

This presentation premiered at WaterSmart Innovations

watersmartinnovations.com



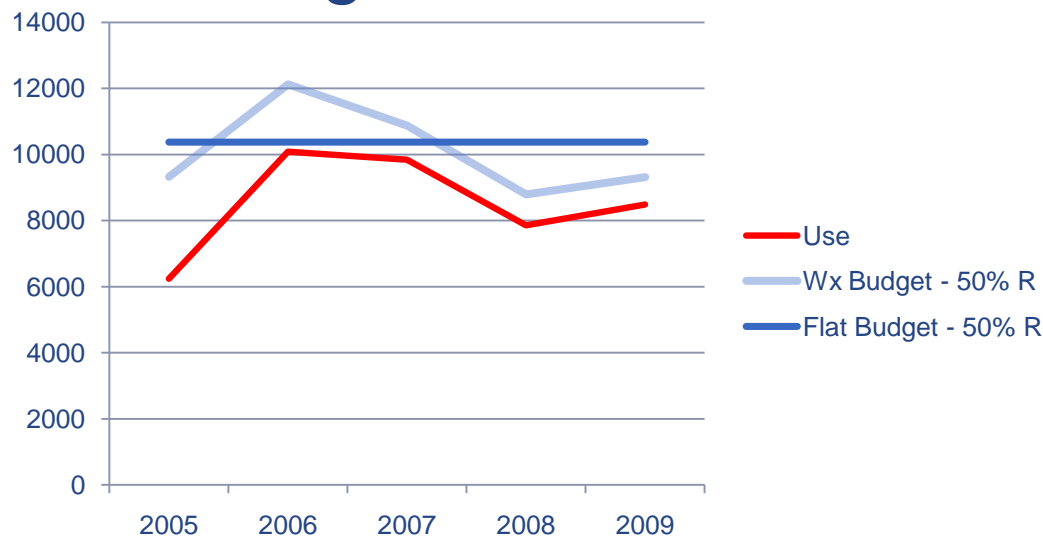
USING WATER BUDGET RANGES TO IMPROVE IRRIGATION CONSERVATION ANALYSIS

Presented by: Karen Galt, Landscape Architect
Irrigation Coordinator for Seattle Parks and Recreation
2010 WaterSense Innovations Conference
Las Vegas, NV

Concept



- A weather-based water budget **range** improves conservation analysis and outcome by providing a more complete story than a **fixed** water budget.



Context

- YES, Seattle has days without rain
- Irrigation season typically considered from April – September, recently it's been more like June-September
- Parks' system has around 275 irrigated landscapes, roughly 15-17 million sq. ft., or 350-400 acres
- Spend around \$.8-1.2 million annually on irrigation water



Water budgets are
NOT part of our water
utility's business
structure (yet)

Context

- Never really asked before: “how much should we be watering?” *We could be wasting, or very conservative already, we just had no benchmark!*

As funding and water resources diminish, we need to be able to justify how much is needed to provide healthy and functional park landscapes, and identify achievable conservation goals.



Water budgets help answer...



- Are we using the “right amount”?
- Where can we conserve without adversely affecting landscape functions?

How much?

Which sites need our attention?

- How much is the right amount?
 - ▣ Create a baseline use estimate that changes each year, like heating-deg. days
 - ▣ Quantifying helps defend/define use in shortage situations and justify \$ budget allocations
- Where can we conserve?

Conservation candidate sites would:

 - ▣ Show consistent high use over time, by some reasonable percent (pick one)
 - ▣ NOT follow the annual or seasonal variation

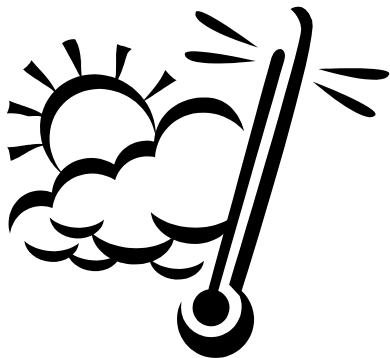


What goes into an irrigation water budget?



