TOWN OF HILLSBOROUGH

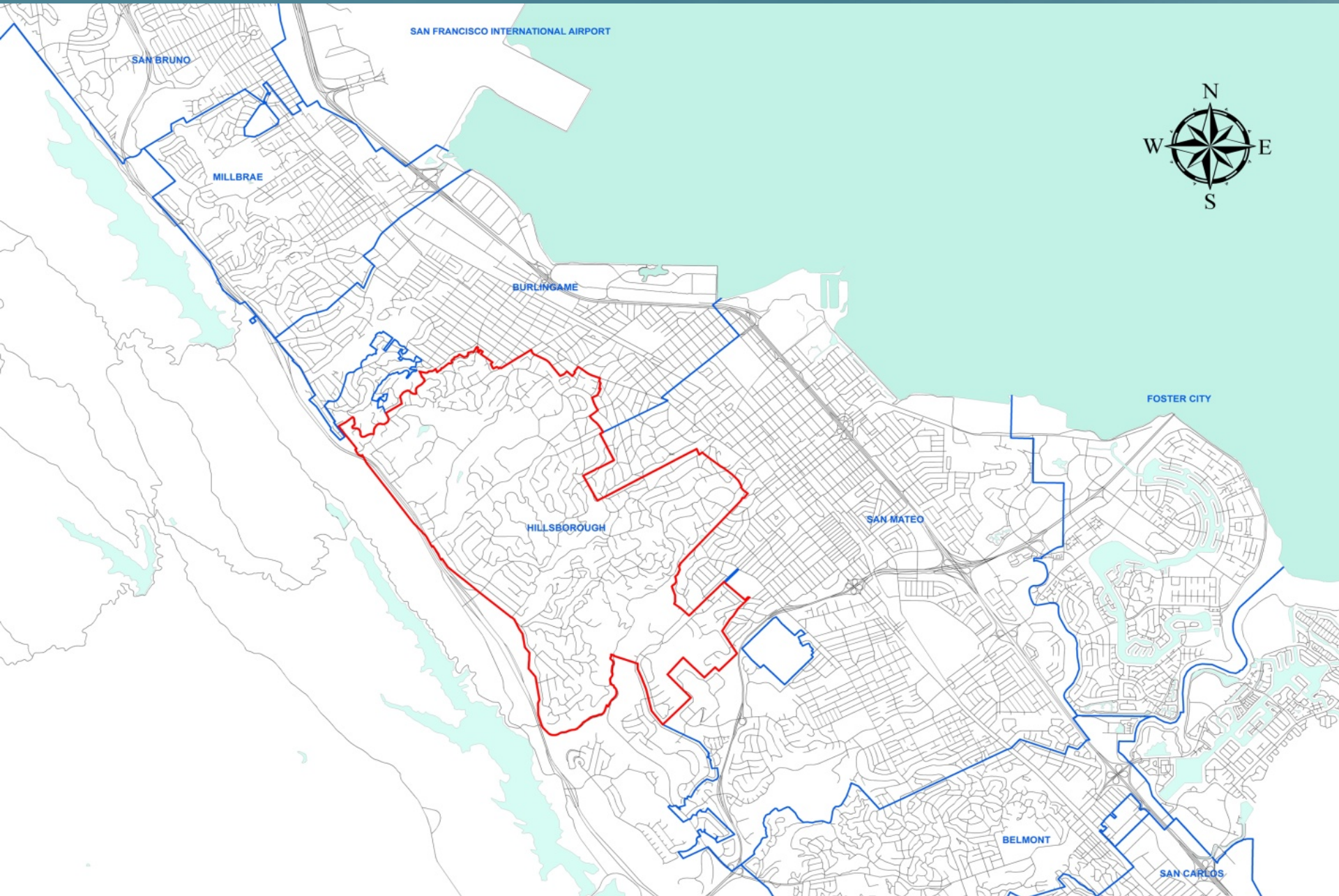
Reducing Water Waste During Unidirectional Flushing Operations

Presentation

Presentation will cover:

- Hillsborough Water System
- Unidirectional Flushing
- NO-DES Flushing
- NO-DES Procurement History
- CA Dept. of Public Health Approval History
- NO-DES Operations to Date
- NO-DES and UDF Operational Comparison
- Preliminary Comparative Analysis
- Conclusion

