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# MEMO

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Date: December 9, 2010

To: Village of La Grange Park

Attn: Ms. Julia Cedillo, Interim Village Manager

From: Paul E. Flood

Re: Sewer Alternative Recommendations

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As requested, we have prepared a preliminary review of projects and programs that can be implemented to mitigate flooding concerns raised by Village residents. The scope of the review was limited to issues related to the sewer backup, street flooding, and rear yard flooding. We reviewed the existing sewer system to identify limitations and evaluate potential improvements that can be utilized by the Village to address the negative effects associated with stormwater runoff. Issues pertaining to basement seepage caused by groundwater infiltrating through foundation cracks were not directly addressed, as these are structural issues of particular buildings.

## **The Village's Sewer System**

Ninety-percent (90%) of the Village is served by combination sewers that convey sanitary flow and runoff from rain events in the same pipes. The primary purpose of the Village's system is to transport domestic waste, or dry weather flow to the Metropolitan Water Reclamation District of Greater Chicago's (MWRDGC) wastewater treatment facilities. The Village's local system can be broken down to three types of pipes: collector mains, trunk mains, and outfall sewer mains. The collector mains are typically located on the north-south streets and collect wastewater from homes and businesses. The collector mains connect to larger diameter trunk mains that are typically located on east-west oriented streets. The trunk mains are connected to the Village outfall sewers located on Woodlawn Avenue in the area west of LaGrange Road and 31<sup>st</sup> Street east of LaGrange Road. During dry days, these outfall mains convey wastewater to the MWRDGC interceptor sewers, which then convey to their Stickney treatment plant. (Exhibit A)

During rain events, the combined sewer system collects stormwater runoff and conveys it to the MWRDGC Deep Tunnel facilities and the Village's overflows to Salt Creek. Currently, when the Deep Tunnel reaches its capacity, the excess runoff is discharged directly into Salt Creek through the Village's five (5) Combined Sewer Overflows (CSO). The Deep Tunnel is one component of an ongoing construction project by the MWRDGC's Tunnel and Reservoir Plan (TARP) to reduce localized flooding and improve water quality for combined sewer systems by creating a system of tunnels and reservoirs to capture the runoff from these events for subsequent treatment. The tunnel portion of the system servicing the Village has been completed but the

initial phase of the reservoir, located in Hodgkins, will not be available until 2017. The reservoir will not be fully completed until 2029.

### **Sewer System Limitations**

Limitations related to the Village combined sewer pipe capacity, the MWRDGC Deep Tunnel capacity to handle flows, and Salt Creek's water elevation at the start and during the course of rainfall events all can be contributing factors to the flooding. The stormwater flows generated during a rain event are a function the size of the tributary area, the type of ground cover within the area, and the intensity/duration of the particular rain event. These factors, and the limited capacity of the sewer system to convey and store stormwater flows, are the principle causes of flooding within the Village. During some rain events, sections of the Village's combination sewer system can reach their hydraulic conveyance capacity, at which time the pipe can no longer convey water by gravity. When these pipes reach this limit they have become "surcharged", meaning that water must build in elevation within the system in order to convey additional flows through the pipe. The elevation of surcharge within the sewer system is the determining factor for how many residents experience basement flooding and street flooding issues.

A surcharged pipe within a sewer system can be created by different types of rainfall events that can affect the sewers capacity.

#### ***High Intensity – Short Duration Rain Event***

The system can become surcharged during short duration, high intensity events. In these instances, the Village's smaller collector sewers are the limiting factor in the system. These smaller pipes do not have the capacity to convey flows from the street and building drains that are connected to the system quickly enough to the trunk and outfall sewers. During these events, the basement flooding and street flooding occur rapidly and recede over a matter of a few hours after the event.

#### ***Low Intensity – Long Duration Rain Event***

During longer duration and less intense events, the MWRDGC may close off the Deep Tunnel as the capacity of the tunnel is reached. It should be noted that the tunnel represents only 4% of the planned storage volume for the Tunnel and Reservoir Plan (TARP). As the reservoirs are completed, the additional storage will allow for the Village's connections to the Deep Tunnel to be more effective in reducing in the occurrences of basement flooding during these types of events.

