Minimum Sewer Study Requirements

January 2024

This document outlines the minimum requirements for sewer studies. Each sewer study becomes a "stand-alone" document and is incorporated into the Sacramento Area Sewer District (SacSewer) Sewer System Capacity Plan (SCP). Sewer studies must be clear, precise, and easy to understand. SacSewer requires a sewer study for the following developments:

- New subdivisions
- Redevelopments with an increase in density
- Upstream areas that require service through the project
- Predicted downstream capacity constraints triggered by the project
- Gravity sewer service may not be possible to serve the project or surrounding area
- Off-site sewer facilities, improvements, or upgrades may be required

An **Environmental/Financial Sewer Study (Level One)** ensures technical compliance with the SCP and demonstrates it is feasible to provide sewer service to the project. The study focuses on topography, phasing and timing, interceptors, large trunks, and sewer sheds. Schematic lines cover the remainder of the site and any upstream areas. Generally, this study does not include smaller trunks, collectors, manholes, reservations and easements, and subdivision layouts. SacSewer approves the study for Environmental/Financial purposes.

A **Specific/Community Master Plan (Level Two**) establishes the backbone trunk system and sheds, locates and sizes pump stations, and shows the depth of pipes. The study focuses on topography, phasing and timing, interceptors, trunks, and defining reservations and proposed shed shifts. Schematic lines cover the remainder of the site, upstream areas, and collectors. Generally, this study is not sufficient for trunk design. Proposed residential street layouts may not be shown.

A **Subdivision Sewer Study (Level Three)** designs the sewer system for the project site and forms the basis for the improvement plans. The study focuses on everything required for a Level Two study, along with collector pipes, residential street layouts, manhole details, and any exceptions to SacSewer Standards and Specifications (SacSewer Standards). Any request for non-standard facilities must include supporting documentation.

Some of the minimum requirements may not apply to a specific project. In these cases, a note is sufficient to meet the requirement (i.e. "There are no proposed shed shifts" or "There are no interim facilities").

The current version of SacSewer's Standards, the SCP, and Sacramento County Standard Construction Specifications or local jurisdiction requirements take precedence over this document. SacSewer requires the following in sewer studies:

Title Page

Include the name of the project, date, engineering firm, and engineer of record stamp and signature.

A. Table of Contents

B. Executive Summary

A brief summary (no more than 2/3 of a page)

1. **Purpose Statement**.
   a. Summarize the ability to gravity serve the project
   b. Detail off-site areas (upstream or downstream)
   c. Discuss the environmental documentation required (Level One)
   d. Summarize documentation used to establish the Finance Plan (Level One)
2. **Project and Study Characteristics**
   a. Brief description of the project and proposed land uses
   b. Brief description of the project's location
   c. Total project acreage, equivalent single-family dwelling units (ESDs), and peak wet weather flow (PWWF) in mgd
   d. Total upstream acreage, ESDs, and PWWF entering project
   e. Total acreage, ESDs, and PWWF exiting project or at a critical point
   f. Name of receiving trunk or trunk shed
   g. Name of the receiving interceptor
   h. Note if development phasing will occur
   i. Note if a pump station or pump station upgrades is required
   j. State whether interim facilities have been approved and the mechanism to remove these interim facilities in the future
   k. State whether trunk shed shifts have been approved
3. **Findings**
   a. Brief summary of any issues and results

C. Introduction

1. **Level of Study**
   a. Discuss the level of study and why it is the appropriate level
2. **Location**
   a. On-site – Describe features (streets, creeks, etc.) surrounding the on-site project area. Exhibits must clearly show boundaries. Please do not use the names of other subdivisions in the report unless they constitute the best description. Adjacent subdivision names are acceptable on the exhibits. Staff does not necessarily have historical knowledge of subdivision names.
   b. Off-site – Describe features surrounding the off-site study area. The exhibits must clearly show boundaries.
3. **Topography**
   a. On-site
      1. General elevations and direction of drainage
      2. Specific geographic features
   b. Off-site
      1. General elevations and direction of drainage
      2. Specific geographic features
4. **Site Descriptions**
   a. On-site project description

1. Project characteristics and attributes
2. Special features, project requirements, or limitations explicitly affecting sewer service

b. Off-site study area description
1. Study area characteristics and attributes
2. Special features, study area requirements, or limitations explicitly affecting sewer service

