System Optimization: The First Step in CSO Control Alternatives Development

Don Walker

NEWEA 2015 Specialty Conference Series



Outline

- System Characterization
 - ✓ Groundwork for system optimization
- Examples of Typical Optimization Measures
 - ✓ Static weir raising
 - ✓ Localized hydraulic relief
 - ✓ Vortex valves
 - ✓ Bending weirs
 - ✓ Pump station operations
 - ✓ Use of remote flow/level monitoring to optimize existing facility operation

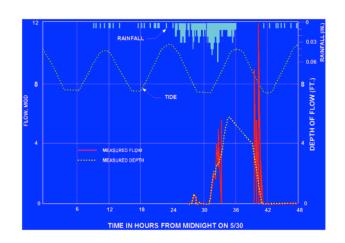


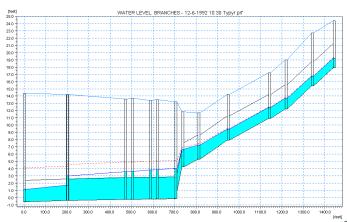
System Characterization

- First step in LTCP development
 - ✓ Collection system mapping/GIS
 - √ Flow monitoring
 - ✓ Inspection data
 - ✓ Collection system modeling



 Develop system understanding & confidence in analytical tools used to assess optimization measures

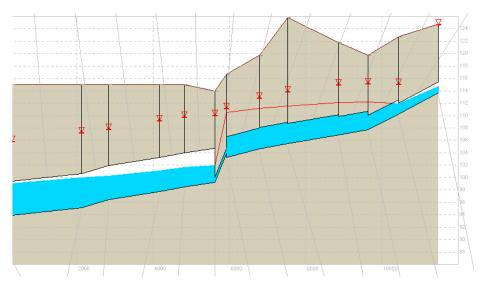




A=COM

Optimization Approach

- Search for opportunities what to look for:
 - ✓ Large-diameter pipes with available capacity
 - ✓ Flow restrictions/areas of high headloss
 - ✓ Under-utilized tanks/facilities
 - ✓ Pump capacities
 - ✓ CSO regulator configurations

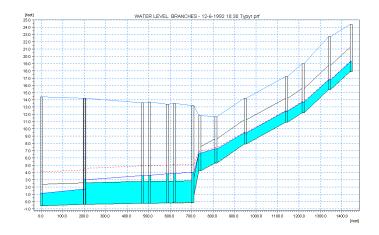


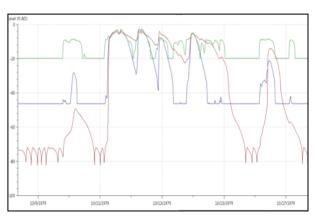




Modeling Tools

- Profiles
- Level and Flow vs. Time
- Color-coding output for pipe surcharge state, velocities, etc.

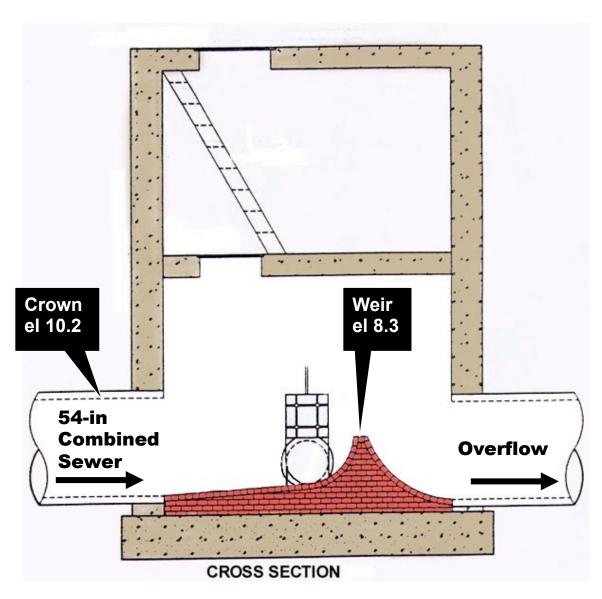






Page 5

Example: Static Weir Raising

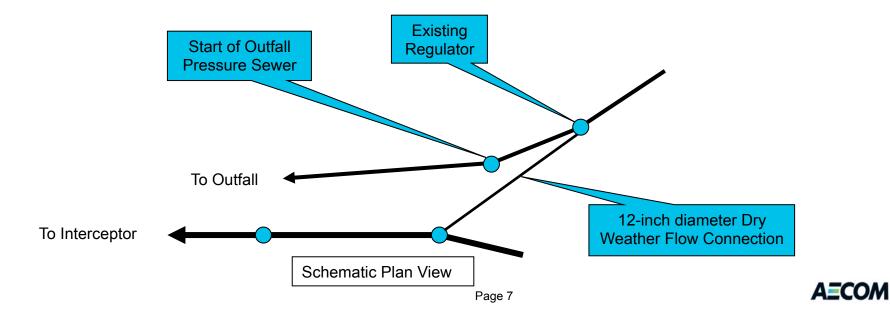


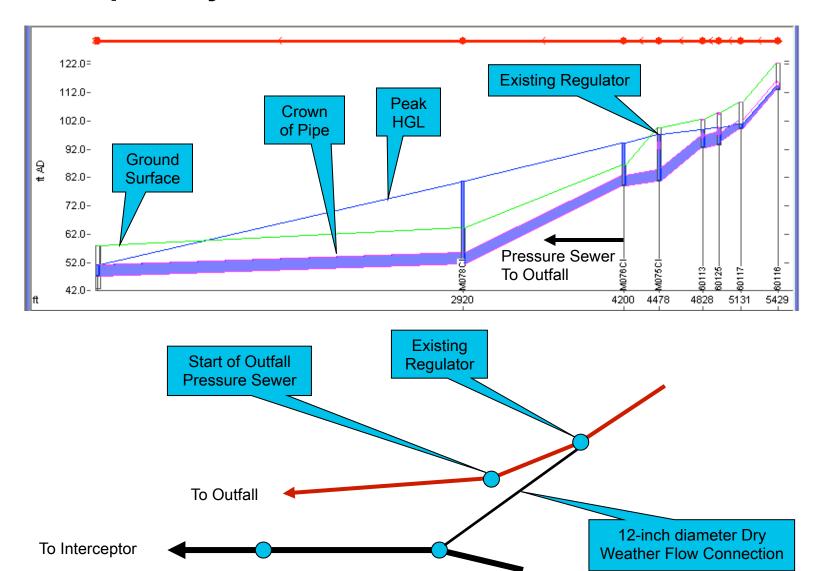
- Incrementally raise weir in model
- Check performance in typical year
- Check HGL impact in larger storm
- Look for opportunity to lengthen weir to offset higher HGL

Watch out for:

- Impacts to other outfalls
- Adverse HGL impacts upstream or downstream



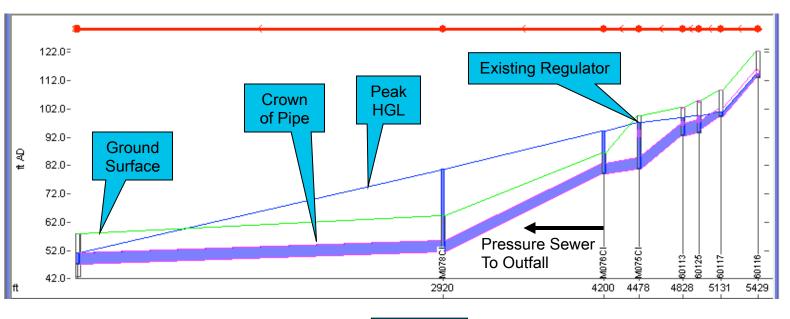


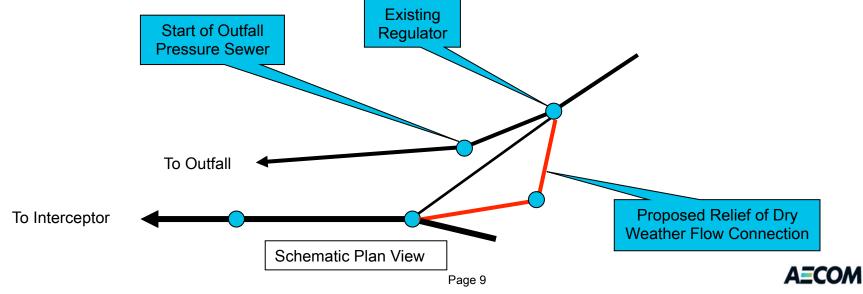


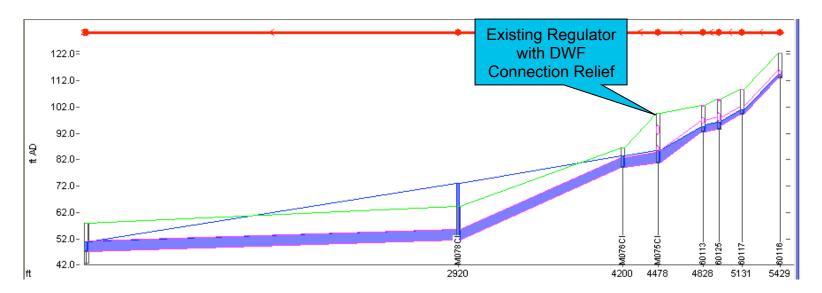
Schematic Plan View

Page 8

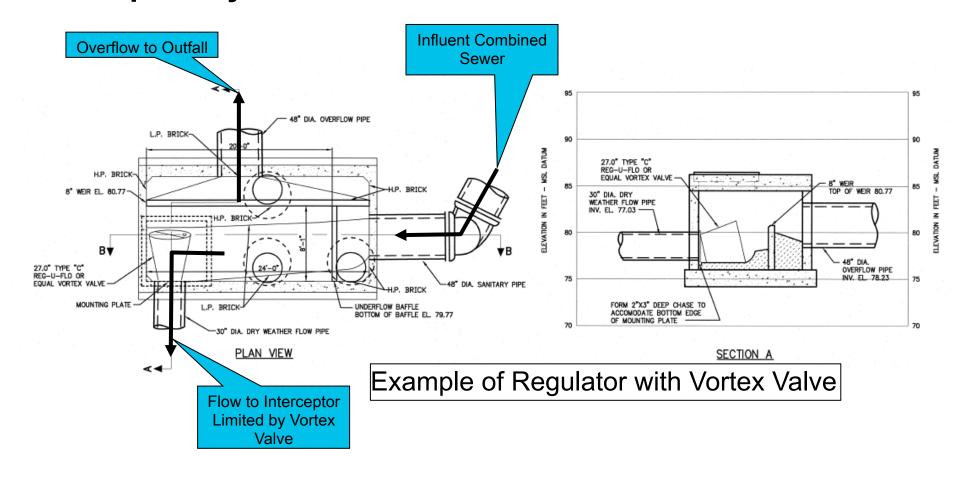








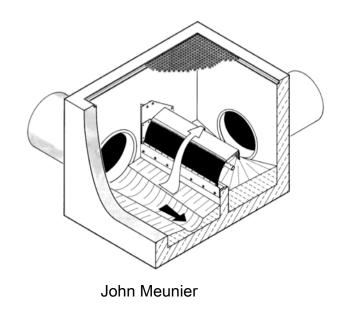
- Relief of DWF connection reduced CSOs in typical year
- BUT: Model predicted adverse HGL impact downstream of relief point during 25-year storm
- **Solution**: Provide vortex valve in regulator to limit peak flow through DWF connection



Example: Bending Weirs

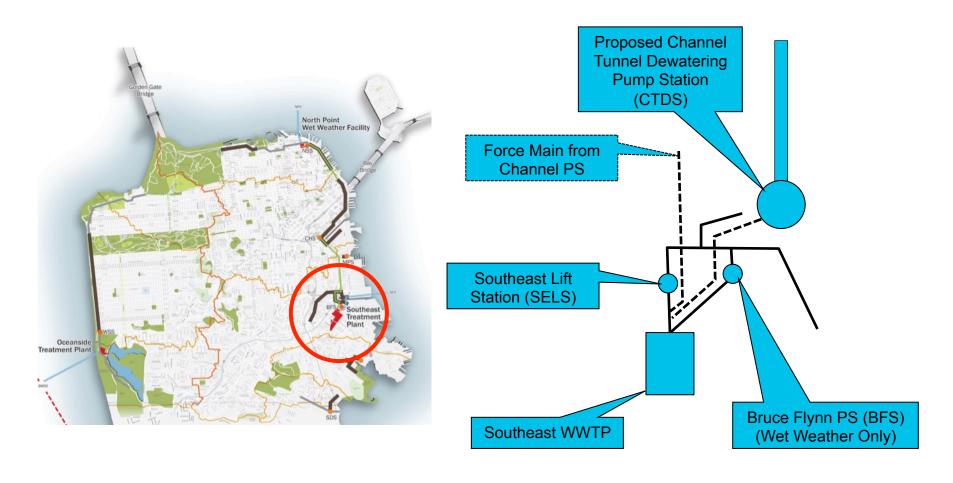
A common issue: Raising weir provides benefit in small storm, but creates unacceptable increase in upstream HGL in larger storm

Solution: Provide bending weir instead of static raised weir



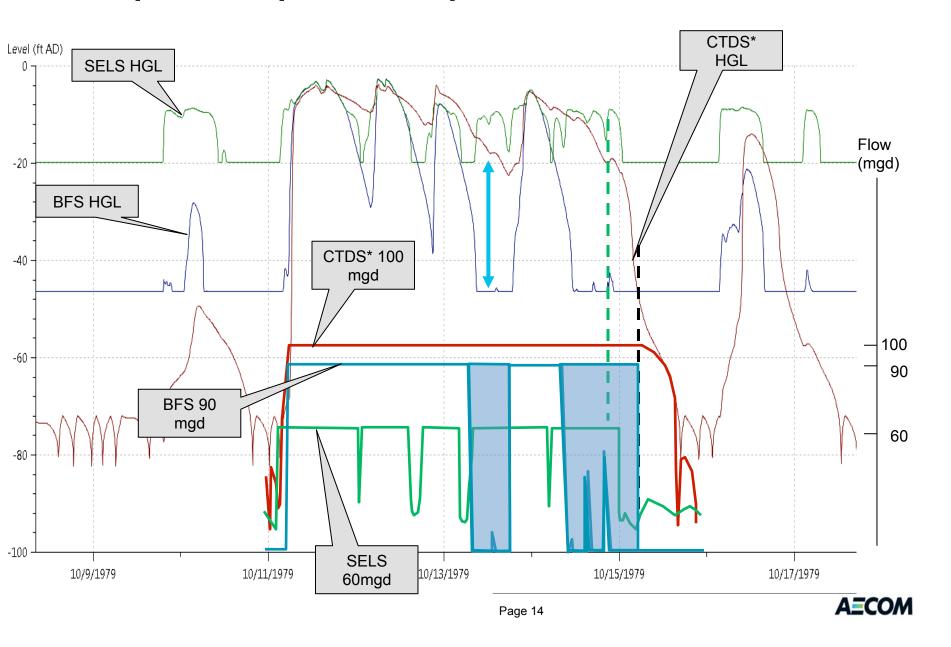
Grande Water Management Systems

Example: Pump Station Optimization

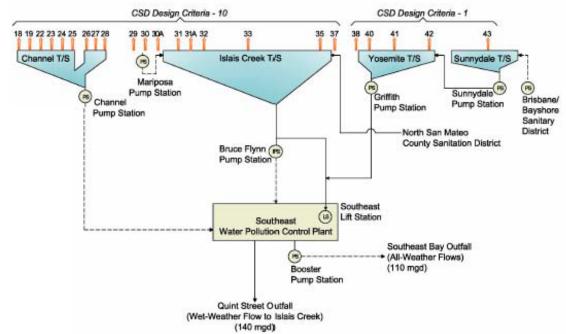


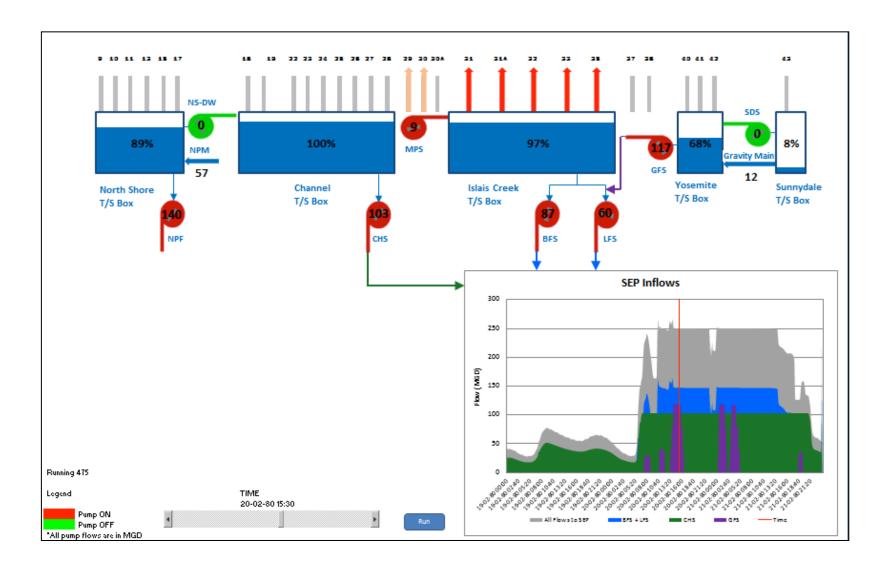
Question: Can the existing pump stations be used to optimize the dewatering of the Channel Tunnel?

