SCMA 2015 Annual Conference

"Membranes: Technology, Treatment, Techniques And Troubleshooting"

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Abilene's Integrated Water Supply Approach – What to Do When All the Easily Treated Water is Gone

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Enprotec / Hibbs & Todd, Inc.

Overview

- Abilene's Water Utilities
- Abilene's Water Supply Situation
- Abilene's Response to Dwindling Water Supplies
- Water Supply Options
  - Reuse – Hamby Water Reclamation Facility
  - New Water Source – PK Drought Response
  - Maximize Existing Facilities – Hargesheimer WTP

Abilene's Water Utilities

- Abilene serves treated potable water to approximately 125,000 retail users and an additional 32,000 wholesale users.
- Abilene has approximately 40,000 retail connections and connections with 14 wholesale water systems.
- Abilene supplies reclaimed wastewater to 25 contracted reclaimed customers citywide and an additional 10 irrigators around the Hamby Water Reclamation Facility.

Abilene's Water Sources

- Abilene diverts approximately 24,500 ac-ft/yr of surface water from its three surface water sources (about 22 MGD) …
- … and delivers 23,700 ac-ft/yr to its retail and wholesale customers (about 21 MGD)
- Abilene's retail customers use about 86% (about 18 MGD) of the total treated water that is produced from the water production system while its wholesale customers use about 14% (about 3 MGD)

Abilene's Water Sources

- The ongoing drought is affecting Abilene's raw water sources.

Abilene's Water Sources

- Abilene relies on surface water from Lake Fort Phantom Hill, Hubbard Creek Reservoir and O.H. Ivie

- Raw surface water from these three sources is treated at three surface water treatment plants (WTPs) operated by the City
  - Grimes WTP (Conventional)
  - Northeast WTP (Conventional)
  - Hargesheimer WTP (Membrane Filtration and RO)

City of Abilene
Water Production and Wastewater Reuse Schematic (Before January 2015)

Hubbard Creek Reservoir

Lake Fort Phantom Hill

Northeast WTP

Grimes WTP

Hamby WRF

Outfall 001 Freewater Creek

Outfall 002 Kirby Lake

Reuse Customers

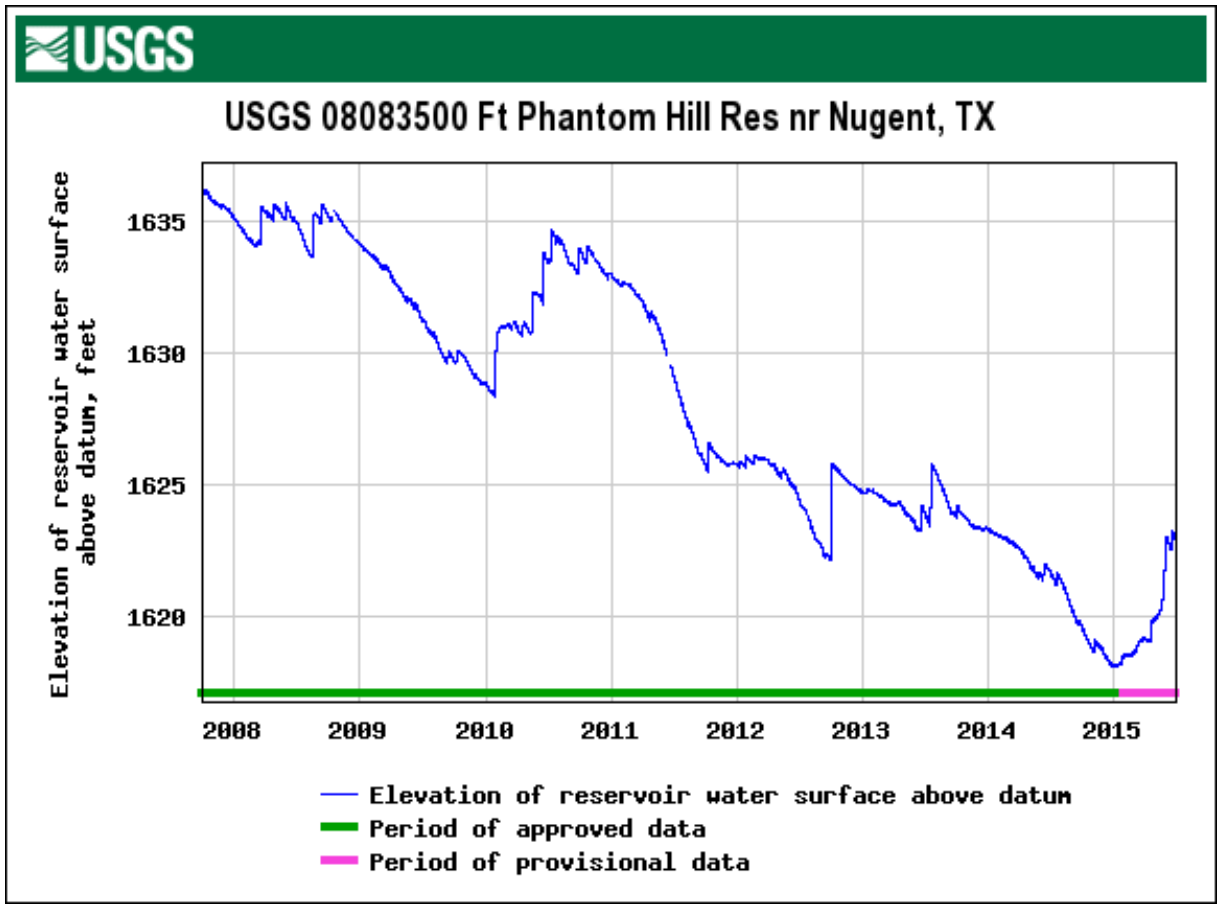
Lake O.H. Ivie

Southside WTP

Abilene's Water Sources

Lake Fort Phantom Hill (full pool 1,635.9 ft msl ; -13.03 ft)

