

***Inflow and Infiltration/
Sewer Overflow Reduction Program
Part 1***

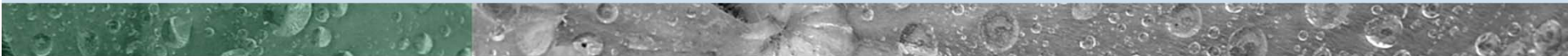
September 8, 2011





Agenda for this Presentation

- Background information about inflow and infiltration
- A quick look at some of the data we are using
- Where does I/I occur in LGVSD system?
- Where does LGVSD stand today in regards to I/I?
- A review of current I/I reduction programs
- Findings and Recommendations





Definition of Inflow, Infiltration, and I/I

Inflow

Rainfall that **enters the sewer system through direct connections**, such as downspouts and area drains that are connected to sewer laterals.

Infiltration

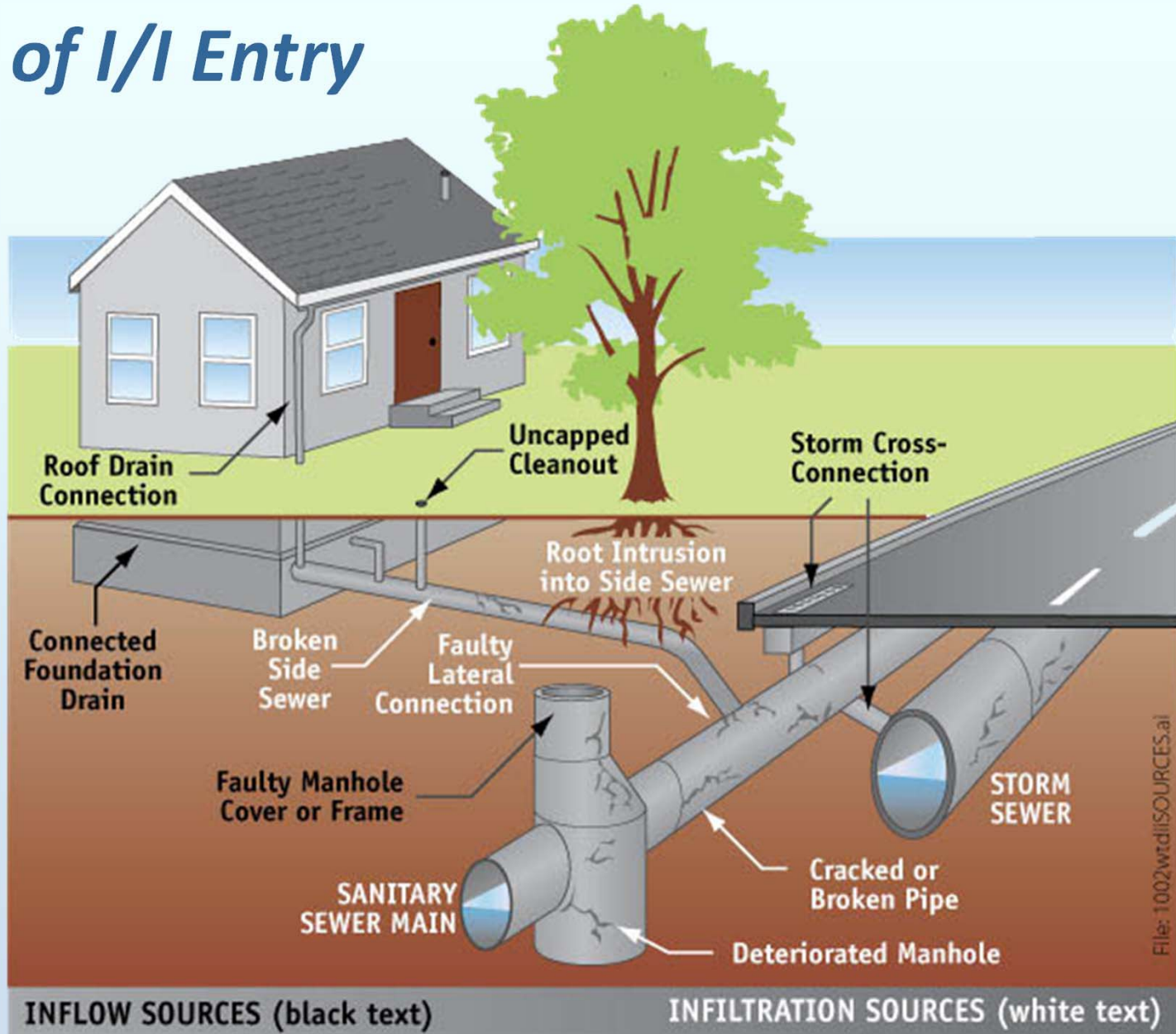
Rainfall that **accumulates as groundwater in sewer trenches** and then **enters the sewer system through failed joints and structural problems** (e.g. cracks and holes in pipes: Pre-1958 pipe joints leak).

