

# Fulfilling the Promise of San Diego's Purple Pipe Program

Hooman Partow, City of San Diego Todd Engstrand, HDR Eric Scherch, HDR





# City of San Diego Recycled Water Plants



North City Water Reclamation Plant Opened 1997



South Bay Water Reclamation Plant Opened 2002



## In 2019, San Diego's Northern Service Area Recycled Water System turned 22 years old





Northern Service Area

- City Parks and Golf Courses
- Dual Plumbed Buildings
- Cooling Towers
- HOAs
- University of California, SD
- MCAS Miramar
- Caltrans
- City of Poway/Olivenhain MWD



# San Diego's Southern Service Area Recycled Water System is 17 years old





- Southern Service Area
  - Otay Water District
  - Caltrans
  - International Boundary and Water
    Commission Plant



## 2018-2020 Recycled Water System Condition Assessment and Optimization Plan

- Drought
- Pure Water San Diego
- Existing Recycled Water System Infrastructure
- 800 Recycled Water
  Metered Connections
- 11 MGD Average Recycled Water Demands
- Maintenance Costs





# San Diego's Purple Pipe System – What Does It Include?

- 104 miles of Transmission and Distribution Pipeline
- 3 Pump Stations
- 2 Storage Reservoirs
- 13 Pressure Reducing Stations
- 211 Transmission Valves (>16 in)
- 1,901 Distribution Valves
- 545 Air and Vac Valves







# Recycled Water System – How's The Performance?

Overall 20 year performance is Excellent

- Minimal pipe leaks/breaks
- Pump Station performance issues
- Valve failures

Goal of the study was to proactively assess system condition to develop a capital improvement program geared toward long term service success.



### Program Implementation – What's the Approach?

		DATA TRACEING LOG City of San Diego: FW System Contition Assessment and Optimization 81-Mar-18			
Туре	Descéption	Date Requested	Request Addressed to:	Requested Receipt by:	Date Received:
1 615	Geodatatase for Utilities and Land Uses (Existing and General Plan)	15-May-18	Fabiola Amarillas	Jernifer Duffy	
2 615	Other pertinent GS layers, including service area boundaries, easements and sphere of influence boundary	15-May-18	i Fabiola Amarillas	Jernifer Duffy	
3 Modeling	Current RW hydraulic model in EP4NET and relevent notes	15-May-18	Fabiola Amarillas	Jernifer Duffy	
4 Modeling	Description of capital facilities constructed since last hydraulic model update	15-May-18	Fabicia Amarillas	Jernifer Duffy	
5 Modeling	Capital Improvement Plans	15-May-18	Febicia Amarillas	Jernifer Duffy	
5 Modeling	Description and maps illustrating planned future system expansion	15-May-18	Fabicla Amarillas	Jernifer Duffy	
7 Modeling	Historical SCADA data for all available facilities for the last 2 years in 15 minute intervals	15-May-18	Fabicia Amarillas	Jernifer Duffy	
8 Modeling	Historical Supply and Production records for the last 5 years	15-May-18	Febicia Amarillas	Jernifer Duffy	
9 Enginzering	As Builts for BW System or Design Wans for current upgrades	15-May-18	Fabiola Amarillas	Jernifer Duffy	
10 Engineering	Past Master Plans and native files, if available	15-May-18	Fabiola Amarillas	Jernifer Duffy	
11 Engineering	Relevent Engineering Reports	15-May-18	Febicia Amarillas	Jernifer Duffy	
12 Engineering	Current Master Reclamation Permit	15-May-18	Fabicla Amarillas	Jernifer Duffy	
13 Engintering	List of any near term RW retrofit/conversion projects	15-May-18	Fabiola Amarillas	Jernifer Duffy	
14 Engineering	interagency Agreements	15-May-18	Fabiola Amarillas	Jennifer Cutty	
15 Engineering	3W Customer Fourly AMI data, if available	15-May-18	Fabiola Amarillas	Jernifer Duffy	
Engintering	Readly available reports describing the Utility's level of service, operations, maintenance, and reneval				
15	strategy (e.g. master plans, etc.).	15-May-18	Febicia Amarilles	Jernifer Duffy	
17 Finance	RW billing database, lest 10 years	15-May-18	Fabicla Amarillas	Jernifer Duffy	
18 Operations	Current Interagency agreements rel operations (MOOs, etc.)	15-May-18	Fabicia Amarillas	Jernifer Duffy	
19 Operations	Current seasonal operational control logic and settings for valves and pump stations	15-May-18	Fabiola Amarillas	Jernifer Duffy	
20 Operations	Cross connection testing program	15-May-18	E Fabiola Amarillas	Jernifer Duffy	
21 Operations	Customer complaint data (water quality, pressure, back ups, sewer overflows, etc.)	15-May-18	Fabiola Amarillas	Jennifer Duffy	

