



Southeast Texas Trends in Urban Reuse

Sustainable Water Resources: Preserving Our Natural Assets as the Region Grows Symposium,
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Climate Conditions

- Relatively abundant rainfall (45 plus in/yr)
- High Humidity
- Subject to extended dry summer periods
- Reliance on tropical storms to break drought periods

Water Supply

- Relatively cheap and abundant groundwater



- Permit renewal in 1990's required reuse study
- Texas Commission on Environmental Quality established reuse rules
 - Allowed reuse under authorization by Executive Director
 - Less involved than obtaining a permit
 - Reduced notice requirements
 - Reuse prior done under permit requirements



- Low cost available groundwater
- Facilities needed irrigation water while systems were developing so wells were needed anyway
- Cost and disruption of putting reuse lines through established neighborhoods.
- Still some rule issues such as flushing
- Lack of effluent quantity during dry periods necessitating backup unless using firm yield quantities



Golf courses in close proximity to WWTPs

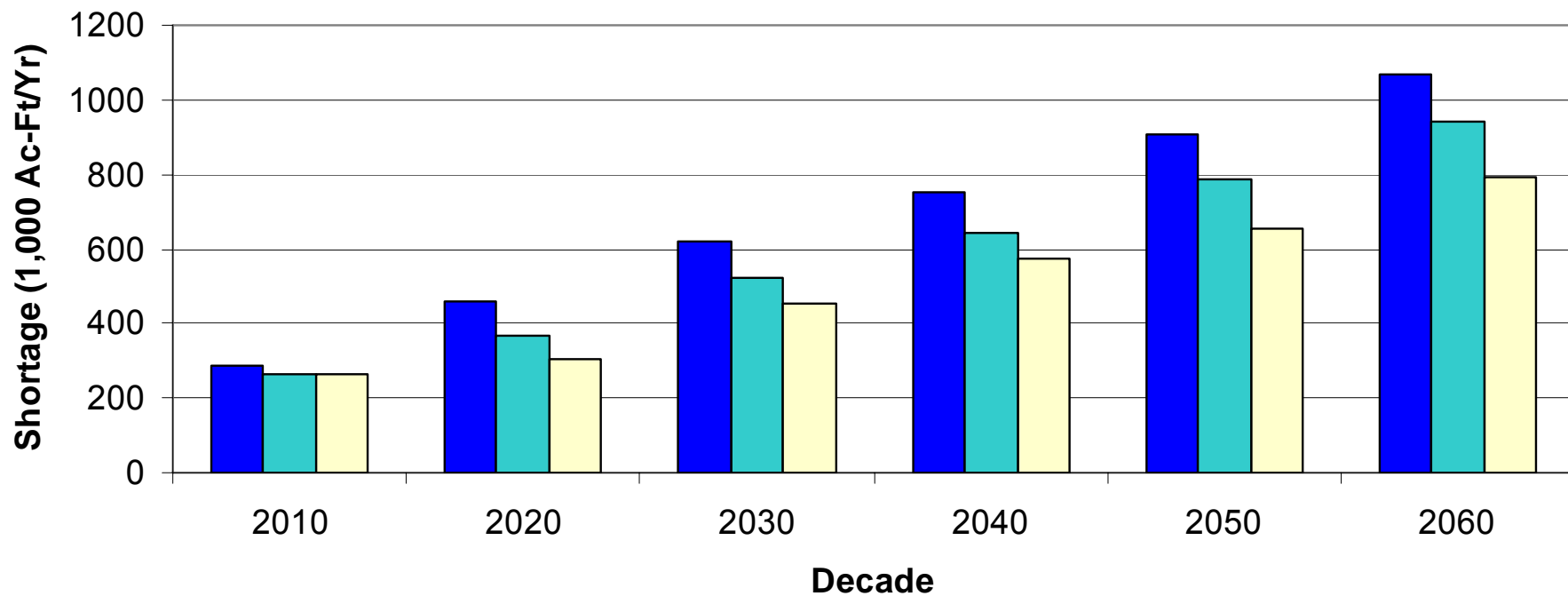
- Could use a lesser effluent quality because of control of access
- Needed a drought proof supply to protect investment
- Minimal line requirements
- Little impact on the treatment plants
- Mostly in master planned communities



- Groundwater usage reductions mandated by Subsidence District and local groundwater districts around Houston
- Costs now compared to imported surface water plus some reuse incentives
- Increasing demands for irrigation water in master planned communities
- Increasing attention to environmental issues by MPC developers



