

Flagstaff's Journey: Developing a Reclaimed Water Master Plan

Erin Young R.G., Interim Director

WRA July 26, 2021





Presentation Outline



Wastewater effluent is a drought proof supply
We've got a lot left over
Best & highest use

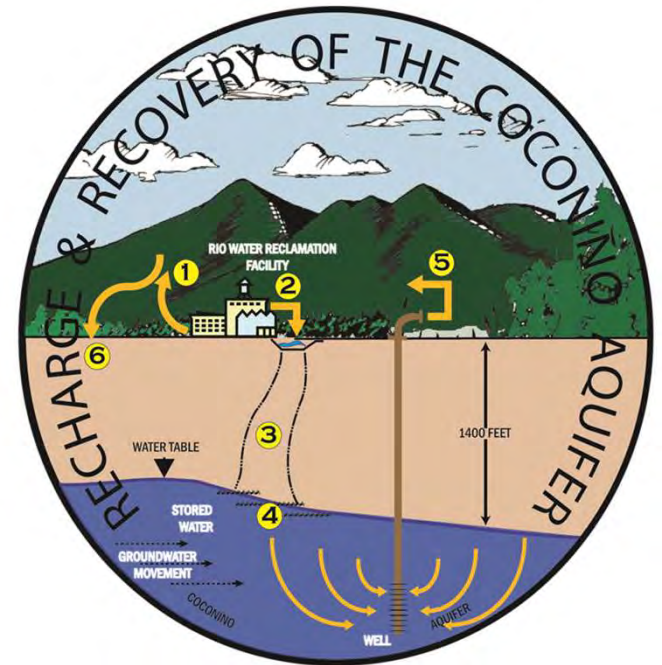
Water Resource Planning for Flagstaff

Local Policy

Reports & Studies

Drivers for Reuse Options

Next Steps





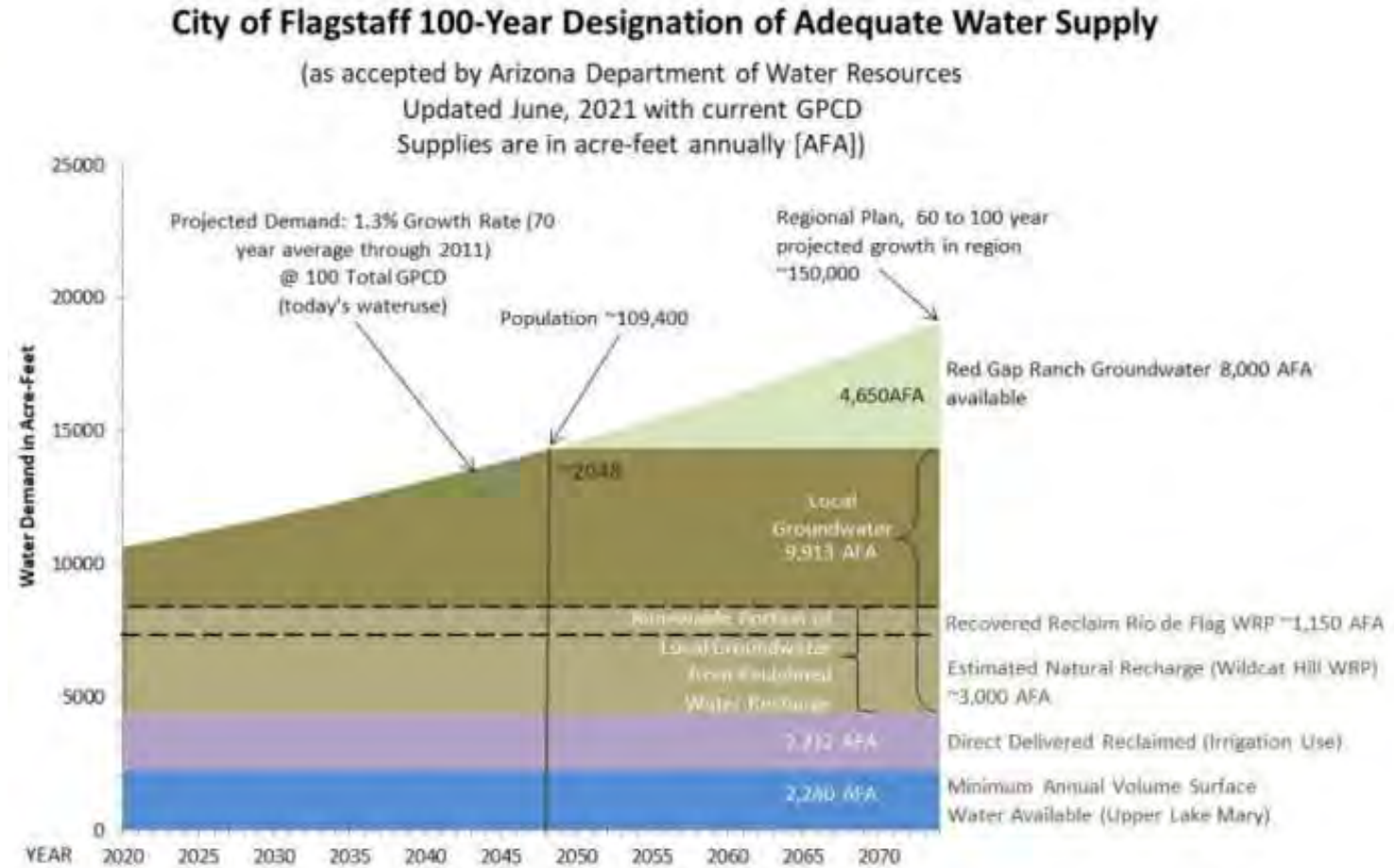
Flagstaff's Designation of Adequate Water Supply



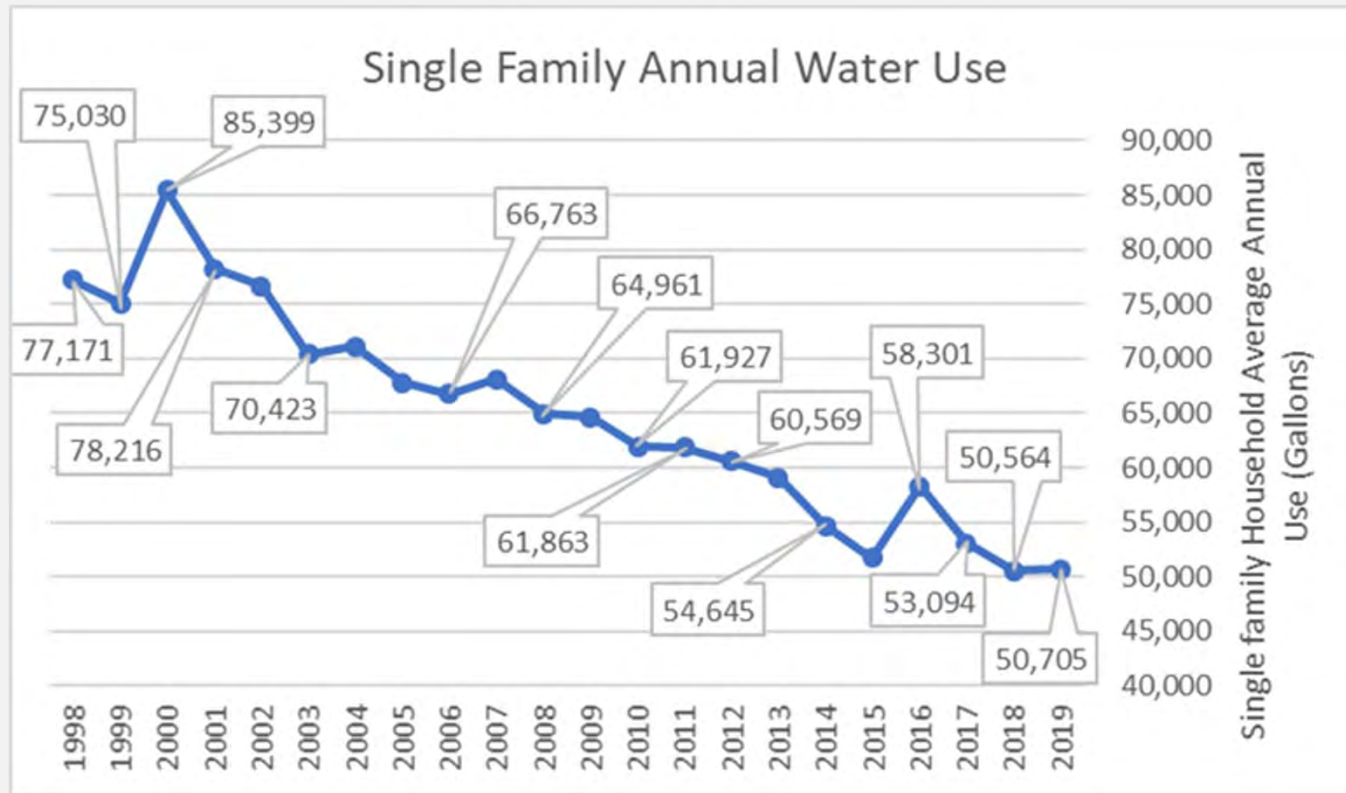
Criteria

- Continuously Available
- Legally Available
- Physically Available
- Water Quality
- Financial Capability

Options for Recycled Water?

