

# FEBRUARY 28, 2011

# BASEMENT FLOODING

# WARD 4

ROBERT P. KELLY, P.E.  
DIRECTOR OF ENGINEERING  
CITY OF WESTLAKE  
440-617-4145



# FEBRUARY 28, 2011 RAIN EVENT

- OVER 2" OF RAIN
- ABOUT 10" OF SNOW MELT
- MAJOR STREET FLOODING
  - HOLLYWOOD
  - DUNFORD
  - HILLIARD/HORSESHOE
  - CANTERBURY/STRAWBERRY
  - BRADLEY / LINCOLN
  - COLUMBIA / FIRST
  - CLAGUE / QUAIL HOLLOW
  - BRETTON WOODS SUBDIVISION



# West end Hollywood Dr.



2-28-11

# DOVER DITCH – BRETTON WOODS



# HISTORICAL RAIN EVENTS

- 2-28-11 RAIN EVENT
  - 25-50 YEAR STORM EVENT
  - 100 YEAR FLOOD EVENT

## TOP 10 RAIN EVENTS IN 100 YEARS

RANK	DATE	RAIN
1	9/7/1996	4.59
2	8/20/2005	3.55
3	8/13/1994	3.55
4	5/24/1955	3.36
5	10/15/1954	3.36
6	7/27/1928	3.38
7	9/12/1938	3.34
8	8/7/2007	3.33
9	2/28/2011	3.09*
10	2/6/2008	2.5*

Rainfall (inches) for given recurrence interval

Duration	2-month	3-month	4-month	6-month	9-month	1-year	2-year	5-year	10-year	25-year	50-year	100-year
10-day	1.70	2.05	2.36	2.78	3.19	3.47	4.29	5.34	6.17	7.30	8.19	9.14
5-day	1.37	1.64	1.86	2.15	2.47	2.69	3.34	4.23	4.95	5.96	6.82	7.74
72-hr	1.26	1.48	1.67	1.94	2.23	2.42	2.99	3.72	4.34	5.31	6.15	7.09
48-hr	1.18	1.38	1.53	1.78	2.04	2.22	2.75	3.42	3.99	4.87	5.66	6.55
24-hr	1.12	1.31	1.43	1.65	1.88	2.04	2.50	3.10	3.60	4.39	5.11	5.89
18-hr	1.06	1.23	1.34	1.56	1.77	1.92	2.35	2.91	3.38	4.13	4.80	5.54
12-hr	0.97	1.13	1.24	1.43	1.63	1.77	2.17	2.70	3.13	3.82	4.45	5.12
6-hr	0.84	0.98	1.07	1.24	1.41	1.53	1.88	2.32	2.70	3.29	3.83	4.42
3-hr	0.72	0.84	0.92	1.06	1.21	1.31	1.60	1.98	2.30	2.81	3.27	3.77
2-hr	0.65	0.76	0.83	0.96	1.09	1.18	1.45	1.80	2.09	2.55	2.96	3.42
1-hr	0.53	0.61	0.67	0.78	0.88	0.96	1.17	1.46	1.69	2.06	2.40	2.77
30-min	0.41	0.48	0.52	0.61	0.69	0.75	0.93	1.15	1.33	1.62	1.89	2.18
15-min	0.30	0.35	0.38	0.45	0.51	0.55	0.68	0.84	0.97	1.19	1.38	1.59
10-min	0.24	0.28	0.30	0.35	0.40	0.43	0.52	0.65	0.76	0.92	1.07	1.24
5-min	0.13	0.15	0.17	0.19	0.22	0.24	0.30	0.37	0.43	0.53	0.61	0.71

\*SIGNIFICANT SNOW MELT

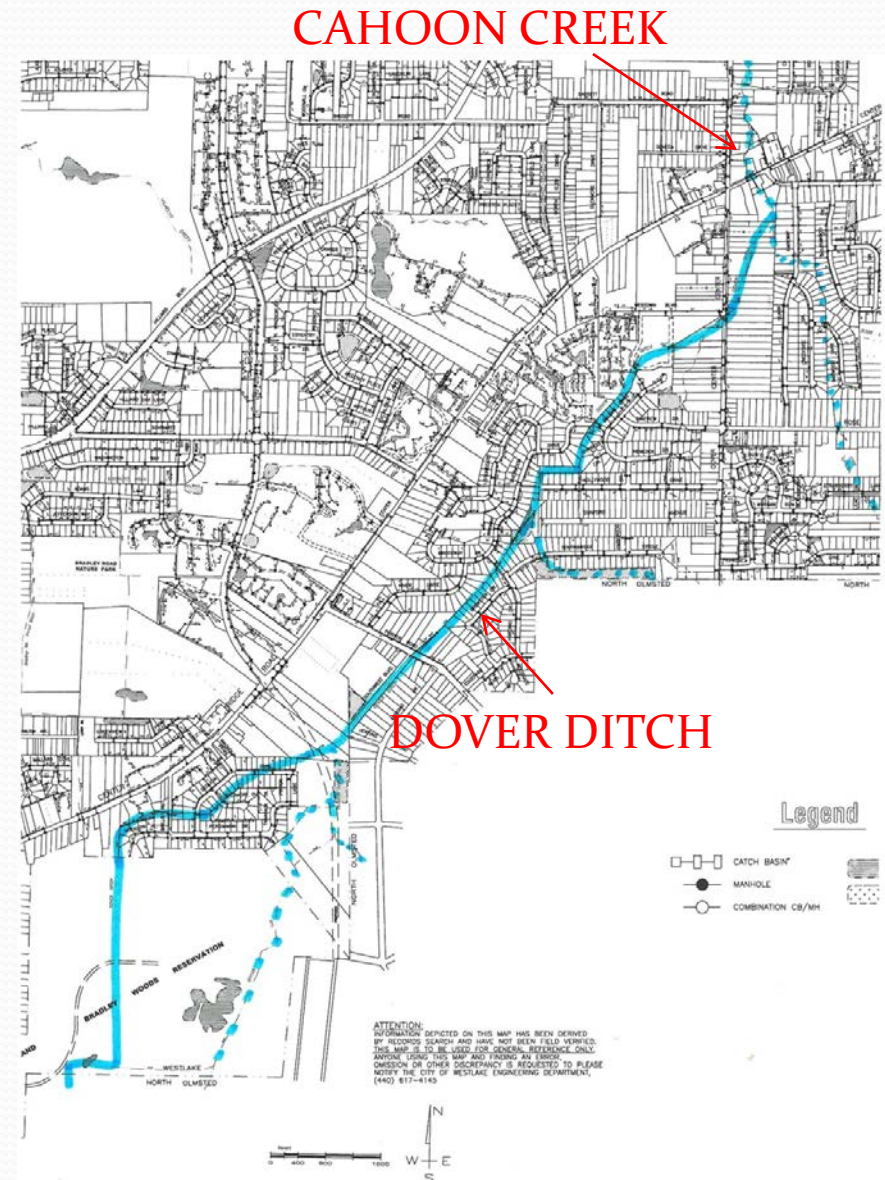
# WHY A 100 YEAR FLOOD EVENT?

- 2-20-11 RAIN (.93")
- 2-21-11 ICE AND RAIN STORM (.53") , DEVELOPED FALLEN BRANCHES
- 2-25-11 BLIZZARD 10"- 12" OF SNOW
- 2-26-11 RAIN (.57")



# DOVER DITCH

- CONNECTS TO CAHOON CREEK
- TRIBUTARY AREA
  - 2,200 ACRES
  - 100 YEAR FLOW
    - 729 CFS
    - 330,000 GALLONS/MIN
    - VOLUME OF WATER IN OLYMPIC SIZE POOL - < 2 MINUTES
  - WESTLAKE & N.O.



# DOVER DITCH @ DOVER CENTER



UPSTREAM



DOWNSTREAM



# DOVER DITCH



UPSTREAM @ SHERWOOD DR.



NORTH OF HOLLYWOOD DR.

# DOVER DITCH



NORTH OF HOLLYWOOD DR.  
UPSTREAM FROM HOLLYWOOD  
LATERAL



WEST OF HOLLYWOOD DR. @ BEND



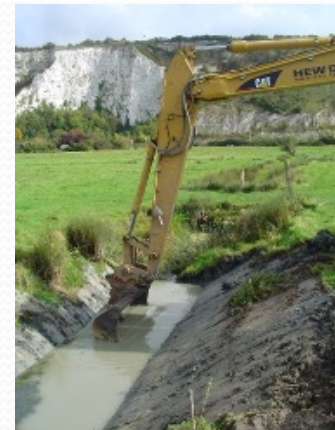
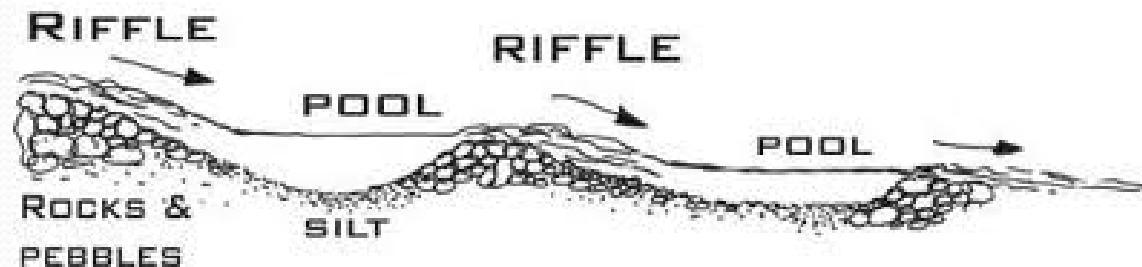
# 2008 ZWICK STUDY-DOVER DITCH

- PRIVATE BRIDGES ANALYZED
  - CAPACITY
  - HEIGHT
- CONCLUSION- IF THE BRIDGES ARE REMOVED THE WATER LEVEL (100 YEAR RAIN) WILL BE **MINIMALLY** LOWERED
  - DOVER CENTER
  - WESTOWN
  - SHERWOOD
  - HOLLYWOOD
  - HARDING



