City of Wichita Falls Water Conservation and Emergency Direct Potable Reuse

Daniel K. Nix
Utilities Operations Manager

Wichita Falls TEXAS

The Last Drought 1995- 2000

Lessons Learned

- City constructed Reverse Osmosis Plant.
- Activated Lake Kemp Source.
- Raised the drought restriction triggers by 10%, to start conserving sooner.
- Began investigating the potential of Wastewater Reuse.

The Current Problem

Loss of Rainfall

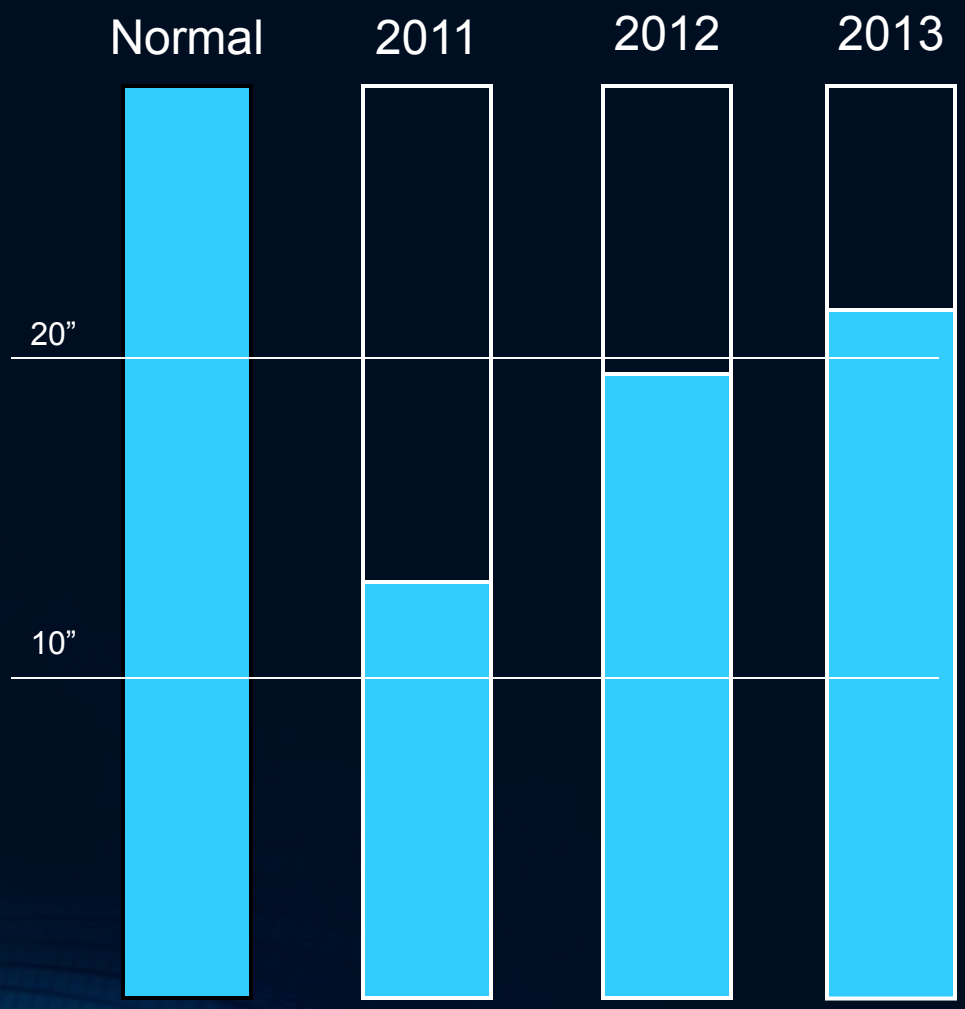
The annual average rainfall for the Wichita Falls area is 28.5 inches.

In 2011 we were 15.5 inches below normal.

In 2012 we were 8.75 inches below normal.

In 2013 we were 7.24 inches below normal.

