

Seawater Distribution Water Flow Model

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Natural Energy Laboratory of Hawai`i Authority (NELHA)



- ▶ 870 acre facility
- ▶ Opportunities for energy and ocean-related fields
- ▶ Seawater distribution system delivers over 35 million gallons per day of deep seawater (DSW) and surface seawater (SSW) to over 40 users

Pump Stations

- ▶ North System
 - ▶ 40"/28" pump station
 - ▶ North route
 - ▶ South route
 - ▶ Ka`u pump station
- ▶ South System
 - ▶ 55" pump station
 - ▶ Interim SSW pump station
 - ▶ DSW booster pump station



55" DSW pump station



40" DSW chamber

Goal

Analyze past pump station input and client output data to balance flow rates, and create automated flow diagram for easy interpretation.

Data before: Operations Table

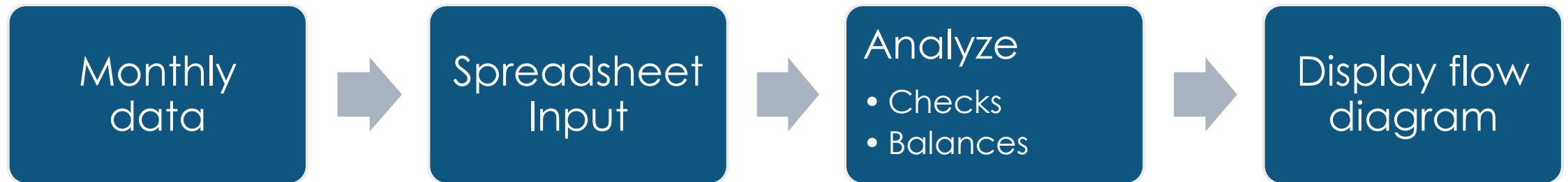
NATURAL ENERGY LAB OF HAWAII		PERIOD:		April 01 - May 01, 2014					
INFORMATION FOR OPERATIONS MANAGER:		DAYS:		30	43200	MINUTES			
TENANT / OTHER USAGE	kw	ELECT. (kWH/MO.)	FW (GAL)	FW (GPM)	SSW (GAL)	SSW (GPM)	DSW (GAL)	DSW (GPM)	
GUARD SHACK (FW)									
GATEWAY ENERGY CENTER									
SISH (Old Main Campus)									
SISH (North Campus 1)									
SISH (North Campus 2)									
SISH (NBC Hatchery)									
SISH (Grow Out / Lot 99)									
KING OCEAN FARM, INC.									
CYANOTECH (Low flow FW)									
CYANOTECH (High Flow FW / 18" DSW)									
RHSF (Site)									
RHSF (Road)									
KONA COLD LOBSTER #1 (Front)									
KONA COLD LOBSTER #2 (Back)									
MERA PHARMACEUTICALS									
FARM COMPOUND COMBINATION									
HOST IRRIGATION (1")									
LAB AIRCOND.									
ADM. AIRCOND.									
PUBLIC BEACH COMPLEX									
KONA COAST SHELLFISH									
TAYLOR SHELLFISH KONA (Site)									
TAYLOR SHELLFISH KONA (Expansion)									
INDO-PACIFIC SEA FARMS									
MOANA TECHNOLOGIES, INC. (HOST)									
KEAHOLE SOLAR - SOPOGY									
KAMPACHI FARMS (Old Meters)									
KAMPACHI FARMS (New Meters)									
KEAHOLE POINT HATCHERY									