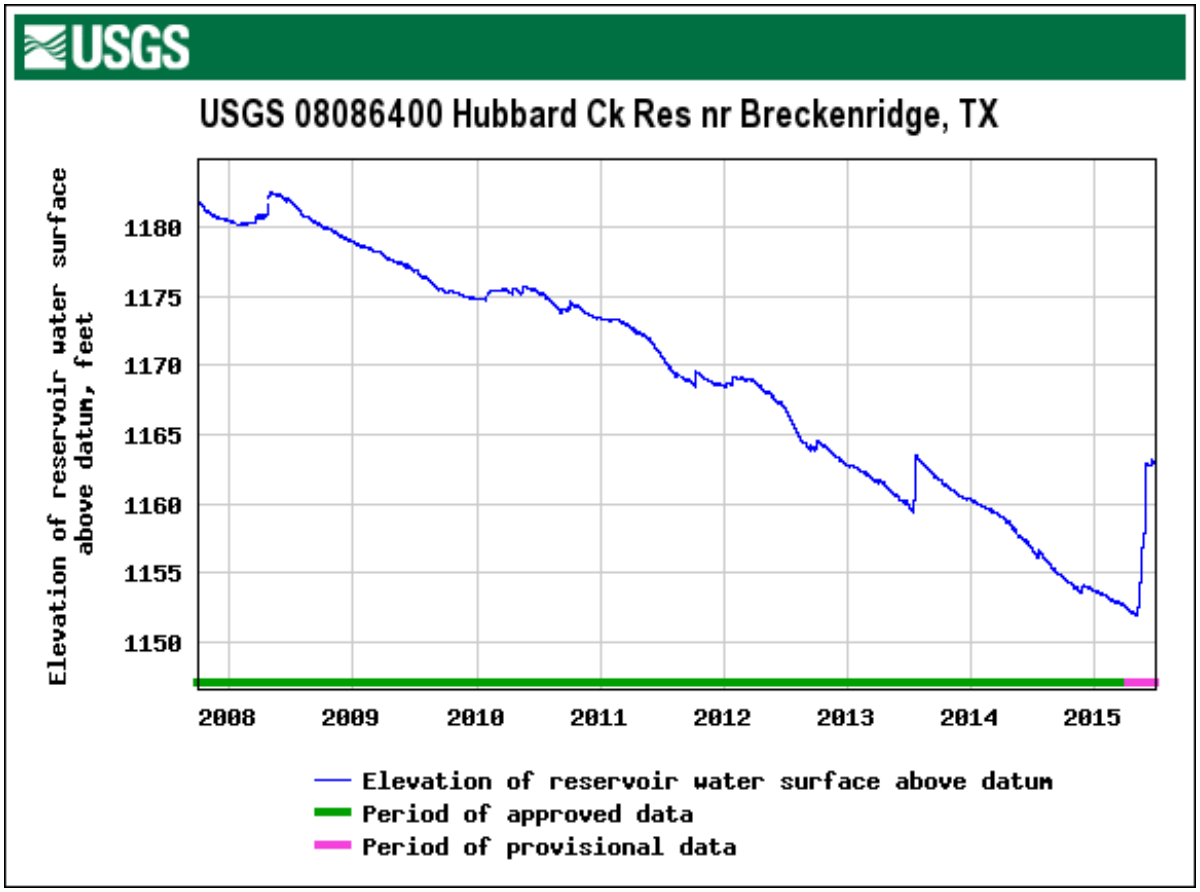
as of June 29, 2015



Abilene's Water Sources

Hubbard Creek Reservoir (full pool 1,183.0 ft msl; -20.05 ft)

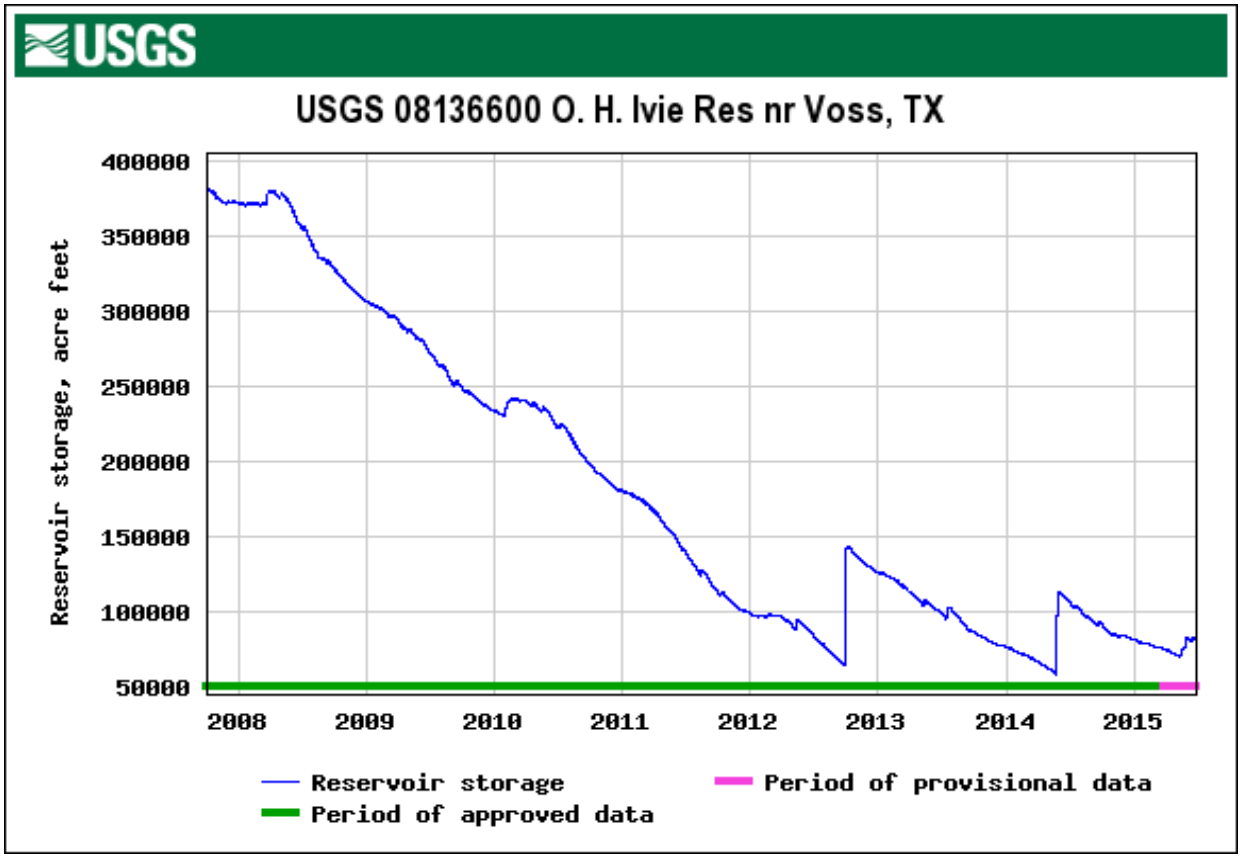
as of June 29, 2015



Abilene's Water Sources

Lake O.H. Ivie (full pool 1,551.5 ft msl; -43.09 ft)

as of June 29, 2015



Where do we go from here?