Over 30 inches below normal
for the past 3 years



The Current Problem

Record Temperatures

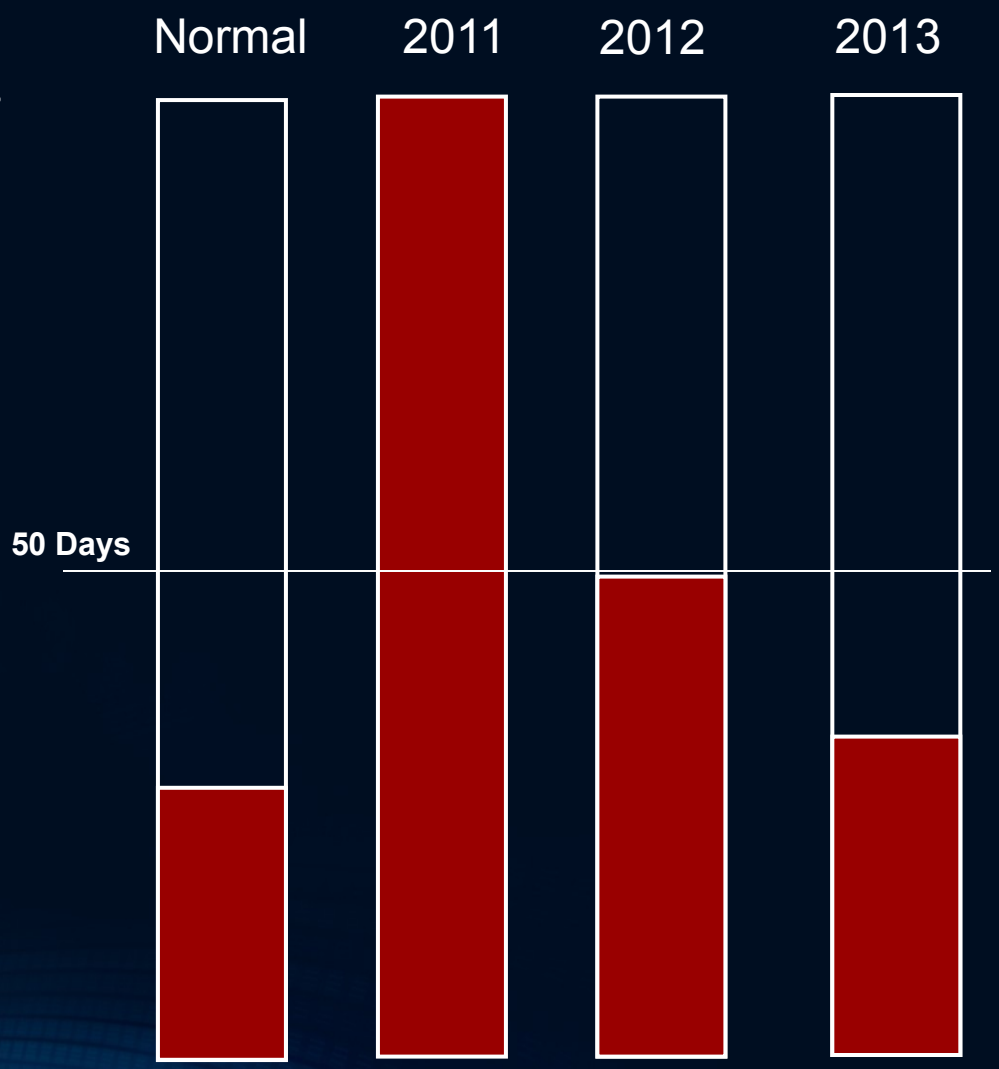
Wichita Falls typically averages 28 days over 100 degrees

In 2011 we had 100 days.

The Weather Channel ranked Wichita Falls the #1 Worst Summer anywhere in the U.S. for 2011.

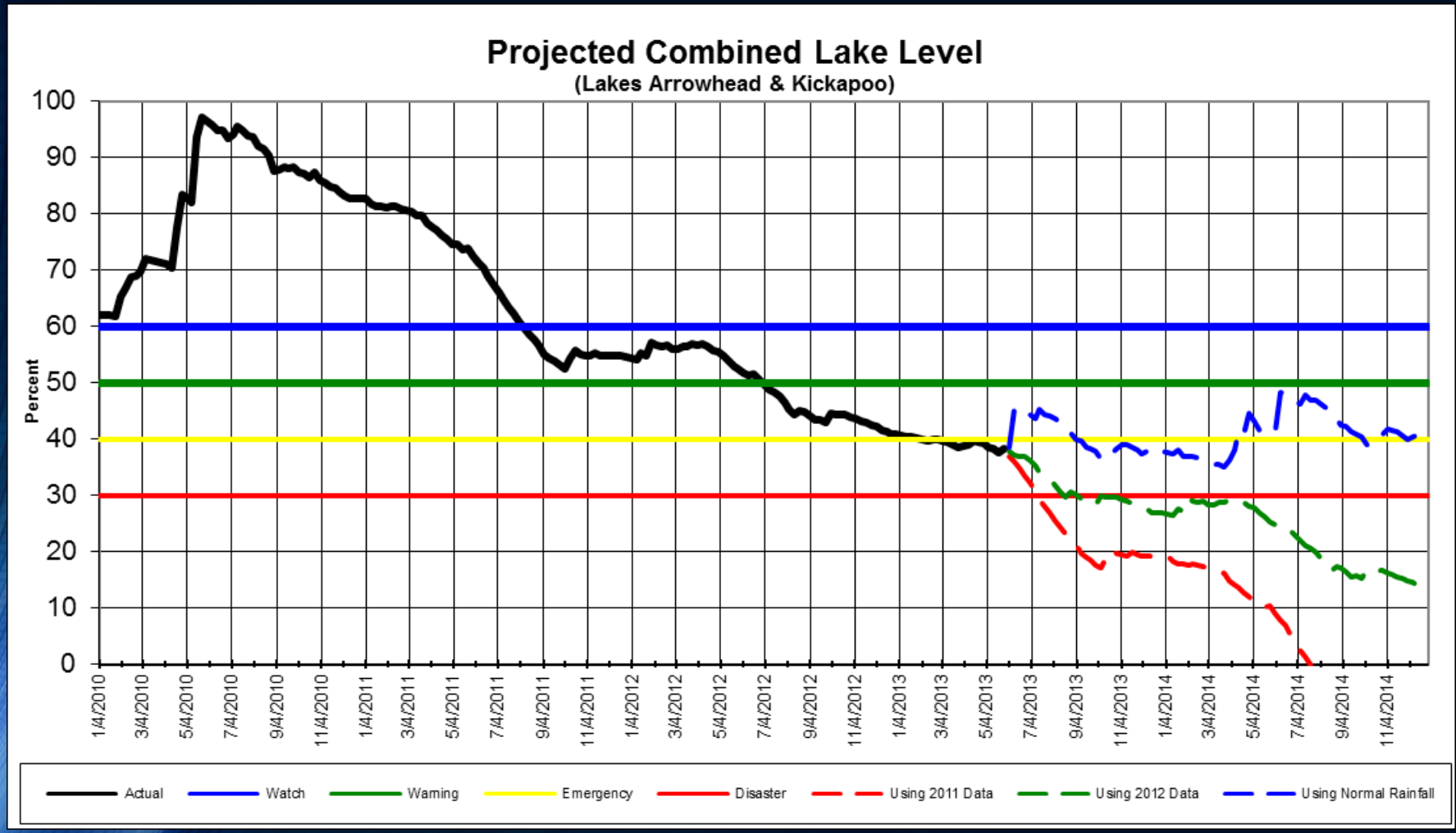
In 2012 we had 50 days.