Inflow and Infiltration (I/I)

I/I is the combination of inflow and infiltration.



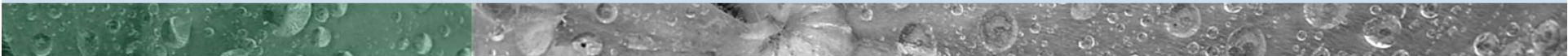
Points of I/I Entry



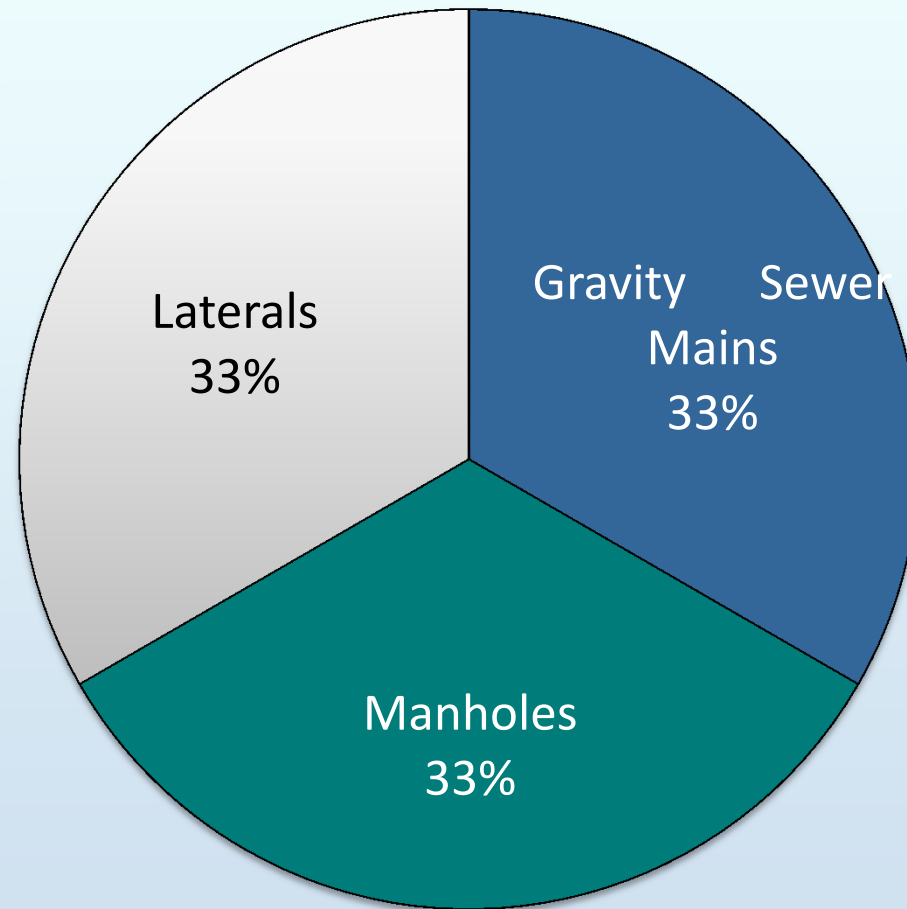


Nature of I/I at LGVSD

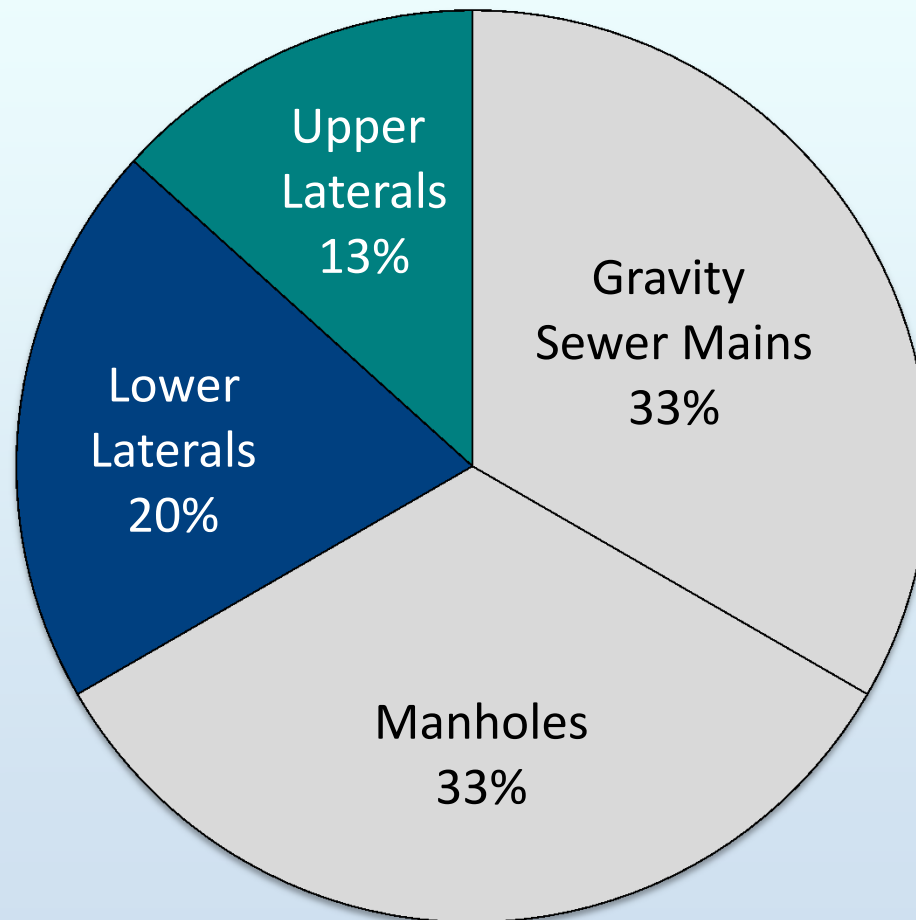
- Accurately determining the relative proportions of inflow and infiltration in the LGVSD sewer system is not possible at this time.
- LGVSD has identified a low number of inflow sources.
- For the purposes of this analysis, infiltration is assumed to be the major source of rainfall entering the sewer system.



Relative Contribution to Infiltration



Relative Contribution to Infiltration





Problems Caused by I/I

Damaged/deteriorated sewer system components (pipelines, laterals, manholes) cause overflows and allow entry of rainwater that can overload the sewer system.

Regulatory Problems

- Sewer overflows are prohibited*
- Exceeding peak flows and/or effluent quality parameters at treatment plant is prohibited

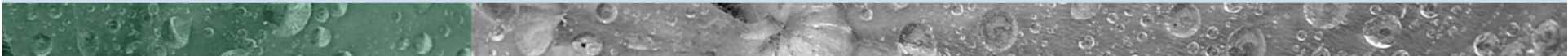
Health and Environmental Problems

- Potential harm to health and/or the environment

Public Perception and Political Problems

- Customers don't want spills, regulatory problems, etc.

