

# STORAGE TANK ALTERNATIVES

THE WELDS AND BOLTS

Michelle Johnson, P.E. (ID)

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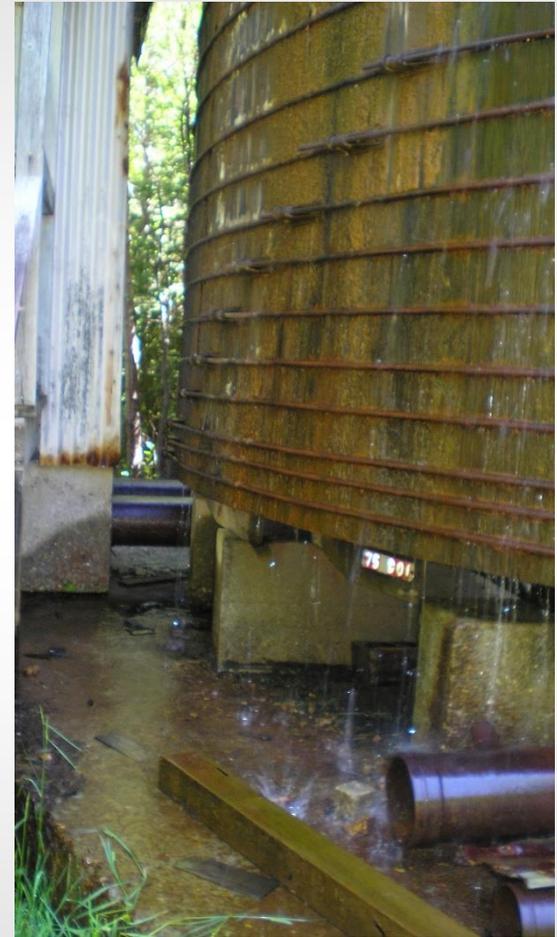
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# Outline

- First Things First
- Site Constraints and Considerations
- The Details
- And, what can you afford today, and 20 years from now?

# First Things First

- Do you need a tank?



