

City of Oakland



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Bureau of Design & Construction

Septic Tank Effluent Pump (STEP) and Septic Tank Effluent Gravity (STEG) System Guidelines and Force Main Standard

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APPROVED:

A handwritten signature in black ink, appearing to read "Danny Lau".

Danny Lau, P.E.
Assistant Director

12/11/18

Date

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1. Introduction

The purpose of this document is to provide direction and define requirements for the design and installation of tanks, pumps and associated piping to transport septic tank effluent to the City of Oakland public sewer infrastructure for *Septic Tank Effluent Pump (STEP) and Septic Tank Effluent Gravity (STEG) Systems and related collection piping and Force Mains* in City of Oakland. Previously, there were no guidelines or standards for STEP and STEG systems and related collection piping and Force Mains.

The goal is to provide efficient, cost effective and reliable service to the customers of City of Oakland. A low-pressure sanitary sewer system will only be considered where a thorough study of all alternatives clearly indicates a conventional gravity collection system, with or without a central sewage pump station, is not practical or feasible.

The design professional is advised to consult all current City of Oakland codes, standards, ordinances, and regulations, in addition to complying with the guidelines and standard herein. Furthermore, the applicant shall be responsible for securing any additional permits and entitlements from other regulatory agencies.

The County of Alameda shall be engaged for issuance of installation permit and Operating Permit for on-lot STEP and STEG units, in accordance with requirements as specified in the County of Alameda's Onsite Wastewater Treatment System (OWTS) Manual. The County of Alameda's OWTS Manual can be found at the following link:

http://www.acgov.org/aceh/landuse/documents/LAMP_Final_2018-06-05.pdf

All STEP and STEG systems shall be designed in compliance with these guidelines, unless otherwise approved by the City of Oakland, as well as applicable codes, ordinances, and regulations.

For design guidelines pertaining to public sanitary sewer systems, please consult the City of Oakland's *Sanitary Sewer Design Standards*, dated effective August 2008.

City reserves the ultimate right to approve or dis-approve any STEP/STEG system.

Terminology and Definitions.

Table 1. Glossary of Terms	
Term	Definition
Access riser	Access riser is a concrete or plastic pipe that runs vertically from the pump-out openings or access ports at the top of a septic tank to about ground level.
ACDEH	Stands for Alameda County Department of Environmental Health
Centrifugal pump	A type of pump used to transport fluids by conversion of rotational kinetic energy to the hydrodynamic energy of the fluid flow, using an impeller to accelerate the flow along the rotating axis and radially outward to a discharge chamber.
Effluent filter	A device used at the outlet of a septic tank or at the inlet to an effluent pump, to prevent the passage of solids in excess of three-sixteenths (3/16) of an inch in diameter.
Effluent pump	A sewage pump designed and used to pump sewage effluent that has undergone primary treatment (settling and anaerobic digestion) through a septic tank.
Effluent sewer system	A system of small diameter pipelines that collect and convey sewage effluent that has gone through septic tank treatment at individual properties before entering the collector pipes. The effluent from each property is discharged either by gravity (STEG) or by a pump (STEP). The effluent sewer system serves to transport the wastewater to the main gravity sewer system or the treatment plant.
Force main / pressure pipe	A pipe under internal pressure created by being on the discharge side of a pumping station
IAPMO	The International Association of Plumbing and Mechanical Officials
OWTS	OWTS stands for Onsite Wastewater Treatment System. It refers to a wastewater disposal facility that includes tanks, piping, treatment devices or other facilities that convey, store, treat and dispose of wastewater subsurface, either on the property where it originates or an adjacent or nearby property under the control of the user. In Alameda County, OWTS are under the regulatory authority of ACDEH