Shortages for All Region H After Reuse



■ Initial Shortages ■ Shortages Following Conservation and Contract Expansion ■ Shortage After Reuse

- Master Planned Community began with land acquisition in 2002 by Terrabrook
- Terrabrook holdings acquired by Newland Communities in 2003
- Reclaimed water to be provided pre- development to reduce costs
- Environmental stewardship by developer to reduce demand on fresh water supplies



- Master utilities plan done by TCB in 2004
- TBG partners hired in 2006 to review development and revise land plan
- New land use plan developed in 2007
- TCB revised initial system models to incorporate changes

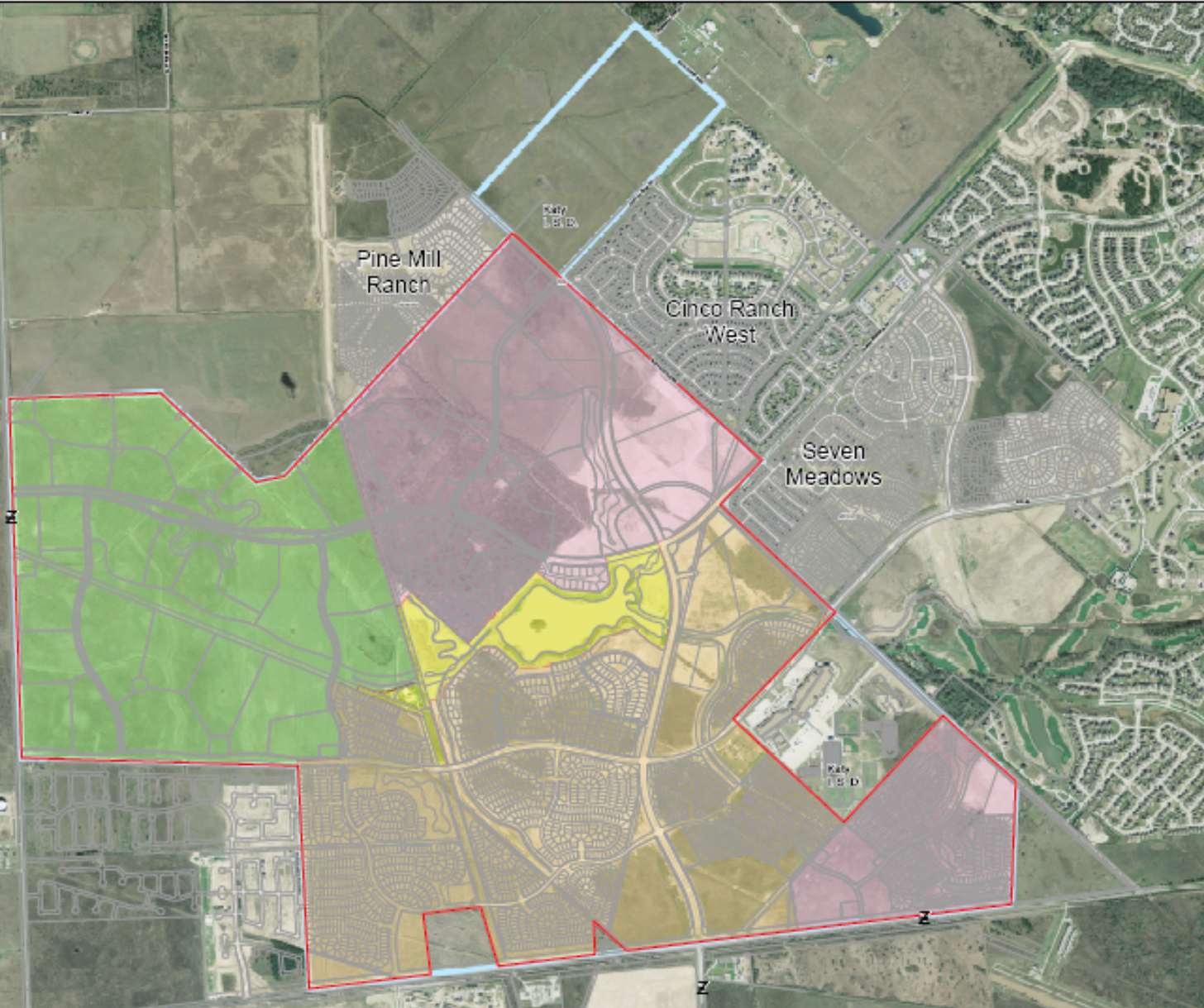


Cinco Southwest Development Area

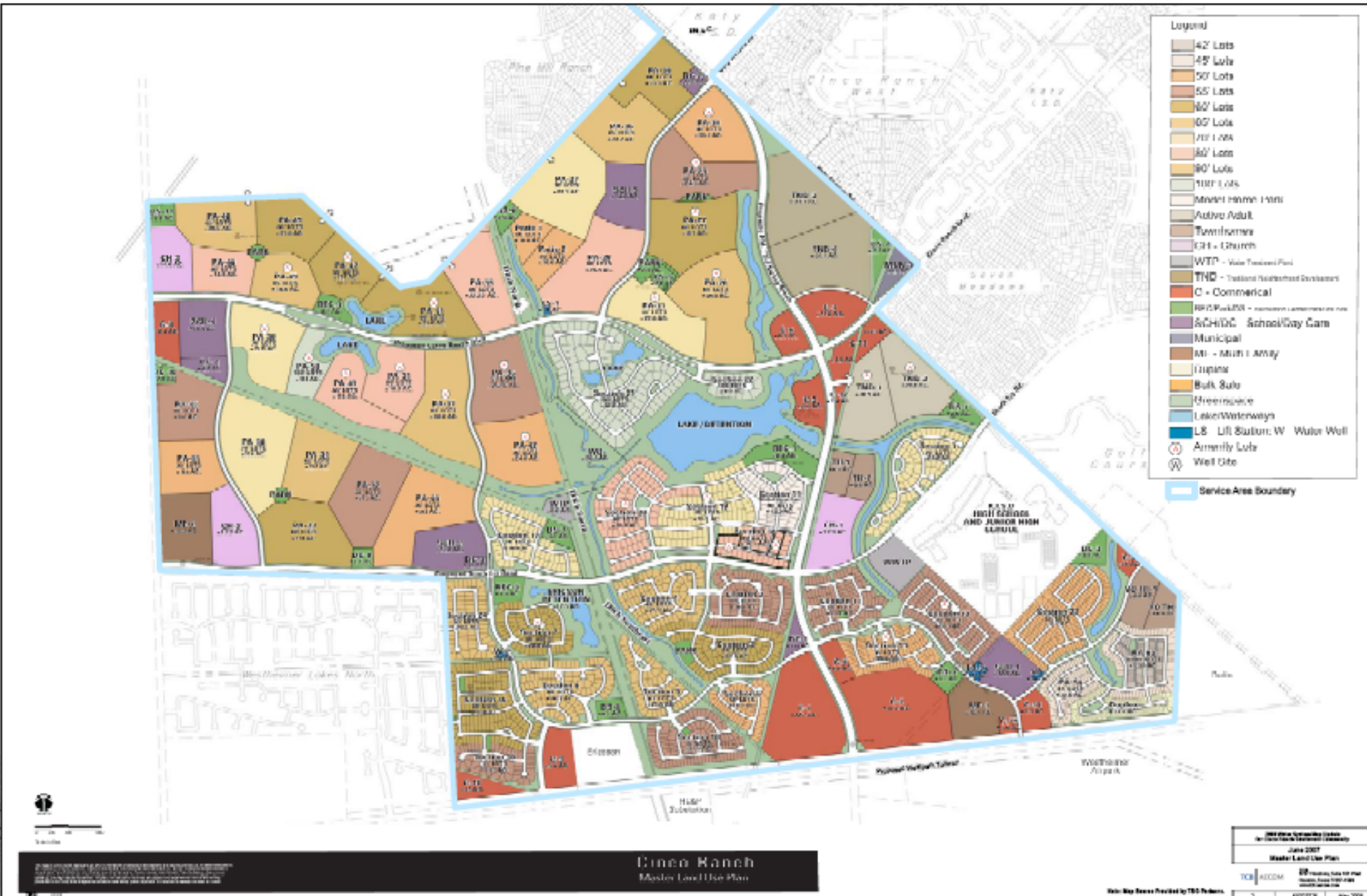


Vicinity Map

- Legend**
- Community Boundary
 - City District Boundary
 - Municipal Utility District Boundaries
 - City District WSD No. 1
 - City District WSD No. 2
 - City District WSD No. 3
 - City District WSD No. 4

