Water Conserv II: A Central Florida Water Recycling Program

David MacIntyre, PE, D.WRE
&
Luisa Maria Gomez, PE

January 16, 2014

PARSONS BRINCKERHOFF

Agenda

- Location and Scale of WCII
- Regional Water Supply Constraints
- Recycled Water Use Types at WCII
- Institute of Food & Agricultural Sciences
- Recycled Water Quantities
- Typical Recycled Water Quality
- Possible Future Development Factors

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Water Conserv II History

- Jointly Owned by Orange County and City of Orlando
- Regulated by 3 State Agencies
  - FDEP
  - SJRWMD
  - SFWMD
- World's Largest Water Reclamation Project Combining Agricultural Irrigation and Rapid Infiltration Basins (RIBs)
- 1983 – Construction Started
- December 1, 1986 – Operations Began
- 1990 to 2012 – Multiple system modifications/expansions

1986 – 2013

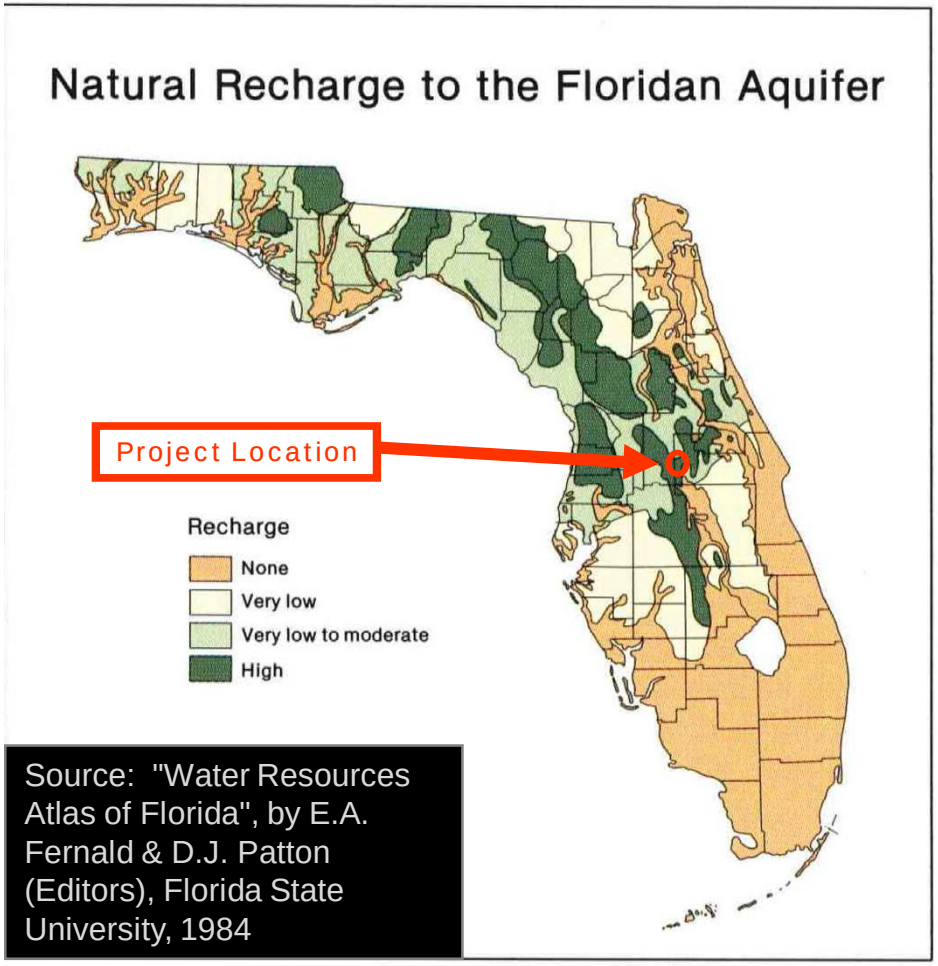
1986

- 10 Citrus Growers
- 18 Turnouts
- 13.79 MGD Average Annual Daily Flow
- 15.88 MGD AADF RIB Capacity

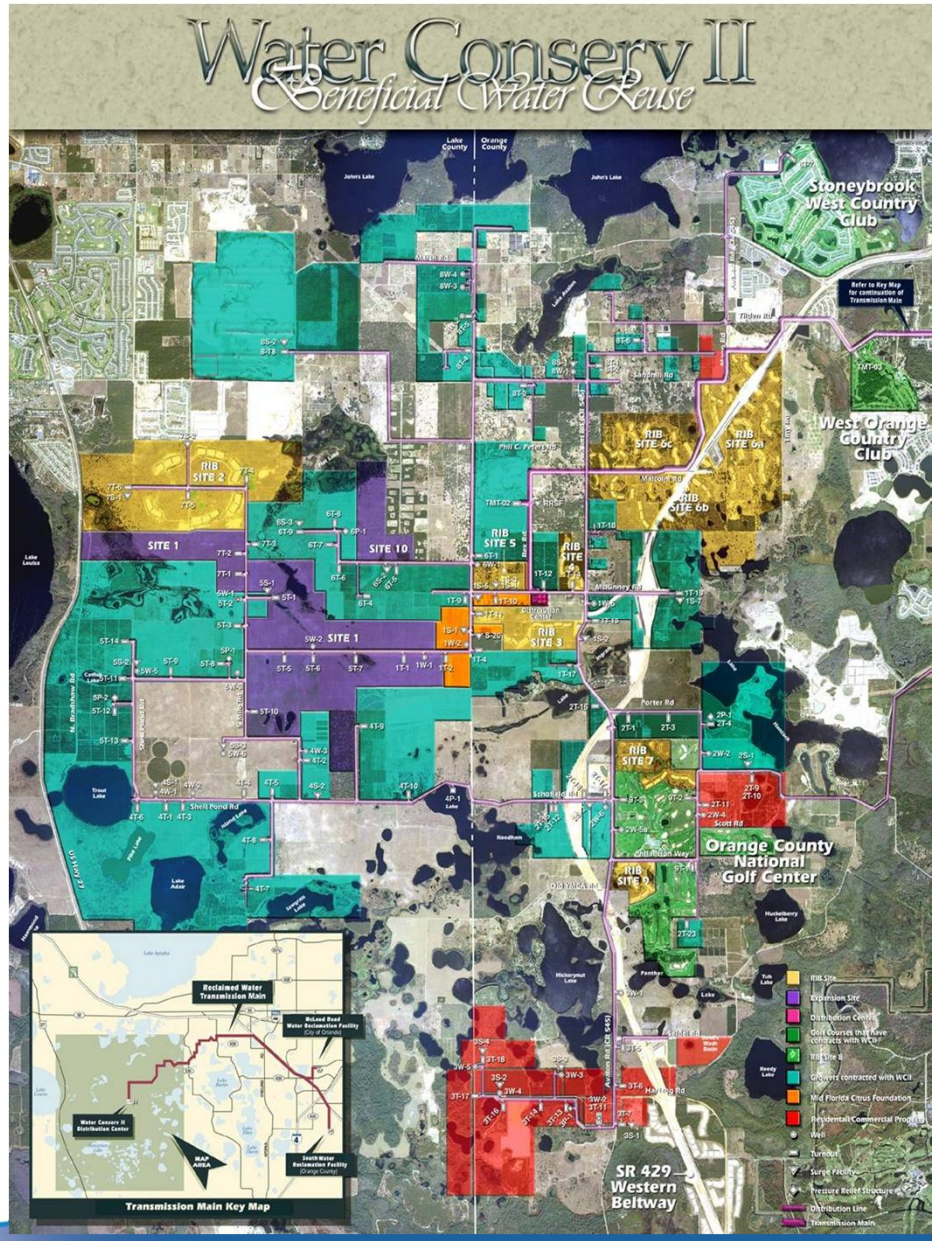
2013

- 67 Customers
- 52 Turnouts
- 34.00 MGD Average Annual Daily Flow
- 32.70 MGD AADF RIB Capacity

Location Maps



Source: "Water Resources Atlas of Florida", by E.A. Fernald & D.J. Patton (Editors), Florida State University, 1984