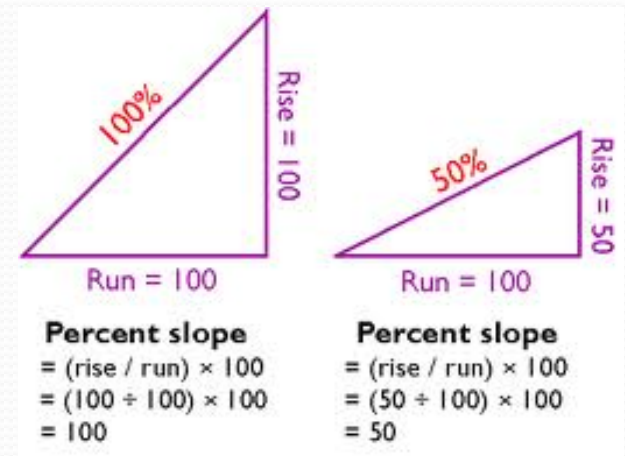
# RE-GRADING OF DOVER DITCH

- THE EXISTING PROFILE OF THE DITCH IS NOT UNIFORM AND IS UNEVEN.
- HYDROSPHERE ENGINEERING (ZWICK REPORT 2008)
  - LEVELING OUT THE DITCH WILL NOT HELP WITH THE FLOODING
  - THE DITCH WAS HISTORICALLY STRAIGHTENED AND IS NOW NATURALLY REESTABLISHING IT'S RIFFLE POOL PROFILE



# DOVER DITCH LOWERING

- DITCH **CAN NOT** BE LOWERED DUE TO FLAT SLOPE AND FEDERAL ENVIRONMENTAL REGULATIONS IN PLACE
- CAHOON CREEK TO HARDING- **FLAT**
  - DOWNSTREAM SECTION- 2,000 FEET
    - .15% SLOPE
    - TOTAL FALL OF 3 FEET
  - UPSTREAM SECTION-5,000 FEET
    - .04% SLOPE
    - TOTAL FALL OF 2 FEET