Confidential Data

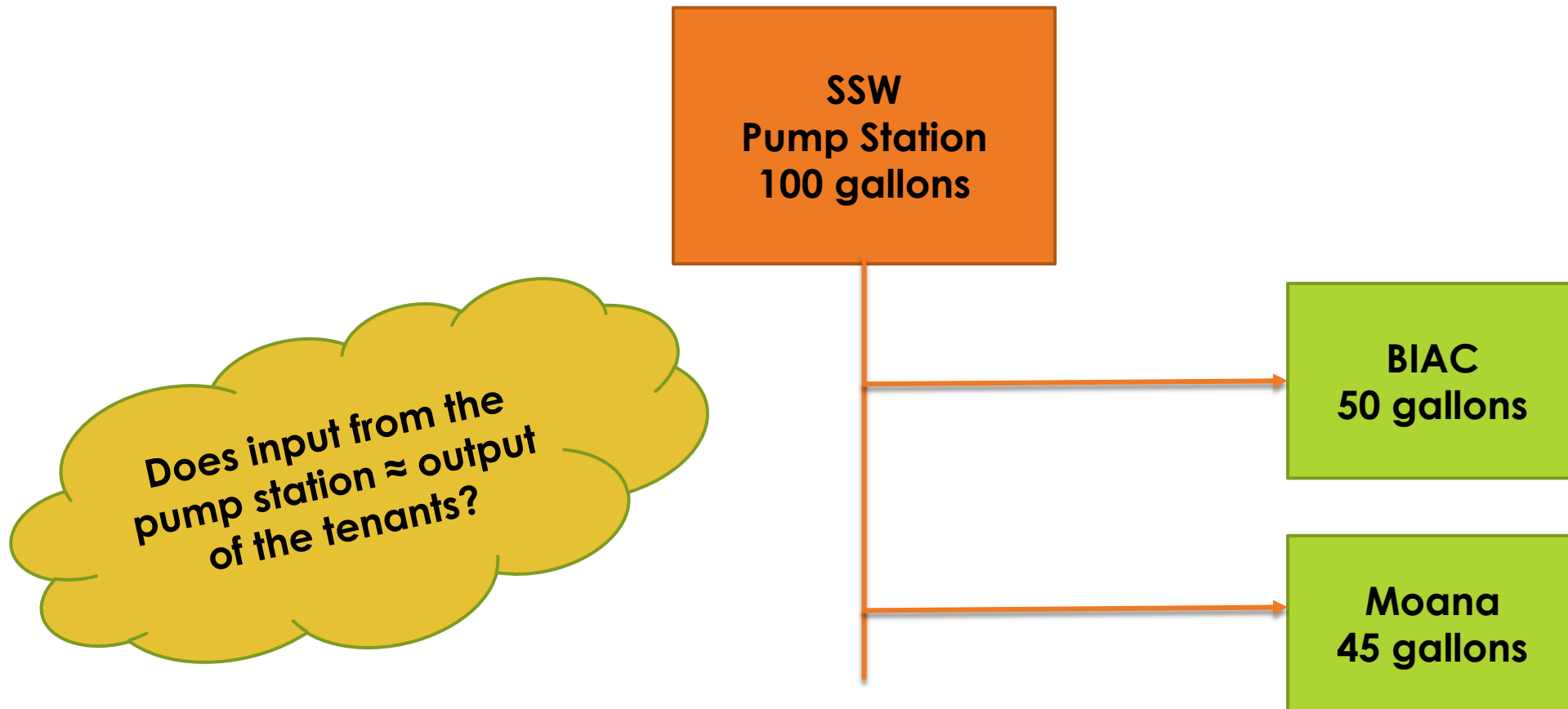
Chart Function

- ▶ Tool for troubleshooting flow meter discrepancies
- ▶ Comparison of last 6 months
- ▶ Flow meter checks within acceptable error

Overview



Simplified flow diagram



Check and balance output

Results						
Checks:	Name:	Description:				
Alert/Check	Crossover check calculations	Checks the two crossover to BIAC calculations to see if they're equal				
OK	55" SSW Check using calc1	Checks the first crossover to BIAC calculations				
Alert/Check	55" SSW Check using calc 2	Checks the second crossover to BIAC calculations				
Alert/Check	Interim SSW Check using calc 1	Checks the ISSW numbers in the range of ± acceptable error (C46) with BIAC crossover calculation 1				
OK	Interim SSW Check using calc 2	Checks the ISSW numbers in the range of ± acceptable error (C46) with BIAC crossover calculation 2				
	Checks average gallons over a period of six months with the current month running within the acceptable error range noted on the data sheet:					
OK	South SSW average check					
Calculations						
Description:	*numbers are in kilogallons					
1) BIAC crossover calculation 1						
BIAC total = 55" SSW pump station + some ISSW pump station (crossover to BIAC #)						
BIAC total:	55" pump sta.	crossover				
2) BIAC crossover calculation 2						
ISSW in = crossover to BIAC + BIAC 6" + Moana + fountain spillway + WHEA new campus						
ISSW	crossover	BIAC 6"	Moana	fountain	WHEA	
3) Interim SSW check using crossover calculation 1						
ISSW in = crossover to BIAC + BIAC 6" + Moana + fountain spillway + WHEA new campus						
ISSW	crossover	BIAC 6"	Moana	fountain	WHEA	
4) Interim SSW check using crossover calculation 2						
ISSW in = crossover to BIAC + BIAC 6" + Moana + fountain spillway + WHEA new campus						
ISSW	crossover	BIAC 6"	Moana	fountain	WHEA	

Conclusion

- ✓ Interpret the operation data sheet
- ✓ Designed flow diagram based on mapping the pipelines
- ✓ Check the balances between input of pump stations to output of clients

Further development

- ▶ Access database
- ▶ Analyze “real time” data
- ▶ Model future flow
- ▶ Improve on flow meters

Acknowledgment

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