

A Wide Range of Potential Reuse Applications

King County (Seattle, WA) is studying whether to implement a reuse program involving dispersed satellite plants that may operate on a seasonal basis. Potential end uses include urban and agricultural irrigation, and less common applications including wetlands creation, and direct or indirect streamflow augmentation to increase environmental protection for fisheries recently listed under the Endangered Species Act. As shown in **Table 1**, the reuse applications have different water quality requirements, ranging from Washington's Class A reuse standards to high levels of nutrient and TOC removal.

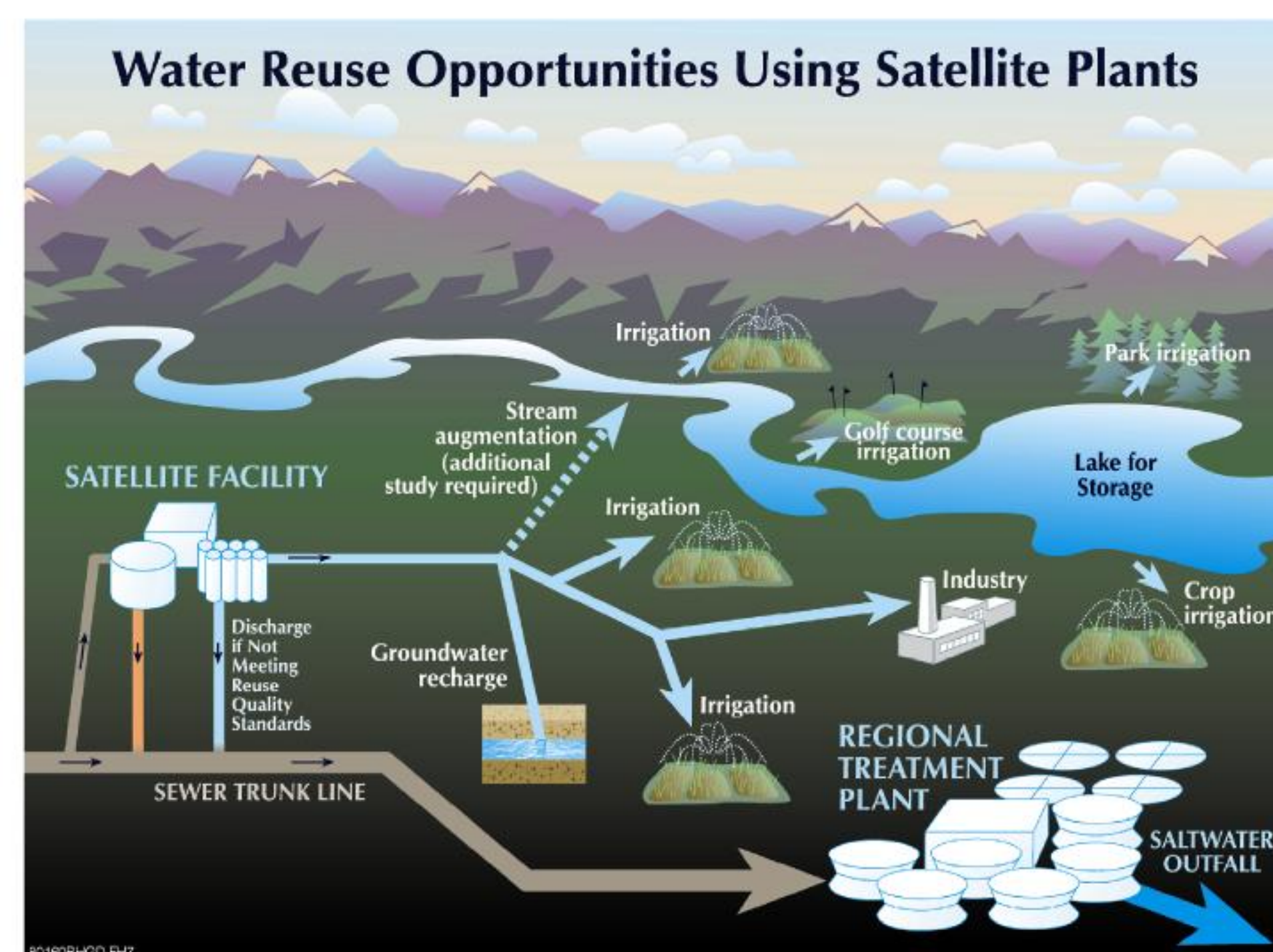


Table 1

Anticipated Water Quality Requirements for Potential Reuse Applications (Monthly Average)