# First Things First

- Not always a new tank



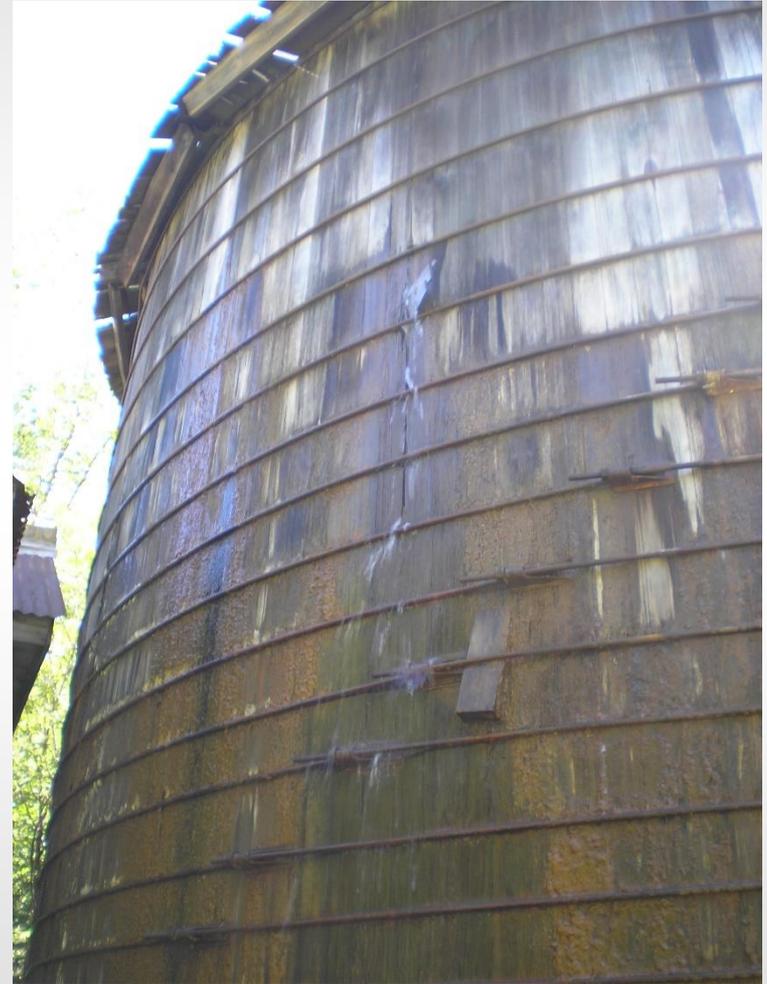
# First Things First

- Other options to use existing facilities



# First Things First

- So, you need a tank..
  - How much volume?
    - Fire Flow – IBC
    - Emergency - Variable
    - Equalization – Peak Hour



# First Thing's First

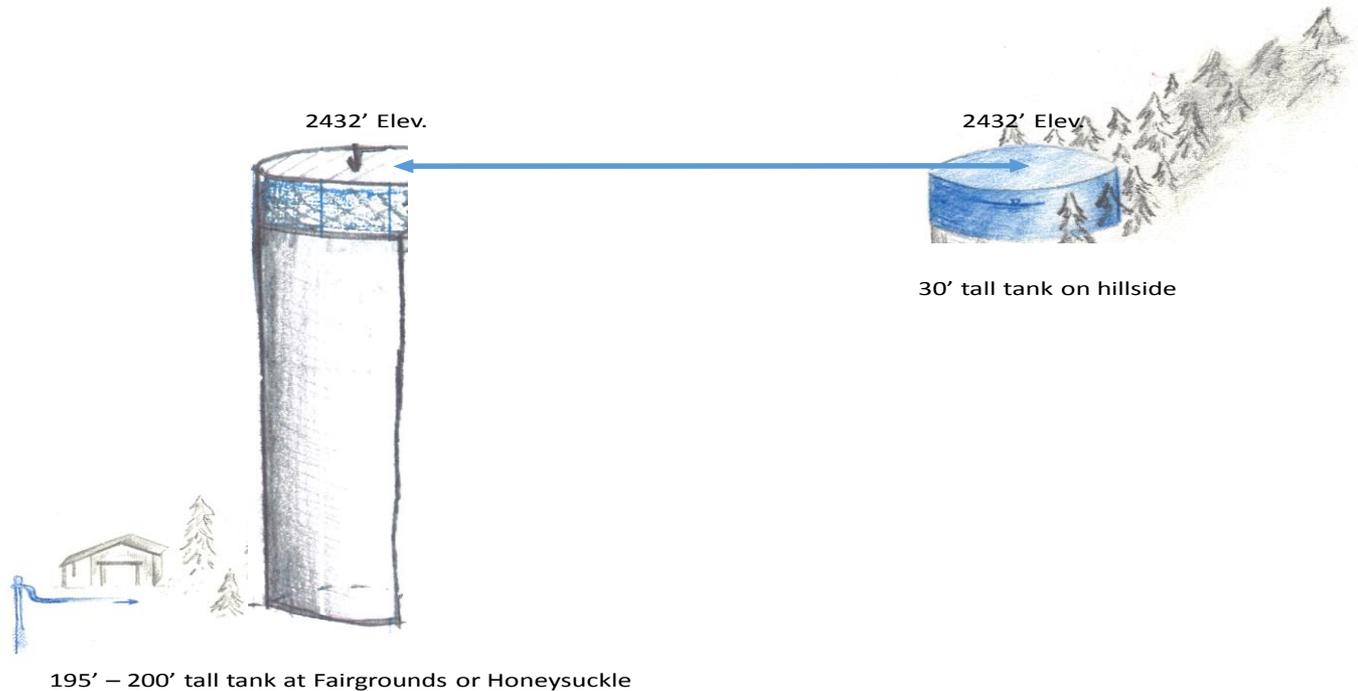
- Now you know the volume....
- Determine overflow and operational elevations:
  - Are you matching an existing tank?
  - Hydraulic connectivity?
  - Meeting minimum pressure criteria?
  - Will you over pressure any areas at the elevations considered?

