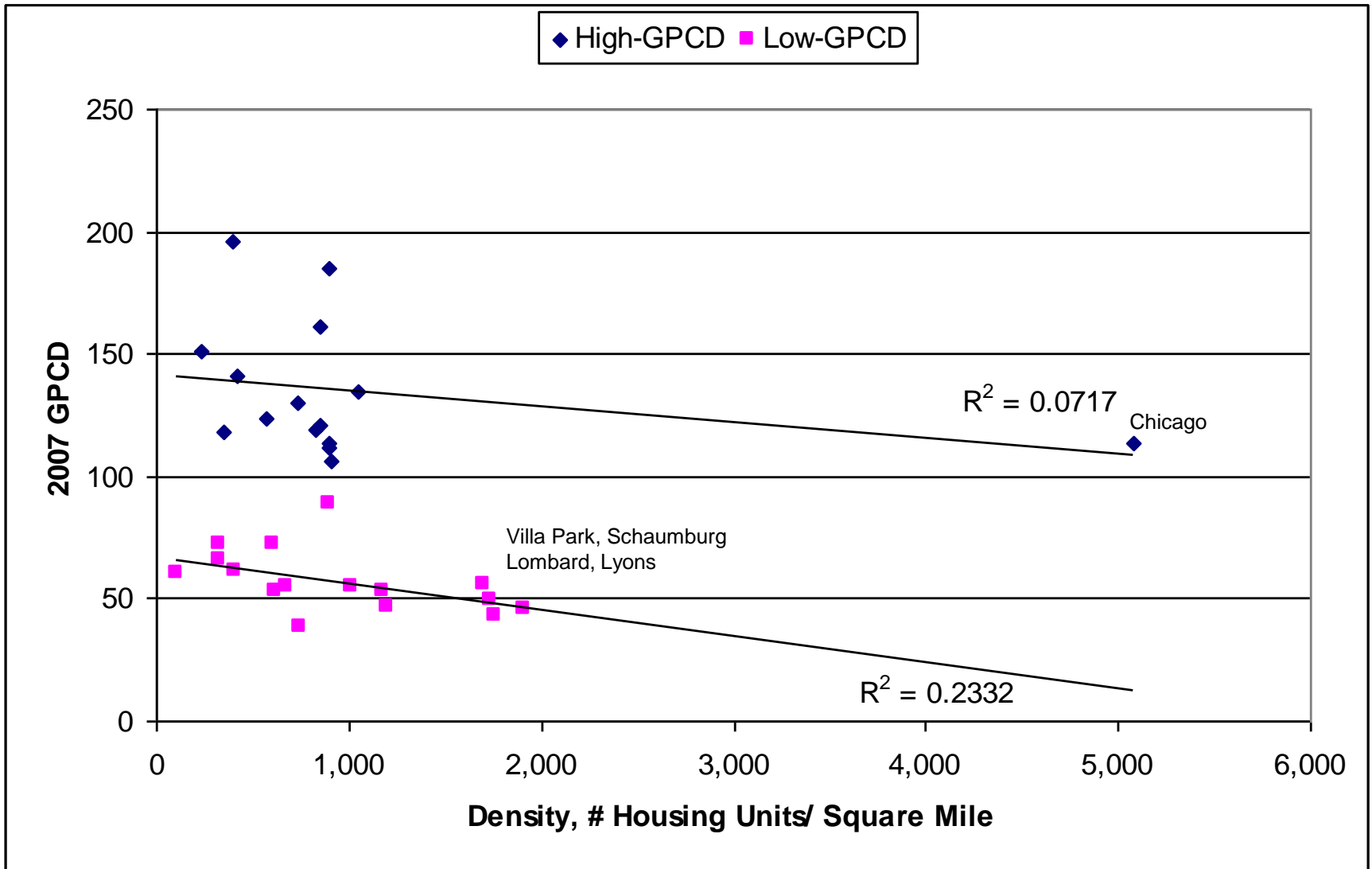
High and Low GPCD Rates Vs. Median Home Value



High and Low GPCD Rates Vs. Percent Low-Density (SF) Housing



High and Low GPCD Rates Vs. Housing Density (Gross)



Determinants of Residential GPCD

- Median home value (+)
- Housing density (units per square mile) (-)
- Percent of housing in 1-detached and 1-attached structures (+)
- Marginal price of water (-)
- Unique characteristics of each place (+/-)

Other Residential Areas

- Include residential areas with their own sources and some with wholesale water purchases:
 - Apartment complexes and condominiums
 - Home owner associations
 - Residential subdivisions
 - Mobile home parks