It is an estimated volume of water, based on the replacement need of a given plant type for a specified area and given time interval. Industry references generally follow a formula like this:

$$\text{Water budget (CCF)} = \frac{[(ET_o \times K) - R_{eff}] \times \text{Area}}{1200 \times \text{DU}}$$



CCF = 100 cubic feet (Seattle billing units of water)

ET_o = reference evapotranspiration rate (cool season turf)

for time interval

K = species/landscape factor

Area = irrigated area in square feet

R_{eff} = effective rainfall

1200 = constant/units conversion

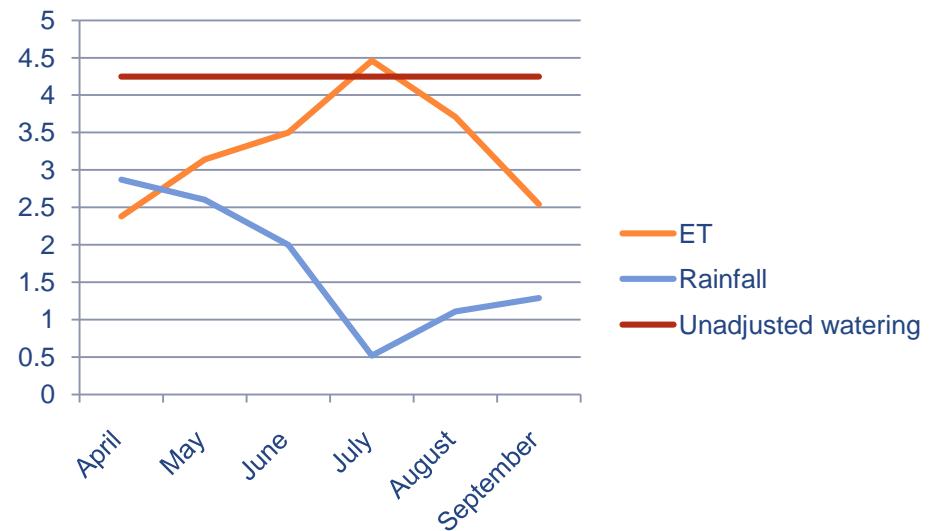
DU = distribution uniformity or system efficiency

ET-based irrigation



- Generally accepted now as ‘how much one should water’
- It’s becoming part of certification programs:
 - ▣ EPA Watersense Water Budget Approach
 - ▣ Sustainable Sites Initiative (SITES™)

In the PNW, “shoulder seasons” are commonly good conservation opportunities.



Formula variables

- Given all those formula variables, you can generate a wide range of figures, but folks tend to generate just one number for their budget
- Variation examples:
 - ▣ 25% vs. 75% 'effective rain'
 - ▣ Changing the K, landscape coefficient
- What's the right answer? Use site knowledge and pick your numbers and stick with 'em (my advice).

Formula variables affect output



Effective rain change yields a budget range => **1216 -1863 CCF**

Turf "K" change from 75% to 100% yields a budget range => **1855 -2502**

PLANNING LEVEL ESTIMATED WATER BUDGET CALCULATOR

SITE: **Wallingford PF**

Instructions: Insert square footage of irrigated turf and shrub areas in red boxes below to estimate the site's water use in CCF for an April - September irrigation season. 1 CCF = 748 gallons.

Equation: $((Lscp \text{ Coeff} \times ET \text{ o}) - (X\% \times \text{Rain})) \times \text{Area in SF} / (1200 \times DU)$
 K = Landscape Coefficient / ET Adjustment
 DU = System Distribution Uniformity Adj.

Turf	75%	Shrub	50%
Rotor	70%	Spray	65%

	AVERAGE Irrigation Season, Month by Month							Total
	April	May	June	July	Aug	Sept	21.14	
Local Data - ET	2.39	3.26	3.83	4.75	4.14	2.78	21.14	
ET o Historical Averages*								
Local Data - RAIN	2.39	1.94	1.38	0.64	0.97	1.51	8.84	
Rain Historical Averages*								

*Units here are inches per month
 Note: 75% is fairly conservative, 25% and 50% effective rain calculators are here - UNHIDE cells 29-46.