After the Deep Tunnel is closed, the limiting factor during these events is the Village's Combined Sewer Overflows (CSO) to Salt Creek. The Village's CSO capacity can be reduced due to high water levels on Salt Creek. As the creek's water level rises, the capacity of the Village's combined sewer overflow becomes more restricted. As the combined overflow becomes restricted, additional sources of flow from the Village are stored in the pipes within the system. When the volume that can be stored within the pipe is reached, the pipes within the system slowly surcharge starting from the downstream sections. Typically, the CSO capacity affects the Village when Salt Creek's water level is high due to recent wet periods occurring prior to a long rainfall event of lower intensity.

### **Stormwater Runoff Issues**

Property owners in the Village experience three distinct types of runoff generated issues during rainfall events of significant intensity and/or duration.

#### ***Sewer Backup - Basement Flooding***

The first is basement flooding related to sewerage backup. When the sewer system is surcharged, sewage can potentially back up through the sanitary service connections into basements, sub-basements, and crawl spaces where backflow prevention is not in place. (See Exhibit B). The basement flooding can be the result of either long duration, low intensity events or short duration, high intensity events. Backflow prevention devices are typically part of overhead plumbing, but can also be a stand-alone system on a gravity pipe service. (See Exhibit C). The check valve on either of these systems prevents water from backing up to lower level floor drains and fixtures (sinks and toilets) during occurrences of surcharge within the Village's sewer system. In instances when a check valve is installed on a gravity service it is crucial that downspouts and sump pump discharges from footing drains be disconnected for the service as they can potentially create flooding within the protected service.

#### ***Street Flooding***

A second concern in the Village is street flooding of significant duration and depth causing road closures and flooding in adjacent residential buildings. The area south of 31<sup>st</sup> Street and east of LaGrange Road is particularly prone to this type of street flooding when high intensity rainfall events occur, such as those experienced on June 23 and July 23 of 2010. The topography of this area creates the most severe flooding between Oak and Jackson Street from Barnsdale Road to Sherwood Road. The runoff from these events can lead to roadway flooding of sufficient depth to overflow into stairwells and window wells of residential structures. Street flooding is largely not a result of sewage backup onto the street. Street flooding is caused because the sewer pipes have become surcharged, which reduces their capacity to receive additional flows. Flooded streets present issues for pedestrian and vehicles within the area. Drivers may not know the depth of water that has accumulated on a roadway, in particular when the depth of the flooding obscures the curb and center line of the streets. In some instances, cars can stall when entering these areas damaging the vehicle and blocking the roadway. Additionally vehicles moving through these flooded areas create a "wake" that results in additional water being pushed to window wells and stairwells of nearby structures. Parked cars can become damaged as water elevations can rise above the floorboard of the vehicles. The depth of water can also affect the ability of people to access or leave their property to address flooding issues in their building.

#### ***Rear Yard Flooding***

Village residents also expressed concerns about the frequency and duration of inundation of their rear yards. Many residents have experienced an increase in the severity of rear yard drainage issues. The redevelopment of existing properties by the replacement of residences and addition to existing structures has increased the impervious area within the Village over the last 15 to 20 years. This increased impervious area creates greater runoff, with less opportunity for water to percolate into the ground. This condition is most evident to residents with the lowest rear yard elevations in the area. Rear yard flooding is experienced year round including during heavy snowmelts when the soils are not permeable due to frost. In addition to the inconvenience of limiting property use, some residents experience damage related to their accessory structures such as garages from repeated inundation of the floor and lower section of these buildings. Often the residents that are affected have not completed the improvements to their own property,

but because they are the lowest area on the block, have an increase in depth and duration of the flooding.

### **Improvements to the Storm Sewer System**

Flooding issues were formally studied by the Village in 1979, 1986 and 2002. The Village has implemented several projects and programs over the recent years to address flooding within the community.