- The City of Abilene began looking at options.
- It was quickly determined that all of the easily treated water was gone.
- The City of Abilene determined that there was no single answer or “silver bullet” to address the drought
- A multi-faceted approach using advanced treatment technologies would be required to develop long-term, sustainable water sources for the City.

Water Sources

- The City ultimately decided to pursue three separate projects utilizing different water sources to accomplish the goal of a sustainable, diverse water supply.
- The first project (Phase I) involved improvements to the City's WRF to develop an Indirect Potable Reuse Water supply for the City.
- The second project (Phase II) involved identifying additional water rights from a new water source (Possum Kingdom Reservoir) and construction of an advanced treatment system to produce water quality equal to the quality of the water supplies being replaced.
- The third project (Phase II) involved constructing improvements to the City's newest water treatment plant to further utilized the existing infrastructure in place.

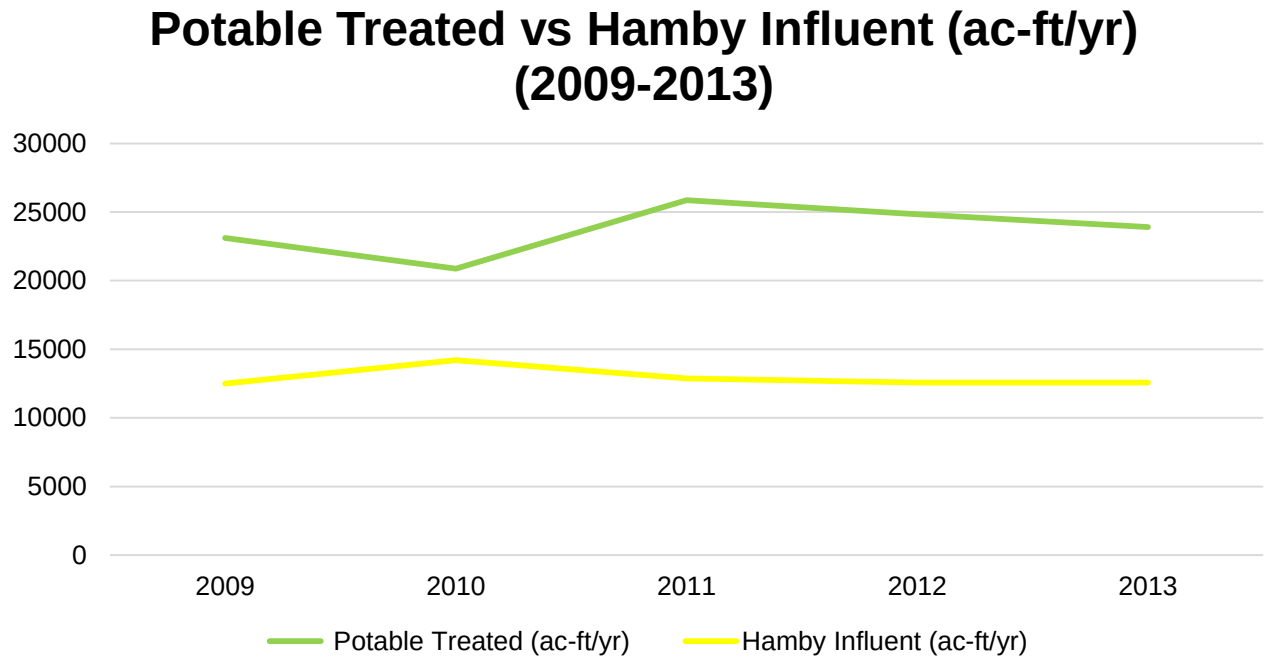
Phase I: Hamby Water Reclamation Facility

Hamby Water Reclamation Facility

- The Hamby WRF was constructed in the 1950s and underwent some modifications over the years but represented a first generation activated sludge WWTP (1970s technology).
- Effluent from the Hamby WRF was usually suitable for discharge to Freewater Creek, and for irrigation reuse, but was unsuited for indirect potable reuse.

