# Why Not WRRF?

*Drivers | Challenges | Path Forward*

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*TACWA Meeting*

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WWTP
WRRF
Wastewater
Treatment Plant
Water Resource
Recovery Facility

# Nutrients

# Energy

# Water

## *Water Resource Recovery*

# WRRFs of the Future

- *Wastewater is a re-N-E-W-able resource*
  - *Nutrients*
  - *Energy*
  - *Water*
- *Protection of human health/Environment + Recovery of valuable resources*

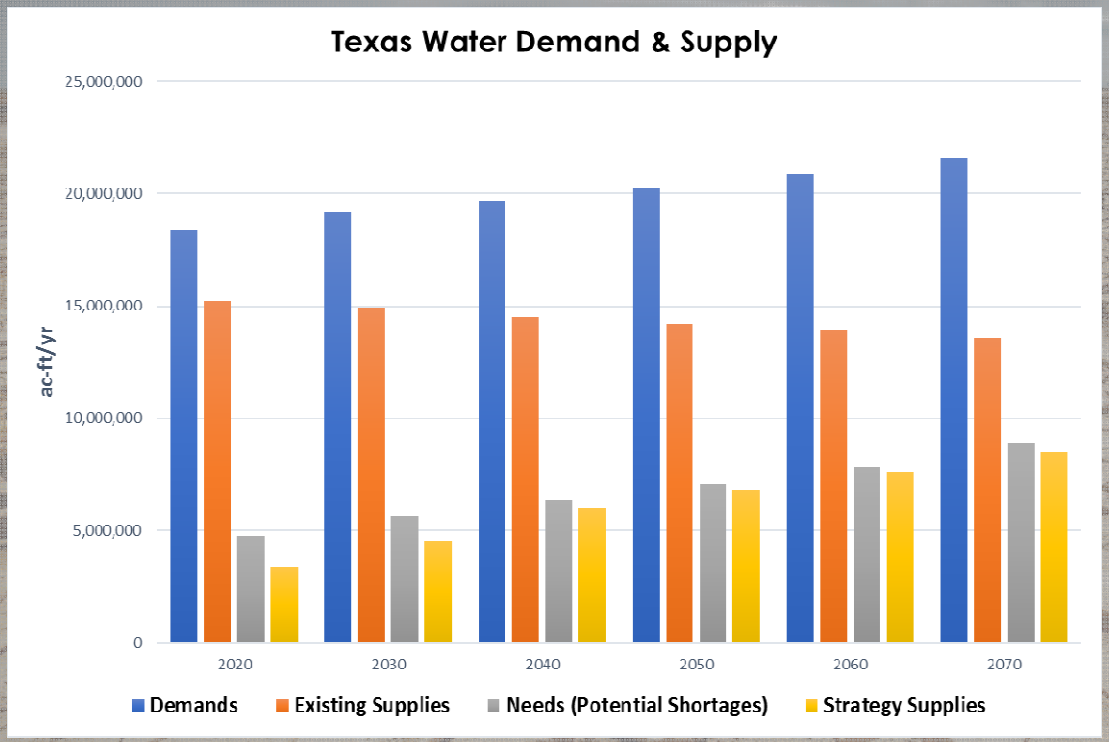


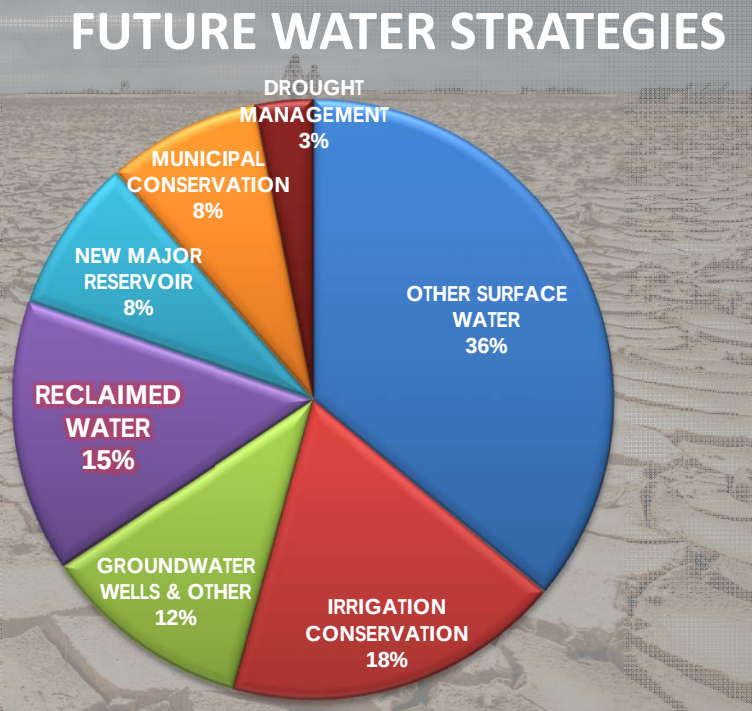
# Why Not WRRF?