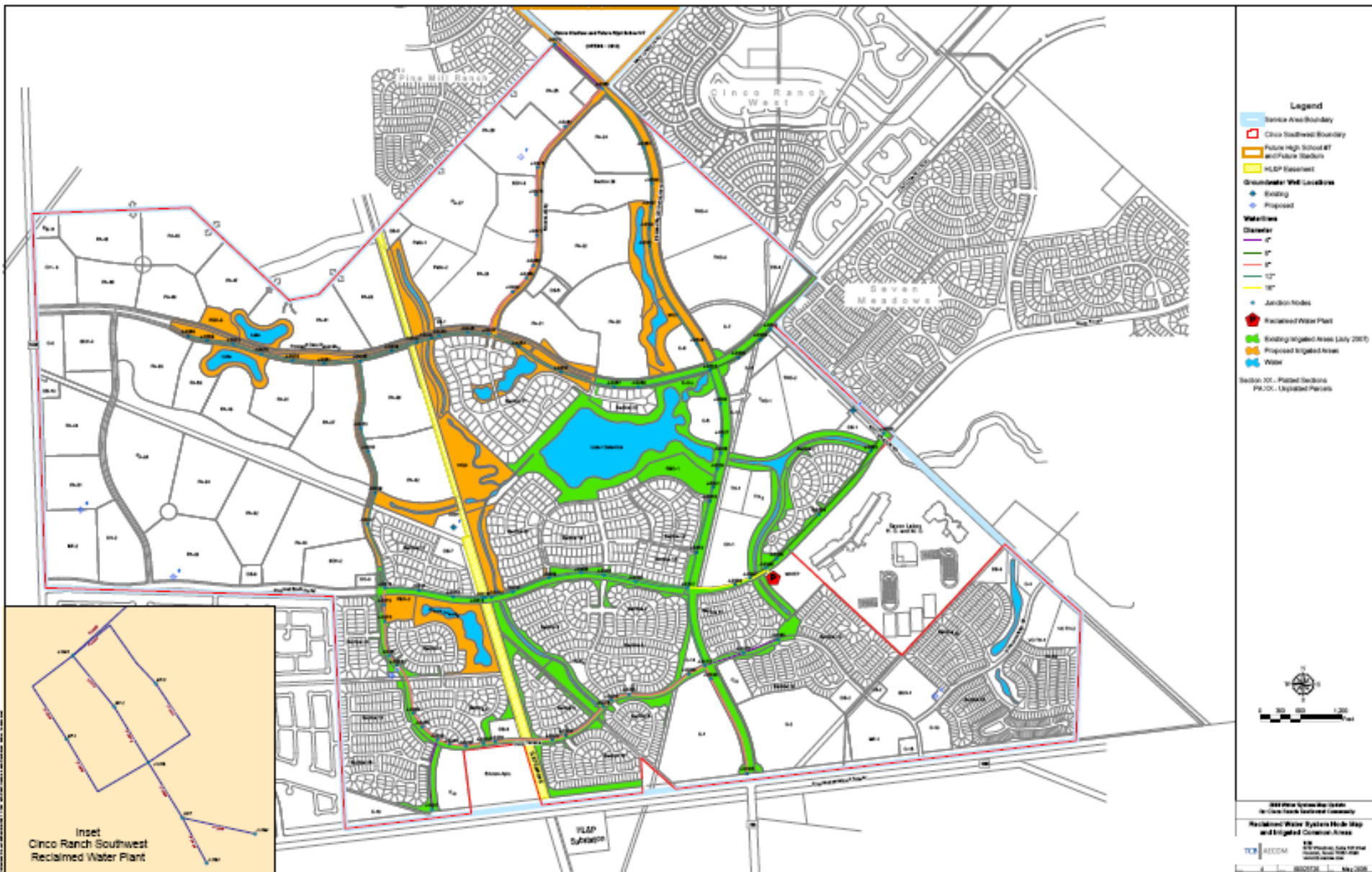


Cinco Southwest Land Use



Description	Devel. Area ² (acres)	Equiv. Conn. ³ (ESFC)	Equiv. Conn. (%)	ADF ⁴ (gpm)	PDF ⁵ (gpm)	PHF ⁶ (gpm)
COMBINED WATER SYSTEM DEMANDS						
2004 Report Through Phase 3¹						
Residential (including O4)	2,036	7,332	66%	2,205	5,909	10,932
Non-Residential (excluding O4)	383	2,387	22%	721	1,443	1,443
Irrigation of KISD w/ potable water	36	461	4%	70	141	141
Common areas potentially irrigated w/ reclaimed water	179	885	8%	135	270	270
Total	2,634	11,065	100%	3,132	7,763	12,786
2008 Report						
Residential (excluding common areas)	1,408	6,048	45%	1,834	5,154	9,536
Non-Residential (excluding common areas)	555	2,480	18%	758	1,516	1,516
Irrigation of common areas + KISD w/ potable water	245	2,416	18%	369	738	738
Common areas potentially irrigated w/ reclaimed water	300	2,643	19%	404	808	808
Total	2,507	13,587	100%	3,365	8,217	12,598
Percent Change (2008 to 2004 Reports)						
	-5%	23%		7%	6%	-1%

