



# Using the Plant Water Balance

CIBO E/E Committee

June 6, 2017

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*Director, Environmental Stewardship, Citizens Energy Group*

# Discussion Topics

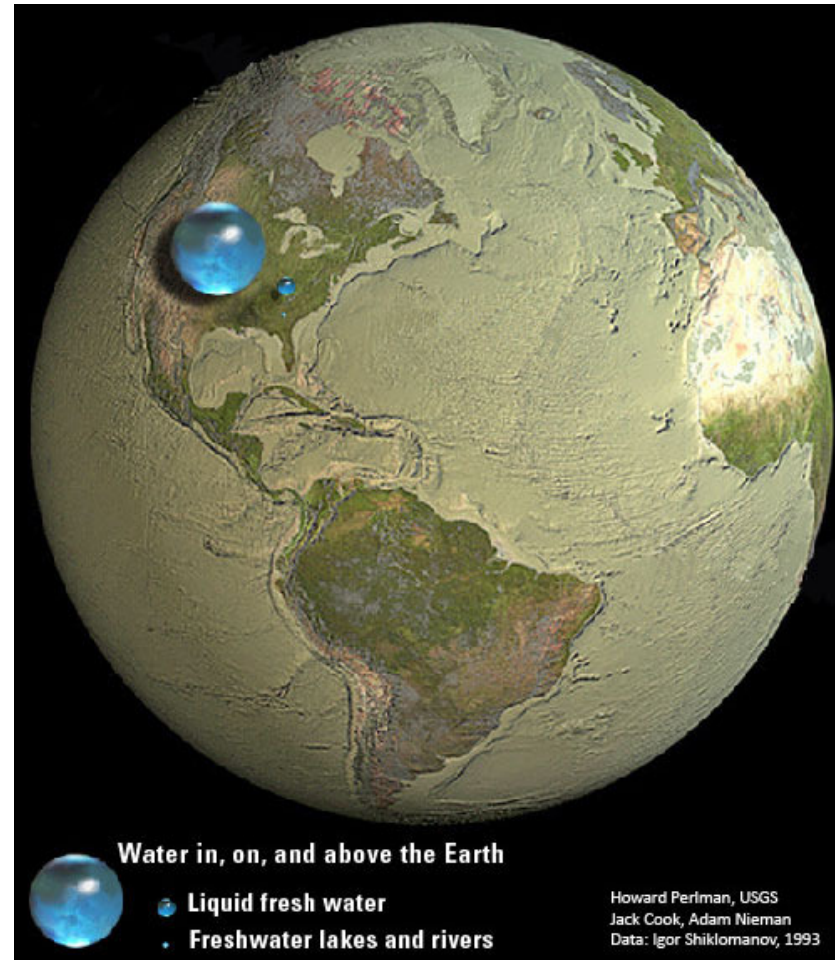
- Understanding the Plant Water Balance
- Use of the Water Balance for Environmental Purposes
- Hidden Opportunities in the Water Balance