Pressure effluent sewer system	A network of small diameter pipelines, following the profile of the ground, used for the collection and conveyance of wastewater from a group of homes, each using a small effluent pump to discharge to the main. A pressure sewer can also accept gravity effluent connections from STEG units at homes that are located at a high enough elevation above the hydraulic grade line to preclude the need for a pump.
Private force main	The private force main in its entirety is owned by, and the responsibility for its maintenance lies with, the property owner, the homeowners' association, or the responsible party whom it serves.
Public force main	Public force main means a sanitary force main pipe owned and controlled by the City of Oakland.
Pump chamber or pump tank	A vessel containing one or more sewage pumps where sewage wastes collect and are periodically pumped to a sewer system or other location for treatment and/or disposal.
Pump unit	An individual sewage pumping facility, located normally at the property or building served, including the pump tank, pump, piping, valves, electrical controls and other appurtenances.
Qualified service provider	An individual capable of operating, monitoring and maintaining individual septic tanks, holding tanks and pump units on properties connected to the public sewer system. An individual registered with the ACDEH as a "Service Provider" meets this qualification.
Septic tank	A watertight receptacle that receives sewage from a building or structure, that functions to separate solids from liquids, retain and digests organic matter, and provide for the resulting effluent to be discharged for further onsite treatment and disposal, or discharge to a sewer collection system.
Septage pumper	A person who is qualified to pump and haul liquid and solid wastes from septic tanks, and registered with Alameda County Department of Environmental Health pursuant to California Health and Safety Code and the ACDEH OWTS Manual.
Sewage pump	A pump, normally submersible, capable of pumping sanitary wastewater (sewage) from a lower to a higher elevation. It is used particularly where elevation of the source (i.e., house) is not sufficient for gravity flow to the public sewer system.

Solids handling pump	A sewage pump, normally centrifugal, capable of pumping the combined flow of liquid and sewage solids from residences other domestic waste sources. These are the common type of pump used for single house sewer connections requiring pump-up to a gravity main. They should be capable of passing solids up to 2 inches in size with a minimum discharge pipe size of 2-inch diameter.
STEG system	A type of effluent sewer system used for the gravity collection and conveyance of septic tank effluent from a group of homes to the downstream main sewer system or treatment plant. The network of pipes follows the profile of the ground, using small diameter pipes installed with variable or inflective gradients and clean-outs in place of conventional manholes. Each house has an individual septic tank and effluent filter ahead of the connection to the STEG collection sewers.
STEG unit	An individual septic tank, effluent filter, access risers and outlet piping that provides primary sewage treatment (settling and anaerobic digestion) and discharged to a small diameter effluent sewer collection system. The STEG unit must be located at an elevation sufficiently higher than the effluent sewers to ensure gravity flow away from the septic tank at all times.
STEP system	A type of pressure sewer system used for the collection and conveyance of septic tank effluent from a group of homes to the downstream main sewer system or treatment plant. Each connecting property normally has an individual STEP unit (tank and pump), or a STEG unit (gravity flow) if sufficient elevation is available.
STEP unit	An individual septic tank and effluent pumping facility, located normally at the property or building served, including the septic tank, integral or separate pump tank, pump, piping, valves, electrical controls and other appurtenances. The effluent from the STEP unit may be discharged to a small diameter gravity effluent or pressure sewer system, or directly to a conventional gravity sewer.
Turbine pump	A type of centrifugal pump used in sewage effluent pumping applications that demand more head than a traditional single stage centrifugal submersible pump can deliver.

2. Maintenance Responsibility for Private STEP and STEG Systems and Force Mains

Property owners utilizing a STEP or STEG system shall maintain all building sewer drains, gravity sewer pipes, septic tanks, pump chambers, pumps, electrical panels, pressurized sewer pipes, backflow devices, sewer laterals to the main, and service connections at the main. Maintenance shall include, but not be limited to, cleaning, pumping retained solid waste, replacing, repairing, and clearing those facilities. Where a STEP or STEG system serves more than one single family dwelling, a commercial facility with multiple owners, or a development with multiple ownership, the obligation to maintain the system shall be the property owner's, homeowners' association, or any other entity responsible for the maintenance of the property and facilities owned in common.

STEP and STEG systems shall be inspected routinely to verify proper performance of all components of the system in conformance with applicable requirements contained in the OWTS Manual and in the Operating Permit issued by the ACDEH for the system. The property owner shall be responsible for retaining a qualified service provider to perform necessary inspection and maintenance work on the STEP or STEG unit, as applicable, and for any reporting requirements as specified in the Operating Permit.

3. Design Criteria for STEP and STEG Systems

A. General

STEP systems and STEG systems shall not be allowed, where a practical or feasible alternative gravity route exists. City reserves the ultimate right to approve or dis-approve any STEP/STEG system.

No STEP or STEG units shall be installed within City rights-of-way or City easements.

B. STEG Guidelines

Design and installation of septic tanks and appurtenances used for STEG units shall be in accordance with applicable standards contained in the County of Alameda OWTS Manual, including, but not limited to, items related to siting, sizing, construction materials, configuration, piping, effluent filters, access, and installation.

