Chicago Metropolitan Agency for Planning

The Potential for Wastewater Reuse in Northeastern Illinois: Initial Approach

June 24, 2008

Scope

- Planned water reuse
  - deliberate direct or indirect use of reclaimed water, without relinquishing control over the water during its delivery
- Nonpotable reuse

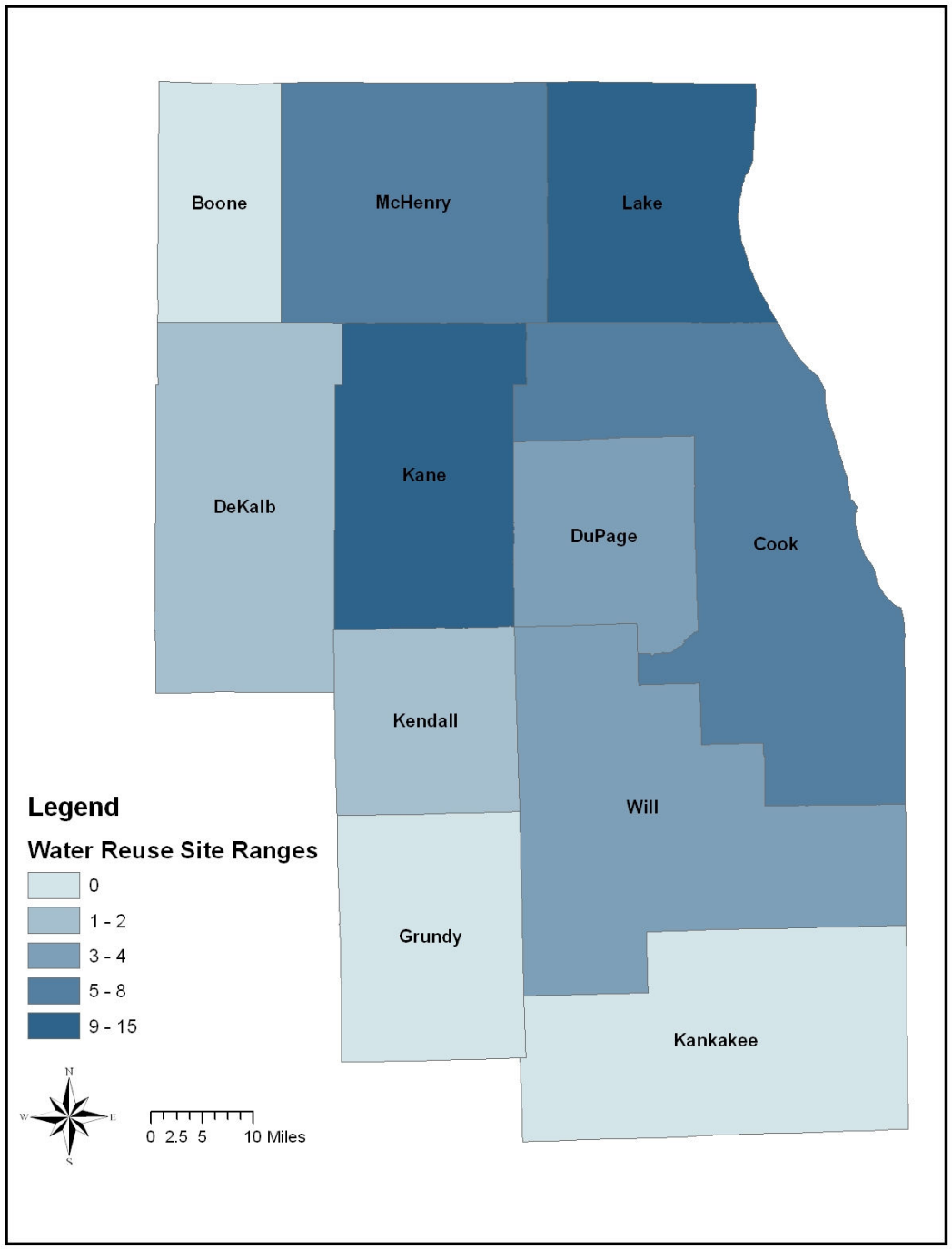
Planned reuse in the region

- Sheaffer system
  - Treatment in aerated pond, followed by filtration and disinfection
  - Final effluent used to irrigate open space or associated golf course

Treatment pond at Fields of Long Grove

Sheaffer systems in region (2008)