# The Blue Marble

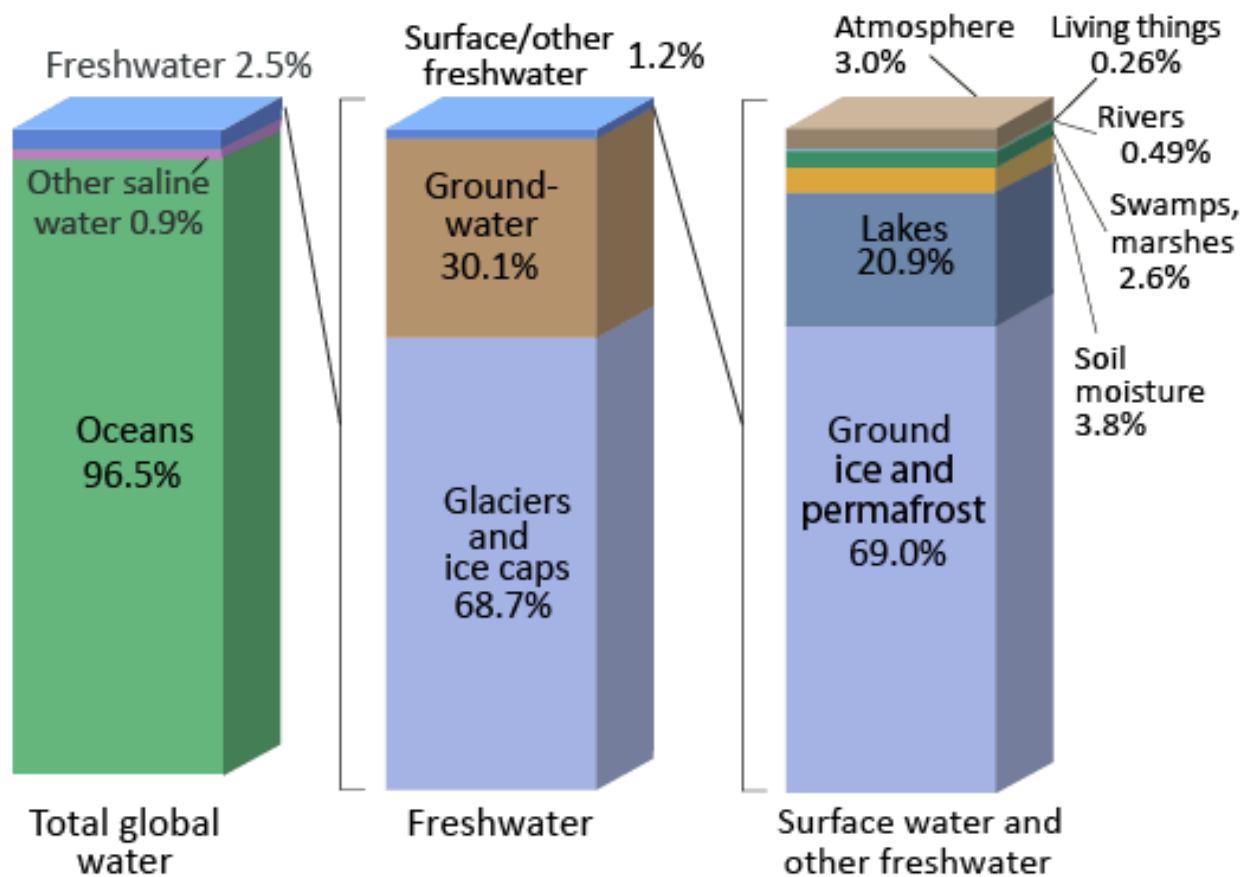


# A Finite Resource that is Infinitely Recyclable?



<https://water.usgs.gov/edu/earthwherewater.html>

# Where is Earth's Water?



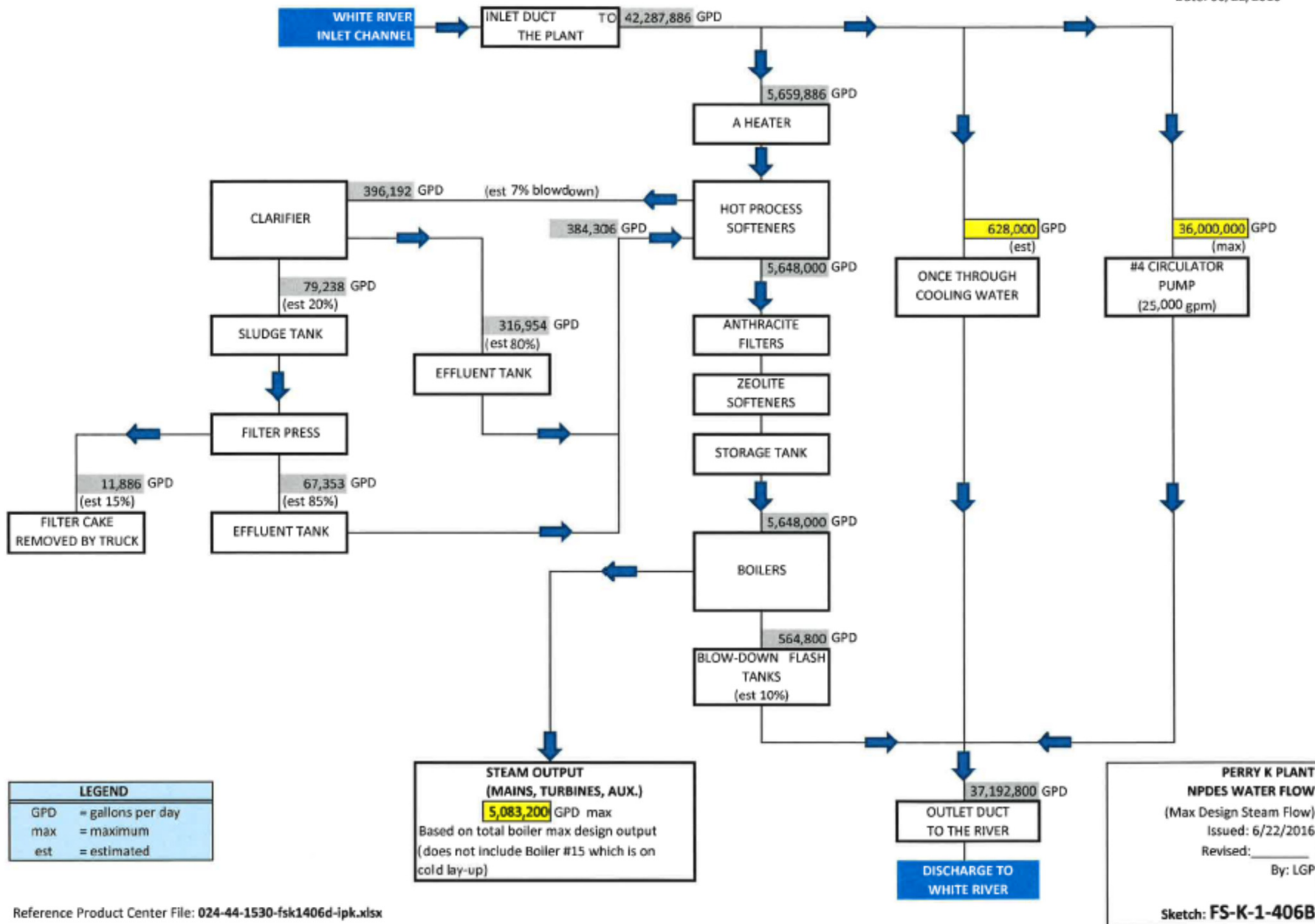
Source: Igor Shiklomanov's chapter "World fresh water resources" in Peter H. Gleick (editor), 1993, *Water in Crisis: A Guide to the World's Fresh Water Resources*.  
NOTE: Numbers are rounded, so percent summations may not add to 100.