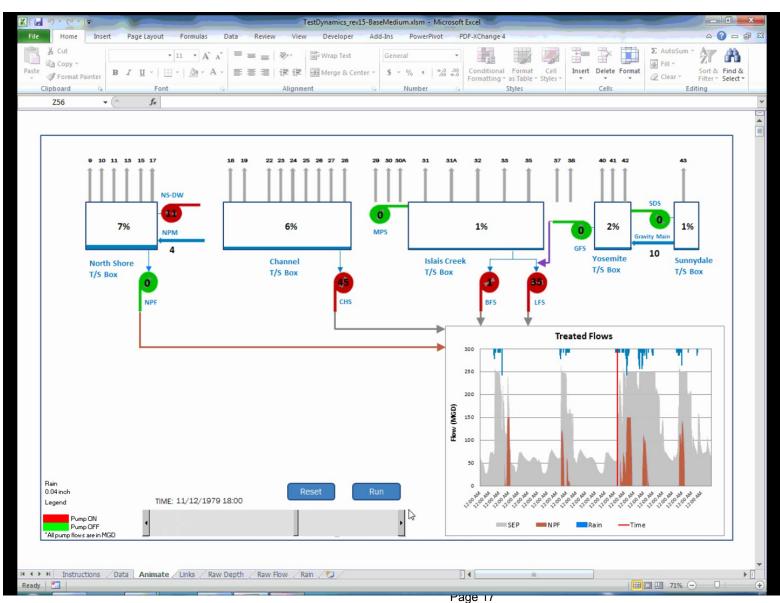
Example: Pump Station Optimization

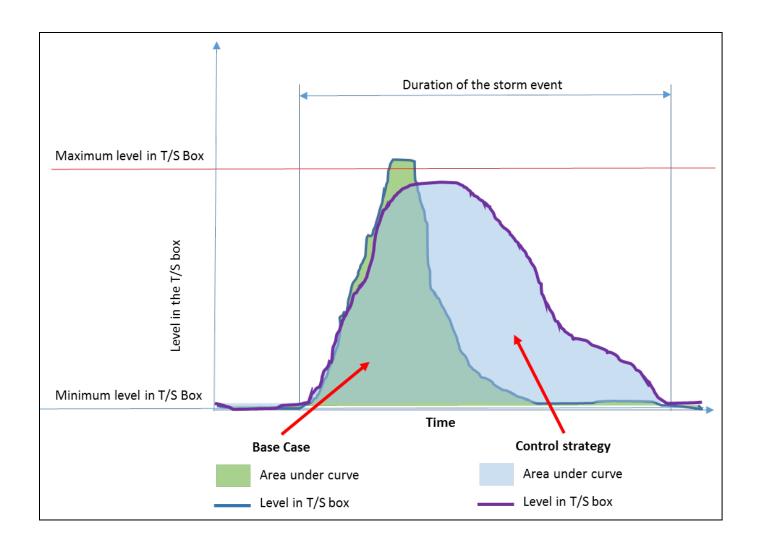


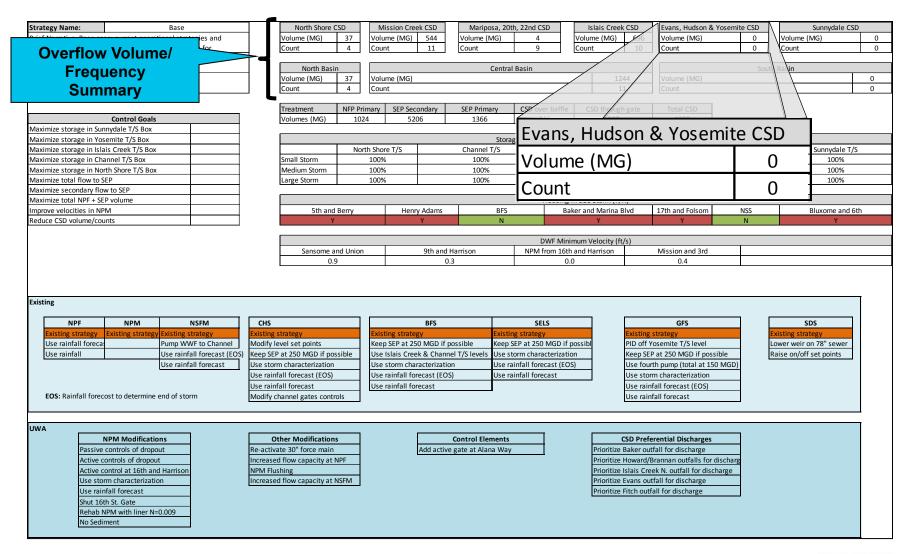


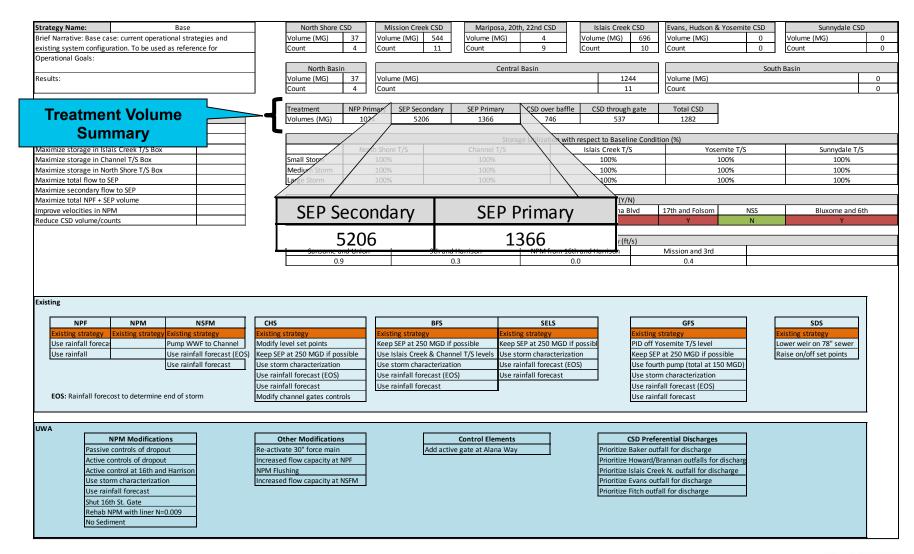


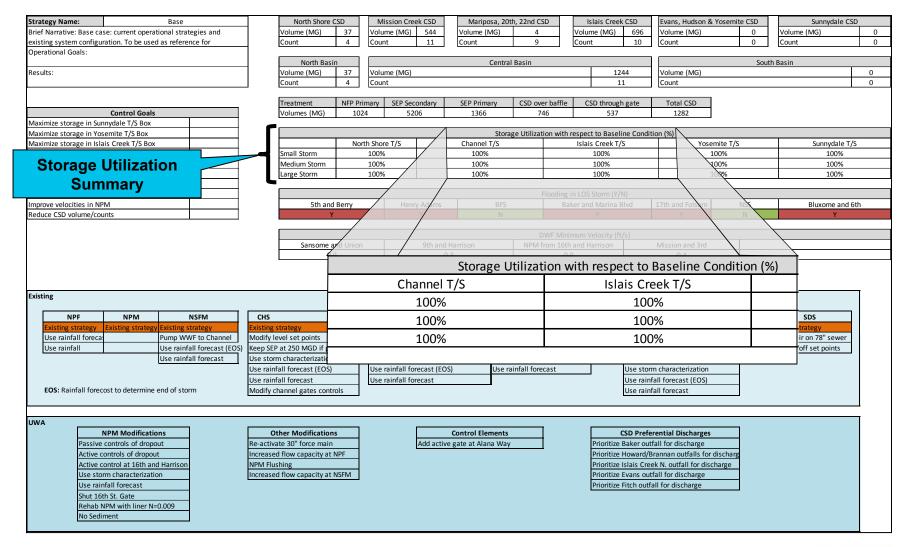


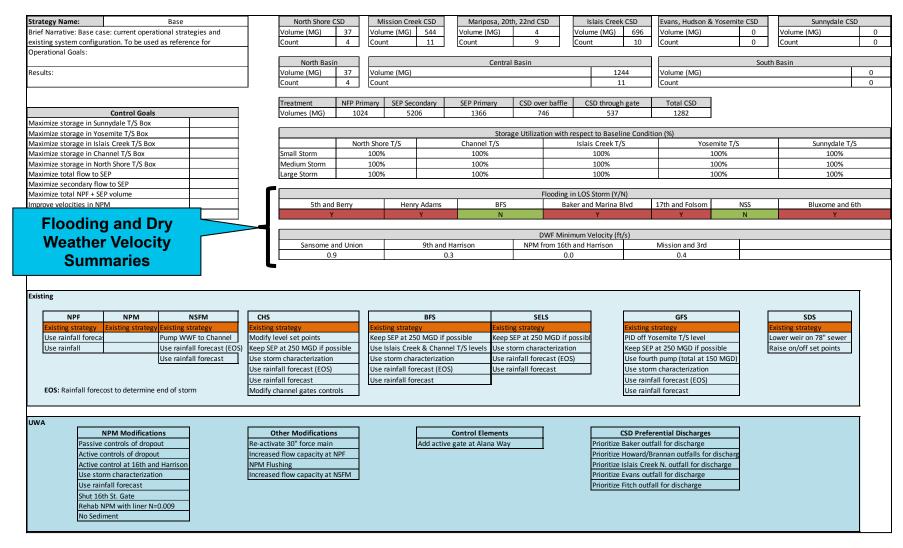












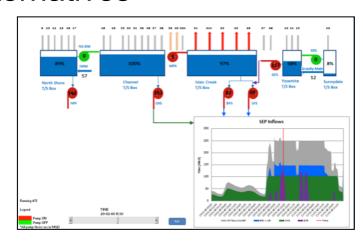
Volume (MG) 3.7 Count 1.1 Volume (MG) 5.44 Count 1.1 Volume (MG) 4 Count 1.0 Volume (MG) 5.65 Count 0.0 Coun	Bert Namarius: Base case: current operational strategies and existing system configuration. To be used as reference for Operational Goals: Count	North Reserve Sase case: current operational strategies and time gastem configuration. To be used as reference for retroral Goals:	trategy Name:		Base	North Shore	CSD	Mission Cre	eek CSD	Mariposa, 20t	th, 22nd CSD	Islais Cree	CSD	Evans, Hudson &	Yosemite CSD	Sunnydale (CSD
North Basin Volume (MG) 37 Count 11 Count 1	North Basin Volume (MG) 37 Count 11 Volume (MG) South Basin Volume (MG) 37 Count 11 Count 11 Count Volume (MG) South Basin Volume (MG) 37 Count 11 Volume (MG) South Basin Volume (MG) 37 Count 11 Count Volume (MG) South Basin Volume (MG)	North Basin Volume (MG) 37 Volume (M		ase: current opera	tional strategies and	Volume (MG)	37	Volume (MG)	544	Volume (MG)	4	Volume (MG)	696	Volume (MG)	0	Volume (MG)	T
North Basin Volume (MG) 37 Count 11 Count 11 Count 1244 Volume (MG) Count 11 Count 11 Count 11 Count 1244 Volume (MG) Count Volume (MG) Volume	Sestis: North Sasin Volume (MG) 1244 Volume (MG) 1244 Volume (MG) Count 11	North Sasin Volume (MG) 3 2 Count 1 11 Count 1244 Count 11 Count	xisting system configu	uration. To be used	d as reference for	Count	4	Count	11	Count	9	Count	10	Count	0	Count	
Volume (M/G) 37 Count 4 Volume (M/G) 1244 Count 11 Count Count Count 1 Count Count Count 1 Count C	Volume (MG) 37 Count 4 Count 11 Count 1244 Count 11 Count 1244 Count	Volume (M/s) 37 Count 4 Volume (M/s) 1244 Count 11 Volume (M/s) Count 1 Count Count 1 Count Coun	perational Goals:											_	•		
Count 4 Count 1 1 Count 1	Count 4 Count 1 4 Count 520 Count 1 4 Count 11 Count 11 Count 12 Count	Count 4 Count 1 Count				North Bas	in			Central	l Basin				Sou	rth Basin	
Control Goals aximize storage in Sunnydale T/S Box aximize storage in Sunnydale T/S Box aximize storage in North Shore T/S Box aximize storage in Sunnydale T/S Box aximize storage in North Shore T/S Box	Control Goals aximize storage in Soundate 175 Box aximize storage in Yosemite 175 Box aximize storage in Soundate 175 Box aximize storage in North Shore 175 Box aximize storage in North Sho	Control Goals imize storage in Sunnydale T/S Box Imize storage in Normal F/S Box Imize storage in Normal Normal Normal In Normal Normal In Normal I	esults:			Volume (MG)	37	Volume (MG)				12	14	Volume (MG)			
Auximize storage in Summydale 17,8 Box aximize storage in Vosemite 17,8 Box aximize storage in Vosemite 17,8 Box aximize storage in Channel 17,5 Box aximize storage in Channel 17,5 Box aximize storage in Channel 17,5 Box aximize storage in North Shore 17,5 Box aximize total Rep. aximize 10,000 aximize 10,	Volumes (MG) 1024 5206 1366 746 537 1282	Control Goals Miles storage in Sumydale T/S Box Storage in Start F/S Box Storage in Start F/S Box Storage in In Start F/S Box Storage in In Start F/S Box Storage in North Shore T/S Box Storage Village T/S Box Sto				Count	4	Count				1	1	Count			
Auximize storage in Summydale 17,8 Box aximize storage in Vosemite 17,8 Box aximize storage in Vosemite 17,8 Box aximize storage in Channel 17,5 Box aximize storage in Channel 17,5 Box aximize storage in Channel 17,5 Box aximize storage in North Shore 17,5 Box aximize total Rep. aximize 10,000 aximize 10,	Volumes (MG) 1024 5206 1366 746 537 1282	Control Goals Miles storage in Sumydale T/S Box Storage in Start F/S Box Storage in Start F/S Box Storage in In Start F/S Box Storage in In Start F/S Box Storage in North Shore T/S Box Storage Village T/S Box Sto										•					
aximize storage in Sunnydale T/S Box saximize storage in Sunnydale T/S Box saximize storage in Sunnydale T/S Box soximize storage in Sunnydale T/S Box soximize storage in Channel T/S Box soximize storage in Sunnydale T/S Box soximize storage in Channel T/S Box soximize storage in Channel T/S Box soximize storage in Channel T/S Box soximize storage in Sunnydale T/S Box soximize storage in Channel T/S Box soximize storage in Channel T/S Box soximize storage in Sunnydale T/S Box soximize storage in Channel T/S Box soximize storage	laximize storage in Sumydale T/S Box Sumydale T/S	strange in Sunnydale T/S Box simize storage in Yosemite T/S Box simize storage in Stalis Creek T/S box Storage Utilization with respect to Baseline Condition (%) Small Storage in Yosemite T/S Box North Shore T/S Storage Utilization with respect to Baseline Condition (%) Small Storage in Stalis Creek T/S Yosemite T/S Sunnydale T/S Small Storage in Channel T/S Small Storage in Channel T/S Small Storage in Channel T/S Small Storage Utilization with respect to Baseline Condition (%) Small Storage Utilization with respect to Baseline Condition (%) Small Storage Utilization with respect to Baseline Condition (%) Small Storage Utilization with respect to Baseline Condition (%) Small Storage Utilization with respect to Baseline Condition (%) Small Storage Utilization with respect to Baseline Condition (%) Small Storage Utilization with respect to Baseline Condition (%) Small Storage Utilization with respect to Baseline Condition (%) Small Storage Utilization with respect to Baseline Condition (%) Small Storage Utilization with respect to Baseline Condition (%) Small Storage Utilization with respect to Baseline Condition (%) Small Storage Utilization with respect to Baseline Condition (%) Small Storage Utilization with respect to Baseline Condition (%) Small Storage Utilization with respect to Baseline Condition (%) Small Storage Utilization (Treatment	NFP Prin	mary SEP Se	condary	SEP Primary	CSD over baffle	CSD throug	gate	Total CSD			
aximize storage in Yosemite T/S Box saximize storage in Storage Utilization with respect to Baseline Condition (%) aximize storage in Channel T/S Box saximize storage in North Shore T/S Box saximize total RV use T/S Box saximize storage in North Shore T/S Box 100% 100% 100% 100% 100% 100% 100% 100	aximize storage in Yosemite T/S Box Storage Utilization with respect to Baseline Condition (%) Saximize storage in Channel T/S Box Saximize storage in Channel T/S Box Small Storm 100% 10	Storage In Yosemite T/S Box		Control Goals		Volumes (MG)	1024	4 52	206	1366	746	537		1282			