Cinco Southwest Irrigated Areas



- Change in acreage from 179 of common area and 36 acres for Katy ISD schools
- New acreage 545 acres total
- Old landscaping plan provided approximately 0.67 acre inch per week
- New plan provides for 1 acre inch per acre per week
- 1 acre inch per acre per week in line with recommendations from Texas A&M



- Traditionally use lowest reliable effluent flow because it is difficult to change from effluent to potable if effluent not available
- Must have reliable supply for valuable landscaping
- Cinco Southwest to drill irrigation wells anyway until effluent available
- Subsidence rules allow groundwater use if alternative source maximized



Maximizing Effluent Usage

Usage Rate (gpd/ESFC)	Number of ESFCs at Ultimate Development	Projected Flows (gpd)	Percentile of Available Flows	Excess RW Available (gpd)
116	8,528	989,220	100	0
142	8,528	1,208,371	99	219,151
160	8,528	1,364,136	98	374,916
161	8,528	1,374,507	97	385,288
166	8,528	1,413,284	96	424,064
167	8,528	1,426,961	95	437,741
170	8,528	1,449,378	94	460,158
172	8,528	1,469,026	93	479,806
174	8,528	1,484,009	92	494,789
177	8,528	1,508,157	91	518,937
180	8,528	1,532,128	90	542,909
194	8,528	1,650,987	80	661,767
207	8,528	1,764,065	70	604,065

Maximizing Additional Acreage

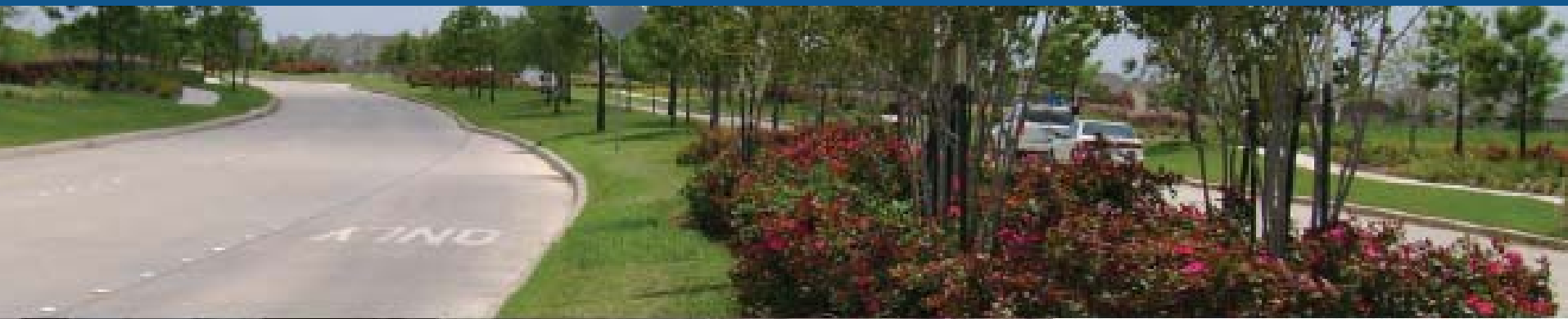
Availability Percentage	Excess RW Available (gpd)	Watering Days per Week	Additional Weekly Effluent	Additional Acreage Covered
100	0	6	0	0
99	219,151	6	1,314,909	48
98	374,916	6	2,249,499	83
97	385,288	6	2,311,725	85
96	424,064	6	2,544,386	94
95	437,741	6	2,626,446	97
94	460,158	6	2,760,947	102
93	479,806	6	2,878,838	106
92	494,789	6	2,968,733	109
91	518,937	6	3,113,621	115
90	542,909	6	3,257,451	120
80	661,767	6	3,970,601	146
70	774,845	6	3,624,389	171

- Saved the cost of one new well for the drinking water system (approx. \$1.5 mil.)
- Reduced the peak daytime demand for the drinking water system pumps and moved that demand to off peak hours at night.
- Reduced tankage sizes for the same reasons
- Allows Groundwater Reduction Plan participants to share 1.5 to 1 credit for reuse



- Requirements for alternative sources in high groundwater usage areas making reuse more attractive economically
- Effluent use for landscaping widely accepted in the area
- All 80 percent and greater reliability effluent produced by this plant is consumed in landscaping
- More water from other sources needed to irrigate remainder of irrigated areas





Questions and Answers

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