CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

SEWER CAPACITY IMPACT ANALYSIS GUIDELINES

2009

CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

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I. INTRODUCTION

OBJECTIVES OF THE SEWER CAPACITY IMPACT ANALYSIS (SCIA) GUIDELINES

The primary objectives of this document are to provide: 1) comprehensive guidelines describing the appropriate methodology and process for preparing a sewer capacity impact analysis[1] (SCIA) report; and 2) a framework for the City of San José's (City's) policies with respect to sewer system capacity. Developers shall use this document as a guide for preparing SCIA reports that comply with the sewer related policies of the City. This document supersedes any other document(s) from which it differs, including portions of the City's 1982 Sanitary Sewer Level of Service (LOS) Policy. Moreover, each SCIA will be completed based on a project-specific work scope that will clarify any conflict with City policies.

These guidelines will help expedite preparation and review of SCIA reports by Developers and City staff, respectively. It is expected that Developers will prepare complete documents as established in these guidelines. Both the Developer and City staff shall conduct their work professionally and objectively, and adhere to the State of California's engineering ethics for licensed professionals. The SCIA report must be prepared by a California Board for Professional Engineers' licensed Civil Engineer.

BACKGROUND

On June 15, 1982, the City Council adopted a Sanitary Sewer Level of Service (LOS) Policy (Council Policy 8-7) with the purpose of ensuring that the City will not have capacity-related sewage spills due to insufficient capacity in the collection system. Other key benefits that were identified included:

- Greater assurance that the Capital Improvement Program would fund the most critically needed new sewer mains; and
- Addressing sanitary sewer capacity on a development by development basis would preclude the necessity for such drastic measures as a moratorium on building permits that could result from uncontrolled growth without adequate capacity.

[1] Abbreviations and definitions (glossary) are provided in Appendix D.

The City established a set of guidelines under the LOS Policy to provide a format for developers, engineering consultants, and the general public to follow. The purpose of the LOS Policy was to ensure that new developments would not be connected to the system if they would result in creating insufficient capacity in the sanitary sewer collection system. Such a condition would require construction of sewer improvements before the development could proceed.

City staff determined that the existing LOS Policy required updating to include a formalized hydraulic analysis process for Developers and City staff to follow for applying and reviewing new development connections to the sanitary sewer system. This LOS Policy update would help protect the health and safety of the public by mitigating capacity-related sewage spills while continuing to allow new development to occur in a responsible and sustainable manner. It is anticipated that the City Council will adopt an updated LOS Policy, as described in Chapter II. The guidelines presented in this document are intended to support the implementation of the updated policy.

II. SANITARY SEWER LEVEL OF SERVICE (LOS) POLICY

The purpose of the LOS Policy is to guide analyses and determinations regarding the overall conformance of a proposed development with the City's criteria. This would ensure that new developments would not be connected to the sanitary sewer system if they would result in a LOS lower than "D" as defined below, in downstream sewers (some exceptions are identified for infill projects). Such a condition would require construction of sewer improvements before the development could proceed.

LOS POLICY

The LOS is determined based upon the capacity for flow in the sewer pipe under specified flow conditions. The City's Sanitary Sewer Design Guidelines define design criteria to be 2/3 full under specified flow conditions. A copy of these guidelines is available from the Department of Public Works upon request.

The levels of service are defined as follows:

Level of Service	Definition
A	Meets City's design criteria under peak wet weather flow.
B	Meets City's design criteria under peak dry weather flow and no more than 100 percent of full pipe capacity under peak wet weather flow.
C	No more than 80 percent of full pipe capacity under peak dry weather flow and no more than 100 percent of full pipe capacity under peak wet weather flow.
D	No more than 90 percent of full pipe capacity under peak dry weather flow and no more than 110 percent of full pipe capacity under peak wet weather flow.
E	No more than 110 percent of full pipe capacity under peak dry weather flow and no more than moderate surcharge under peak wet weather flow.
F	More than moderate surcharge under peak dry weather flow or significant surcharge or predicted overflow under peak wet weather flow.

LOS POLICY IMPLEMENTATION

In keeping with the City's future growth plans proceeding in an orderly and planned manner, any new development proposed in the City shall conform to the LOS Policy so that it does not create adverse impacts on the existing sewer system and has adequate sewer capacity in place to support it. (Note: developments covered under an existing Area Development Policy may have somewhat different requirements than those described in this document.)

The LOS Policy will be implemented by requiring development applications to include a SCIA report unless they are exempted from this Policy. An SCIA report is required if the proposed development may result in the following:

- Increase in average dry weather flow (ADWF) of 100,000 gallons per day or larger; or
- Increase in ADWF of 20,000 gallons per day but less than 100,000 gallons per day and impacting downstream sewer mains with a background LOS of "D" or lower; or
- Any increase in flow impacting downstream sewer mains with a background LOS of "E" or lower

See Chapter V for method for determining ADWF and definition of "background" conditions.

