King County

Brightwater

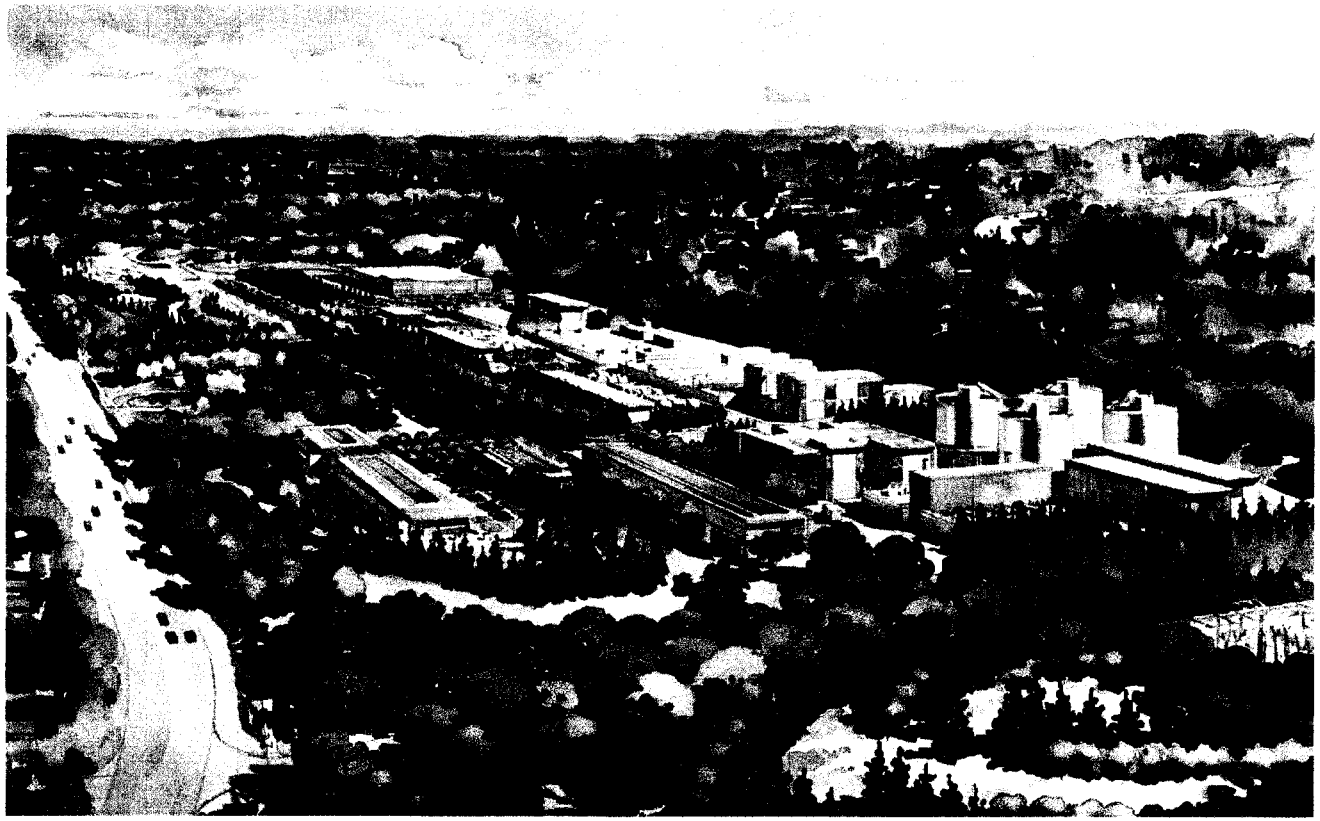
TREATMENT SYSTEM

Wet Weather Flows, Membrane Bioreactors, and Blending – Protecting and Improving Water Quality

