WASTEWATER FLOW COMPONENTS

3.1 INTRODUCTION

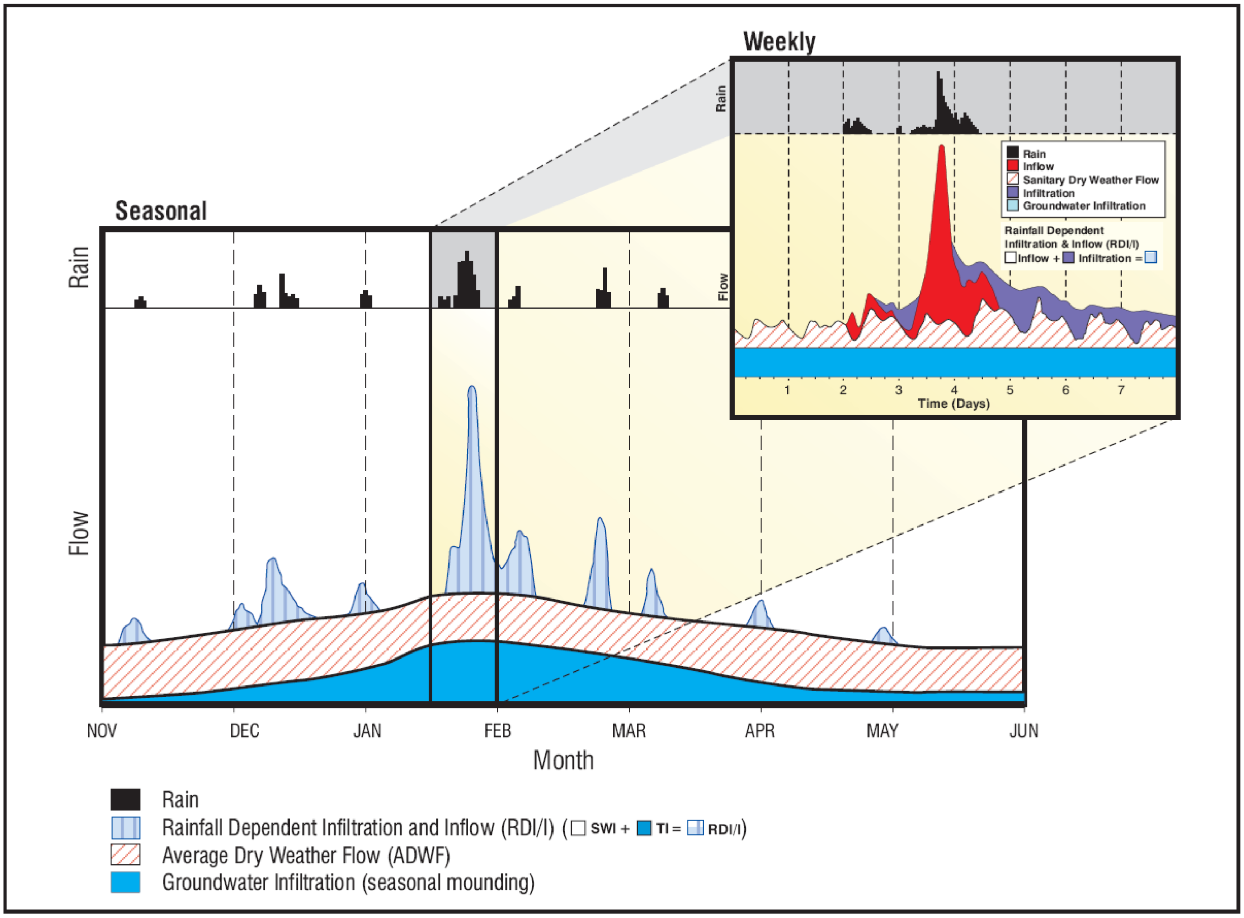
A sanitary sewer collection system receives two flow components: dry weather flow (DWF) and wet weather flow (WWF). The Base Wastewater Flow (BWF) is flow generated by routine water usage in the residential, commercial, business, and industrial sectors of the City. The WWF component includes baseflow, storm water inflow, and groundwater infiltration (GWI). This extraneous groundwater and storm water, termed infiltration/inflow (I/I), is dependent upon groundwater levels and rainfall patterns, and may enter the system through pipe and manhole defects or direct drainage connections. Figure 3.1 illustrates the various wastewater flow components and a description of each flow component is detailed in the following sections.