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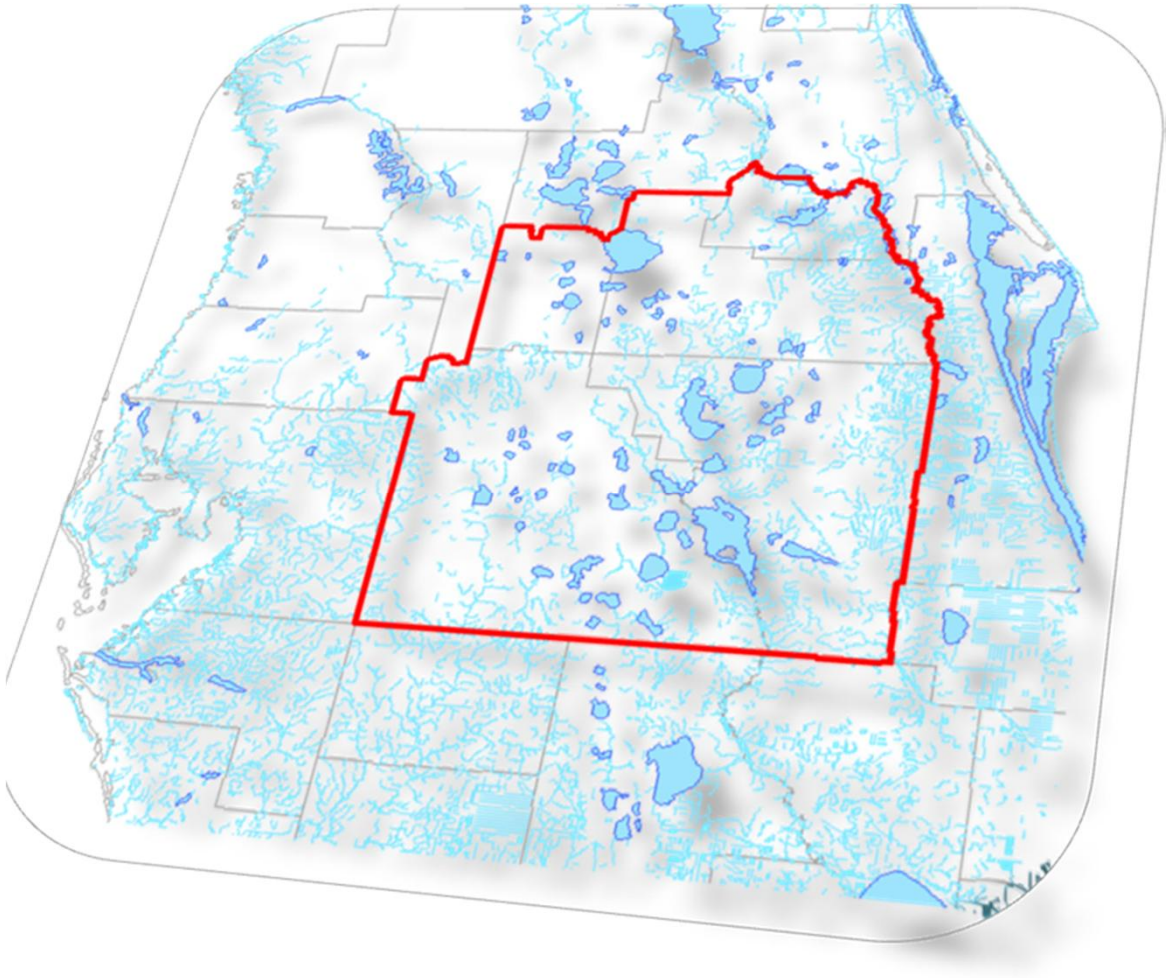
Central Florida Water Initiative



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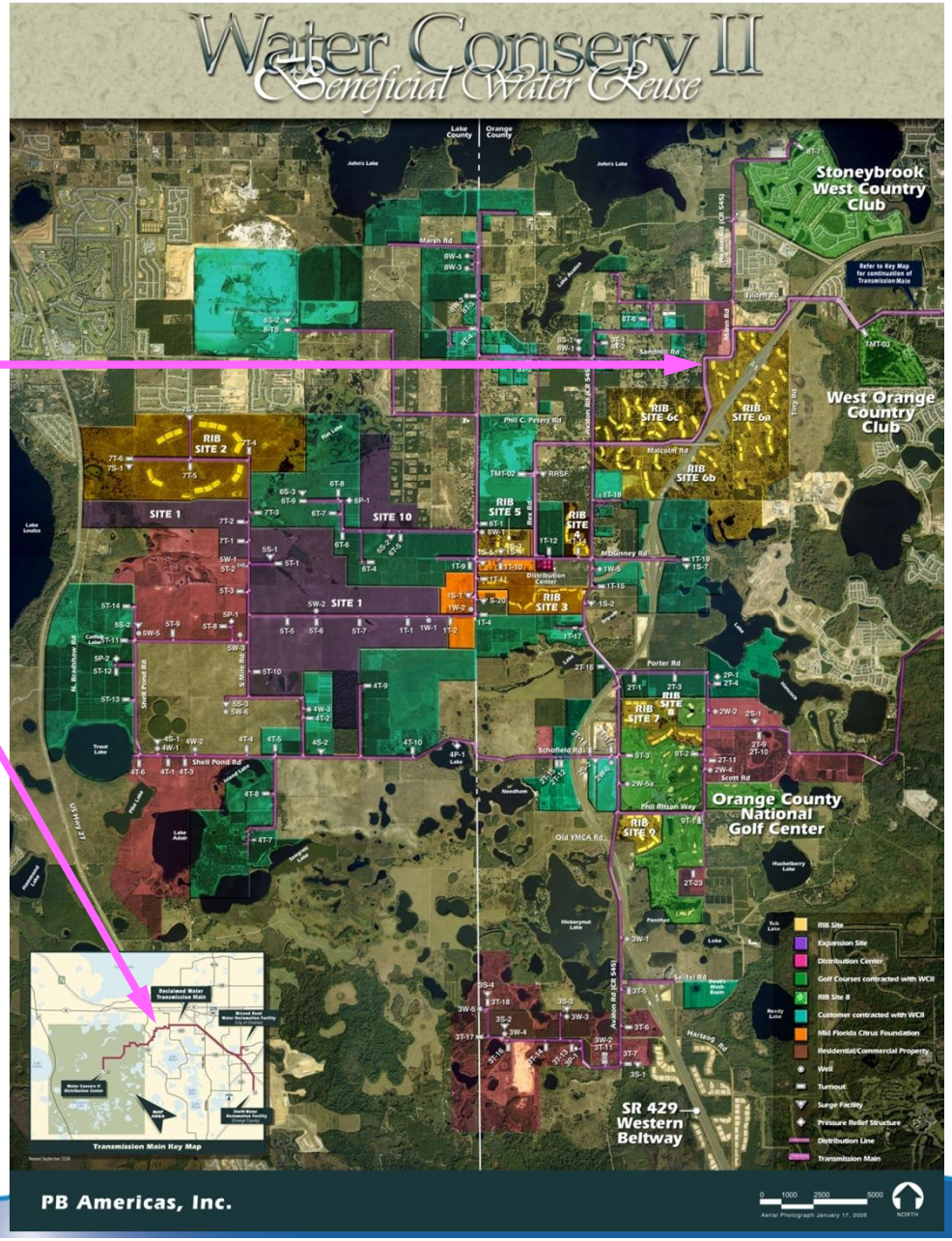
System Components

- Transmission Main
- Distribution Center
- Distribution System
- Supplemental Wells