5. Land Use and Zoning

a. On-site/Off-site
1. Discuss existing land uses and proposed land uses
2. Attach the proposed land use exhibit
3. Use the proposed land uses for flow calculations
    a. In the absence of specific information, the design flow will be a minimum of 6 ESDs per gross acre
    b. Open space, recreational areas, parks, roads, detention basins, and all other unidentified uses will use a minimum design flow of 6 ESDs per gross acre
    c. Preserve areas and other conservation areas that will remain undeveloped in perpetuity may be assigned 0 ESDs/acre if conservation easements are provided

D. Vicinity Map

Include a full-page vicinity map of an appropriate scale to quickly locate the project site

E. Design

1. Assumptions

Clearly state the assumptions made and the basis for these assumptions. The following are examples of assumptions:

a. Future upstream development will not occur or will not be served through the project or study area
b. Downstream sewer facilities have the capacity for the study area flows
c. A particular interceptor, trunk, or relief project will be in service before the project or study area requiring service

2. Approach

State the methods used to determine flows. The following are examples of methods used:

a. Major sheds were defined from topography
b. Schematic backbone of major trunks was established from topography
c. Land uses were interposed over the major sheds to establish ESDs/acre
d. Sub-sheds were created by overlaying known subdivisions and street alignments
e. Site observations or SacSewer sewer shed maps were used to determine shed areas
f. Site observations or SacSewer facility maps were used to determine actual connections
g. SacSewer provided existing flows at a particular point (attach documentation)
h. Flows were determined by the use of SacSewer's Standards and the design criteria noted in this study
i. A spreadsheet was developed to calculate and determine flow and facility characteristics
j. Flows using SacSewer's Standards were compared to interim flows to determine design of proposed interim facilities
k. Cost analyses were prepared to compare alternatives (Level One)

3. Design Criteria

State the basic design criteria used. Use the following as applicable:

a. The most current SCP
b. The most recent version of SacSewer's Standards
c. School flow criteria. See Section 201.1.5 of SacSewer's Standards. The larger of the methods must be used.

F. Sewer flow Information (Levels Two & Three)

Flow data obtained from another study must reference the source of information. Changes in flow data for particular points must be explained if it's inconsistent with the most current study.

1. **On-site Flows (Total Project Acreage, ESDs, & PWWF)**
   a. Provide existing flow data
   b. Provide full development flow data as proposed
   c. Describe development phasing flow data, if any. Note the changes in flows, acreage, and ESDs at specific times and projected phases of development
   d. Discuss sub-shed flows
2. **Off-site Flows (Total Off-site Study Area Acreage, ESDs, & PWWF)**
   a. Upstream Sewer
      1. Provide existing flow data
      2. Provide full development flow data as proposed
      3. Describe development phasing flow data, if any. Note the changes in flows, acreage, and ESDs at specific times and projected phases of development.
      4. Note entry points of upstream flows to the project area
      5. Discuss sub-shed flows
   b. Downstream Sewer
      1. Provide existing flow data
      2. State point of connection to the downstream system
      3. Describe available capacity
      4. Explain proposed flow data (by development phasing times)
      5. Discuss impact to downstream system from project and study area

G. Sewer Alignments and Facilities

1. **Interim Facilities**
   a. Discuss alternatives and include the following for each:
      1. Alignment
      2. Gravity versus force mains and pump stations
      3. Other features and requirements to provide capacity
      4. Costs estimate (Level One)
      5. Recommend an alternative as a solution and why it is recommended
2. **Ultimate Facilities**
   a. Discuss the following:
      1. Alignment
      2. Gravity versus force mains and pump stations
      3. Trigger event (or timeframe) to require switching from the interim to the ultimate facilities
      4. Method of switching to the ultimate facilities
      5. Other features and requirements to provide capacity

H. Conclusion

A paragraph about the level of study and the condition of service, including the following:

1. Purpose of the study and the relevance for design
2. Interim versus ultimate solution
3. Total acreage, ESD's, and flow (mgd)

I. Spreadsheet Information

Some sewer studies require more than one spreadsheet, depending on the analysis. The spreadsheet(s) must be on a separate page of the report. The following are recommended column titles on the spreadsheet(s):