* GWDR prohibits overflows to surface waters and those that cause a nuisance.

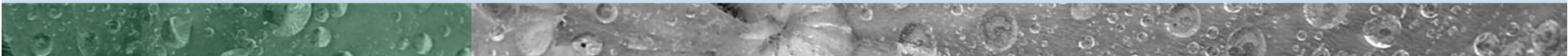




Where Does LGVSD Stand on I/I?

LGVSD has Moderately Elevated I/I

- Current Peak Hour I/I \approx 20 MGD
 - Peak Hour Wet Weather Flow of Record = 22 MGD
 - Average Dry Weather Flow = 2.3 MGD
- 1,000 gallons per acre per day at upper limit of “10 State Standards” for modern sewer system design
 - EBMUD Satellites range from 2,000 to 17,000 GPAD
- 690 gallons per capita per day is above the EPA guideline for excessive I/I of 275 gallons per capita per day





District Goal:

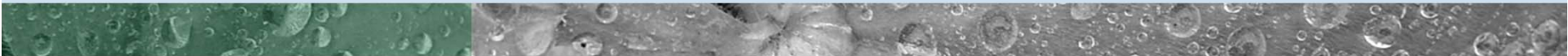
Proactive Regulatory Compliance

Effluent Blending during peak flow events may not be allowed in the future

- 16 of 52 treatment plants in the SF Bay Region are currently permitted to discharge blended effluent during peak flow events.
- The RWQCB is considering issuing permits that limit flows from collection systems to the secondary treatment capacity within the next 10 years.
- LGVSD's peak flow of record is 20 MGD and its secondary treatment capacity is 9 MGD.

Comment:

Proactive compliance likely to be less costly than meeting mandated compliance schedules.