Water Budget (CCF) Calculator 25% Effective Rain								
Enter Area in SF of Turf and Shrubs:		Turf	101500	Shrub	20000			
	April	May	June	July	Aug	Sept	Avg Total	
Turf Budget	144	237	306	411	345	206	1649	
Shrub Budget	15	29	40	57	47	26	214	
Site Total Water Budget							1863	
By Month, Season or Average	159	266	346	467	392	232		

Water Budget (CCF) Calculator 50% Effective Rain								
Enter Area in SF of Turf and Shrubs:		Turf	101500	Shrub	20000			
	April	May	June	July	Aug	Sept	Avg Total	
Turf Budget	72	178	264	391	316	161	1382	
Shrub Budget	0	17	31	53	41	16	158	
Site Total Water Budget							1540	
By Month, Season or Average	72	195	295	444	357	177		

Water Budget (CCF) Calculator 75% Effective Rain								
Enter Area in SF of Turf and Shrubs:		Turf	101500	Shrub	20000			
	April	May	June	July	Aug	Sept	Avg Total	
Turf Budget	0	119	222	372	287	115	1115	
Shrub Budget	-15	4	23	48	34	7	101	
Site Total Water Budget							1216	
By Month, Season or Average	-16	124	245	420	321	121		

CCF PLANNING LEVEL ESTIMATED WATER BUDGET CALCULATOR

SITE: **Wallingford PF**

Instructions: Insert square footage of irrigated turf and shrub areas in red boxes below to estimate the site's water use in CCF for an April - September irrigation season. 1 CCF = 748 gallons.

Equation: $((Lscp \text{ Coeff} \times ET \text{ o}) - (X\% \times \text{Rain})) \times \text{Area in SF} / (1200 \times DU)$
 K = Landscape Coefficient / ET Adjustment
 DU = System Distribution Uniformity Adj.

Turf	100%	Shrub	50%
Rotor	70%	Spray	65%

	AVERAGE Irrigation Season, Month by Month							Total
	April	May	June	July	Aug	Sept	21.14	
Local Data - ET	2.39	3.26	3.83	4.75	4.14	2.78	21.14	
ET o Historical Averages*								
Local Data - RAIN	2.39	1.94	1.38	0.64	0.97	1.51	8.84	
Rain Historical Averages*								

*Units here are inches per month
 Note: 75% is fairly conservative, 25% and 50% effective rain calculators are here - UNHIDE cells 29-46.

Water Budget (CCF) Calculator 25% Effective Rain								
Enter Area in SF of Turf and Shrubs:		Turf	101500	Shrub	20000			
	April	May	June	July	Aug	Sept	Avg Total	
Turf Budget	216	335	421	554	470	290	2287	
Shrub Budget	15	29	40	57	47	26	214	
Site Total Water Budget							2502	
By Month, Season or Average	231	365	462	611	517	316		

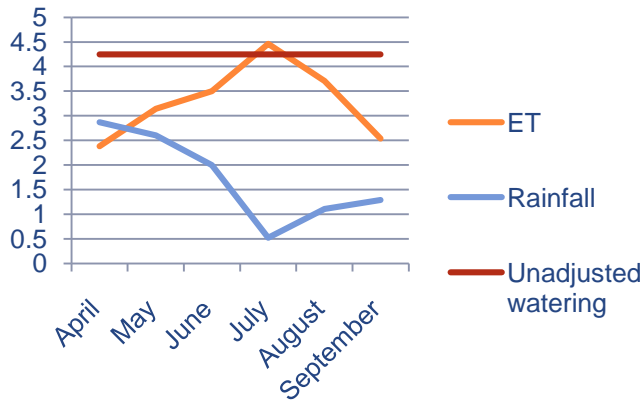
Water Budget (CCF) Calculator 50% Effective Rain								
Enter Area in SF of Turf and Shrubs:		Turf	101500	Shrub	20000			
	April	May	June	July	Aug	Sept	Avg Total	
Turf Budget	144	277	380	535	441	245	2020	
Shrub Budget	0	17	31	53	41	16	158	
Site Total Water Budget							2178	
By Month, Season or Average	144	293	411	587	481	261		