# HOLLYWOOD / DUNFORD AREA

- DOVER DITCH
- EHLE LATERAL
  - 242 ACRES



PHOTO #1

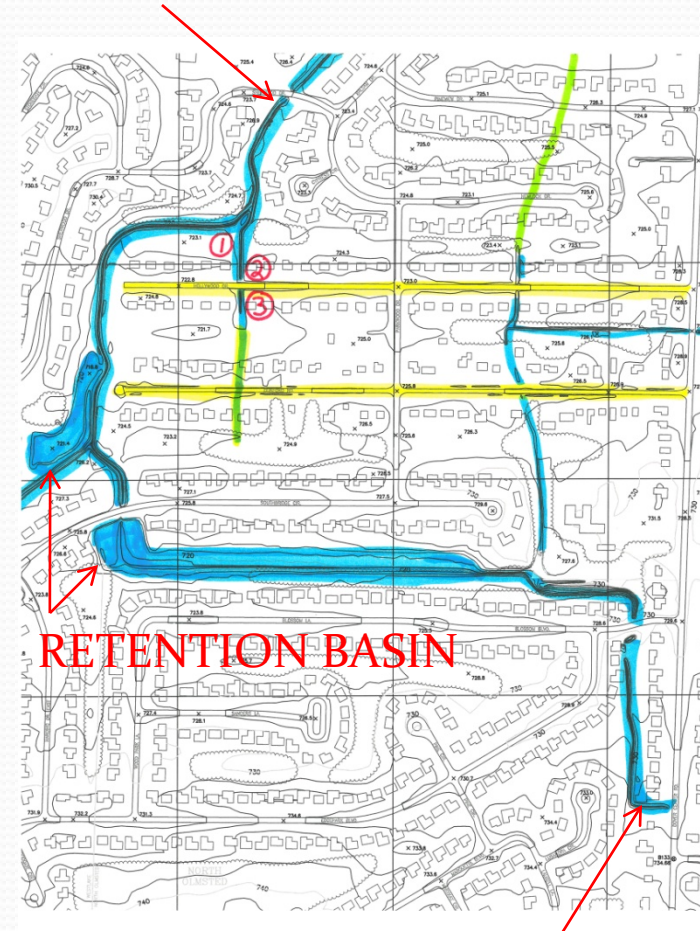


PHOTO #2



PHOTO #3

DOVER DITCH

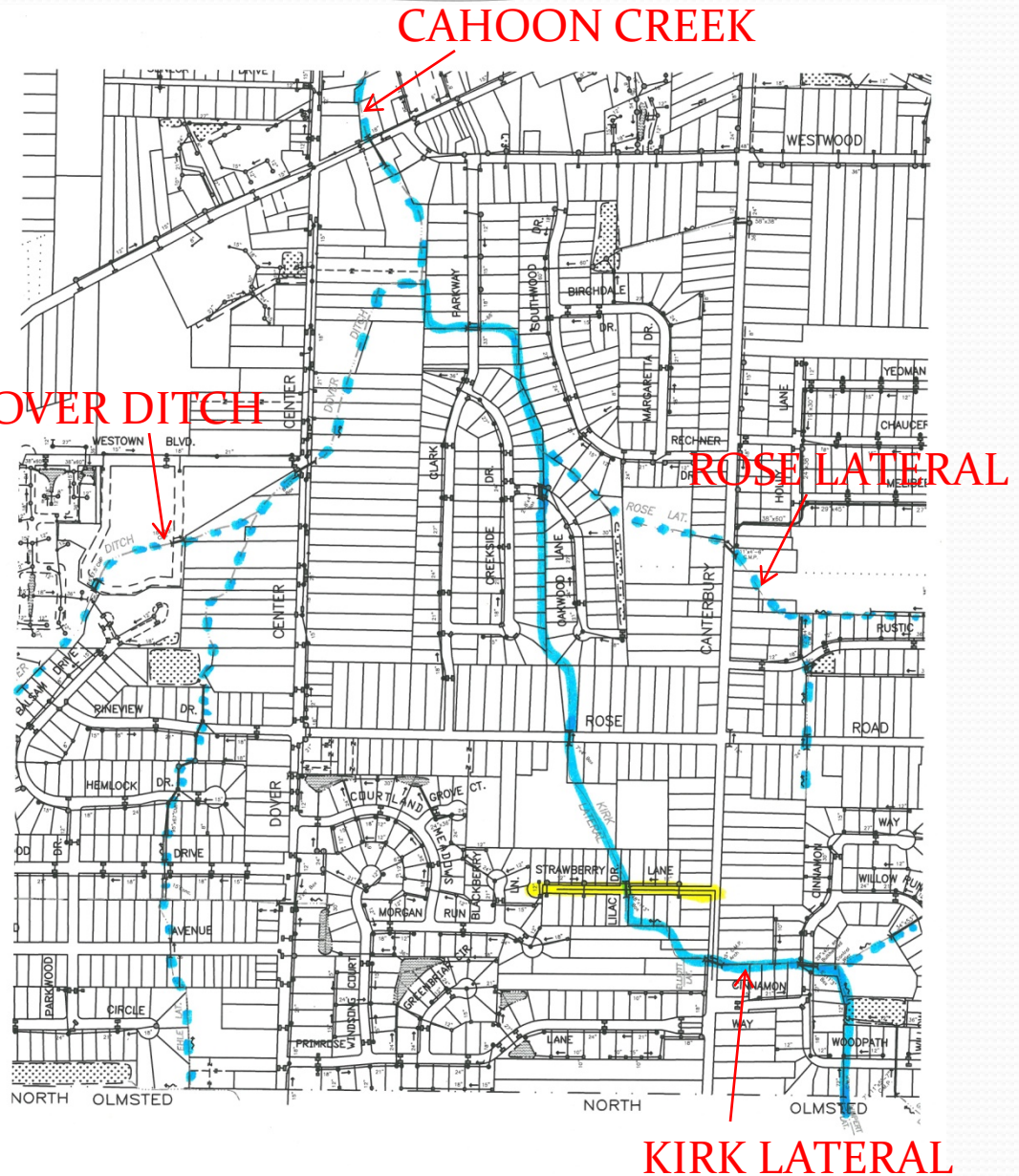


RETENTION BASIN

EHLE LATERAL

# STRAWBERRY LANE AREA

- KIRK LATERAL
  - CONNECTS TO CAHOON CREEK
- TRIBUTARY AREA
  - 615 ACRES
  - WESTLAKE & N.O





# KIRK LATERAL



UPSTREAM @ ROSE ROAD



DOWNSTREAM @ STRAWBERRY LANE

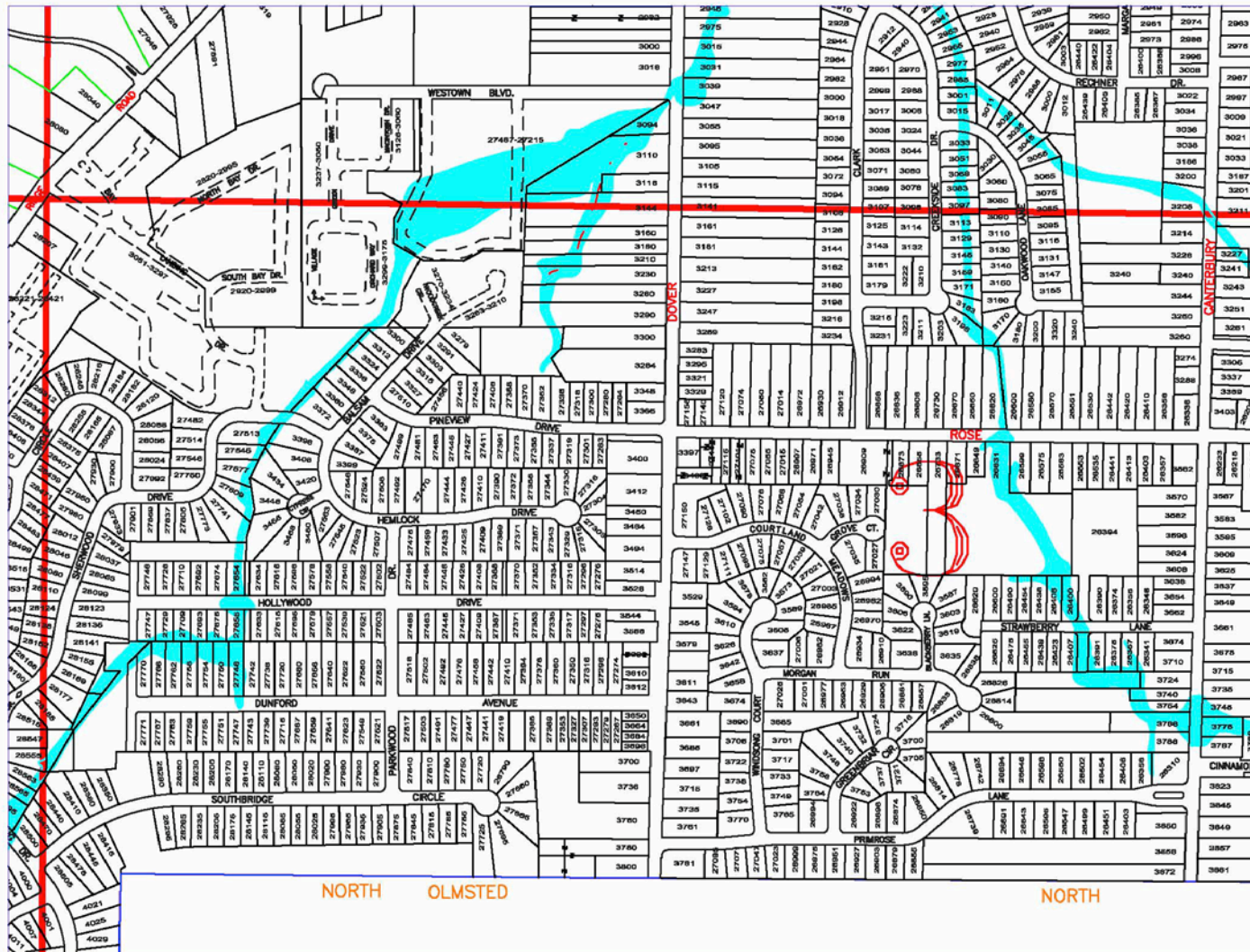
# KIRK LATERAL & DOVER DITCH



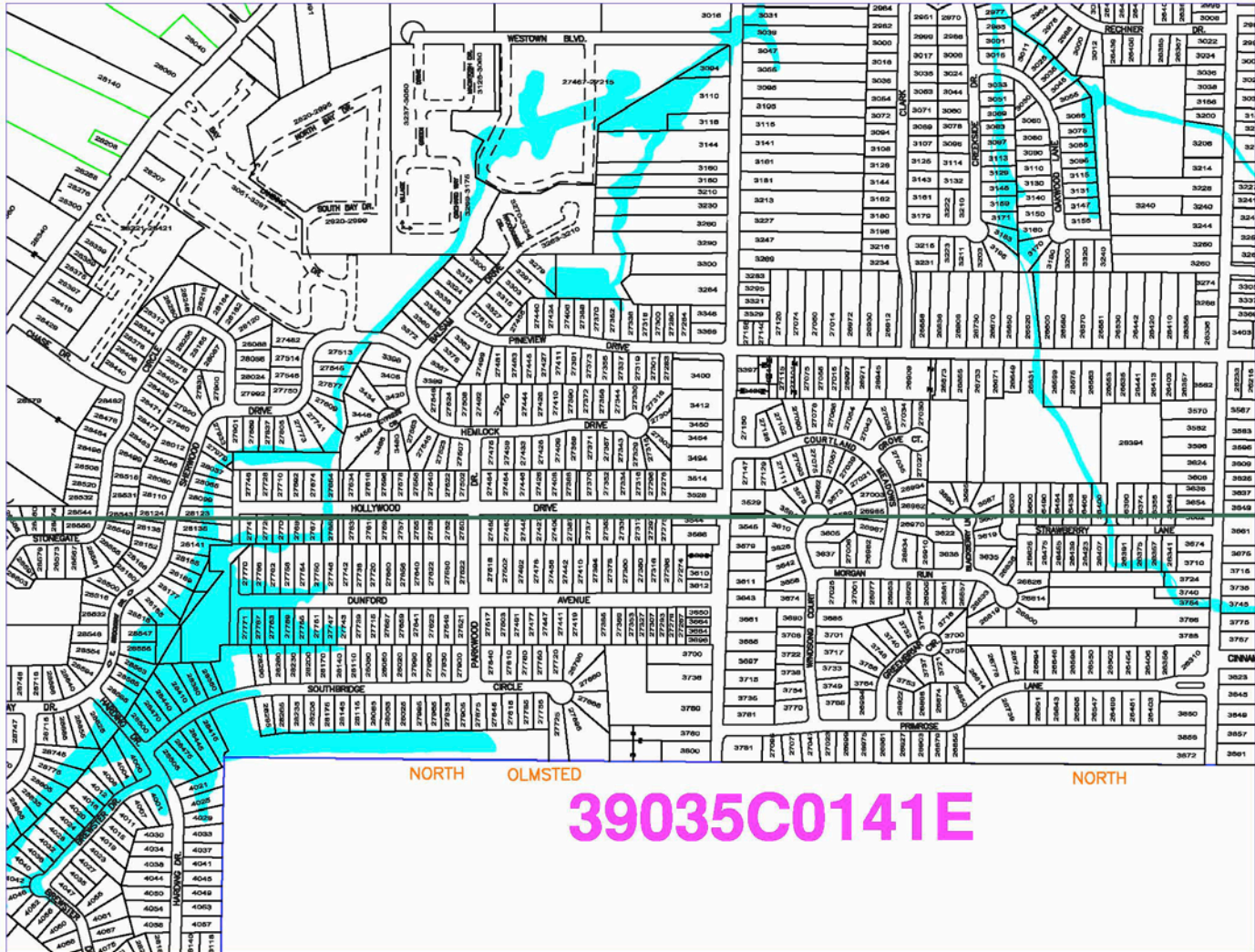
# CITY DITCH MAINTENANCE



# 1978 FEMA FLOOD PLAIN MAP



# 2010 FEMA FLOOD PLAIN MAP



# STORM SEWER DESIGN

- PRIMARY STREETS- 10 YEAR STORM
- SECONDARY STREETS- 5 YEAR STORM
- RETENTION BASIN- 10 YEAR STORM
- COUNTY CULVERTS- 25 YEAR STORM

# RETENTION BASINS



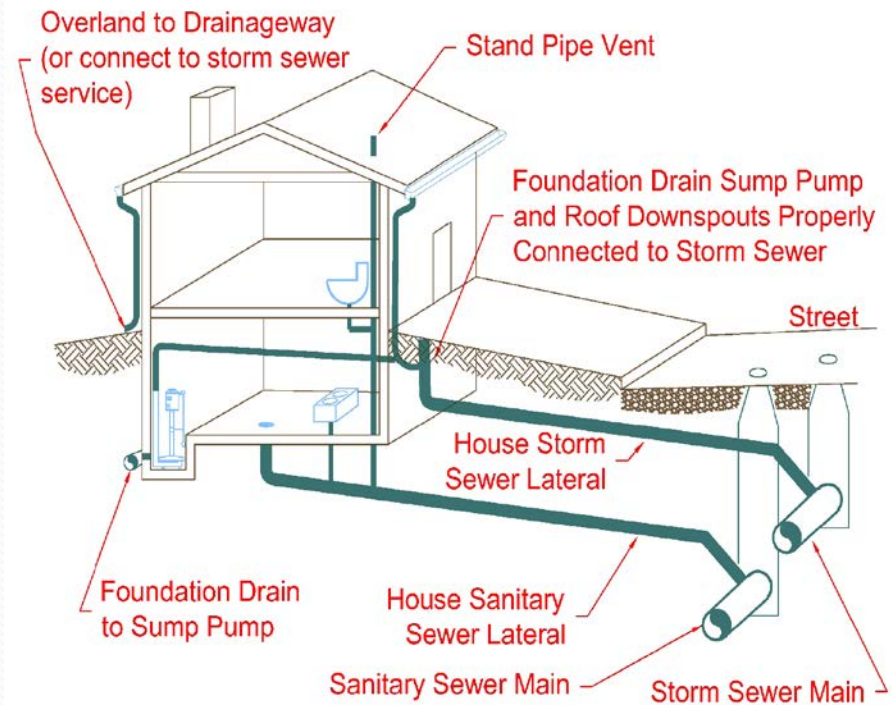
SHERWOOD RETENTION BASIN



SOUTHBRIDGE RETENTION BASIN

# HOUSE PLUMBING

- STORM SEWER
  - DOWNSPOUTS
  - FOUNDATION DRAIN
  - SUMP PUMP
  - YARD/DRIVEWAY DRAINS
- SANITARY SEWER
  - SHOWERS
  - SINKS
  - TOILETS
  - WASHING MACHINE
- FLOOR DRAINS
  - STORM OR SANITARY