In 2013 we had 32 days.



The Current Problem

Lake Level Decline



The Current Problem

Lake Level Decline

2009

2013

The Current Problem

Lake Level Decline

2009

2013

The Current Problem

Lake Level Decline

2009

2013

The Current Problem

Lake Level Decline

2009

2013

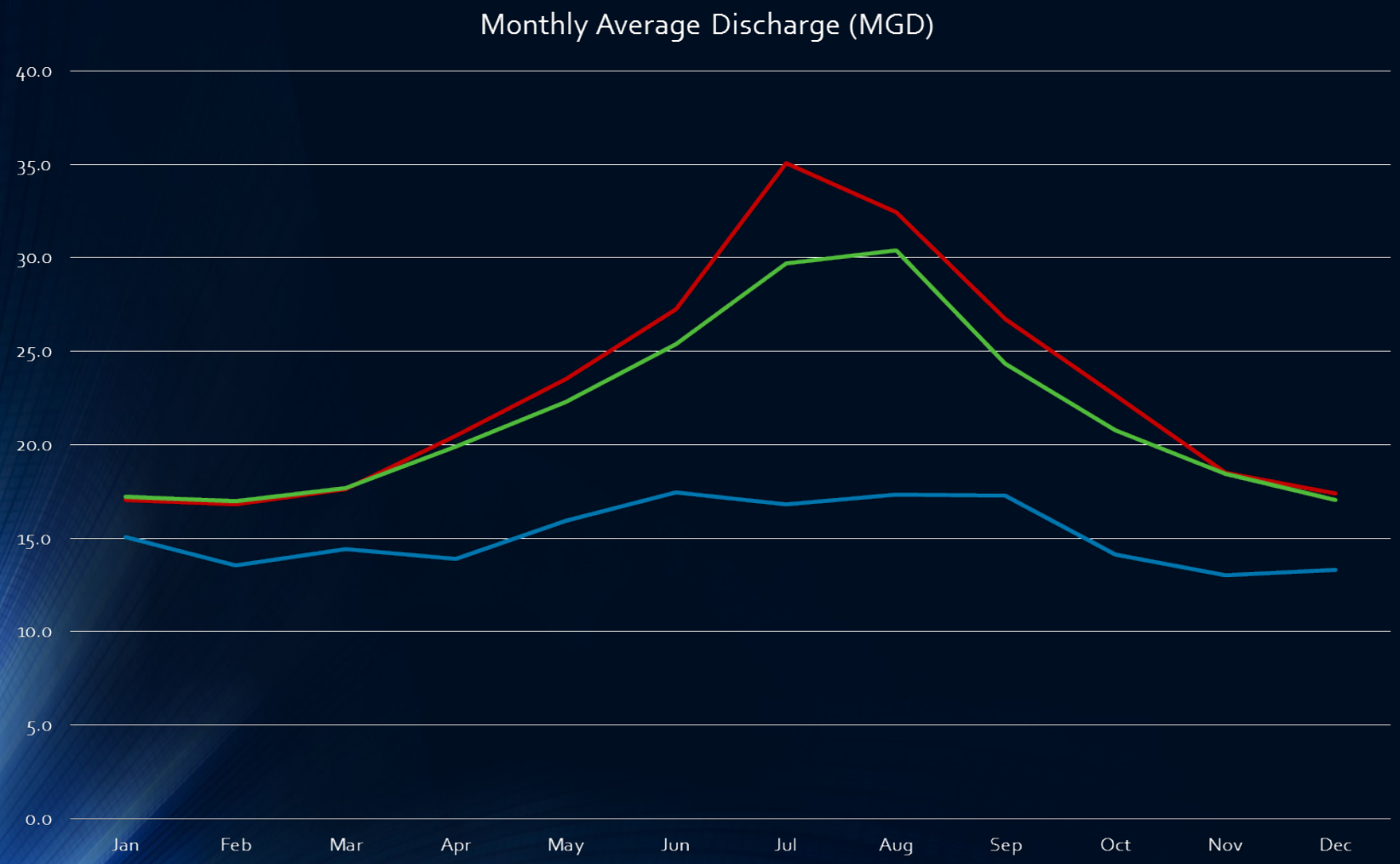
Water Conservation

Results

- Stage 1 – August 2011
- Stage 2 – July 2012 (saved 500 MG)
- Stage 3 – February 2013 (saved 2 BG)
- Stage 4 – November 2014 (??)