Hillsborough, California

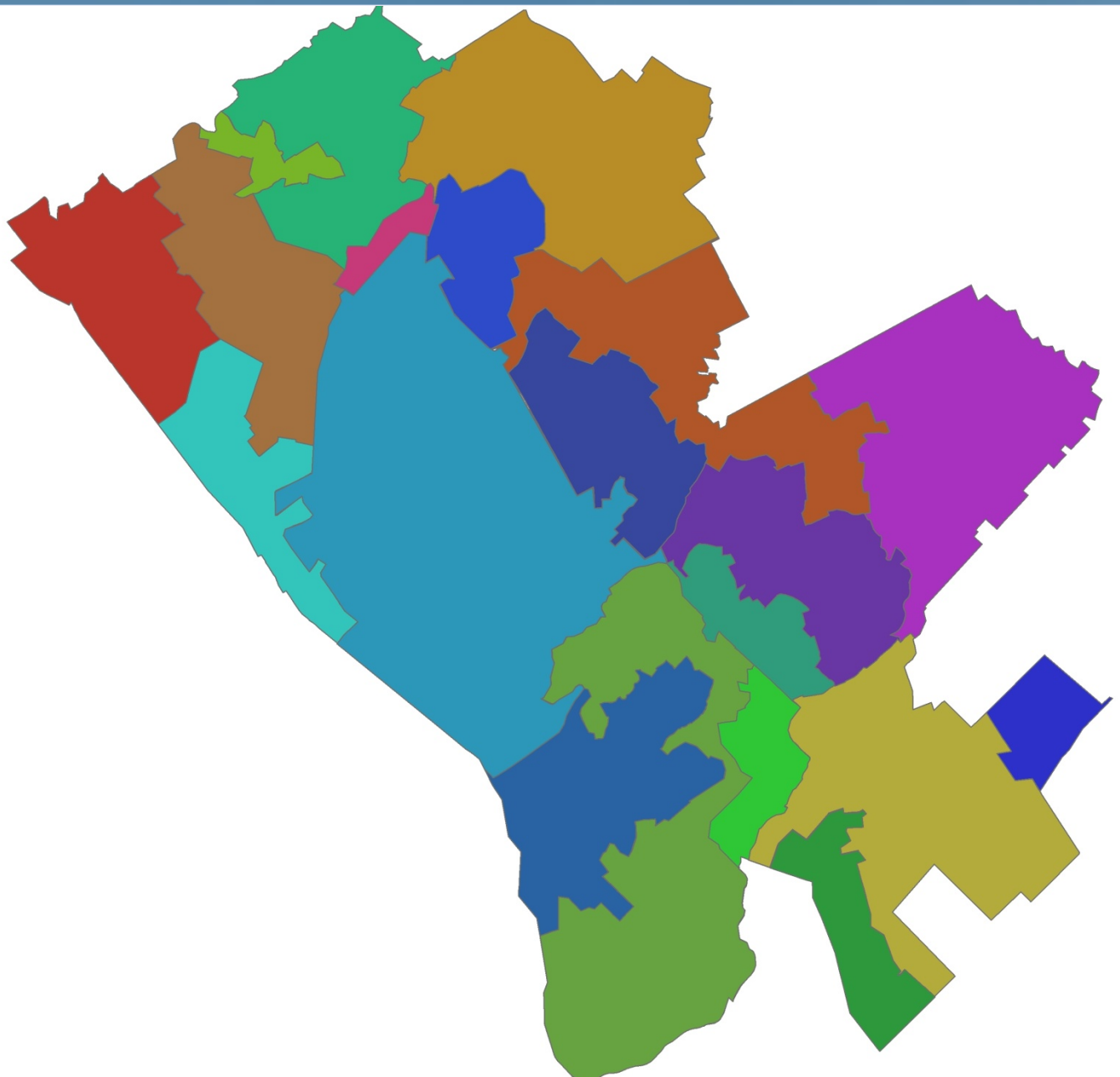


Hillsborough, California

Residential Community with:

- 6 square miles of hilly terrain
- 4,300 service connections (99% SFR)
- 116 miles of water main
- 18 Storage Tanks, 20 Pressure Zones
- 165 Dead End Water Mains
- 8.4 million gallons max storage
- High per capita water use
- 3.1 MGD (6 MGD Summer, 1 MGD Winter)
- 8” mains and 2” connections predominate