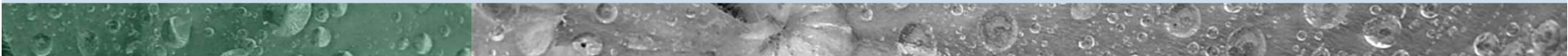
LGVSD's Approaches to Eliminating Blending

Approaches

- Reduce I/I entering the sewer system
- Increase secondary treatment capacity
- Construct storage for flows exceeding secondary treatment capacity until flows subside following storm events

Recommendation #1: Establish effluent blending compliance goals and timeframe.

Recommendation #2: Direct staff and consultants to identify the optimum mix of approaches to providing secondary treatment for all flows.





A QUICK LOOK AT DATA





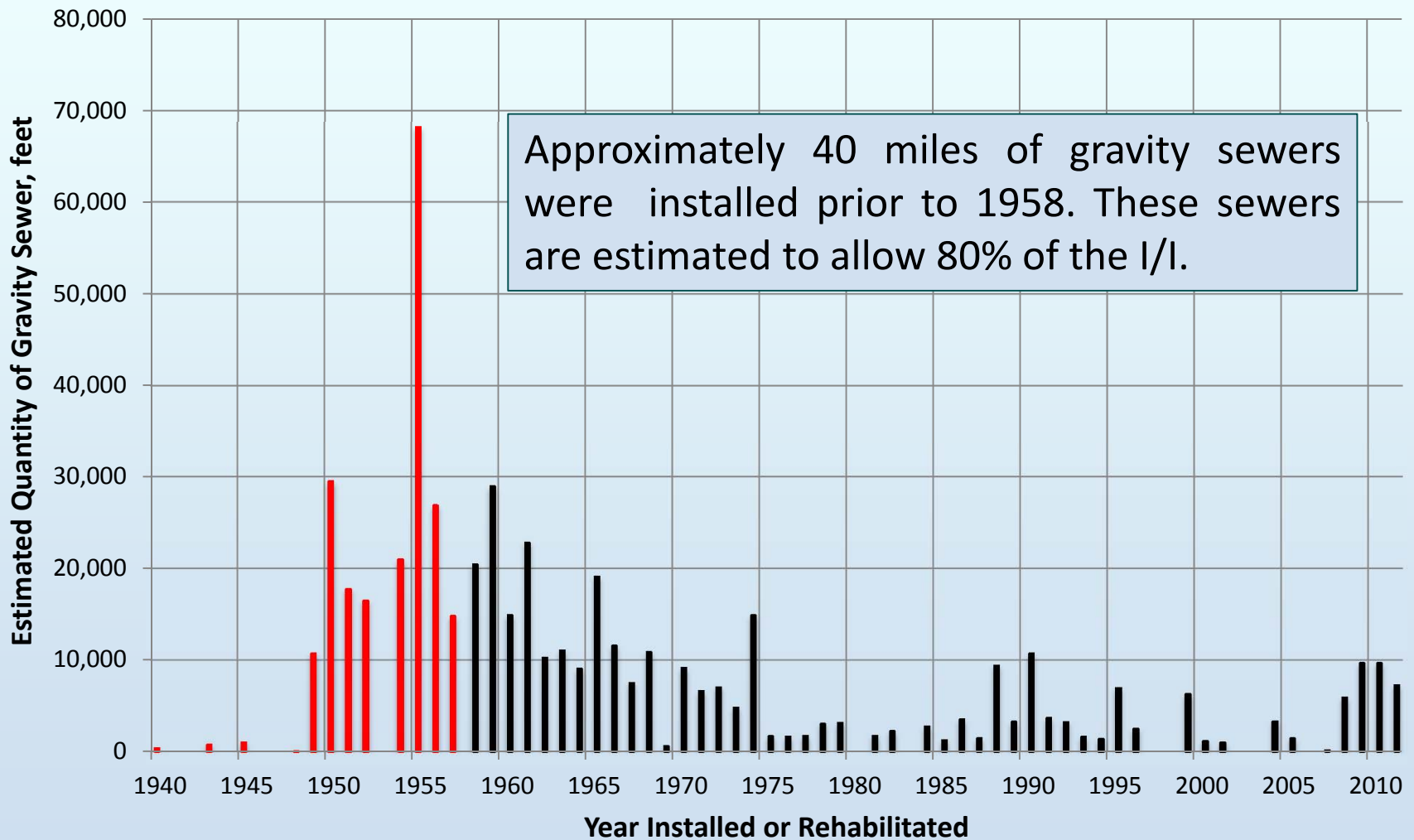
LGVSD Sewer System Facts

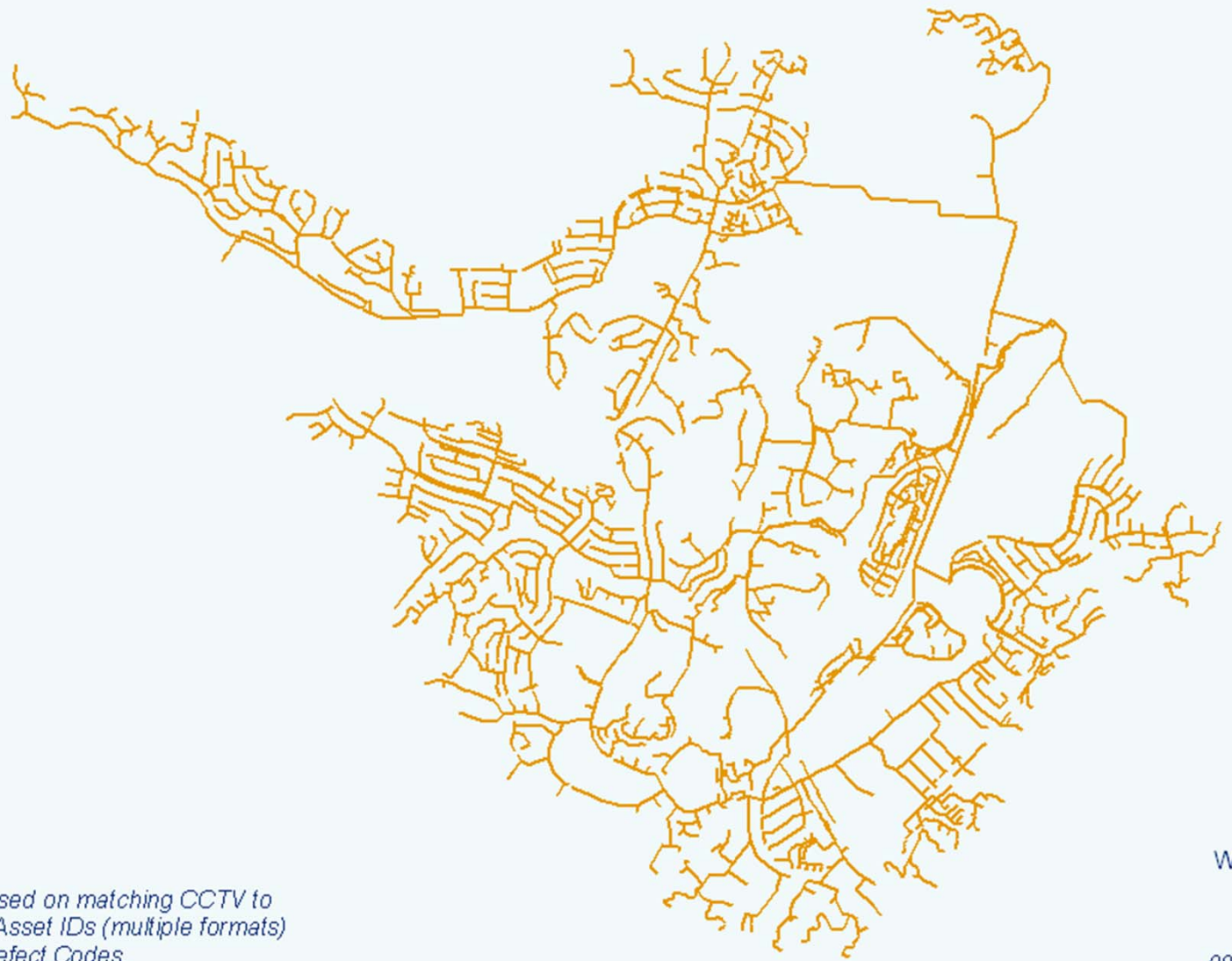
Parameter	Value
Population	32,000
Private Sewer Laterals, count	9,200
Private Sewer Laterals, miles (estimated)	72
Public Gravity Sewers, miles	101
Public Pressure Sewers*, miles	8
Manholes	2,900