Water Budget (CCF) Calculator 75% Effective Rain								
Enter Area in SF of Turf and Shrubs:		Turf	101500	Shrub	20000			
	April	May	June	July	Aug	Sept	Avg Total	
Turf Budget	72	218	338	515	412	199	1753	
Shrub Budget	-15	4	23	48	34	7	101	
Site Total Water Budget							1855	
By Month, Season or Average	56	222	361	564	446	205		

Nature's variables



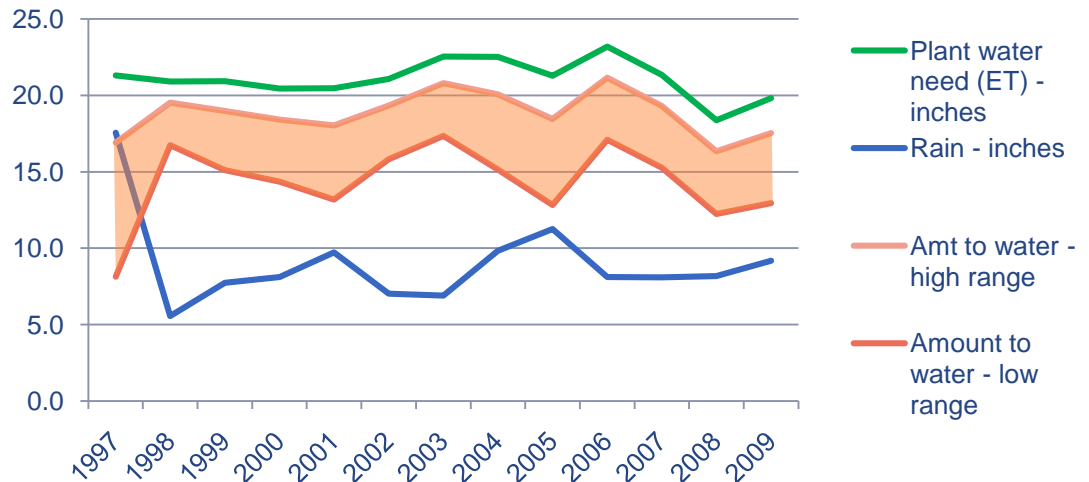
The luxury of having local weather stations and someone recording the data...