Hillsborough Pressure Zones



City Council Directive

In 2007, Hillsborough's City Council directed Public Works to:

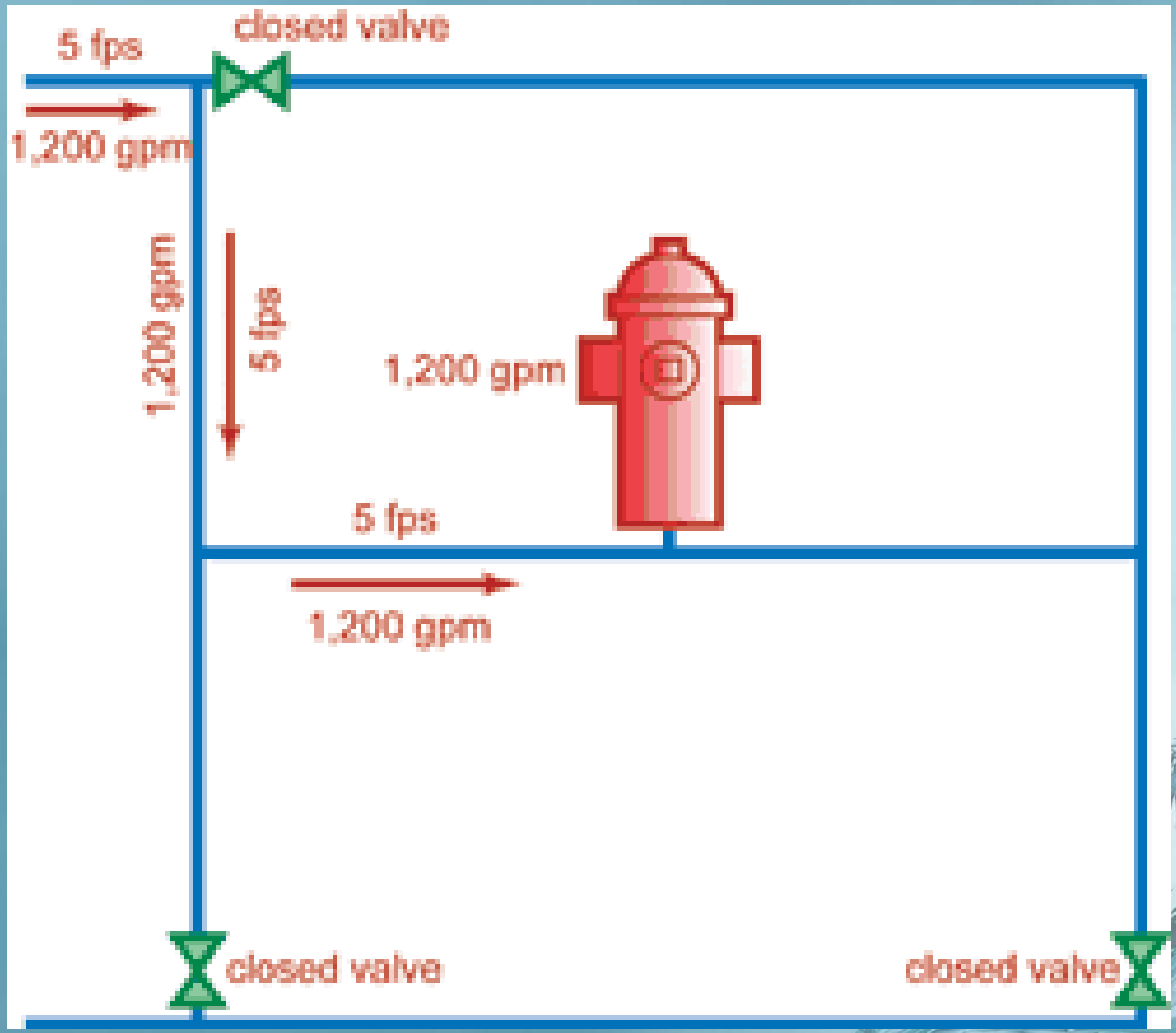
- Conserve water wasted during Unidirectional Flushing ("UDF").
- Eliminate customer complaints associated with UDF.