Homeowners Associations

Name of HOA	County	Resid.	Gallons/Capita/Day		
		Units	Min	Max	Mean
Briarcrest Sub. HOA, Long Grove	Lake	44	211.4	358.0	284.3
Royal Melbourne HOA, Long Grove	Lake	83	168.7	455.0	255.8
Second Street WA	Lake	11	100.0	400.0	250.0
Prairie Ridge HOA, Naperville	McHenry	49	64.4	180.1	117.6
Warrenville-Ray St HOA	Du Page	30	108.8	108.8	108.8
Prairie Oaks Estates HOA	Grundy	32	66.2	138.9	95.0
Eastmoreland WSA	Will	222	82.4	124.0	95.0
Summit HOA	Lake	12	66.7	117.0	88.4
Tanneron Bay HOA	Lake	76	73.6	102.0	85.9
Liberty Park HOA	Du Page	358	62.3	97.5	84.0
West Shore Park HOA	Lake	154	74.2	93.2	82.3
DI Well HOA	Lake	46	63.4	141.4	80.6
Crystal Heights HOA	McHenry	37	55.3	99.7	75.3
Shawnita Terrace WA	Will	42	42.0	91.6	74.8
Garden Street IA	Will	18	58.2	74.7	71.1
Golf Greenwood IA	Cook	69	50.4	94.4	69.7
Lindentree Townhome	Cook	66	66.5	66.5	66.5
Maple Hill IA	Du Page	65	44.7	78.8	66.4
Blan Mar Hills HOA	Lake	7	62.8	62.8	62.8
Crystal Lawns Add. IA	Will	410	37.4	93.8	57.1
Lakewood Shores IA	Will	249	35.7	77.7	47.8
Ports Of Sullivan LOA	Lake	148	46.7	46.7	46.7
Shadow Lakes II HOA	Will	729	21.5	71.9	31.7
Total/Average	--	2,957	72.3	138.0	99.9

Name of Mobile Home Park	County	MH	Gallons/Capita/Day		
		Units	Min	Max	Mean
Des Plaines	Cook	155	57.0	750.0	152.4
Busy Bee	Will	30	108.4	171.4	151.2
Modern	Will	32	136.4	160.0	142.7
Treasure Island	Will	128	69.1	303.4	133.9
Linway Estates	Cook	242	125.6	137.2	133.2
Capron	Boone	40	72.8	199.2	120.5
Evergreen Village	DeKalb	130	69.4	154.5	116.4
Gateway	Will	244	78.4	188.8	107.5
Bookwalter Woods	Grundy	168	74.2	135.0	102.9
Sunny Acres	Kankakee	188	63.9	207.4	101.8
Park Meadowland West	Boone	40	20.5	167.9	97.3
Busy Bee #2	Will	13	61.0	111.8	96.0
Oak Grove MH Village	Kane	81	72.0	205.5	94.2
Walls Inc	DuPage	53	70.6	101.2	91.0
Touhy	Cook	435	75.3	87.7	83.8
Willoway Terrace	Cook	295	41.5	194.9	83.3
Riverside	Will	11	83.3	83.3	83.3
West Shore Park HOA	Lake	151	74.2	93.2	82.0
Santa Fe	Cook	40	80.0	80.0	80.0
A C MHP	Kankakee	15	0.0	202.0	80.0
Shady Oaks	Grundy	365	69.2	99.1	79.9
Chain O Lakes	Lake	66	52.2	100.0	79.4
Spring Lakes	Cook	500	58.1	98.3	78.1
Manteno	Kankakee	74	65.1	86.9	77.1
Royal Oaks	McHenry	59	60.0	114.5	76.5
Imperial	Will	180	65.5	79.8	76.2
Oakbrook Estates	McHenry	146	57.6	114.2	74.3
Countryside Estates	Kankakee	88	60.0	81.1	73.5
Diamond Lake	Lake	63	59.4	99.3	73.5
Silo	Cook	30	48.0	102.0	72.7