Small infill projects that would add less than 2,000 gallons per day ADWF to the collection system (equivalent to approximately 10 single family homes) and that do not impact a sewer with a background LOS "F" will be exempted from this Policy.

Larger infill projects that would add more than 2,000 but less than 20,000 gallons per day ADWF to the collection system and that do not impact a sewer with a background Level of Service "E" or "F" will be exempted from this Policy. Twenty thousand (20,000) gallons per day of sewage flow would result from a development of approximately 100 single family detached units or a commercial office building of approximately 100,000 to 200,000 square feet.

However, at the City's discretion, any infill project impacting a sewer with a background LOS of "D" or lower may be evaluated by the City (through flow monitoring and/or hydraulic modeling) in order to verify that the development would not result in an unacceptable LOS.

The following Table 1 summarizes the trigger for a SCIA report.

Table 1: Trigger for SCIA

	Background LOS (Trigger for SCIA)			
Development Flow	**A, B, or C**	**D**	**E or F**	**F**
< 2,000 gpd	Ok	Ok	Ok	SCIA
< 20,000 gpd	Ok	Ok	SCIA	SCIA
20,000-100,000 gpd	Ok	SCIA	SCIA	SCIA
>100,000 gpd	SCIA	SCIA	SCIA	SCIA

The purpose of a SCIA report is to: 1) determine if the proposed project will have significant impacts on LOS for the sanitary sewer mains downstream of the proposed discharge; and 2) identify mitigation measures for all significant LOS impacts, as needed. The developer must evaluate project impacts using accepted professional standards and the methodology specified in Chapter IV.

EXTENT OF SCIA STUDY

The extent of the sewer system to be included in the SCIA study is determined by the following criteria:

(1) Inclusion of all 6- and 8-inch mains downstream of the discharge point of the proposed development.

(2) Inclusion of all downstream sewer mains 10-inch or larger in diameter where the ratio of the ADWF of the proposed development project to the sewer main background flow is more than 5%.

In general, the Interceptor System can be excluded from the SCIA study.

Additional downstream sewers (whether or not they meet the above criteria) may be required to be included in the SCIA study at the discretion of City staff.

DETERMINATION OF SIGNIFICANT SEWER LOS IMPACTS

A significant LOS impact occurs when the SCIA demonstrates that the proposed development would either: (1) cause the LOS to fall below a Level "D" in any downstream sewer main, or (2) increase the background average dry weather flow in a sewer main already operating at LOS "E" or "F" by more than 1 percent, unless the project is exempted from the Policy.

When a significant impact occurs, the SCIA must also identify improvements that would mitigate this impact.

III. SCIA PROCESS

INTRODUCTION

The purpose of the SCIA is to identify impacts by the project on LOS for the sanitary sewer mains downstream of the proposed discharge. The SCIA must be reviewed and approved by City staff to ensure that it is prepared in accordance with the requirements and goals of the City. Upon

completion of the final review, the SCIA review staff will issue a final memorandum of its findings to the Public Works Department Project Coordinator.

