

# Constructed Wetlands for Brine Water Management:

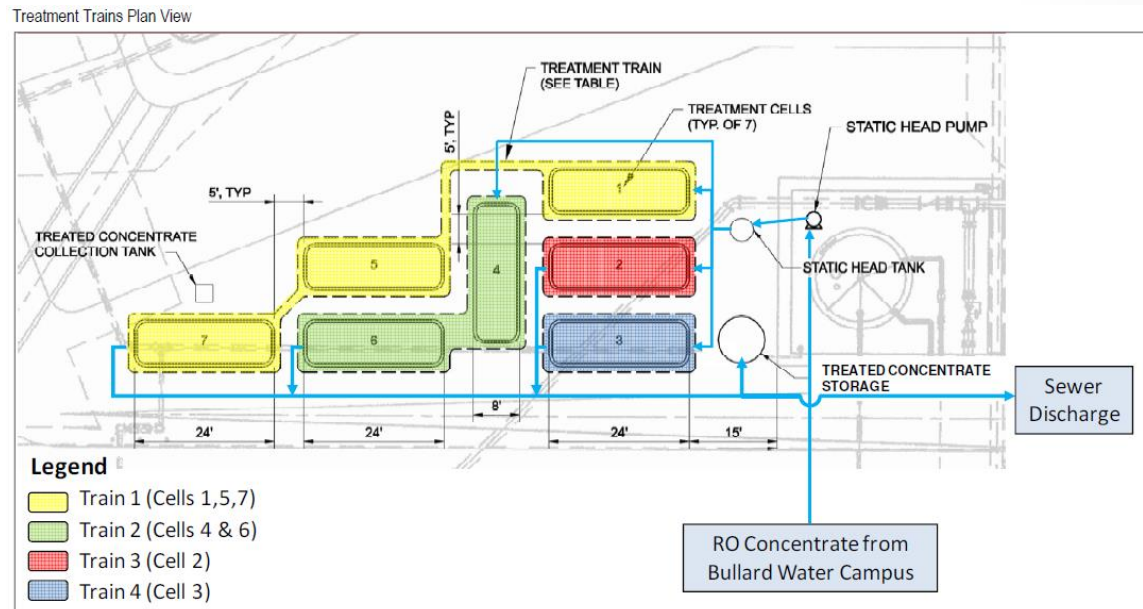


## A CASE STUDY OF THE BULLARD REGULATING WETLAND (GOODYEAR, AZ)

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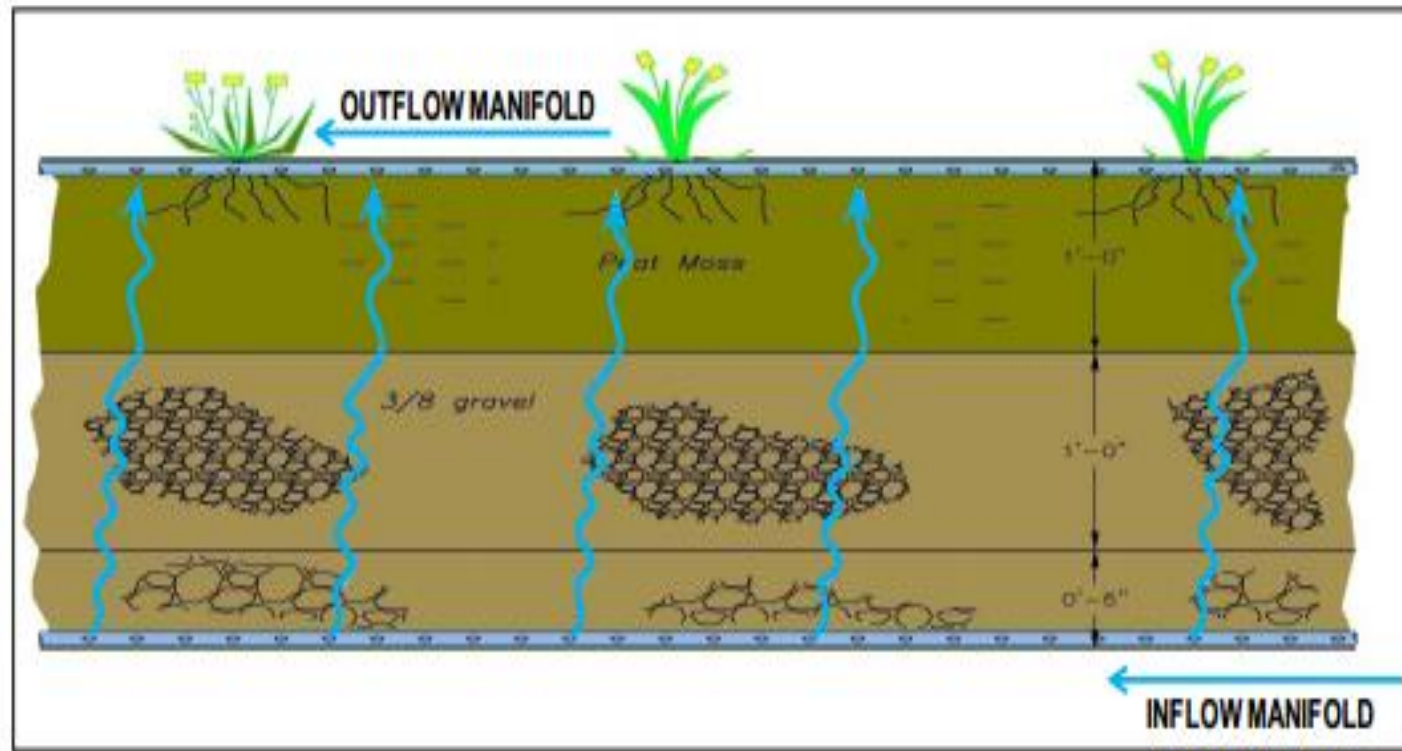
# What is the purpose of this study?