1. Node number
2. Land use(s)
3. Gross acreage per land-use entering each node
4. ESDs per land-use entering each node (either the number of units or six ESDs per acre, whichever is greater)
5. Total gross acreage
6. ESDs
7. Inflow and Infiltration (I/I)
8. Average Dry Weather Flow (ADWF)
9. Peaking Factor (PF)
10. Peak Dry Weather Flow (PDWF)
11. Peak Wet Weather Flow (PWWF)
12. Pipe size (outgoing)
13. Peak PWWF velocity
14. Invert depth
15. Subscripts
    a. Reference to other calculations in report
    b. Notation of abbreviations used in table
    c. Other notations if needed for pertinent or unusual items

    Note: Contributing flows vs. cumulative flows. Contributing flows (for both acreage and ESD) are those flows entering the sewer system at any given node. Cumulative flows (for both acreage and ESD) are all flows in the pipe at any given node, including both contributing flows and upstream flows. Pipe sizing is based upon the cumulative flows, not the contributing flows.

J. Sewer Study Map (Suggested Scale 1" = 100')

1. **Datum**
    a. Use NGVD 29 and provide the conversion factor to NAVD 88.
2. **Node Information**
    a. Node Number – Each node must have a unique identifier
    b. Total gross acreage (A) entering each node, which is not accounted for in upstream node data. Round to the nearest tenth of an acre and be consistent.
    c. ESDs entering each node, which is not accounted for in upstream node data. Round to the nearest tenth of an ESD and be consistent.
    d. Sum of gross acreage (ΣA)
    e. Sum of ESDs (ΣESD)
    f. PWWF (mgd)

g. Node information must be placed at numerous locations throughout the map i.e. at the beginning and end of each sub-shed, at major intersections, etc.

3. Manhole (MH) Information

a. Pipe Invert Elevations
   1. Note the invert elevation for each pipe entering and exiting the manhole along with the pipe size, whether it is flowing in or out of the manhole, and the bearing direction. (Ex: INV=171.40 8" OUT (S)).

b. Depth of Invert
   1. Depth is measured from MH rim (top of the proposed grade) to the exit pipe's invert.
   2. Minimum manhole depth is 5 feet from the crown of pipe to the finish grade in all traffic areas.

c. Summit Manholes
   1. Place summit manholes whenever possible and feasible.

d. Label all drop connections

4. Pipe Information

a. Diameter
   1. Minimum 8-inches

b. Length
   1. To the nearest foot

c. Slope
   1. Note the slope to the nearest ten thousandths place
   2. Use conventional rounding for all calculations
   3. The minimum slopes are based on a minimum velocity of 2 fps when the pipe is flowing half full. Since upstream reaches generally have low volumes of flow, the following standard applies:
      a. All upstream reaches of 8-inch pipes must have a minimum slope of 0.0070 until at least 6 ESDs are being served.
   4. SacSewer recommends, and may require, increasing the slopes beyond the minimum required slopes wherever possible. Reducing drop connections, when feasible, may also be required.

5. Grade Information

The information on the sewer study map must be readable. The following are possible options:

a. Topography with contour lines or spot grades
b. Pad elevations with major contour lines and proposed street grades

6. Sub-sheds

a. Gross acreage must include roads
c. Place node information at the upstream and downstream nodes within each sub-shed

7. Vicinity Map

8. North Arrow and Map Scale

9. Legend

10. Notes

11. Map Title

12. Exhibit or Appendix Title

13. Revision Date of Map

14. Engineering Firm Name and Address

K. Addendums

Any significant change in the proposed land use or sewer configuration of an approved study that impacts the sewer design may require a sewer study addendum.

L. Electronic Files

In addition to the study, the design engineer must submit Geodatabase files as the sewer study approaches approval (see Attachment A). AutoCAD files should not be submitted in lieu of Geodatabase files. The Geodatabase files must be compatible with the ArcGIS suite (ESRI) using the coordinate system of NAD 83 State Plane California II (horizontal) and NGVD 29 (vertical). The Geodatabase files must contain separate layers for interim and permanent facilities and the following attributes (see Attachment A for additional information):

1. Manholes – unique manhole ID and rim/ground elevations
2. Pipelines – Upstream and downstream MH and invert, diameters (inches), pipe lengths (feet), and gravity/force main
3. Pump station – Estimated pumping capacity (gpm)
4. Sewer Sheds – Unique shed ID defined by loading manhole
5. Land use layer – Land use codes, land use description, proposed ESD densities (ESD/acre)

M. Supporting Documentation

Add the following as needed and when referenced in the report:

1. General, specific, or community plan exhibit(s)
2. Land use, aerial, or parcel maps
3. Map of referenced areas showing boundaries or facilities mentioned
4. Other sewer studies or parts thereof
5. Cost analyses (required when alternative facilities are proposed)

Submittal Requirements

1. Submit full studies via drop box or e-mail at sasddevservices@sacsewer.com. Sewer studies can take up to 25-days to review.
2. As the study approaches approval, send electronic Geodatabase files via drop box or e-mail at sasddevservices@sacsewer.com (see Attachment A).