Drivers

Challenges

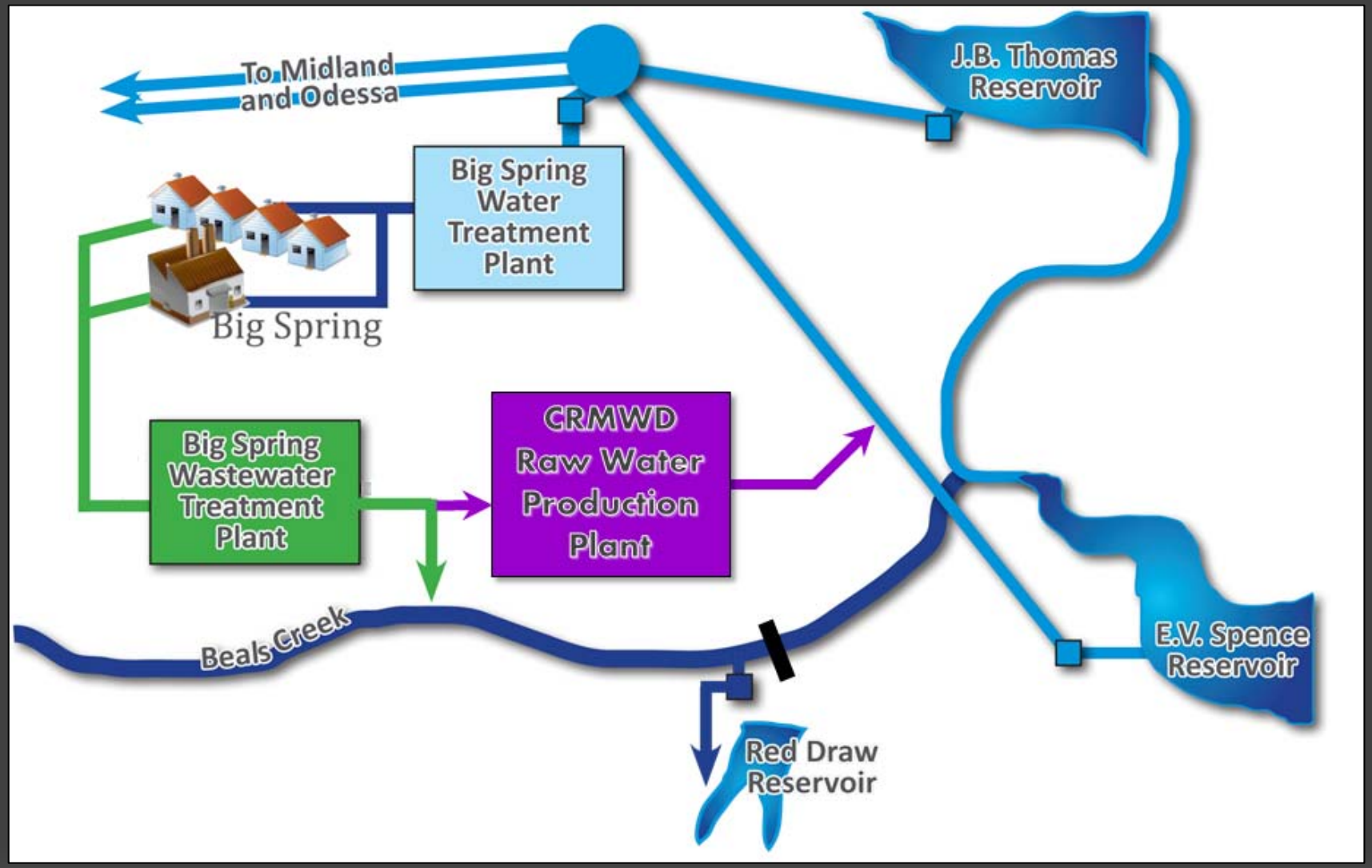
Path Forward




# Water Scarcity

Increasing Water Demand | Decreasing Water Supply | Reclaimed Water Viable Option