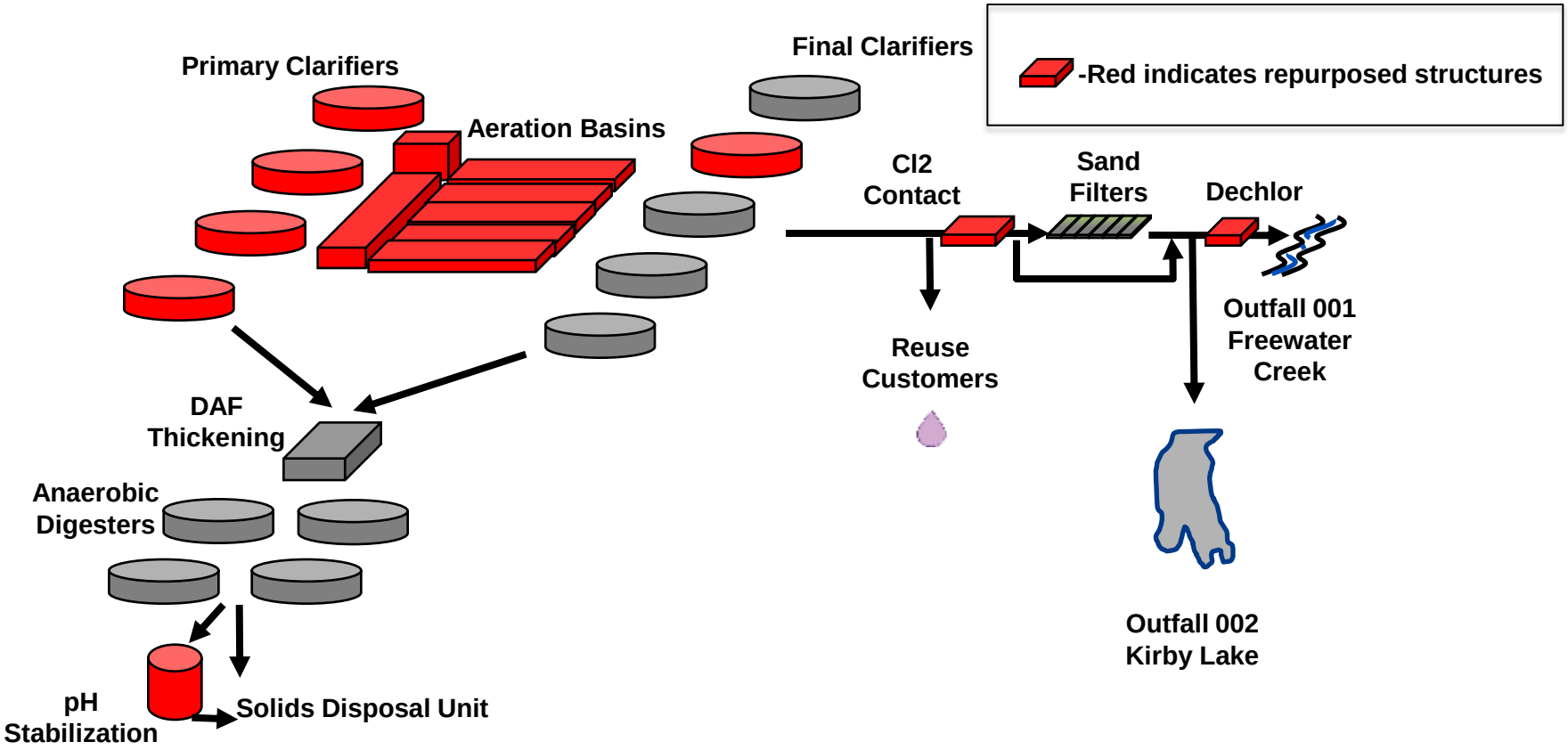
Hamby Water Reclamation Facility

- Hamby WRF treated an average of 11.6 MGD from 2009-2013 or about 13,000 ac-ft/yr, which represents about 55% of the potable water produced by Abilene's water production plants.



Hamby WRF (Pre-2015)

Hamby Water Reclamation Facility
Existing Plant Process Schematic



Hamby Water Reclamation Facility

- Processes that go away…
  - Primary clarification
  - Sludge thickening
  - Anaerobic digestion
  - Final clarification
  - Tertiary sand filtration
  - Gas chlorination

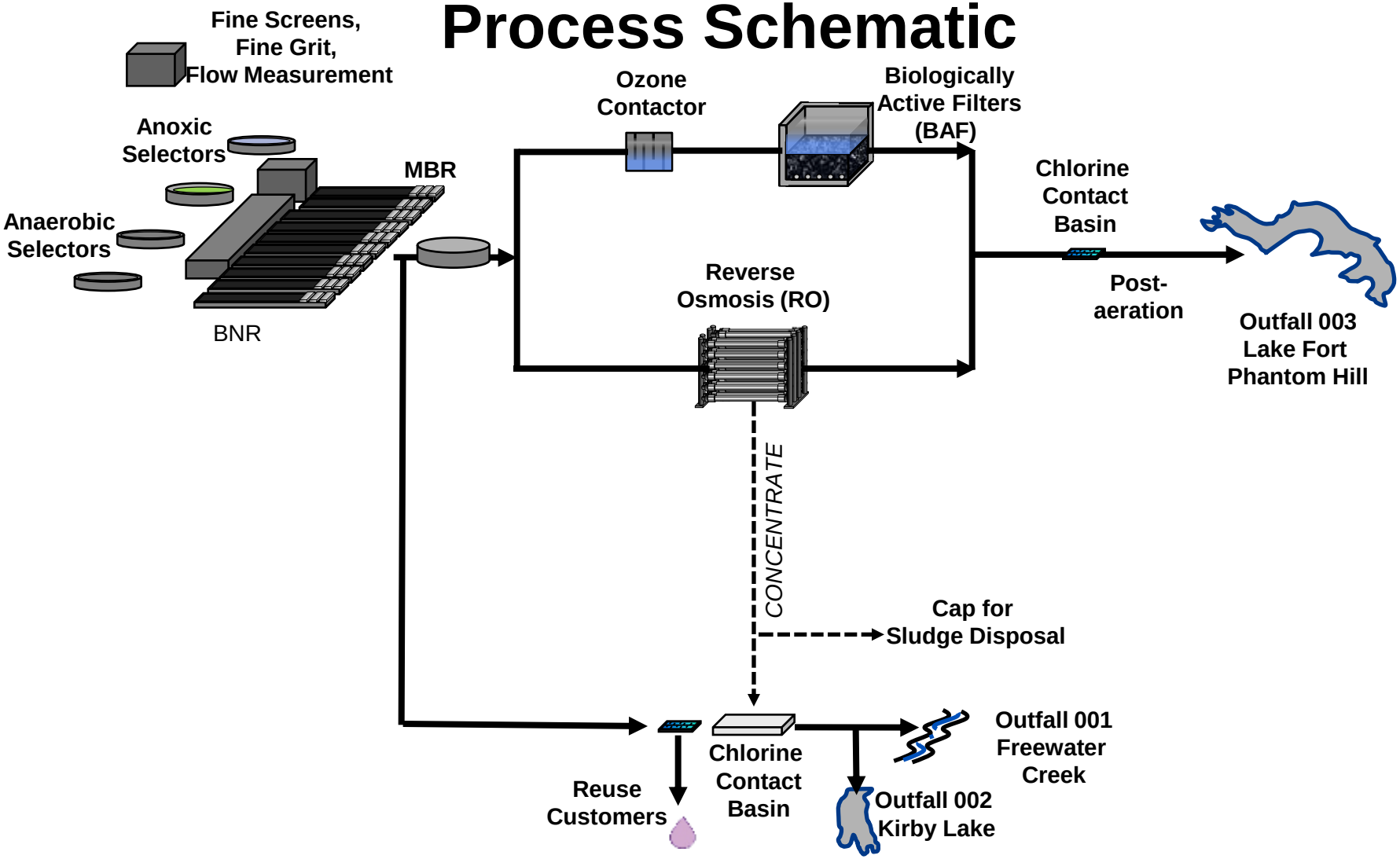
Hamby Water Reclamation Facility

- The City determined that it would preserve and repurpose as much of the original WWTP structures as was feasible and cost effective.
  - Primary clarifiers converted to anaerobic/anoxic selector zones for the BNR.
  - 4 of the 5 aeration basins remain as aeration basins;
    1 repurposed to influent/RAS mixing zone and mixed liquor pump station.
  - 1 final clarifier converted to advanced treatment storage basin.
  - Existing chlorine contact continues as is.

Hamby Water Reclamation Facility

- New structures and processes:
  - Preliminary treatment enhancements including fine screening and fine grit removal.
  - BNR control structure serves to distribute flow within the BNR process (anaerobic, anoxic, recycle flows).
  - MBR system.
  - Reverse osmosis system.
  - Ozone system.
  - Biologically active filters.
  - Post-aeration.
  - Bleach disinfection.