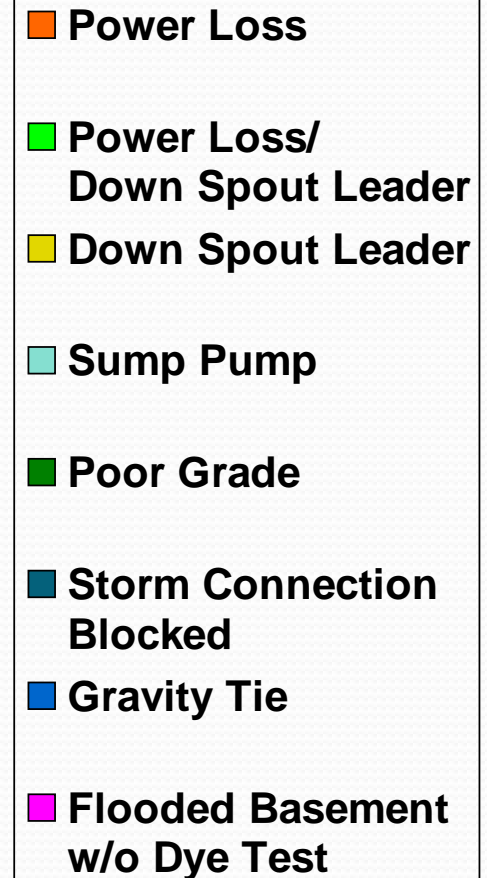
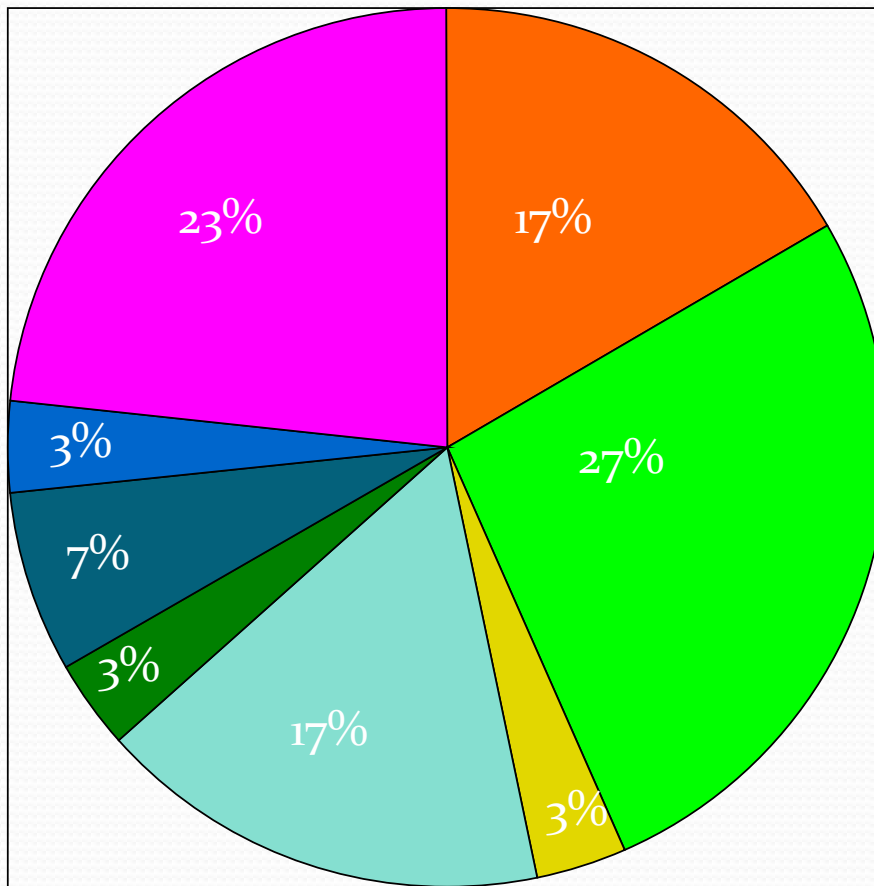


# BASEMENT FLOODING

- STORM WATER INFILTRATION
  1. EXCESSIVE WATER AT FOUNDATION
    - COMPROMISED FOUNDATION DRAIN
    - SUMP PUMP FAILURE
    - GRAVITY TIE
    - COMPROMISED DOWNSPOUT LEADER
    - POOR GRADE AT FOUNDATION
  2. COMPROMISED WATERPROOFING / BACKFILL
  3. COMPROMISED STORM CONNECTION
- SANITARY BACK-UP

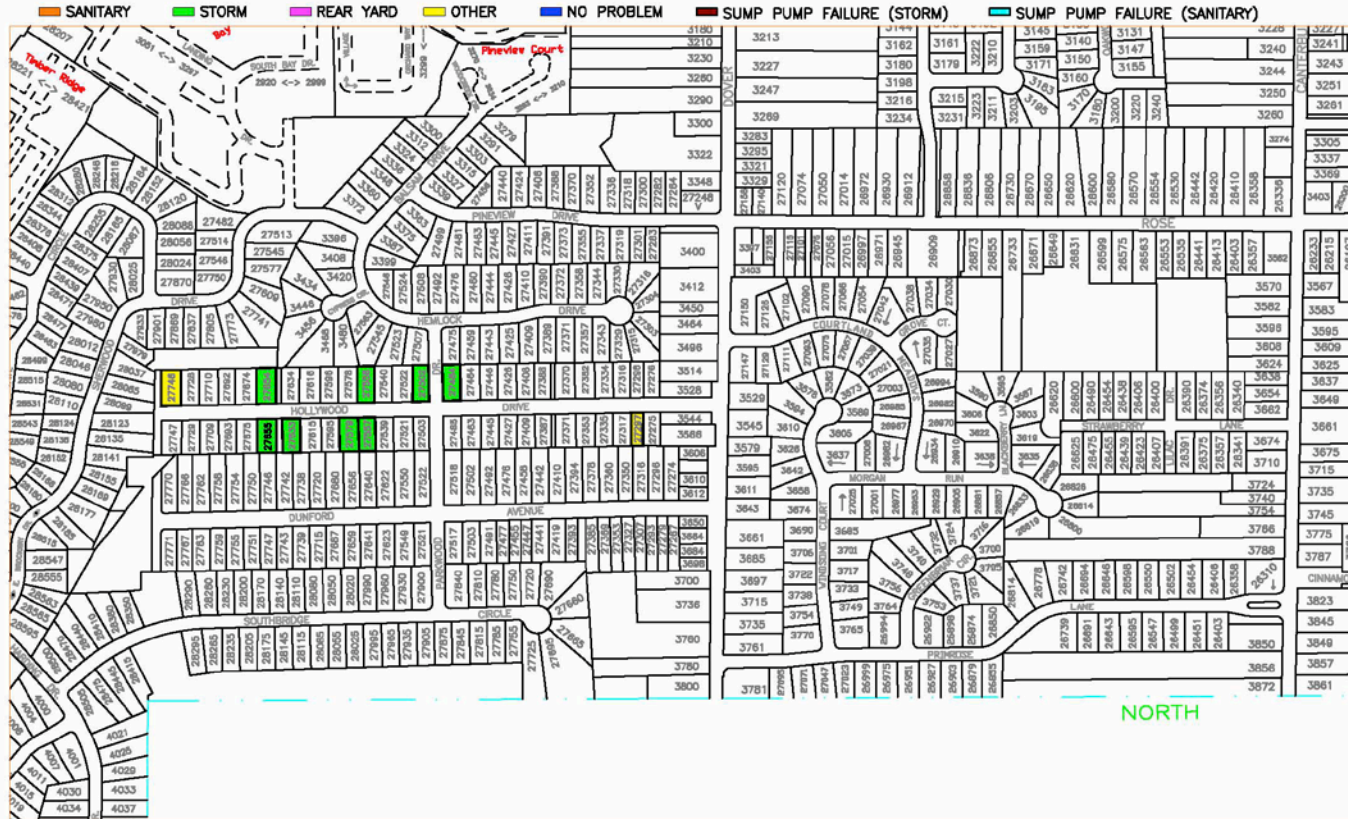


# 2005 ESTATES BASEMENT FLOOD STUDY



# 2-6-08 RAIN EVENT

ADDRESS MAP – THE CITY OF WESTLAKE



# 2-28-11 RAIN EVENT

## CITY OF WESTLAKE, OHIO- 2/28/2011 RAIN EVENT

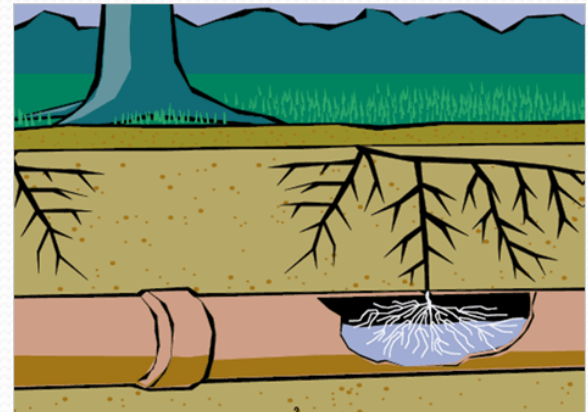
Sanitary Surcharge    Storm Surcharge    To Be Determined





# COMPROMISED PLUMBING

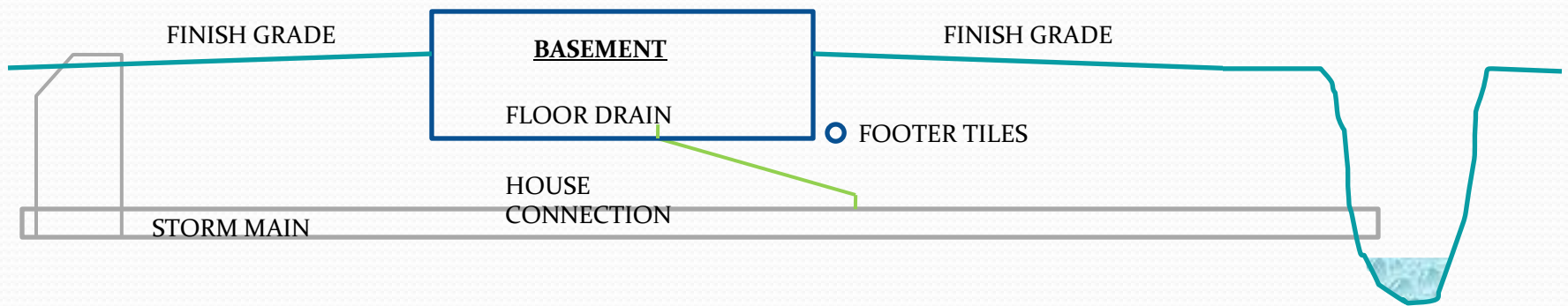
- IF THE DOWNSPOUT LEADER IS COMPROMISED WATER IS NOT DRAINED AWAY FROM THE HOUSE AND CONTRIBUTES TO BASEMENT FLOODING



# GRAVITY TIE

- STORM MAIN IS IN SURCHARGE CONDITION DURING MAJOR RAIN EVENTS
- WATER MIGRATES UP THE STORM CONNECTION
- WATER FLOODS THE BASEMENT
  - FOUNDATION DRAIN
  - FLOOR DRAIN (IF CONNECTED TO STORM)