Additional requirements for STEG systems include:

- Gravity lateral piping shall have a minimum 4-inch diameter and shall maintain a continuous positive grade from the septic tank to main connection point.
- Gravity collection piping and main shall have a minimum 4-inch diameter and shall maintain a minimum velocity of 1 feet per second (fps) at design flow conditions.
- A cleanout shall be installed on the outlet side of the septic tank.
- A ball valve and check valve shall be installed at the lateral connection to the gravity or force main per City Design Standard Detail S104.
- The septic tank, vents, and all building connections shall be a minimum of 10 feet above the maximum possible hydraulic grade line in the force main.

C. STEP Guidelines

1. Septic tanks and Pump tanks/chambers

Design and installation of septic tanks, pump tanks/chambers and appurtenances used for STEP units shall be in accordance with applicable standards contained in the County of Alameda OWTS Manual. This includes, but is not limited to, items related to siting, sizing, construction materials, configuration, piping, effluent filters, access, and installation.

2. Pumping Equipment

Design and installation of pumping equipment and appurtenances used in STEP units shall be in accordance with applicable standards contained in the County of Alameda OWTS Manual, with the additional provision that the pump may be located in either the second chamber of the septic tank or in a separate pump tank.

All pumps in the STEP system shall be designed to meet the head and flow parameters for the design application.

3. Electrical Equipment

Electrical equipment, controls and appurtenances for STEP units shall be in accordance with applicable standards contained in the County of Alameda OWTS Manual. Prior to installing electrical components associated with STEP systems, a permit to perform electrical work shall be obtained from the City of Oakland and all inspection requirements shall be met.

4. Pipe Size

STEP units should have minimum discharge piping size of 1.25 inch. Solids handling sewage pump units shall have a minimum discharge piping size of 2 inch.

D. Force Mains and Apparatus

1. Force Mains

- Public force main pipes shall be a minimum of four (4) inch diameter. Private force main pipes shall be a minimum of two (2) inches diameter.
- A minimum ten (10) foot wide easement shall be required for pipelines within private properties.
- The force main location shall meet the current separation requirements set forth by the California Department of Public Health requirements.

- The force main shall enter the receiving manhole with a smooth flow transition to the gravity sewer system at a point not more than 1 foot (0.3 m) above the flow line.
- Where feasible, force mains shall be designed with a continuous uphill slope without high points to minimize the need for air-release valves on the force main.
- The minimum velocity of effluent pressure pipes under design flow conditions (full build-out) shall be one (1) foot per second (fps). The maximum velocity for normal operating conditions shall be eight (8) feet per second to avoid excessive friction head losses.
- All pipes shall be designed to withstand H-20 highway loading and existing sub-surface conditions. Pipe materials shall be HDPE (High Density Polyethylene) SDR 11 with smooth interior, class 52 ductile iron pipe with approved lining/coating, cast iron pipe with approved lining/coating, AWWA C-900 or other pipe material approved by the City of Oakland. All fittings and connections shall be restrained against thrust.
- Tracer wire shall be installed with all force mains. Tracer wire shall be coated 8 gauge THHN insulated copper wire which shall be attached to the top of and along the entire length of the force main. Wires shall terminate within manholes, valve boxes, electrical boxes, or concrete traffic boxes for locator equipment to be attached. Wires shall extend a minimum of 3 feet with into access point. All wire connections shall be made with copper crimps wrapped with electrical tape.
- For pipeline trenching on steep slopes, special design features may be required by the City of Oakland. These design features may include check dams, trench dams, special anchors, or special pipe materials.
- For pipe crossings, clearance requirements, pipe cover, trenching, backfill material, and compaction shall be designed per the City of Oakland's Sanitary Sewer Design Standards.

2. Apparatus

- Air relief valves shall be placed at high points in the force main to prevent air locking. Vacuum relief valves may be necessary to relieve negative pressures on force mains.
- Isolation valves should be considered where force mains connect into a common force main or where multiple force mains combine. Isolation valves shall be full port ball valves.
- Flushing ports shall be installed at the terminal points of the force main. Flushing ports shall have an isolation valve and cam lock fitting.

- Pressure pipes shall have pressure-type cleanouts installed every 1,000 feet maximum in areas of continuously flat to moderately sloping terrain.

E. Backflow Prevention Devices

STEP and STEG systems that serve plumbing fixtures located less than one (1) foot above the rim elevation of the most adjacent public sewer structure shall be protected from backflow by installing a backflow prevention device on the private sewer line in conformance with City of Oakland standards. The backflow prevention device shall be constructed on private property and shall be installed by the permittee. The maintenance of the backflow prevention device shall be the obligation of the property owner or the property owner's successor in interest. The City of Oakland shall not be obligated to validate the proper functioning of backflow prevention devices.