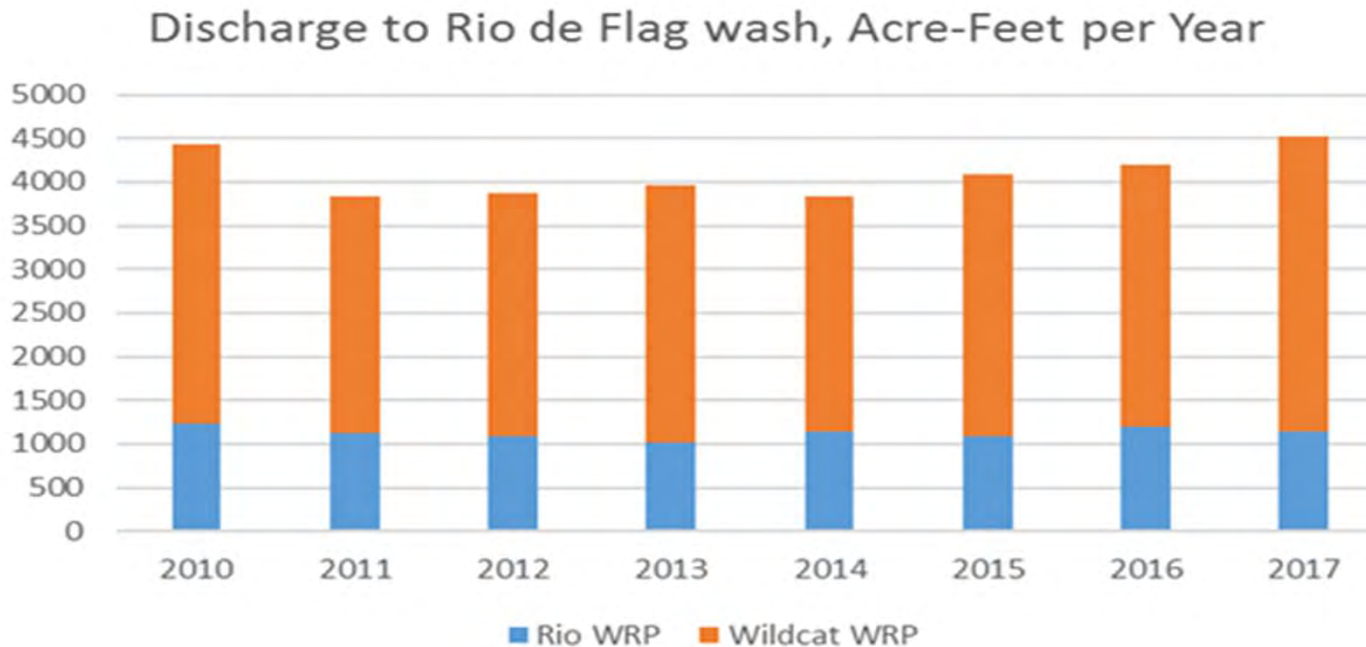


General Trend in Water Use



Single Family Annual Water Use has been dropping by about 1,000 gallons a year per household for the last 20 years

How much water is on the table?



On an annual basis, from 3,500 to 4,500 acre-feet of water is available each year for recycling back into the community.

Reclaimed Water Alternatives

1. Direct Reuse (Expand Purple Pipe)
- 2a. Streambed Recharge with Advanced Treatment
- 2b. Streambed Recharge without Advanced Treatment
- 3a. Recharge Wells with Advanced Treatment
- 3b. Recharge Wells without Advanced Treatment
6. Augmentation of ULM with Advanced Treatment
7. Direct Potable Reuse





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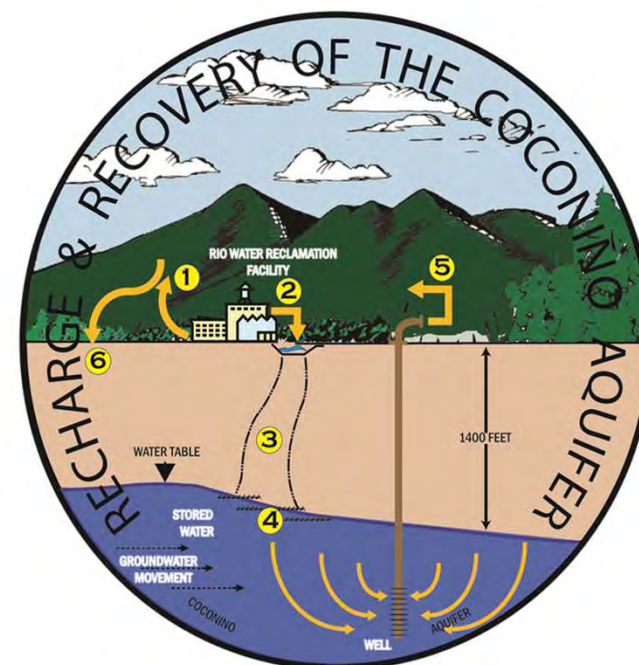
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City Code Promoting Aquifer Recharge

City Code

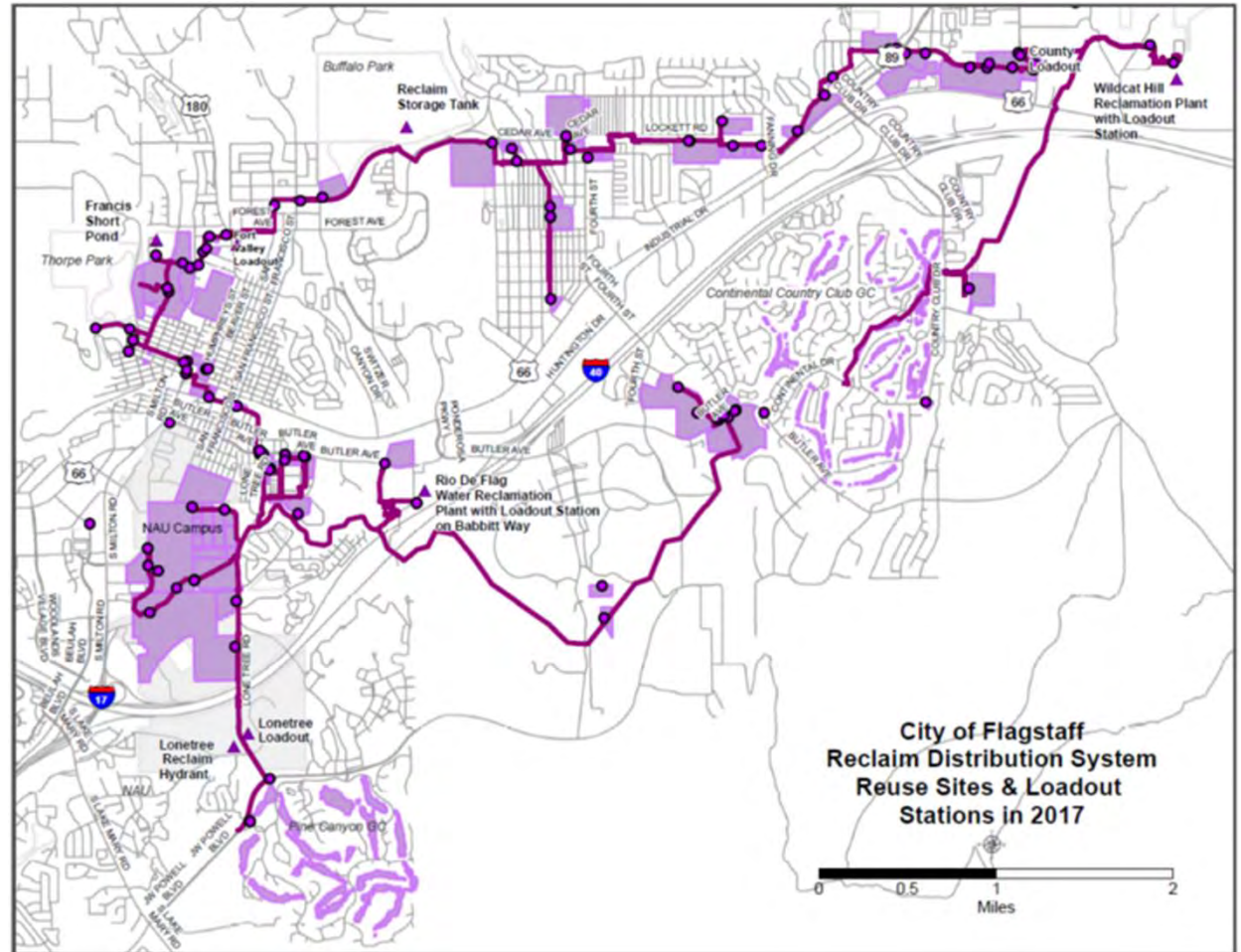
- **Infiltration Trench:** Subsurface facilities designed to provide on-site stormwater retention in areas of good infiltration by collecting and recharging stormwater runoff into the ground, and to filter pollutants to improve water quality and contribute toward groundwater recharge.
- **10-50.60** Promote and improve the quality of the environment by enhancing air quality, reducing the amount and rate of storm water runoff, improving storm water runoff quality, and increasing the capacity for groundwater recharge
- **Table 10-50.60.010.A.: Benefits of Sustainable Landscaping Storm Water Management** Landscape vegetation reduces the amount and rate of storm water runoff, improving storm water runoff quality, and increases the capacity for groundwater recharge.