- The Woodlawn Outfall Sewer Improvements west of LaGrange Road increased the conveyance capacity to the Deep Tunnel. Additionally, this project increased the overflow capacity by increasing the size and revising the outfalls elevation to be above the “normal” water elevation of Salt Creek.
- The Village’s Storm Relief Sewer Project North of 31<sup>st</sup> Street helped reduce flooding within that area, and increased the available conveyance of the 31<sup>st</sup> Street outfall sewer for the area south of 31<sup>st</sup> Street, by disconnecting some roadway drainage areas from the combined sewer system. (See Exhibit D)
- The Village’s passage of its Stormwater Management Ordinance implemented improvements to the Village code by requiring drainage plans to be prepared and approved for increases in impervious areas due to development. Additionally the ordinance requirement that best management practices (BMPs) be utilized to address the effects of changes in drainage patterns has mitigated the additional runoff.

It should be noted that an east side relief sewer was proposed in 1986 to reduce the risk of basement flooding to a level of about 10% each year once the MWRDGC Tunnel and Reservoir Project is completed. The proposed relief sewer system would serve that portion of the Village lying east of LaGrange Road and south of 31<sup>st</sup> Street. The Village has requested re-evaluation of that project as well as other projects that it may consider to mitigate flooding issues within the community.

### **Mitigation Strategies / Options**

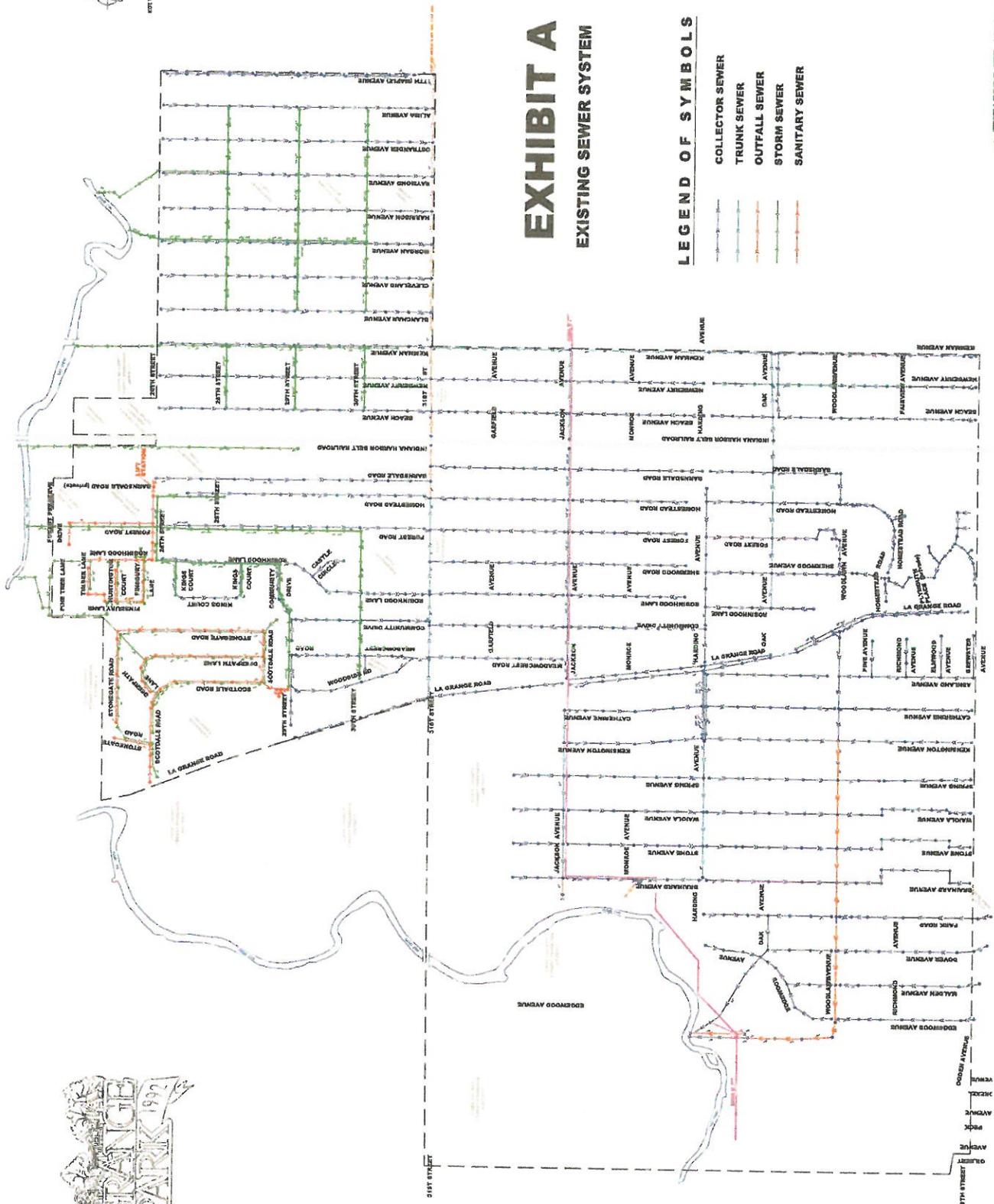
Attached is a table briefly describing some alternatives to address flooding issues within the Village. The projects and programs can be considered in whole or in part, and in various combinations as strategies the Village may want to consider implementing. Also included in this table are preliminary estimates of cost, where appropriate, and a summary of the benefits and limitations associated with each option.