- Generally serve “self-contained” development
  - Subdivision
  - Business park
  - Camps, nature centers
- But Cortland, IL in Dekalb County has installed municipal scale system (1.5 mgd)



Graywater projects – City of Chicago

- **Built:**

- **1244 N. Clybourn -** a true greywater system which collects water from showers and lavs, treats with filters, UV, and chlorine drip, and supplies water closets
- **3656 N. Halsted -** a rainwater harvesting system which collects rainwater from the roof and groundwater from the basement, treats with filters, UV, and chlorine drip, and supplies water closets and urinals

- **Underway:**

- **Museum of Science and Industry -** a true greywater system which collects water from lavs and supplies water closets. Approved by City of Chicago, currently under review by IDPH.
- **4895 N. Ravenswood -** a single-family home with rainwater harvesting system, treats with filters, UV, and chlorine tablets and supplies water closets. Approved by City of Chicago and IDPH.

Golf Courses

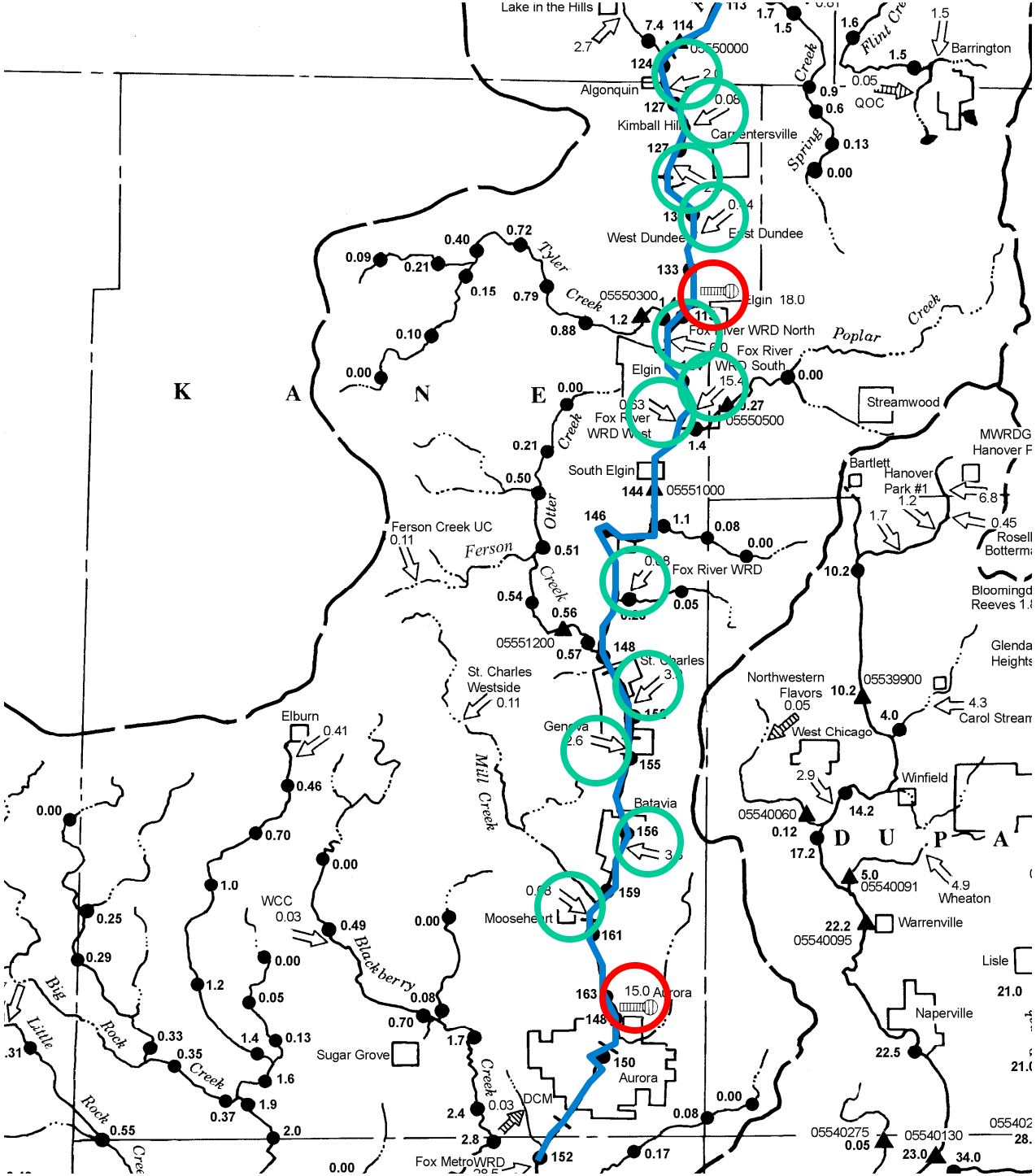
- Fox Links (Elk Grove Village Park District)
  - MWRD
- Itasca Country Club (private)
  - Itasca STP
- White Pines (Bensenville Park District)
- Potentially others