Effluent Quality Parameter	Class A Reclaimed Water Uses		Groundwater Recharge		Streamflow Augmentation		Lake Discharge	
	Wetlands	Surface Percolation	Direct Recharge-Potable	Ultimate Discharge-Marine	Ultimate Discharge-Lake	Anticipated Limits	Worst Case Limits - Match Background	
BOD ₅ , mg/L	30	20	30	5	10	10	10	
TSS, mg/L	30	20	30	5	10	10	10	
Total P, mg/L	-	1	-	1-2	0.1	0.01	0.01	
Ammonia-N, mg/L	-	<2	-	<2	<2	<2	0.02	
Total N, mg/L	-	3	10	10	-	-	0.6	
Turbidity, NTU	2	2	2	0.1	2	2	2	
TOC, mg/L	-	-	-	1	-	-	2	
TDS, mg/L	-	-	-	Site Specific	-	-	500	
Total Coliform, #/100 ml'	2.2	2.2	2.2	1	2.2	2.2	2.2	
Metals, Inorganic and Organic Toxics	-	Surface Water Standards	Site Specific	Drinking Water Standards or Background	Surface Water Standards	Surface Water Standards	Surface Water Standards	

1- Weekly Median

Future Potential Use

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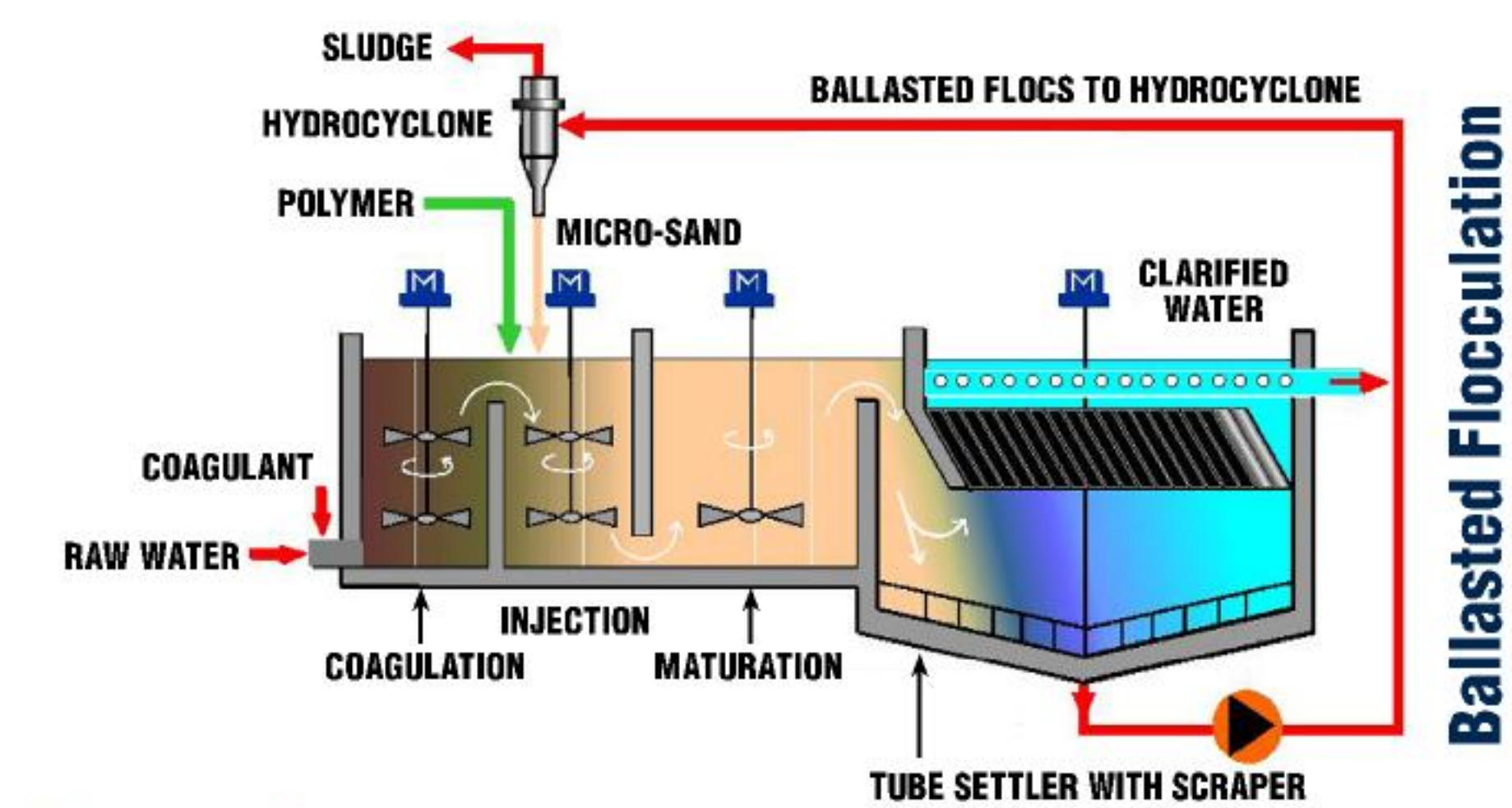
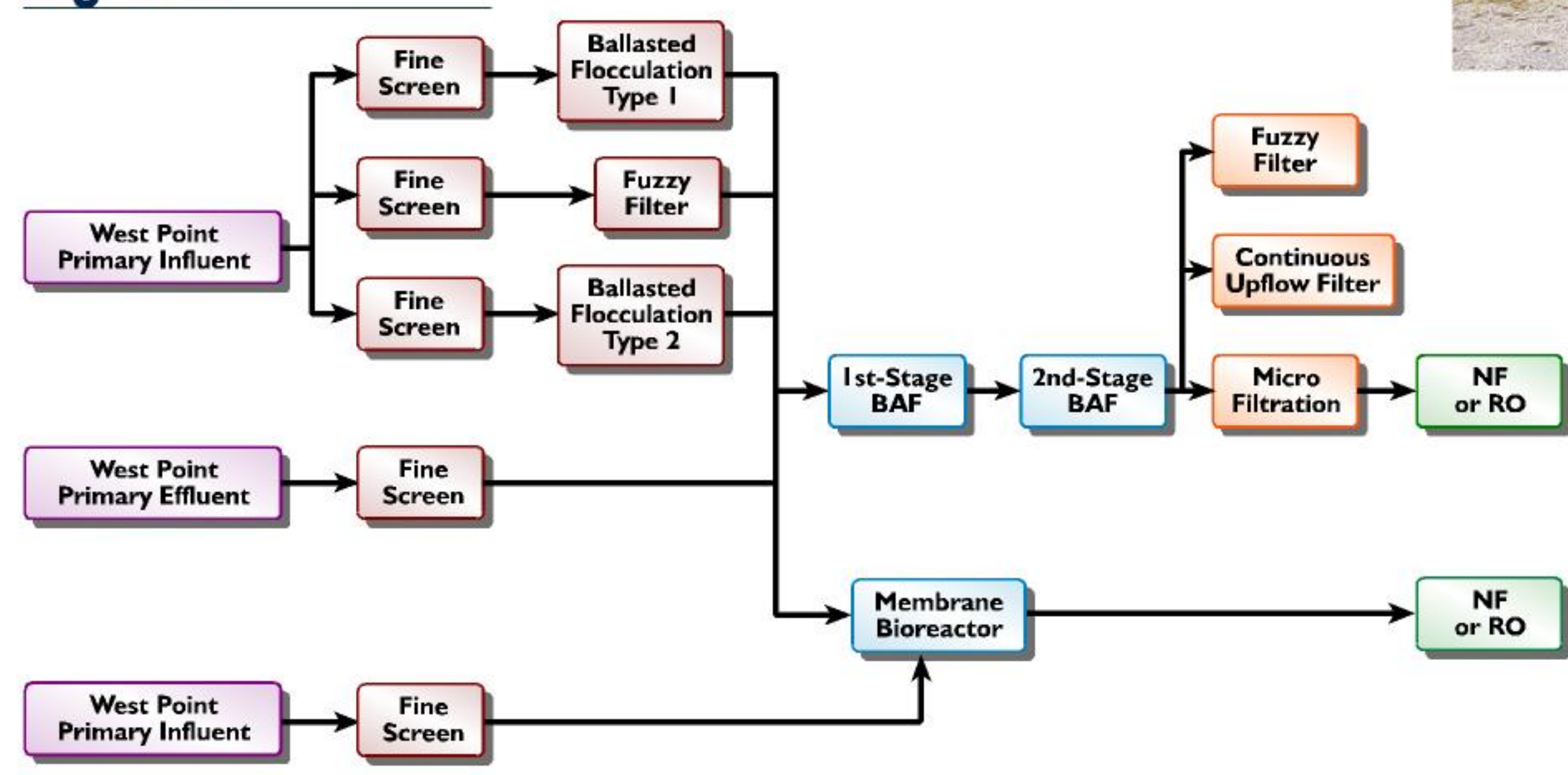