Program	Description	Cost	Benefits	Limitations
Storm Sewer System with Detention Facility	Installation of a separate storm sewer system servicing entire area east of LaGrange Road and south of 31st Street with the installation of detention facility to address flooding . Additionally the detention facility would store the water in excess of that that can be conveyed to Salt Creek during substantial rainfalls and during periods in which high water levels in the creek reduce the capacity of the outlet to convey storm water.	\$44,000,000	The work would eliminate stormwater runoff from the roadway and eliminate basement flooding in the area due to sewer back-ups associated with roadway runoff. The detention pond will reduce the duration and frequency of flooding on the roadway during significant rainfall events to a chance of occurrence to 10% each year. Additionally the system would allow for a restricted release of drainage from flood prone rear yard drainage areas, which would reduce the duration of such occurrences.	A significant area of existing developed properties would need to be cleared and excavated to create the detention facility. It is estimated that 32 contiguous properties would be required for the detention facility.
Storm Sewer System without detention	Installation of a separate storm sewer system servicing entire area east of Lagrange Road and south of 31st Street	\$23,000,000	The work would remove roadway stormwater runoff from the combined sewer system, resulting in the elimination of basement flooding due to sewer back up associated with roadway runoff. Additionally the system would allow for a restricted release of drainage from flood prone rear yard drainage areas, which would reduce the duration of such occurrences. The storm sewer would reduce the duration and frequency of flooding on the roadway during significant rainfall events to a chance of occurrence of 20% each year.	The occurrence of street flooding would not be eliminated and the duration would be dependent on water levels of Salt Creek during the time of release.

Program	Description	Cost	Benefits	Limitations
Storm Sewer System Without detention (continued)	An example of partial implementation of a storm sewer to be constructed between Barnsdale and Sherwood from Oak to Jackson, which was the area most dramatically affected by 2010 storms. Storm sewer on affected streets, with lift station & generator at PW yard and discharge north of 31 <sup>st</sup> Street	\$4,300,000 - \$6,100,000	Project would reduce occurrence and duration of street flooding within one of the lowest areas of the Village. Additionally the immediate area would benefit during short duration - high intensity events, with the result of a decrease in sewer back-ups related to surcharge of the collector pipes, which often occur during such storms.	Long duration lower intensity events may still result in sewer back up. Potential for some street flooding to occur remains. System would rely on pump discharge to reduce cost of outfall to Salt Creek, but could be susceptible to mechanical failure.
Combined Relief Sewer	The installation of a sewer that would take flows in excess capacity of the existing system and divert these flows to the "Deep Tunnel" drop shaft located near the LaGrange water tower on the southeast corner of Gordon Park. Additionally the project would place restrictors in the outlet pipes of storm structures to reduce the rate of runoff entering the system.	\$9,000,000	The work would reduce the occurrence and duration of flooding within basements for the affected area. Additionally drainage structures along the main branch of the sewer and the four collector sewers would be directly connected to the sewer resulting in a decrease of street flooding along the path of the sewer. The system can be expanded to extend up the local streets to allow connection of additional drainage structures.	The estimate does not include costs associated with easements that would need to be acquired from IHB railroad, LaGrange or LaGrange Park District. The release to the "Deep Tunnel" would be restricted below its design capacity until 2029 at which time the MWRD's reservoirs are anticipated to be completed. This will reduce the effectiveness of the relief sewer. Additionally, the outlet for the relief sewer will be controlled and at times closed depending on the capacity of the tunnel and reservoir to handle flows after its construction. Limited relief until further extension of system is completed to pick up storm drains, but the project does not include alternate overflow to Salt Creek.