Metropolitan Water Reclamation District of Greater Chicago

	2006 total discharge		Estimated reuse		
Facility	10^3 m^3/d	MGD	10^3 m^3/d	MGD	Reuse (%)
Stickney	2759	729	30.20	7.99	1.1
Calumet	1071	283	2.12	0.56	0.2
North Side	946	250	0.98	0.26	0.1
James C. Kirie	133	8.9	1.17	0.31	0.3
John E. Egan	99	26	3.70	0.98	3.8
Hanover Park	34	8.9	3.59	0.95	10.7
Lemont	9.7	2.5	<0.04	< 0.01	<0.4
Total	5053	1335	41.77	11.05	0.8

Source: Anderson and Meng (draft, 2008); Knight and Sokol (1991)

Unplanned indirect potable reuse

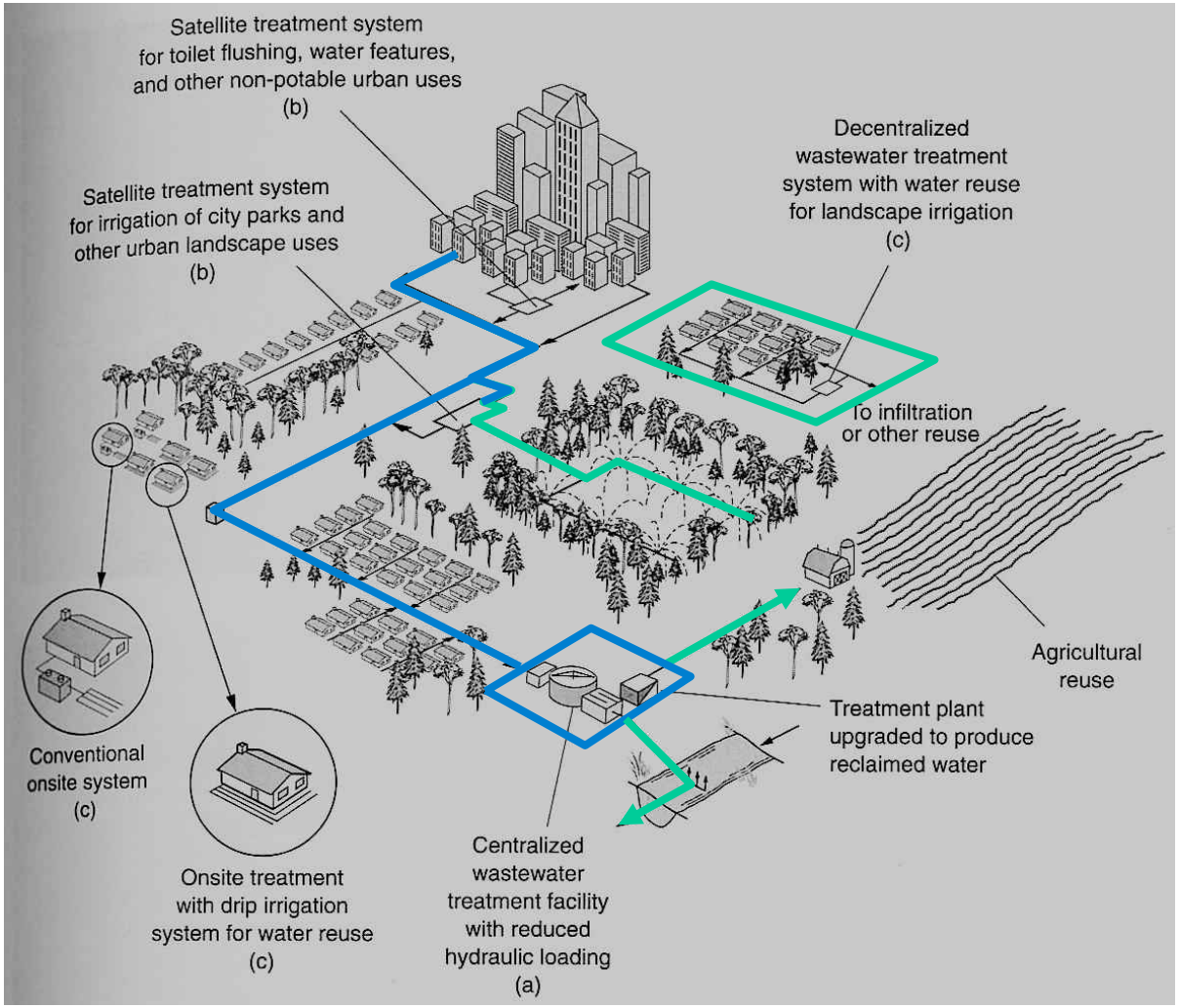


Source: Illinois State Water Survey

Reuse in other regional plans

Regional Plan	Year	Amount of supply
Region D - North East Texas	2060	8% total
Region E - Far West Texas	2060	8% total
Region C	2060	6% total
Atlanta	2030	5% (13% of new supply)

Reuse options with centralized treatment systems



Source: *Water Reuse: Issues, Technologies, and Applications*. Metcalf & Eddy, Table 6-12.