### **Data Gathering**



### Inspection Techniques and Forms



City of San Diego Recycled Water Condition Assessment Report SAN DIEGO

City of San Diego

+

0 6 500

South Bay

**Risk Model Development** 

e Water Maste

Fulfilling the Promise of the Purple Pipe System Sen Diego, CA

November 15, 2019

Condition Assessment Report and User Manual

City of San Diego Recycled Water System Condition Assessment and Optimization Plan

In-Line Valve and Air Valve Condition Assessment Technical Memorandum 8/01/2019

SAN DIEGO

### Condition Assessment Summary Tech Memos

## **Reservoir Inspections**

### In Service Interior Dive Inspections Exterior Inspections



Miramar (Meanley) Recycled Water Storage Reservoir – 9 MG



Black Mountain Ranch Recycled Water Storage Reservoir – 3 MG



# Reservoir Diving, Cleaning and Inspection

What's important here...





# Reservoirs – What Else Was Really Important

- Chlorination Systems
- Permanent back up water supply systems





2-INCH HIGH LINE



### EMPTY – DEC 11, 2011

## Pump Station Inspections – What to Consider

- Pump Performance and Testing
- Equipment Environment



Miramar (Meanley) 890 Zone and 790 Zone Pump Stations



Canyonside 825 Zone Pump Station



### Valve Inspections – How Do You Pick Em'?

- Risk Assessment Analysis CoF and LoF
- Workshop with your Client

	City of an Direct Network Direct Net					
SOMWAT D FAC BED NU	WANT THE ADDRESS OF AND	toth Annel 212 05 00/72 Bis F Laf WORKING &	WANEAU CAME	CLINES PROMINENT ACTIONS PLATERING	Presser Lann O Sean Sec Ond Some Datest of Par So	re Ford Some and Some Toron
710 006310 7151 0351488		1 11 11 12 12K 1	9750202 0 10 logr1	10/Fan 13/25 1 4		
T10 0000 T10 005430	Series Se		R* MORE: C IP Inde I CA VIECA II IaII Inde I CA VIECA II IAII INDE			
10	STREET, Y IS N IS		1147 0 10 10 10 10 10 10 10 10 10 10 10 10 1	Watten U I I		
723 042904 743 042940 743 042940			AN YORK C. DOLD BASS	Norther 171 81 4		
913 (RD-41) 728 (42958	ROMERCY 14 A B	5 100 17 30 V	2.13234 I 12452 Brack I	00.500 939 81 4 Worker 928 81 4		1 28 23 49
72 00190 72 00187		5 93 HL 7 MK 3 6 62 HL 34 3	14.402222 1 27997 8005 5 21.604214 1 12033 6005 6	Volument 425 0.5 4		33 128 33 4.86 33 128 34 4.86 34 128 34 4.96 34 4.96
18 81328	CONSTRUCT IN S		100-1 2 2452 0 80 1 2 1 1 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2	10,4100 1,21 4 1,21 2,1 4 1,21 2,1 4		01 2N 13 48
Y18 0712712 Y18 0712712 Y18 058464		1 102 011 MA 0 1 102 011 MA 0 1 102 011 MA 0	8 (2008) 2 (2004) (2007) 4 (2005) 2 (2004) (2007) 8 (2005) (2) (2007) (2007)	00,4100 013 01 0 00,4100 015 03 0 00,4100 015 03 0 00,4100 015 0 00,4100 0 0,4100 0 0,410000000000000000000000000000000000		1 2.19 33 6.00 1 1.00 23 4.00 1 27 33 4.0
福 福津	NEWS 1 1					1 1 1 1
710 (SMA)0 <sup>2</sup> 715 (SMA)0 <sup>2</sup>		D 110 127 Ars 4	A PECHA DI PETER POTTO C all'164 21 ILLE POTTO C all'164 21 ILLE POTTO	20 11.0% 1 4 20 4424 2 4		
T12 2008096 T13 2008436	NUTRRY IS S		8.302972 21 1013 More: 1402437 27 14004 More:			1 22 23 44
TT CARLON	ROMERATOR IS N	0 18 10 26 10 2 18 10 26 3	2 52 10 16 21 16 14 17 North	00 439 2 4 00 11.08 1 4		
73 00073	ATTENCY IS N HI					
Y S SCIPTIN				5 20s 9 1		
	開設する					<u>+ +</u>
TOU CHEND TOUR CHENNE	ACTION OF A T		51 5467 4 (PS) 8 80 1 (8 306 (7 1667 6 80 1	VERTER 25.15 1 4		2 23 24 48
+ III (2016)				20 2121 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		3 3 2 2
715 CH 28	ATTRACT St. 1 II		2.3(63) (a CR 200) 6(4)(3) (a 166 (a)			
Y 10 10 10 10 10 10 10 10 10 10 10 10 10	RANGER V III C III III		2010/01 12 120 1000			
720 101648			27 Maile 22 (1214 Note 3 05 764018 22 (1952 Mailes			1 22 43 4
可國利						
14			A SUBLE AT THE SOUTH AND A SUBLEY AND A SUBL			1 4 1 4
	ATTENY A A A			Novime 17 631 1 4 Oly 14 138 2 4		1 1 1 2
110 CONST						
100 04708 100 04046	MILLER A R R R	D 04 034 04 8	10-10 V Up 11 Base 1 ST ST 2012 - 1105 - 1106 - 1106 - 1106 - 1106 - 1106 - 1106 - 1106 - 1106 - 1106 - 1106 - 1106 - 1106 - 1106 - 1	Norten 222 84 1		2 200 22 4M 2 201 20 50
95 11411		5 12 143 50 6 1 100 100 100 100 100		5 번에 원 1 # HIM 원 7		
1.5		101 (03)				1 200 2 600 200 20 500
113 117430 713 (01288			142(18) 1 (12) (12) 1142(19) 4 (10) 1 (12)	Reality 21 4	1 1 1 1	2 20 11 49
Yub 00000			41 Status Y 1822 Each StateST Y 933 Marca Marca	00.4180 25.175 6.1 4		28 50 48 28 50 48
100	RH88 3 6 8		1980 1 Serie 20	Cortan Staty Staty		N B B
110 00100 110 001000 110 001000	RUMBRU S S N		84.25 % 12 % 12 % 14 % 14 % 14 % 14 % 14 % 14	20 0125 1 4 21255 2 4 21255 1 4		
119 G802	SCHOOL B B C	8 44 104 4 10 8 198 1951 275 9	1231313 La	# 13.54 i 4 # 25.25 i 4		
T 82 903482 T 81 903482	ATTENCY IS IN IN		A12790A 2) 12 Mart 1 (1.0172 12 10 10) Mart 1			
TILL DIRECT	A CARENT & CARENA		CONTRACTOR CONTRA			3 3 3 4
Low Horses	in the first	the fact for the	ere man how how how o	on here 13 4		