Program	Description	Cost	Benefits	Limitations
New 31st Street Outfall	The installation of a larger outfall or parallel pipe along Village sewer located in 31st Street to east intersection with Salt Creek.	\$2,480,000	The pipe could be in lieu of outfall to "Deep Tunnel" in LaGrange or as a supplement to the system to allow for additional overflow capacity to Salt Creek when "Deep Tunnel" is closed due to limits on capacity.	Benefit of the system is limited during high intensity rainfall events as collector sewer capacity is limiting factor creating the flooding.
Street Drainage Restriction	The project involves the installation of restrictors in the pipe to reduce the rate at which water enters the existing pipe.	\$1,750,000	The work reduces the frequency of sewer back-up in the Village. The restrictor would be variable in size to account for capacity of system and available roadway storage.	The work would result in an increase in the frequency, and area of "street flooding".
Isolated Detention	The installation of restrictors in the pipe to reduce the rate at which water enters the existing pipe, with the excavation of existing lots near intersections to be used as smaller detention facilities.	\$900,000 per location.	The work would reduce the frequency of sewer back-up in the Village. The smaller ponds located at intersections would reduce the frequency and duration of street flooding.	Acquisition of property is significant with a minimum of 2 lots each at approximately 28 locations being required to have significant benefit.
Disconnection of downspouts & prohibit the introduction of new drain tile flows (inflow) to system	The village would pass an ordinance requiring all downspouts to be disconnected from combined sewer and not allowing future connections of sump pumps for drain tiles from being connected to sewer service from the site.	Resident Cost	Approximately 45% of homes within the area have downspouts connected to system that adds 6 acres of impervious area tributary to the system. The number of sump pumps connected cannot be calculated without inspection, but inflow can aggravate back up experienced in other properties. The disconnection of downspouts will also have an environmental impact as it will reduce the amount of water that is required to be treated as combined sewage.	Cost born by residents, potentially can aggravate flooding within low lying area (rear yards).

Program	Description	Cost	Benefits	Limitations
Backflow Prevention Program	Expand Village's pilot program to annual program with commitment of certain dollars to program on first come first served basis	Annual Program Resident Cost \$4,000 to \$12,500 per location with Village Participation TBD	Prevent sewer backup only by allowing residents with gravity system to install a "check valve" on their service by either insertion on existing gravity line or by installing "overhead plumbing" with ejector pump. Past program was a match up to \$1,000 per location, Village can budget annual program cap	Peak times of demand for participation may exceed annual budget amount.
Rain Garden Program	Address rear yard drainage by allowing a restricted release from rear yards when resident creates Rain Garden or infiltration basin/swale, or other small BMP within property to retain a quantitative volume of runoff from tributary area	Annual Program Resident Cost with Village Participation TBD	Address the duration of flooding for areas where rear yard drainage is an issue. The restricted flows would be sufficiently small to not adversely affect system capacity during normal rainfall events and release would be after specific volume has been retained on site	Increase of volume of flow into system, may create issue during Salt Creek flooding events, and during long duration storm events.
Flooding Emergency Response Plan	The Village's development and implementation of an emergency response plan to address circumstances of flooding should be considered. Issues such as the closing of roads, redirecting of traffic, access to property for emergency personnel, notification to residents of assistance that may be available, and the Village's role in addressing the flooding and assisting its residents are some of the items that should be reviewed.	Staff time to develop and implement the program	Mitigates street "wakes" that result from vehicles passing through flooded streets where water is pushed to window wells and stairwells of nearby structures. Helps to mitigate the damage to parked cars as water elevations can rise above the floorboard of the vehicles.	