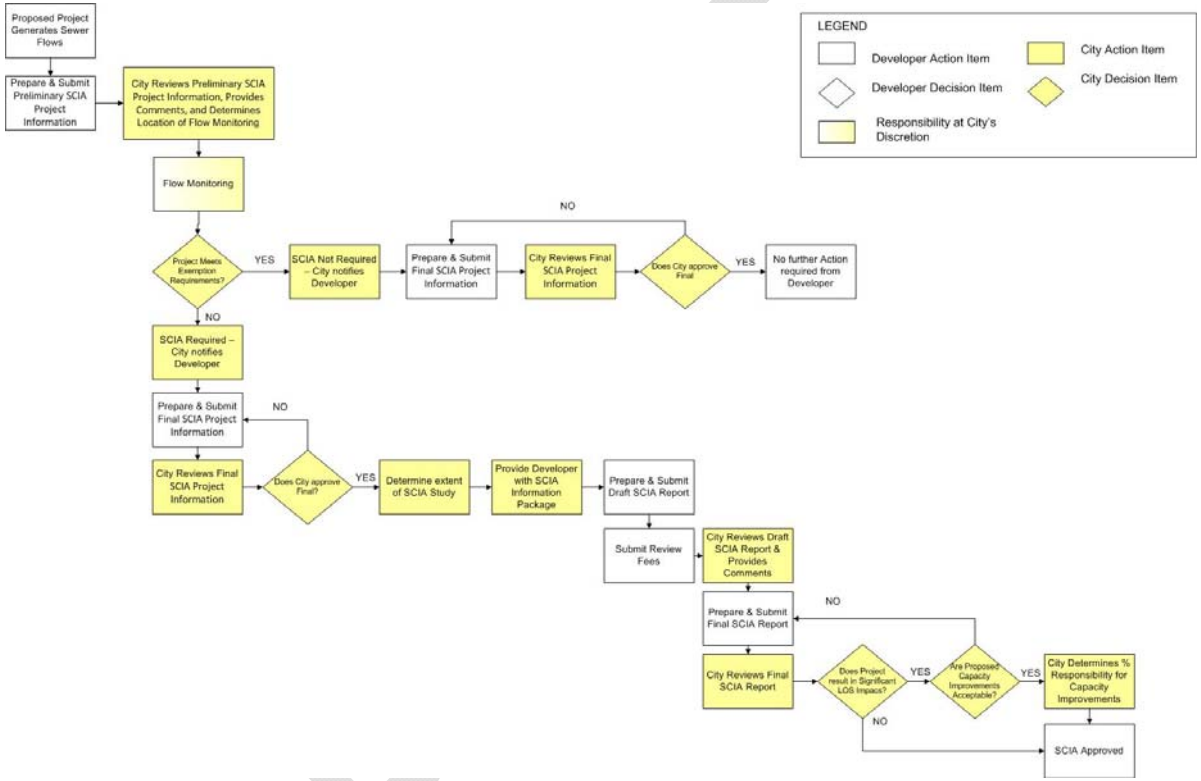
SCIA REVIEW FEE

A review fee is required of all SCIAs to recover the cost of City staff time. This fee is based on the size and/or the flow of the proposed project. The applicable SCIA review fees are due to the Department of Public Works upon submittal of the Draft SCIA and **review will not begin until full payment is received**. Contact the Department of Public Works to obtain a copy of the current fee schedule.

SCIA PROCESS AND SUBMITTAL

A flow chart outlining the steps required for completion of a SCIA is shown in Figure 1.

Figure 1: SCIA Process



As shown in Figure 1, the SCIA process is triggered by submittal of a permit application and begins with submittal of Preliminary SCIA Project Information. Developers shall prepare and submit one (1) copy of the Preliminary SCIA Project Information to the City for review and approval. The purpose of the Project Information is to provide a general overview of the proposed project sufficient for the City to determine the need for a SCIA. The Project Information should include the following:

- Development description (including development acreage, number and type of dwelling units, and type and square footage of non-residential building space)
- Project site plan, including sewer layout and proposed connection point to existing sewer system.
- Estimated average flow from the new development (including appropriate calculations)

The City will review the Preliminary SCIA Project Information and determine the location of flow monitoring, as needed to confirm existing flows. Responsibility for implementation of the flow monitoring will be at the City's discretion. Small infill projects (contributing less than 2,000 gpd ADWF) are exempt from conducting flow monitoring, although the City may choose to do so itself.

The City will review the Preliminary SCIA Project Information and provide comments to the Developer. Notification of responsibility for flow monitoring and a description of the flow monitoring plan (including chosen locations) will be provided with the Draft SCIA Project Information comments. At this point, the Developer should implement the flow monitoring plan, if required to do so (refer to Flow Monitoring Guidelines in Appendix C). Once the flow monitoring has been completed, the Developer should submit results to the City. For infill projects, the City will review these results and determine whether the project qualifies for the Infill Project exemption policy. Once the exemption status has been determined, the City will notify the Developer. For other projects with less than 100,000 gpd ADWF development flow, the City will notify the Developer if the project requires a SCIA per the criteria presented in Section II, Table 1.

All projects must submit Final SCIA Project Information incorporating City comments regardless of their exemption status. The Final Project Information must address all City comments and must be submitted to the City for approval. The City will notify the Developer on the status of the Final Project Information. Should the City determine that comments and instructions provided were not adequately addressed in the Final Project Information, a revised version will be required. Once the City approves the Final Project Information, the Developer will submit one (1) copy of the Final Project Information to Department of Public Works and City Planning for record keeping.

If the project does not meet the Infill Project exemption policy or requires a SCIA per the criteria presented in Section II, Table 1, the City will request that a Draft SCIA report be developed. Based on the information provided in the Final Project Information, the City will determine the extent of the SCIA to be performed by the Developer. Upon approval of the Final SCIA Project Information, the City will send out a map depicting the extent of the SCIA study. The Developer will have access to additional city-wide sewer information through the City's internet site including:

- Maps of the sewer system with available pipe size, length, material and slope information. The Developer should note that surveys of pipe inverts may be necessary to complete the SCIA analysis should the data be missing from the City's sewer database
- As-built drawings for additional research of sewer system information
- Background ADWF, PDWF, and PWWF for 10-inch and larger pipelines based on existing City hydraulic models
- Maps of calculated sewer level of service for 10-inch and larger pipelines based on existing City hydraulic models and/or flow monitoring data
- Inflow and infiltration (I/I) information based on existing City's hydraulic models and flow monitoring data
- Location and description of approved developments to be included in the background conditions

A standard review timeline has been established by the City to process the SCIA and review it properly and expeditiously. Information in **Table** 2 provides only the City's review and response time for typical projects. Developer's preparation times are not included. However, it is the responsibility of the Developer to allow for adequate time for the process so that the project meets public hearing dates. For projects categorized as needing special handling or those that would involve special case studies, which are not part of a typical SCIA, the timeline may vary.