Attachment A

GIS FILE REQUIREMENTS – Checklist and Examples

In addition to the Sewer Study report, the Design Engineer shall submit Geodatabase files with each sewer study submittal. AutoCAD files should not be submitted in lieu of Geodatabase files. The Geodatabase files should be compatible with the ArcGIS suite (ESRI) using the coordinate system NAD 83 State Plane California II (horizontal) and NGVD 29 (vertical). Provide the conversion factor from vertical datum NGVD 29 to NAVD 88.

The data files must consist of the following attributes and the **exact column headings as shown in the examples** (your data will vary from examples provided). All attributes should be included in all submittals and resubmittals.

CHECKLIST

1. ***Manholes*** – In the form of points

- ☐ Manhole ID **(MH_ID)** (Manhole ID needs to be unique. Use SacSewer Grid Number for existing connection manholes)
- ☐ Rim Elevation, *in feet* **(Rim_Elev)**
- ☐ Permanent or Interim **(Perm_Inter)**

EXAMPLE

Correct

MH_ID	Rim_Elev	Perm_Inter
MH-1	90.4	Permanent
MH-2	95.1	Permanent
MH-3	87.0	Permanent
MH-4	88.0	Interim
MH-5	78.3	Permanent
MH-6	85.6	Interim
MH-7	84.8	Permanent
MH-8	79.6	Permanent
342-200-1072	90.9	Permanent

Incorrect

MH_ID	Rim_Elev	Perm_Inter
MH-1	90.4	Permanent
MH-2	95.1	Permanent
MH-2	87.0	Permanent
MH-3	87.0	Permanent
MH-4	88.0	Interim
MH-5	78.3	Permanent, Interim
MH-6	85.6	Interim
MH-7	-8.4	Permanent
MH-8	79.6	Permanent
MH-9	90.9	Both

Identical manhole ID

Potential error – this value is significantly lower than the other rim elevations

Not an existing SacSewer manhole Grid Number

Cannot be both permanent and interim

CHECKLIST

2. ***Pipelines*** – In the form of lines

- ☐ Upstream Manhole **(US_MH)**
- ☐ Downstream Manhole **(DS_MH)**
- ☐ Upstream Invert, *in feet* **(US_Invert)**
- ☐ Downstream Invert, *in feet* **(DS_Invert)**
- ☐ Diameter, *in inches* **(Diameter)**
- ☐ Length, *in feet* **(Length)**
- ☐ Gravity or Force Main **(Gravity_FM)**
- ☐ Permanent or Interim **(Perm_Inter)**

EXAMPLE

Correct

US_MH	DS_MH	US_Invert	DS_Invert	Diameter	Length	Gravity_FM	Perm_Inter
MH-1	MH-2	83.4	82.6	8	200	Gravity	Permanent
MH-3	MH-6	81.2	80	10	193	Gravity	Permanent
MH-4	MH-5	82.2	81.7	8	145.5	Gravity	Permanent
MH-5	MH-6	81.7	80	8	300	Gravity	Interim
MH-6	MH-7	80	79.5	10	254.3	Gravity	Permanent
MH-7	MH-8	79.5	74.9	8	303	Gravity	Permanent
MH-8	MH-10	74.9	73.1	8	77	Gravity	Permanent
MH-2	MH-10	82.6	73.1	10	180.2	Gravity	Permanent
MH-3	MH-10	79	73.1	12	314.159	Gravity	Interim
MH-10	MH-9	73.1	85.4	6	256.35	Force Main	Permanent