3.2 BASE WASTEWATER FLOW

The BWF is the flow generated by the City's residential, commercial, and industrial customers. The flow has a diurnal pattern that varies with land use categories. Typically, a residential diurnal pattern has two peaks, with the more pronounced peak following the wake-up hours of the day, and a less pronounced peak occurring in the evening. Commercial and industrial patterns, though they vary depending on the type of use, typically have more consistent higher flow patterns during business hours and lower flows at night. Furthermore, the diurnal flow pattern experienced during a weekend may vary from the diurnal flow experienced during a weekday. Given that the City does not possess a significant tourism or vacation home component to the local economy, compared with the conventional residential service, it is not expected that weekend diurnal flows would exceed those experienced during the week. Therefore, for the purposes of hydraulically evaluating the collection system, a combined residential/commercial/industrial weekday diurnal curve will be used.

3.3 GROUNDWATER INFILTRATION

GWI, one of the components of I/I, is associated with extraneous water entering the sewer system through defects in pipes and manholes. This component is related to the condition of the sewer pipes, manholes, and groundwater levels. GWI may occur throughout the year, although GWI rates are typically higher in the late winter and early spring. Dry weather GWI (or base infiltration) cannot easily be separated from BWF by flow measurement techniques.



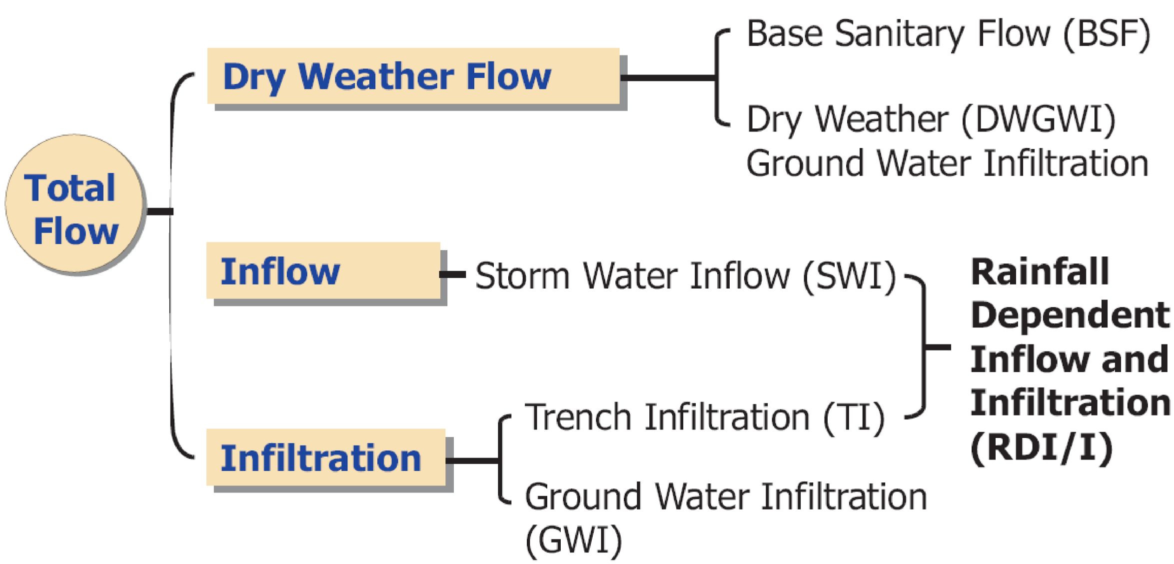


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Figure 3.1
WASTEWATER FLOW COMPONENTS
SANITARY SEWER MASTER PLAN
CITY OF OROVILLE

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3.4 AVERAGE DRY WEATHER FLOW

The average dry weather flow (ADWF) is the average flow that occurs on a daily basis during the dry weather season. The ADWF includes the BWF generated by the City's residential, commercial, and industrial users, plus the dry weather GWI component.

3.5 PEAK DRY WEATHER FLOW

The peak dry weather flow (PDWF) is the highest observed hourly flow that occurs during the dry weather season. The PDWF component is one of the parameters that is typically used for designing the capacity of sewer pipes. Under all conditions, the sanitary sewer system should be capable of passing the PDWF without surcharging the sewer due to hydraulic limitations of any particular pipe segment. It is understood that some minor surcharging might occur due to the system operational strategies or other known reasons.

3.6 PEAK WET WEATHER FLOW

The peak wet weather flow (PWWF) is the highest hourly flow that occurs during the 10-year, 24-hour design storm. The PWWF component is typically used for designing the capacity of the sewer system while providing some acceptable allowance for surcharging. In this study, PWWF was used to evaluate the system's WWF capacity. Unlike the PDWF analysis, the PWWF hydraulic analysis allows surcharging during wet weather conditions with the hydraulic grade line rising up to 3 feet below the manhole rim. Flows that exceed this criterion are considered to be causing a deficiency.