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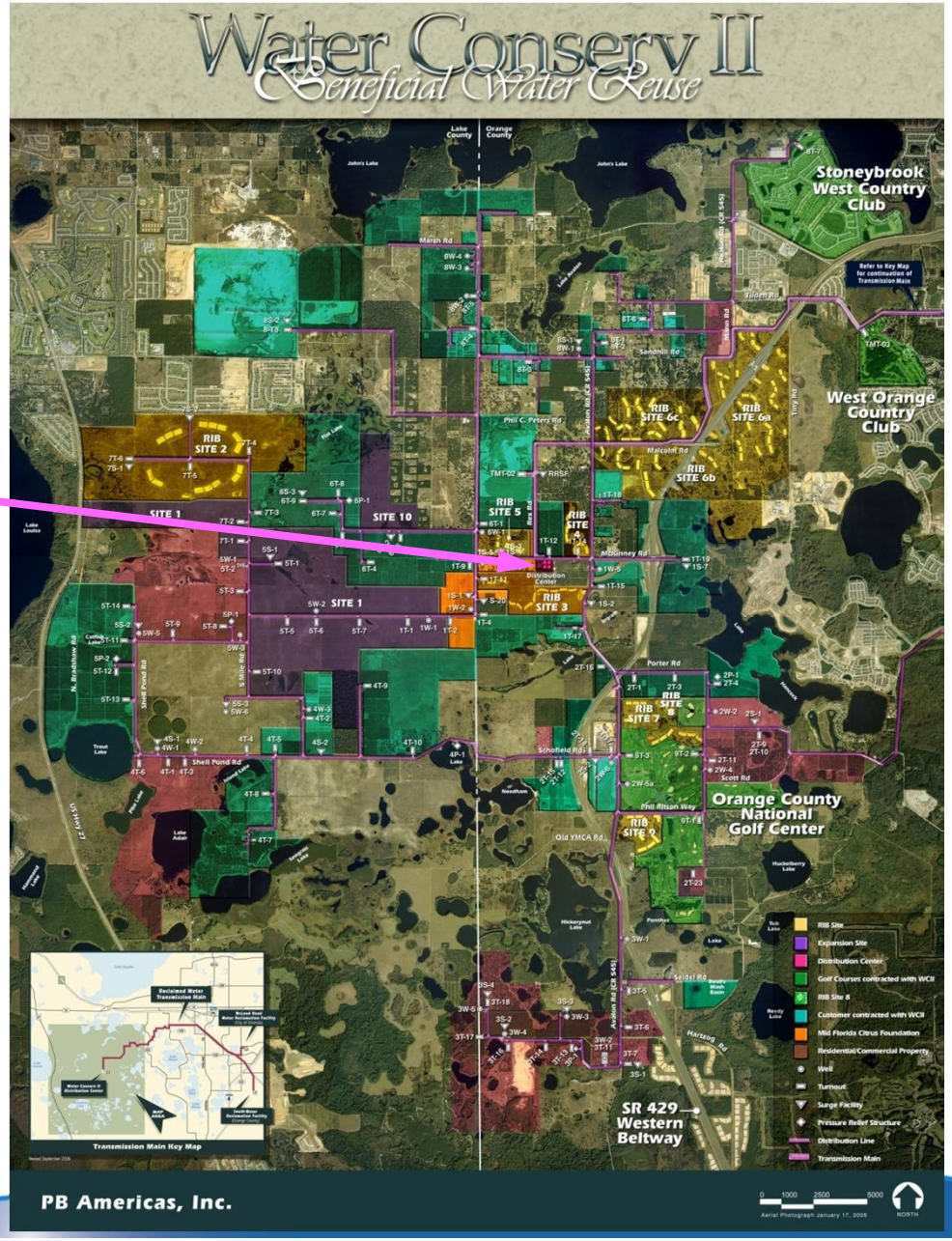

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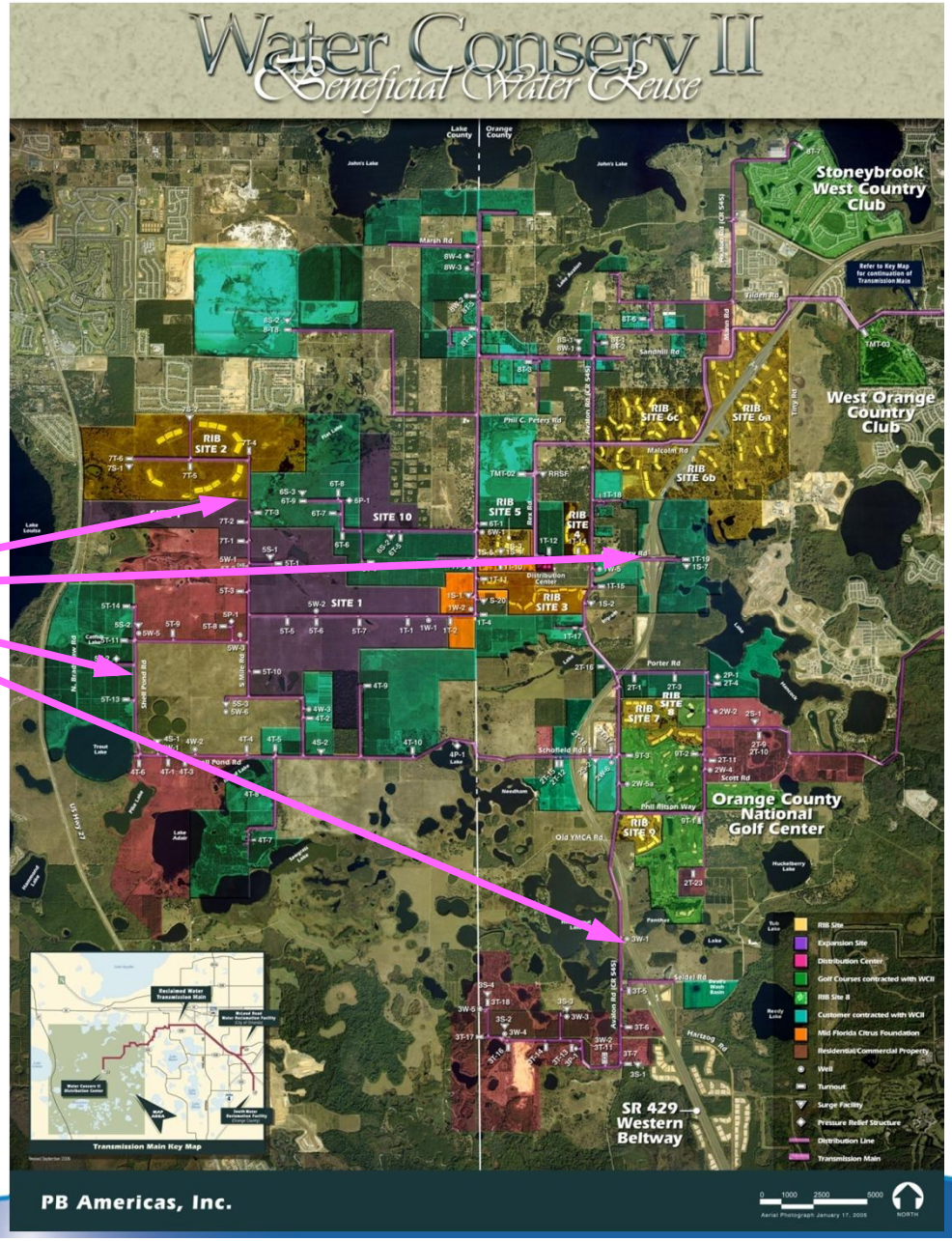