Reuse scenarios

- Potential project types in NE IL
  - Reuse of wastewater from existing centralized plant
  - Reuse of wastewater from new centralized plant
  - Satellite reuse
- Potential users
  - Landscape irrigation
  - Commercial/industrial
  - Agricultural irrigation

Possible motives for reuse

- Less expensive supply source for user
- Protect high quality receiving body
- Preventing or forestalling capacity expansion for drinking water utility
  - With satellite reuse, could also prevent need to expand centralized wastewater treatment plant
- Restrictions on use of potable water
- Additional revenue stream for wastewater plants

Initial study

- Focused on landscape irrigation
- Install new distribution line from existing centralized treatment plants to serve users

Study outline

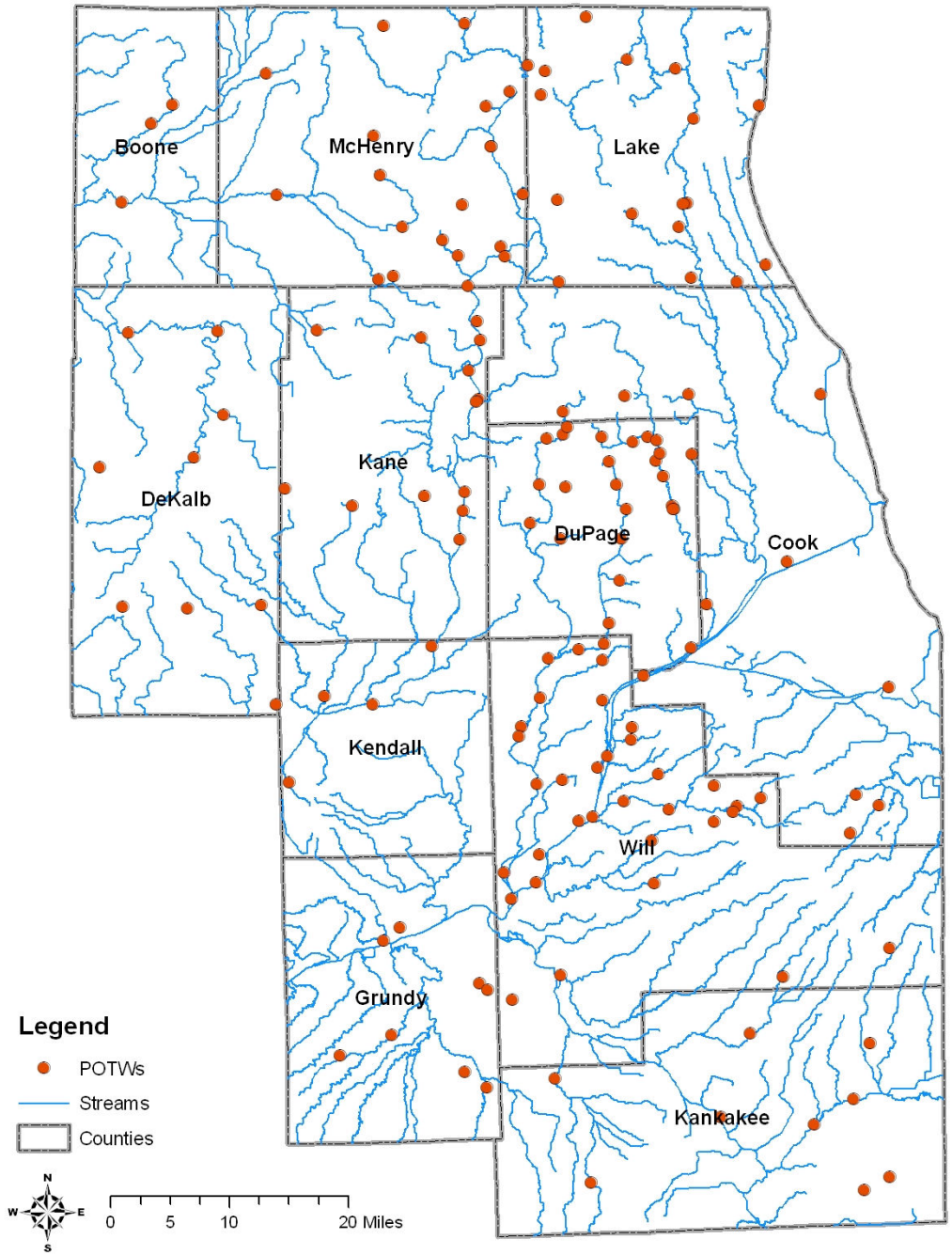
1. Total potential landscape irrigation demand + location and total potential supply + location