Pollard
water

Unidirectional Flushing

The goal of UDF is to:

- Isolate a section of water main.
- Flow water @ 5 feet per second.
- Remove and flush sediment and buildup from water main pipes.


closed valve
5 fps
1,200 gpm
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5 fps
1,200 gpm
closed valve
closed valve

Unidirectional Flushing

UDF does a good job, but also has challenges:

- Wastes a lot of potable water.
- Creates reportable storm water discharge event.
- Results in customer complaints.
- Risk of property damage (flooding).
- Risk of water hammer (water main break).
- Engineer’s study to do correctly.

NO-DES

What is NO-DES?

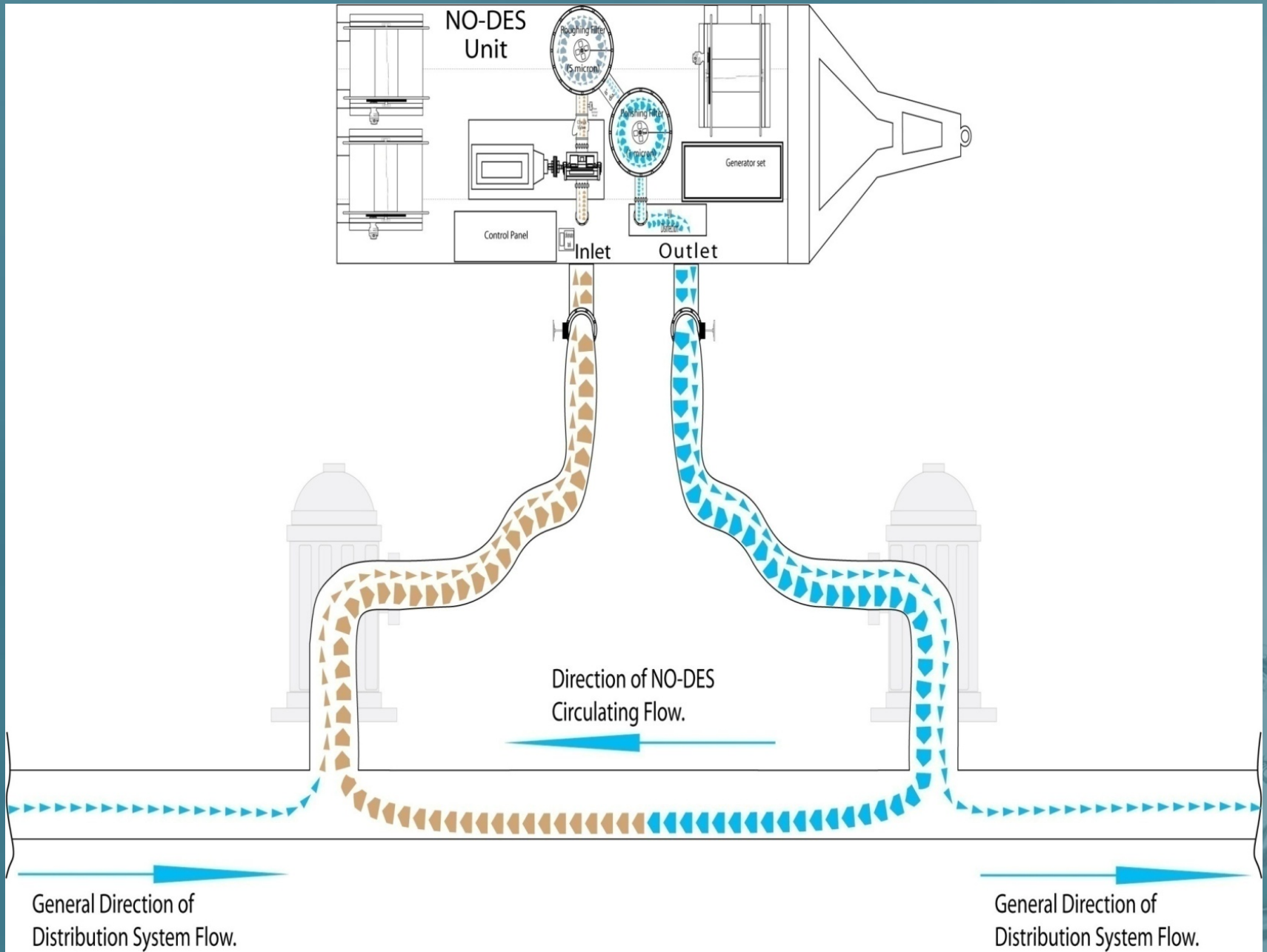
Neutral Output Discharge Elimination System