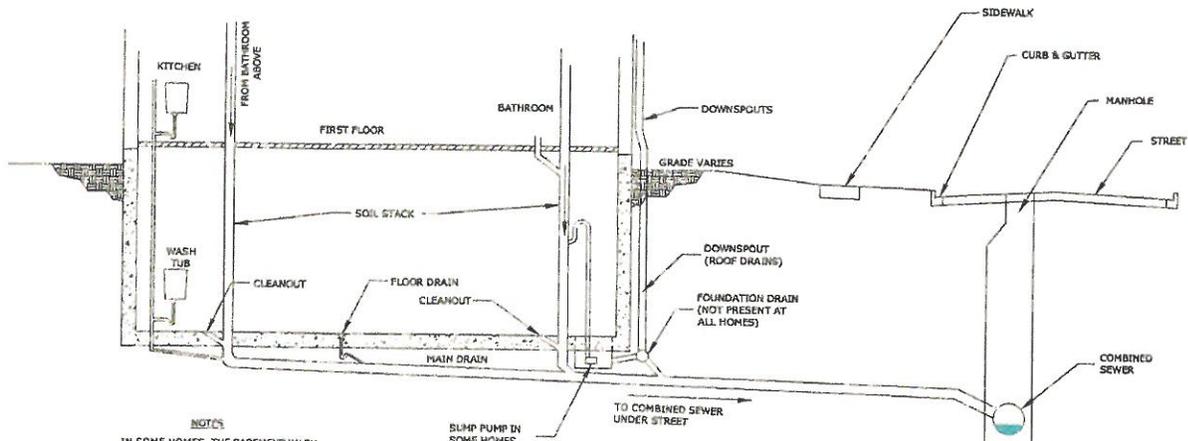


# EXHIBIT A

## EXISTING SEWER SYSTEM

### LEGEND OF SYMBOLS

- COLLECTOR SEWER
- TRUNK SEWER
- OUTFALL SEWER
- STORM SEWER
- SANITARY SEWER

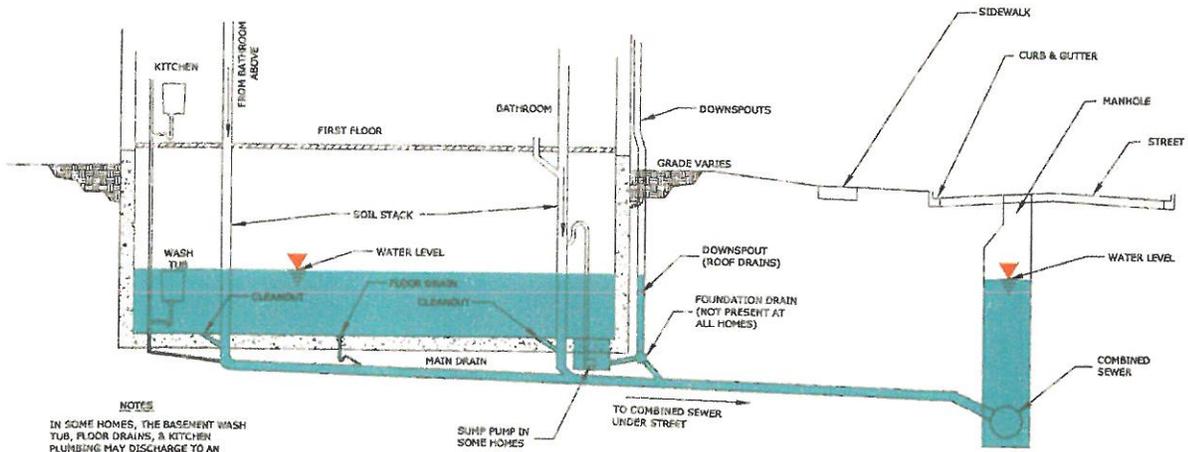


**NOTES**

IN SOME HOMES, THE BASEMENT WASH TUB, FLOOR DRAINS, & KITCHEN PLUMBING MAY DISCHARGE TO AN EXTERIOR CATCH BASIN LOCATED BEHIND OR ALONGSIDE THE BUILDING.

SOME HOMES MAY ALSO HAVE A FOUNDATION DRAIN WITH A GRAVITY CONNECTION TO THE BUILDING SEWER OR MAY FLOW TO A SUMP PUMP IN THE BASEMENT.