2. Impact of siting regulations or USEPA guidelines

3. Economic feasibility

Publicly Owned Treatment Works

- 140 in region (not counting emergency and excess flow facilities)
- ~1,800 mgd average annual flow



Municipal wastewater flow

County	Average flow (mgd)
BOONE	5
COOK	1,344
DE KALB	11
DU PAGE	120
GRUNDY	4
KANE	43
KANKAKEE	17
KENDALL	38
LAKE	92
MCHENRY	27
WILL	66
Total	**1,767**

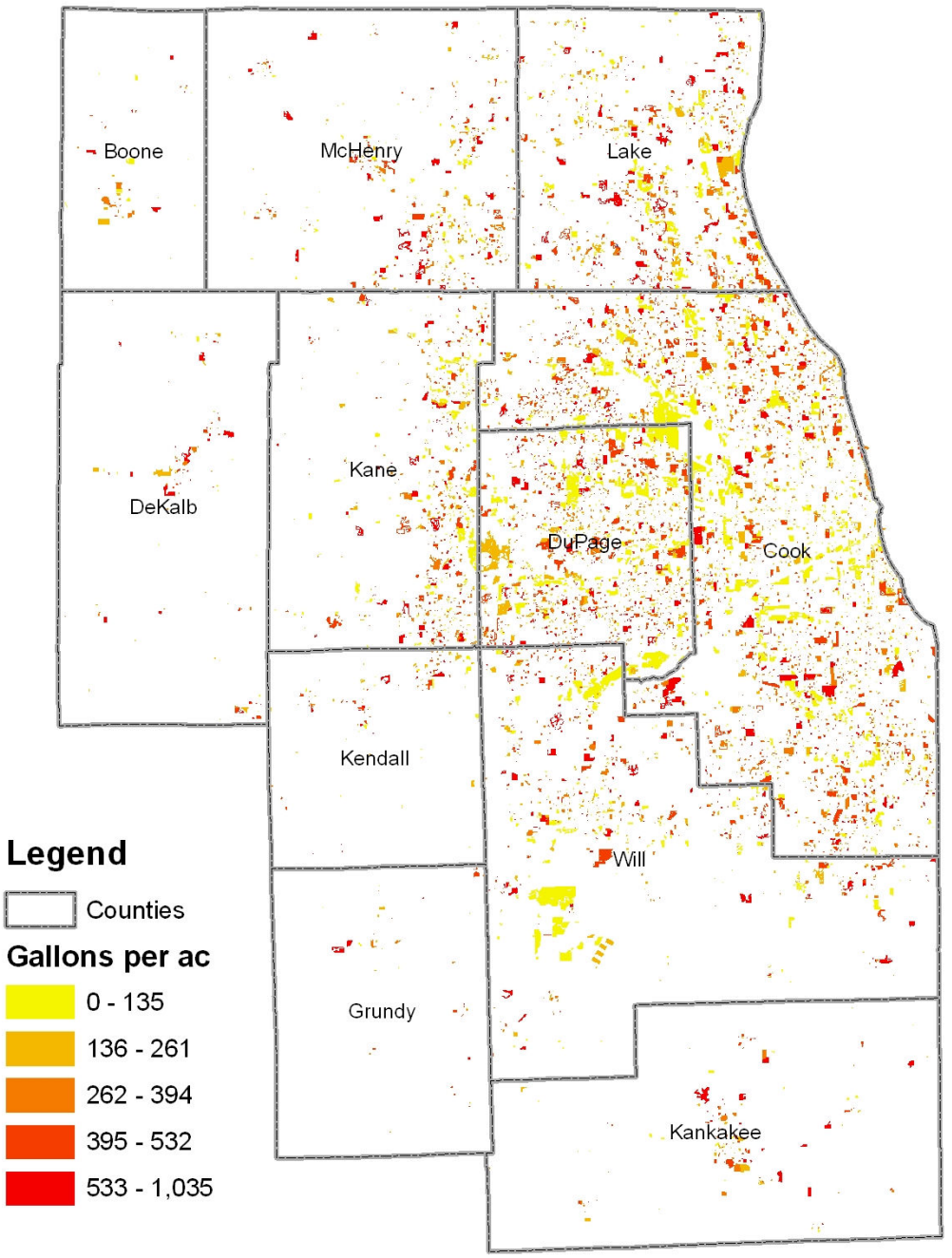
Source: USEPA Permit Compliance System (average 2006-2007)