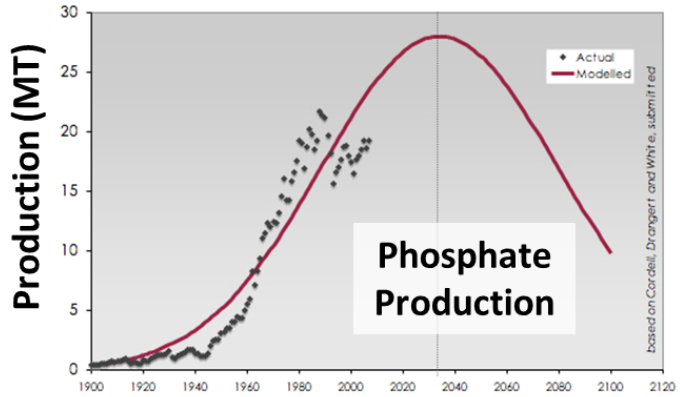



# Direct Potable Reuse (DPR)

Colorado River Municipal Water District (CRMWD)| City of Wichita Falls

# Growing Nutrient Demand for Agriculture

- ***Biosolids Rich in Nutrients***
  - ***Nitrogen***
  - ***Phosphorus***
- ***Extracting Phosphorus from wastewater is more efficient than mining from reserves***
- ***Phosphorus is a non-renewable resource***




US Phosphate Rock Reserves = **40 yrs**

(USGS, 2016)

**15% of annually mined P ends up in human excreta**

(Cordell et al., 2009)

# Growing Nutrient Demand for Agriculture

- ***N production from non-bioavailable sources (Haber Bosch Process) is energy intensive and non-sustainable***
- ***Green house gases (GHG) emission from Nitrogen Production***

GHG Emissions from NH3 Production

=

GHG Emissions from **1.7 Million Cars**


**“Hou-Actinite”**
**City of Houston**

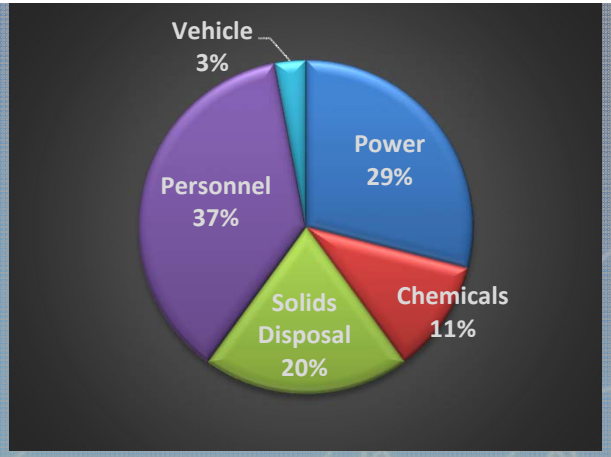

**“Bloom”**
**DC Water**


**“Milorganite”**
**Milwaukee Metropolitan Sewerage District**

# Biosolids as Commercial Fertilizers

# Increasing Use and Cost of Energy

- ***Energy use accounts for one-third of total operating cost***
- ***Increasing cost of energy***
- ***Energy from fossil fuels contributes carbon footprint and greenhouse gases (GHG)***
- ***Focus on energy neutrality through energy reduction and recovery***