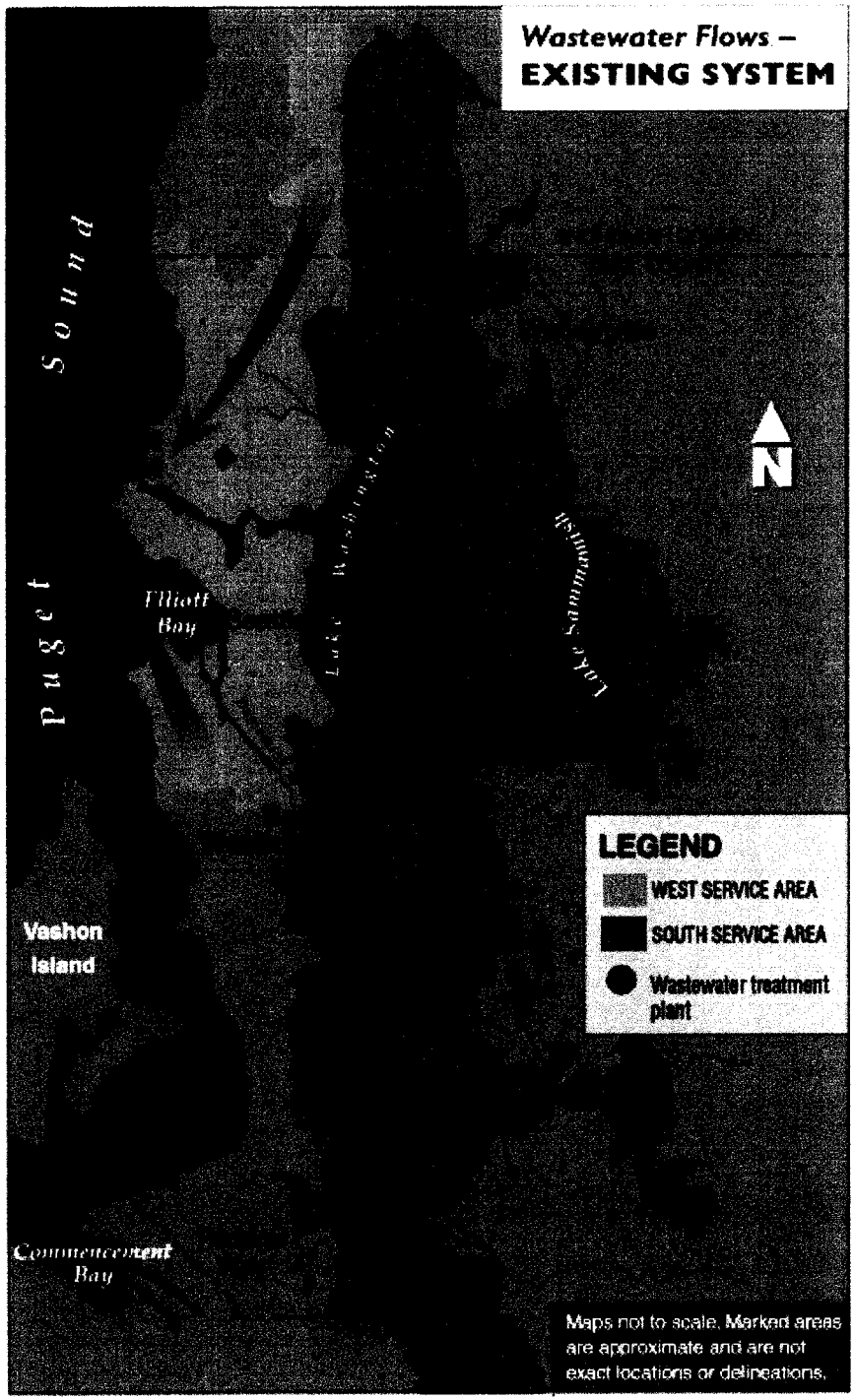
NACWA Summer Conference
Hilton Head, S.C.
July 20, 2005