NO-DES

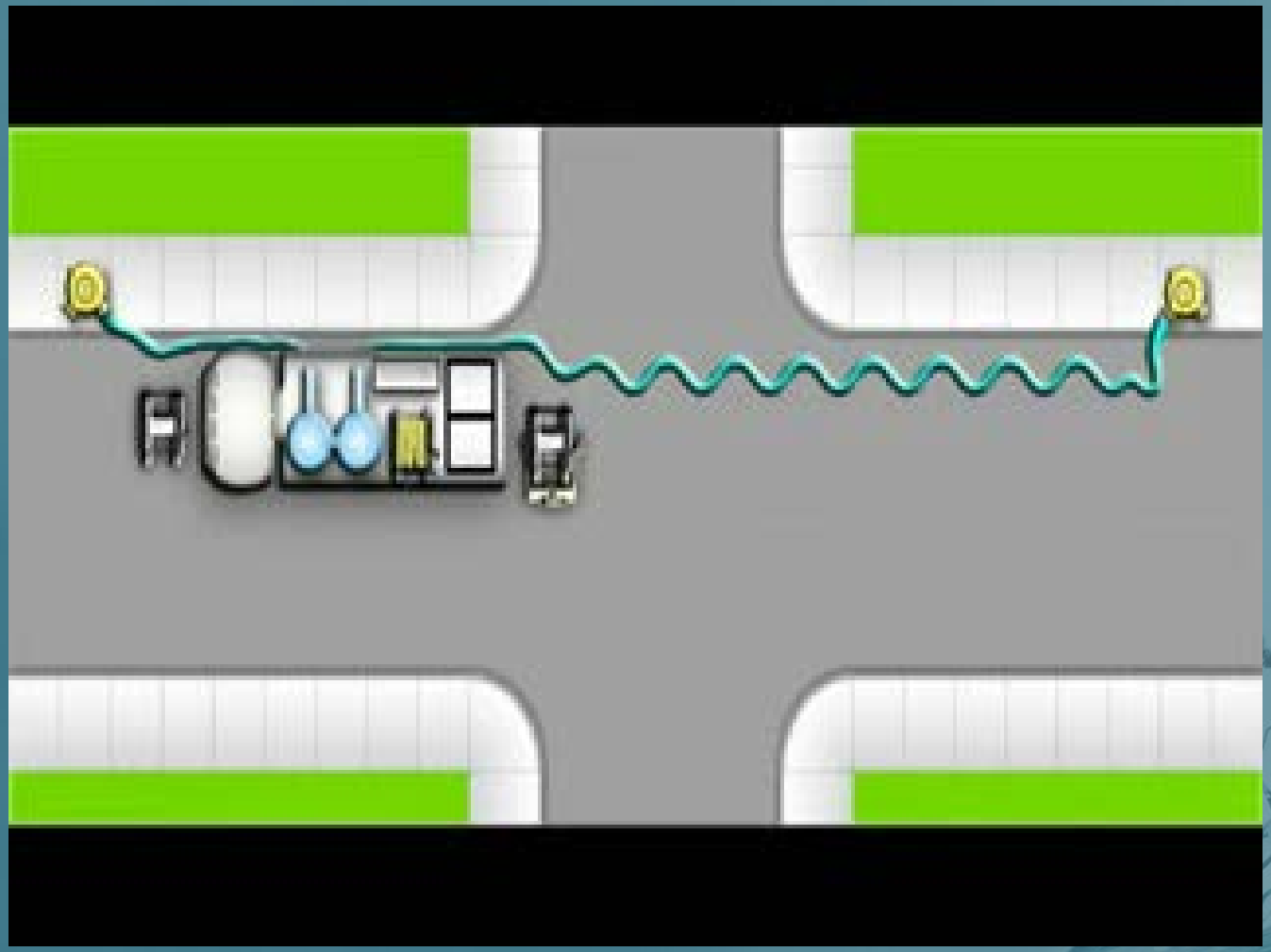
A new water flushing technology that:

- Connects to two water hydrants.
- Creates a reverse hydraulic loop between two water hydrants using on-board pump.
- Filters water to 1 micron absolute.
- Measures water flow and turbidity with on-board instruments.