* Also called force mains



Gravity Sewer Facts





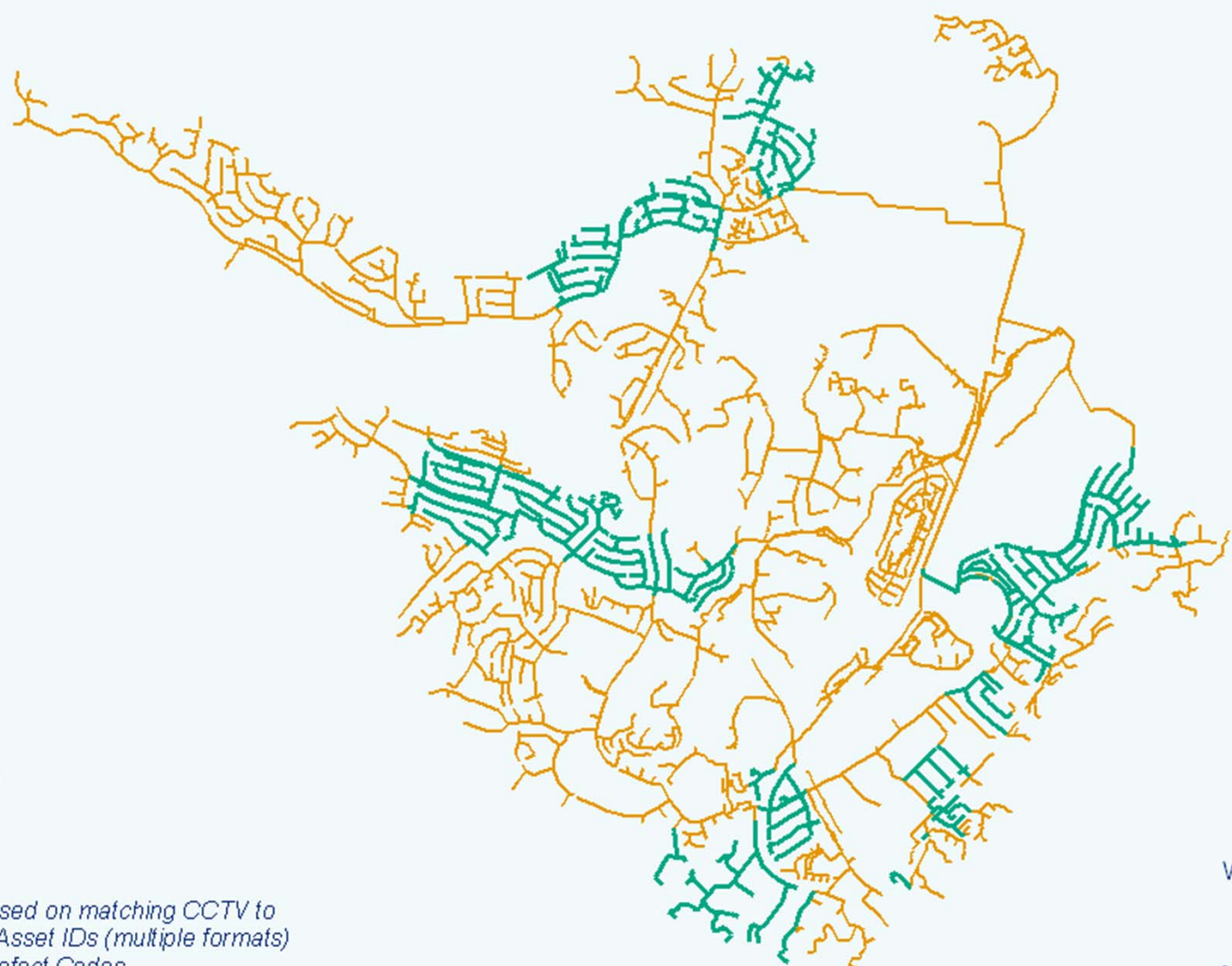
Legend

— Sewer Main

* Preliminary results based on matching CCTV to Pipes and Structures Asset IDs (multiple formats) and PACP codes to Defect Codes.