Table 2: Average City Review/Response Times for Activities

Activity	Average City Review/Response
Preliminary Project Information	5 working days
Final Project Information	10 working days
Draft SCIA	15 working days
Final SCIA	10 working days

The draft and final submittals shall be reviewed by City staff within the average time outlined above. As a general comment, all tables and figures included in the submittals must be legible and professionally prepared.

Two (2) copies of the Draft SCIA including appendices must be submitted to City staff for review along with the required SCIA review fees. **Do not publicly circulate the draft until City staff has determined it to be complete.** The City may provide comments on the Draft SCIA report that must be incorporated into the Final SCIA report. Should the City determine that comments provided were not adequately addressed in the Final SCIA a revised version addressing such comments will be required. Once the City approves the Final SCIA, a total of three (3) Final SCIA reports must be submitted to the Department of Public Works and City Planning for record keeping.

SCIA UPDATE

To ensure that the information included in the SCIA is current and correct, SCIA updates may be required by City staff on a project-by-project basis. Criteria to be considered for the SCIA update include:

- SCIA is five years or older
- Average or peak flow has significantly changed
- LOS policy or the SCIA Guidelines has significantly changed

IV. CONTENTS OF A SCIA

This section describes the key elements needed to meet the requirements that the City has established for a SCIA. All SCIA reports must include the following key elements to be considered complete:

- Executive Summary
- Introduction
- SCIA Extent and Existing Sewer System
- Flow Monitoring
- LOS Calculation Worksheet
- Impacts and Proposed Mitigation Measures

A description of each element is provided in ensuing sections.

EXECUTIVE SUMMARY

The Executive Summary (ES) provides a brief description of the sewer analysis performed using the LOS Calculation Worksheet, including impacts that the proposed project is expected to have on the sewer system. The ES needs to include **Table A - 1** of the LOS Calculation Worksheet presenting the level of service for all study pipelines and all study scenarios. The impacts (as shown on Table A-1) and proposed mitigation measures to the sewer system also need to be identified. The ES also needs to include Table B-1 of the LOS Calculation Worksheet for Mitigated Conditions. This table will show that the proposed mitigation measures are sufficient to meet the LOS Policy requirements.

INTRODUCTION

The introduction must include a project description to identify the size and location of the proposed project that was analyzed in the SCIA report. Development information to be included in this section is outlined in **Table**3 below.

Table 3: Development Information to be Included in the SCIA Introduction Section

Type of Development	Development Information
Residential	▪ Type of residential development (i.e. single family, town homes, condos, apartments) ▪ Number of dwelling units (including breakdown by type) ▪ Average size of dwelling unit (including breakdown by type) ▪ Total number of square feet for the development site
Non-Residential	▪ Type of non-residential development (i.e. commercial, industrial, institutional, etc.) ▪ Number of square feet of proposed building space ▪ Total number of square feet for the development site

The type, size, and number of units used to perform the analysis must be consistent with the development application filed for the project.

Figures required for this section include a site location map and a site plan. **Figure 2** illustrates a sample site location map. A site plan, if available, is also required to show the proposed sewer lateral pipelines and connection(s) to the existing sewer system.

Figure 2: Sample Site Location Map

<<Insert fig 2 here- sample site location map>>

EXISTING SEWER SYSTEM

This section describes the existing sewer system of the SCIA study. The description will be based on the extent of the SCIA study and additional sewer system information available from the City's website as discussed in Chapter III.

Table 4 below must be filled in using the city-wide sewer system and related information provided by the City on its internet website and must be included in this section.

Table 4: Information on Existing Sewer System included in SCIA

Segment ID	Upstream Manhole	Downstream Manhole	Diameter	Length	Slope	Material

This section must also include a figure showing the following information:

- Boundary of SCIA analysis
- Existing sewer segments located within this boundary. Each sewer segment must be clearly labeled on the figure.

Figure 3 below illustrates a sample SCIA analysis extent map.

Figure 3: Sample SCIA Analysis Extent Map

<<Insert fig 3 here- sample site location map >>

FLOW MONITORING

Flow monitoring is required for each SCIA report. Flow monitoring requirements are detailed in 0. Flow monitoring is needed to establish the existing flow conditions around the project site. Specifically, flow monitoring is required at locations just upstream and downstream where the proposed project will tie into the existing system. The City may direct the developer to install flow meters at additional locations where the City deems it necessary. The flow monitoring site reports, as discussed in APPENDIX C, must be included in this section.

DOT MAINTENANCE RECORDS

Development project applicant is required to discuss findings from DOT maintenance records, particularly any reported/observed sewer problems for the sewer system in the study. Problems reported in maintenance records or field observations should be identified in the SCIA report and will be considered by the City when determining impacts to sewer LOS.

LOS CALCULATION WORKSHEET

The LOS Calculation Worksheet must be included in this section. The Developer will be required to include the LOS Calculation Worksheet for each sewer segment as defined and listed in Table 4. A blank copy of this worksheet is included in APPENDIX A. The purpose of this worksheet is to determine if the proposed project will have significant impacts on sewer LOS for the sanitary sewer mains downstream of the proposed discharge location. A significant impact is determined if the minimum LOS requirement is not met. The methodology used to fill out this worksheet is presented in Chapter V.