**QUESTION #1 TO ASK YOURSELF:  
IS WATER USED ON ALL 365 DAYS OF  
THE YEAR IN EXACTLY THE SAME  
MANNER?**



# PERRY K STEAM PLANT - NPDES WATER FLOW DIAGRAM (Max Design Steam Flow)

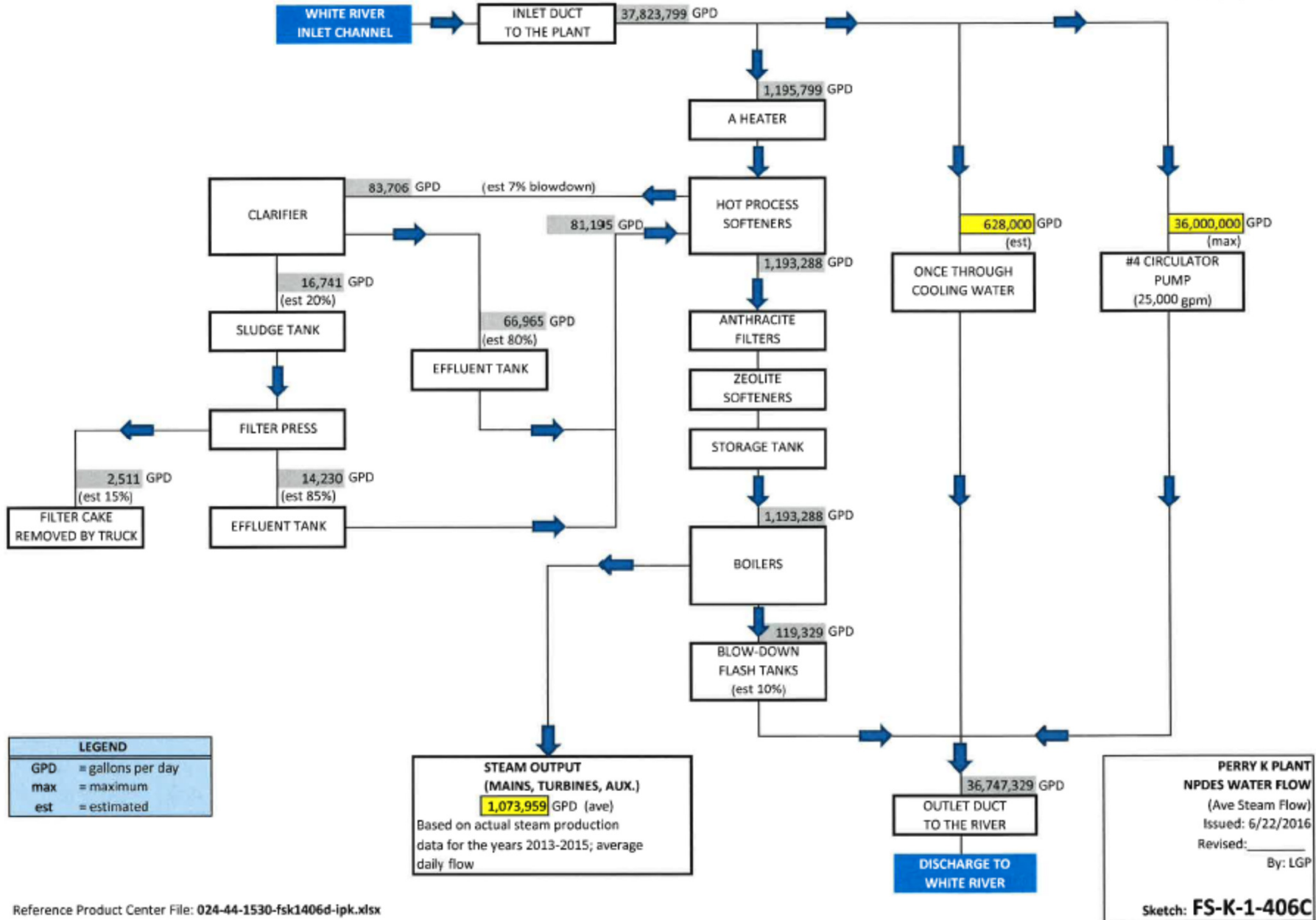
Date: 06/22/2016



Reference Product Center File: 024-44-1530-fsk1406d-ipk.xlsx

# PERRY K STEAM PLANT - NPDES WATER FLOW DIAGRAM (Average Steam Flow)

Date: 06/22/2016





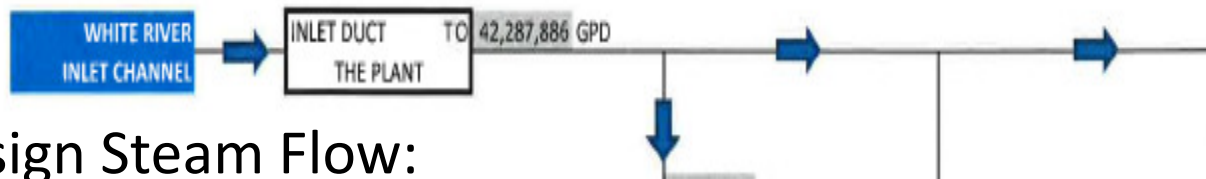
# Where does the Water Balance Start?