Mobile Home
Parks
Per capita > 72
gpcd

Name of Mobile	County	MH	Gallons/Capita/Day		
Home Park		Units	Min	Max	Mean
Woodcreek	Will	50	57.1	91.7	72.2
Avalon	Lake	32	72.0	72.0	72.0
Paradise	Cook	277	48.0	101.3	71.0
Old Mazon	Grundy	13	52.1	83.4	71.0
Barberry Acres	Kankakee	22	45.4	112.0	70.8
Oak Lawn	Boone	185	38.2	93.2	70.6
Candlelight Village	Cook	309	55.8	93.7	68.8
Sunset	Cook	450	50.8	111.4	68.8
Pheasant Lake Estates	Will	550	53.9	84.0	67.9
Alpine Village	Cook	625	52.8	72.1	66.3
Holly Hock Hill	Lake	29	50.0	99.6	65.7
Oasis - Elgin	Cook	599	51.0	102.2	65.4
Vietzen	DuPage	99	51.7	85.2	64.6
Lakeview	Lake	189	42.5	118.1	64.5
Shoreline Terrace	Lake	163	41.8	117.4	63.2
Rivercrest	Kankakee	17	0.0	75.0	62.5
Pauls	Lake	18	43.8	108.7	61.8
Margarets Hi-Acre	Kane	100	14.9	89.1	61.6
Rockland Llc	Lake	66	41.1	114.0	60.7
Breazeale	Kane	77	5.9	100.9	55.3
Park City	Lake	615	10.0	91.1	53.1
Pleasant Ridge	DuPage	142	44.5	58.2	51.1
Bills	Kankakee	30	44.9	64.5	50.2
Dearborn	Kane	14	32.1	42.3	38.9
Giannis	Will	16	14.9	98.2	38.6
Patterson	Kane	15	26.0	59.2	37.6
Parkview	Will	27	37.0	37.0	37.0
Criswell Court	Will	72	24.2	72.0	35.7
Total/Average		8,863	54.0	123.4	78.6

Mobile Home
Parks
Per capita < 72 gpcd

Apartment Complexes

Name of Apartments	County	Resid.	Gallons/Capita/Day		
		Units	Min	Max	Mean
Pine View Apts	Lake	18	97.7	100	99.5
Plum Creek Condos	Cook	228	79.7	112	92.8
Bourbon Square Apts	Cook	272	49.2	113.3	83.8
Melrose Rental Apts	Kane	19	72	99.7	78.9
Terrace Oak Apts	Lake	30	66.7	66.7	66.7
Heiden Gardens Condos	Lake	88	47	90.7	66.1
Strawberry 1 Condos	Lake	156	47.1	72	63.7
York Center Co-Op	Du Page	79	33.2	85	55.7
Plum Grove Condos	Cook	82	29.4	57.6	37.5
Lake Run Apts	Cook	350	--	--	--
Total/Average		1,322	58	88.6	71.6

Residential
Subdivisions
Per Capita > 90

Name of Subdivision	County	Residential	Gallons/Capita/Day		
		Units	Min	Max	Mean
Glenstone Sub	Lake	15	145.1	614.9	323.7
Clearview Sub	Will	112	92.4	324.1	234.2
Towners Sub	Lake	69	94.0	257.8	174.2
Beckwith Sub	Will	23	96.8	250.0	172.5
Hawthorn Estates Sub	Grundy	11	33.1	274.0	151.5
Countryside Lake Sub	Lake	269	111.8	185.7	147.7
Lake In The Woods Sub	Du Page	285	116.7	145.4	131.0
Fairhaven Estates	Lake	88	104.8	129.5	120.2
Ogden Gardens Sub	Kane	119	80.5	155.7	117.4
Valley View Sub	DeKalb	48	57.7	231.8	115.2
West Shoreland Sub	Lake	63	89.4	138.7	112.4
Polo Drive & Saddle Rd. Sub	Du Page	31	69.7	191.8	106.2
Donny Brook Estates Sub	DeKalb	12	84.4	147.9	104.0
Tee And Green Sub	Du Page	17	68.9	138.7	103.7
Glen Ellyn Heights Sub	Du Page	346	51.4	149.9	102.0
Grandwood Park Sub	Lake	1443	59.4	249.6	101.4
Lake Shannon Inc	Kankakee	152	53.2	150.4	100.2
Ridgewood Sub	Will	68	55.5	152.0	99.3
Oakdale Acres Sub	Kankakee	139	83.1	104.9	96.1
Storybook Highlands Sub	Kendall	32	89.1	102.7	94.7
Huntley Community Sub	Will	16	35.0	139.1	94.7
Wadsworth Oaks Sub	Lake	62	47.3	238.1	89.5