Figure 1



Wastewater Source Options

Primary Treatment Options

Biological Treatment Options

Tertiary Treatment Options

Advanced Treatment Options



Biological Aerated Filter



Membrane Bioreactor



Fuzzy Filter



Nanofiltration - Reverse Osmosis

Design and Operational Concerns

- The reuse plants may be located in sensitive urban developments; requiring compact footprints, attractive appearance, low odors and minimal operational impact on surrounding neighbors.
- Given the remote location of the plants, the County needs facilities that are simple to operate and control, and can be run unattended.
- Meeting seasonal reuse demands requires facilities that can start up quickly and accommodate intermittent operation.
- Affordability of the treatment processes will be a key determinant of the feasibility of the program.

Program Objectives

- Develop performance and operational information on combinations of emerging and established unit processes that can produce Class A effluent quality.
- Upgrade "Baseline Class A Treatment Trains" to provide higher effluent quality through process modifications or additional treatment steps.
- Familiarize King County staff with the performance, and operational and maintenance characteristics of the processes.
- Demonstrate plant performance to regulators, water purveyors and other stakeholders.

Performance Metrics

Treatment Performance	Operational Characteristics
Pollutant removal efficiency	Chemical and energy consumption
Resiliency to changing influent conditions, including stressed conditions	Operating cost
Treatment reliability and consistency	Potential for fouling or short operating runs
Water production efficiency	Ease and speed of seasonal start-up
Acceptable unit loading rates	Operational and maintenance ease
Flexibility to be upgraded to higher levels of treatment	Potential for unattended operations of treatment
	Odor Control

Candidate Processes

The unit processes to be included in the pilot test are shown in **Figure 1**. This arrangement will allow testing of multiple process configurations to achieve the various water quality objectives. It also will allow unit processes to be tested under a variety of influent water quality conditions. The capacity range from 350 gpm (ballasted flocculation), to 10 gpm (reverse osmosis).

Test Schedule

Beginning in April 2001, testing will be performed over a nine-month period with the following areas of focus.

Month 1	<ul style="list-style-type: none"> Start-up/Shake-down of biological processes
Month 2 & 3	<ul style="list-style-type: none"> Test Fuzzy Filter in primary treatment application Test biological processes using West Point primary effluent
Months 4 & 5	<ul style="list-style-type: none"> Test Ballasted Flocculation Type 1 Conduct demonstration tests for Class A reclaimed water
Months 6, 7 & 8	<ul style="list-style-type: none"> Test Ballasted Flocculation Type 2 Test combined systems for nutrient removal Test advanced systems for organics and salt removal
Month 9	<ul style="list-style-type: none"> Examine further nutrient removal options Reexamine earlier components of the testing program

Conclusion

Water reuse will play an increasingly important role in the Pacific Northwest, with wide-ranging applications having different water quality objectives. Newer technologies that are compact, high-rate, and easy to automate offer potential advantages for these uses. This study will assess the performance capabilities and operational characteristics of candidate systems. This information will be combined with other factors such as capital cost, facility footprint, residuals generation, and aesthetic considerations to aid the County in the selection of the preferred technologies for implementation.