City Code Promoting Reclaimed Water

City Code

- “The City encourages the use of reclaimed wastewater for irrigation of large projects”
- 25 years developing reclaimed water in code and policy
- City provided upfront cost to build infrastructure in 1990s
- Cheap rates to promote reclaimed water use





Flagstaff Water Policy (2014)



Aquifer Recharge & Recovery Policy C6

In order to ensure groundwater supplies are sustainable and resilient to the impacts from prolonged drought, the City should be involved in the recharge of its unused renewable water supplies. In addition, the City should plan and implement strategies to recover those renewable water supplies that are stored underground to meet its customers contracted-for or long-term water needs.

- Policy C6.1 The Utilities Division should develop a Groundwater Recharge & Recovery program that is in compliance with applicable State laws (Arizona Revised Statutes Title 45, Chapter 3.1, Underground Water Storage and Replenishment). The purpose of this program would be to optimize the management and use of the City's reclaimed water.
- Policy C6.2 The City should continue to develop local water recharge and recovery initiatives. These initiatives should: a. Maximize the storage of the City's unused reclaimed water underground (recharge) by developing, constructing and permitting City-owned Underground Storage Facilities, where appropriate, through the Arizona Department of Water Resources. b. Capture and recover the stored reclaimed water through water supply wells located down-gradient and permitted as Recovery Wells through the Arizona Department of Water Resources.
- Policy C6.3 The City should remain engaged, informed and involved in state-wide and regional discussions regarding groundwater use, recharge and recovery.



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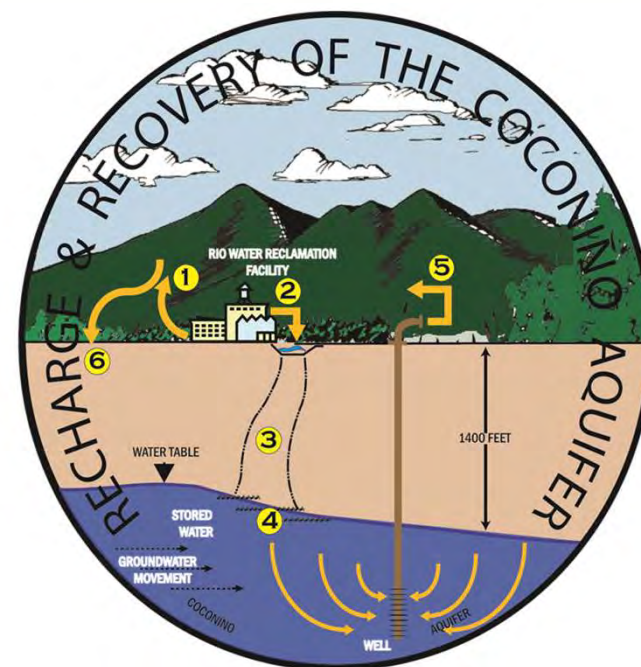
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Technical Reports



- Carollo Alternatives Analysis - 2017
- Brown & Caldwell “Inside the Fence” - 2018
- Carollo Biosolids Master Plan – Nov 2019
- Natural Channel Designs Aquifer Recharge Feasibility Study 2020
- Brown & Caldwell Reclaimed Water Master Plan - 2021

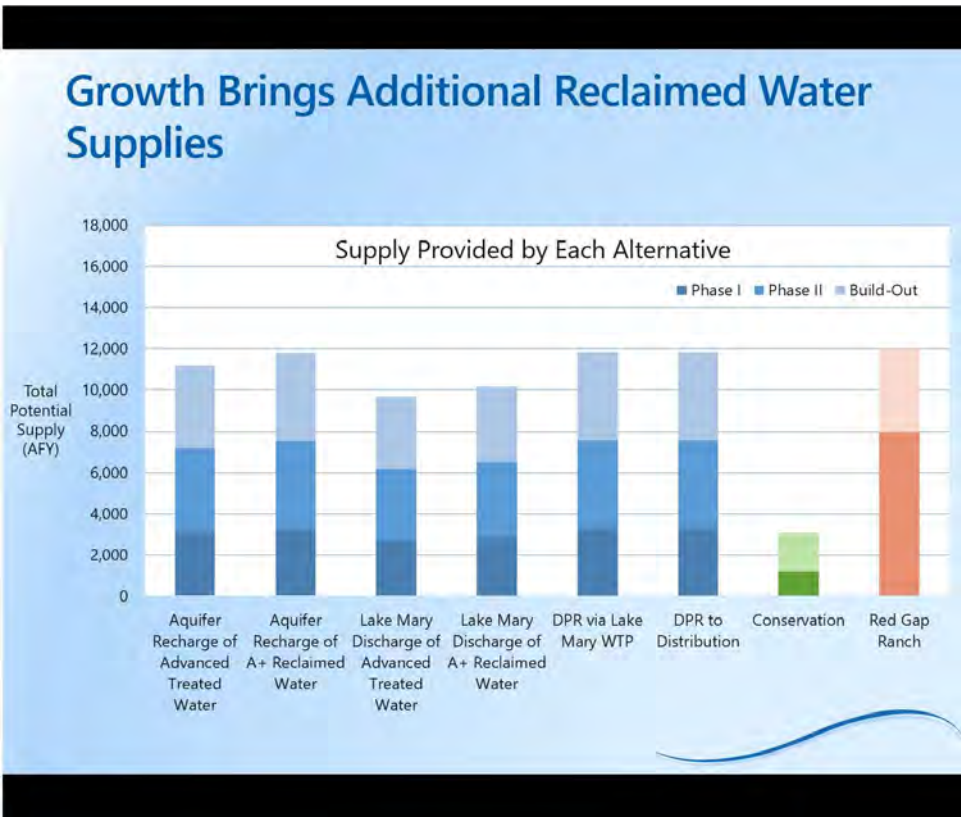
Steps towards Potable Reuse...conceptual study



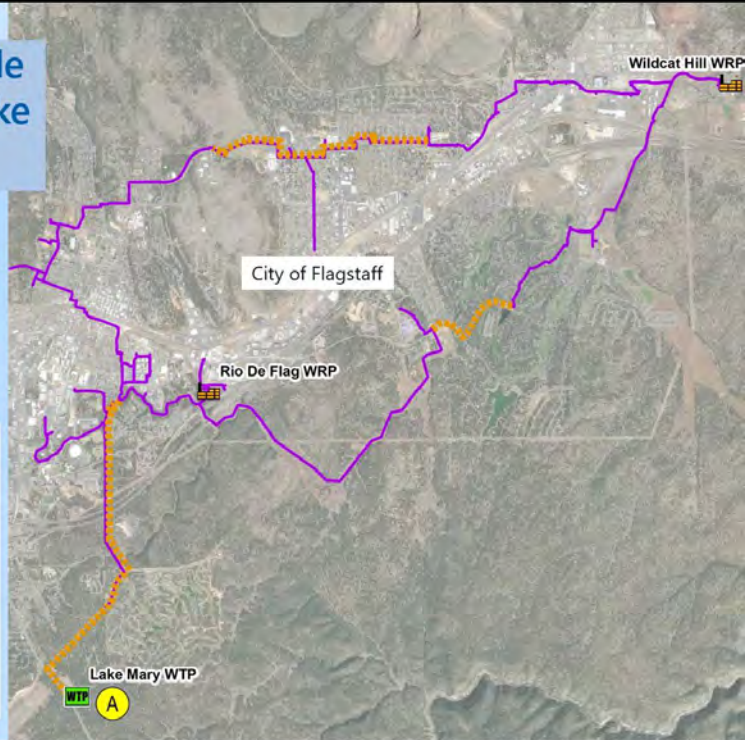
City of Flagstaff
Water Supplies Development