Month to Month

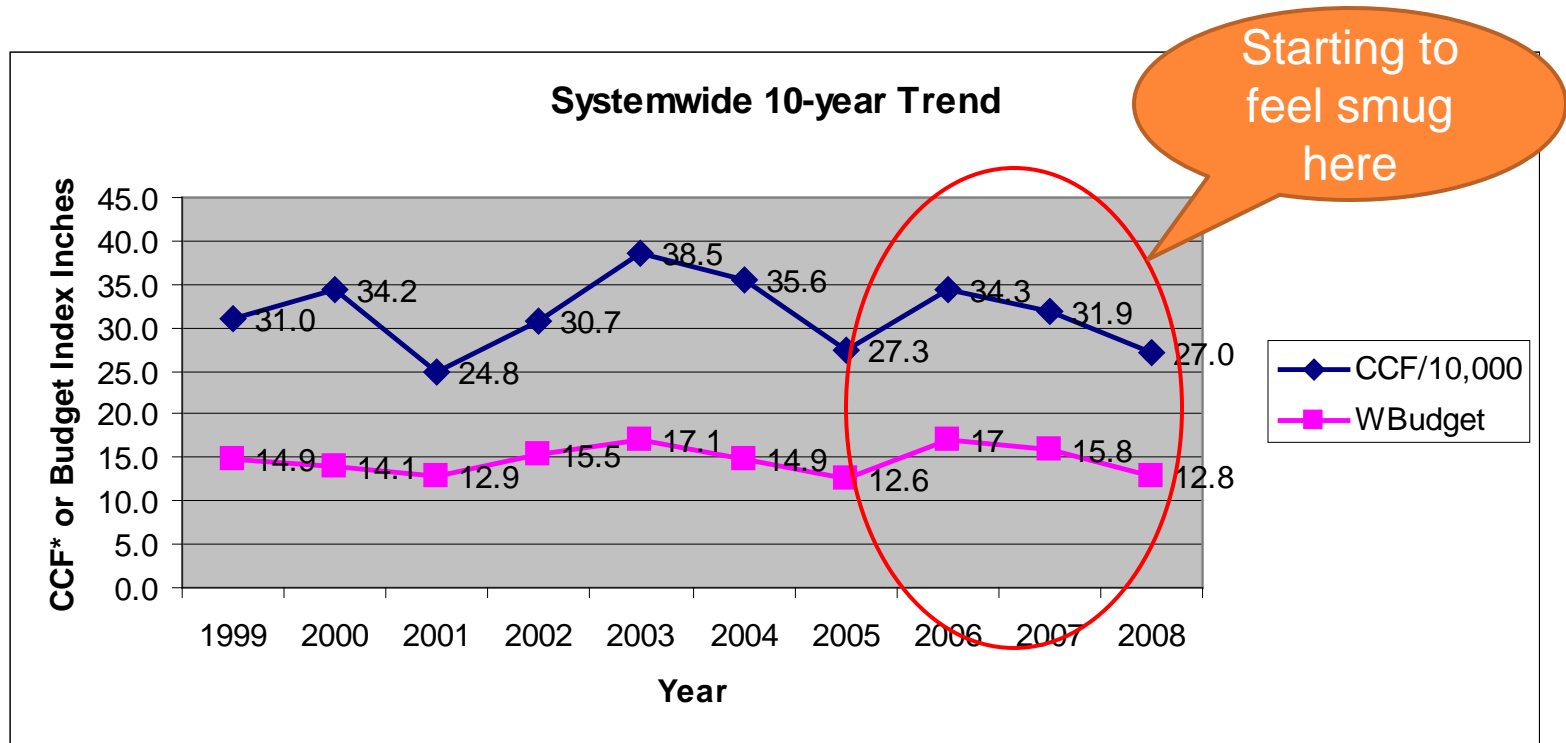
ANNUAL SEASON (April-Sept) Subtotals By Year

Year	2005	2006	2007	2008	2009
ETo (inches)	21.27	23.19	21.35	18.38	19.83
Rain (inches)	11.26	8.12	8.09	8.18	9.18