4. Submittals and Drawing Standards

STEP and STEG system construction plans submitted for permitting shall include a site plan, design plan, and supporting details. Engineering calculations shall be provided to the City of Oakland for all new STEP and STEG systems.

Note: Installation plans for individual STEP and STEG units shall be submitted to the ACDEH for permitting in accordance with requirements contained in Alameda County OWTS Manual.

STEP and STEG system plans shall conform to the City's *Drafting Standards*. Drawing scales shall be 1:40 horizontally and 1:4 vertically, or 1:20 and 1:5, 1:50 and 1:5. The scales used shall be indicated on the plans.

All elevations shall be based upon the City of Oakland vertical datum and shall be shown on the plans at all points having a change of grade. Cuts to the nearest one-half foot shall be shown on the plans at all structures and at other significant points.

A. Site Plan

The STEP/STEG system site plan shall include, but not be limited to, the following:

- Existing improvements
- Proposed improvements
- Lots to be served
- Property lines
- Existing and proposed laterals
- Existing and proposed utilities
- Existing and proposed buildings
- Existing and proposed fences
- Existing and proposed trees
- Existing and proposed watercourses and drainage infrastructure

- Existing and proposed easements
- Existing and proposed right-of-way

B. Design Plan

The STEP/STEG system design plan shall include, but not be limited to, the following:

- Plan and profile of gravity and pressure sewer mains for any proposed STEP or STEG system
- Length and locations of pipes
- Pipe materials and sizes
- Pipe valve, fittings, and miscellaneous plumbing fixtures
- Locations of existing and proposed power poles
- Location of discharge to public sewer system
- Locations of cleanouts
- Private Force Main Discharge Lateral Connection: Detail of the private force main discharge connection to the public sewer system
- Soils data

C. Design Details

Design details to support the construction plans for STEP/STEG system shall include, but are not limited to, the following:

- Trench profile and trench sections
- Detail of connection of pressure pipe to public sewer collection system
- Details of cleanouts

Design details for individual STEP and STEG units shall accompany the on-lot facility installation plans provided to ACDEH and shall be in accordance with requirements contained in Alameda County OWTS Manual.

D. Calculations

The engineering calculations shall provide design support to the construction of STEP systems and STEG systems, typically including the following:

- Hydraulic calculations including the basis for average and peak flows and all assumptions including rationale for peaking.
- Calculated pipe velocities for design flow conditions for different segments of the private and public force main, based on selected pump characteristics, pipe lengths and elevation data for each connection.
- Calculations and system curve for the force main, which shows the total energy losses associated with the range of expected flows and pumping rates, and

requirements for each STEP and/or STEG connection in the system. Pump head-capacity curves shall be plotted on the system curves. The system shall be capable of conveying the design peak flow rate.

- Calculations supporting the design of individual STEP and STEG units shall accompany the on-lot facility installation plans provided to ACDEH and shall be in accordance with requirements contained in Alameda County OWTS Manual. The STEP pump capacity and/or STEG elevation for individual connections shall be consistent with the calculations and requirements identified in the STEP/STEG system design provided approved by the City of Oakland.

5. Required Permits

Permits are required for all STEP and STEG systems (see Exhibit “A” S100). Permits include, but are not limited to, the following:

A. City of Oakland Permits

- Work performed in City right-of-way.
- Private Sewer Lateral.
- Pump electrical installations.
- Other improvements as determined by the City of Oakland.

B. County of Alameda Permits

- Abandonment of Septic Tank.
- Installation permit for private (on-lot) STEP and STEG units
- Operating Permit for private (on-lot) STEP and STEG units

6. Final As-Built Document Submittal

Prior to final of permits for STEP and STEG systems, the design professional or property owner shall provide final as-built plans in AutoCAD and PDF file formats to the City of Oakland for review and approval.

As-built plans for private (on-lot) STEP and STEG units shall be provided to ACDEH in accordance with requirements contained in Alameda County OWTS Manual.

7. Testing of System Components

Prior to final of permits for STEP and STEG systems, the installed system components shall be tested.

Pressure piping shall be water and/or air tested in accordance with the current City of Oakland Standard Specifications. In special situations and applications, the City of Oakland may require closed circuit televised (CCTV) inspection.

Testing of individual STEP and STEG units, including tanks, pipes, pumps and appurtenances, shall be conducted in accordance requirements contained in Alameda County OWTS Manual.