Water Conservation

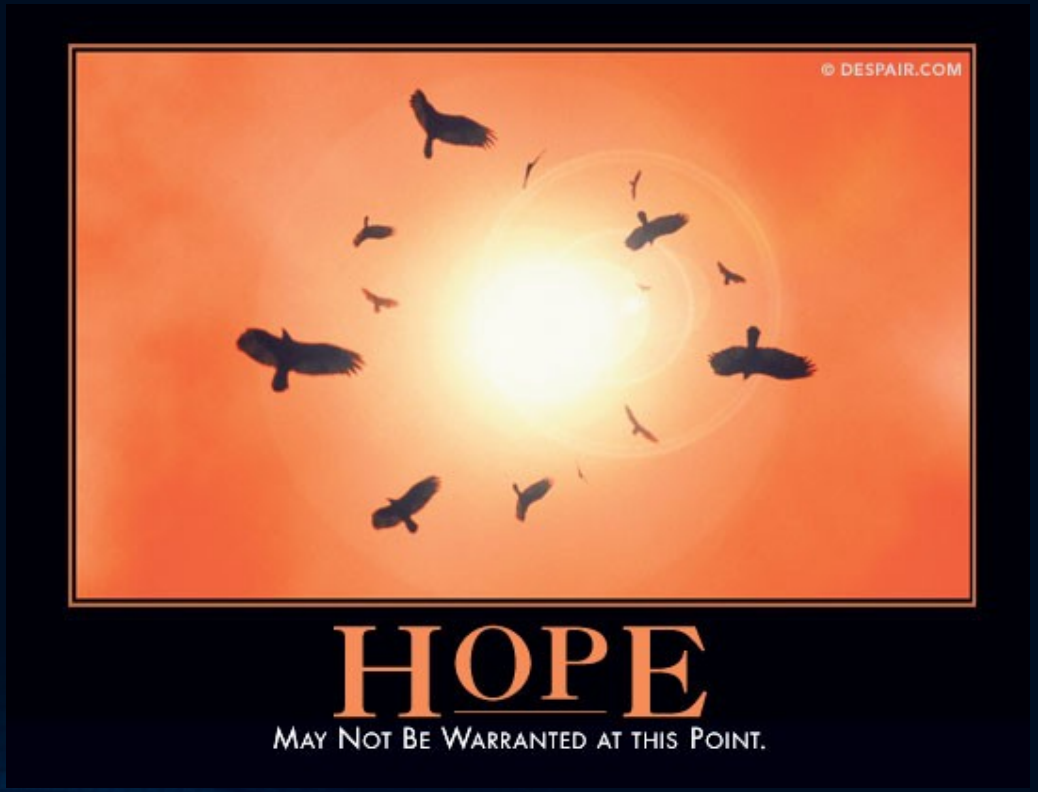
Results



Water Conservation

Unfortunately, we can not conserve our way out of this drought.

So, what's the Plan??



Emergency Direct Potable Reuse

Wastewater Effluent

Quantity?

- The River Road WWTP averages 12 MGD discharge to the Big Wichita River.
- Drought reductions have lowered that to 8.5 MGD.
- Using the Reverse Osmosis would generate 5 MGD of source water.
- Blended with 5 MGD water from Lakes would produce 10 MGD water for health and sanitation needs. (40 – 50 percent of need)

Wastewater Effluent

Quality?

- The River Road WWTP effluent has been tested for the last 16 months for numerous regulated and non-regulated compounds.

- Wastewater Effluent currently meets all 97 drinking water standards, with the exception of:
  - Nitrate
  - Trihalomethanes
  - Microbials

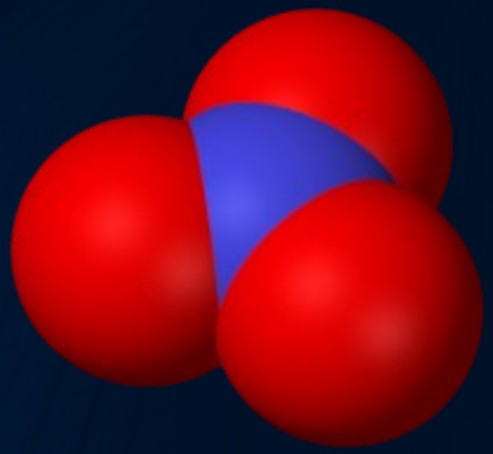
  - Could the City remove these 3 compounds to Drinking Water Standards

Wastewater Effluent

Quality?

- Nitrate – estimated 80% removal through Reverse Osmosis.

  Effluent = 18 ppm
  RO Permeate = 3.6 ppm
  Blend with Raw Surface Water = 1.8 ppm



Wastewater Effluent

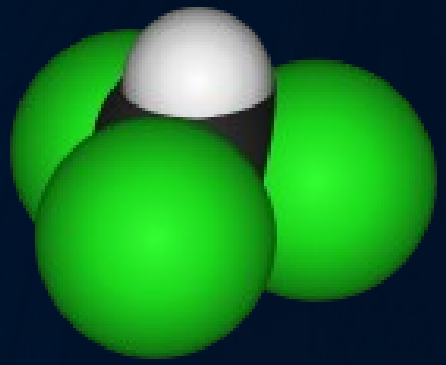
Quality?

- Trihalomethanes – estimated 40% removal through Reverse Osmosis with an addition of 15 ppm from Conventional Treatment.

  Effluent = 106 ppb
  RO Permeate = 63.6 ppb
  Blend with Raw Surface Water = 31.8 ppb
  Conventional Treatment = 46.8 ppb (MCL 80 ppb, WF Avg 15ppb)

- Reduced Trihalomethanes in Wastewater Effluent by using Chloramines.

  Effluent = 10 ppb
  RO Permeate = 6 ppb
  Blend with Raw Surface Water = 3 ppb
  Conventional Treatment = 18 ppb



Wastewater Effluent

Quality?

- Microbes – log removal credits:
  - Virus – 8 log Removal using Disinfection and Physical Processes
  - Giardia – 6 log Removal using Disinfection and Physical Processes
  - Cryptosporidium – 5.5 log Removal using Physical Processes

Direct Potable Reuse

Concept Paper

The City had confirmed that all required Treatment Processes were already on-site.
Just had to connect them with a pipeline.