# First Things First

- Available Properties and things to consider:
  - Easements/property acquisition
  - Funding/schedule
  - Elevation relative to existing tanks
  - Proximity to airports
  - Access
  - Soil type
  - Neighborhood concerns
  - Aesthetics

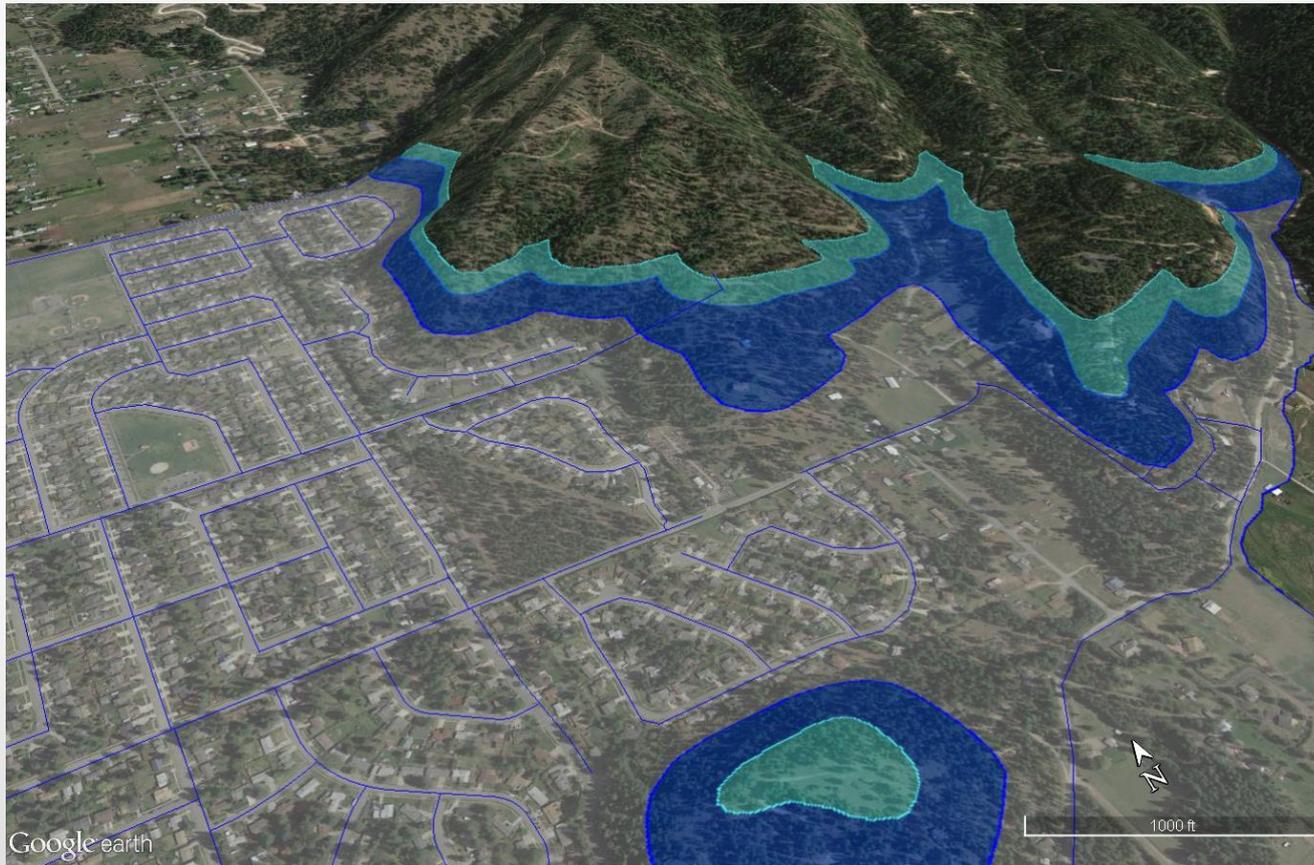
# Site Constraints and Considerations

- Elevated vs. Ground Level



# Site Constraints and Considerations

- Identify potential locations



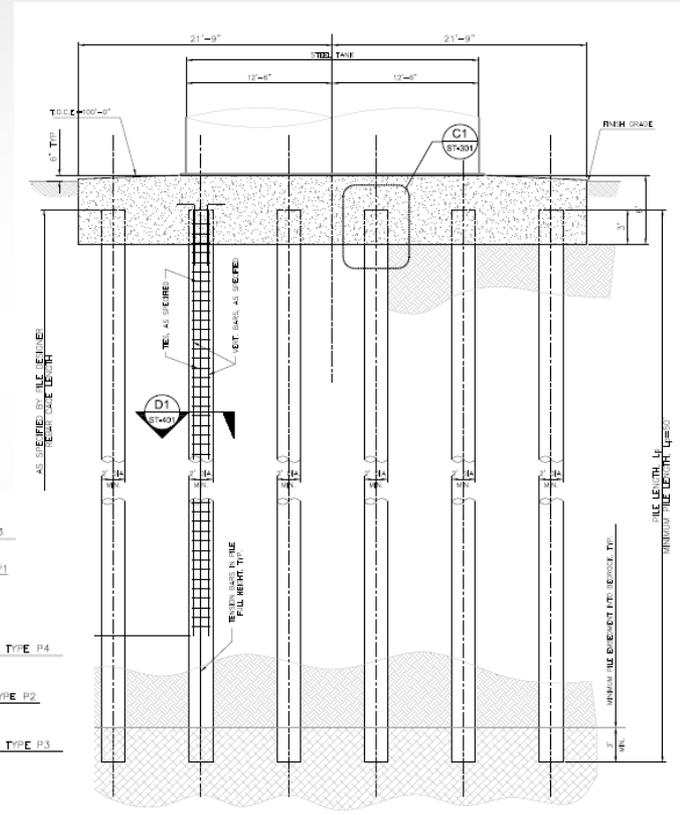
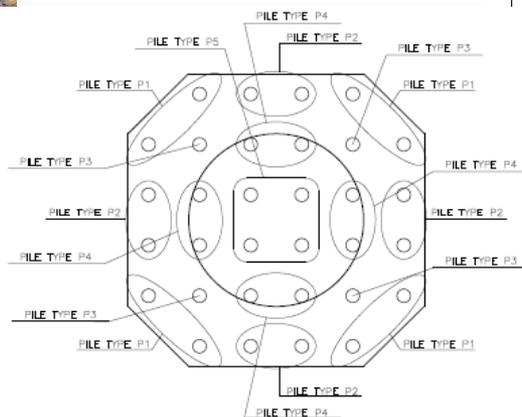
# Site Constraints and Considerations

- Access and System Connectivity



# Site Constraints and Considerations

- Geotechnical Analysis



B1 PILE LOAD SCHEDULE FOR AUGER-CAST PILE OPTION  
SCALE: 1/4"=1'-0"

# Site Constraints and Considerations

- Aesthetics
  - Color
  - Buried or partially buried
  - Graffiti resistant coatings
  - Landscaping
  - Access



# The Details

- Material Selection
- Ground Level
  - Concrete or Steel?
- Elevated
  - Steel or Composite?

# Ground Level



# Concrete

- Types of Concrete Tanks
  - Wire Strand Wrapped Pre-Stressed
  - Internal Tendon Pre-Stressed
  - Cast in Place

Advantages	Disadvantages
Low Capital Cost	Cracking/Leaking
Buried/Partially Buried	Large Excavation
Generally Can Construct Year Round	Can be difficult to modify post construction
Local Contractors for much of the work	Little design flexibility
Long Service Life	

# Concrete



# Steel Water Tanks

Welded Steel	Glass Lined Bolted Steel	Epoxy Lined Bolted Steel
Advantages		
Maximum design flexibility	Lower Construction Cost	Lowest Construction Cost
No leaking	Bolt and seal work can be done while on-line	Bolt and seal work can be done while on-line
Aesthetics	Minimal maintenance cost	
Disadvantages		
Recoat interior and exterior over lifetime	Coating failure is difficult to repair	Difficult to recoat
Specialty Contractor to install		