#### **SD Recycled Water Master Plan**

#### Valve Analysis

Likelihood of Failure (LoF) and Consequence of Failure (CoF) Evaluation Criteria

#### Consequence of Failure (CoF):

[Overall 1-5]

1. Consequence of Failure Scoring Matrix (100%)

CoF Factor	Description	Weighting
System Criticality (1-5)	System Performance and Criticality	60%
Extent of Pipe (1-5)	Length of Pipe to shut down if valve fails	30%
Pipe Score (1-5)	LoF pipe score from HDR analysis	10%
Total (1-5)		100%

#### Likelihood of Failure (LoF):

[Overall 1-5]

- 1. Field Condition Score (100% unless null)
  - a. If not, then:
- 2. Likelihood of Failure Scoring Matrix (100%)

LoF Factor	Description	Weighting
Age (1-5)	Age of Valve	30%
Type (1-5)	Valve Type (BFV,CKV,GV,etc)	30%
Static Pressure (1-5)	Pressure Zone - Ground Elevation	30%
Time of Concentration / Cl <sup>.</sup> Residual (1-5)	Capture potential buildup of solids in system	10%
<u>Total (1-5)</u>		100%



### Valve Inspections – What's Important?

- Coordination with operations
- Agreement on when and how to test
- Develop Plan B
- Work plan and schedule
- Coordination meetings before every week's operation



### Valve Inspections – What Did We Find?

- 13 Pressure Reducing Stations Varying States of Condition
- 25% Transmission Non-Operational
- 22% Distribution Non-Operational
- 41% Air Valve Non-Operational
- Valve Exercising Program
- Orange and Black Material Build Up In Valves







### Miles and Miles of Pipe – Where to Start?

### • Risk model development



• Access (Easements) (5%)



### **Cathodic Protection**

- AWWARF 2608
- External Corrosion and corrosion control of buried water mains
- Identified mains without CP
- Identified mains where potential readings did not meet NACE SP0169, Section 6.2.1.3 criteria



### Soil Corrosion

• AWWARF 2608

### Reported Causes of Corrosion Transmission Mains

Corrosive Soil 59%

### Reported Causes of Corrosion Distribution Mains









# Pipe Risk Model



- Land Use Zones (5%)
- Access (Easements) (5%)

### Impacts to Customers





# Pipe Assessment

- Risk model prioritized pipelines for condition assessment evaluation
- Soil corrosivity survey for 30-inch DIP along Dairy Mart Rd
  - Identifies soil corrosivity hot spots
  - Supports future cathodic protection implementation

Dairy Mart Road Pipeline - 30-Inch Ductile Iron



## Into The Future

- Maintenance Plan
- Capital Improvement Program Plan
- Cost of Service Study
- Asset Management Plan