8. Geotechnical Investigation

For projects with inherent hazards involving excavation, trenching, and laying in certain soil formations and in unstable soils or terrain, the City of Oakland reserves the right to require a geotechnical investigation and report prior to the approval of construction plans. Locations of steep hillsides, areas with shallow soil overlaying rock, areas of known instability, areas of bay mud or filled wet terrain, or areas with seepage shall be investigated.

9. Special Design Problems

Where special design problems are considered by the City of Oakland, additional reports, calculations, plans, or data may be requested from the design professional to facilitate review. In special situations and applications, the City of Oakland may require calculations for the need of Hydrogen Sulfide Suppression, and if necessary, a proposal of suppression measures.

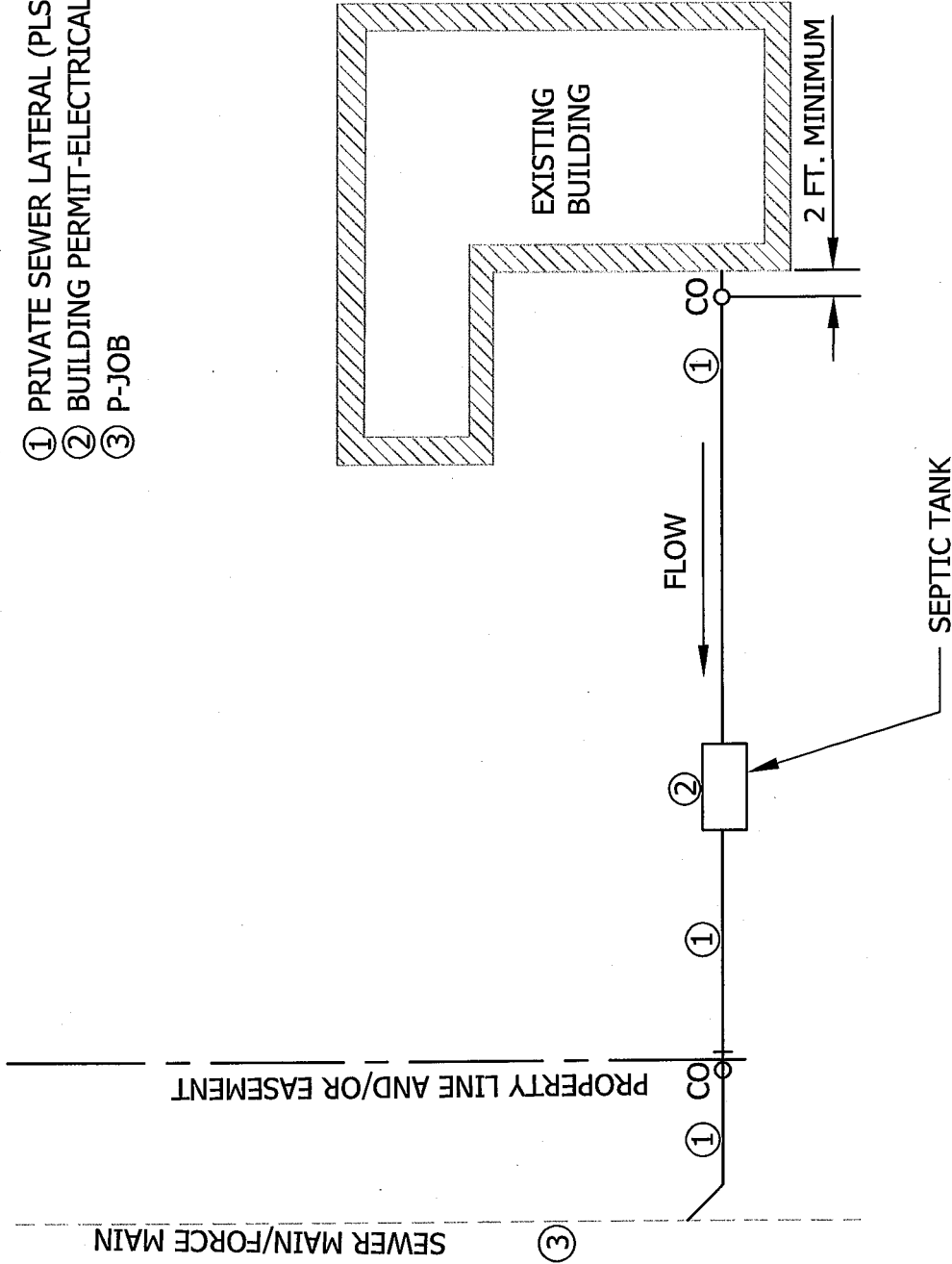
10. Typical Sample Details

Below is an index of sample details contained in these Design Guidelines:

- Standard S100 – Typical Permits (Exhibit “A”)
- Standard S101 – Discharge For Private Force Main To Gravity Lateral
- Standard S102– Private Sewer and Force Main Trench Detail
- Standard S103 – Backflow Check Valve Installation Detail
- Standard S104 – Private Force Main and Service Connection Detail

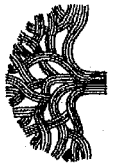
For details pertaining to private on-lot STEP and STEG facilities are contained in Alameda County OWTS Manual.