TECHNICAL MEMORANDUM - WATER SUPPLY ALTERNATIVES COSTS

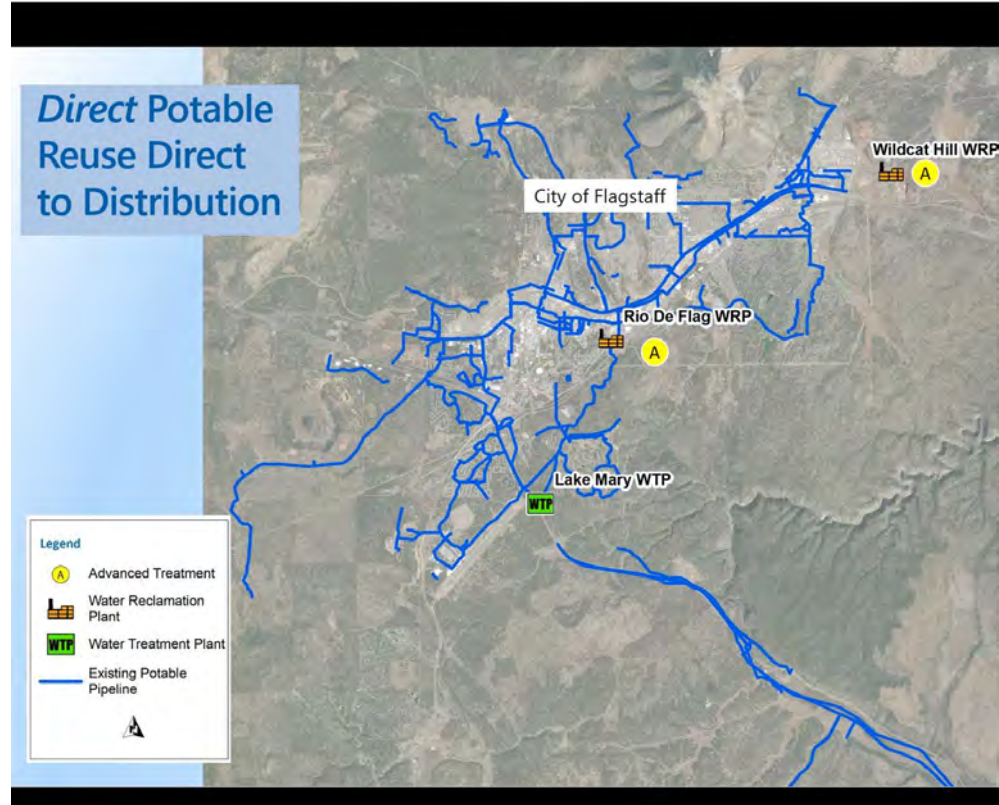
FINAL | October 2017



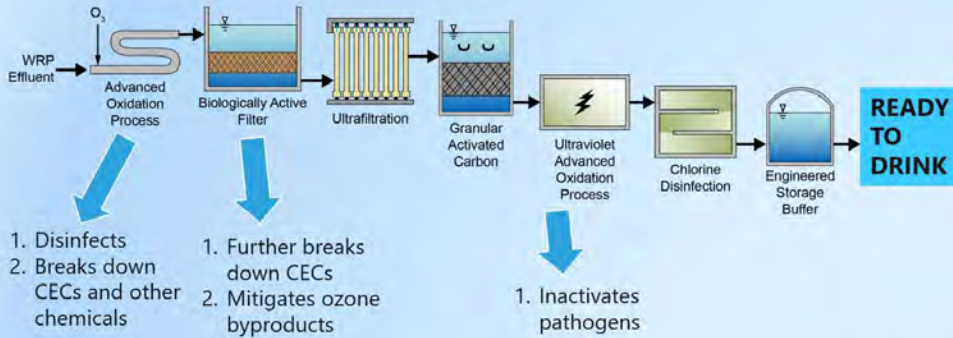
Direct Potable Reuse via Lake Mary WTP



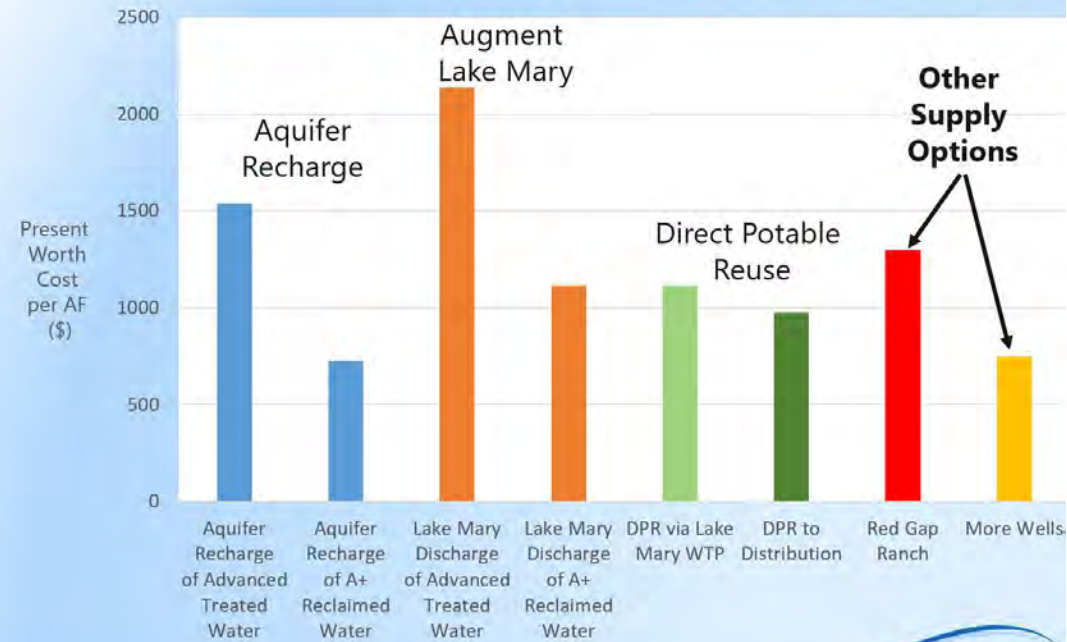
Direct Potable Reuse Direct to Distribution



An Extensive Multi-Barrier Advanced Purification Process Is Proposed for *Direct Potable Reuse*



Potable Reuse Has Similar Cost to Other Options

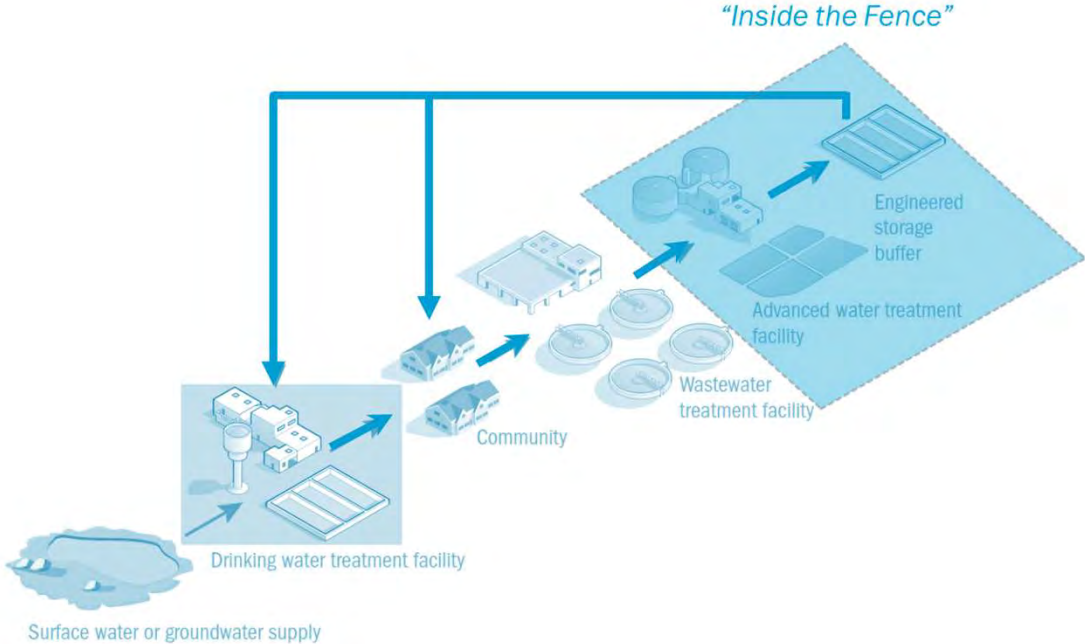


Steps towards Potable Reuse...2018 “inside the fence” study



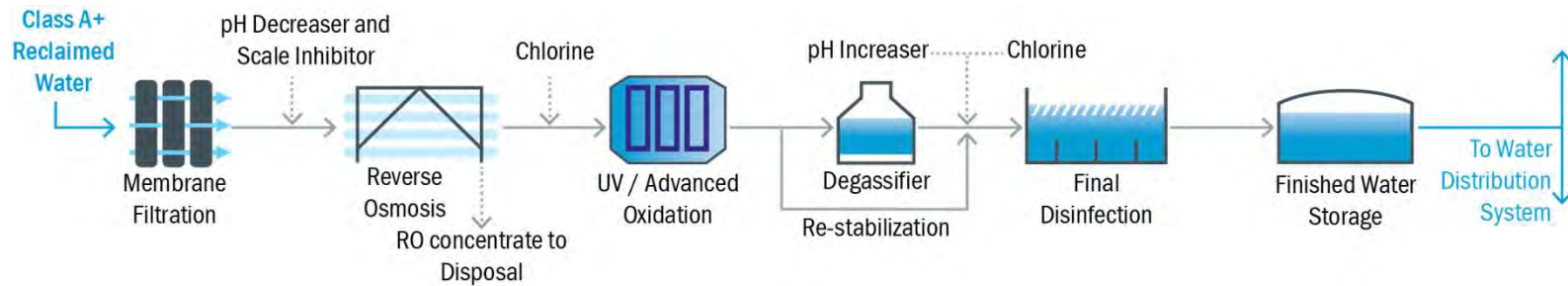
Advanced Water Reclamation Feasibility Study