- Initial report to inform full-scale implementation of Bullard Wetland pilot project
  - Economic Analysis
  - Ecological Analysis
  - Social Analysis
  - Recommendations
- Methodology



# Bullard Wetland Pilot Project

Vertical Flow Wetlands



# Ecological Analysis

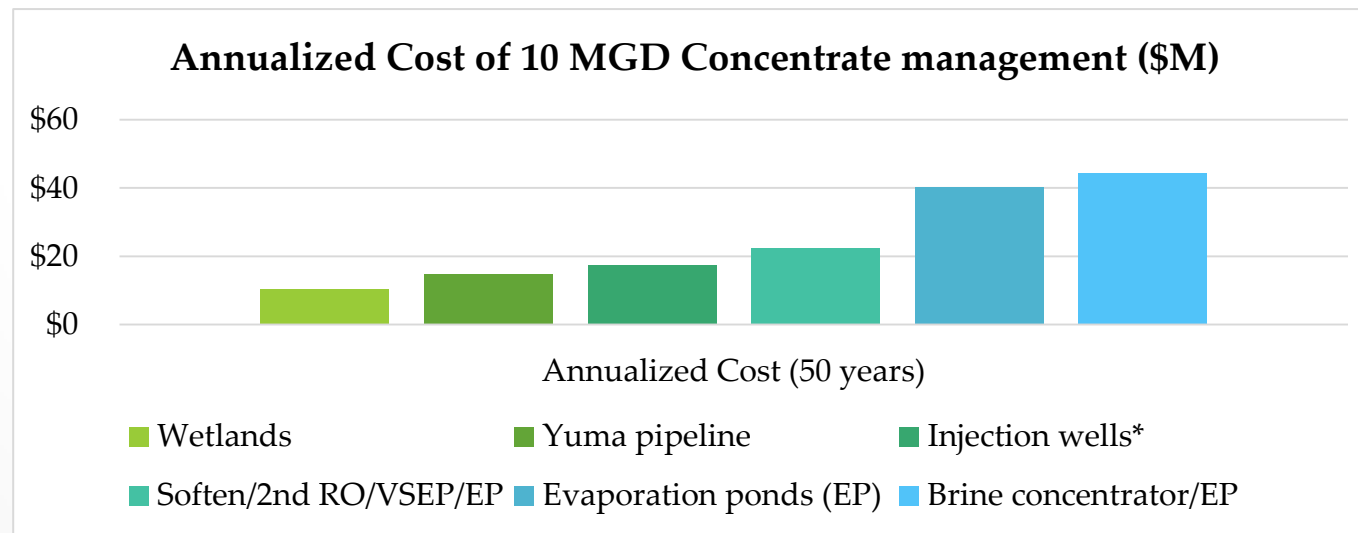
Projected Wetland Performance

Parameter (units)	Summer			Winter		
	Concentrate	Effluent	Removal	Concentrate	Effluent	Removal
Selenium (µg/L)	41.9	0.6	98.5%	19.0	2.0	89.4%
Arsenic (µg/L)	29.1	8.4	71.1%	18.4	9.2	50.1%
Chromium (µg/L)	43.0	6.0	86.0%	33.0	4.4	86.7%
Nitrate (mg/L)	56.0	0.5	99.2%	54.0	1.3	97.6%
TDS (mg/L)	7,450	14,534	N/A	7,840	9,629	N/A
Flow (mgd)	0.50	0.26	48.7%	0.50	0.41	18.6%



# Economic Analysis

Cost of 10 MGD Concentrate Management (millions of dollars)						
10 MGD	Regulating Wetlands	Yuma pipeline	Injection wells*	Soften/2 <sup>nd</sup> RO/VSEP/EP	Evaporation ponds (EP)	Brine concentrator/EP
Capital	\$150.22	\$266.11	\$114.46	\$286.56	\$651.69	\$ 272.71
O&M	\$1.75	\$0.62	\$11.31	\$6.9	\$3.5	\$29.75
Annualized (50 years)	\$10.37	\$14.92	\$17.46	\$22.30	\$40.26	\$44.40
*No known site in central Arizona that meets criteria for concentrate injection. (Adapted from Poulson, 2010)						










# Economic Analysis

- Opportunity Costs
  - Potentially lower costs on land and economic activity
  - Potentially higher costs on time and human resources
- Secondary Risks/Costs
  - Vector Control
  - Vegetation Management