- ① PRIVATE SEWER LATERAL (PLS) PERMIT
- ② BUILDING PERMIT-ELECTRICAL
- ③ P-JOB



CITY OF OAKLAND

EXHIBIT "A"

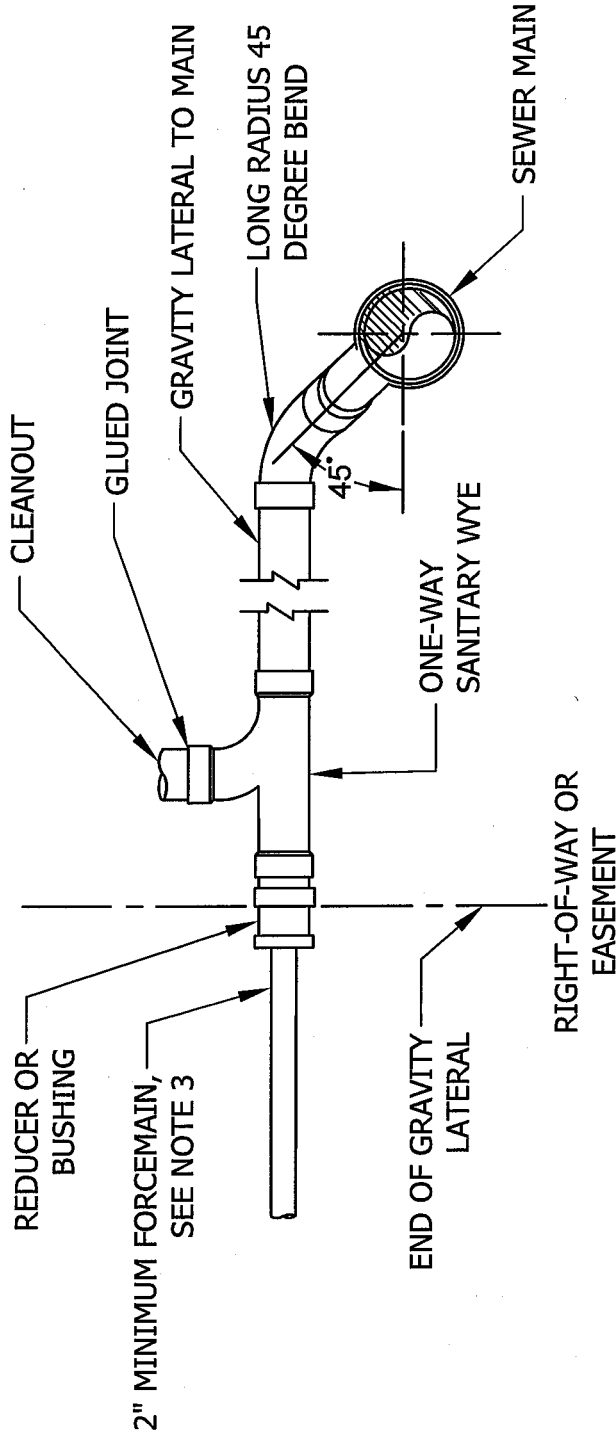


TYPICAL PERMITS

ENGINEERING DESIGN MANAGER

DATE: 11/28/18

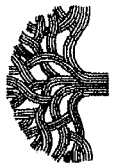
S100



NOTES

1. ALL ALTERNATE DESIGNS MUST BE APPROVED BY THE CITY OF OAKLAND.
2. CONSTRUCTION DETAILS, SLOPE, AND MATERIALS SHALL CONFORM TO THE CITY OF OAKLAND'S SANITARY SEWER DESIGN STANDARDS, AUGUST 2008.
3. FORCE MAIN SHALL HAVE PRESSURE-TYPE CLEANOUTS EVERY 100' MAXIMUM.