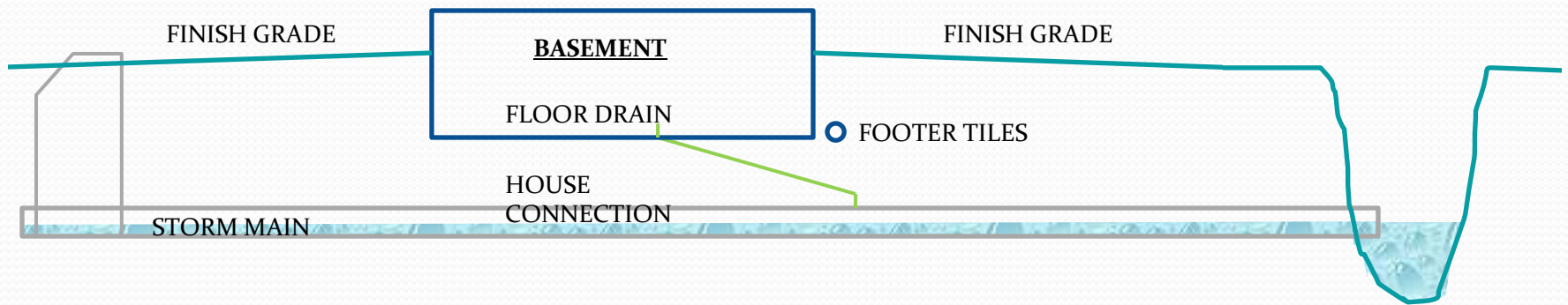
# GRAVITY TIE-BASEMENT FLOODING



RAIN EVENT CAUSES INCREASE FLOWS  
IN DITCH

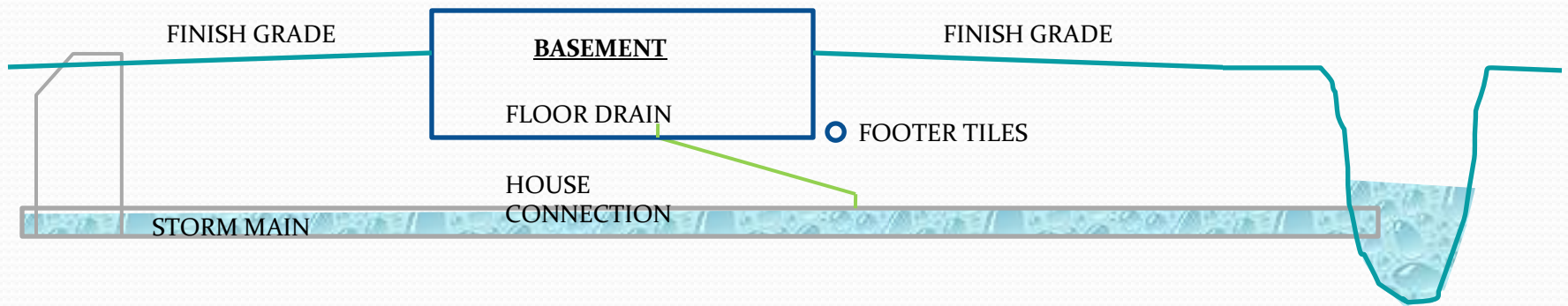


# GRAVITY TIE-BASEMENT FLOODING



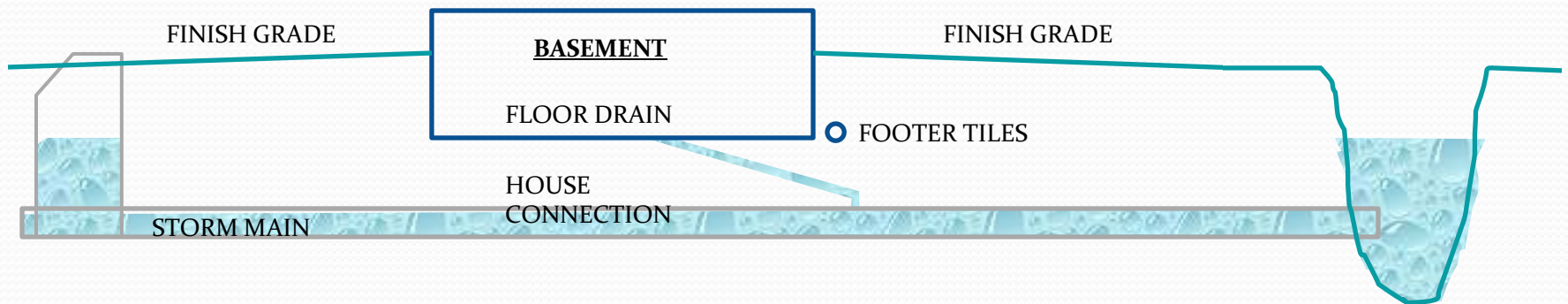
AS RAIN EVENT PROGRESSES DITCH FLOW  
INCREASES AND STORM MAIN FLOW  
INCREASES

# GRAVITY TIE-BASEMENT FLOODING



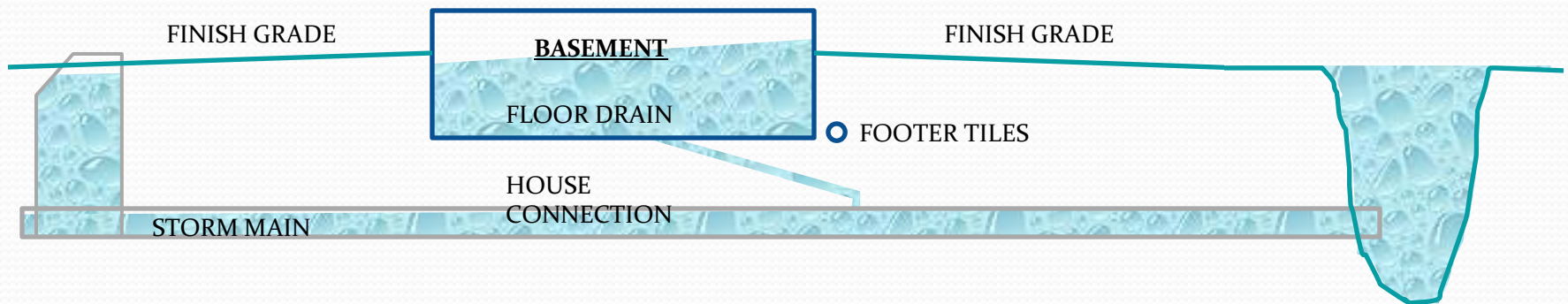
**DITCH WATER ELEVATION INCREASES AND  
STORM MAIN BECOMES SURCHARGED**