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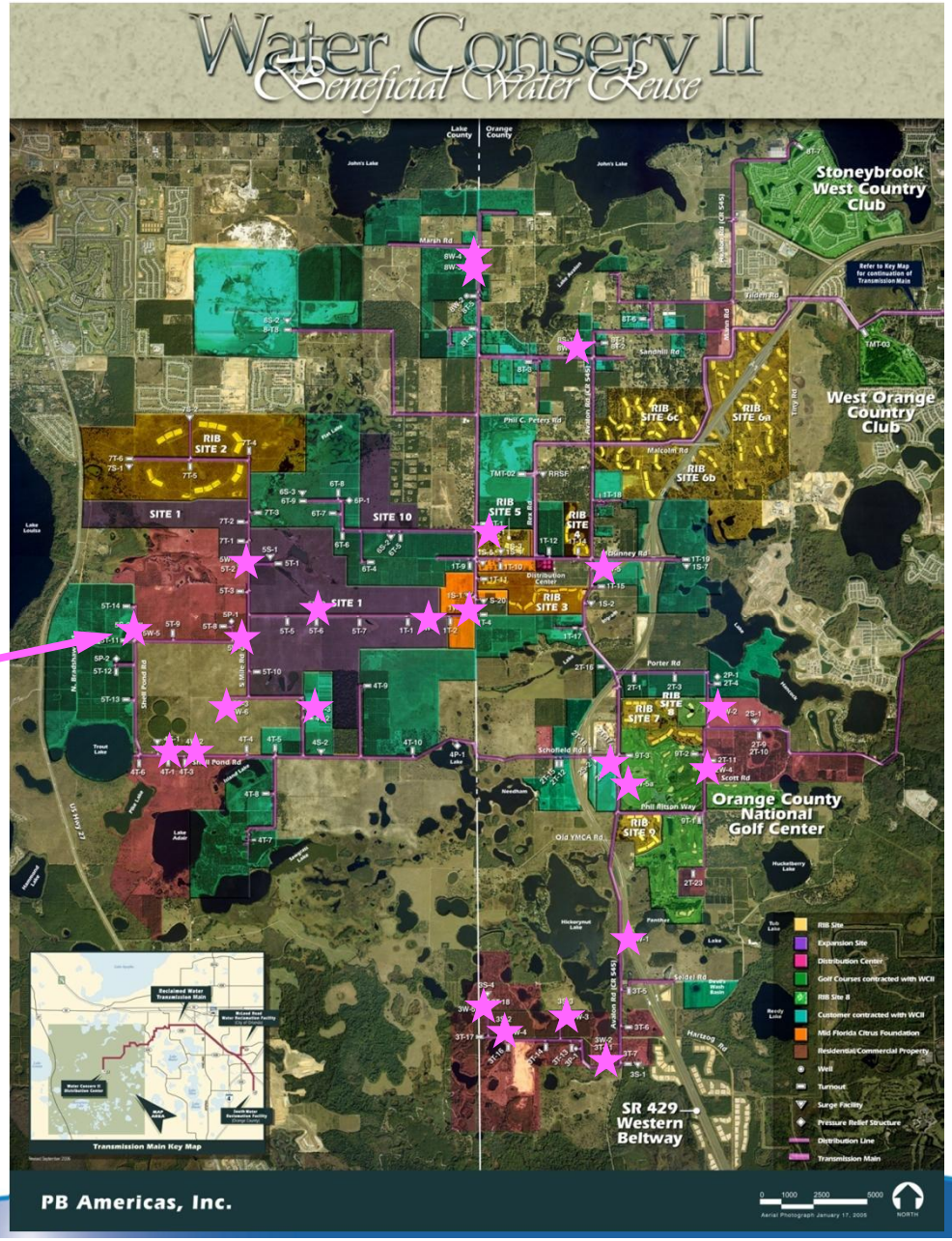

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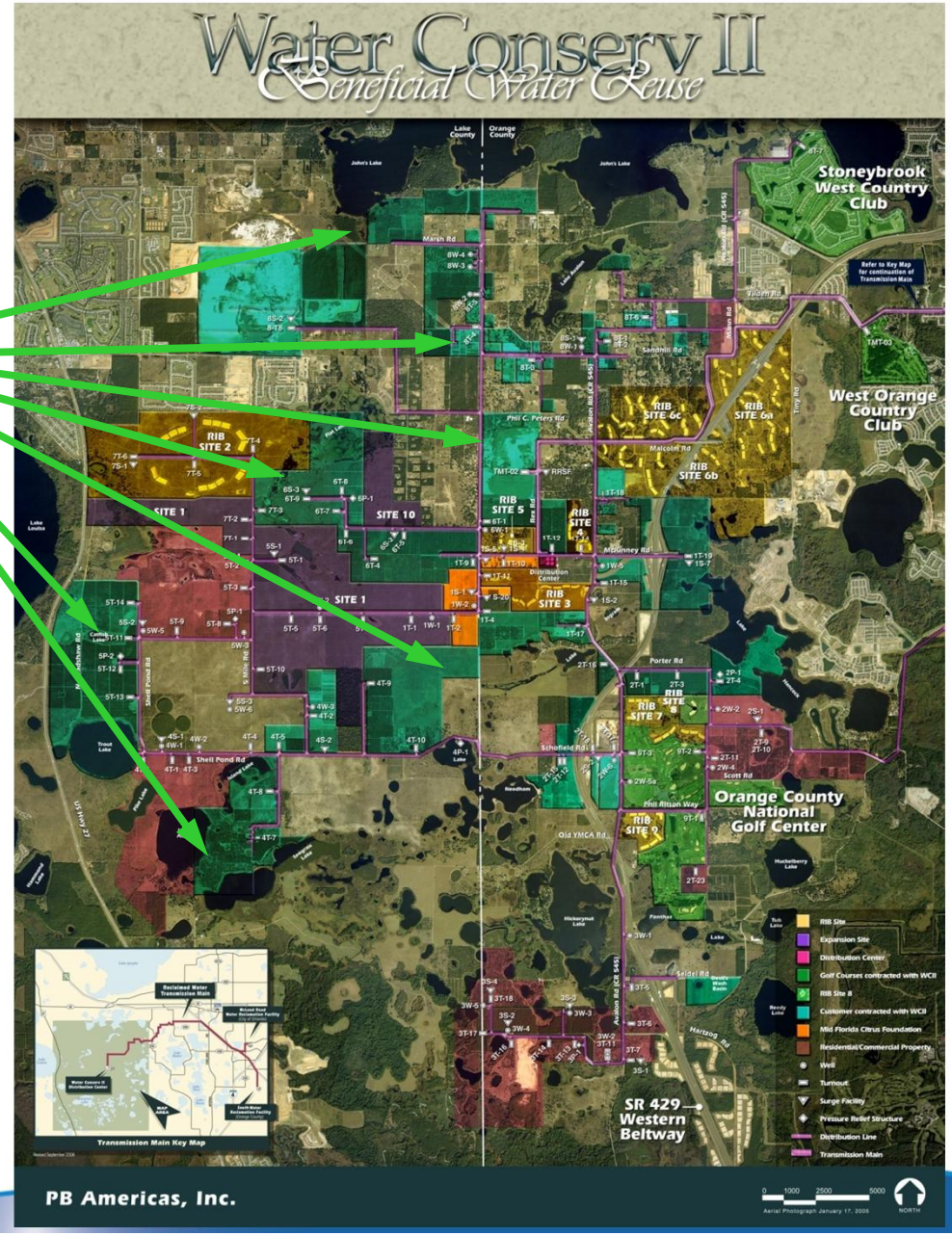
System Components

- Multiple Ag. Irrigation Sites
- Golf Courses
- Sand Mine
- IFAS Research Groves
- RIB Sites