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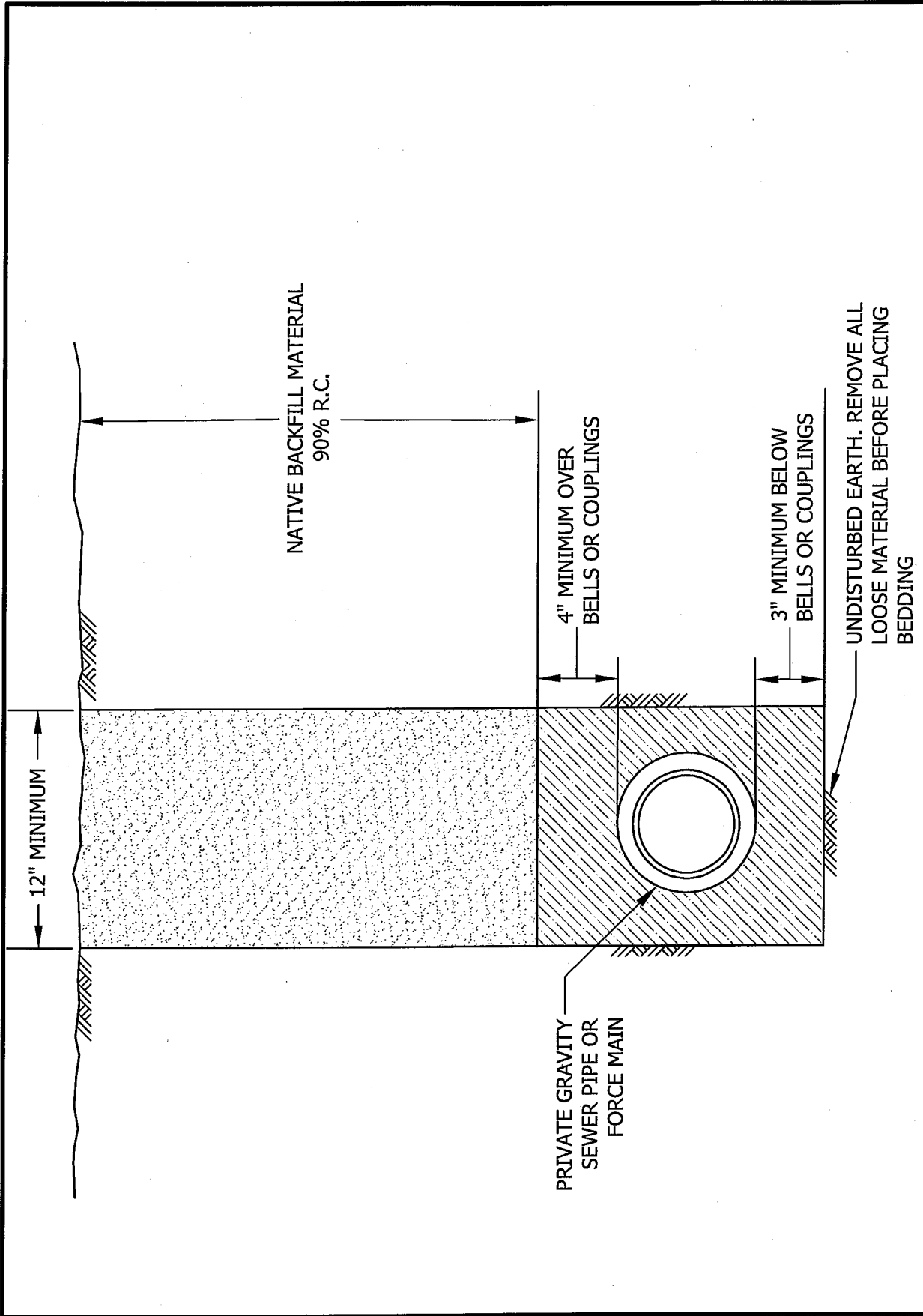
SEPTIC TANK EFFLUENT PUMP (STEP) SYSTEM, SEPTIC TANK EFFLUENT
GRAVY SYSTEM GUIDELINE, AND FORCE MAIN STANDARD