- Identification of Incoming Water Sources
  - On-site wells
  - Surface water intakes
  - Municipal/Public Water Supply
- Determination of incoming volumes
  - Monthly billing consumption?
  - Meters?
  - Engineering Estimates?



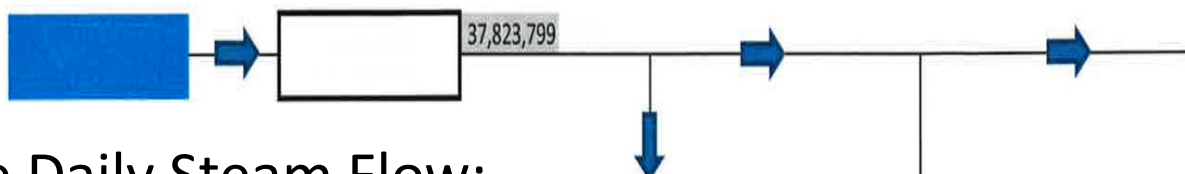
## PERRY K STEAM PLANT - NPDES WATER FLOW DIAGRAM (Max Design Steam Flow)

Date: 06/22/2016



At Max Design Steam Flow:  
42,287,886 GPD

## PERRY K STEAM PLANT - NPDES WATER FLOW DIAGRAM (Average Steam Flow)



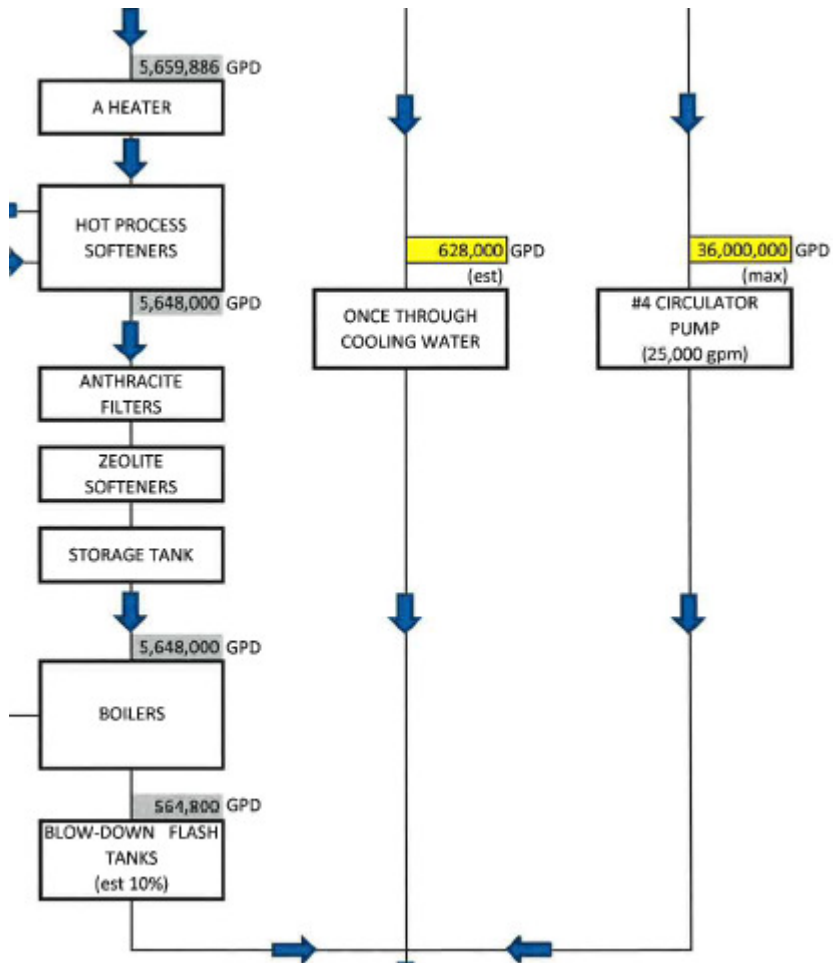
At Average Daily Steam Flow:  
37,823,799 GPD