North Shore T/S Sunnydale T/S	aximize storage in Islais Creek T/S Box aximize storage in North Shore T/S aximize storage in North Shore T/S Box aximize storage in North Shore T/S aximize storage in North Shore T/	North Shore T/S Sunnydale T/S	aximize storage in Su	innydale T/S Box													
Samil Storm 100% 100% 100% 100% 100% 100% 100% 100	Small Storn ge in Channel T/S Box Small Storn 100% 1	simize storage in Channel T/S Box imize storage in North Shore T/S Box imize total T/S Box imize total North Shore T/S Box imize total T/S Box imize total North Shore T/S Box imize total T/S Bo	aximize storage in Yo	semite T/S Box						Stora	ge Utilization with	respect to Basel	ne Condit	ion (%)			
Medium Storm 100% 1	Medium Storage in North Shore T/S Box Medium Storage in North Shore Medium Storage	Medium Storm 100% 100% 100% 100% 100% 100% 100% 100	aximize storage in Isla	lais Creek T/S Box			Nort	h Shore T/S		Channel T/S		Islais Creek T/	S	Yosei	mite T/S	Sunnydale '	T/S
Large Storm 100%	Large Storm 100%	Imize total flow to SEP	aximize storage in Ch	nannel T/S Box		Small Storm		100%		100%		100%		1	00%	100%	
aximize secondary flow to SEP aximize total NPF + SEP volume prove velocities in NPM duce CSD volume/counts Sth and Berry Henry Adams BFS Baker and Marina Blvd 17th and Folsom NSS Bluxome and 6th	aximize secondary flow to SEP aximize total NPF + SEP volume Sth and Berry Henry Adams BFS Baker and Marina Blvd 17th and Folsom NSS Bluxome and	imize secondary flow to SEP imize total NPF + SEP volume rove velocities in NPM uce CSD volume/counts Sth and Berry Henry Adams BFS Baker and Marina Blvd 17th and Folsom NSS Bluxome and 6th Y Y N Y N Y N Y N Y N Y N Y N Y N Y N	aximize storage in No	orth Shore T/S Box		Medium Storm		100%		100%		100%		1	00%	100%	
Asimize total NPF + SEP volume Sth and Berry Henry Adams BFS Baker and Marina Blvd 17th and Folsom NSS Bluxome and 6th	aximize total NPF + SEP volume prove velocities in NPM Sth and Berry Henry Adams BFS Baker and Marina Blvd 17th and Folsom NSS Bluxome and Y N Y Y	Indige total NPF + SEP volume Torove velocities in NPM Sth and Berry Henry Adams BFS Baker and Marina Bivd 17th and Folsom NSS Bluxome and 6th Y N N V N N V N N				Large Storm		100%		100%		100%		1	00%	100%	
String String String strategy Existing	Sth and Berry Henry Adams BFS Baker and Marina Blvd 17th and Folsom NSS Bluxome and duce CSD volume/counts Sth and Berry Henry Adams BFS Baker and Marina Blvd 17th and Folsom NSS Bluxome and DWF Minimum Velocity (ft/s)	ting NPF NPM NSFM Stiting strategy Existing strategy Use rainfall forecast Use rainfall															
DWF Minimum Velocity (ft/s) Sansome and Union 9th and Harrison NPM from 16th and Harrison 0.9 0.3 0.0 0.4 NPF NPM NSFM Existing strategy Existing strategy Use rainfall forecast Pump WWF to Channel Use rainfall forecast Use rainfall forecast (EOS) Use rainfall forecast (EOS) Use rainfall forecast (EOS) Use rainfall forecast (EOS) Use rainfall forecast (EOS)	DWF Minimum Velocity (ft/s) Sansome and Union 9th and Harrison NPM from 16th and Harrison 0.9 0.4 NPF NPM NSFM Existing strategy Existing strategy Use rainfall forecast (EOS) Use rainfall forecast Use rainfall forecast (EOS)	The properties of the properti	aximize total NPF + SE	EP volume													
Sansome and Union O.9 O.3 O.0 O.4 Sansome and Union O.9 O.0 O.4 DWF Minimum Velocity (ft/s) Sansome and Union O.9 O.0 O.4 Sansome and Union O.9 O.0 O.4 DWF Minimum Velocity (ft/s) O.0 O.0 O.4 Sansome and Union O.9 O.0 O.4 DWF Minimum Velocity (ft/s) O.0 O.0 O.0 O.0 O.0 Sansome and Union O.9 O.0 O.0 O.0 O.0 DWF Minimum Velocity (ft/s) O.0 O.0 O.0 O.0 O.0 DWF Minimum Velocity (ft/s) O.0 O.0 O.0 O.0 O.0 DWF Minimum Velocity (ft/s) O.0 O.0 O.0 O.0 O.0 DWF Minimum Velocity (ft/s) O.0 O.0 O.0 O.0 O.0 DWF Minimum Velocity (ft/s) O.0 O.0 O.0 O.0 O.0 O.0 DWF Minimum Velocity (ft/s) O.0 O.0 O.0 O.0 O.0 O.0 O.0 O.	DWF Minimum Velocity (ft/s)	ting DWF Minimum Velocity (ft/s)	prove velocities in NI	PM		5th and	l Berry	Hen	nry Adams	BFS	Ba	ker and Marina I	lvd	17th and Folsom	NSS	Bluxome and	6th
Sansome and Union 0.9 0.3 NPM from 16th and Harrison 0.0 0.0 0.0 0.0 NPM from 16th and Harrison 0.0 0.0 0.0 0.0 0.0 NPM from 16th and Harrison 0.0 0.0 0.0 0.0 0.0 NPM from 16th and Harrison 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	Sansome and Union 0.9 0.3 NPM from 16th and Harrison 0.0 0.0 0.0 0.0 NPM from 16th and Harrison 0.0 0.0 0.0 0.0 0.0 NPM from 16th and Harrison 0.0 0.0 0.0 0.0 0.0 NPM from 16th and Harrison 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	Sansome and Union 9th and Harrison NPM from 16th and Harrison Mission and 3rd 0.9 0.3 0.0 0.4 NPF NPM NSFM Existing strategy Existing str	educe CSD volume/co	ounts		1	,		Υ	N		Υ		Υ	N	Υ	
Sansome and Union 0.9 0.9 0.3 0.0 0.4 String NPF NPM NSFM Existing strategy Existing strategy Existing strategy Use rainfall forecast	Sansome and Union 9th and Harrison NPM from 16th and Harrison Mission and 3rd 0.9 0.3 0.0 0.4 NPF NPM NSFM Existing strategy Existing strategy Existing strategy Use rainfall forecast [COS] Use rainfall orecast Use rainfall forecast [COS] Use rainfall forecast (EOS)	Sansome and Union 9th and Harrison NPM from 16th and Harrison Mission and 3rd 0.9 0.3 0.0 0.4 NPF NPM NSFM Existing strategy Existing str															
sting NPF NPM NSFM Existing strategy Existing s	sting NPF NPM NSFM Existing strategy Existing strategy	ting NPF NPM NSFM Existing strategy									DWF Mini	mum Velocity (fi	/s)				
NPF NPM NSFM Existing strategy Existing strategy Existing strategy Existing strategy Use rainfall forecast (EOS) Use rainfall forecast	NPF NPM NSFM Existing strategy Existing strategy Existing strategy Use rainfall forecast (EOS) Use rainfall forecast	NPF NPM NSFM Existing strategy				Sansome :	and Union		9th and H	arrison	NPM from 16th	and Harrison		Mission and 3rd			
NPF NPM NSFM Existing strategy Existing strategy Use rainfall forecast	NPF NPM NSFM Existing strategy Existing strategy Existing strategy Use rainfall forecast	NPF NPM NSFM Existing strategy Existing strategy Existing strate				Julijoliic	ina Omon										