IMPACTS AND PROPOSED MITIGATION MEASURES

This section must include a description of all significant impacts (as identified using the LOS Calculation Worksheet) and their corresponding proposed physical improvements and associated costs. Improvements could include enlarging the existing sewer, adding a parallel sewer, adding or improving a pump station, diverting flow to another sewer with available capacity, peak flow reduction, etc. (Note: if peak flow reduction is proposed, the method used must be substantiated to the City's satisfaction.) The Department of Public Works must approve any proposed mitigation measure. Acceptance of all proposed mitigation measures will be at the City's discretion.

This section must also include **Table B - 1** of the LOS Calculation Worksheet – Mitigation Condition (see Appendix B). This table lists the mitigated LOS for all downstream sewers. The purpose of this table is to demonstrate that the proposed improvements are effective.

V. LOS CALCULATION WORKSHEET METHODOLOGY

The LOS Calculation Worksheet is included in Appendix A. Impacts to the LOS will be determined based on calculations of average dry weather flow (ADWF), peak dry weather flow (PDWF), and peak wet weather flow (PWWF). Existing ADWF will be obtained from flow monitoring results, flow calculations, or City's hydraulic model (for pipes included in the model). PDWF is defined by the City using the following standard equation:

$$PDWF = 2.5 \times ADWF^{0.9}$$

Where:

ADWF is in million gallons per day (mgd)

Wet weather flows represent dry weather flows plus some infiltration/inflow (I/I) flows. I/I flows include groundwater infiltration (GWI) and rainfall-dependent infiltration/inflow (RDI/I) flows. For purposes of LOS calculations, PWWF is defined by the City using the following equation:

$$PWWF = I/I\ Factor \times PDWF$$

The I/I Factor to be used for the LOS calculations will be provided by the City for 10-inch and larger lines. The I/I factor to be used for 6-and 8-inch lines will be based on the I/I factor of the nearest downstream 10-inch or larger sewer main as modeled in the City's hydraulic model.

The LOS Calculation Worksheet establishes impacts to the LOS for downstream sewers under four study conditions: Existing; Background; Project; and Cumulative. A description of each study condition as well as the methodology used to determine flows under each condition is presented in ensuing sections.

EXISTING CONDITIONS

The existing condition presents the existing flows in the portions of the sewer system that may be impacted by the proposed project. Existing condition flows (ADWF, PDWF, and PWWF) for pipes 10-inch and larger will be provided by the City based on its existing hydraulic model. For smaller pipes (e.g. 6 and 8-inch), the existing (pre-project) ADWF will be based on flow monitoring results. Once the ADWF is determined via flow monitoring, the developer must also calculate the PDWF and PWWF using the standard City equations provided above.

BACKGROUND CONDITIONS

Background Conditions represent baseline conditions from which project impacts are identified. The Background Conditions include the existing conditions flow plus the flow from approved developments that have not been constructed or are unoccupied. The City will provide background condition flows (ADWF, PDWF, and PWWF) for pipes 10-inch and larger based on its existing hydraulic model. For smaller pipes (e.g. 6 and 8-inch), the background ADWF will be calculated based on development information. The City will provide information on any approved or unoccupied developments, including their estimated ADWF that could impact the area downstream of the project. The Background Conditions ADWF is therefore calculated as follows:

$$ADWF_{Background\ Conditions} = ADWF_{Existing\ Conditions} + ADWF_{Approved\ Developments}$$

The Background Conditions PDWF and PWWF must be calculated using the standard City equations presented above.

PROJECT CONDITIONS

The Project Conditions will be used to determine the impacts that the proposed project will have on the sewer system. As discussed previously, the SCIA Introduction will include detailed development information to be used to calculate the development ADWF. Refer to the LOS Calculation Worksheet for instructions on this calculation. The flow factors needed to perform the calculation can be found in the "Sewage Treatment Plant Collection Fees, Coefficients and Rates Table". A copy of this table is available from the Department of Public Works upon request. If flow factors for the proposed development are not listed in the table, then the developer is responsible for estimating the development flow and providing backup information to support calculation assumptions.

The Project Conditions ADWF is calculated as follows:

$$ADWF_{Project\ Conditions} = ADWF_{Development} + ADWF_{Background\ Conditions}$$

The Project Conditions PDWF and PWWF must be calculated using the standard City equations. Any additional peak flows not accurately represented by the standard PDWF equation must be added to the Project Conditions PDWF subtotal. Examples of flows not accounted for in a development standard PDWF calculations may include blow-down flows from a cooling tower or data center.

CUMULATIVE CONDITIONS

Cumulative Conditions represent a future scenario needed to determine the total sewer system capacity requirements from potential long-term future development in accordance with the City of San José General Plan. The Cumulative Conditions will include flows determined from existing, background, and project conditions plus future flows expected from future developments in the area. The City will provide the developer with the future ADWF. The Cumulative Conditions ADWF is calculated as follows:

$$ADWF_{Cumulative\ Conditions} = ADWF_{Future\ Developments} + ADWF_{Project\ Conditions}$$

The Cumulative Conditions PDWF and PWWF must be calculated using the standard City equations.