NO-DES


NO-DES
Unit
Roughing filter
75 micron
Polishing filter
5 micron
Generator set
Control Panel
Inlet
Outlet
Direction of NO-DES
Circulating Flow.
General Direction of
Distribution System Flow.
General Direction of
Distribution System Flow.

NO-DES



NO-DES System

Hose, Hose Reel and Hose Burro

Hose Burro Unloading Hose Reel

Hose Burro Deploying Hose

Hose Deployed

Hose Ramps

Hose Connected to Hydrant

Filtration Chambers

Filter Chamber and Filter Bags

Bag Filters Before and After

Bag Filters Fully Loaded

Instrument Box

Turbidity Meters

Procurement History

Milestone	Date
Initial Contact with NO-DES	July 2007
Novato, CA Field Demonstration	Dec. 2008
CWSRF Forgivable Loan Contract Agreement	Sept. 2009
NO-DES Purchase Agreement	Nov. 2009
CDPH Demonstration Phase Approval	May 2010
NO-DES Delivery	Feb. 2011

Procurement History

Perceived Need: 2007

- City Council Directive.
- UDF operations suspended due to drought.
- Implement Dead End Flushing Program to maintain water quality.
- 5 years later, playing catch-up.

Procurement History

Investigation: 2007 - 2010

- Very Thorough
  - ✓ Numerous conference calls and meetings
  - ✓ Field demonstrations
  - ✓ Equipment Specification based on Hillsborough and CDPH feedback
  - ✓ Performance requirements in Purchase Agreement

Procurement History

Specifications

- 275 psi rating
- Truck mounted unit
- PTO powered water pump
- In-take and outlet turbidity meters
- ANSI certified parts
- US steel & manufacture (ARRA)
- CDPH approval

Procurement History

Grant: Sept. 2009

- Clean Water State Revolving Fund
  - ✓ EPA
  - ✓ State Water Resources Control Board
  - ✓ Expanded Use Program
  - ✓ ARRA Funded
- $300,000 “forgivable loan”
- Water Conservation and Green Infrastructure
- Grant was instrumental in Town’s decision to purchase NO-DES

California Department of Public Health

Milestone	Date
Contact CDPH - Intent to Purchase	Fall 2009
Field Demonstrations	Various
Established Condition of Operation	May 2010
Approval of WQ Monitoring Plan	July 2010
Revised WQ Monitoring Plan	October 2011
Revised WQ Monitoring Plan	October 2012

CDPH Approval

Conditional Approval: May 2010

- Demonstration Phase
- Operate at Town's own risk
- Approval of WQ Testing Protocol and SOP
- Very rigorous certified water quality testing
- Establish a performance baseline
- Normal Operations only in Hillsborough
- WQ Testing has been reduced to a more financially sustainable level

History of Procurement

Delivery & Training: February 2011

- Two weeks of training
  - ✓Hose Burro Certification
  - ✓Operator Certification

- Classroom and Field Training
  - ✓12 separate flushes
  - ✓6,700 feet of water main flushed

Operations to Date

WATER MAIN LINE FOOTAGE FLUSHED BY NO-DES			
Zone	**Start Date**	**End Date**	**Footage**
Major Hayes Zone	2/7/2011	2/16/2011	6,730
Forest View Zone	3/1/2011	6/7/2011	19,074
Sierra Zone	9/20/2011	5/17/2012	38,595
Total			**64,399**
% Complete			12%

Operational Differences

- Water Loss
- Labor
- Customer Satisfaction
- Certified WQ Sampling
- Quality of Flush
- Easements
- Risk of Flooding and Property Damage
- Supplies (Dechlorination Tablets vs. Filters)
- NPDES Reporting
- Water Main Jumper

Preliminary Analysis

Preliminary Analysis:

- Forest View Zone and Sierra Zone.
- UDF & NO DES Actual and NO-DES Future comparisons.
- Inherent challenges in comparing UDF and NO-DES costs.
- Report available early next year.
- Report will be updated on an ongoing basis.