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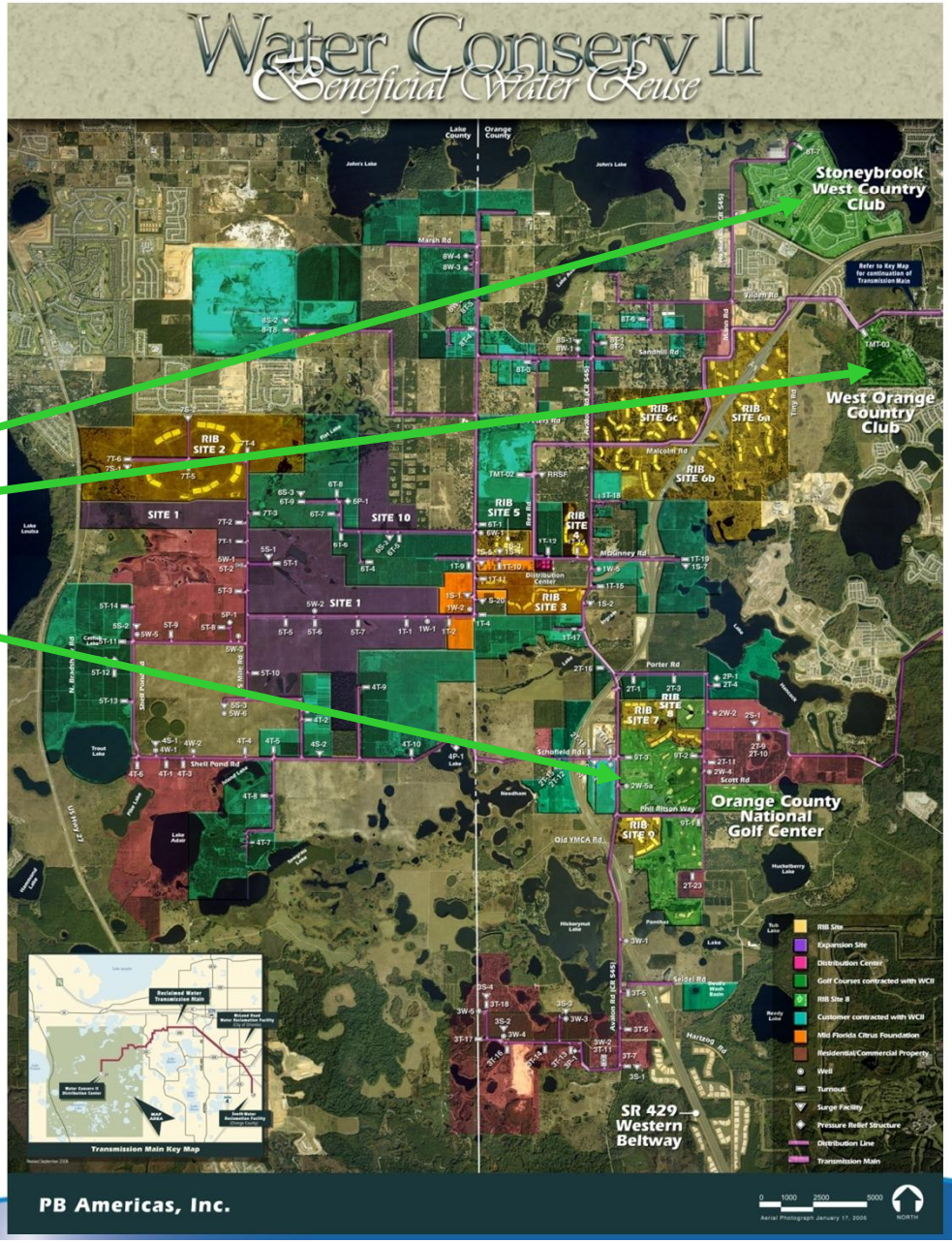

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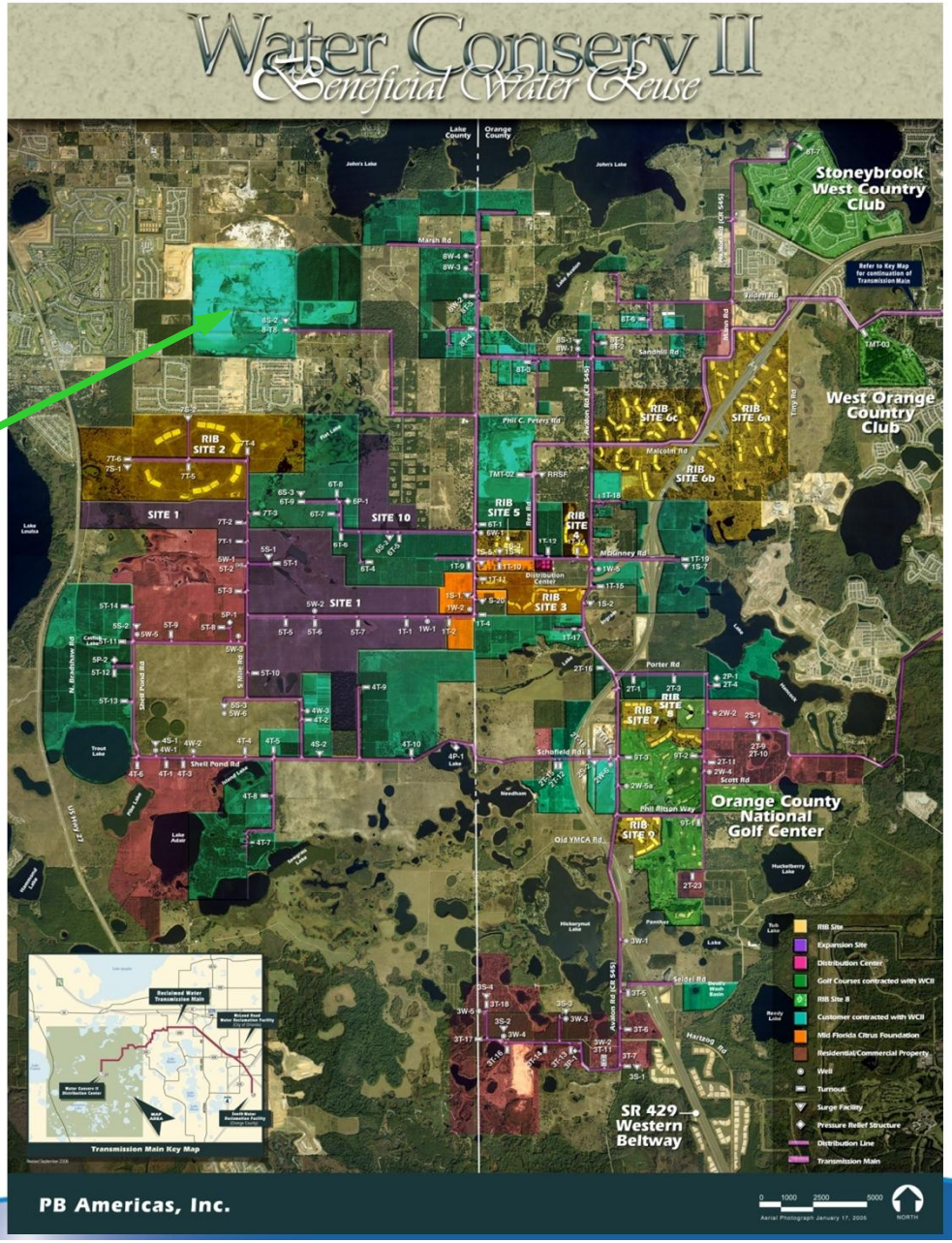

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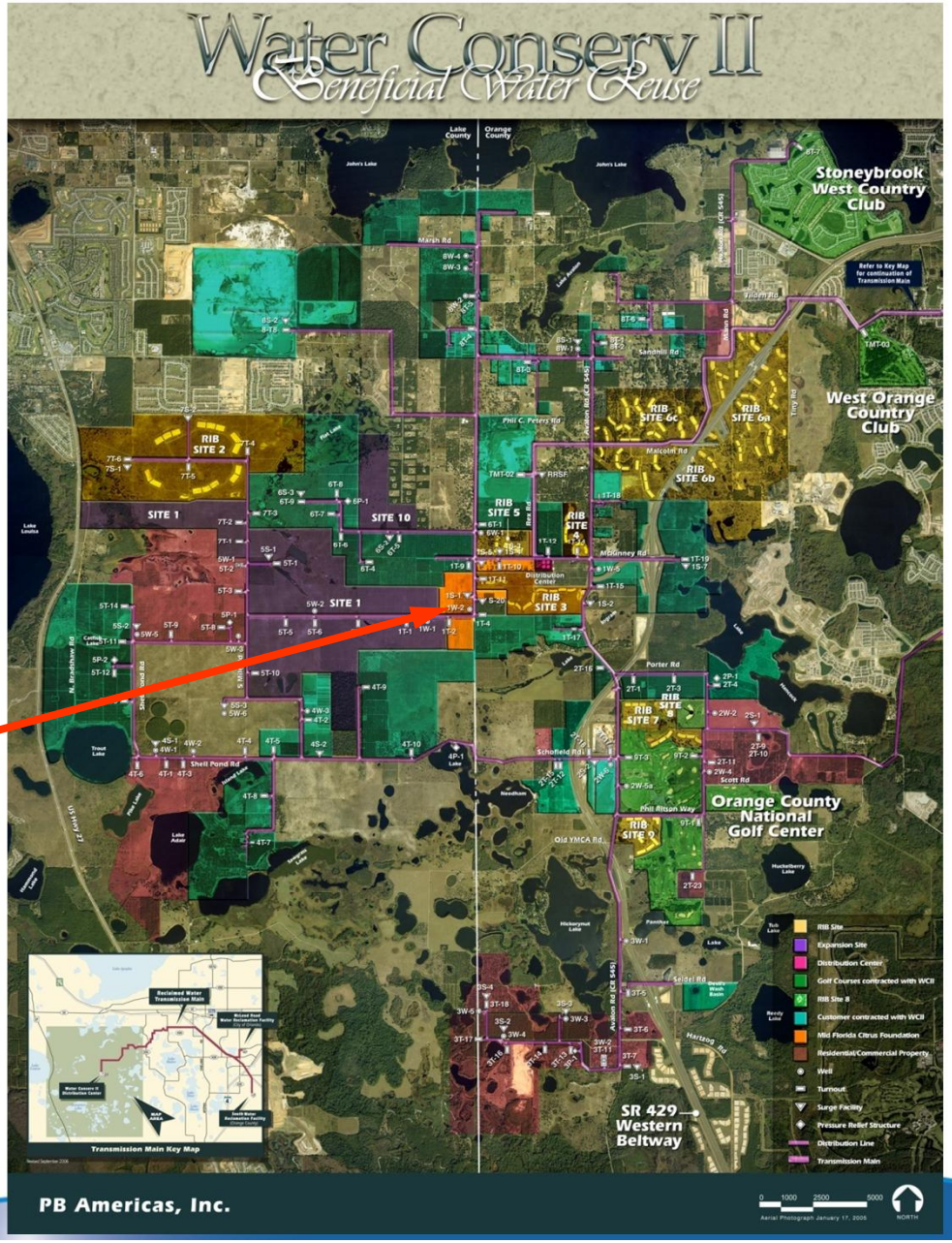