# GRAVITY TIE-BASEMENT FLOODING



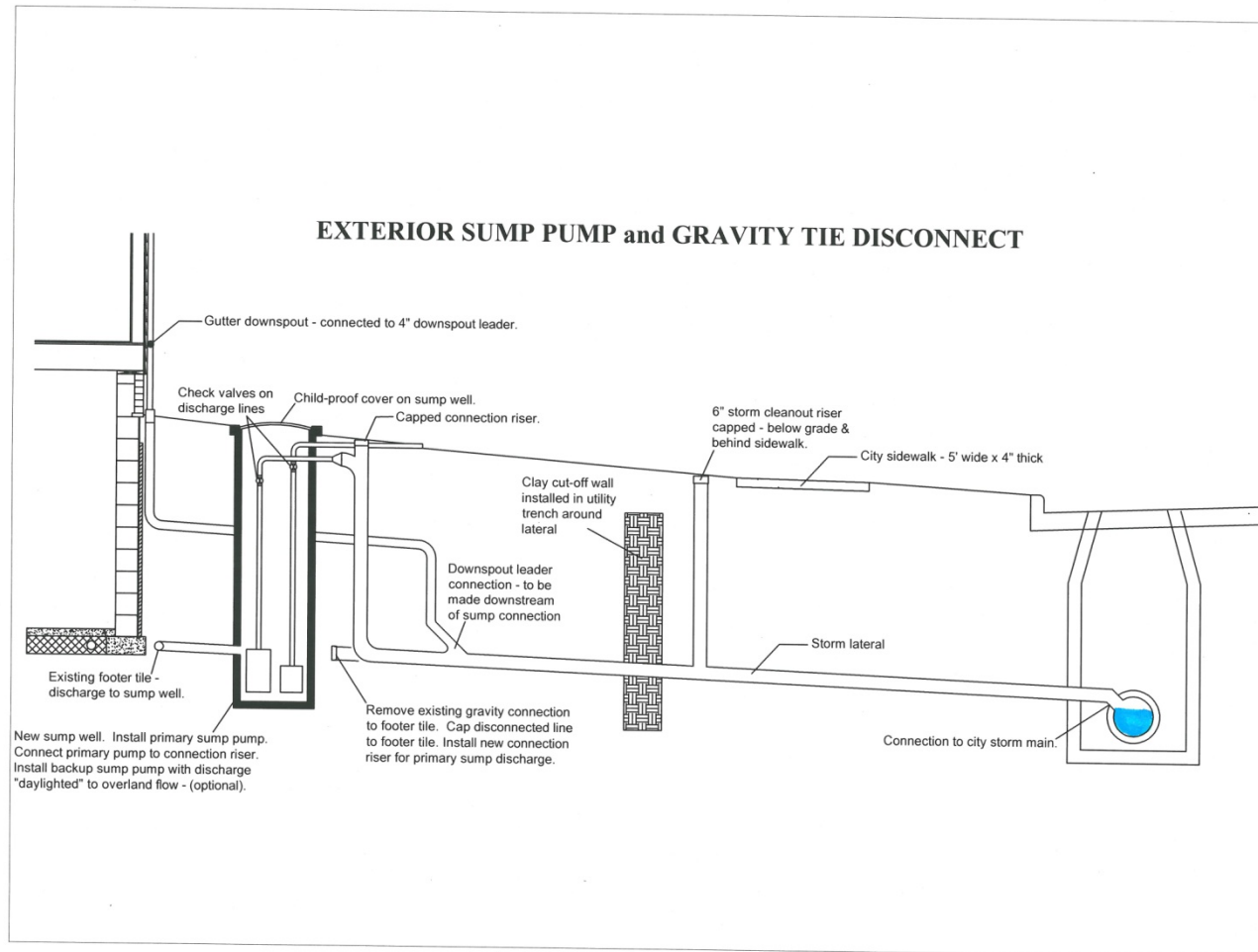
AS STORM MAIN SURCHARGES WATER  
MIGRATES UP THE STORM CONNECTION

# GRAVITY TIE-BASEMENT FLOODING

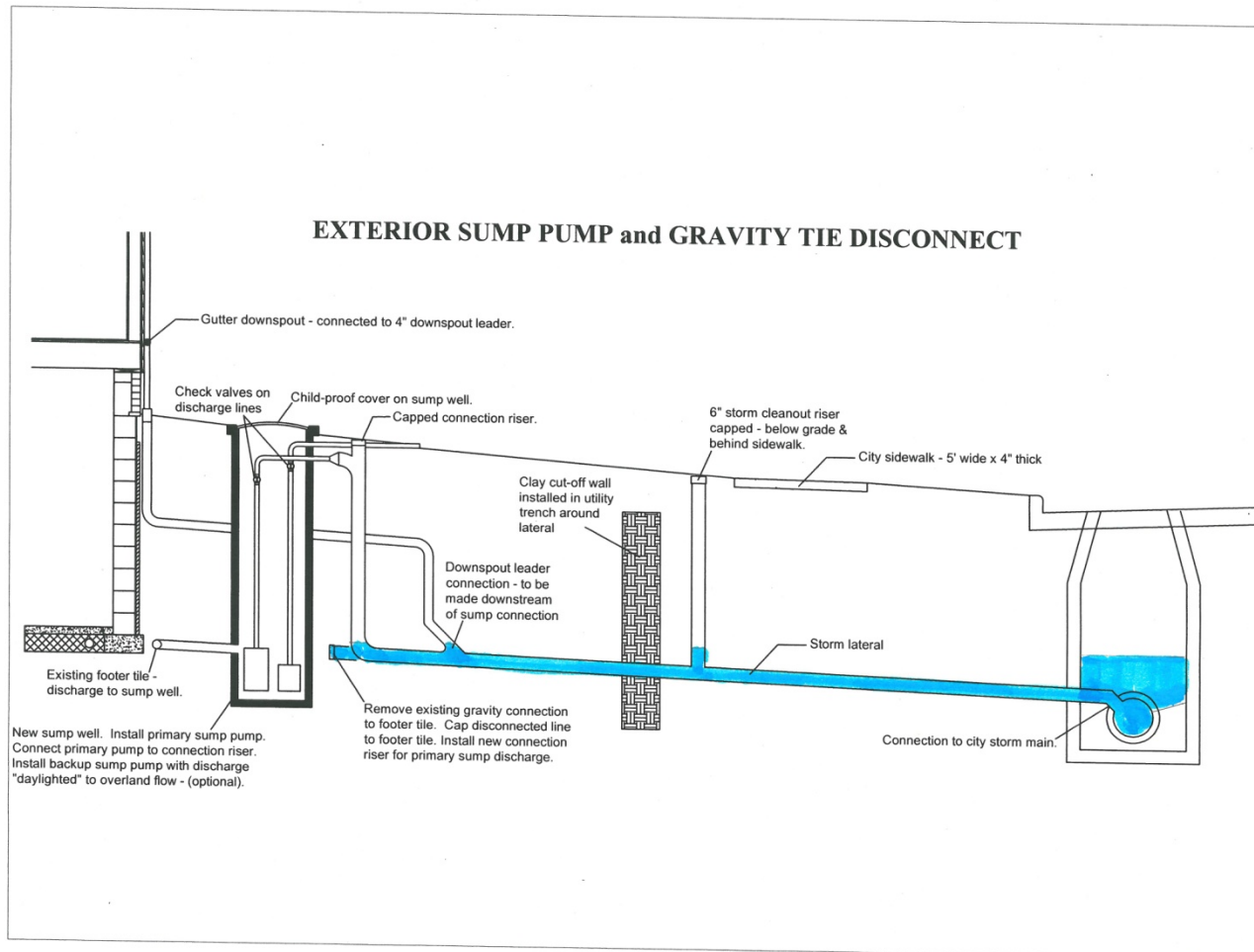


AS DITCH APPROACHES FLOOD STAGE WATER FLOODS THE BASEMENT THRU THE FLOOR DRAIN AND/OR FOUNDATION DRAIN. WATER SEEKS THE FLOOD STAGE ELEVATION

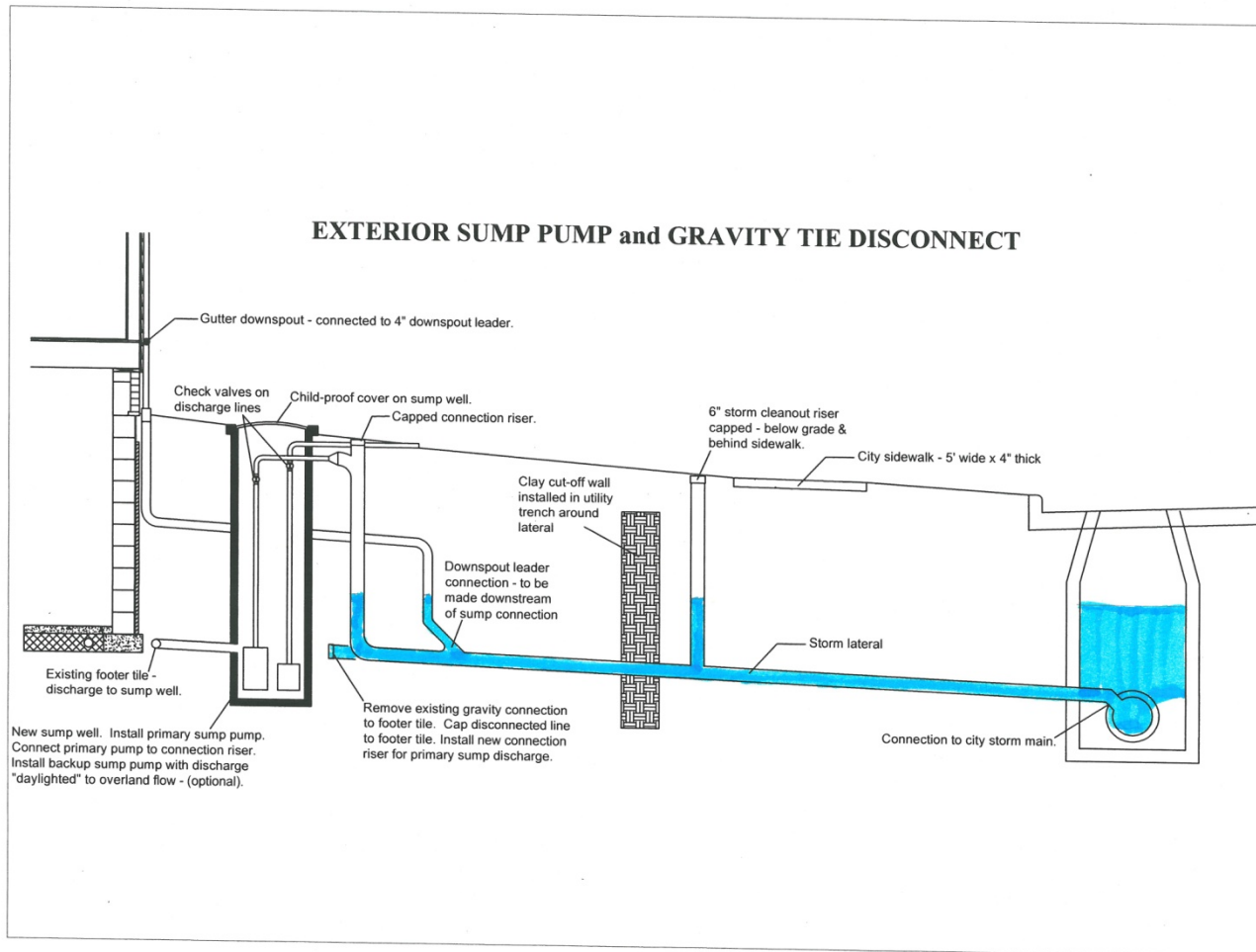
# EXTERIOR SUMP PUMP- GRAVITY TIE DISCONNECT



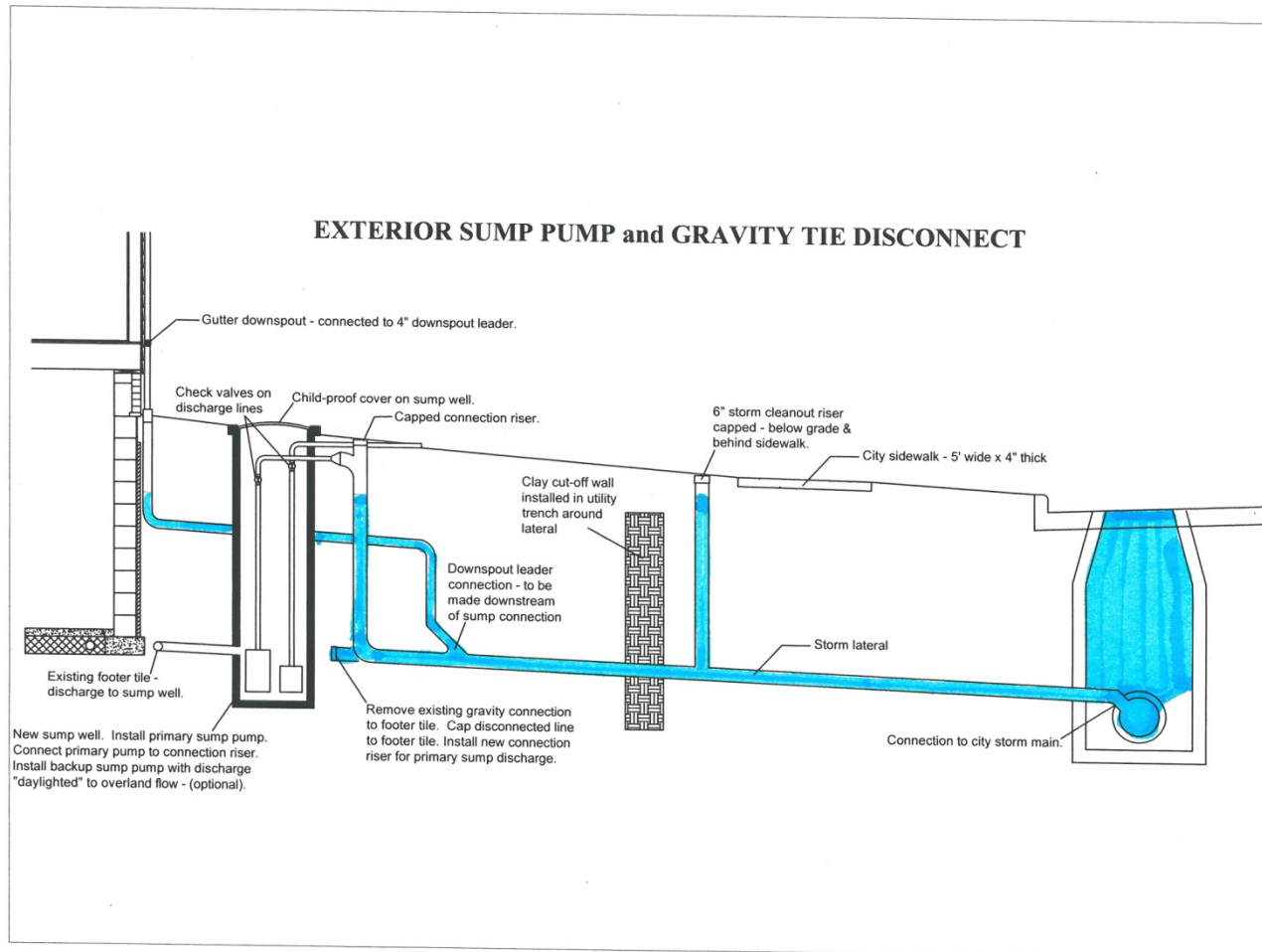
# EXTERIOR SUMP PUMP- GRAVITY TIE DISCONNECT