June 2018

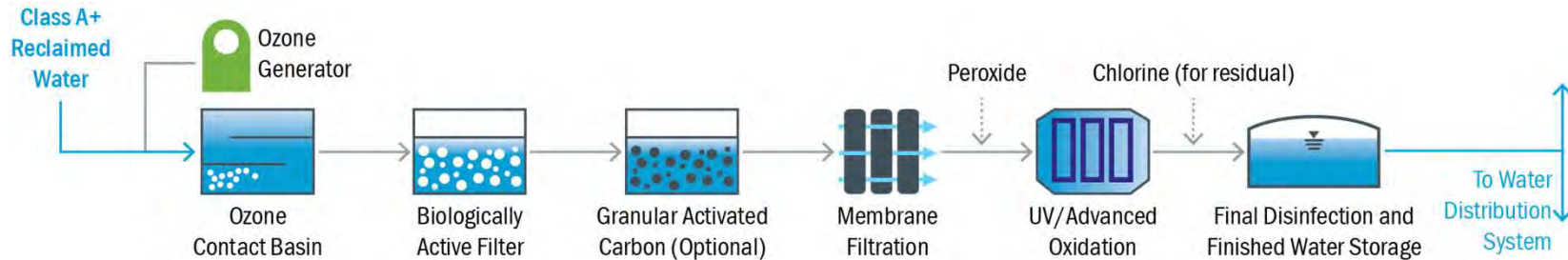


Treatment Options

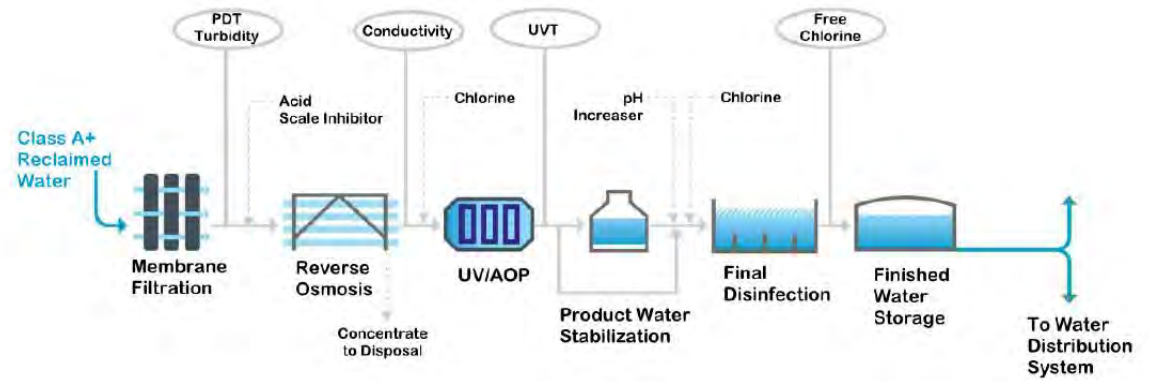
- Using Reverse Osmosis



- Using Ozone-Biological Filter



Alt 1: RO-Based Train



Rio De Flag / Process Treatment Alternative 1 Layout



Figure 2-2. RO-Based Treatment at Rio de Flag

Wildcat Hill / Process Treatment Alternative 1 Layout






Figure 2-3. RO-Based Treatment at Wildcat Hill

RO Brine Disposal

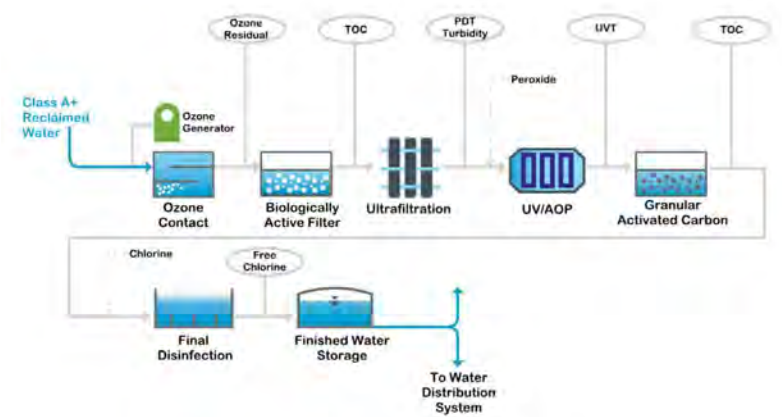


Pond sizes

- For 6 mgd: 15.3 acres 
- For 10 mgd: 25.5 acres 
- For 14 mgd: 35.7 acres 



Alt 2: Ozone BAF-Based Train



Rio De Flag / Process Treatment Alternative 2 Layout



Figure 2-5. O₃/BAF-Based Treatment at Rio de Flag

Wildcat Hill / Process Treatment Alternative 2 Layout



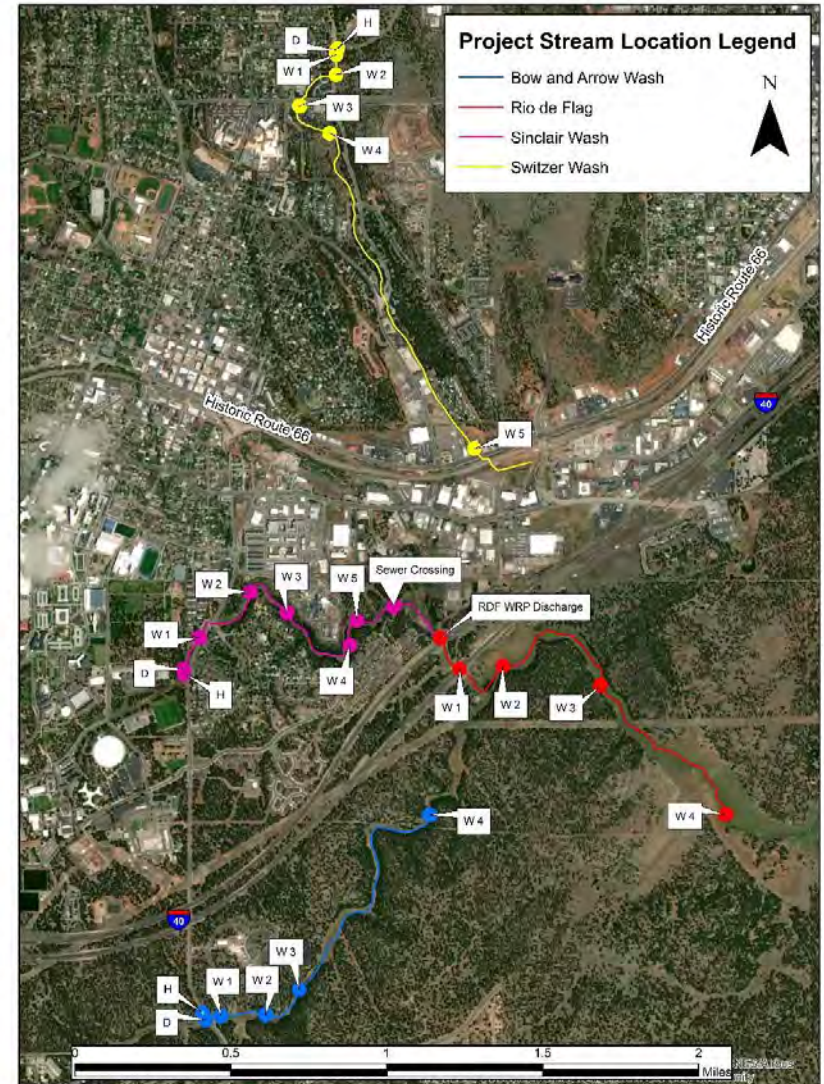
Figure 2-6. O₃/BAF-Based Treatment at Wildcat Hill



Natural Channel Design, Inc.