**FLOOR PLUMBING  
(DRY WEATHER CONDITIONS)**



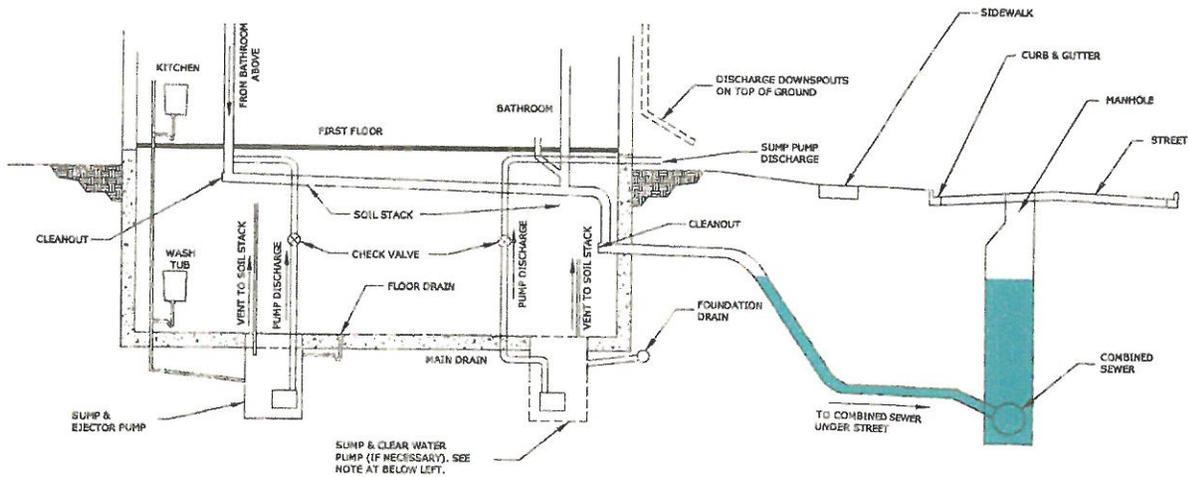
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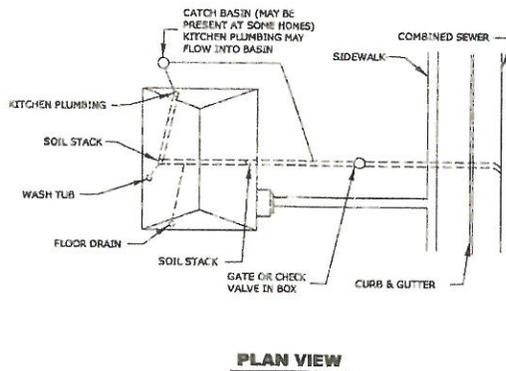
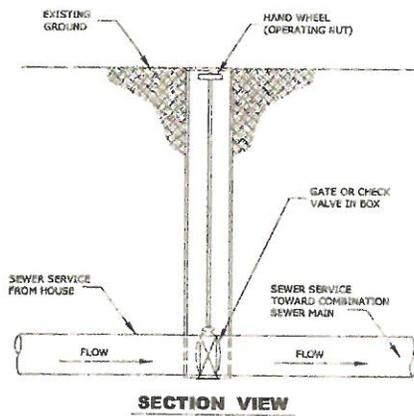
**FLOOR PLUMBING  
(SURCHARGE CONDITIONS)**

**EXHIBIT B**  
**TYPICAL GRAVITY SEWER SERVICE**



NOTE  
 CLEAR WATER SUMP PUMP DISCHARGE SHALL DISCHARGE TO A FRONT OR REAR YARD WHERE SUFFICIENT SPACE EXISTS TO ACCEPT FLOW.