**Operation & Maintenance Cost Breakdown at WRRFs**

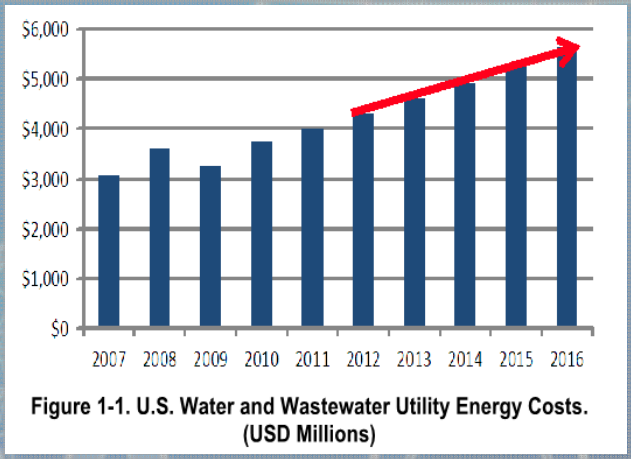



**Figure 1-1. U.S. Water and Wastewater Utility Energy Costs. (USD Millions)**

**Source: A Guide to Net-Zero Energy Solutions for WRRFs Report**

# Stricter Environmental Regulations

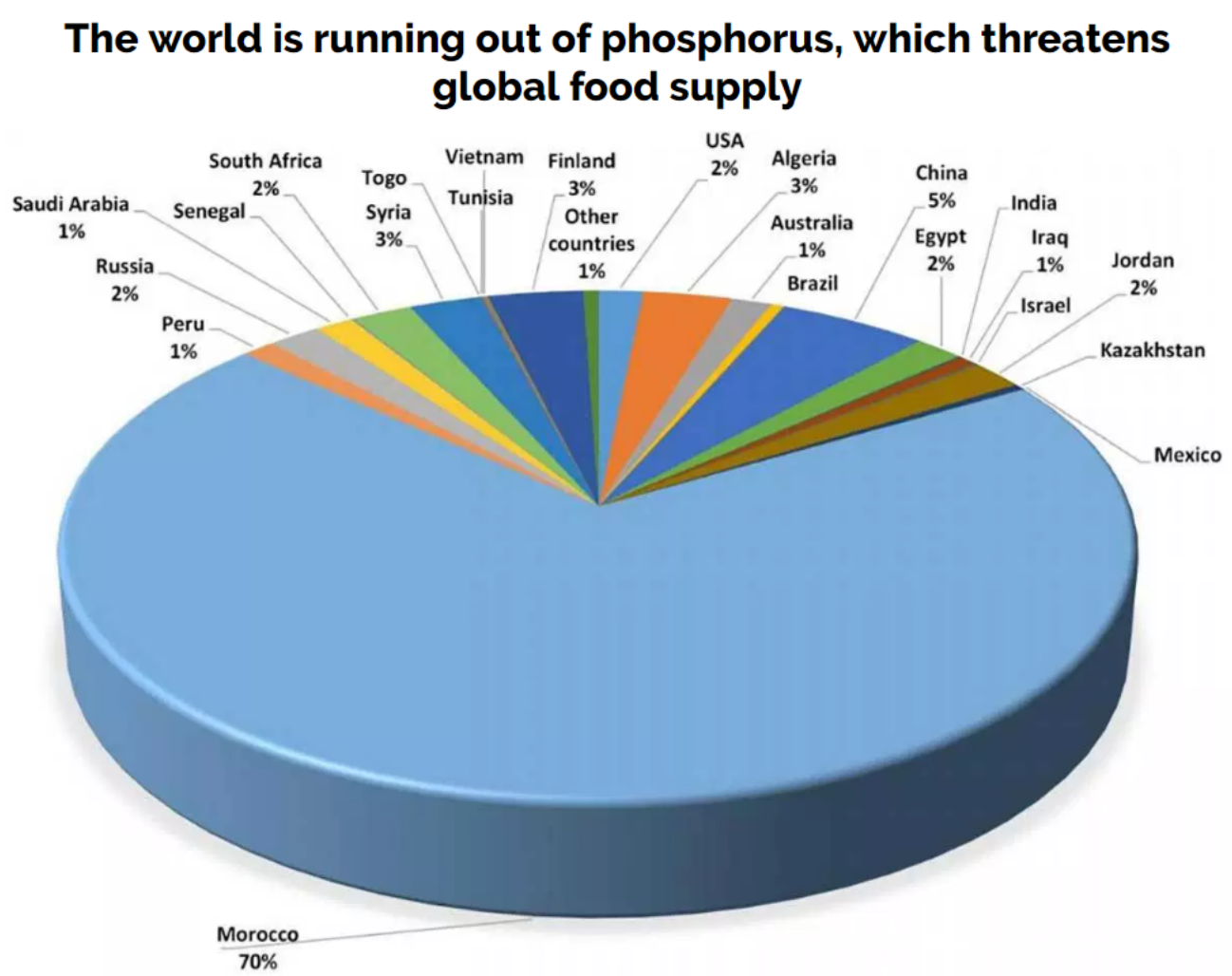
- ***Potential nutrient limits in the future***
- ***Biological Nutrient Removal (BNR) processes and Sidestream treatment for enhanced removal of Nutrients***
- ***Biosolids from BNR processes rich in Phosphorus***