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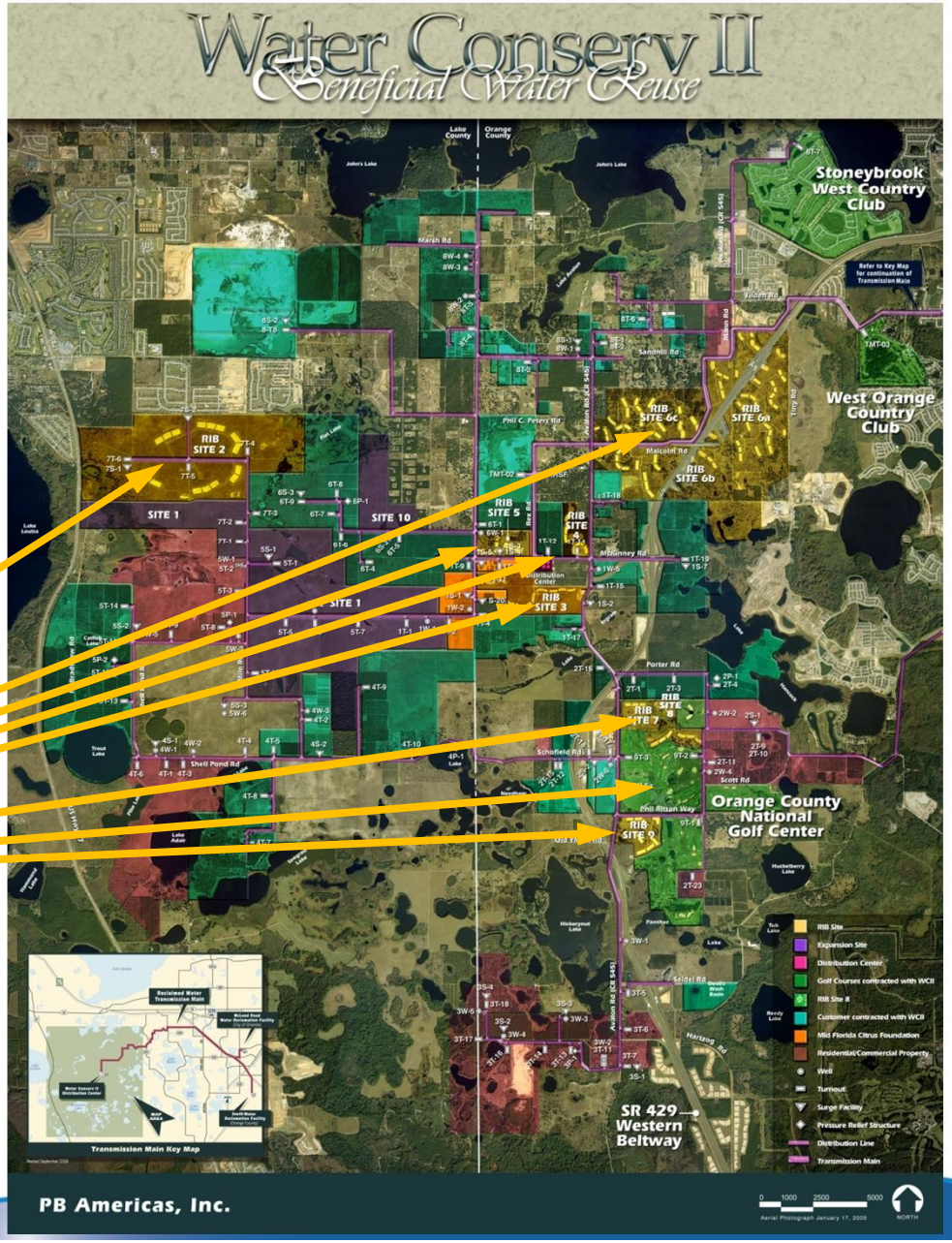

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IFAS Crop & Recycled Water Research

IFAS Crop & Recycled Water Research

- Maximum allowable recycled water constituent concentrations for healthy citrus
- Optimum recycled water irrigation rates (citrus health & economic return)
- Appropriate fertilization rates for citrus on recycled water irrigation
- Economic value of dissolved nutrients in recycled water
- Optimum citrus root stocks and cultivars
- Economic feasibility of non-citrus crops, including:
  - Peaches
  - Figs
  - Grapes
  - Exotic timber