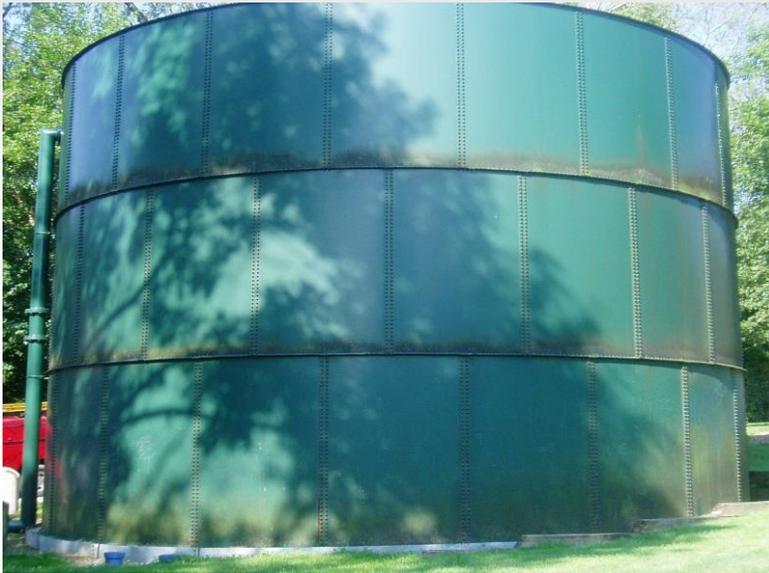
# Steel Tanks



Welded Steel



# Steel Tanks



Epoxy Lined Bolted Steel

Glass Lined Bolted Steel



# Elevated Storage

- Elevated Storage
  - Composite Pedestal
  - Standpipe
  - Multi-Column
  - Flared Steel Column (Golf Ball and Tee)

# Elevated Storage

Composite Tank	Standpipe	Multi-Column	Flared Steel Column
Advantages			
Lower space can be utilized for storage	Low capital cost	Minimize dead storage	Aesthetics
Minimize dead storage			Lower recoating costs
Lower recoating cost			Minimize dead storage
Disadvantages			
Special formwork	Water stagnation and water quality concerns	High cost for recoating	Higher construction costs
Modifications to the tank are difficult		Vandalism potential	

# Elevated Storage



Composite Pedestal

Welded Standpipe



# Elevated Storage



Multi Column

Flared Steel





# O&M Considerations

- Mixing
  - Active v. passive
  - Aeration, impeller, or sheet-flow
- Heating
- Chemical Addition
- Coatings

# Lifecycle Considerations

	Elevated Storage	Ground Level
Pumping Costs	\$	\$
Coating Costs	\$\$\$	\$
Mixing Costs	\$\$	\$
Replacement Cost	\$\$\$	\$\$

# Budgeting/Funding

## ■ Lifecycle Costs

	Capital Cost	O&M (Present Worth)	Tank and Foundation Salvage	Total 40-Year Lifecycle Cost
Standpipe – Welded	\$1.7M	\$0.3M	\$50,000	\$1.99M
Standpipe – Epoxy Lined, Bolted Steel	\$1.4M	\$0.95M	\$0	\$2.4M
Standpipe – Glass Lined, Bolted Steel	\$1.5M	\$0.69M	\$0	\$2.15M
Ground Level Tank and Booster	\$1.4M	\$0.98M	\$0	\$4.23M

# Budget/Funding

- Funding
  - What can you afford now?
  - What can you afford in 20 years?

# Conclusion/Take-Aways

- Planning to evaluate system needs
- Understand the limitations of the site
- Consider short term and long term costs when selecting materials
- Consider short term and long term funding

# QUESTIONS?

Michelle Johnson, P.E.

[mjohnson@jub.com](mailto:mjohnson@jub.com)

(208) 762-8787

7825 Meadowlark Way

Coeur d'Alene, Idaho

[www.jub.com](http://www.jub.com)



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