# Decreasing Landfill Capacity

- ***Sludge hauling/disposal cost can be significant***
- ***Reduced landfill capacity***
- ***Landfills produce greenhouse gases***
- ***Stricter landfill regulations***

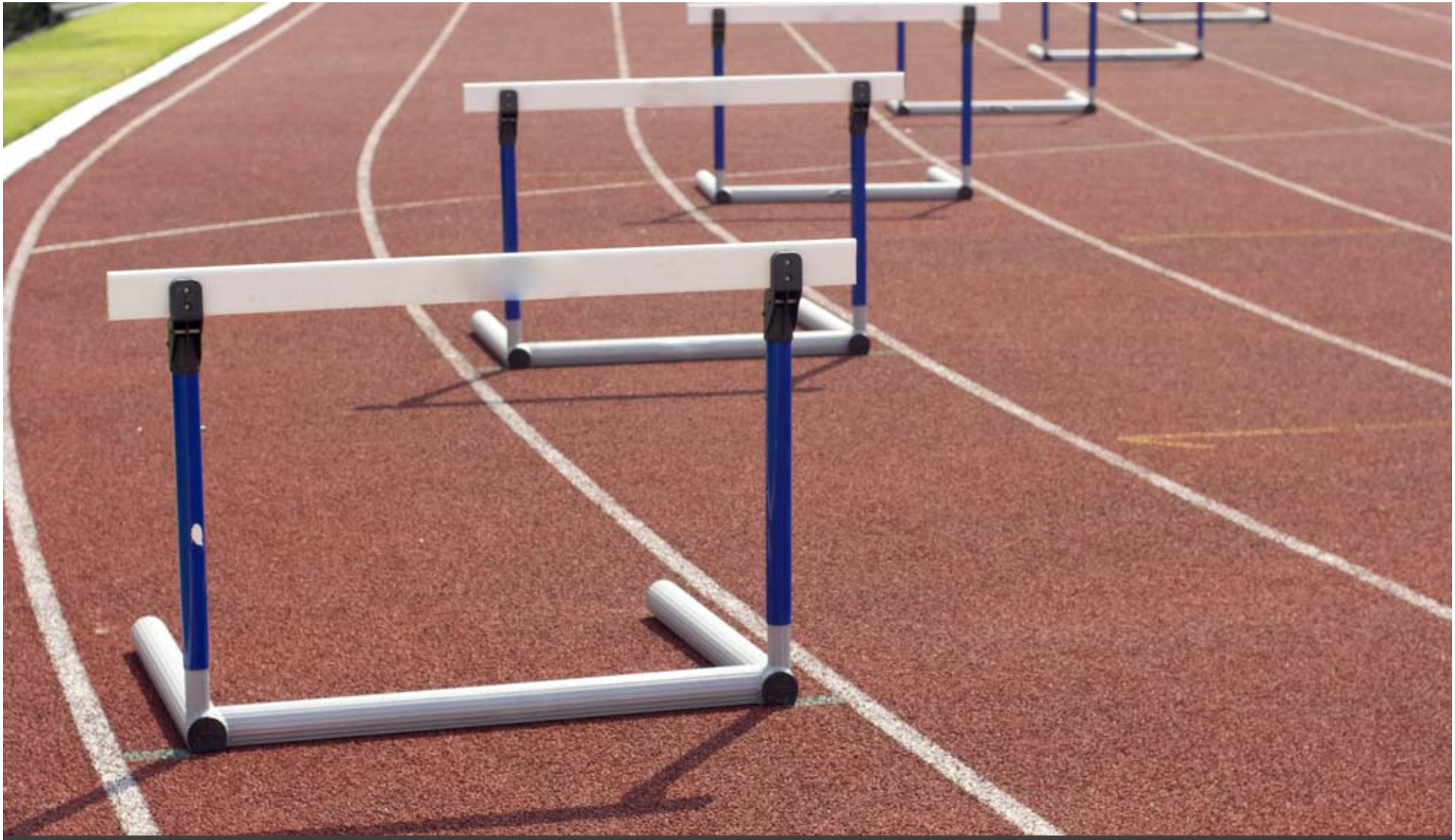
# Resiliency

- ***Enables WRRFs to operate independently during power outages due to natural disasters***
- ***Not relying on landfill capacity for sludge disposal***
- ***Resilient to variability of waste streams***