Hamby Water Reclamation Facility Process Schematic

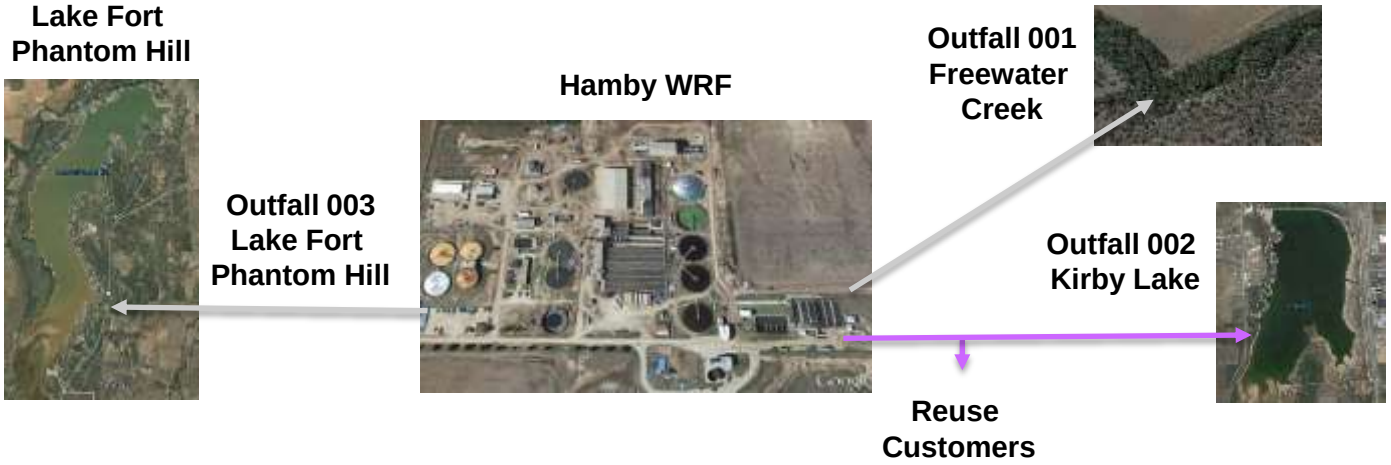


Hamby Water Reclamation Facility

- Challenges
  - Timeline for Completion - CMAR was utilized
    - Design Began – May 2013
    - Construction Began – December 2013
    - First Discharge of Advanced Treated Effluent Released – January 2015
    - Construction Completed – Anticipated September 2015
  - Maintaining operation of the existing WRF and maintaining required effluent quality
    - Extensive coordination between CMAR and City
    - Utilization of existing flow equalization

Hamby Water Reclamation Facility

- Wastewater Effluent and Reuse Schematic



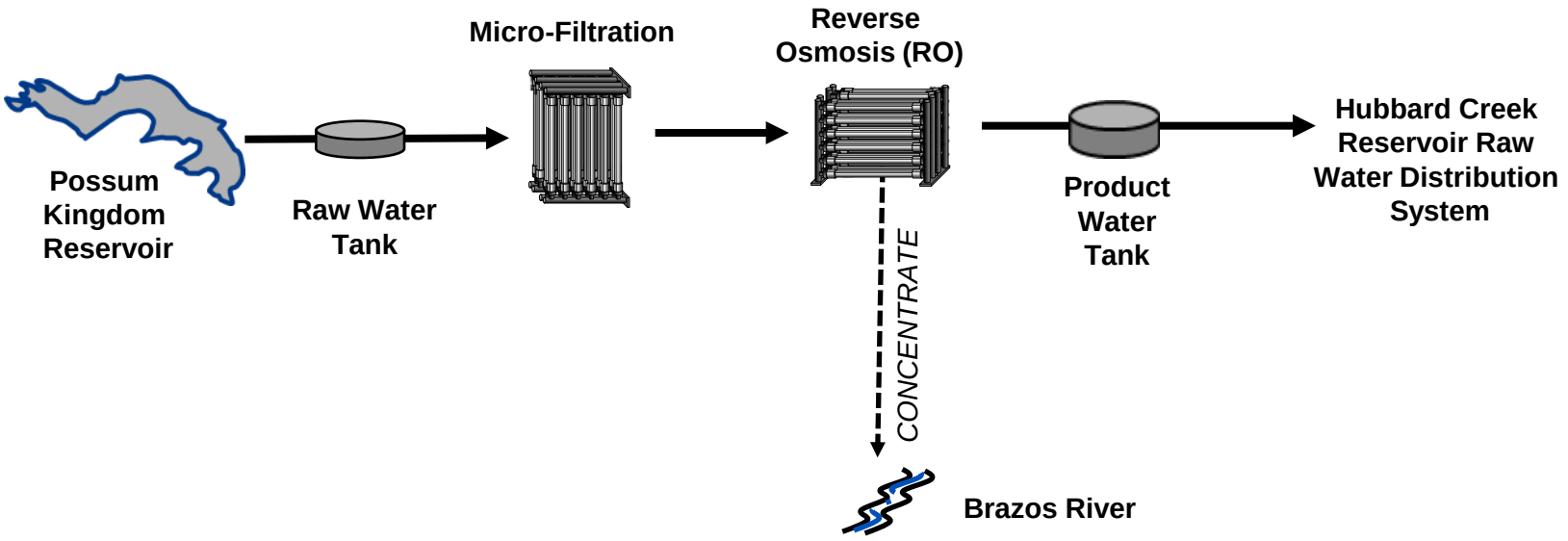
Phase II: PK Drought Response Project

- Project elements include:
  - Upgrading an existing Raw Water Intake Pump Station.
  - Construction of approximately 42 miles pipeline improvements:
    - 36-inch Raw Water Pipeline
    - 36-inch Product Water Pipeline
    - 12-inch Concentrate Pipeline
  - Construction of a Raw Water Roughing Facility designed to desalinate raw PK water prior to being sent to Abilene for final, conventional water treatment.