Completed December 2020

Aquifer Recharge Feasibility Study Infiltration Evaluation





Recharge Feasibility Study

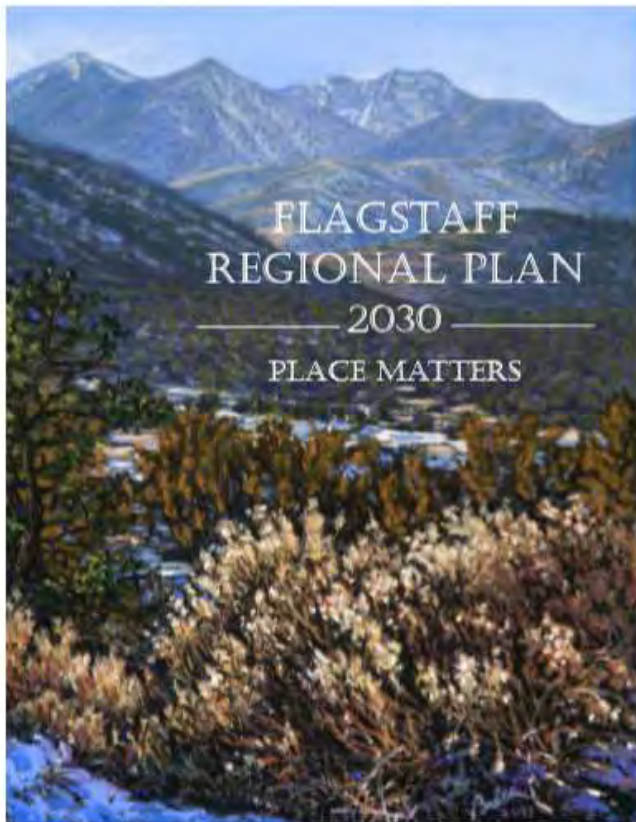


Recharge Feasibility Study – FY19

- **Goal is to cost-effectively recharge 100% of excess reclaimed water to the C aquifer in locations within our groundwater capture zone**
- **Falls under council's goal "To Become a Leader in Water Conservation in All Sectors"**
 - "One Water" paradigm
 - **ADWR Managed Recharge Facility**
 - ADWR Constructed Recharge Facility? (Groundwater Recharge Wells?)
 - Identify additional benefits inside or outside the city



City Plans





Aquifer Recharge Feasibility Study – Infiltration Evaluation



Data Collection

- Conduct steady flow infiltration studies at 500 & 1000 gpm for Bow and Arrow Wash, Sinclair Wash and Switzer Wash
- Conduct year-long fluctuating flow study at Rio de Flag I-40 plant

Goals

- Estimate infiltration rates and permeability properties of the streambeds at the locations tested
- Determine if potential releases will have significant effects on stream bed morphology
- Determine surface flow extent given the range of test flows
- Identify natural or manmade inflection points thresholds or boundaries that control seepage rate or recharge
- Develop stage-discharge rating curve models for the test sites.





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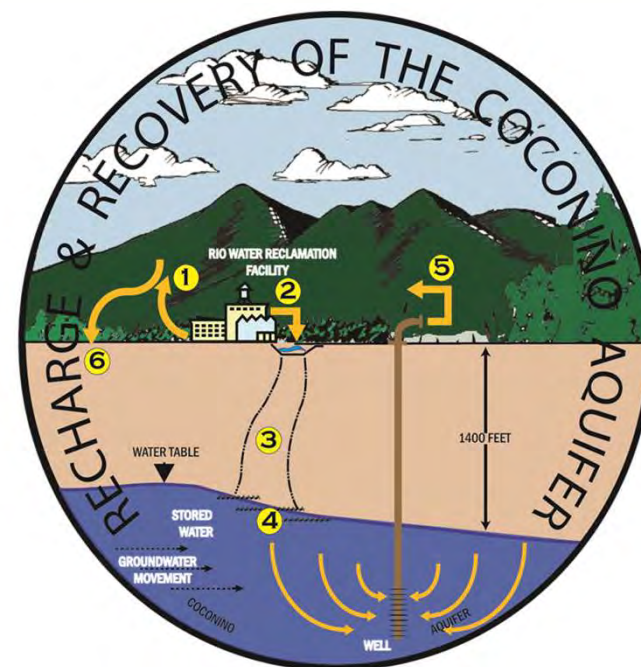
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Drivers for Reuse – Community & Options

Next Steps



Project Drivers

- Recycling water is smart
- Unallocated supply is 50% of City's annual potable demand
- Delay need for Red Gap Ranch
- Public opinion is strong
- Goals:
 - Feedback to narrow down alternatives
 - Understand community values
 - Identify preferred alternative



Aquifer recharge seepage rate test using reclaimed water, March 2020

HELP GUIDE FUTURE MANAGEMENT OF RECLAIMED WATER IN FLAGSTAFF



Brown AND Caldwell



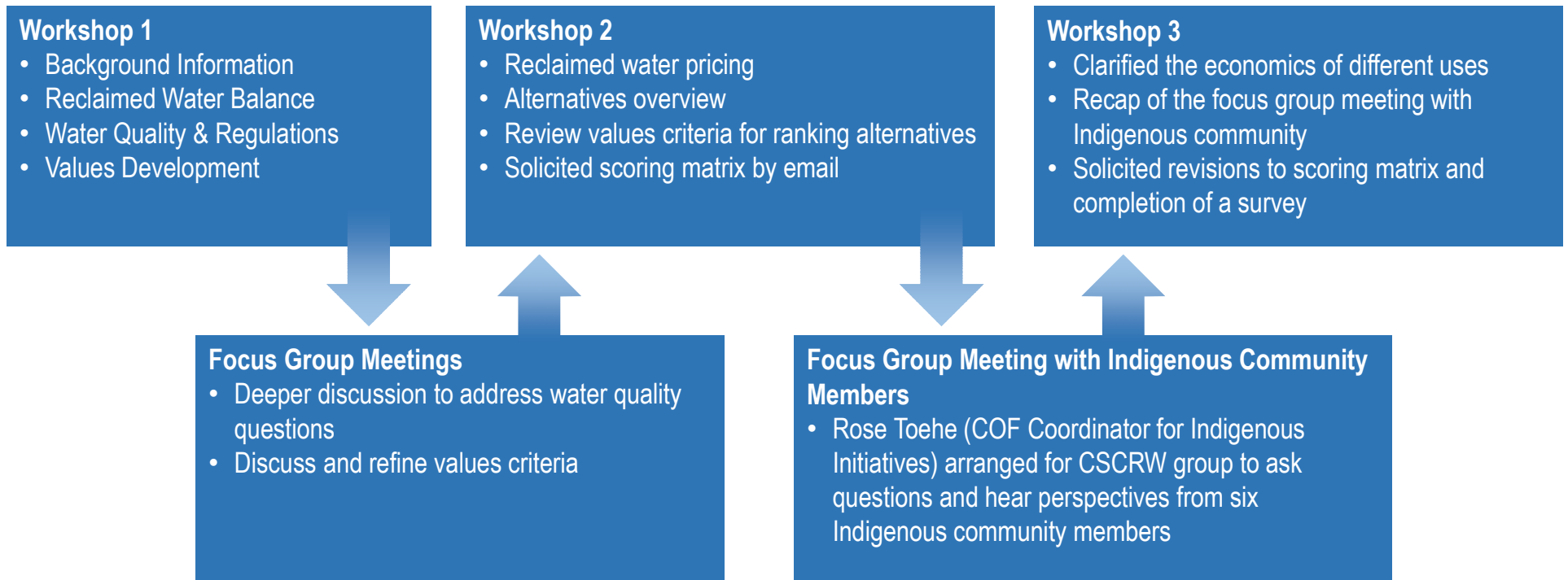
A Community Framework for Future Reclaimed Water Management Strategies in Flagstaff

Katie Vanyo and Erin Young



Stakeholder Process

CSCRW Goal: Feedback on best and highest use of unallocated/uncommitted reclaimed water



The Committee

- General Public
- Stakeholder ask
 - Interest in Making a Difference
 - Opened Minded
- City/BC Goal
 - Diverse Backgrounds
 - Represent community



Background Info: Definitions

Influent

Advanced Treatment

Parts per (million, billion, trillion)