# EXTERIOR SUMP PUMP- GRAVITY TIE DISCONNECT



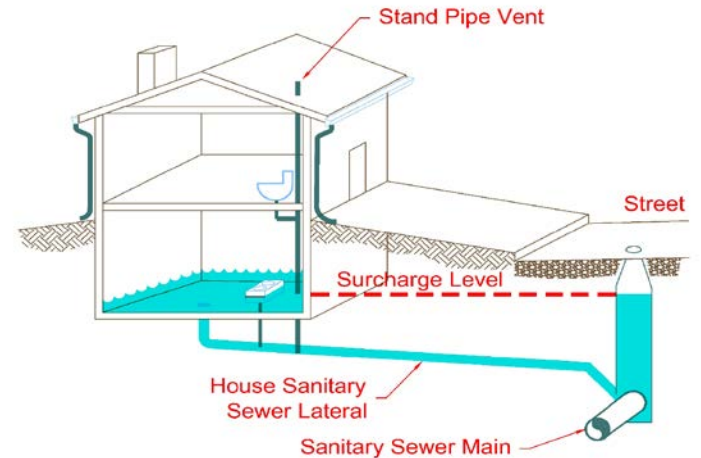
# EXTERIOR SUMP PUMP- GRAVITY TIE DISCONNECT





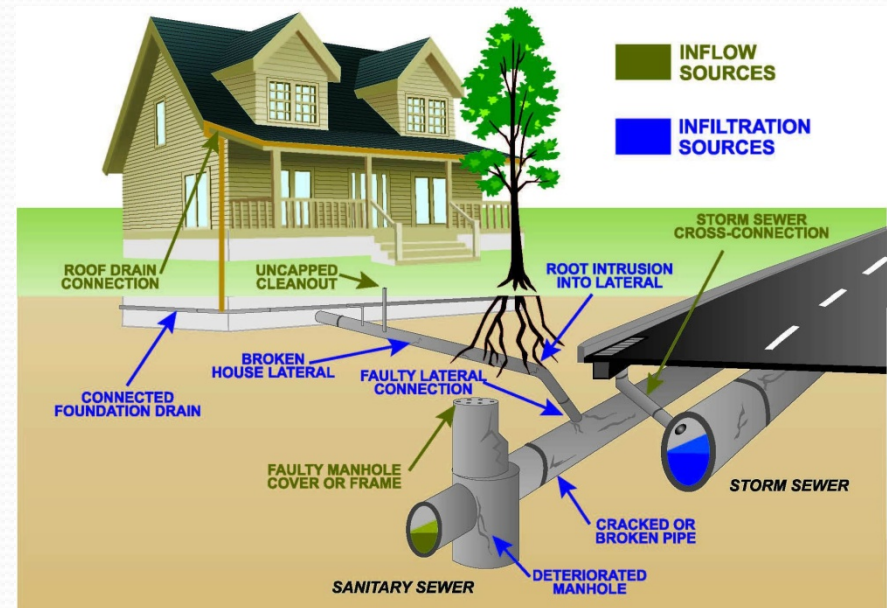
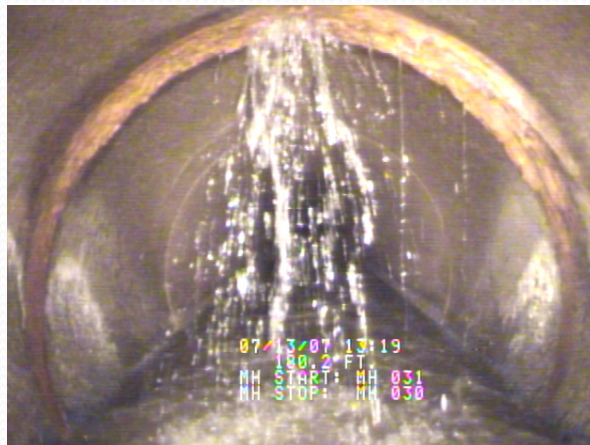
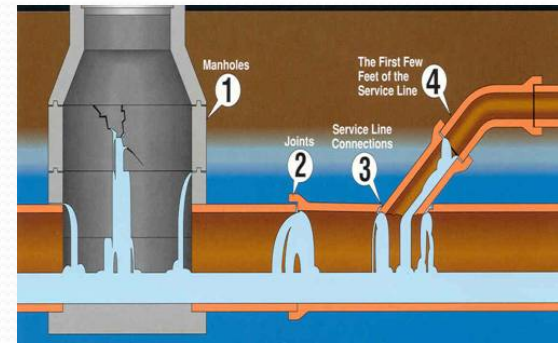
# SANITARY SEWER BACK-UP

- RESULTS FROM THE SANITARY SEWER BEING SURCHARGED.
- WATER FROM THE SANITARY SEWER BACKS UP THRU THE CONNECTION AND FLOODS THE BASEMENT:
  - FLOOR DRAINS
  - BASEMENT TOILET
  - BASEMENT SHOWER



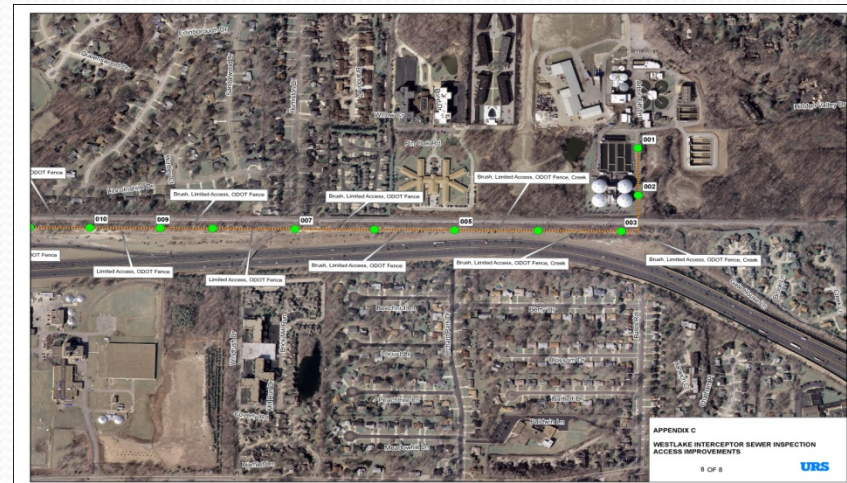
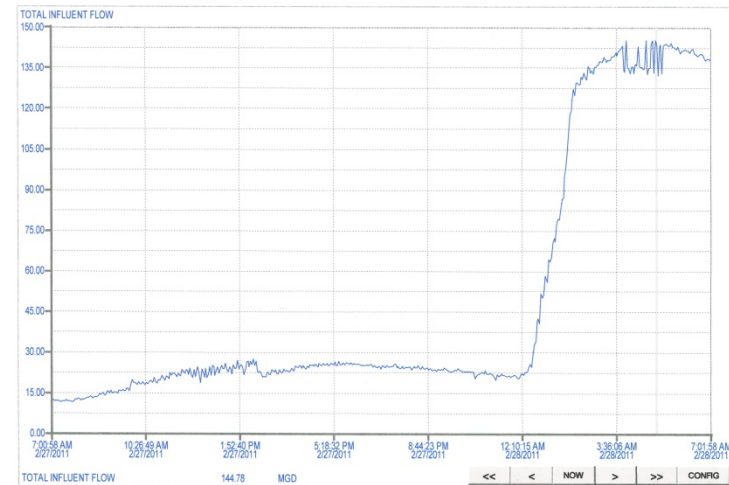
# SANITARY INFILTRATION & INFLOW