Preliminary Comparative Analysis

Five Categories:

- Flushing Details and Water Loss
- Labor Costs
- Vehicle Fuel and Maintenance Costs
- Certified Lab Testing Costs
- Miscellaneous Costs

Preliminary Comparative Analysis

FLUSHING DETAILS, COMBINED	Historical UDF	NO-DES Actual	NO-DES Future
Number of Flushes	51	45	42
Total Feet of Line Flushed	53,120	57,669	59,711
Total Feet of Hose Deployed	N/A	31,424	25,825
Average Feet of Line/Flush	1,042	1,282	1,422
Total Gallons of Water Lost	1,217,405	31,424	25,825
Average Gallons of Water Lost/Flush	23,871	698	615
Gallons of Water Lost/Foot of Line Flushed	22.9	0.54	0.43
End Average NTU	1.22	0.376	N/A
Total Gallons Filtered & Treated	N/A	344,567	
Total Cost of Water Lost	***$ 8,056***	***$ 208***	***$ 171***
Cost of Water/Linear Foot Flushed	***$ 0.152***	***$ 0.004***	***$ 0.003***

Preliminary Comparative Analysis

LABOR DETAILS, COMBINED	Historical UDF	NO-DES Actual	NO-DES Future
Total Hours of Active Flushing	36	19	20
Total Hours of Flushing Operations	101	146	116
Number of Maintenance Workers/Flush	1	3	2
Number of Lead Workers/Flush	1	1	1
Average Labor Cost/Hr per Flush	$ 477	$ 1,386	$ 966
Total Labor Costs for Flushing Operations	***$ 24,398***	***$ 62,443***	***$ 40,557***
Cost of Labor/Linear Foot Flushed	***$ 0.459***	***$ 1.083***	***$ 0.679***

Preliminary Comparative Analysis

NO-DES EMPLOYEES AND DUTIES	
Employee	**Duties**
Lead Worker	NO-DES Operator. Takes water quality samples. Reviews maps
Maintenance Worker A	Hose Burro Operator. Controls Hydrants and Valves.
Maintenance Worker B	Sets up hose ramps. Directs traffic. Assists MW A.
(Optional) Maintenance Worker C	Assists with traffic control where necessary

Preliminary Comparative Analysis

UDF EMPLOYEES AND DUTIES	
Employee	**Duties**
Lead Worker	Review maps. Valve isolation. Flood control. Supervises Opps.
Maintenance Worker A	Review maps. Valve isolation. Flood control. Water Testing.
(Optional) Maintenance Worker B	Traffic control.

Preliminary Comparative Analysis

FUEL AND MAINTENANCE DETAILS, COMBINED	Historical UDF	NO-DES Actual	NO-DES Future
Pickup Truck	1	1	1
Pickup Truck Operations Cost ($.55/mile)	$ 269	$ 141	$ 133
NO-DES Unit	0	1	1
NO-DES Operations Cost ($1.50/mile)	$ -	$ 405	$ 378
Hose Burro Fuel/Maintenance	$ -	$ 120	$ 120
Filter Costs	$ -	$ 3,979	$ 4,120
Total Fuel and Maintenance	***$ 269***	***$ 4,645***	***$ 4,751***
Maintenance Costs/Linear Foot Flushed	***$ 0.005***	***$ 0.081***	***$ 0.080***

Preliminary Comparative Analysis

LAB TESTING DETAILS COMBINED	Historical UDF	NO-DES Actual	NO-DES Future
Total Lab Testing Costs/Flush	$ -	$ 148	$ 38
Total Lab Testing Labor Costs/Flush	$ -	$ 36	$ 24
Total Lab Testing Vehicle Operation Cost/Flush	$ -	$ 3	$ 1
Total Lab & Testing Costs/Flush	$ -	$ 186	$ 63
Total Lab Testing Costs	***$ -***	***$ 8,391***	***$ 2,633***
Lab Costs/Linear Foot Flushed	***$ -***	***$ 0.145***	***$ 0.044***

California Department of Public Health

Certified Lab Testing	Number of Tests Per Flush		
	Feb. 2011	Sept. 2011	Oct. 2012
Total Coliform P/A	2	2	2
Heterotrophic Plate Count	2	2	0
Color	2	1	0
Odor	2	1	0

Preliminary Comparative Analysis

MISCELLANEOUS COSTS COMBINED 5	Historical UDF	NO-DES Actual	NO-DES Future
PG&E Energy and System Maint. Costs	$ 255	$ -	$ -
De Chlor Tablet Costs	$ 3,188	$ 250	$ 250
Notifications Print Costs (6)	$ 369	$ -	$ -
Notification Labor	$ 1,302	$ 90	$ 90
Total Miscellaneous Cost	***$ 5,113***	***$ 340***	***$ 340***
Miscellaneous Costs/Linear Foot Flushed	***$ 0.096***	***$ 0.006***	***$ 0.006***