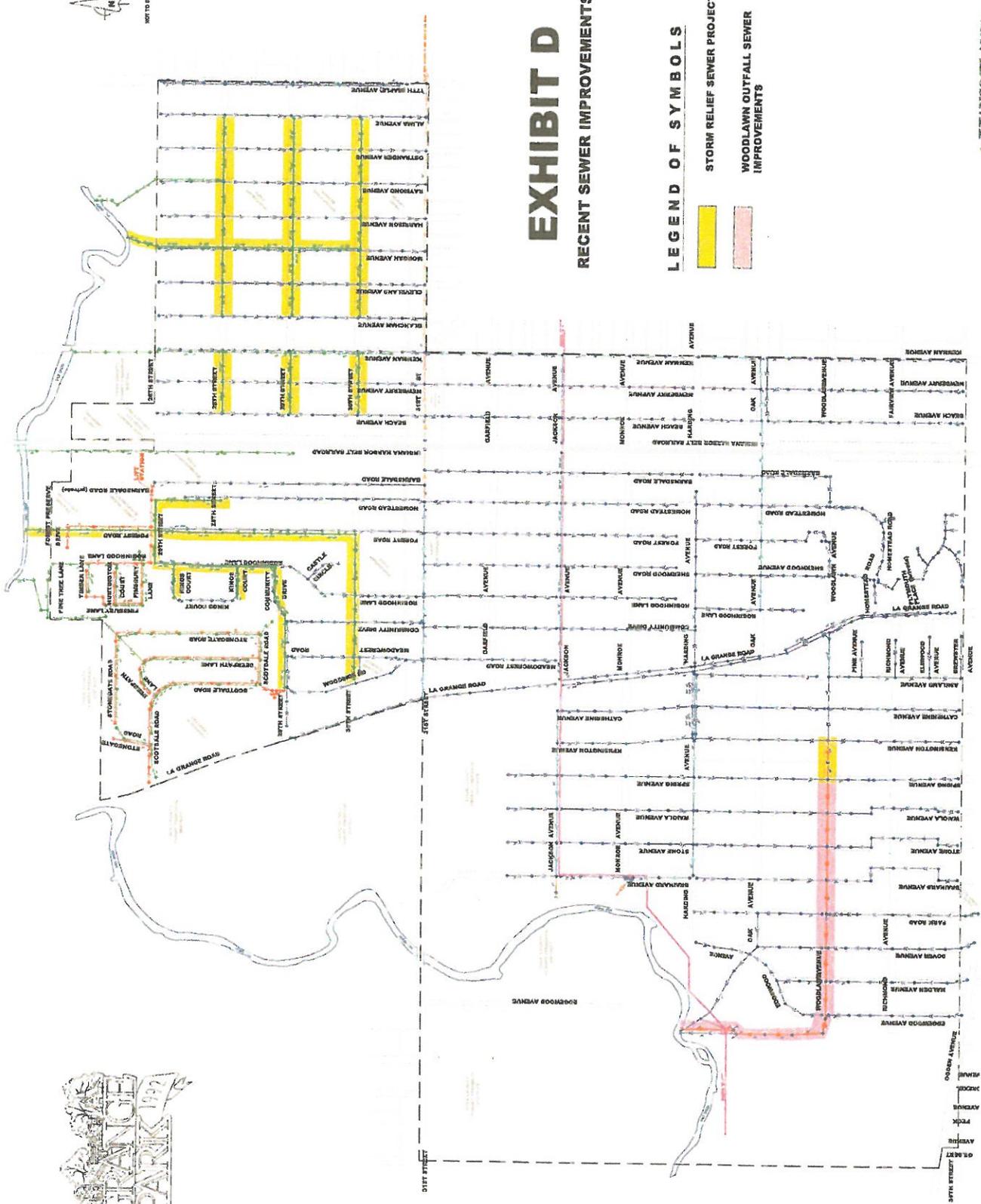
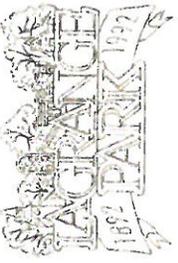
### **FLOOR PLUMBING (OVERHEAD SEWER)**



### **FLOOR PLUMBING (GATE OR CHECK VALVE)**

# EXHIBIT C

TYPICAL OVERHEAD PLUMBING AND GATE VALVE INSTALLATION



# EXHIBIT D

## RECENT SEWER IMPROVEMENTS

### LEGEND OF SYMBOLS

- STORM RELIEF SEWER PROJECT
- WOODLAWN OUTFALL SEWER IMPROVEMENTS