LOS DETERMINATION

Once the PDWF and PWWF are calculated for all study conditions, then the LOS for each of the existing sewer pipelines in question can be calculated for all study conditions. The LOS is based on a comparison of peak flow to full pipe flow capacity. Full pipe flow capacity is calculated using Manning's equation based on pipeline diameter, slope, and a Manning's coefficient (n) of 0.013. City-wide sewer and relevant information will be provided by the City on its website. The LOS is based on the full pipe capacity calculations for an individual pipe, not considering potential backwater from downstream capacity deficiencies. However, flow data, maintenance records and field observation may be used towards determining actual LOS at the discretion of the City. The developer must evaluate the impact to all downstream sewers located within the SCIA extent as defined in Chapter II.

If for any study condition, the calculated PDWF or PWWF as a factor of full pipe capacity is greater than 100 percent in any pipe, the City may, at its discretion, conduct additional hydraulic modeling to determine the extent of predicted surcharge in order to confirm the LOS.

A significant LOS impact occurs when the pipe's LOS meets the criteria set forth in Chapter II under the Project Conditions.

MITIGATED CONDITIONS

Proposed development will be required to mitigate significant LOS impacts. For improvements involving replacement of an existing pipe or construction of a new pipe, the proposed

improvements must be designed to convey the cumulative conditions flow and meet the design criteria in City's Sanitary Sewer Design Guidelines.

For alternative improvements where the existing pipe remains in place but the development's contributing flow is reduced (e.g. via water conservation measures, infiltration/inflow reduction measures, etc.) or flow is diverted to another pipe with available capacity, the proposed improvements must raise the LOS for the existing pipe to a minimum LOS "D" or above.

Proposed developments shall be responsible for any sewer main mitigation improvements along project frontage to the nearest downstream manhole.

Proposed development required to mitigate significant LOS impacts on existing sewer mains equal to or larger than 12 inches downstream of the project site may be eligible for credit on connection fee requirements, and other developments or the City may participate in funding for the additional upsizing. The City's participation will be determined based on future masterplanning needs of the area, and the current CIP funding and priorities.

Another way of mitigating the significant LOS impact is for one or more developers to enter into a construction agreement with the City to fund a sanitary sewer project that is scheduled for future years of the City's Capital Improvement Project. Developer(s) would advance the funds for construction and the City would reimburse the developer(s) in the year in which the City would otherwise construct the sewer project.

For improvements involving replacement of an existing pipe or construction of a new pipe, the new pipe must be designed to convey the cumulative conditions flow.

APPENDIX A. LOS CALCULATION WORKSHEETS

Level of Service (LOS) Calculation Worksheet

*Note: a separate calculation sheet is required for each sewer segment as listed in **Table** 4 of Chapter IV.

SEWER SEGMENT DESCRIPTION

Sewer Segment ID:_____

Sewer Diameter: _____

Sewer Slope: _____

STANDARD EQUATIONS

Peak Dry Weather Flow

$$PDWF = 2.5 \times ADWF^{0.9}$$

Where:

ADWF = Average Dry Weather Flow (million gallons per day, mgd)

Peak Wet Weather Flow

PWWF = I/I Factor x PDWF

Manning's Equation

$$Q = \frac{A \times 1.49 \times R_h^{\frac{2}{3}} \times S^{\frac{1}{2}}}{n}$$

Where:

A = Pipe cross sectional area (square feet)

R_h = Pipe hydraulic radius (defined as the cross sectional area of the pipe divided by the wetted perimeter in feet). For full pipe capacity calculations, wetted perimeter is equal to the pipe's diameter.

S = Pipe slope

n = Manning's Coefficient (0.013)

FLOW CALCULATIONS

Existing Conditions (Calculate for 8-inch and smaller Pipelines otherwise obtain from City)

1. Average dry weather flow (ADWF) from flow monitoring: _____million gallons per day (mgd)
2. Peak dry weather flow (PDWF) (apply City equation to #1): _____mgd
3. I/I Factor (obtain from City if 10-inch and larger otherwise make equal to I/I factor of the nearest downstream 10-inch or larger sewer main): _____
4. Peak wet weather flow (PWWF) (#2 x #3): _____mgd

Background Conditions (Calculate for 8-inch and smaller Pipelines otherwise obtain from City)

5. ADWF from other approved developments (City will provide): _____mgd
6. ADWF Background Conditions (#1 + #5): _____mgd
7. PDWF Background Conditions (apply City equation to #6):_____mgd
8. I/I Factor (obtain from City if 10-inch and larger otherwise make equal to I/I factor of the nearest downstream 10-inch or larger sewer main): _____
9. PWWF Background Conditions (#7 x #8):_____mgd

Project Conditions

10. Size of development[2]: _____ dwelling units(DU)/square feet (SF) of non-residential building space
11. Unit Flow Factor (refer to City of San José Design Guidelines for Sanitary Sewers) : _____ gallons per day per DU/ gallons per day per SF

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[2] Exemption requirements should be checked to verify if SCIA is required. Developments under a certain size criteria are not required to prepare a SCIA.