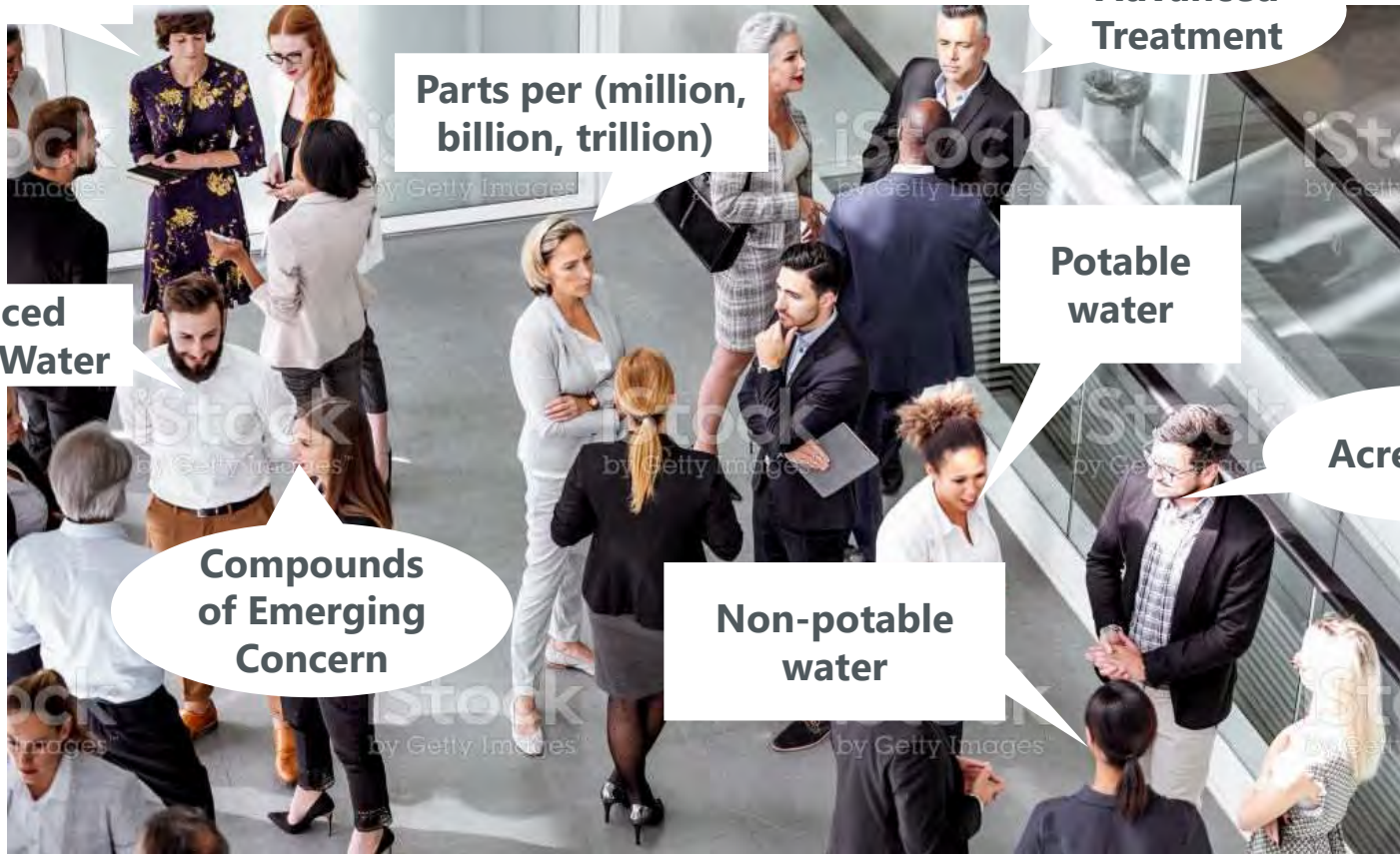
Potable water

Advanced Purified Water

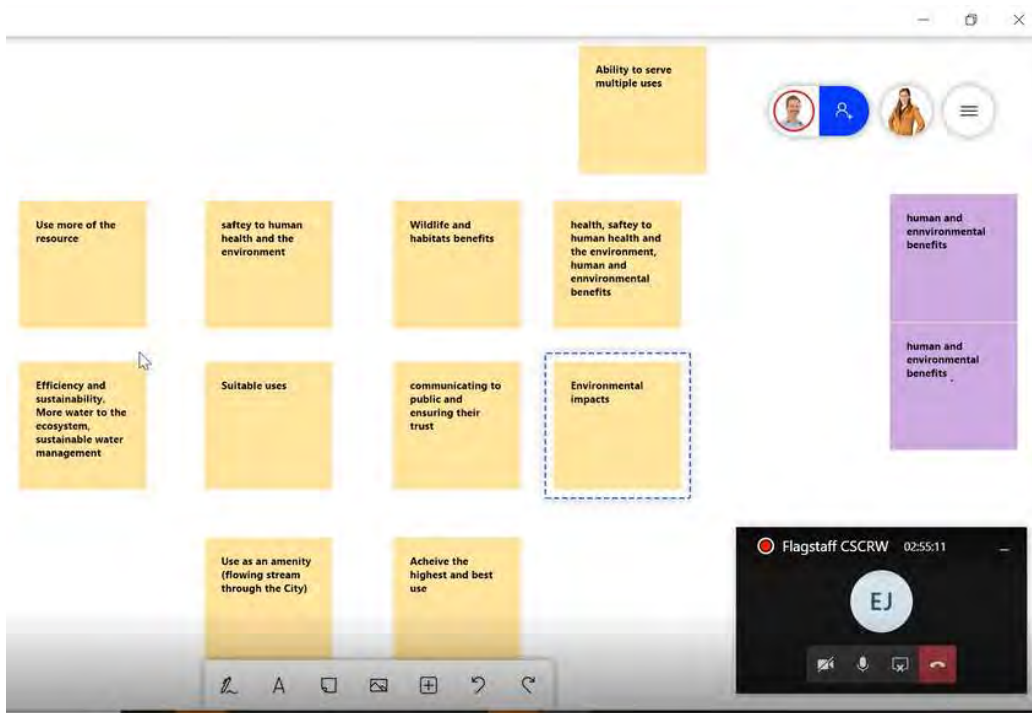
Acre-Foot

Compounds of Emerging Concern

Non-potable water



Values – What's Important?



Health, Quality

Water Sustainability

Energy Efficiency

Aesthetics/Amenity

Respect

Equity



"Stakeholder Committee" On Management Options



- **Best Use of the Water Resource**
 - Water Supply Reliability/Sustainability
 - Environmental Water Uses, Aesthetics
- **Water Quality Concerns**
 - Effluent Discharge to Environment, Public Health, Drinking
- **Investment Trigger/Timing**
 - Water Resource/Reliability Needs - Climate Change, Growth...
 - Effluent/Reclaimed Water Discharge – Problem Acute?
- **Energy Use – Carbon Footprint**
- **Capital and Operating Costs**
 - Who Pays? Rate Impacts

**Reclaimed Water is
an Investment**

Why, When, How?

Evaluation Matrix

- 1 Does not satisfy the criteria
- 2 Somewhat satisfies the criteria
- 3 Mostly satisfies the criteria
- 4 Completely satisfies the criteria

	1	2a	2b	3a	3b	5	6
Criteria	Direct Reuse (Expand Purple Pipe)	Streambed Recharge with Advanced Treatment	Streambed Recharge without Advanced Treatment	Recharge Wells with Advanced Treatment	Recharge Wells without Advanced Treatment	Augmentation of ULM with Advanced Treatment	Direct Potable Reuse
Health, Quality							
Water Sustainability							
Energy Efficiency							
Aesthetics/Amenity							
Respect							
Equity							
Total							

What we found

- More Information!
- Common Goals
- What is most important
- Agreement
- Disagreement



ARE YOU INTERESTED IN MAKING A DIFFERENCE? APPLY FOR THE COMMUNITY
STAKEHOLDER COMMITTEE ON RECLAIMED WATER!
WE NEED YOUR HELP IN DEFINING THE FUTURE OF THIS IMPORTANT WATER RESOURCE



Professionals Dedicated To Arizona's Water



Lessons Learned



Virtual Workshop Format



Words Matter – Values Statement Exercise



Community vs City Staff perspectives



Context for Technical Material



Open Discussion

We need a Phase 2!



Professionals Dedicated To Arizona's Water





Big Picture Issues and Information Needs



Cultural Perspectives, Public Perceptions Impact All Options

The Big Picture

- **No Acute Water Resource Need**
 - 100 Year Supply Designation, Growth, G/W Margins
- **Environmental Concerns, Aesthetics**
 - Emerging, Unregulated Contaminants Discharge
 - Aesthetics Lake Mary, Walnut Canyon
- **Upper Lake Mary – Uncertainty**
 - Climate Change Impacts on Yields, G/W Pumping
 - Quality Issues, Operational Viability?
- **Local Groundwater – Long-Term Sustainability**
 - Adequate Rights, 100 Year Supply Designation Limit
 - Very Good Quality, Pumping Costs
- **Direct Potable Reuse**
 - Simplicity, Resource/Supply Benefits, Water Quality?
- **Purple Pipe System – Expansion?**
 - Water Fully Allocated in Summer? Equity Issues
 - Not Equivalent “Alternative,” Demand?