Existing strategy Existi	Existing strategy Existing strategy Existing strategy Use rainfall forecas Pump WWF to Channel Use rainfall forecast (EOS) Use rainfall forecast Use rainfall fo	Existing strategy Use rainfall forecast	isting								0.	0		0.4			
Use rainfall forecast	Use rainfall forecast	Use rainfall forecast Pump WWF to Channel Use rainfall forecast (EOS) Use rainfall forecas		NDM	NICEA .	0.			0.3			0				SDC SDC	
Use rainfall Use rainfall forecast (EOS) Use rainfall forecast (EOS) Use rainfall forecast	Use rainfall Use rainfall forecast (EOS) Use rainfall forecast (EOS) Use rainfall forecast	Use rainfall Use rainfall forecast (EOS) Use rainfall forecast Use storm characterization Use rainfall forecast Use storm characterization Use rainfall forecast (EOS) Use rainfall forecast	NPF			0.		Friedrice standard	0.3		SELS	0	Friedler	GFS			
Use rainfall forecast Use storm characterization Use rainfall forecast (EOS) Use rainfall forecast (EOS) Use rainfall forecast (EOS) Use rainfall forecast	Use rainfall forecast Use storm characterization Use rainfall forecast (EOS) Use rainfall forecast (EOS) Use rainfall forecast (EOS) Use rainfall forecast	Use rainfall forecast Use storm characterization Use storm characterization Use rainfall forecast (EOS) Use rainfall forecast (EOS) Use rainfall forecast	NPF Existing strategy	Existing strategy	Existing strategy	CHS Existing strategy			0.3 BFS egy	Existir	SELS ng strategy			GFS strategy		Existing strategy	
Use rainfall forecast (EOS) Use rainfall forecast (EOS)	Use rainfall forecast (EOS) Use rainfall forecast (EOS)	Use rainfall forecast (EOS) Use rainfall forecast (EOS) Use rainfall forecast	NPF Existing strategy Use rainfall foreca	Existing strategy	Pump WWF to Channel	CHS Existing strategy Modify level set points	9	Keep SEP at 2	BFS egy 250 MGD if po	Existir ssible Keep S	SELS ng strategy SEP at 250 MGD if	oossibl	PID off Y	GFS strategy osemite T/S level		Existing strategy Lower weir on 78" sewer	
Use rainfall forecast Use rainfall forecast Use rainfall forecast (EOS)	Use rainfall forecast	Use rainfall forecast	NPF Existing strategy Use rainfall foreca	Existing strategy	Pump WWF to Channel Use rainfall forecast (EOS)	CHS Existing strategy Modify level set points Keep SEP at 250 MGD if po	9 Issible	Keep SEP at 2 Use Islais Cre	BFS egy 250 MGD if poek & Channe	Existir ssible Keep S I T/S levels Use st	SELS ng strategy SEP at 250 MGD if i torm characterizati	oossibl on	PID off Y Keep SEF	GFS strategy osemite T/S level P at 250 MGD if poss	ible	Existing strategy Lower weir on 78" sewer	
			NPF Existing strategy Use rainfall foreca	Existing strategy	Pump WWF to Channel Use rainfall forecast (EOS)	CHS Existing strategy Modify level set points Keep SEP at 250 MGD if pc Use storm characterization	9 Issible	Keep SEP at 2 Use Islais Cre Use storm cha	BFS egy 250 MGD if potek & Channe aracterization	ssible Keep S 1 T/S levels Use st Use ra	SELS ng strategy SEP at 250 MGD if , torm characterizati ainfall forecast (EO	oossibl on	PID off Y Keep SEF Use four	GFS strategy osemite T/S level at 250 MGD if poss th pump (total at 150	ible	Existing strategy Lower weir on 78" sewer	
EUS: Kainfail Torecost to determine end of storm Modify channel gates controls Use rainfall forecast		Modify channel gates controls Use rainfall forecast	NPF Existing strategy Use rainfall foreca	Existing strategy	Pump WWF to Channel Use rainfall forecast (EOS)	CHS Existing strategy Modify level set points Keep SEP at 250 MGD if pc Use storm characterization Use rainfall forecast (EOS)	9 Issible	Keep SEP at 2 Use Islais Cre Use storm cha Use rainfall for	BFS egy 250 MGD if potek & Channe aracterization orecast (EOS)	ssible Keep S 1 T/S levels Use st Use ra	SELS ng strategy SEP at 250 MGD if , torm characterizati ainfall forecast (EO	oossibl on	PID off Y Keep SEF Use four Use stor	GFS strategy osemite T/S level of at 250 MGD if poss th pump (total at 150 m characterization	ible	Existing strategy Lower weir on 78" sewer	
	EUS: Kainrail Torecost to determine end or storm Modify channel gates controls Use rainfall forecast		NPF Existing strategy Use rainfall foreca Use rainfall	Existing strategy	Pump WWF to Channel Use rainfall forecast (EOS) Use rainfall forecast	CHS Existing strategy Modify level set points Keep SEP at 250 MGD if pc Use storm characterizatior Use rainfall forecast (EOS) Use rainfall forecast	9 sssible	Keep SEP at 2 Use Islais Cre Use storm cha Use rainfall for	BFS egy 250 MGD if potek & Channe aracterization orecast (EOS)	ssible Keep S 1 T/S levels Use st Use ra	SELS ng strategy SEP at 250 MGD if , torm characterizati ainfall forecast (EO	oossibl on	PID off Y Keep SEF Use four Use storn Use raint	GFS strategy osemite T/S level of at 250 MGD if poss th pump (total at 150 m characterization fall forecast (EOS)	ible	Existing strategy Lower weir on 78" sewer	
			NPF Existing strategy Use rainfall foreca Use rainfall EOS: Rainfall foreca	Existing strategy	Existing strategy Pump WWF to Channel Use rainfall forecast (EOS) Use rainfall forecast end of storm	CHS Existing strategy Modify level set points Keep SEP at 250 MGD if pc Use storm characterizatior Use rainfall forecast (EOS) Use rainfall forecast Modify channel gates cont	9 sssible rols	Keep SEP at 2 Use Islais Cre Use storm cha Use rainfall for	BFS BFS ESV 150 MGD if pc Lek & Channe aracterization orecast (EOS) orecast	ssible Keep S I T/S levels Use st Use ra	SELS ng strategy SEP at 250 MGD if , torm characterizati ainfall forecast (EO	possibl on 5)	PID off Y Keep SEF Use four Use stori Use rainf	GFS strategy ossemite T/S level P at 250 MGD if poss th pump (total at 15/ m characterization fall forecast (EOS) fall forecast	ible	Existing strategy Lower weir on 78" sewer	
NPM Modifications Control Elements CSD Preferential Discharges	NPM Modifications Control Elements CSD Preferential Discharges		NPF Existing strategy Use rainfall foreca Use rainfall EOS: Rainfall foreca	Existing strategy a cost to determine	Existing strategy Pump WWF to Channel Use rainfall forecast (EOS) Use rainfall forecast end of storm	CHS Existing strategy Modify level set points Keep SEP at 250 MGD if pc Use storm characterization Use rainfall forecast (EOS) Use rainfall forecast Modify channel gates cont	9 sssible rols	Keep SEP at 2 Use Islais Cre Use storm cha Use rainfall for	BFS BBS BBS BBS BBS BBS BBS BBS BBS BBS	Existir ssible Keep S I T/S levels Use st Use ra Use ra	SELS ng strategy SEP at 250 MGD if , torm characterizati ainfall forecast (EO ainfall forecast	oossibl on (5)	PID off Y Keep SEP Use four Use store Use rainf Use rainf	GFS strategy osemite T/S level P at 250 MGD if poss th pump (total at 15/ m characterization fall forecast (EOS) fall forecast	ible	Existing strategy Lower weir on 78" sewer	