Location, location, location

Identifying potential customers

- Where are the land uses expected to have extensive grassy cover?
  - CMAP land use inventory + NAVTEQ/USGS
- How much turf do they have?
  - "Developed open space" category from National Land Cover Dataset
  - Omitted if also >10% tree canopy
  - Subtracted impervious area
- How much water would they use?
  - Used USGS mass balance method for potential irrigation demand

Potential customers



Potential demand

Land use	Potential GPD
Golf courses	25,384,302
Recreational open space	15,737,567
Educational facilities	9,671,344
Cemeteries	5,112,826
Industrial parks	3,445,850
Religious facilities	2,063,194
Cultural/entertainment	2,019,474
Government services	1,279,500
Other institutional	1,058,211
Medical facilities	932,695
Office campuses	893,752
Business parks	517,886
Correctional facilities	218,588
Total	**68,335,189**

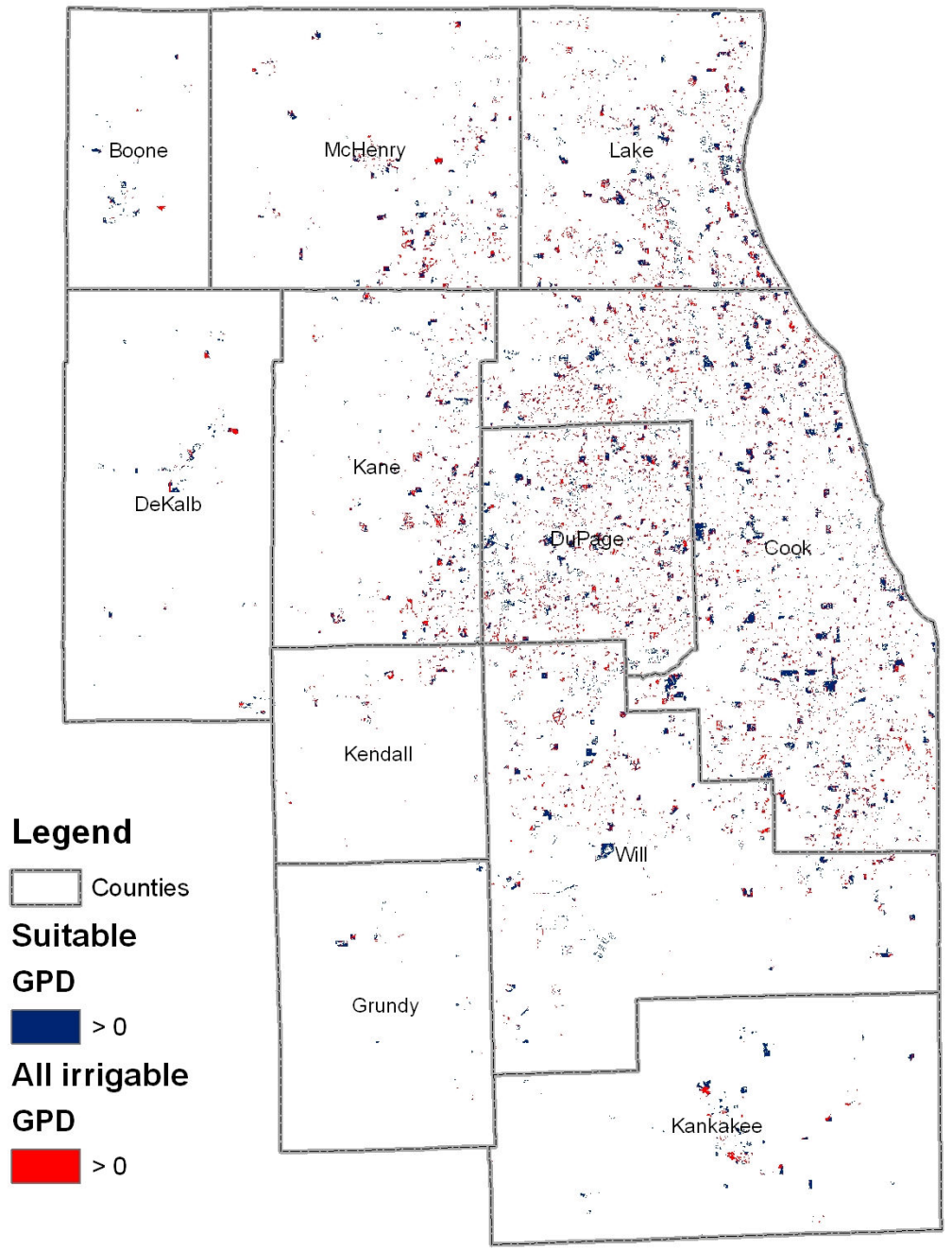
Limited regulation

- State land application regulations
  - PART 372 Illinois design standards for slow rate land application of treated wastewater
- No federal requirements
  - But USEPA produced *Guidelines for Water Reuse* (2004)

Areas unsuitable for land application (IL Admin Code)

- Wellhead setback zones from Illinois Groundwater Protection Act
- Slope greater than 8%
- Wetlands
- Floodplain with less than 10 year return frequency
- Groundwater depth less than 4 ft
- Depth to bedrock less than 10 ft
- Distance to residential lot line less than 200 ft

Impact of land application regulations



Potential demand with land application regulations