Year to Year

Analysis - a more complete story

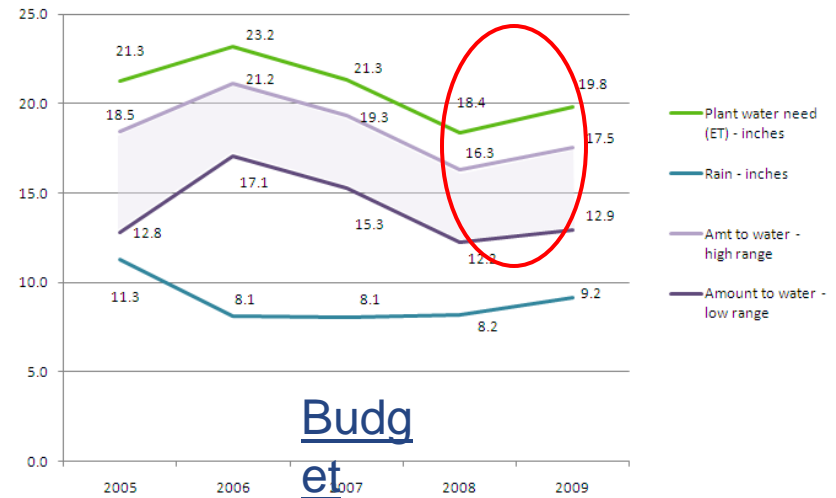
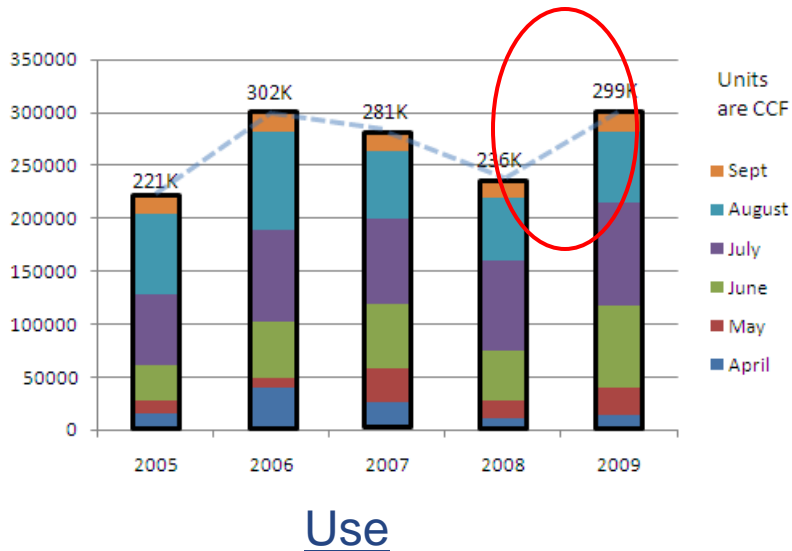


Early attempt to check overall water use against a weather-based index 'budget'. Compare the curves, not the values – CCF vs. inches

System level – see annual trends



- Combing, analyzing, summarizing utility data...



Continuing to check use against the weather-based trend...last year a steeper increase than should have been if only responding to “plant water need”

Still not there yet with a baseline total, but we have a benchmark, a process and a goal in sight!

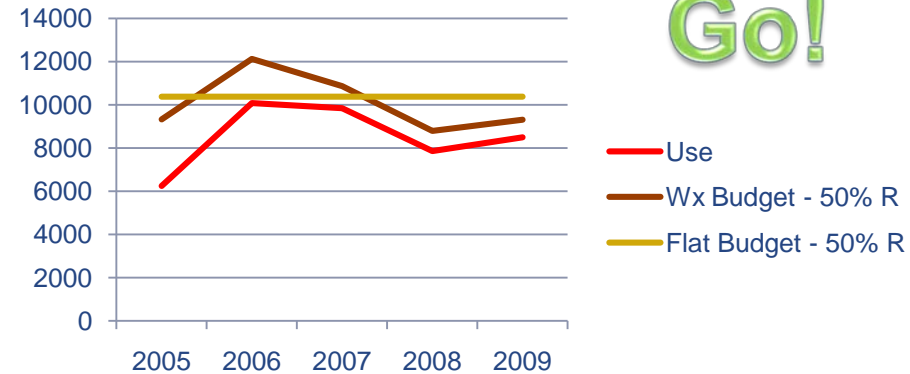
Site level – see annual trends



Go!