By ASRASR (Own work) [CC BY-SA 4.0], via Wikimedia Commons

# Resiliency



# WRRF Challenges

- ***Key challenge for WRRFs of the Future***
- ***Capital cost investment for resource recovery implementation can be high***
- ***Tight capital improvements budget***

# Capital Cost Investment

- ***Complexity of operation of resource recovery techniques***
- ***Need for skilled labor to operate WRRFs of the Future***
- ***Investment for training and development for next generation workforce***



# Complexity of Operation | Skilled Labor

# Aging Infrastructure

- ***Capital expenditure focus on replacement of aging critical infrastructure***
- ***With aging infrastructure maintaining service and compliance is a key challenge***



- ***Lack of public awareness and understanding of WRRF goals***
- ***Difficult and costly to educate public on benefits of water reuse and biosolids***



# Public Perception & Acceptance

# WRRF – Path Forward


# WRRF – Path Forward

- ***Develop Resource Recovery Plan***
- ***Replace aging infrastructure with resource recovery in mind***



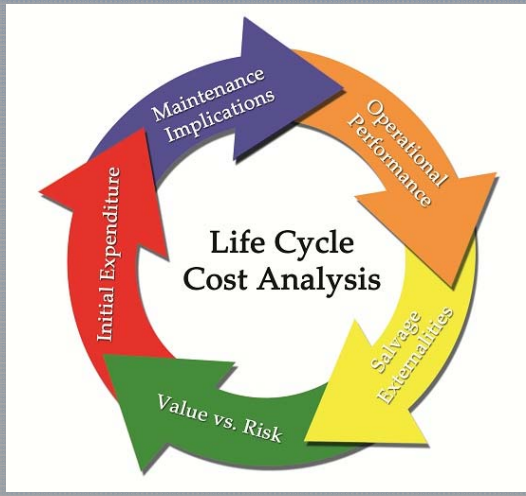
# Resource Recovery Plan

# Public Education & Engagement

- ***Educate ratepayers understand the goals of WRRFs***
- ***Raise awareness of water demand and supply***
- ***Outreach to educators to develop lesson plans to engage young minds***
- ***Find creative ways to engage public***

# Rethink Affordability of Resource Recovery

- ***Look at lifecycle cost for broader view***
- ***Revenue streams from resources: water, nutrients and energy***
- ***Consider non-monetary factors:***
  - ***Resilience***
  - ***Environmental stewardship***
  - ***Local economic activity***



- *Wastewater is a re-N-E-W-able resource*
- *Resource Recovery can be the norm in the future*
- *Plan Now for Resource Recovery*
- *Public Awareness and Education is Key*