PK Drought Response Project

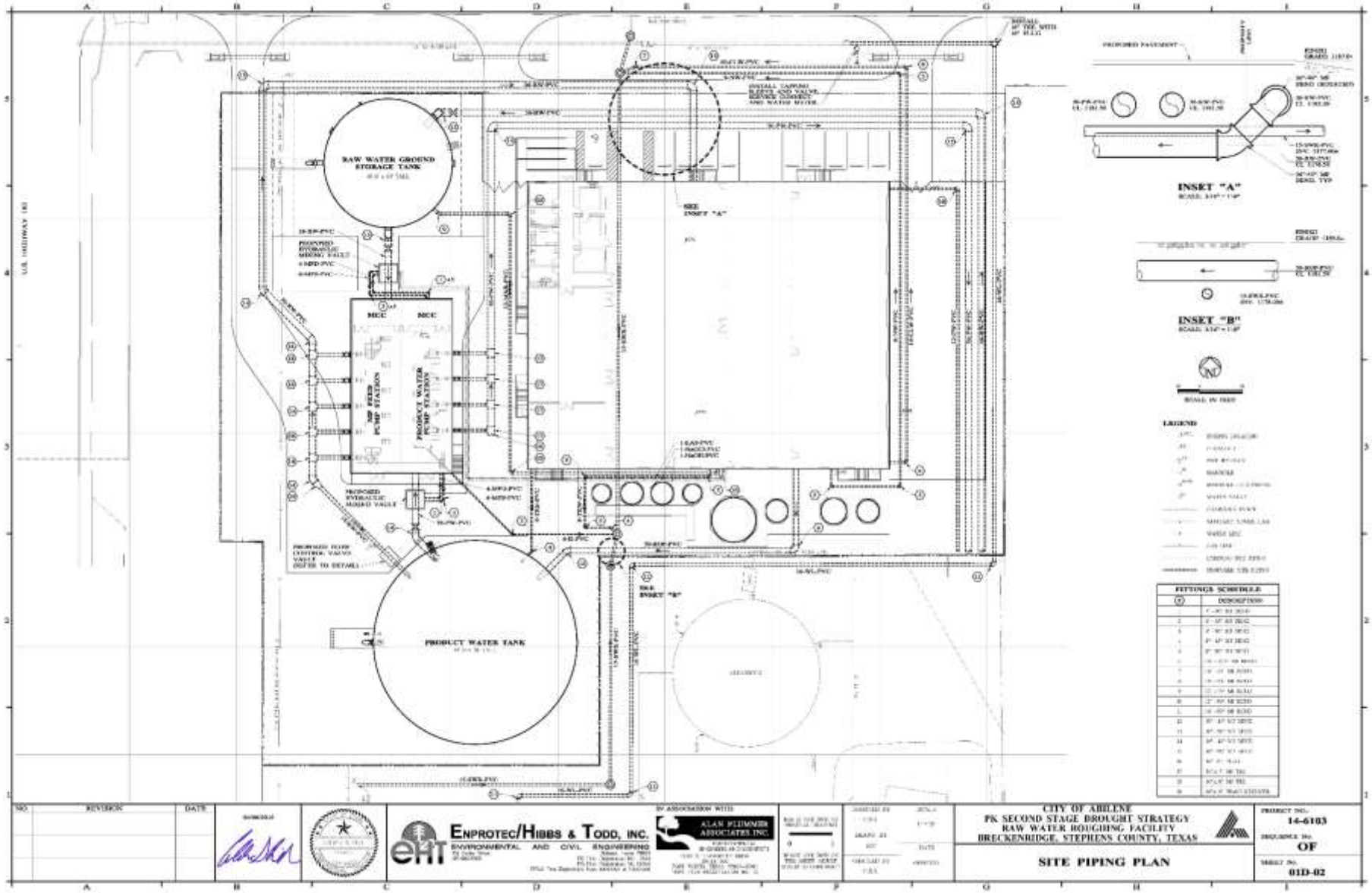
- Raw Water Roughing Facility includes:
  - Raw water pumping, transmission and storage
  - New pretreatment MF system to protect the new RO system
  - Tertiary recovery MF system to enhance overall water recovery
  - RO treatment for dissolved mineral reduction
  - Chloramine disinfection throughout the MF and RO systems to maintain positive bio-fouling control
  - Product water storage, pumping and transmission
  - RO concentrate waste transmission and disposal

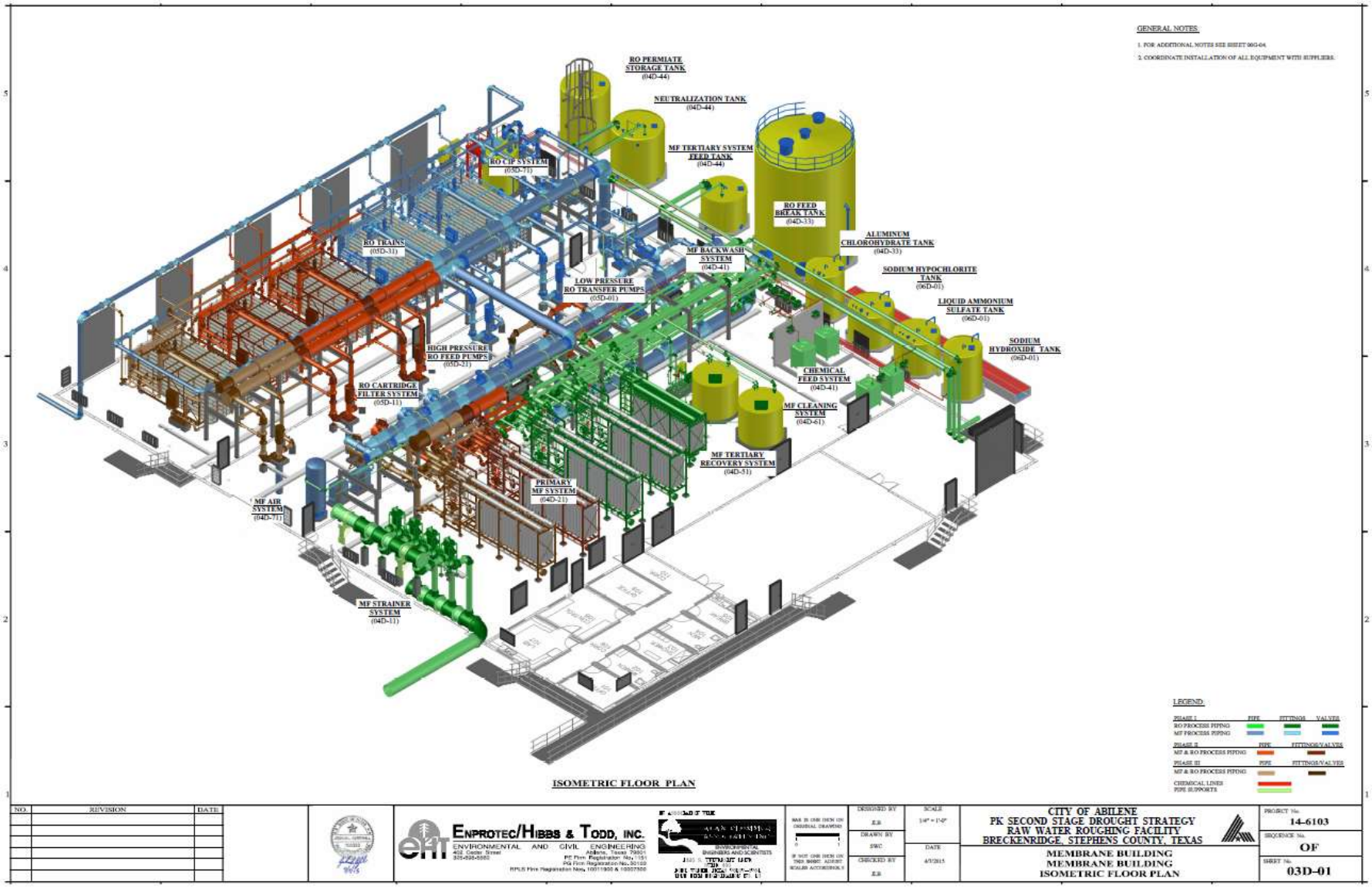
PK Drought Response Project
Process Schematic



