Why is More Research Needed?

- Analytical Challenges and Limitations
- Identify and Address Health and Environmental Risks
- Quantity and Quality
- Variability over Time
- Logistical Considerations
- Permitting and Regulatory Structures

When and Where Should Research be Focused?

- Volume exceeds disposal capacity
- Volume of water needed exceeds availability
- Higher quality produced water (less treatment needed)
- Projected local demand exceeds reliable supply
- Other local drivers

How Should Research be Conducted?

- Applied and Strategic
- Collaborative
- On actual produced water (not synthetic)

HOW?

Basic Research Needs

Lab Analytical Method Development and Capacity

Characterization Raw and Treated using various Technologies

Study actual Produced Water (not synthetic)

Science Based Regulatory and Monitoring Standards

Fit for Purpose Risk Assessment for various Reuse

Land Application

- Constituents present at what level
- Agronomic rates
- Absorption, infiltration, permeability in various soil types and ground cover
- BMPs at surface or shallow depths to prevent runoff
- Irrigation strategies
- Model development for long term soil health
- Expand toxicity test in terrestrial environments
- Worker exposure considerations
- Ecosystem adaptation to water quality change
- Impacts to ground water and surface water

Water Resources

- Model fate and transport of constituents
- Bioaccumulation
- Quantity vs Quality impacts
  - Aquatic life at various flowrates
  - Point of stress
  - Ratio of fresh water to produced water and impacts based on different stream types
- Impacts of ASR/MAR
  - Impacts to wells
  - Plume movement
  - Underground chemical interactions

Water Resources

- Assimilative capacity of receiving water
  - Impacts to designated beneficial uses
  - Impacts to downstream water bodies (terminal lakes, etc)
- Crossing jurisdictional boundaries
  - Discharge permit implications
  - Injection into large aquifer under lying multiple states
  - Ownership and liability
  - Water transfer rules
  - Multi-agency involvement

Water Resources

- Watershed implications
  - Impacts to TMDLs
  - Wasteload Allocations
  - Impacts to permit limits of downstream discharge
  - Ionic balance or other chemical changes
  - Biomonitoring species impacts
  - Water quality improvement
  - Impacts to other wells
  - Impact to groundwater classified as USDW or surface water classified as PPWS or EPPWS

Industrial Uses

- Implications of changes in water characteristics
- Impact on process operation or products
- Impacts to solids management and wastestream disposal
- Pretreatment needs
- Secondary market development (lithium, iodine, etc)
- Worker safety

Livestock and Wildlife

- What are appropriate treatment technologies?
- What are appropriate levels of constituents?
- Bioaccumulation
  - What species are more/less susceptible?
  - Which contaminants?
  - Short term and long term impacts (acute, chronic, sub-leathel, etc)
  - Impacts to food chain
- Ecosystem impacts to discharge stopping

Legal and Regulatory Questions

- What permits or authorizations are required?
- What agencies have regulatory authority?
- Who owns or controls rights to produced water?
- How is produced water defined?
- Who has liability for spills, disposal, etc?
- When or where does liability or ownership transfer?
- How do other environmental regulations impact reuse?

Logistical Considerations

- When is there a need for the produced water?
  - seasonal vs year round
  - Water stress
- What is the available infrastructure? What is the necessary infrastructure?
- What operational decisions need to be made to consider produced water reuse?

Economic Considerations

- Treatment
  - What are treatment options?
  - What do they cost?
  - What are disposal costs?
- Transportation and Infrastructure
  - What are the methods available?
    - Trucking vs Piping (hard infrastructure or temporary)
- Contract management
- Energy costs for various treatment, transportation and disposal

Economic Considerations

- What markets might be developed?
- How can solids be managed?
- Water rights
  - How has them?
  - Who has to pay for them?
  - If/when are permits required?
- When is it economically feasibility to reuse?

Benefits

- What circumstances lead to a “win-win-win”? (industry-citizens-environment)

GWPC

- Taskforce established September 2019
- Project Groups
  - Policy/Regulatory
  - Water Quality
  - Water Quantity
- Focus Areas
  - Ownership, liability, NPDES delegation
  - ASR/MAR
  - Treatment technologies
  - Land application
  - Expanded in oilfield use