NPM Modifications Other Modifications Control Elements CSD Preferential Discharges Passive controls of dropout Re-activate 30" force main Add active gate at Alana Way Prioritize Baker outfall for discharge	NPM Modifications Other Modifications Control Elements CSD Preferential Discharges Passive controls of dropout Re-activate 30" force main Add active gate at Alana Way Prioritize Baker outfall for discharge	Passive controls of dropout Re-activate 30" force main Add active gate at Alana Way Prioritize Baker outfall for discharge	NPF Existing strategy Use rainfall foreca Use rainfall EOS: Rainfall forec	e controls of dropce	Pump WWF to Channel Use rainfall forecast (EOS) Use rainfall forecast end of storm	CHS Existing strategy Modify level set points Keep SEP at 250 MGD if pc Use storm characterizatior Use rainfall forecast (EOS) Modify channel gates cont Other Modification Re-activate 30" force main	sssible	Keep SEP at 2 Use Islais Cre Use storm cha Use rainfall for	BFS BBS BBS BBS BBS BBS BBS BBS BBS BBS	Existir ssible Keep S I T/S levels Use st Use ra Use ra	SELS ng strategy SEP at 250 MGD if , torm characterizati ainfall forecast (EO ainfall forecast	possibl on 5)	PID off Y Keep SEF Use four Use stor Use rainf Use rainf	GFS strategy osemite T/S level P at 250 MGD if poss th pump (total at 150 m characterization fall forecast (EOS) fall forecast	ible D MGD)	Existing strategy Lower weir on 78" sewer	
NPM Modifications Other Modifications Control Elements CSD Preferential Discharges Passive controls of dropout Re-activate 30" force main Add active gate at Alana Way Prioritize Baker outfall for discharge Active controls of dropout Increased flow capacity at NPF Prioritize Howard/Brannan outfalls for discharge	NPM Modifications Other Modifications Control Elements CSD Preferential Discharges Passive controls of dropout Re-activate 30" force main Add active gate at Alana Way Prioritize Baker outfall for discharge Active controls of dropout Increased flow capacity at NPF Prioritize Howard/Brannan outfalls for discharge	Passive controls of dropout Active controls of dropout Active controls of dropout Increased flow capacity at NPF Add active gate at Alana Way Prioritize Baker outfall for discharge Prioritize Howard/Brannan outfalls for discharge	NPF Existing strategy Use rainfall foreca Use rainfall foreca EOS: Rainfall foreca NA Passive Active of	cost to determine NPM Modification controls of dropocontrols of dropocon	Pump WWF to Channel Use rainfall forecast (EOS) Use rainfall forecast end of storm ons out	CHS Existing strategy Modify level set points Keep SEP at 250 MGD if pc Use storm characterizatior Use rainfall forecast (EOS) Use rainfall forecast Modify channel gates cont Other Modification Re-activate 30" force main	sssible	Keep SEP at 2 Use Islais Cre Use storm cha Use rainfall for	BFS BBS BBS BBS BBS BBS BBS BBS BBS BBS	Existir ssible Keep S I T/S levels Use st Use ra Use ra	SELS ng strategy SEP at 250 MGD if , torm characterizati ainfall forecast (EO ainfall forecast	prioritize Prioritize	PID off Y Keep SEF Use four Use stor Use rainf Use rainf Use rainf Use rainf Use rainf Use rainf	GFS strategy osemite T/S level P at 250 MGD if poss th pump (total at 15i m characterization fall forecast (EOS) fall forecast	ible D MGD)	Existing strategy Lower weir on 78" sewer	
NPM Modifications Other Modifications Control Elements CSD Preferential Discharges Passive controls of dropout Re-activate 30" force main Add active gate at Alana Way Prioritize Baker outfall for discharge Active control at 16th and Harrison NPM Flushing Prioritize Howard/Brannan outfalls for discharge	NPM Modifications Other Modifications Control Elements CSD Preferential Discharges Passive controls of dropout Re-activate 30" force main Add active gate at Alana Way Prioritize Baker outfall for discharge Active control at 16th and Harrison NPM Flushing Prioritize Howard/Brannan outfalls for discharge	Passive controls of dropout Active controls of dropout Active control at 16th and Harrison Re-activate 30" force main Increased flow capacity at NPF Active control at 16th and Harrison NPM Flushing Add active gate at Alana Way Prioritize Baker outfall for discharge Prioritize Howard/Brannan outfalls for discharge Prioritize Islais Creek N. outfall for discharge	NPF Existing strategy Use rainfall foreca Use rainfall EOS: Rainfall foreca NA Passive Active of Active	cost to determine NPM Modificatie controls of dropocontrols of dropocontrol at 16th an	Existing strategy Pump WWF to Channel Use rainfall forecast (EOS) Use rainfall forecast end of storm ons out tt d Harrison	CHS Existing strategy Modify level set points Keep SEP at 250 MGD if pc Use storm characterizatior Use rainfall forecast (EOS) Use rainfall forecast Modify channel gates cont Other Modification Re-activate 30" force main	sssible rols	Keep SEP at 2 Use Islais Cre Use storm cha Use rainfall for	BFS BBS BBS BBS BBS BBS BBS BBS BBS BBS	Existir ssible Keep S I T/S levels Use st Use ra Use ra	SELS ng strategy SEP at 250 MGD if , torm characterizati ainfall forecast (EO ainfall forecast	Prioritize Prioritize Prioritize	PID off Y Keep SEF Use four Use storn Use rainf	GFS strategy osemite T/S level P at 250 M/GD if poss th pump (total at 15i m characterization fall forecast (EOS) fall forecast rential Discharges fall for discharge trannan outfalls for dek N. outfall for disc	ible D MGD)	Existing strategy Lower weir on 78" sewer	