# *Call me ~~WWTP~~ WRRF*

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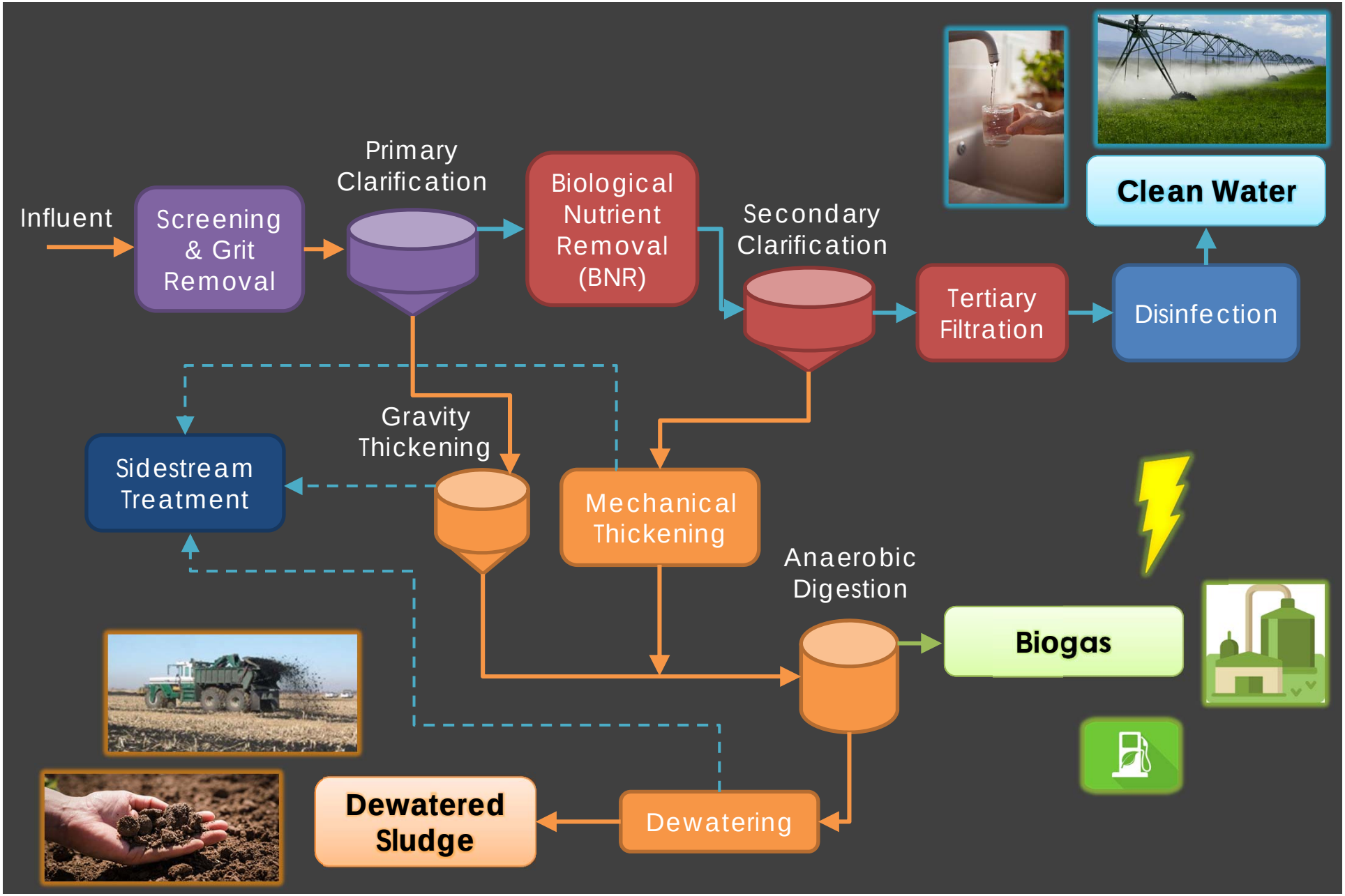
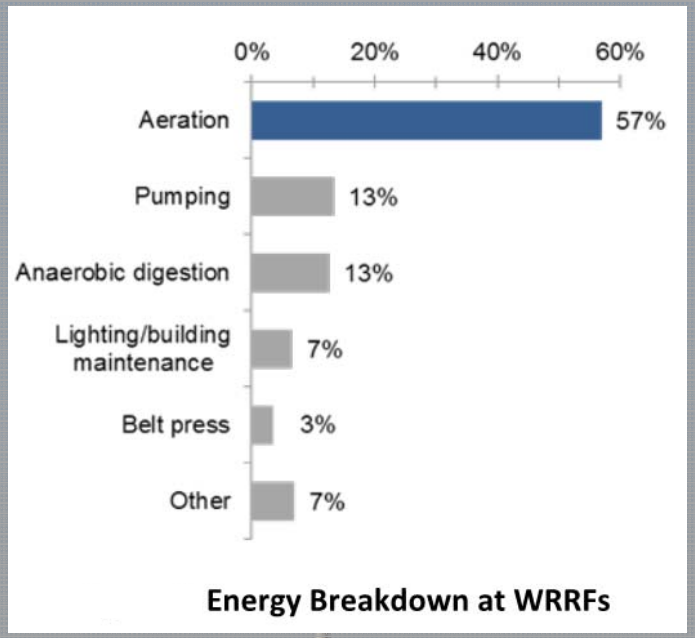



# WRRF of the Future

# Reduce Energy Consumption

- ***Reduce net energy consumed per unit of water treated***
- ***Use of energy efficient technologies/processes: fine bubble diffuser, high efficiency blowers etc.***
- ***Energy auditing of facility***
- ***Energy reduction goals***




Source: NSF.USDOE.USEPA – Energy Positive Water Resource Recovery Workshop Report, 2015