# Next: What is the Water Use Within the Plant System?

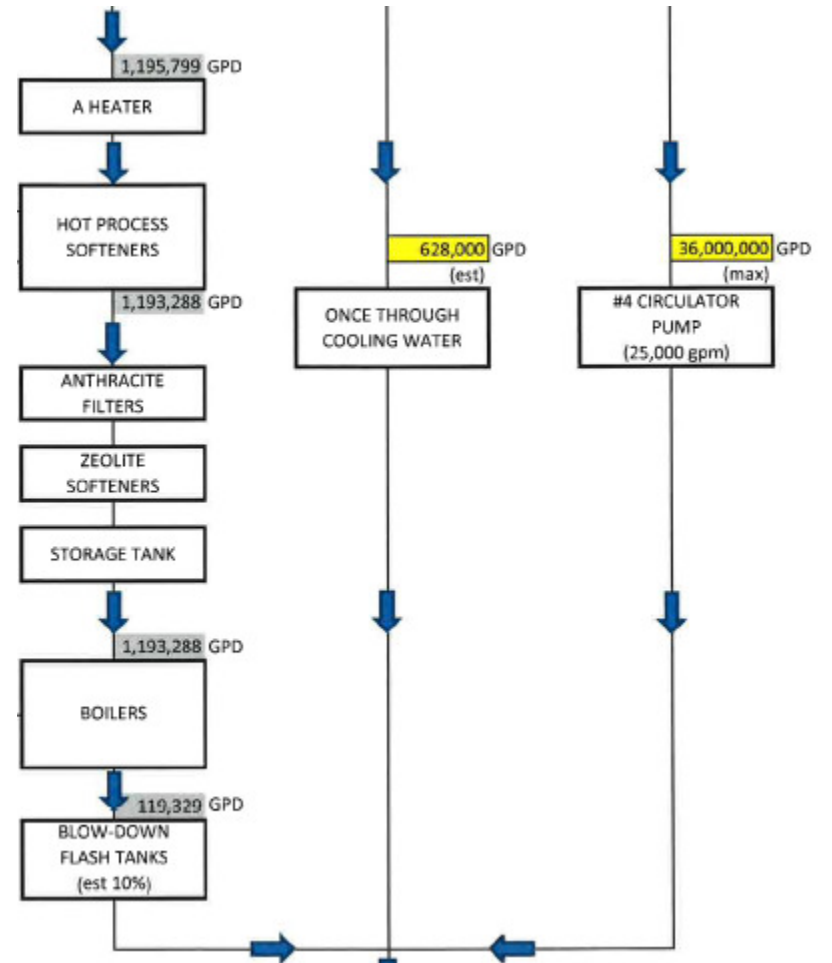
- Equipment cooling
  - Once through / recirculating cooling
  - Contact/Non-contact?
- On-site boiler water treatment
- Consumptive uses
  - Production processes
  - Locker rooms – baths & showers
  - Kitchens
  - Outdoor irrigation
- Losses
  - Evaporative
  - Leaks
  - Blowdowns / traps



## Perry K Steam Plant Max Design Steam Flow Conditions



## Perry K Steam Plant Average Steam Flow Conditions

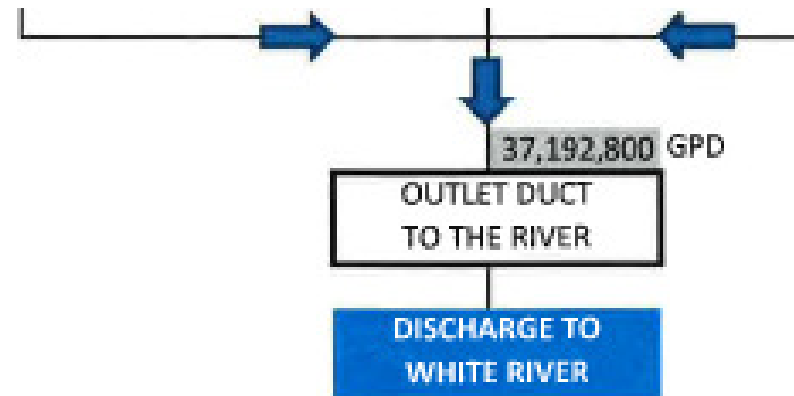
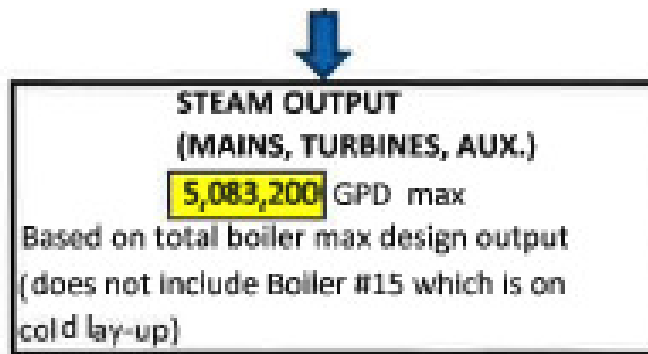