Overview

Brightwater: a case study for blending



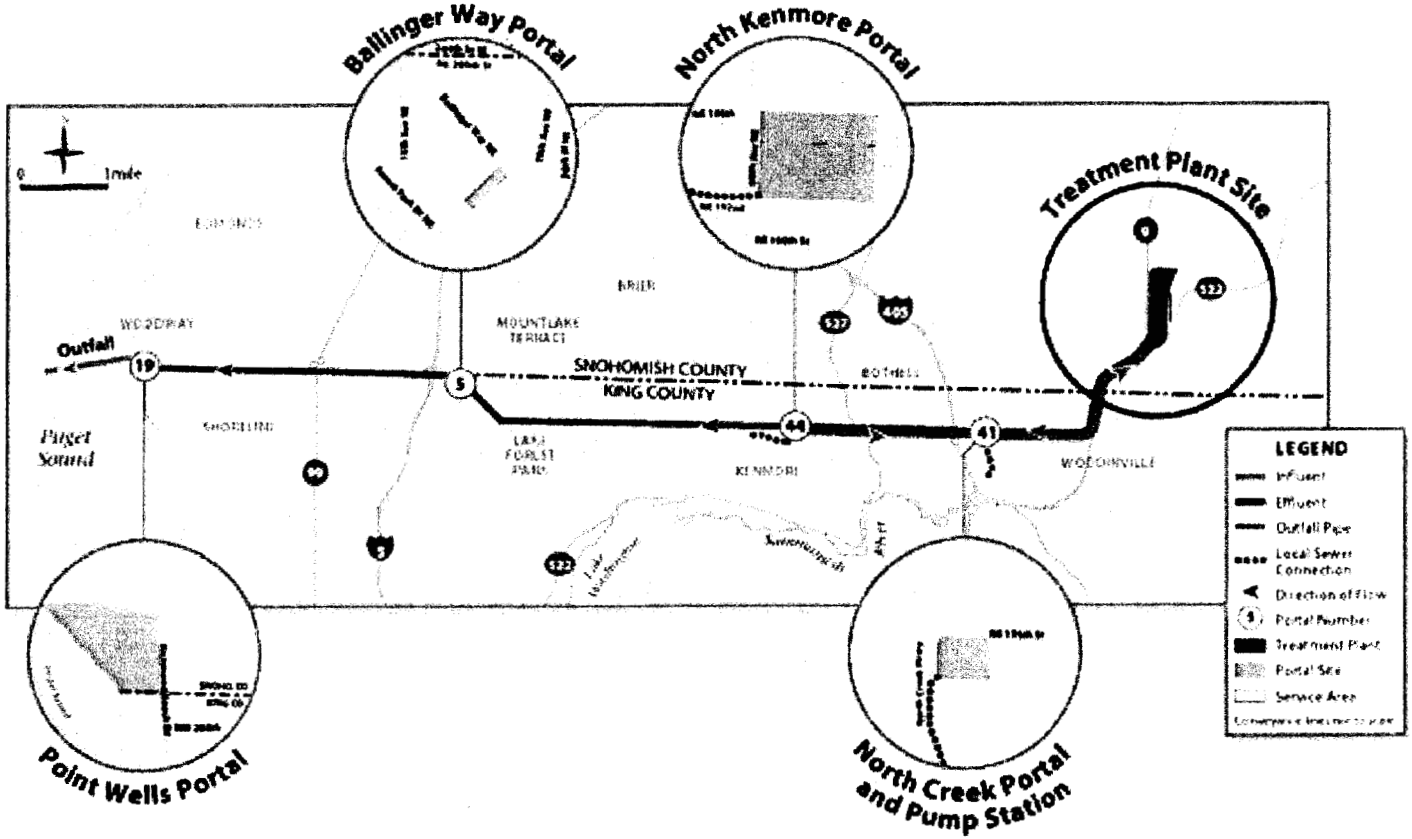
Artist's rendering of the Brightwater Treatment Plant, scheduled for completion in 2010