PK Drought Response Project

- Raw Water Roughing Facility to reduce usage of raw water from Hubbard Creek Reservoir by utilizing water from PK Lake.
- Facility will reduce dissolved constituent levels with the goal of finished water treatment to be completed by two WTPs.


RAW WATER GROUND STORAGE TANK
PRODUCT WATER TANK
INSET "A"
INSET "B"
LEGEND
FITTINGS SCHEDULE
ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
ALAN PLUMMER ASSOCIATES, INC.
CITY OF ABILENE
PK SECOND STAGE DROUGHT STRATEGY
RAW WATER ROUGHING FACILITY
BRECKENRIDGE, STEPHENS COUNTY, TEXAS
SITE PIPING PLAN
14-6103
OF
01D-02


GENERAL NOTES
1. FOR ADDITIONAL NOTES SEE SHEET 00G-04.
2. COORDINATE INSTALLATION OF ALL EQUIPMENT WITH SUPPLIERS.
RO PERMIATE STORAGE TANK (04D-44)
NEUTRALIZATION TANK (04D-44)
MF TERTIARY SYSTEM FEED TANK (04D-44)
RO CIP SYSTEM (05D-71)
RO FEED BREAK TANK (04D-33)
ALUMINUM CHLOROHYDRATE TANK (04D-33)
RO TRAINS (05D-31)
MF BACKWASH SYSTEM (04D-41)
SODIUM HYPOCHLORITE TANK (06D-01)
LOW PRESSURE RO TRANSFER PUMPS (05D-01)
LIQUID AMMONIUM SULFATE TANK (06D-01)
HIGH PRESSURE RO FEED PUMPS (05D-21)
SODIUM HYDROXIDE TANK (06D-01)
CHEMICAL FEED SYSTEM (04D-41)
RO CARTRIDGE FILTER SYSTEM (05D-11)
MF CLEANING SYSTEM (04D-61)
MF TERTIARY RECOVERY SYSTEM (04D-51)
PRIMARY MF SYSTEM (04D-21)
MF AIR SYSTEM (04D-71)
MF STRAINER SYSTEM (04D-11)
LEGEND
ISOMETRIC FLOOR PLAN
NO. REVISION DATE
ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
DESIGNED BY
DRAWN BY
CHECKED BY
SCALE
DATE
CITY OF ABILENE
PK SECOND STAGE DROUGHT STRATEGY
RAW WATER ROUGHING FACILITY
BRECKENRIDGE, STEPHENS COUNTY, TEXAS
MEMBRANE BUILDING
MEMBRANE BUILDING
ISOMETRIC FLOOR PLAN
PROJECT No. 14-6103
SEQUENCE No. OF
SHEET No. 03D-01

PK Drought Response Project

- Challenges
  - Time – CMAR was utilized
    - Design Began – September 2014
    - Construction Began – January 2015
    - Construction Completion – Anticipated December 2015
  - Site Footprint – Facility was designed using a 3D drafting format to determine piping and structure collision detection issues.
  - Waste Handling Requirements – Alternatives were reviewed and a 26-mile pipeline was constructed for ultimate disposal of RO concentrate into the Brazos River.

Hargesheimer Water Treatment Plant

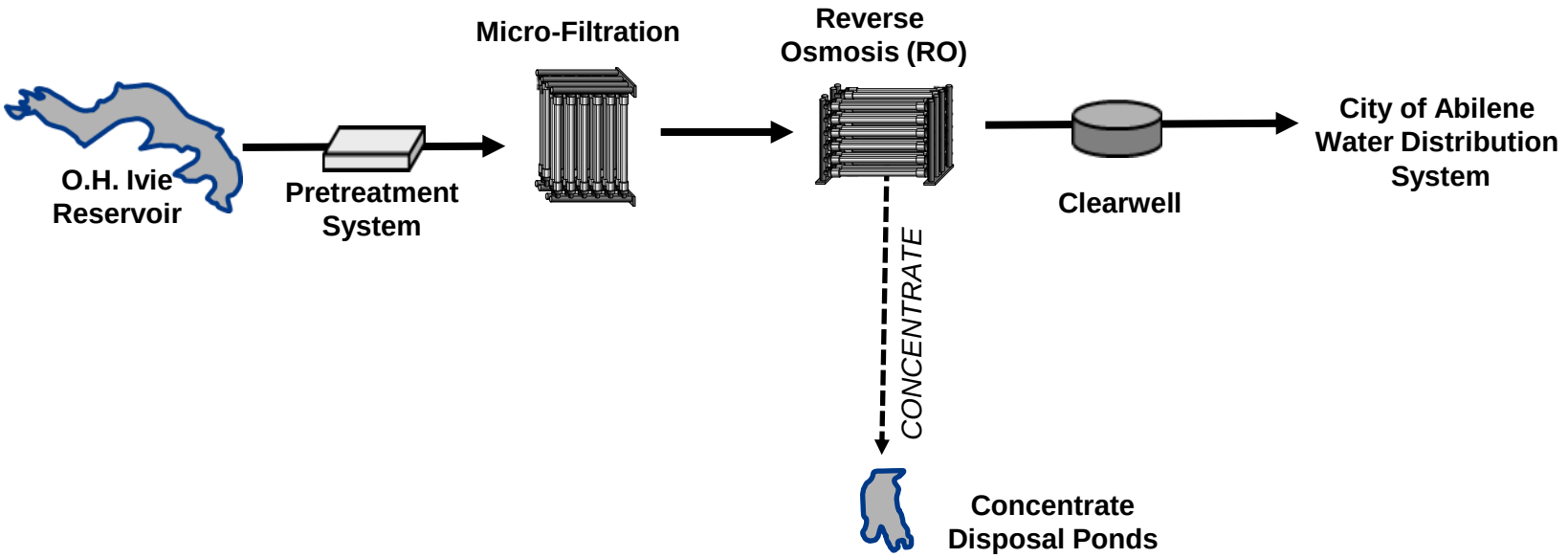
- The Hargesheimer WTP was constructed in 2002 to treat raw water from O.H. Ivie Reservoir