# How Does Water Leave the Plant?

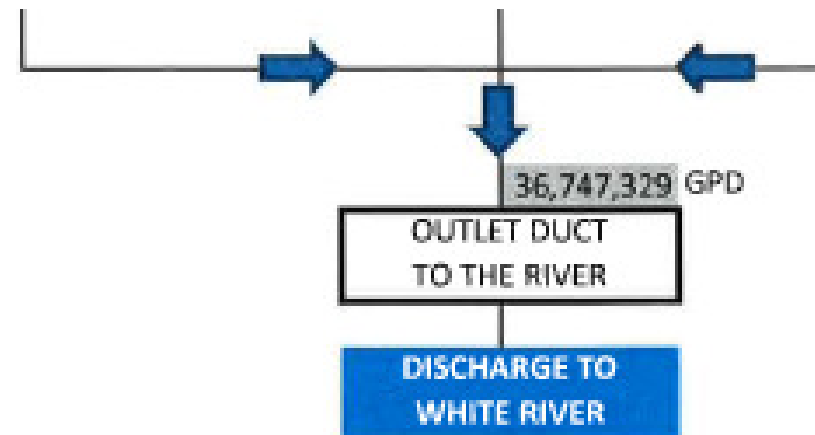
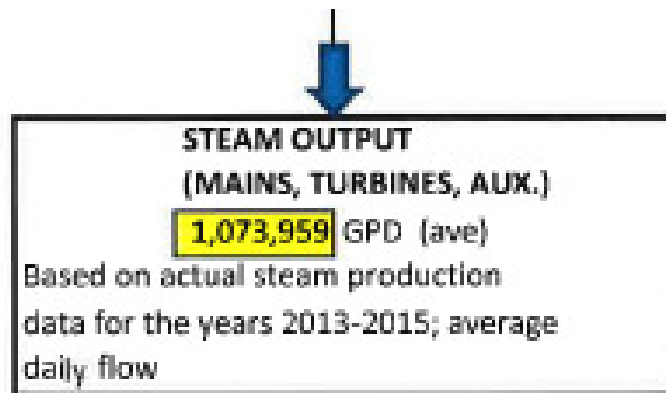
- As (or in) a Finished Product(s)?
- Losses?
- Discharges to sanitary sewer?
- Discharges to surface water?
- Underground injection?



## Perry K Steam Plant Max Design Steam Flow Conditions



## Perry K Steam Plant Average Steam Flow Conditions



# Use of the Water Balance

- Compliance with Regulations
  - Consumptive Use Permitting
  - Surface Water Intake Reporting
- NPDES Permitting
  - Calculation of water quality based effluent limits
  - Monthly reporting
- Efficiency Projects



# Are there Hidden Opportunities?

- Consider the sub-processes
  - Condensation pathways
  - Non-contact cooling loops
  - Irrigation systems
- *Challenge the Process*
  - *WHY* is water used in the manner that it's being used?
  - *WHAT* can we change without sacrificing efficiency?





*Water is the most essential element of life.  
Without water, there is no coffee....  
Use what we have wisely to protect future  
generations!*

**QUESTIONS?**