Residential
Subdivisions
Per Capita < 90

Name of Subdivision	County	Residential	Gallons/Capita/Day		
		Units	Min	Max	Mean
Bel-Air Sub	Will	14	72.0	97.9	89.3
Buck Lake Estates Sub	DeKalb	50	73.4	98.8	88.5
Heatherfield Sub	Grundy	30	32.2	195.4	86.8
Hillside Manor Sub	Kankakee	108	70.6	94.4	84.4
Deering Oaks Sub	McHenry	20	61.9	101.3	81.8
Ridgecrest North Sub	Grundy	28	60.6	122.9	81.0
Sylvan Lake 1st Sub	Lake	69	53.1	110.2	80.1
Rand Estates Sub	Lake	32	72.0	99.7	79.5
Ingalls Park Sub	Will	249	66.4	86.1	77.8
Wildwood Sub	Lake	4129	65.7	87.0	77.2
Sturm Sub	Lake	18	72.0	83.0	74.3
Highland Lake Sub	Lake	98	57.1	94.4	71.6
Highland Sub	Kane	20	43.8	109.6	70.6
Pekara Sub	Lake	1204	64.9	82.3	70.5
Brooks Farm Sub	Lake	521	62.4	79.0	68.9
Hillview Sub	Will	33	51.9	99.4	68.5
Arden Shores Estates Sub	Lake	22	56.9	84.2	67.6
Steeple Run Sub	Du Page	626	54.7	76.6	67.0
Fox Lake Hills Sub	Lake	843	49.9	78.9	66.2
Fair Acres Sub	Will	52	50.0	73.4	62.8
College View Sub	Will	189	45.9	72.7	60.1
Fox Lawn Subivision	Kendall	85	46.2	76.3	58.4
Dixie Estates Sub	Will	57	45.5	80.2	54.1
Balmoral Heights Sub	Will	128	30.4	58.5	47.6
Sunnyland Sub	Will	104	35.3	58.7	45.6
Acorn Acres Sub	Lake	95	28.7	88.8	44.9
Orland Hills Sub	Cook	43	31.3	31.3	31.3
Total/Average		12286	64.8	140.7	96.9

Back to Scenario Forecasts

- Assumptions about future shifts in residential development and the resultant per capita rates of residential water use:
 - Assumption 1 - No future changes in the distribution of GPCD rates
 - Assumption 2 - GPCD in all new housing declines from 93.5 to 75.0 gpcd by 2050
 - Assumption 3 - GPCD in all new housing declines to 60 gpcd

Assumption 1 - Constant Distribution

County	2005 Population	2005-GPCD	2005-MGD	2050 Population	2050 -MGD
Boone	50,483	73.6	3.7	68,626	5.0
Cook	5,303,683	103.9	551.0	6,336,829	658.4
DeKalb	97,665	77.8	7.6	159,147	12.4
DuPage	929,113	75.5	70.2	1,070,063	80.8
Grundy	43,838	97.6	4.3	85,419	8.3
Kane	482,113	79.4	38.3	928,027	73.7
Kankakee	107,972	119.3	12.9	162,755	19.4
Kendall	79,514	100.7	8.0	280,552	28.2
Lake	702,682	75.2	52.9	973,458	73.2
McHenry	303,980	75.2	22.9	589,272	44.3
Will	642,813	93.2	59.9	1,459,021	136.0
NE Illinois	8,743,856	93.6	818.0	12,113,169	1,139.8
					+39.3%

Assumption 2 - 75 GPCD

County	2050- MGD	2005- MGD	Difference in MGD
Boone	5.0	4.8	-0.3
Cook	658.4	637.1	-21.3
DeKalb	12.4	11.4	-0.9
DuPage	80.8	78.7	-2.1
Grundy	8.3	7.5	-0.8
Kane	73.7	66.6	-7.0
Kankakee	19.4	18.1	-1.3
Kendall	28.2	24.2	-4.0
Lake	73.2	69.2	-4.0
McHenry	44.3	40.1	-4.3
Will	136.0	120.9	-15.1
NE Illinois	1,139.8	1,078.7	-61.1
			-5.4%

Assumption 3 - 60 GPCD

County	2050-MGD	2005-MGD	MGD Difference
Boone	5.0	4.8	-0.2
Cook	658.4	613.0	-45.4
DeKalb	12.4	11.3	-1.1
DuPage	80.8	78.6	-2.2
Grundy	8.3	6.8	-1.6
Kane	73.7	65.0	-8.6
Kankakee	19.4	16.2	-3.2
Kendall	28.2	20.1	-8.2
Lake	73.2	69.1	-4.1
McHenry	44.3	40.0	-4.3
Will	136.0	108.9	-27.1
NE Illinois	1,139.8	1,033.7	-106.1
			-9.3%

Conclusions

- Residential per capita rates of water use vary between 40 and 200 gpcd
- Communities and service areas with low density, high income or home value and lower price tend to have higher GPCD rates (> 100 gpcd)
- Residential per capita rates between 40 and 70 gpcd are found in the 20 lower percentile of communities and systems

Conclusions, cont.

- By increasing the efficiency of water use in new residential developments total water use could be reduced by 5-10 percent by 2050
- If all homes (both new and those that existed in 2005) reduce per capita rates to the regional average of 75 gpcd total residential use would decline by 20 percent by 2050