12. Development ADWF (#10 x #11 ÷ 1,000,000 OR calculate separately & provide back-up information on assumptions): _____mgd

13. ADWF Project Conditions (#6 + #12) : _____mgd

14. Subtotal PDWF Project Conditions (apply City equation to #13):_____ mgd

15. Additional PDWF not accounted for (e.g. blow-down flow from cooling tower or data center): _____ mgd

16. Total PDWF Project Conditions (#14 + #15): _____mgd

17. Development I/I Factor (obtain from City if 10-inch and larger otherwise make equal to I/I factor of the nearest downstream 10-inch or larger sewer main): _____

18. Total PWWF Project Conditions (#16 x #17):_____mgd

Cumulative Conditions

19. ADWF future developments (City will provide): _____ mgd

20. Cumulative Conditions ADWF (#13 + #19): _____ mgd

21. Cumulative Conditions PDWF (apply City equation to #20): _____ mgd

22. Future Developments I/I Factor (obtain from City if 10-inch and larger otherwise make equal to I/I factor of the nearest downstream 10-inch or larger sewer main): _____

23. Cumulative Conditions PWWF (#21 x #22): _____ mgd

FULL PIPE CAPACITY CALCULATIONS

24. Full Pipe Capacity (use Manning's equation where wetted perimeter is equal to the pipe's diameter): _____mgd

    a.

LOS DETERMINATION

Fill in the table below based on results shown in the d/D calculations and the LOS definitions provided in Chapter II:

Table A - 1: LOS Calculation Worksheet Results

Study Condition	PDWF	% of Full Pipe Capacity	PDWF LOS	PWWF	% of Full Pipe Capacity	PWWF LOS
Existing Conditions	#2			#4		
Background Conditions	#7			#9		
Project Conditions	#16			#18		
Cumulative Conditions	#21			#23		

APPENDIX B. LOS CALCULATION WORKSHEET – MITIGATED CONDITION

Level of Service (LOS) Calculation Worksheet – Mitigated Conditions

*Note: a separate calculation sheet is required for each sewer segment. Worksheet based on replacement sewer. Modify worksheet as needed for other improvement types (i.e. parallel, etc.)

SEWER IMPROVEMENT SEGMENT DESCRIPTION

Sewer Segment ID:_____

New or Parallel Sewer Diameter: _____

New or Parallel Sewer Slope: _____

FLOW CALCULATIONS

25. PDWF Mitigated Condition (Equal to #21): _____ mgd

26. PWWF Mitigated Condition (Equal to #23): _____ mgd

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FULL PIPE CAPACITY CALCULATIONS

a) Full Pipe Capacity New or Parallel Sewer (use Manning's equation where wetted perimeter is equal to the pipe's diameter): _____mgd

LOS DETERMINATION

Fill in the table below based on results shown in the flow calculations and the LOS definitions provided in Chapter II:

Table B - 1: LOS Calculation Worksheet – Mitigated Condition Results

Mitigation Projects	PDWF	% of Full Pipe Capacity	PDWF LOS	PWWF	% of Full Pipe Capacity	PWWF LOS
Mitigated Project ID	#25			#26		

APPENDIX C. FLOW MONITORING GUIDELINES

DEVELOPMENT FLOW MONITORING GUIDELINES

Flow Monitoring Locations:

Flow monitoring locations will be selected by City staff after the extent of the sewer system for the SCIA is approved by the City. Typically, metering sites are needed at immediate upstream of the development project, each downstream reach (e.g., where there are changes in pipe diameter or significant changes in flow, and flow splits. Rainfall monitoring may be required if deemed necessary by City staff.

Flow Monitoring Duration:

A minimum of 14 days of flow monitoring is required (or longer if wet weather monitoring is deemed necessary by City). All locations must be monitored at the same time. Flow meters must be set to take readings at 5-minute intervals and report data at 15-minute intervals.

Flow Monitoring Consultant:

If the City has an active contract with a flow monitoring consultant, the developer may elect to pay a fee to the City to have City's flow monitoring consultant perform flow monitoring for development projects. Contact City's Development Services to obtain a copy of the current fee schedule.

Flow Monitoring Equipment:

Developer will utilize flow meters that measure depth and velocity. Monitoring equipment to be used shall be approved by City. Raingauges will be tipping-bucket style recording gauges. Flow metering equipment shall be adequate for and capable of measuring depth and velocity within 5% accuracy. The flow monitoring services shall guarantee 95% monitor uptime each week. Developer may fulfill these requirements by having redundancy in metering equipment

Meter Site Investigation, Meter Installation and Calibration:

Developer shall comply with City, State, and Federal standards for confined-space entry. The proposed flow monitoring locations will be inspected, and verified for hydraulic suitability by the developer. Developer will also check for debris in the manhole that could impact data quality and coordinate any required cleaning efforts with the City. Developer field crews will look for evidence and signs of erratic flow patterns.