09/06/2011



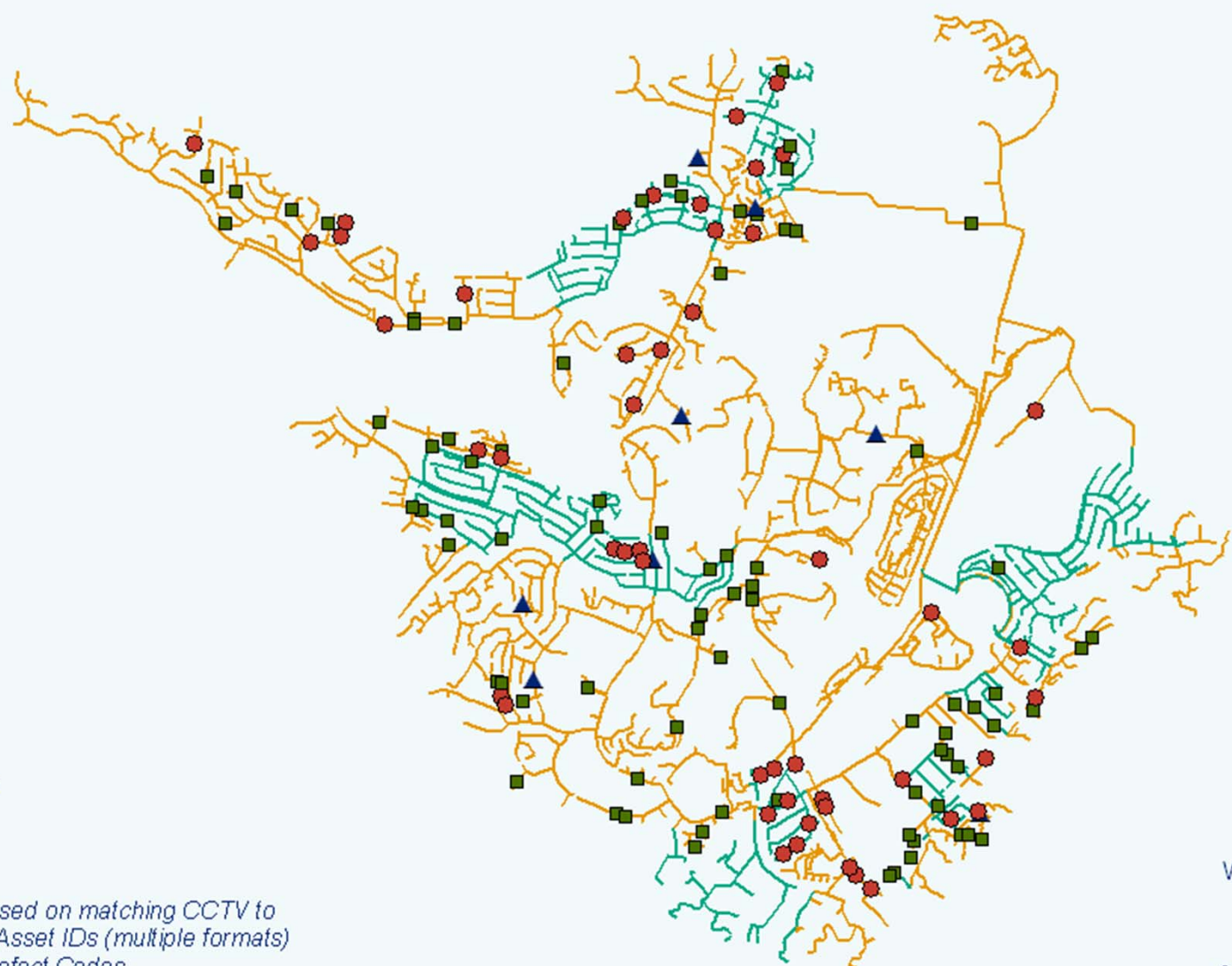
Legend

- Pre-1958 Pipe
- Sewer Main

* Preliminary results based on matching CCTV to Pipes and Structures Asset IDs (multiple formats) and PACP codes to Defect Codes.



09/06/2011



Legend

- Structural 5
- ▲ Structural 4
- Structural 3
- Pre-1958 Pipe
- Sewer Main

* Preliminary results based on matching CCTV to Pipes and Structures Asset IDs (multiple formats) and PACP codes to Defect Codes.

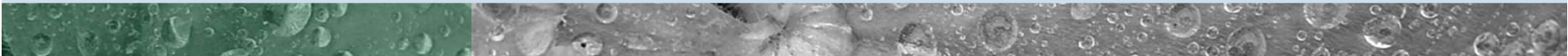


09/06/2011



Why do Pre-1958 Sewers Allow Infiltration?

- Pre-1950 Clay Sewers
 - Short lengths (2-3 feet) = many joints
 - Cement mortar joints fail, allowing infiltration
 - Fragile pipe materials easily damaged, providing entry points for infiltration
 - “Break In” lateral connection was common practice, creating entry point for infiltration
- 1950-1958 Clay Sewers
 - Short lengths (3-6 feet) = many joints
 - Cement mortar joints fail, allowing infiltration



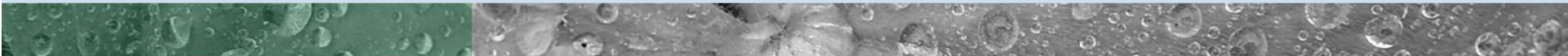


Private Sewer Lateral Facts

9,200 Private Sewer Laterals Totaling

- 8,800 Residential
 - 25 miles lower
 - 45 miles upper
- 400 Commercial
 - 2 miles lower
 - 3 miles upper
- Approximately half of laterals (4,600) installed prior to 1958

Comment: Typically 80+ % of pre-1958 private sewer laterals allow entry of I/I due to materials/methods of construction and damage/deterioration.