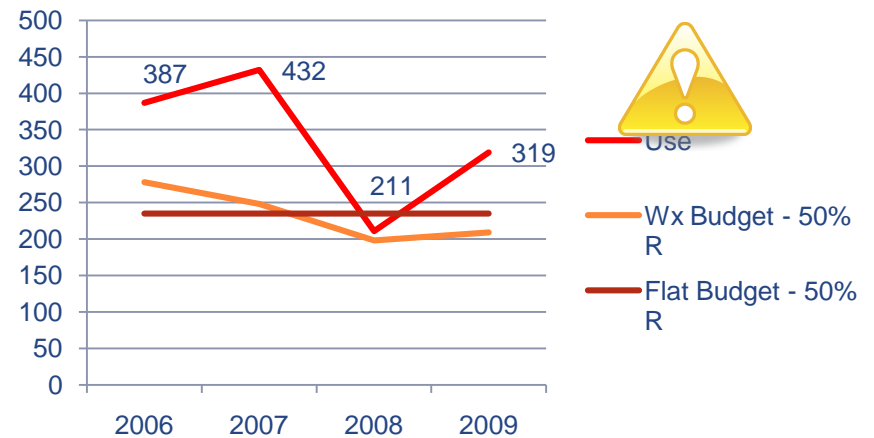
Volunteer Park

Year	2005	2006	2007	2008	2009
Use	6242	10087	9842	7862	8490
Wx Budget - 50% R	9324	12121	10871	8787	9313
Flat Budget - 50% R	10373	10373	10373	10373	10373



Albert Davis Park

Year	2006	2007	2008	2009
Use	387	432	211	319
Wx Budget - 50% R	278	248	198	209
Flat Budget - 50% R	235	235	235	235

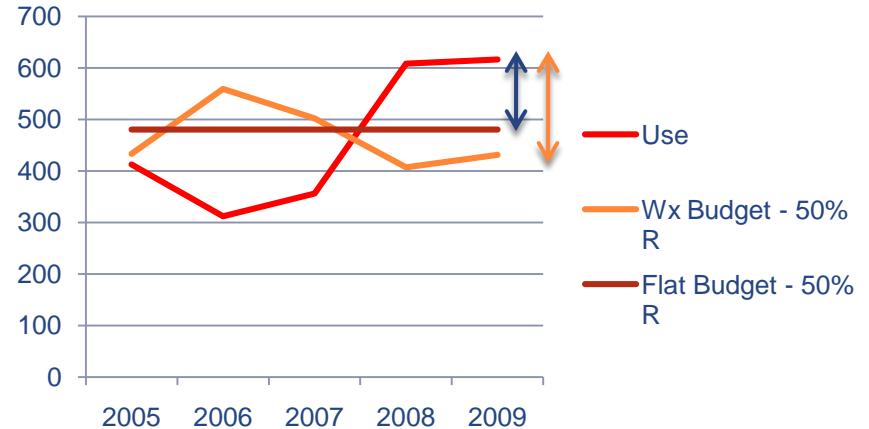


Site level – you may see greater conservation opportunities



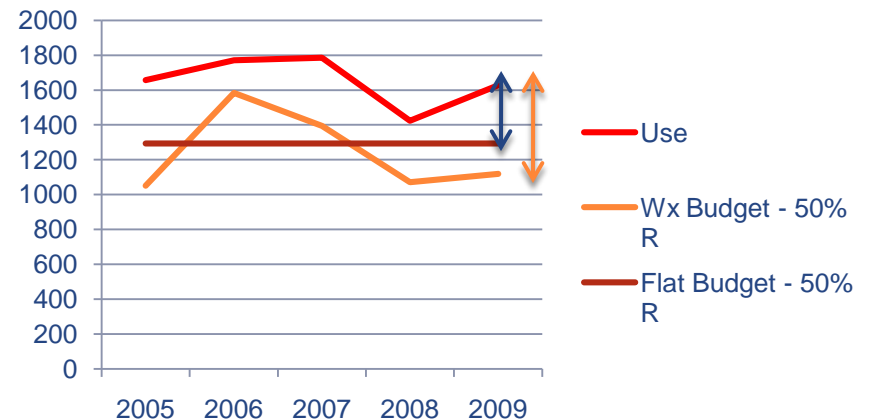
Cedar Park

Year	2005	2006	2007	2008	2009
Use	412	312	356	608	616
Wx Budget - 50% R	433	559	502	407	431
Flat Budget - 50% R	480	480	480	480	480



Sandel PG

Year	2005	2006	2007	2008	2009
Use	1657	1770	1786	1424	1627
Wx Budget - 50% R	1052	1584	1394	1072	1120
Flat Budget - 50% R	1293	1293	1293	1293	1293