Incorrect

Upstream manhole cannot also be the downstream manhole

Duplicate information

Value not logical compared to its upstream invert

Pipe diameter is in feet and not inches

US_MH	DS_MH	US_Invert	DS_Invert	Diameter	Length	Gravity_FM	Perm_Inter
MH-1	MH-1	83.4	82.6	8	200	Gravity	Permanent
MH-3	MH-2	81.2	-80	10	193	Gravity	Permanent
MH-4	MH-5	82.2	81.7	8	145.5	Gravity	Permanent
MH-6	MH-7	81.7	80	0.6667	300	Gravity	Interim
MH-6	MH-7	81.7	80	8	300	Gravity	Permanent
MH-2	MH-8	80	79.5	10	254.3	Gravity	Permanent, Interim
MH-5	MH-9	79.5	80	8	303	Gravity	Interim
MH-8 to MH-10		74.9	73.1	8	77	Gravity	Interim
MH-7	MH-3	82.6	73.1	10	180.2	Gravity	Permanent
MH-10	MH-9	73.1	85.4	6	-256.35	Force Main	Permanent
Manhole 5	MH-4	79	73.1	12	314.159	Gravity	Both

Combined upstream and downstream manholes in one cell

MH-5 is now Manhole 5. Unique manhole ID has changed

Blank information

Negative length

Pipeline identified as a gravity line but upstream invert elevation < downstream invert elevation

Cannot be both permanent and interim

CHECKLIST

3. Pump Stations – In the form of points

- ☐ Pump_Station_ID - if applicable **(PS_ID)** (Pump Station ID needs to be unique)
- ☐ Maximum_Pumping_Discharge_Rate, *in mgd* **(Pump_Rate)**
- ☐ Permanent_or_Interim **(Perm_Inter)**

EXAMPLE

Correct

PS_ID	Pump_Rate	Perm_Inter
1	0.57	Permanent
2	1.4	Interim

Incorrect

PS_ID	Pump_Rate	Perm_Inter
1	-0.57	
1	1.4	Permanent, Interim

Two pump stations with the same ID

Negative discharge rate

Blank information

Cannot be both permanent and interim

CHECKLIST

4. *Sewer Sheds* – In the form of polygons

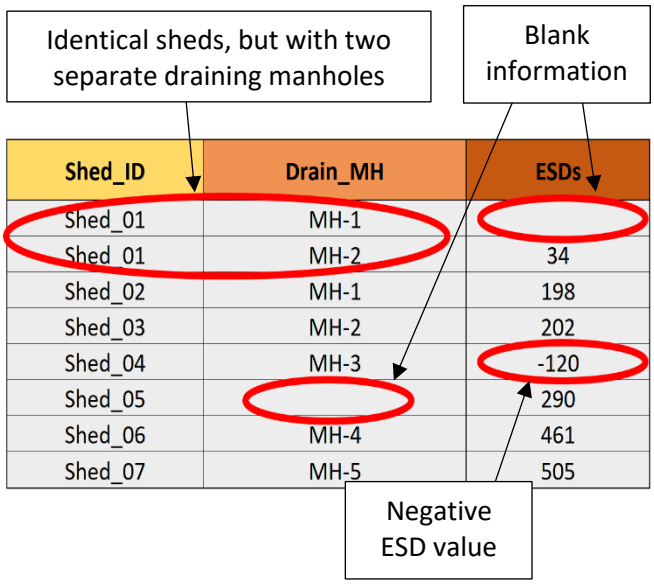
- ☐ Shed ID **(Shed_ID)** (Shed ID needs to be unique)
- ☐ Draining MH **(Drain_MH)**
- ☐ ESDs **(ESDs)**

EXAMPLE

Correct

Shed_ID	Drain_MH	ESDs
Shed_01	MH-1	25
Shed_02	MH-1	100
Shed_03	MH-1	345
Shed_04	MH-2	420
Shed_05	MH-3	168
Shed_06	MH-4	95
Shed_07	MH-4	237
Shed_08	MH-5	505

Incorrect



CHECKLIST

5. *Land Uses* – In the form of polygons

- ☐ Land Use Description **(LU_Desc)**
- ☐ Land Use Codes **(LU_Code)**
- ☐ Proposed ESD Densities, *in ESD/Ac* **(ESD_per_Ac)**

LU_Desc	LU_Code	ESD_per_Ac
Commercial	C	6
Employment	E	6
School	S	6
Future Planning Area	FPA	6
High Density Residential	HDR	20
Industrial	I	6
Low Density Residential	LDR	6
Open Space	OS	6
Medium Density Residential	MDR	10

EXAMPLE