  - Invasive/Disruptive Species Management
  - Liabilities from Impacting Protected Species
  - Frequency of Wetland Media Replacement

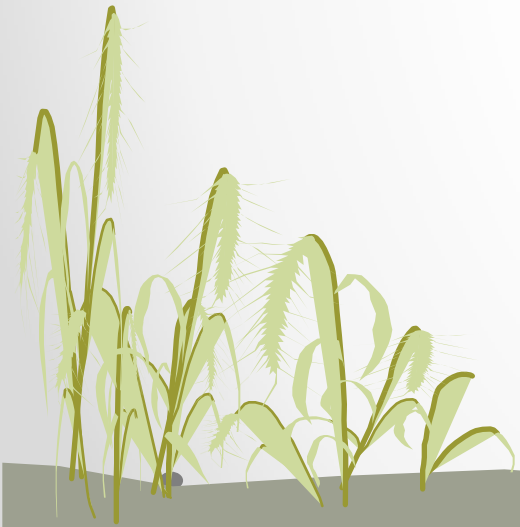


# Social Analysis

Indicator	Definition	Target	Goodyear Data	Assessment
<b>Water Consumption</b>				
Potable water	Average indoor residential use	>31.5 gals/day/person	50 gals/day/person	
	Average person residential	>60 gals/day/person	92.8 gals/day/person	
	Average industrial and commercial use	NA	92.6 gals/day/person	
<b>Urban Heat Island</b>				
Surface Temperatures	Percentage of District >130°F	<1%	NA	
	Percentage of District <105°F	>10%		
Asphalt surface parking	Percentage of District that is asphalt surface parking	<20% of off-street parking	<20%	
<b>Quantity and Quality of Green Systems</b>				
Urban forest	Percentage of District covered by trees	25—40%	1.4%	
Parks and green open space	Ft²/person of parks and green open space	97—215 ft²/person	~195 ft²/person	
			By 2020: 124 ft²/person	
			By 2030: 85 ft²/person	
Native natural environment	Percentage of District that is nature preserves	10% (Phoenix: 10.15%)	31-62%	
Walking and biking trails	Mi of walking trails/1,000 people	1 mi/1,000 people	0.65mi/1,000 people	

# Recommendations

- Full scale implementation
- Future economic and ecological risk evaluations
- Social evaluations: workshops and surveys
- Siting specifics: Estrella Mountain Park?
- Opening the “mixing” wetland to the public





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