3.7 INFLOW AND INFILTRATION

I/I enters the collection system in a variety of ways. Some of the most common sources of I/I are presented in Figure 3.2. Infiltration is defined as storm water flows that enter the collection system by percolating through the soil and then through defects in pipelines, manholes, and joints. Examples of defects that allow infiltration into the collection system are cracked or broken pipes, misaligned joints, deteriorated manholes, and root penetration. Inflow is defined as storm water that enters the collection system via a direct connection to the system. A few examples of inflow are downspout connections, foundation or yard drains, leaky manhole covers, and illegal storm drain connections. The adverse effects of I/I entering the collection system is that they increase both the flow volume and peak flows in the system so that it is operating at or above its capacity. Excessive I/I in the sanitary sewer collection system is the leading cause of sanitary sewer overflows (SSOs). Figure 3.3 illustrates the effects of I/I on a collection system.

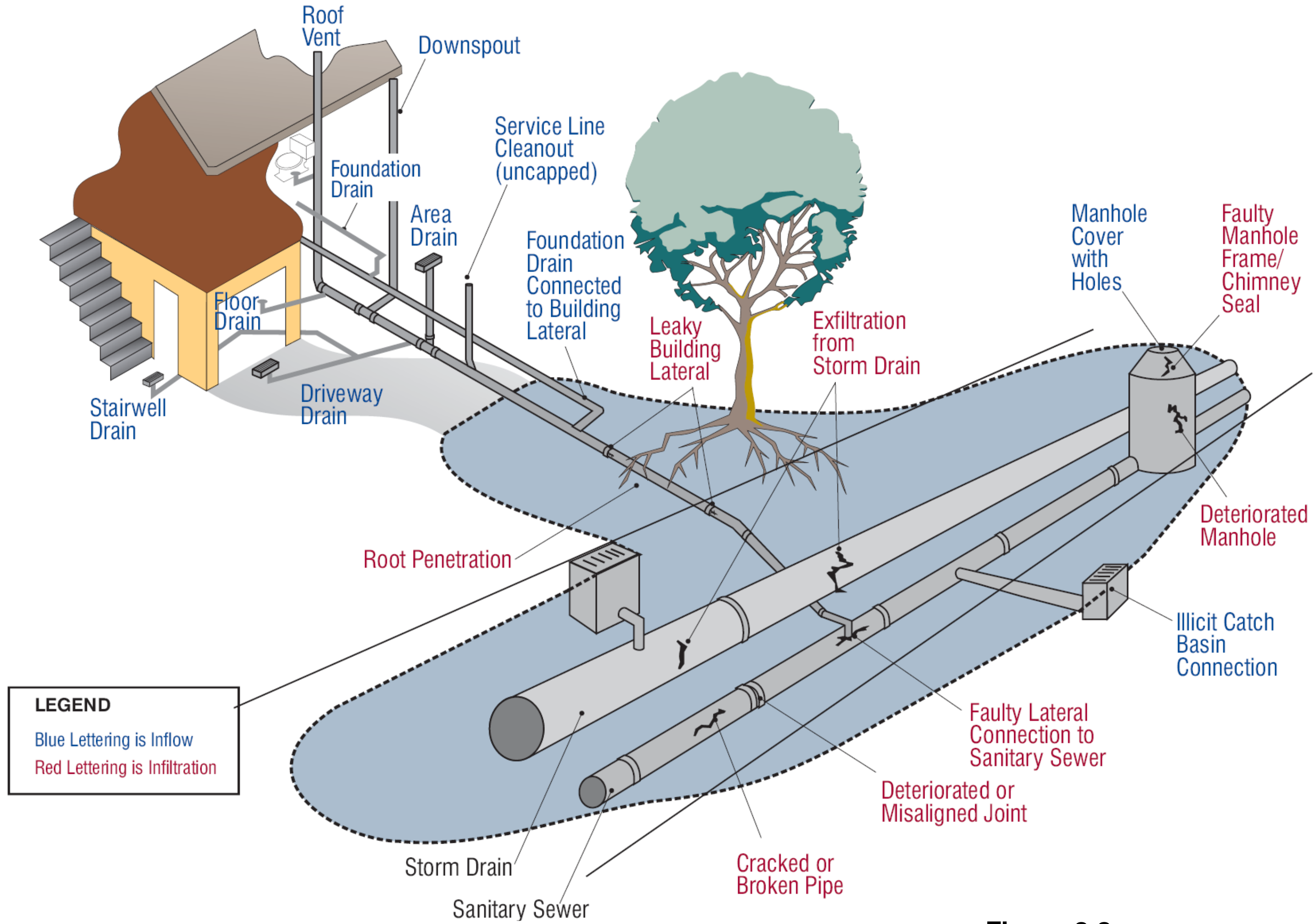

Figure 3.2
TYPICAL SOURCES OF INFLOW AND INFILTRATION
SANITARY SEWER MASTER PLAN
CITY OF OROVILLE

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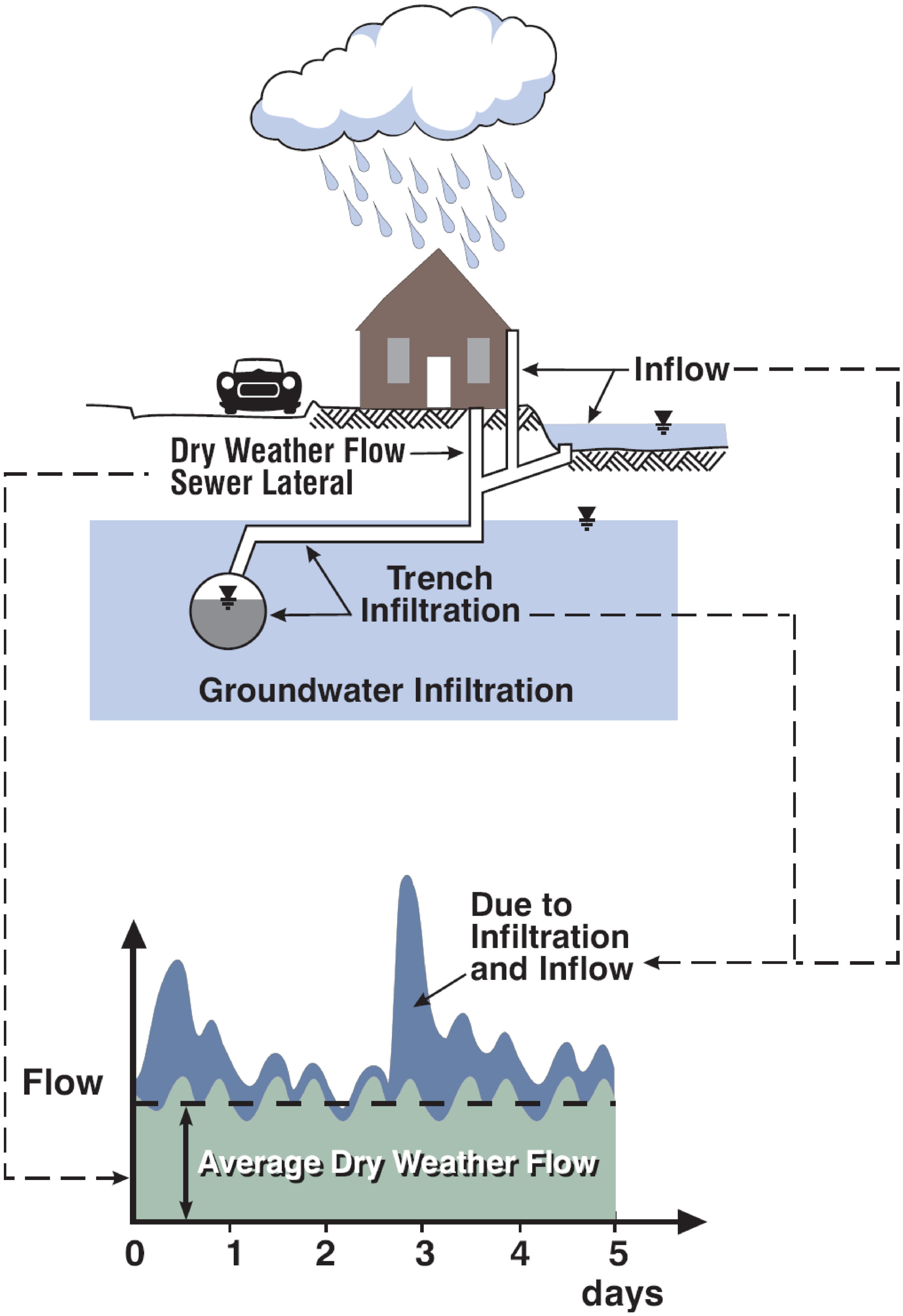

Figure 3.3
EFFECTS OF INFLOW AND INFILTRATION
SANITARY SEWER MASTER PLAN
CITY OF OROVILLE