NPM Modifications Other Modifications Control Elements CSD Preferential Discharges Passive controls of dropout Re-activate 30" force main Add active gate at Alana Way Prioritize Baker outfall for discharge Active control at 16th and Harrison NPM Flushing Prioritize Ilourated Flow capacity at NSFM Use storm characterization Increased flow capacity at NSFM Prioritize Ilourated Flow capacity at NSFM	NPM Modifications Other Modifications Control Elements CSD Preferential Discharges Passive controls of dropout Re-activate 30" force main Add active gate at Alana Way Prioritize Baker outfall for discharge Active control at 16th and Harrison NPM Flushing Prioritize Howard/Brannan outfalls for discharge Use storm characterization Increased flow capacity at NSFM Prioritize Evans outfall for discharge	Passive controls of dropout Active controls of dropout Active controls of dropout Active controls of dropout Active control at 16th and Harrison Use storm characterization Re-activate 30" force main Increased flow capacity at NPF Add active gate at Alana Way Prioritize Baker outfall for discharge Prioritize Howard/Brannan outfalls for discharge Prioritize Islais Creek N. outfall for discharge Prioritize Evans outfall for discharge	NPF Existing strategy Use rainfall foreca Use rainfall foreca Use rainfall EOS: Rainfall foreca NA Passive Active c Active c Use sto	cost to determine NPM Modification e controls of dropout controls of dropout control at 16th and anomeron characterization	Existing strategy Pump WWF to Channel Use rainfall forecast (EOS) Use rainfall forecast end of storm ons out tt d Harrison	CHS Existing strategy Modify level set points Keep SEP at 250 MGD if pc Use storm characterizatior Use rainfall forecast (EOS) Use rainfall forecast Modify channel gates cont Other Modification Re-activate 30" force main	sssible rols	Keep SEP at 2 Use Islais Cre Use storm cha Use rainfall for	BFS BBS BBS BBS BBS BBS BBS BBS BBS BBS	Existir ssible Keep S I T/S levels Use st Use ra Use ra	SELS ng strategy SEP at 250 MGD if , torm characterizati ainfall forecast (EO ainfall forecast	Prioritize Prioritize Prioritize Prioritize	PID off Y Keep SEF Use four Use storn Use rainf Use rain	GFS strategy osemite T/S level of at 250 MGD if poss th pump (total at 15' m characterization fall forecast (EOS) fall forecast fall forecast fall for discharges fall for discharge sek N. outfall for disci- fall for discharge	ible D MGD)	Existing strategy Lower weir on 78" sewer	
NPM Modifications Passive controls of dropout Active control at 16th and Harrison Use storm characterization Use rainfall forecast Other Modifications Control Elements Add active gate at Alana Way Prioritize Baker outfall for discharge Prioritize Howard/Brannan outfalls for discharge Prioritize Islais Creek N. outfall for discharge Prioritize Evans outfall for discharge Prioritize Fitch outfall for discharge	NPM Modifications Passive controls of dropout Active control at 16th and Harrison Use storm characterization Use rainfall forecast Other Modifications Control Elements Add active gate at Alana Way Prioritize Baker outfall for discharge Prioritize Howard/Brannan outfalls for discharge Prioritize Islais Creek N. outfall for discharge Prioritize Evans outfall for discharge Prioritize Fund outfall for discharge Prioritize Fitch outfall for discharge	Passive controls of dropout Active controls of dropout Active control at 16th and Harrison Use storm characterization Use rainfall forecast Re-activate 30" force main Add active gate at Alana Way Prioritize Baker outfall for discharge Prioritize Howard/Branna outfalls for discharge Prioritize Islais Creek N. outfall for discharge Prioritize Fusas particularly for discharge Prioritize Fusas particularly for discharge Prioritize Fusas particularly for discharge	NPF Existing strategy Use rainfall foreca Use rainfall foreca EOS: Rainfall foreca NA Passive Active c Use std Use rainfall	cost to determine NPM Modification controls of dropout control at 16th and orm characterization infall forecast	Existing strategy Pump WWF to Channel Use rainfall forecast (EOS) Use rainfall forecast end of storm ons out tt d Harrison	CHS Existing strategy Modify level set points Keep SEP at 250 MGD if pc Use storm characterizatior Use rainfall forecast (EOS) Use rainfall forecast Modify channel gates cont Other Modification Re-activate 30" force main	sssible rols	Keep SEP at 2 Use Islais Cre Use storm cha Use rainfall for	BFS BBS BBS BBS BBS BBS BBS BBS BBS BBS	Existir ssible Keep S I T/S levels Use st Use ra Use ra	SELS ng strategy SEP at 250 MGD if , torm characterizati ainfall forecast (EO ainfall forecast	Prioritize Prioritize Prioritize Prioritize	PID off Y Keep SEF Use four Use storn Use rainf Use rain	GFS strategy osemite T/S level of at 250 MGD if poss th pump (total at 15' m characterization fall forecast (EOS) fall forecast fall forecast fall for discharges fall for discharge sek N. outfall for disci- fall for discharge	ible D MGD)	Existing strategy Lower weir on 78" sewer	
NPM Modifications Other Modifications Control Elements CSD Preferential Discharges Passive controls of dropout Re-activate 30" force main Add active gate at Alana Way Prioritize Baker outfall for discharge Active controls of fropout Increased flow capacity at NPF Prioritize Howard/Brannan outfalls for discharge Active control at 16th and Harrison NPM Flushing Prioritize Islais Creek N. outfall for discharge Use storm characterization Increased flow capacity at NSFM Prioritize Evans outfall for discharge Use rainfall forecast Prioritize Fitch outfall for discharge Shut 16th St. Gate Prioritize Fitch outfall for discharge	Passive controls of dropout Active controls of dropout Active control at 16th and Harrison Use storm characterization Use rainfall forecast Shut 16th St. Gate Re-activate 30" force main Add active gate at Alana Way Prioritize Baker outfall for discharge Prioritize Baker outfall for discharge Prioritize Islais Creek N. outfall for discharge Prioritize Islais Creek N. outfall for discharge Prioritize Evans outfall for discharge Prioritize Evans outfall for discharge Prioritize Fitch outfall for discharge	Passive controls of dropout Active control at 16th and Harrison Use storm characterization Use rainfall forecast Shut 16th St. Gate Re-activate 30" force main Add active gate at Alana Way Prioritize Baker outfall for discharge Prioritize Howard/Brannan outfalls for discharge Prioritize Islais Creek N. outfall for discharge Prioritize Evans outfall for discharge Prioritize Evans outfall for discharge	NPF Existing strategy Use rainfall foreca Use rainfall foreca Use rainfall foreca WA Passive Active of Use rainfall Shut 16	cost to determine NPM Modification controls of dropout control at 16th an orm characterization infall forecast 5th St. Gate	Pump WWF to Channel Use rainfall forecast (EOS) Use rainfall forecast end of storm ons out tt d Harrison on	CHS Existing strategy Modify level set points Keep SEP at 250 MGD if pc Use storm characterizatior Use rainfall forecast (EOS) Use rainfall forecast Modify channel gates cont Other Modification Re-activate 30" force main	sssible rols	Keep SEP at 2 Use Islais Cre Use storm cha Use rainfall for	BFS BBS BBS BBS BBS BBS BBS BBS BBS BBS	Existir ssible Keep S I T/S levels Use st Use ra Use ra	SELS ng strategy SEP at 250 MGD if , torm characterizati ainfall forecast (EO ainfall forecast	Prioritize Prioritize Prioritize Prioritize	PID off Y Keep SEF Use four Use storn Use rainf Use rain	GFS strategy osemite T/S level of at 250 MGD if poss th pump (total at 15' m characterization fall forecast (EOS) fall forecast fall forecast fall for discharges fall for discharge sek N. outfall for disci- fall for discharge	ible D MGD)	Existing strategy Lower weir on 78" sewer	