Land Use	MGD (unrestricted)	MGD (restricted)
Golf courses	**25.4**	**15.2**
Recreational open space	**15.7**	**5.5**
Educational facilities	**9.7**	**4.6**
Cemeteries	**5.1**	**3.9**
Industrial parks	3.4	2.4
Cultural/entertainment	2.0	1.3
Other institutional	1.1	0.7
Government services	1.3	0.7
Office campuses	0.9	0.6
Medical facilities	0.9	0.6
Religious facilities	2.1	0.6
Business parks	0.5	0.4
Correctional facilities	0.2	0.2
Total	**68.3**	**36.8**

Proximity of demand and supply

Distance from plant	No. of customers	MGD
1.0	1,086	5.4
2.5	3,824	16.7
5.0	7,091	29.0
Any distance	9,432	36.8

Next phase: economics

- Estimate annualized cost of building pipelines and associated facilities to customers
  - Depends primarily on distance to treatment plant
- Compare to cost of using existing water source
- If possible, the monetary value of nitrogen and phosphorus as fertilizer replacement

Potential implementation mechanisms

- Mandatory reuse ordinance
- Economic drivers
  - Price of potable water
  - Need to protect receiving water bodies
- Pilot projects

Challenges

- Health risk
  - bacterial / viral contamination
- Business risk
- Public perception
- Water quality
  - salinity, dissolved and suspended solids, emerging contaminants
- Permitting difficulties

Workshops

- August 28 and 29
- IIT Rice Campus in Wheaton
- Will address commercial/industrial and landscape applications on separate days

Questions?

Jesse A. Elam, AICP
Chicago Metropolitan Agency for Planning (CMAP)
233 S. Wacker Dr., Chicago IL 60606
jelam@cmap.illinois.gov
312.386.8688 (V)