- The plant was designed as a direct filtration plant with no pre-treatment prior to the membrane systems

Phase II: Hargesheimer Water Treatment Plant

- Project elements include:
  - Expanding existing facilities and adding new facilities to increase finished water capacity from 8 MGD to 12 MGD.
  - New pretreatment facility with rapid mix
    - 3-stage flocculation
    - Sedimentation via inclined plate settlers
    - Membrane feed pump station
  - Expansion of MF system
  - Solids handling facility with belt filter press and sludge tank
  - Expansion of existing backwash recovery system

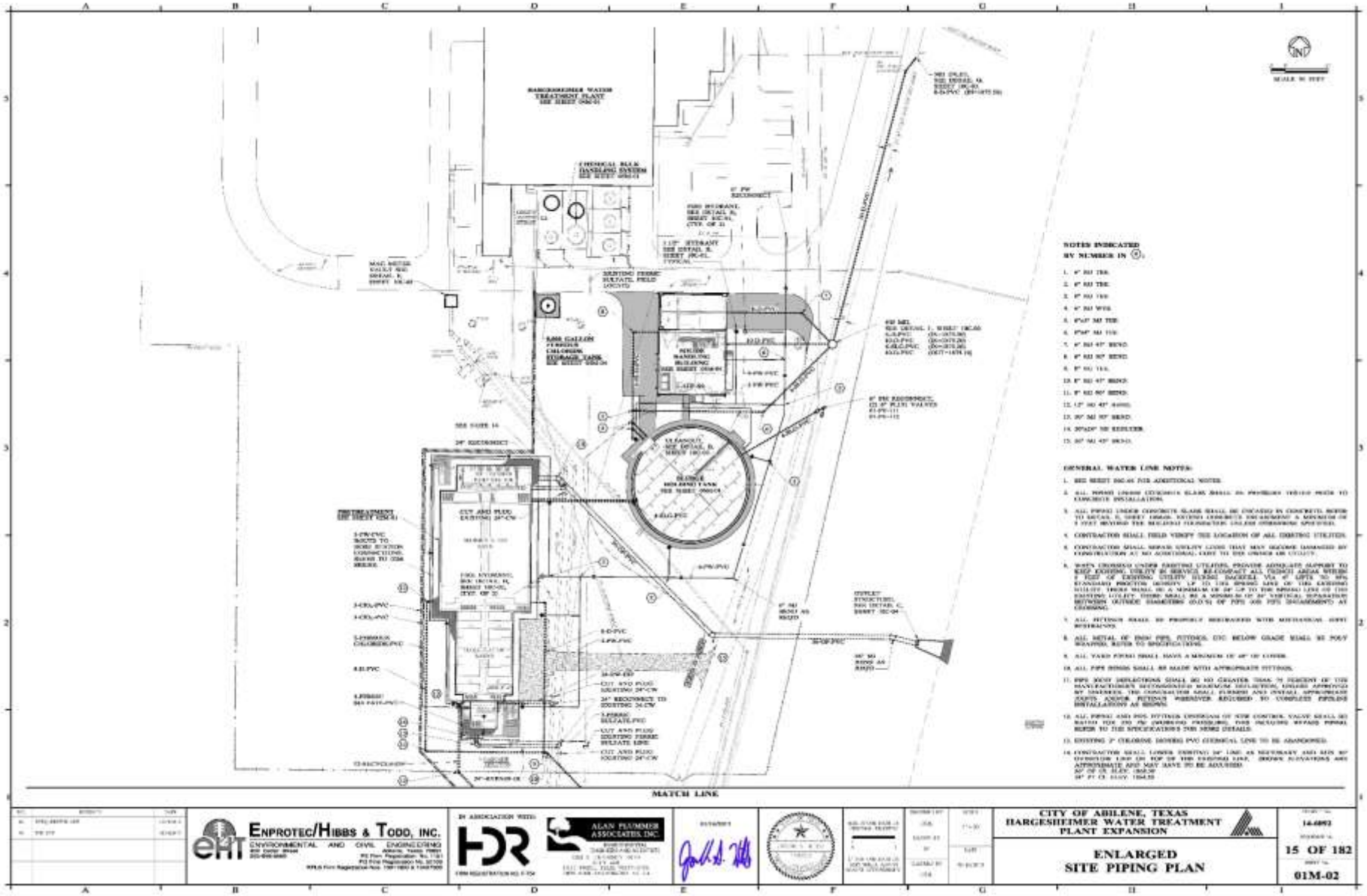
Hargesheimer Water Treatment Plant Process Schematic



Hargesheimer Water Treatment Plant

Hargesheimer Water Treatment Plant

- Expansion of the Hargesheimer Water Treatment Plant to 12.0 MGD including:
  - Vertical turbine pumps with VFDs at both Raw Water Pump Stations
  - Chlorine dioxide generator
  - Pretreatment system with two 7.5 MGD treatment trains
  - Two Microfiltration membrane skids
  - Sludge holding tank
  - Expanded backwash recovery basin


MATCH LINE
ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
IN ASSOCIATION WITH:
HDR
ALAN PLUMMER ASSOCIATES, INC.
CITY OF ABILENE, TEXAS
BARGESHEIMER WATER TREATMENT PLANT EXPANSION
ENLARGED SITE PIPING PLAN
14-6002
15 OF 182
01M-02

Hargesheimer Water Treatment Plant

Hargesheimer Water Treatment Plant

Hargesheimer Water Treatment Plant

- Treatment process systems include:
  - System hydraulic design
  - Raw water delivery system
  - Pretreatment systems
  - Membrane filtration system
  - Disinfection
  - Finished water delivery system
  - Waste stream management systems
  - Chemical delivery systems
  - Reverse Osmosis and blending

Hargesheimer Water Treatment Plant

- Challenges
  - Timeline for Completion -
    - Design Began – September 2014
    - Construction Began – January 2015
    - Construction Completed – Anticipated March 2016
  - Maintaining operation of the existing WTP
    - Extensive coordination with the Contractor and City Staff

Questions?

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