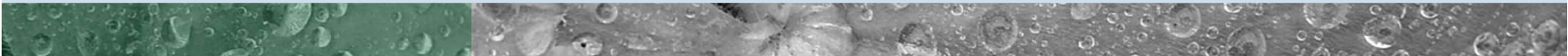


More about I/I Sources

District has an Estimated 20 MGD of I/I

- Gravity Sewers and Manholes
 - Two thirds of I/I \approx 13 MGD
 - 80% of I/I from Pre-1958 Gravity Sewers \approx 11 MGD
- Private Sewer Laterals
 - One third of I/I \approx 7 MGD
 - 80% of I/I from Pre-1958 Laterals \approx 6 MGD

Comment: 40% of the gravity sewers and half of the private sewer laterals are the likely source of 80% of the I/I.



I/I Reduction Effectiveness Depends on Approach

I/I Reduction Methods	Effectiveness at Reducing I/I*
Rehabilitate gravity sewers and manholes	20 - 25%
Add rehabilitation of lower laterals	40 - 45%
Add rehabilitation of upper laterals	70 - 75%

This is what LGVSD does now

Comments:

Current gravity sewer rehabilitation technology cannot eliminate 100% of the I/I.

The current gravity sewer rehabilitation program (mains, manholes, and lower laterals) is addressing less than 50% of the I/I.

* I/I reduction results reported by Princeton New Jersey, WEFTEC 2010 Proceedings



***CURRENT DISTRICT
I/I REDUCTION PROGRAMS***



Smoke Testing





Smoke Testing

38 Properties Failed the Smoke Test (0.6% of total tested)

- ≈ 5% failed in Santa Rosa
- > 10% failed in EBMUD Service Area

0.5 MGD of I/I Eliminated over Past 5 Years

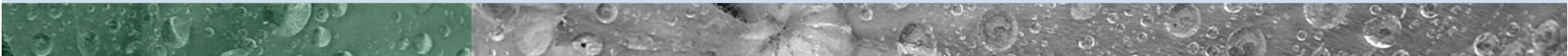
- \$0.40 per gallon per day eliminated

Comment:

Very cost-effective program.

Areas for smoke testing are based on staff observation and experience. This may not be optimum for identifying inflow.

Note: Results based on 2005-2010 smoke test results.





Gravity Sewer Rehabilitation

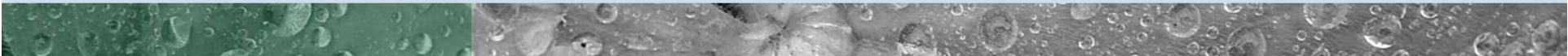
FY 2011/12 Gravity Sewer Rehabilitation and Replacement Budget ≈ \$1 million

- Includes rehabilitation/replacement of manholes and lower laterals

Comments:

Approximately 1 mile of Gravity Sewer Rehabilitation per year has the potential to eliminate ≈ 0.15 MGD of I/I per year

Most mainline rehabilitation projects are identified based on CCTV inspection, overflow history, and maintenance history. This may not be optimum for decreasing I/I.





***FINDINGS AND
RECOMMENDATIONS***



I/I Reduction and Cost of Current Programs

Program	Estimated Annual I/I Reduction, MGD	Estimated Annual District Cost	Estimated Annual Property Owner Cost
Smoke Testing	0.10	\$50,000	\$8,000
Sewer Main Rehabilitation	0.15	\$950,000	\$0
Totals	0.25	\$1,000,000	\$8,000

Comments:

Potential to reduce I/I by 2.5 MGD over 10 years.
10 Year cost is \$10.1 million (2011\$) or \$4 per gallon per day eliminated.



Summary of Recommendations

Recommendation #1

Establish regulatory compliance goals for effluent blending and related timeframe.

Recommendation #2

Direct staff and consultants to identify the optimum balance of approaches to providing secondary treatment for all flows.

Recommendation #3

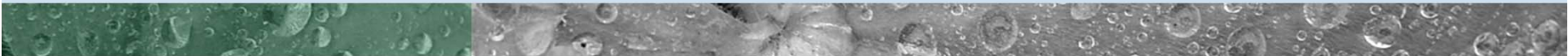
Consider including annual flow monitoring in the comprehensive I/I reduction program to provide information to focus efforts and to measure effectiveness.





Next Presentation

- Response to any questions raised
- Methods to improve effectiveness of current programs
- Additional approaches to I/I reduction



The image features a light blue gradient background. At the top and bottom, there are decorative horizontal bands. The top band is split into two parts: the left part shows water droplets on a light-colored surface, and the right part shows water droplets on a dark blue surface. The bottom band is also split: the left part shows water droplets on a green surface, and the right part shows water droplets on a grey surface. The text "ANY QUESTIONS?" is centered in the lower half of the page.

ANY QUESTIONS?