NPM Modifications Passive controls of dropout Active controls of dropout Active controls of dropout Active controls at 16th and Harrison Use storm characterization Use rainfall forecast Shut 16th St. Gate Rehab NPM with liner N=0.009 Other Modifications Re-activate 30" force main Add active gate at Alana Way Add active gate at Alana Way Prioritize Baker outfall for discharge Prioritize Howard/Brannan outfalls for discharge Prioritize Islais Creek N. outfall for discharge Prioritize Evans outfall for discharge Prioritize Fitch outfall for discharge	NPM Modifications Passive controls of dropout Active controls of dropout Active control at 16th and Harrison Use storm characterization Use rainfall forecast Shut 16th St. Gate Rehab NPM with liner N=0.009 Other Modifications Re-activate 30" force main Increased flow capacity at NPF Add active gate at Alana Way Add active gate at Alana Way Prioritize Baker outfall for discharge Prioritize Howard/Brannan outfalls for discharge Prioritize Elsais Creek N. outfall for discharge Prioritize Evans outfall for discharge Prioritize Fitch outfall for discharge	Passive controls of dropout Active control at 16th and Harrison Use rainfall forecast Shut 16th St. Gate Rehab NPM with liner N=0.009	NPF Existing strategy Use rainfall foreca Use rainfall EOS: Rainfall foreca WA Passive Active of Use rainfall Shut 16 Rehab I	cost to determine NPM Modificatie e controls of dropou control at 16th an orm characterizatie infall forecast 5th St. Gate NPM with liner N=	Pump WWF to Channel Use rainfall forecast (EOS) Use rainfall forecast end of storm ons out tt d Harrison on	CHS Existing strategy Modify level set points Keep SEP at 250 MGD if pc Use storm characterizatior Use rainfall forecast (EOS) Use rainfall forecast Modify channel gates cont Other Modification Re-activate 30" force main	sssible rols	Keep SEP at 2 Use Islais Cre Use storm cha Use rainfall for	BFS BBS BBS BBS BBS BBS BBS BBS BBS BBS	Existir ssible Keep S I T/S levels Use st Use ra Use ra	SELS ng strategy SEP at 250 MGD if , torm characterizati ainfall forecast (EO ainfall forecast	Prioritize Prioritize Prioritize Prioritize	PID off Y Keep SEF Use four Use storn Use rainf Use rain	GFS strategy osemite T/S level of at 250 MGD if poss th pump (total at 15' m characterization fall forecast (EOS) fall forecast fall forecast fall for discharges fall for discharge sek N. outfall for disci- fall for discharge	ible D MGD)	Existing strategy Lower weir on 78" sewer	
NPM Modifications Other Modifications Control Elements CSD Preferential Discharges Passive controls of dropout Re-activate 30" force main Add active gate at Alana Way Prioritize Baker outfall for discharge Active controls of fropout Increased flow capacity at NPF Prioritize Howard/Brannan outfalls for discharge Active control at 16th and Harrison NPM Flushing Prioritize Islais Creek N. outfall for discharge Use storm characterization Increased flow capacity at NSFM Prioritize Evans outfall for discharge Use rainfall forecast Prioritize Fitch outfall for discharge Shut 16th St. Gate Prioritize Fitch outfall for discharge	NPM Modifications Passive controls of dropout Active controls of dropout Active control at 16th and Harrison Use storm characterization Use rainfall forecast Shut 16th St. Gate Rehab NPM with liner N=0.009 Other Modifications Re-activate 30" force main Increased flow capacity at NPF Add active gate at Alana Way Add active gate at Alana Way Prioritize Baker outfall for discharge Prioritize Howard/Brannan outfalls for discharge Prioritize Elsais Creek N. outfall for discharge Prioritize Evans outfall for discharge Prioritize Fitch outfall for discharge	Passive controls of dropout Active control at 16th and Harrison Use rainfall forecast Shut 16th St. Gate Rehab NPM with liner N=0.009	NPF Existing strategy Use rainfall foreca Use rainfall EOS: Rainfall foreca WA Passive Active of Use rainfall Shut 16 Rehab I	cost to determine NPM Modificatie e controls of dropou control at 16th an orm characterizatie infall forecast 5th St. Gate NPM with liner N=	Pump WWF to Channel Use rainfall forecast (EOS) Use rainfall forecast end of storm ons out tt d Harrison on	CHS Existing strategy Modify level set points Keep SEP at 250 MGD if pc Use storm characterizatior Use rainfall forecast (EOS) Use rainfall forecast Modify channel gates cont Other Modification Re-activate 30" force main	sssible rols	Keep SEP at 2 Use Islais Cre Use storm cha Use rainfall for	BFS BBS BBS BBS BBS BBS BBS BBS BBS BBS	Existir ssible Keep S I T/S levels Use st Use ra Use ra	SELS ng strategy SEP at 250 MGD if , torm characterizati ainfall forecast (EO ainfall forecast	Prioritize Prioritize Prioritize Prioritize	PID off Y Keep SEF Use four Use storn Use rainf Use rain	GFS strategy osemite T/S level of at 250 MGD if poss th pump (total at 15' m characterization fall forecast (EOS) fall forecast fall forecast fall for discharges fall for discharge sek N. outfall for disci- fall for discharge	ible D MGD)	Existing strategy Lower weir on 78" sewer	

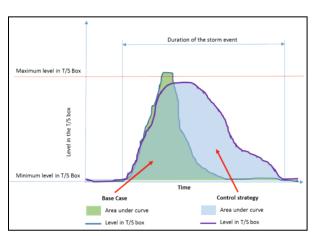
Alternative combinations



Summary

- System Characterization provides understanding and tools to conduct optimization evaluations
- Use modeling tools to identify and evaluate alternatives
- Watch out for potential adverse impacts
- Develop output format to facilitate comparison of alternatives







Page 24

Thank You

Donald.walker@aecom.com