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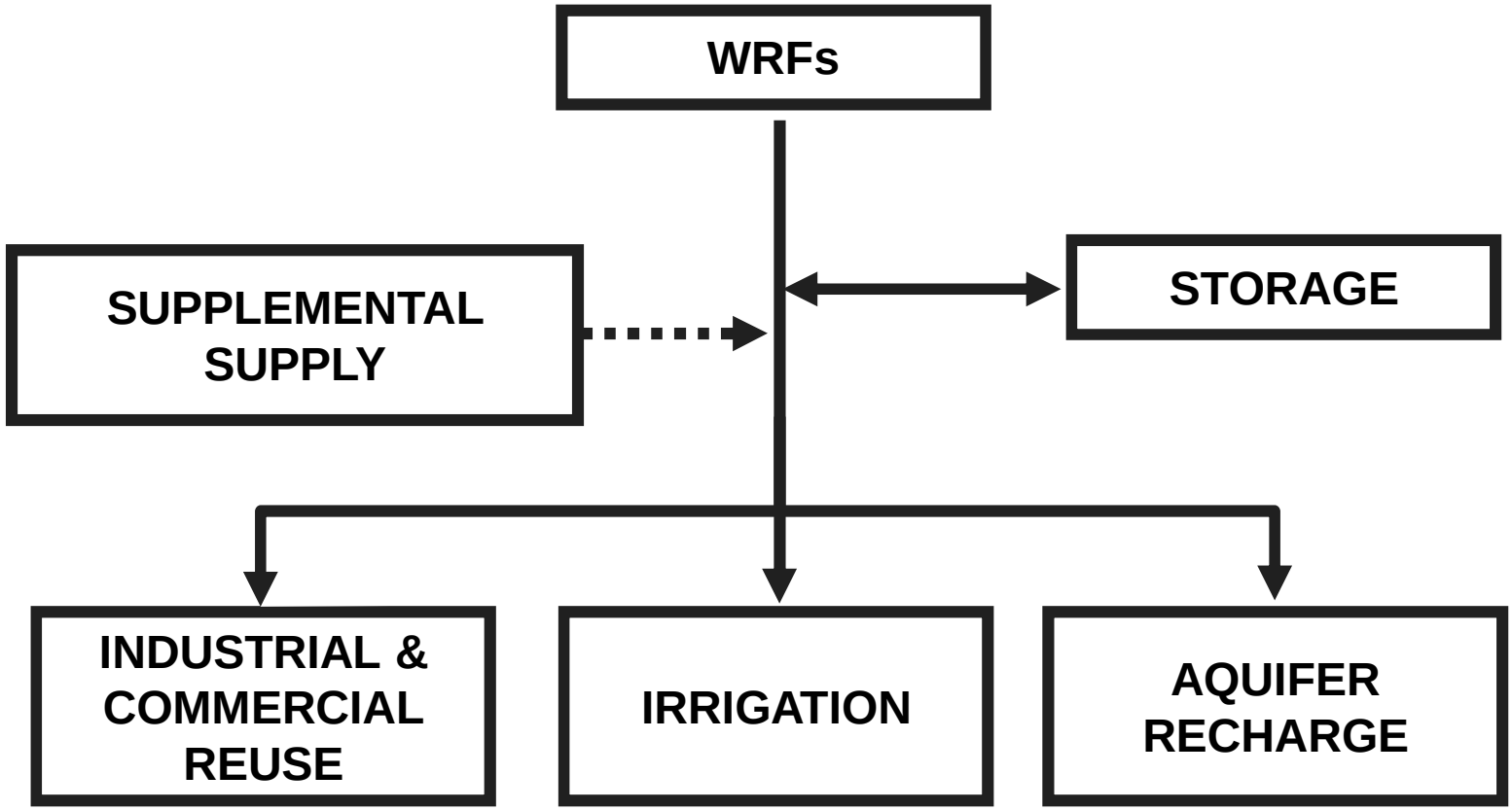
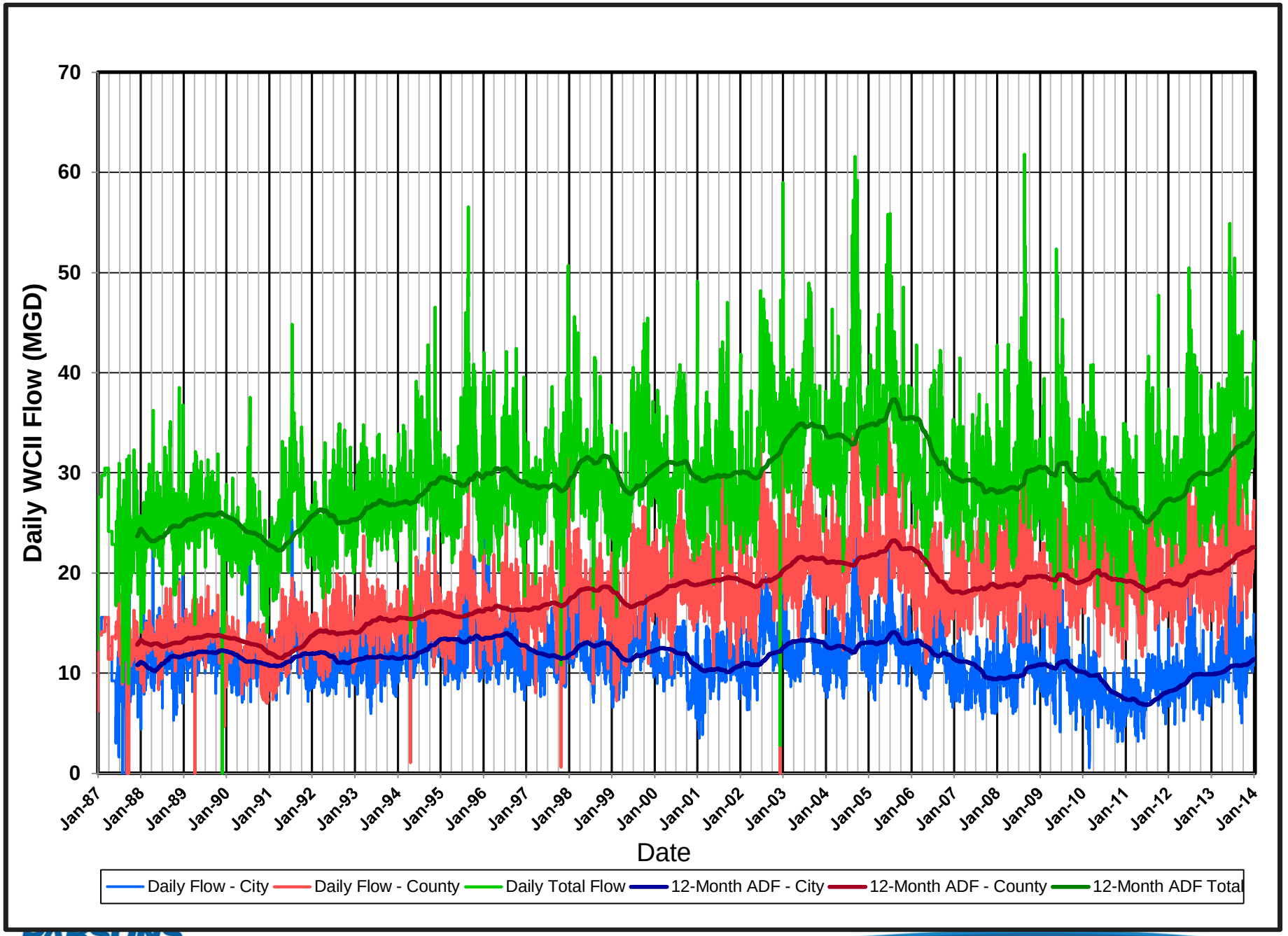
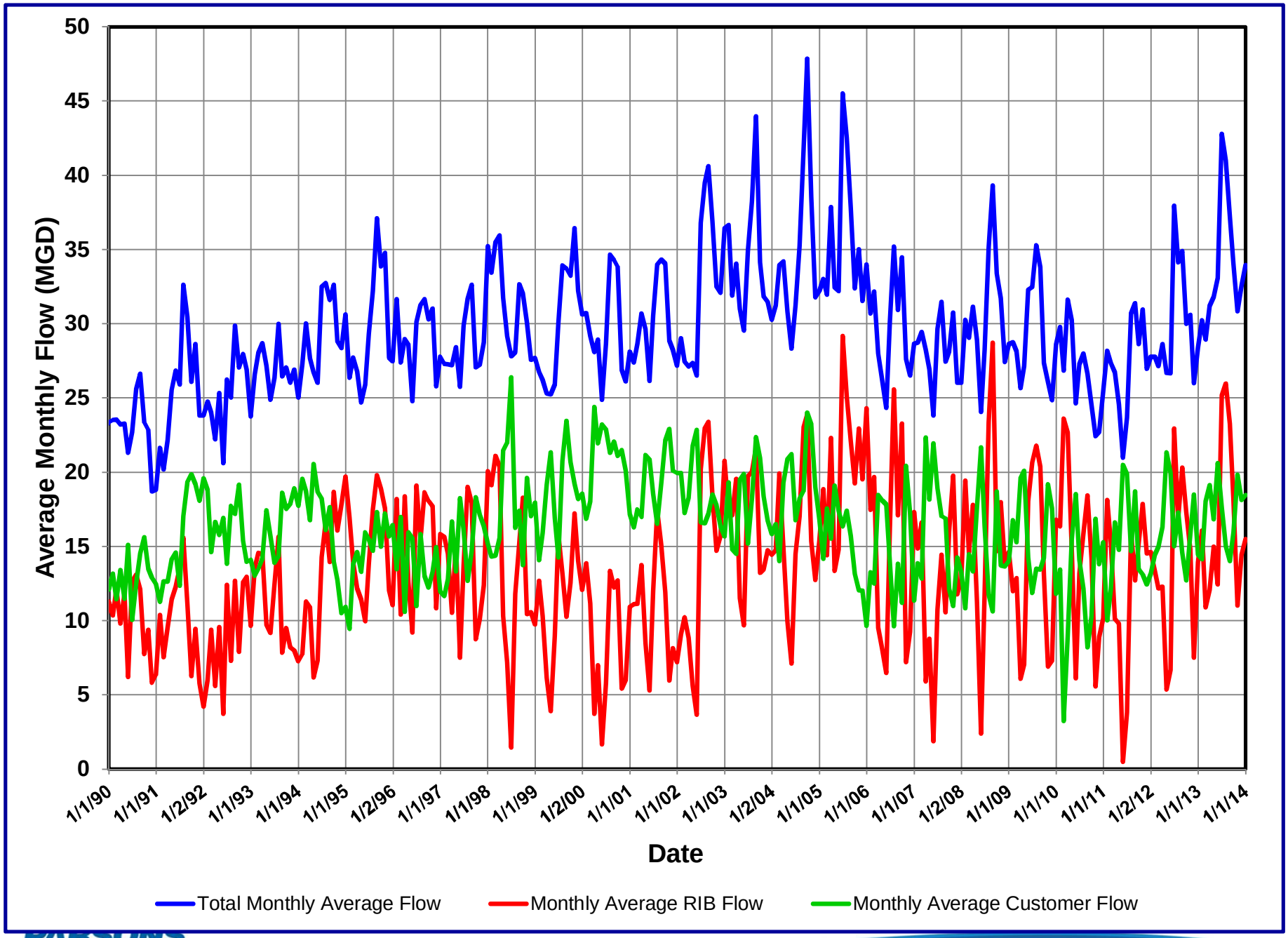
Balanced Multi-application Reclaimed Water Systems