Site reports will be generated upon completion of the site investigations. The site reports will include a sketch of the general location, physical characteristics and diameters of the proposed monitoring locations, manhole depths, flow measurements, and other comments pertinent to the location such as any special traffic or safety issues. Final site locations, including raingauge location, will be approved by City.

Developer field crews will take sufficient manual depth readings with a ruler and velocity readings with a portable, instantaneous velocity meter to confirm the monitor is collecting accurate data based on the actual existing hydraulic conditions at each location.

Flow Monitoring Data Collection and Reporting:

Developer's flow monitoring field crew will return to each of the locations on a weekly basis to collect the data and perform site maintenance and site confirmations as necessary. This includes cleaning depth and velocity sensors, confirmations as needed, and checking an installation to make sure that the ring is secure in the pipe. Developer shall document in the flow monitoring report of the findings during the site visits if any meter has malfunctioned or failed to provide good data, or if changes in site conditions have impacted collection of good data.

The Developer's trained Data Analyst will finalize the data. The data analyst will directly calculate flow using the continuity equation from recorded depth and average velocity data. Flow quantities as determined by the continuity equation, as well as meter-recorded flow depth and velocity (confirmed by field calibration measurements) will be plotted. The analyst will also utilize scatter plots (depth vs. velocity readings) to verify data consistency along with field confirmations.

The flow monitoring report should include the following sheets of data and information:

- Covert sheet - flow monitoring company, map of sewer system, flow monitoring location/manhole id/pipe id and size, address, and monitoring period
- Site report – monitoring equipment/model number, data collection interval, site photo, field observation, and hydraulic information
- Summary sheet – min./avg./max. of flow, depth and velocity, and estimate of capacity based on field measurement
- Tabular data sheet – hourly data and daily min./avg./max. of flow, depth and velocity
- Hydrograph – 15-minute flow, depth and velocity, and rainfall graphs
- Scattergraph – depth versus velocity graph, and flow versus level graph

A sample of a complete flow monitoring report is provided in Attachment C-1.

ATTACHMENT C-1

GLOSSARY

List of Abbreviations and Definitions

ADWF	Average dry weather flow: the average flow during dry (non-rainfall) periods. ADWF should be determined based on the worksheet provided in Appendix A.
Background Flow	Existing Flow plus calculated flow from approved developments that have not yet been constructed or occupied.
Cumulative Flow	Project flow plus future flows expected from additional future developments in the area in accordance with City of San José General Plan.
d/D	Ratio of flow depth to pipe diameter
DU	Dwelling unit
DWF	Dry weather flow: the flow during non-rainfall periods, composed of normal sanitary flow contributions from residential, commercial, institutional, and industrial users of a sewer system plus any dry season groundwater infiltration.
Existing Flow	Current flows as determined by flow monitoring or based on City's sewer model. If existing developments are not fully occupied, Existing Flow is the monitored flow plus calculated unoccupied portion of the existing developments.
FAR	Floor-area-ratio: the ratio of building floor space to total parcel area
gpad or gpd/ac	Gallons per day per acre
gpcd	Gallons per capita per day
gpd	Gallons per day
gpm	Gallons per minute
GWI	Groundwater infiltration: extraneous water that infiltrates into a sewer system from the ground through defective pipes and manholes. Groundwater is considered to be a relatively constant daily flow that varies seasonally and depends on location of sewers with respect to the groundwater table.

I/I	Infiltration/inflow: extraneous groundwater and/or storm water that enter a sanitary sewer system.
I/I Factor	A factor that accounts for the amount of flow attributed to infiltration and inflow. For purposes of LOS calculations, this is the ratio of peak wet weather flow to peak dry weather flow.
LOS	Level of Service
lf	Linear feet
mgd	Million gallons per day
Moderate Surcharge	TBD (will be some combination of maximum surcharge depth and minimum freeboard)
Peaking Factor	Factor used to calculate peak dry weather flow (PDWF) as a multiplier of average dry weather flow (ADWF).
PDWF	Peak dry weather flow: the peak flow during non-rainfall periods
Project Flow	Background Flow plus calculated flow from the development project under review.
PWWF	Peak wet weather flow: the peak flow during a given storm event from dry weather flow plus infiltration and inflow.
RDI/I	Rainfall-dependent infiltration/inflow: the infiltration and inflow into a sewer system directly related to a rainfall event. RDI/I may cause rapid, short-term peak flows in the sewer system that recede after the rainfall has ended.
Significant Surcharge	TBD (will be some combination of maximum surcharge depth and minimum freeboard)
SSO	Sanitary Sewer Overflow
Surcharge	The hydraulic condition in a sewer pipeline in which the elevation of the hydraulic gradeline (water level) is above the crown (top) of the pipe. Under such a condition, the water in the pipe rises into the manholes and could overflow onto the ground if the hydraulic gradeline exceeds the elevation of the manhole rims.