- SOURCES OF STORM WATER IN SANITARY MAIN
  - CROSS-CONNECTIONS
  - INFILTRATION
  - INFLOW
  - COMBINED SEWER



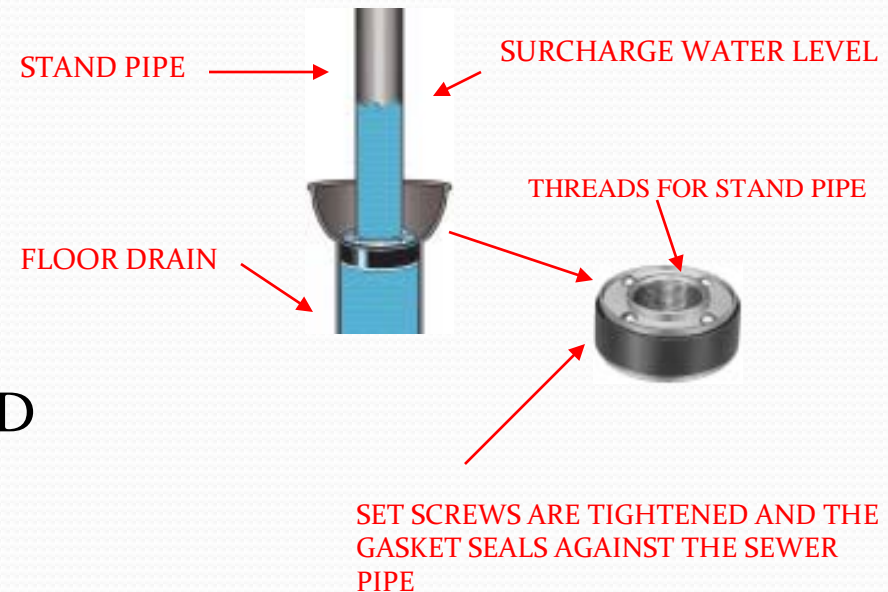
# WASTE WATER TREATMENT PLANT

- FOUR CITIES
  - WESTLAKE
  - BAY VILLAGE
  - ROCKY RIVER
  - FAIRVIEW PARK
- AVERAGE FLOW RATE
  - WESTLAKE 5 MGD
  - TOTAL PLANT 13 MGD
- 2-28-11 FLOW RATE
  - TOTAL PLANT 170 MGD
  - RECORD FLOW RATE
  - 82 MILLION GALLONS TREATED IN 24 HOURS



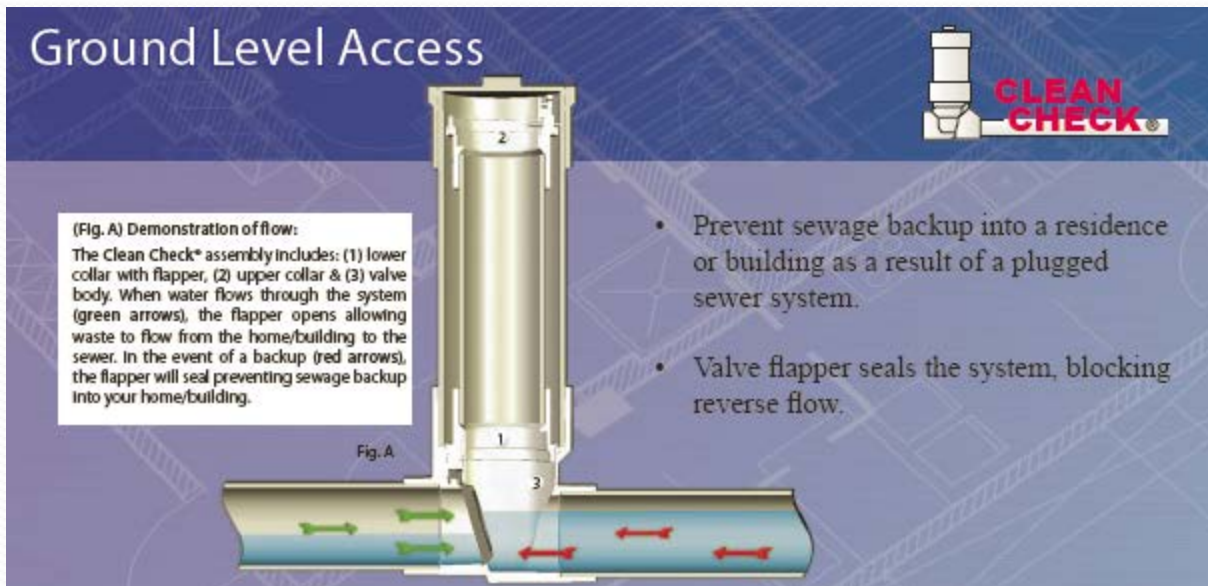
# STAND PIPE

- INSTALLED WITHIN FLOOR DRAIN
- HEIGHT OF THE STAND PIPE IS DICTATED BY PREVIOUS FLOODING
- ALLOWS WATER TO SEEK THE SURCHARGED ELEVATION
- ALL SANITARY FACILITIES NEED TO BE PROTECTED
- IF SANITARY PIPE IS DAMAGED BELOW THE SLAB THIS WILL NOT STOP SEWAGE BACK-UP.
- FLOOD GUARD BRAND
  - [Plumbingsupply.com](http://Plumbingsupply.com)



# EXTERNAL BACKWATER VALVE

- BENEFITS
  - FLAPPER ACCESSED THRU RISER, MH NOT REQUIRED
  - PIPES UNDER THE HOUSE NOT SUBJECTED TO PRESSURE
- BRANDS
  - CLEAN CHECK (75 PSI MODEL AVAILABLE IN 4 MONTHS)
  - CANPLAS (CURRENT MODEL IS RATED AT 60 PSI)

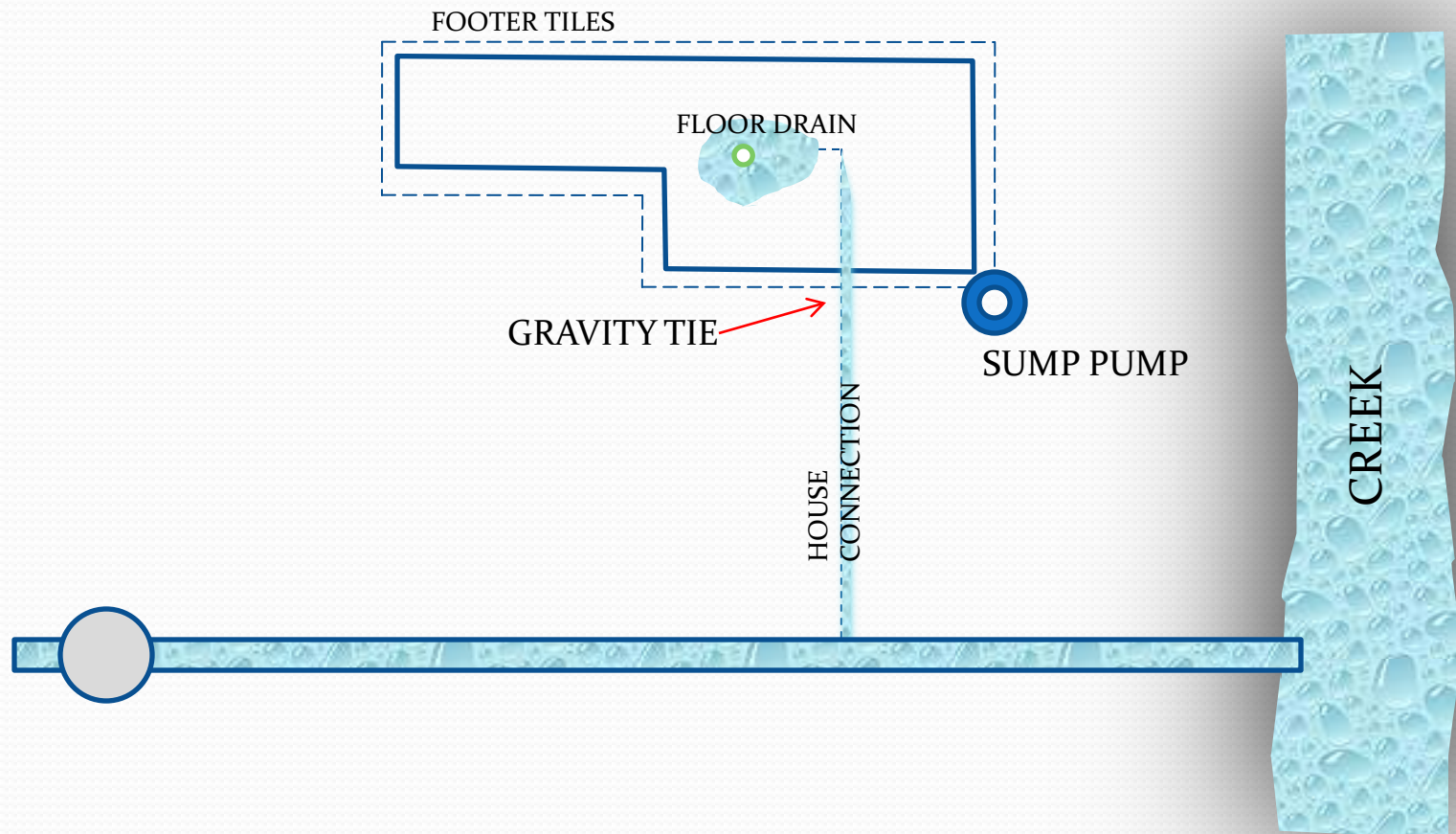


# IMPROPER WATER MITIGATION FOR STORM WATER SURCHARGE

- STAND PIPE (USE FOR SANITARY ONLY)
  - FLOOR DRAIN IS PROTECTED
  - BASEMENT WILL FLOOD FROM FOUNDATION DRAIN
- SUMP PUMP WITHOUT GRAVITY TIE DISCONNECT
  - BASEMENT WILL STILL FLOOD SINCE THE GRAVITY TIE IS NOT DISCONNECTED

# SUMP PUMP WITH GRAVITY TIE

- BASEMENT WILL STILL FLOOD FROM THE FLOOR DRAIN



# MAJOR FLOOD EVENT

- THE FEDERAL GOVERNMENT DETERMINED THAT **FLOODS CAN NOT BE STOPPED**
- RECOMMENDATIONS
  - FEDERAL AND STATE
    - BUY FLOOD INSURANCE
  - CITY OF WESTLAKE
    - **FLOOD PROOF YOUR HOUSE**
    - MITIGATING WET OR FLOODED BASEMENT BROCHURE – INFORMATION AND SOLUTIONS
      - DEPARTMENT OF ENGINEERING WEB PAGE @ [www.cityofwestlake.org](http://www.cityofwestlake.org)



FEMA



NATIONAL  
FLOOD  
INSURANCE  
PROGRAM





# DYE TESTING PROGRAM

- **FREE TO ALL RESIDENTS**
- SERVICE DEPARTMENT LOCATES -CLEANOUTS
- DEPARTMENT OF ENGINEERING
- SIMULATE A RAIN EVENT BY PLACING DYE AT VARIOUS DOWNSPOUTS
- TELEWISE PLUMBING LINES IF NEEDED
- RECOMMENDATIONS GIVEN



# THE END

- QUESTIONS OR COMMENTS