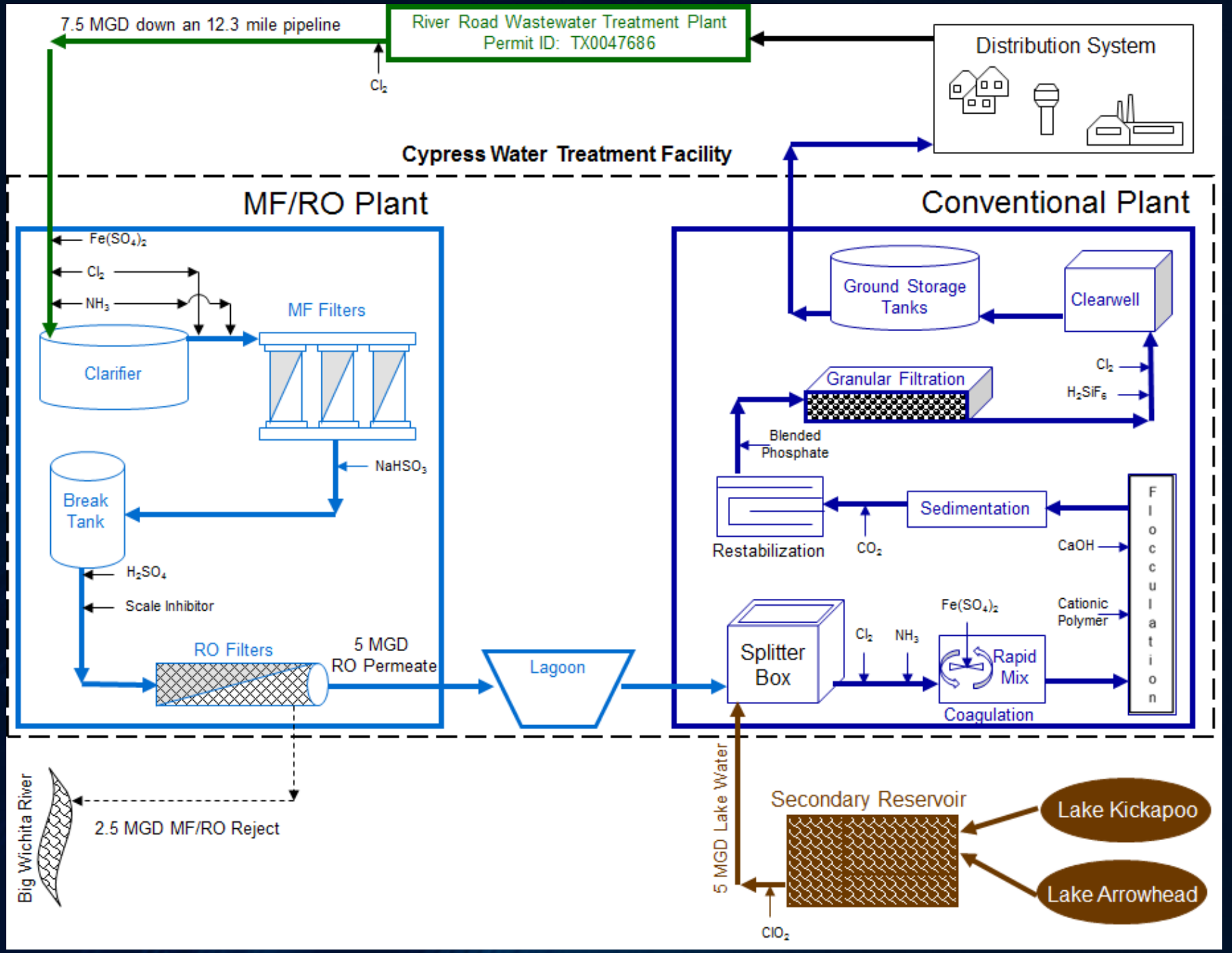
The City developed a Concept Paper detailing:

- Processes to be Utilized
- Removal Efficiencies for Various Contaminants
- Operational Guidelines

Submitted in November 2012.

TCEQ Acceptance February 2013.

- Changed Virus log Removal Requirement to 9.0 log based on Preformed Chloramines
- Changed Giardia log Removal Requirement to 7.0 log based on Maximum Cysts Detected


7.5 MGD down an 12.3 mile pipeline
River Road Wastewater Treatment Plant
Permit ID: TX0047686
Cl_2
Distribution System
Cypress Water Treatment Facility
MF/RO Plant
Conventional Plant
$Fe(SO_4)_2$
Cl_2
NH_3
MF Filters
Clarifier
$NaHSO_3$
Break Tank
H_2SO_4
Scale Inhibitor
RO Filters
5 MGD RO Permeate
Lagoon
Ground Storage Tanks
Clearwell
Cl_2
H_2SiF_6
Granular Filtration
Blended Phosphate
Restabilization
CO_2
Sedimentation
CaOH
Flocculation
Splitter Box
Cl_2
NH_3
$Fe(SO_4)_2$
Rapid Mix
Coagulation
Cationic Polymer
Big Wichita River
2.5 MGD MF/RO Reject
5 MGD Lake Water
Secondary Reservoir
Lake Kickapoo
Lake Arrowhead
ClO_2