Existing System

420 square mile service area
2 regional treatment plants
2 wet weather treatment plants
Small treatment plant in Vashon
330 miles of conveyance pipe
42 pump stations
19 regulator stations
200 mgd of sewage treated
72 dry tons/day of biosolids
Operating budget: $80 Million
Capital budget: $160 Million

Brightwater Treatment System



2010 - 36 mgd plant (AWWF) peaks at 140 mgd

2040 - 54mgd plant (AWWF) peaks at 170 mgd

13 mile conveyance pipeline, 40-450 feet deep

5200 ft. outfall, 600 feet deep

System cost is $1.48 billion (in 2004 $)

King County has both combined and separated systems

- West Point takes large volumes from combined areas
- Blending recognized as viable method for addressing CSOs; permit allows blending above 300 mgd with peak capacity at 440 mgd
- South plant (separated areas) permit authorizes blending, though events are rare
- Brightwater will serve an entirely separated system

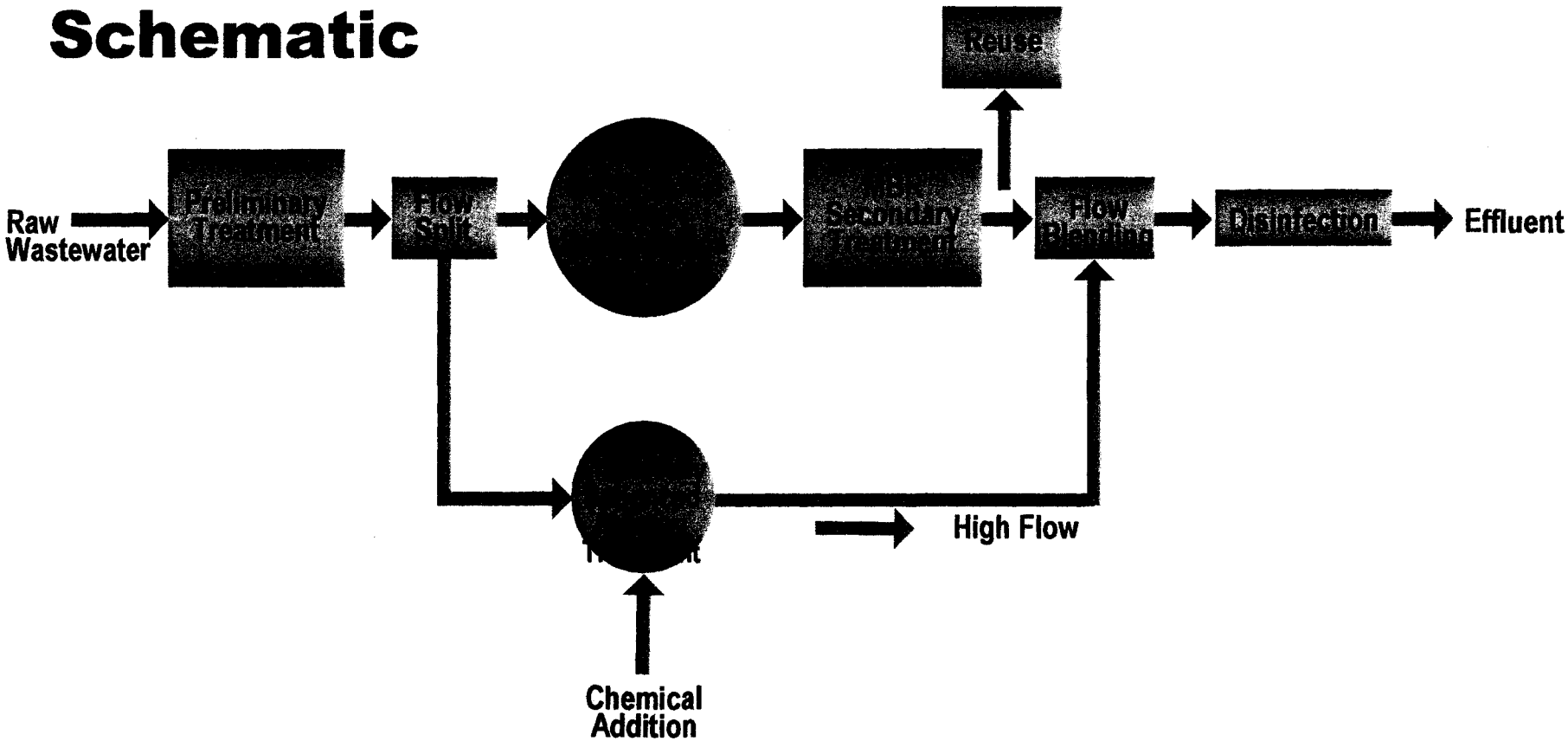
Decision process for Brightwater

- Extensive technical and environmental review
- Application of criteria that met technical requirements and community values
- Innovative design to meet regulatory challenges and be cost-effective
- Involvement of regulators, jurisdictions, and tribal governments
- Presented to decision makers and public

Treatment plant uses Membrane Bioreactor, or MBR

- Split flow treatment for peak flows
- Configured to cost-effectively exceed secondary treatment requirements
- Produces reclaimed water (Class A) without additional filtration for base flows
- Less pollution (BOD, TSS, metals, organics, pathogens)

Liquid Process Flow Schematic



Average flows treated at Brightwater - 2010-2030

- **Daily - 31.3 mgd**
- **Annually - 11.5 billion gallons**
- **Annual portion expected to be blended - 200 to 400 million gallons**