Daily WCII Flow (MGD)
70
60
50
40
30
20
10
0
Jan-87
Jan-88
Jan-89
Jan-90
Jan-91
Jan-92
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Date
Daily Flow - City
Daily Flow - County
Daily Total Flow
12-Month ADF - City
12-Month ADF - County
12-Month ADF Total


Average Monthly Flow (MGD)
50
45
40
35
30
25
20
15
10
5
0
1/1/90
1/1/91
1/2/92
1/1/93
1/1/94
1/1/95
1/2/96
1/1/97
1/1/98
1/1/99
1/2/00
1/1/01
1/1/02
1/1/03
1/2/04
1/1/05
1/1/06
1/1/07
1/2/08
1/1/09
1/1/10
1/1/11
1/2/12
1/1/13
1/1/14
Date
Total Monthly Average Flow
Monthly Average RIB Flow
Monthly Average Customer Flow

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Minimum Recycled Water Quality Standards

- Set by rule (Florida Administrative Code)
- Rules address:
  - **Treatment processes (secondary or better)**
  - **Disinfection processes (high level)**
  - **Performance standards**
  - **Permitting requirements and procedures**
  - **Quality monitoring, record keeping & reporting**
  - **Management of off-spec water**
  - **Agricultural crops that may be irrigated with recycled water**

Recycled Water & Edible Crops

Chapter 62-610.475 FAC (Edible Crops)

1. Irrigation of edible crops that will be peeled, skinned cooked or thermally processed before consumption is allowed. Direct contact of the reclaimed water with such edible crops is allowed.
2. Irrigation of tobacco or citrus is allowed. Direct contact of the reclaimed water with tobacco or citrus is allowed, including citrus used for fresh table fruit, processing into concentrate, or other purposes.
3. Irrigation of edible crops that will not be peeled, skinned, cooked, or thermally processed before consumption is allowed if an indirect application method that will preclude direct contact with the reclaimed water (such as ridge and furrow irrigation, drip irrigation, or a subsurface distribution system) is used.
4. **Irrigation of edible crops that will not be peeled, skinned, cooked or thermally processed before consumption using an application method that allows for direct contact of the reclaimed water on the crop is prohibited**.

2012 Recycled Water Quality Ranges

Parameter	Units	Minimum	Maximum	Average
Total Phosphorus	mg/L	1.05	3.47	2.22
Ammonia Nitrogen	mg/L	<0.12	10.00	0.89
Nitrite Nitrogen	mg/L	<0.01	0.80	0.15
Nitrate Nitrogen	mg/L	1.06	12.30	5.57
Total Inorganic Nitrogen	mg/L	4.64	15.16	6.67
Organic Nitrogen	mg/L	0.44	4.86	1.45
Total Nitrogen	mg/L	5.58	17.16	8.14
Total Suspended Solids	mg/L	<1	2.0	0.45
$CBOD_5$	mg/L	<1	6.6	1.5
Chloride	mg/L	59.3	107.0	88.1

Customer Coordination on Water Quality

WATER CONSERV II
MEMORANDUM

DATE: January 14, 2014

FILE: Constituents

TO: Water Conserv II Participants

FROM: Phil Cross, Senior Project Manager

SUBJECT: Citrus Irrigation Reclaimed Water Constituent Concentrations

Enclosed is a copy of the Citrus Irrigation Reclaimed Water Constituent Concentrations for December and the preceding 5 months.

Citrus Irrigation Reclaimed Water Constituent Concentrations

WATER CONSERV II
CITRUS IRRIGATION RECLAIMED WATER
CONSTITUENT CONCENTRATIONS
December 2013

CONSTITUENTS	MACL	July	August	September	October	November	December
Arsenic	0.10	<0.001272	<0.001272	<0.001272	<0.001212	<0.001272	<0.001272
Barium	2.0	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
Beryllium	0.10	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008
Bicarbonate (Alkalinity)	200	111	110	107	106	103	117
CBOD5 (Carb Biochemical Oxygen Demand)	30	1.6	1.5	1.4	1.6	1.5	1.4
Boron	1.0	0.130	0.140	0.140	0.140	0.140	0.150
Cadmium	0.01	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024
Calcium	200	47.0	49.0	45.0	51.0	48.0	50.0
Chemical Oxygen Demand	120	20	17	23	27	33	13
Chloride	100	78	79	76	84	87	85
Chlorine	10.0	2.0	2.2	2.0	1.8	2.0	2.0
Chromium	0.01	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
Cobalt	0.05	---	<0.008	---	---	<0.008	---
Copper	0.20	<0.0120	<0.0120	<0.0120	<0.0120	<0.0120	<0.0120
ECW (umhos)	1100	653	644	635	631	616	666
Iron	5.0	0.06	0.06	0.07	0.06	0.06	0.07
Lead	0.1	<0.000648	<0.000648	<0.000648	<0.001756	<0.000648	<0.000648
Lithium	0.01	---	<0.02	---	---	<0.02	---
Manganese	0.20	0.015	0.010	0.018	0.009	0.007	0.009
Magnesium	25.0	---	9.0	---	---	9.4	---
Mercury	0.01	<0.000048	<0.000048	<0.000048	<0.000048	<0.000048	<0.000048

Citrus Irrigation Reclaimed Water Constituent Concentrations

WATER CONSERV II
CITRUS IRRIGATION RECLAIMED WATER
CONSTITUENT CONCENTRATIONS
December 2013

CONSTITUENTS	MACL	July	August	September	October	November	December
Nickel	0.20	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080
Nitrite	---	0.283	0.131	0.161	0.143	0.117	0.192
Nitrate	---	6.71	5.91	5.26	6.88	5.98	5.86
Nitrogen (Total)	30	9.64	8.16	7.57	9.40	8.15	9.24
Phosphorus	10	1.62	1.48	1.81	2.45	1.70	1.98
pH	6.0-8.5	7.0	7.0	7.0	6.9	6.9	7.0
Potassium	30	13.0	14.0	13.0	16.0	14.0	14.0
Selenium	0.02	<0.0016560	<0.0016560	<0.0016560	<0.0007880	<0.0016560	<0.0016560
Silver	0.05	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Sodium	70	60.6	58.8	61.0	64.8	66.0	65.8
Sulfate	100	37.3	35.2	34.2	38.2	39.4	55.3
Total Suspended Solids	5	<1	<1	<1	<1	<1	1
Zinc	1.0	0.035	0.033	0.032	0.035	0.042	0.040

NOTES: 1. MACL - Maximum Average Concentration Limits
2. Limits in mg/L - pH is reported in Standard Units (SU) and Conductivity is reported in uhoms/cm.

* No results due to lab error
--- Not scheduled to be sampled

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The Future: Driven by Urbanization & Environmental Constraints

- Increasing urbanization
  - Loss of agricultural land and irrigation customers
  - Urban irrigation generate higher revenues .. and higher costs
- Recycled water is private property, not “Waters of the State”, but…
  - Water Management District pressure to supply recycled water to adjacent communities with expensive Alternative Water Supply options
  - Water Management District pressure to export recycled water for restoration of surface water flows and levels
- Pressure to protect surface waters by reducing recycled water nutrient concentrations
  - Recent Numerical Nutrient Criteria rule
  - Draft Springs Protection legislation
- Direct potable reuse … when?
  - Rapidly becoming cheaper to treat it for direct potable reuse than for “purple pipe” recycling or other Alternative Water Supplies

QUESTIONS?