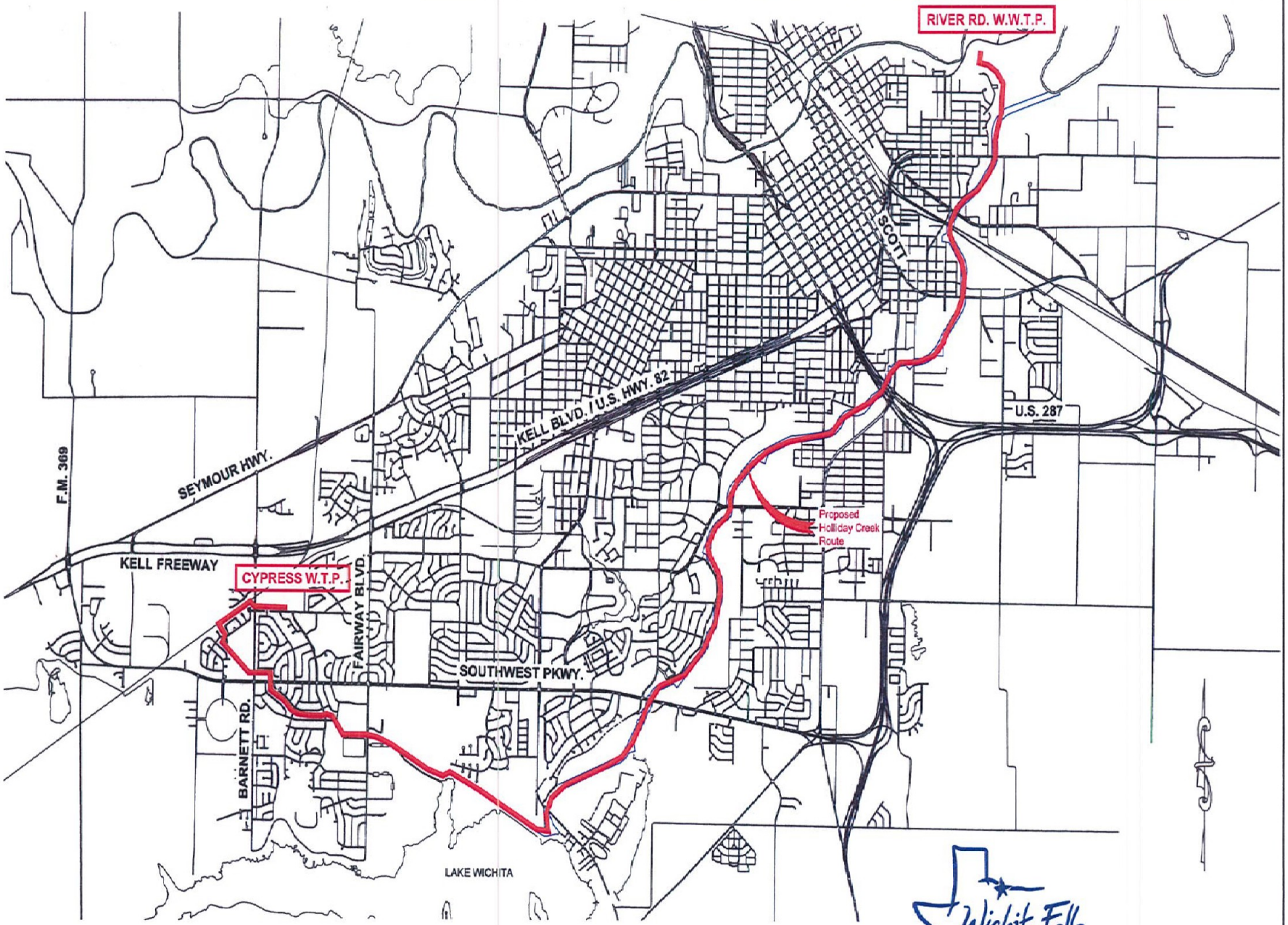
Direct Potable Reuse

Preliminary Engineering Report

The City hired Biggs & Matthews, Inc. to develop the Preliminary Engineering Report

Submitted in May 2013.

TCEQ Acceptance September 2013 to construct pipeline and conduct a 45-day Full Scale Verification test.



LOCATION MAP

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tsco

W #28
913

Direct Potable Reuse

Full Scale Verification

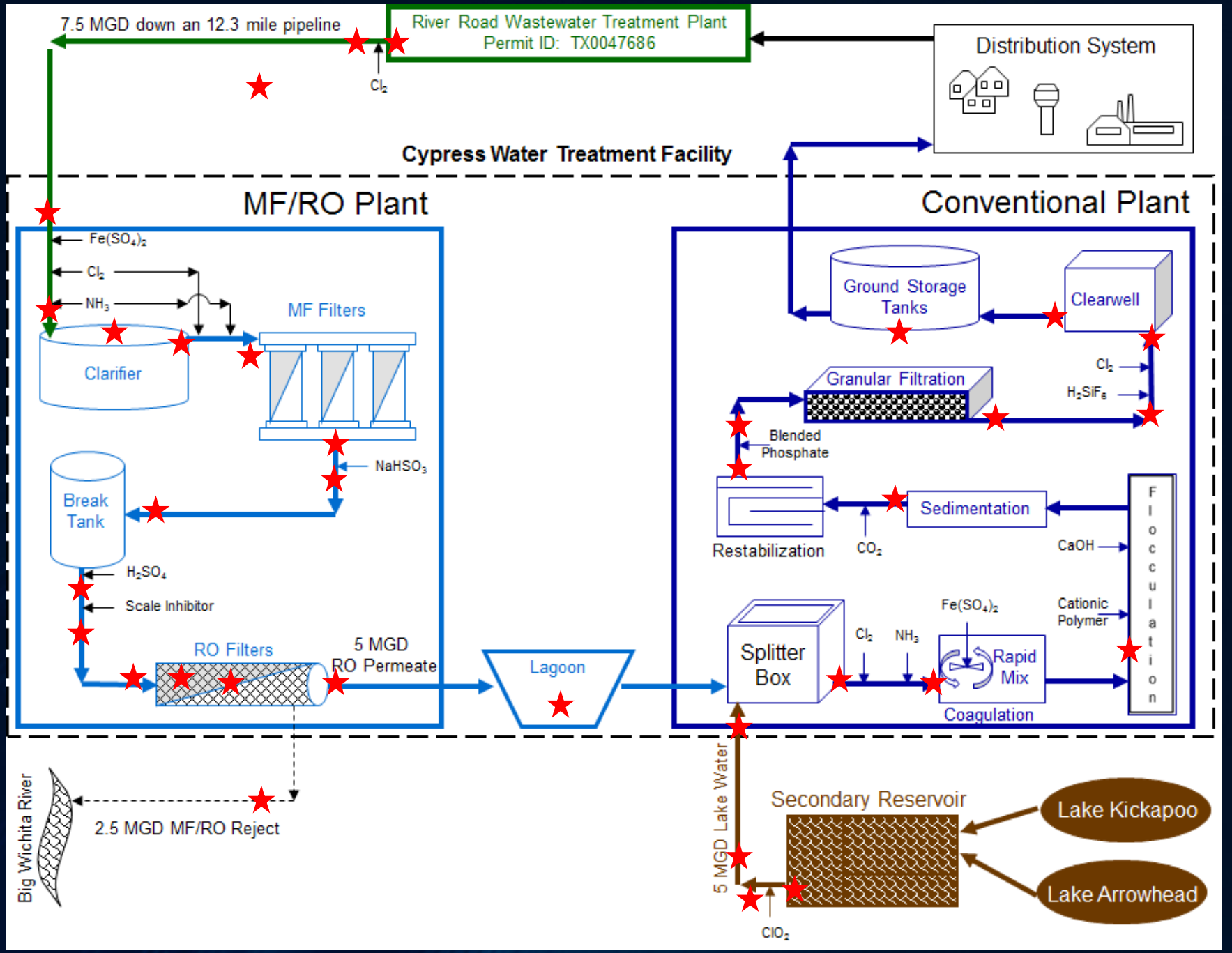
The TCEQ Full Scale Verification Protocol had all of the parameters associated with the 290.41(e)(1)(F), as well as a few others.