Improving Information

- **Water Budgets – 100 Year Supply Designation**
- **Lake Mary Details, Augmentation?**
 - Climate Change, Yields, Water Quality, Evaporation
- **Aquifer Recharge Details**
 - Recharge Effectiveness, Permitting/ADWR Credits
 - Recharge Water Quality, Soil Aquifer Treatment
- **Effluent Water Quality Data/Characteristics**
- **Water Quality Treatment Options**
 - Tailoring Quality to the Specific Application
- **Water Quality Risks/Concerns**
 - Specific/Unregulated Contaminants - Relative Risks
 - Standards Related to Specific Contaminants
- **Costs and Energy Use – For Most Attractive Options**
 - Capital, Treatment Energy, and Pumping Energy

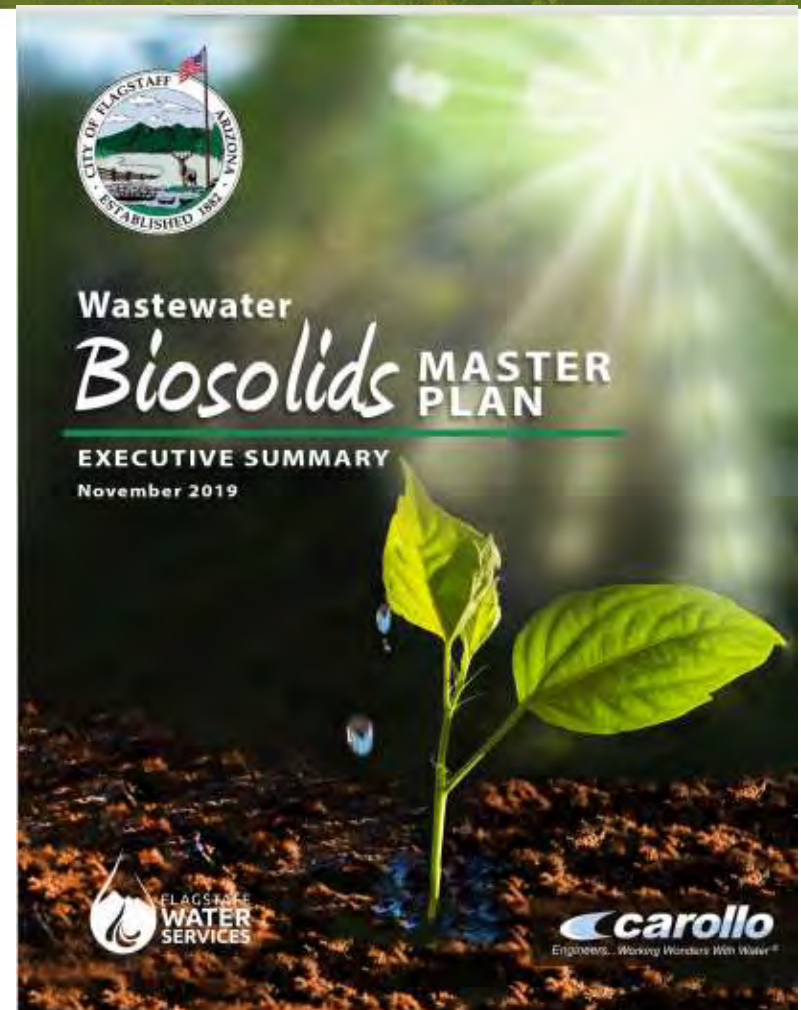


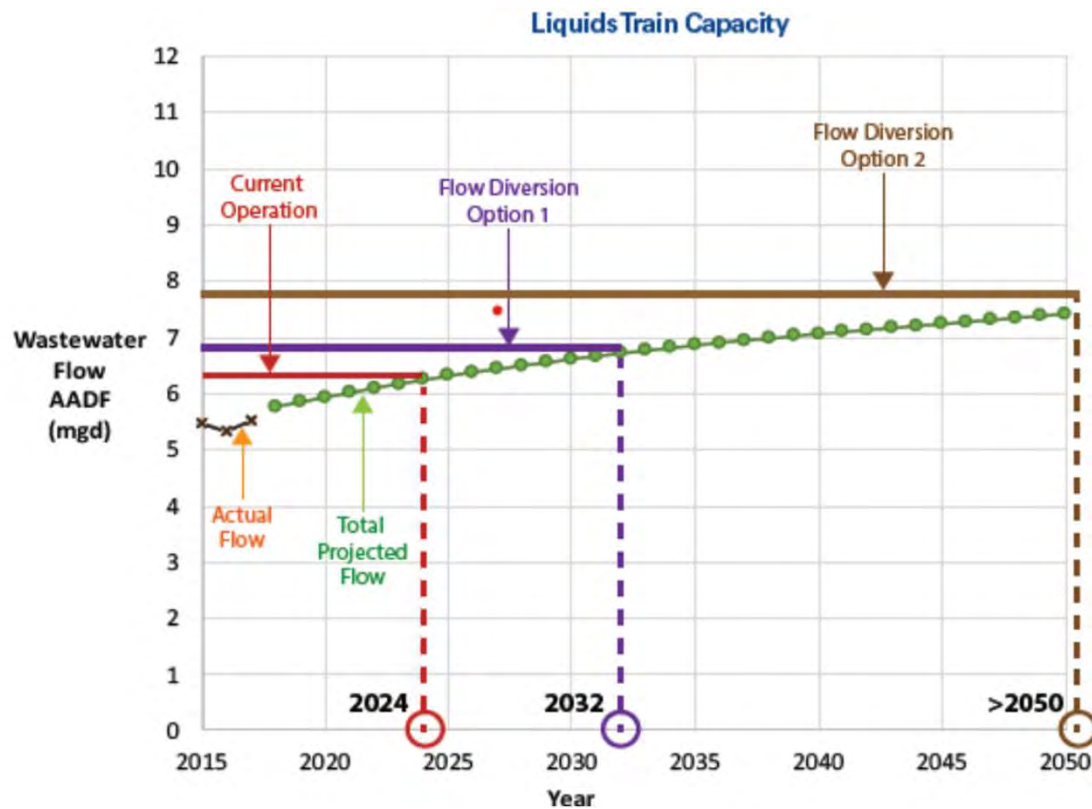
Biosolids Master Plan Nov. 2017



Roadmap & Framework for Biosolids Management

- Nearing operational capacity limits on biosolids treatment/handling
- Unexpectedly alerted us on liquid treatment capacity





need to validate wastewater flows and growth rates (1.7%) within this chart to ensure the predicted timing of when liquid train capacity is reached is still accurate



FUNDING SUMMARY:

- a. Approximately **\$30M(?)** is needed independent of what the City elects to do about the replacement of Wildcat Hill WRP.
 - i. Flow Option 1 Rio WRP bar screen R&R (**~\$750K**)
 - ii. Flow Option 2 (sludge thickening and Vault & Haul): **~\$4M** (mid-point)
 - iii. R&R of key treatment processes at Wildcat WRP: **~\$10M**
 - iv. Underfunded Existing Projects (Digesters, etc): **~\$15M** (mid-point)
 - v. Addition of a second IFAS treatment system or “b” below: **\$?M**

- b. A minimum of **\$50M** is needed to expand Wildcat Hill WRP in 2.5 MGD increments or upwards of **\$100M** should the City decide to expand to 5 MGD which would provide the greatest level of redundancy and is staff’s recommendation at this point.

- c. Or complete replacement of replacement of Wildcat WRP at **\$280M**



Next Steps



- Data collection to inform alternatives analysis
- Retreat with City Council
- Wastewater biosolids master plan



Thank you!



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WE MAKE THE
CITY BETTER



Cara, Ed, Pete, City of Flagstaff , Water Services



Allen Haden, Natural Channel Design
Allen Haden, Natural Channel Design



A.R.S. § 45-801.01 Declaration of policy



- *The public policy of this state and the general purposes of this chapter are to:*
- ***1. Protect the general economy and welfare of this state by encouraging the use of renewable water supplies, particularly this state's entitlement to the Colorado river water, instead of groundwater through a flexible and effective regulatory program for the underground storage, savings and replenishment of water.***
- ***2. Allow for the efficient and cost-effective management of water supplies by allowing the use of storage facilities for filtration and distribution of surface water instead of constructing surface water treatment plants and pipeline distribution.***



Flagstaff Water Policy

Aquifer Recharge

- C6. Recharge & Recovery:
- c. Public Benefit. The Direct or Indirect Reuse of reclaimed water should be encouraged as a significant water management tool to sustain or promote economic vitality, augment the City's water supply (e.g., Groundwater Recharge and Recovery), and support contracted for deliveries for riparian habitat, wetlands or ponds.



Flagstaff Water Policy

Water Policies Continued

- **Groundwater Recharge:** In accordance with Arizona Revised Statutes, groundwater recharge is conducted utilizing either a Constructed (§45-802.01.4) or a Managed (§45-802.01.12) Underground Storage Facility (USF) that has the intent to store water underground.

In general, a Constructed USF is an engineered and designed recharge facility while a Managed USF simply utilizes the natural channel of a stream (e.g., Rio de Flag) to recharge the groundwater aquifer.

Indirect Reuse: In accordance with industry standards, and for the purposes of this policy, Indirect Reuse means the use of reclaimed water that has been previously recharged and stored underground; that has been co-mingled or mixed with the natural groundwater system; then withdrawn or recovered via water supply wells. This co-mingled mix of water meets all Safe Drinking Water Act requirements.



Flagstaff Water Policy



Water Policies Continued

- **Recovery:** In accordance with Arizona Revised Statutes, recovery of stored water is the withdrawal of a water supply (e.g., reclaimed water) that has been previously recharged underground pursuant to applicable state law (§45-831.01 - §45-836.01).



Stormwater?



- Policy WR.5.7. Support healthy watershed characteristics through implementation of practices, consistent with the City of Flagstaff Low Impact Design Manual, that improve flood control and flood attenuation, stormwater quality, and water sustainability; increase groundwater recharge; enhance open space quality; increase biodiversity; and reduce land disturbance and soil compaction.