Preliminary Comparative Analysis

Total Costs, Combined	Historical UDF	NO-DES Actual	NO-DES Future
Total Cost of Water Lost	*$8,056*	*$208*	*$171*
Cost of Water/Linear Foot Flushed	*$0.152*	*$0.004*	*$0.003*
Total Labor Costs for Flushing Operations	*$24,398*	*$62,443*	*$40,557*
Cost of Labor/Linear Foot Flushed	*$0.46*	*$1.08*	*$0.68*
Total Fuel and Maintenance	*$269*	*$4,645*	*$4,751*
Maintenance Costs/Linear Foot Flushed	*$0.01*	*$0.08*	*$0.08*
Total Lab Testing Costs	*$0*	*$8,391*	*$2,633*
Lab Costs/Linear Foot Flushed	*$0.00*	*$0.15*	*$0.04*
Total Miscellaneous Cost	*$5,113*	*$340*	*$340*
Miscellaneous Costs/Linear Foot Flushed	*$0.10*	*$0.01*	*$0.01*
TOTAL COSTS	**$37,836**	**$76,027**	**$48,452**
Total Cost of program	**$0.71**	**$1.32**	**$0.81**

Conclusions for Hillsborough

- There are advantages and disadvantages to traditional UDF and NO-DES operations.
- NO-DES appears to cost more than traditional UDF operations in Hillsborough today, but it is difficult to compare.
- NO-DES cost per linear foot is expected to drop.
- There are important qualitative considerations.
- NO-DES appears to scour pipes better.
- Town will continue to track and report performance and costs.
- More details in Report early 2013

Field Demonstration to Interested Agencies

CONTACT INFORMATION

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Preliminary Comparative Analysis

Forest View Zone	UDF 2003-04	NO-DES 2011-12	NO-DES Future
Total Cost of Water Lost	*$4,264*	*$126*	*$91*
Cost of Water/Linear Foot Flushed	*$0.19*	*$0.01*	*$0.00*
Total Labor Costs for Flushing Operations	*$14,812*	*$38,331*	*$16,434*
Cost of Labor/Linear Foot Flushed	*$0.66*	*$2.01*	*$0.85*
Total Fuel and Maintenance	*$115*	*$1,676*	*$1,614*
Maintenance Costs/Linear Foot Flushed	*$0.01*	*$0.09*	*$0.08*
Total Lab Testing Costs	*$0*	*$5,509*	*$1,128*
Lab Costs/Linear Foot Flushed	*$0.00*	*$0.29*	*$0.06*
Total Miscellaneous Cost	*$2,475*	*$170*	*$170*
Miscellaneous Costs/Linear Foot Flushed	*$0.11*	*$0.01*	*$0.01*
TOTAL COSTS			
Total Cost of program	**$21,666**	**$45,813**	**$19,437**
Cost/linear foot	**$0.96**	**$2.40**	**$1.00**

Preliminary Comparative Analysis

Sierra Zone	UDF 2003-04	NO-DES 2011-12	NO-DES Future
Total Cost of Water Lost	*$3,792*	*$82*	*$79*
Cost of Water/Linear Foot Flushed	*$0.124*	*$0.002*	*$0.002*
Total Labor Costs for Flushing Operations	*$9,585*	*$24,112*	*$24,123*
Cost of Labor/Linear Foot Flushed	*$0.31*	*$0.62*	*$0.60*
Total Fuel and Maintenance	*$154*	*$2,969*	*$3,138*
Maintenance Costs/Linear Foot Flushed	*$0.01*	*$0.08*	*$0.08*
Total Lab Testing Costs	*$0*	*$2,881*	*$1,505*
Lab Costs/Linear Foot Flushed	*$0.00*	*$0.07*	*$0.04*
Total Miscellaneous Cost	*$2,639*	*$170*	*$170*
Miscellaneous Costs/Linear Foot Flushed	*$0.09*	*$0.00*	*$0.00*
TOTAL COSTS			
Total Cost of program	**$16,170**	**$30,214**	**$29,014**
Cost/linear foot	**$0.53**	**$0.78**	**$0.72**