Flow		**§ 290.106(b) Inorganics**		**Free Ammonia**
pH		§ 290.107(b) Organics		Free Chlorine
Turbidity		Total Organic Carbon		Total Chlorine
Temperature		Dissolved Organic Carbon		Monochloramine
CBOD5		Total Trihalomethanes		E. Coli
TSS		Haloacetic Acids		Giardia
TDS		§ 290.108(b)(1) Radionuclides		Cryptosporidium
Nitrate		§ 290.108(b)(2) & 40 CFR § 141.66(d) Radionuclides		Total Culturable Virus
Perchlorate		§ 290.1118(b) Secondary Constituents		
Chlorite		Color		
SDI		Odor		

Direct Potable Reuse

Full Scale Verification

The FSV Protocol has sampling locations at 40 different location throughout the DPR Plant.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2.5 MGD MF/RO Reject
5 MGD Lake Water
Secondary Reservoir
ClO_2
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Lake Arrowhead

Direct Potable Reuse

Full Scale Verification

- City started the TCEQ Mandated 45-day Verification Test on January 27, 2014.

Direct Potable Reuse

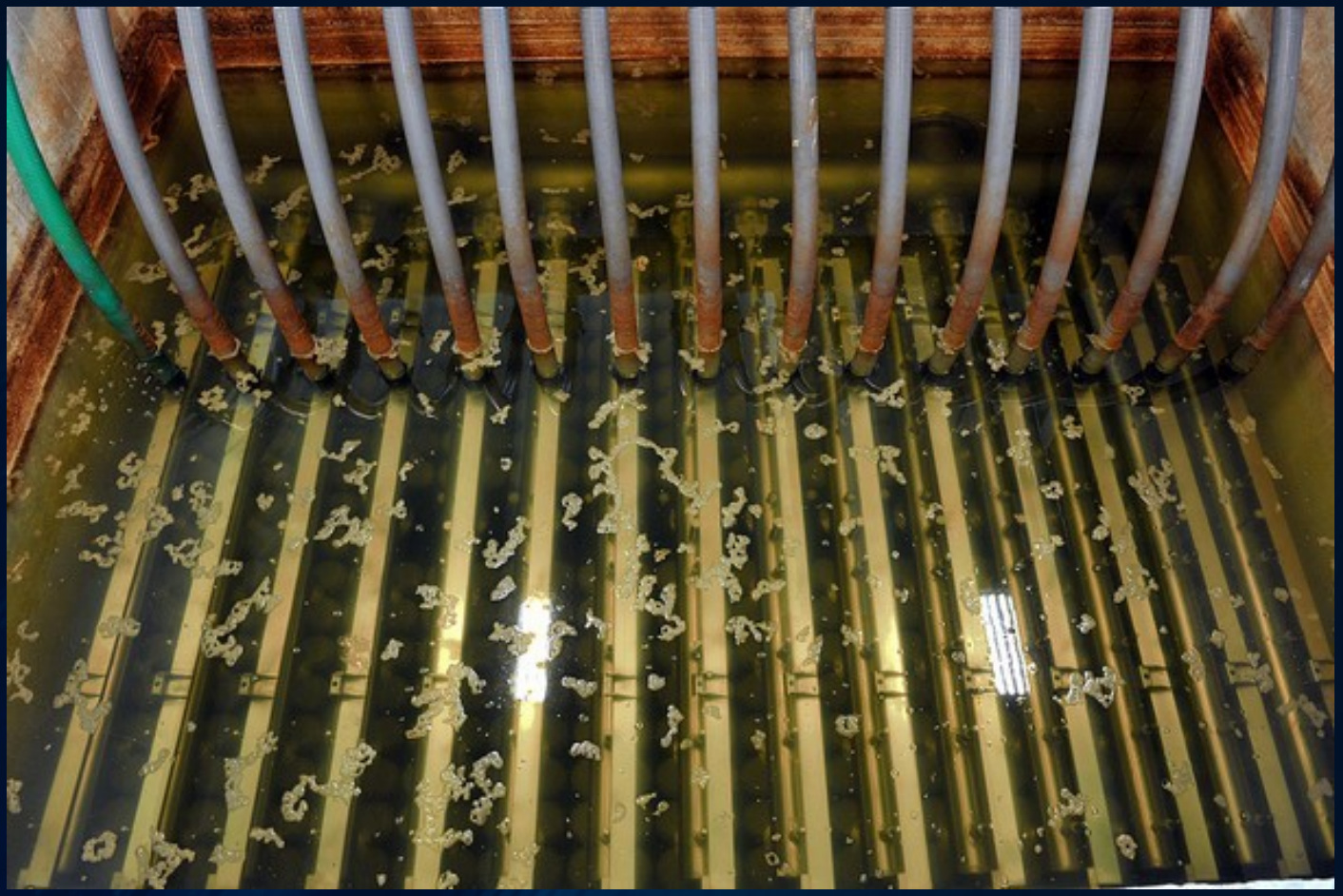
Full Scale Verification

Direct Potable Reuse

Full Scale Verification

Direct Potable Reuse

Full Scale Verification



Direct Potable Reuse

Full Scale Verification

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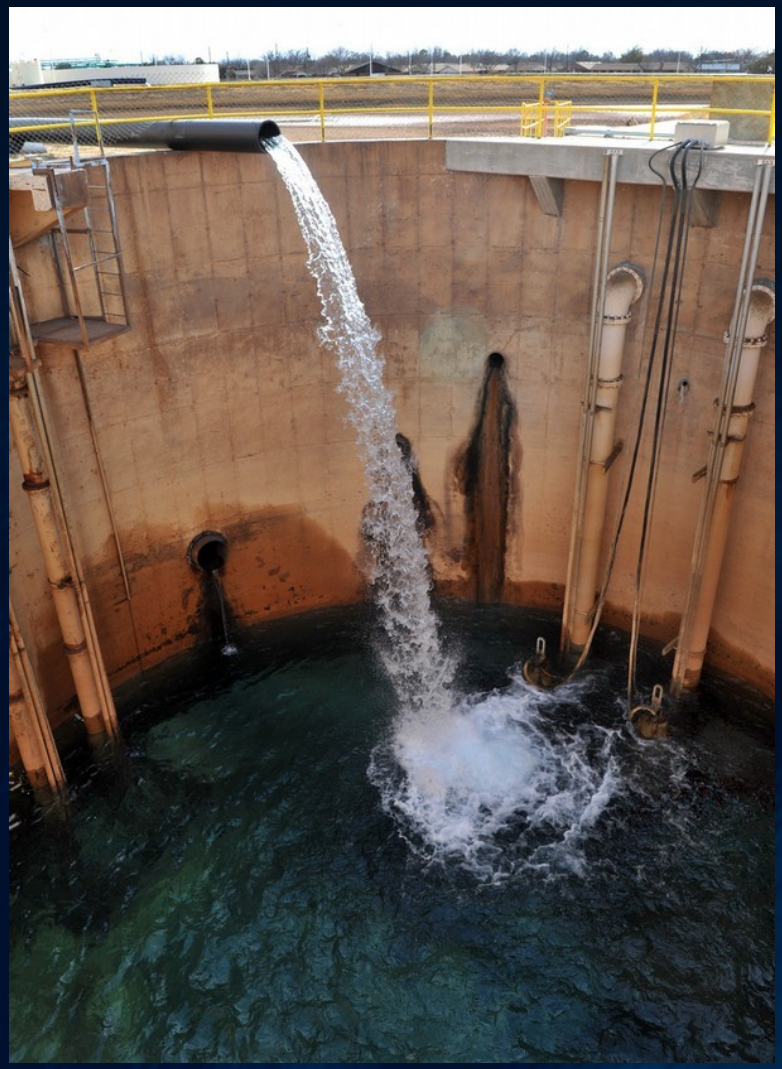
Full Scale Verification



Direct Potable Reuse

Full Scale Verification

	WW Effluent	WW Effluent	RO Permeate	RO Permeate	50/50 Blend	50/50 Blend	End Plant	End Plant
	Estimated	Actual	Estimated	Actual	Estimate	Actual	Estimate	Actual