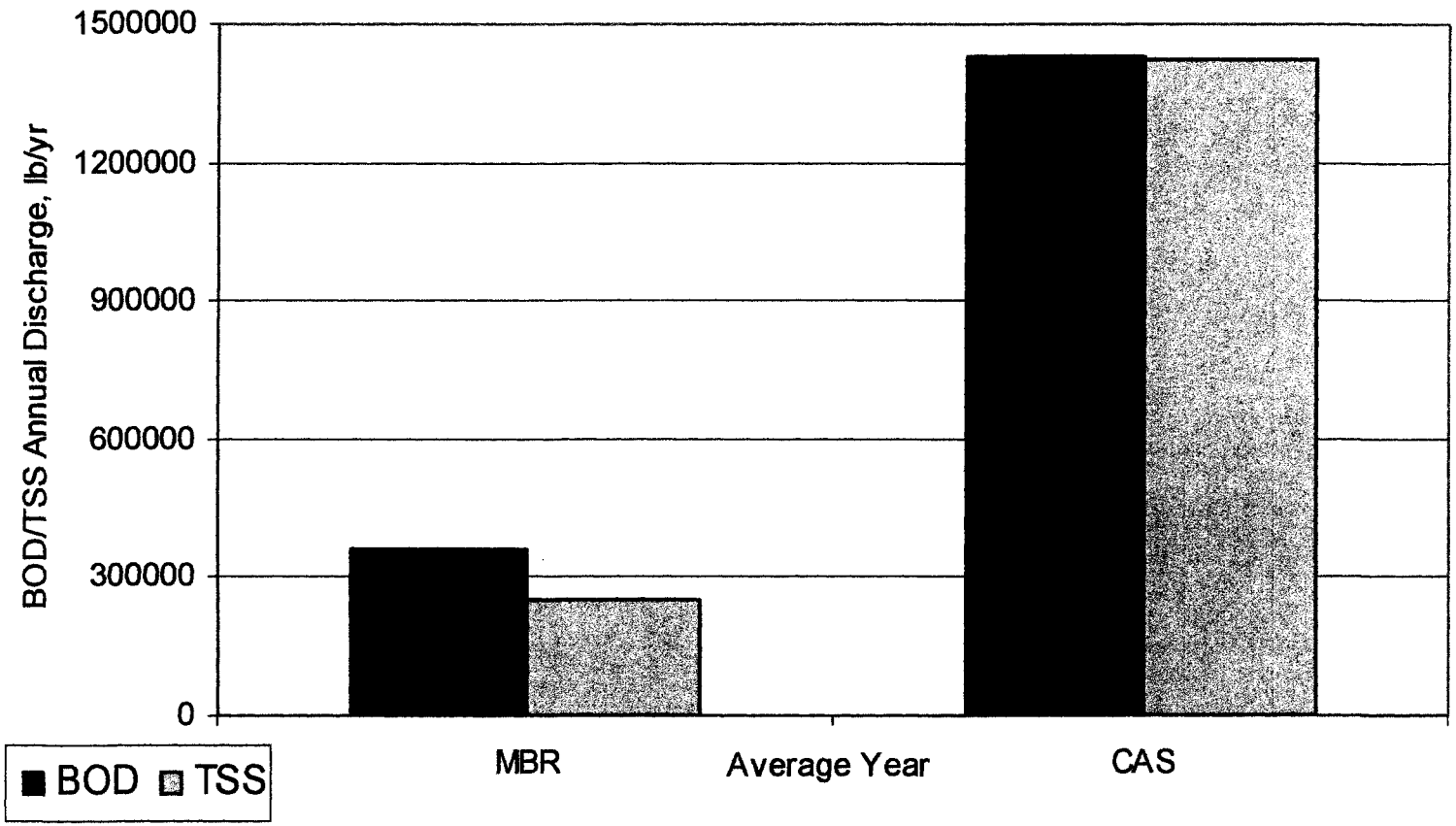
MBR Benefits

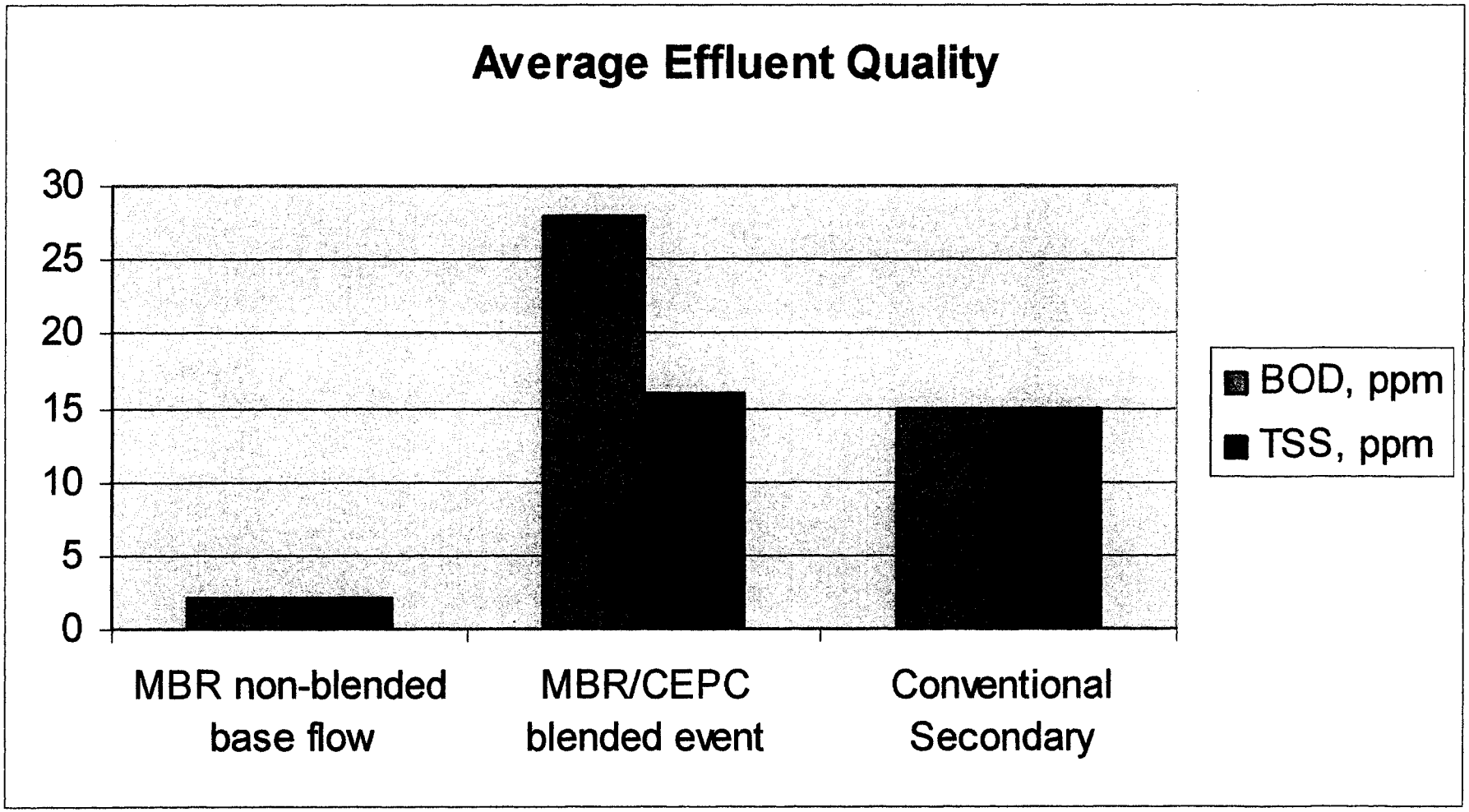
- Smaller footprint
- Fewer odors
- Produces a fully nitrified effluent - reduces oxygen demand on Puget Sound
- Reduce chemicals for disinfection
- Substantially improved effluent quality
- Reclaimed water produced for nearly same cost as conventional secondary treatment

MBR Design

- Will provide full MBR treatment for all but 2% of flow at 38 mgd (average wet weather flow) MBR design capacity
- Blending of flows is expected to occur 35 times in an average year at MBR design capacity

Comparison of the Annual Discharge of BOD and TSS for Conventional Activated Sludge and MBR Split Stream Treatment Alternatives for Brightwater Treatment Plant at 38 MGD