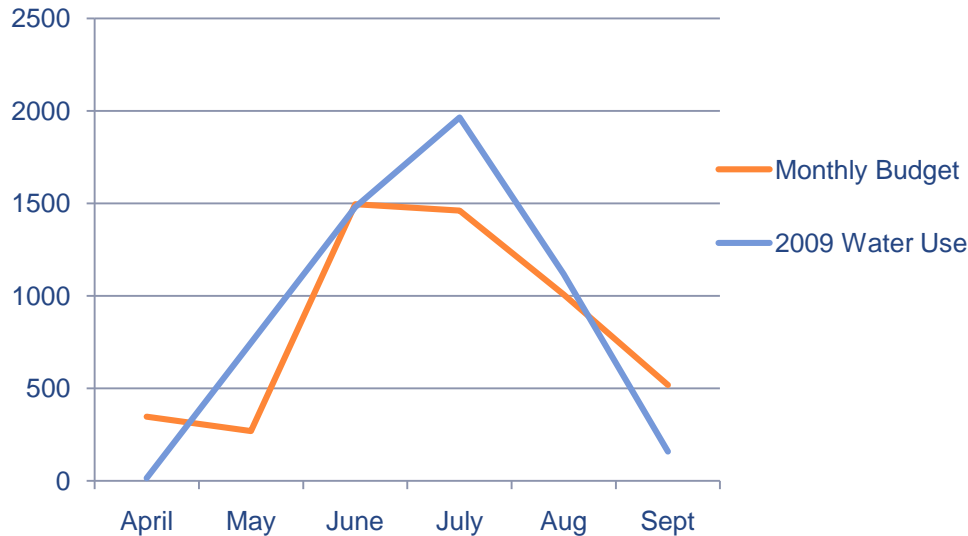


Analysis is scalable

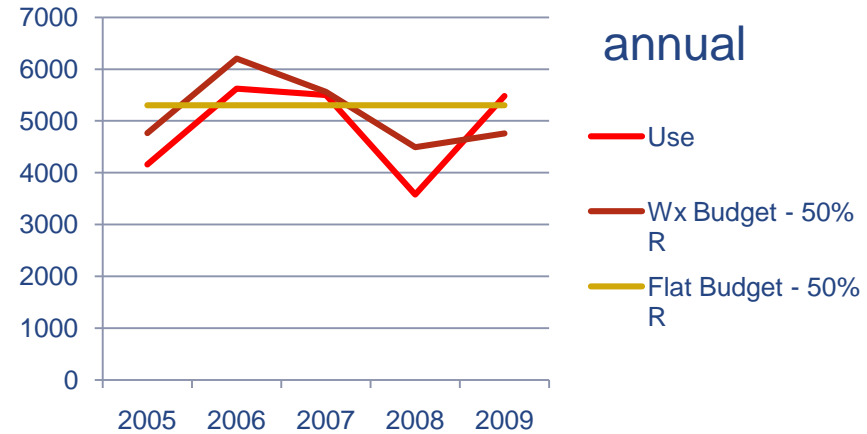


Gas Works Park

Year	2005	2006	2007	2008	2009
Use	4162	5622	5501	3578	5484
Wx Budget - 50% R	4765	6201	5560	4493	4761
Flat Budget - 50% R	5305	5305	5305	5305	5305



monthly



annual

Uses of weather-based budget ranges



- Creates a meaningful baseline that correlates to natural influences – ET and rain DO vary over time (at least in the NW): daily, monthly, annually
- A more certain basis for action: Allows you to see consistent high use relative to changing baseline vs. a blip in the data stream
- Scalable depending on need – system, site, annual, month
- Water users ‘openness’ to hearing about their use is better, moderated by the ‘range’ approach – can lead to more action, less debate?



Contact info:
Karen Galt, Seattle Parks
karen.galt@seattle.gov
206-684-0370 office