Nitrate	18	14	3.6	0.88	1.8	0.74	1.8	0.55
Trihalomethane	10	9.3	6	4.55	3	6.5	18	12.2

Direct Potable Reuse

Full Scale Verification

	WW Effluent	End Pipeline	MF Permeate	RO Permeate	Secondary Reservoir	50/50 Blend	End Plant
E. coli	>200.5	<1.0	<1.0	<1.0	29.0	<1.0	<1.0
Giardia	11	21.4	<0.07	<0.07	<0.07	<0.05	<0.07
Cryptosporidium	<0.01	0.13	<0.07	<0.07	<0.07	<0.05	<0.07
Total Culturable Virus							

Direct Potable Reuse

Full Scale Verification

- 30 Days Perform CIP of MF & RO
  - February 26
  - Will take 1 – 2 days
- Run an additional 10 days
  - Stop on March 10
- Write FSV Report and Submit to TCEQ
  - 1 week after end of FSV
- TCEQ 30 Day Review of Report
  - Hope to have DPR Fully Operational before May 1

Next Drought(s)

Long Range Plans

- Long Term Indirect Potable Reuse (IPR)
  - Take the 12 MGD WWTP discharge back to Lake Arrowhead.
  - $40 M to design / construct
  - 5 years

Next Drought(s)

Long Range Plans

- Lake Ringgold
  - Last significant Lake site in the region.
  - $400 M to design / construct
  - 30 years

Conclusion

- The City of Wichita Falls has been actively engaged in combating drought situations for the last 15 years.

- Currently working on plans to help reinforce the City against the droughts for the next 50 years.

Questions

I INVENTED A FILTER THAT CAN TURN RAW SEWAGE INTO PURE DRINKING WATER IN SECONDS.
Dilbert.com DilbertCartoonist@gmail.com
GLUG GLUG GLUG
11-8-12 ©2012 Scott Adams, Inc./Dist. by Universal Uclick
THE CLEAN WATER ENDS UP HERE IN THE UPPER CONTAINER.