Average Effluent Quality
30
25
20
15
10
5
0
MBR non-blended base flow
MBR/CEPC blended event
Conventional Secondary
BOD, ppm
TSS, ppm

Membrane bioreactor

MBR Costs

	MBR	Conventional	MBR – no blending
Capital:	$400M	$402M	$1 billion
Annual O&M:	$ 9.9M	$ 8.8M	$20M

40 million
+10
50 million

100 million
20
120

300 million

Other Effluent Quality Parameters

Parameter	MBR	CAS
Ammonia-N	**< 1mg/L**	**10 mg/L (non-nitrifying)**
Turbidity	**< 0.5 NTU**	**10 to 15 NTU***

**Greater variability in effluent turbidity due to storms, biology, etc.*

Also, greater removal rates for metals and organics that are associated with particulates (no readily available data)

Conclusions

- Blending with MBRs improves overall environmental protection
- Met regional goals by adding value without significant added costs
- Positioned the treatment plant process to meet future regulatory requirements
- Can provide reclaimed water at lower cost
- State and Region 10 have been supportive of the concept
- Treatment Plant Facilities Plan approved by state Department of Ecology in June 2005; discharge permit requirements (NPDES) still being negotiated

Questions

Don Theiler, Division Director

King County Department of Natural Resources and Parks, Wastewater Treatment Division

don.theiler@metrokc.gov