**DISCHARGE FOR PRIVATE FORCE
MAIN TO GRAVITY LATERAL**

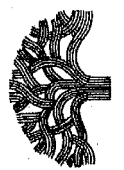
ENGINEERING DESIGN MANAGER

DATE: 11/28/18

S101



**SEPTIC TANK EFFLUENT PUMP (STEP) SYSTEM, SEPTIC TANK
EFFLUENT GRAVY SYSTEM GUIDELINE, AND FORCE MAIN STANDARD**



**PRIVATE SEWER AND FORCE MAIN
TRENCH DETAIL**

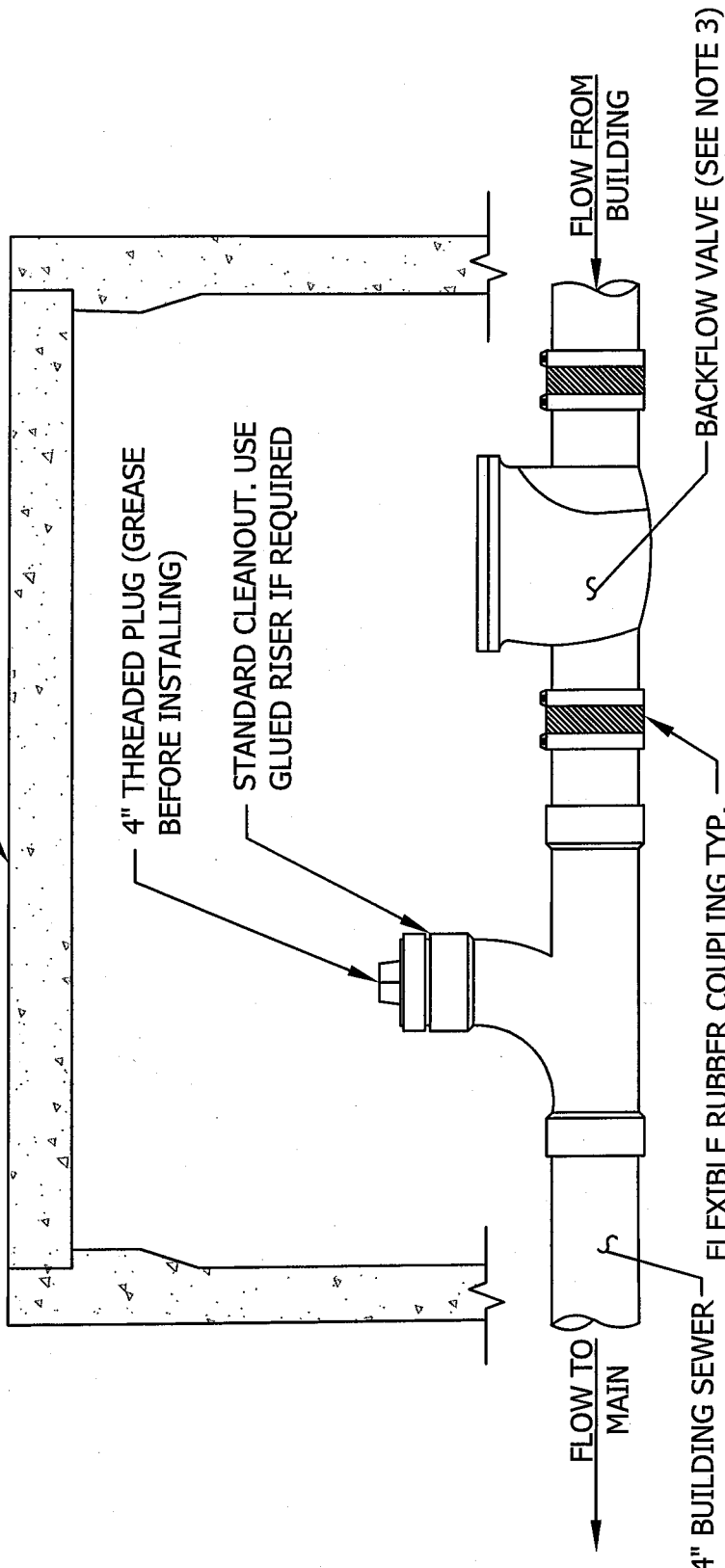
CITY OF OAKLAND

ENGINEERING DESIGN MANAGER

DATE: 11/28/18

S102

REINFORCED CONCRETE UTILITY BOX AND LID
(SEE NOTE 2). SEE APPROVED MATERIALS LIST



4" BUILDING SEWER — FLEXIBLE RUBBER COUPLING TYP.
SEE APPROVED MATERIALS LIST

BACKFLOW VALVE (SEE NOTE 3)

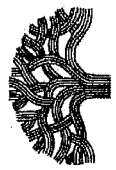
1. THIS INSTALLATION IS REQUIRED WHEREVER THE LOWEST FINISH FLOOR ELEVATION IS TWELVE (12") INCHES OR LESS ABOVE THE RIM ELEVATION OF THE NEAREST UPSTREAM MANHOLE OR CLEANOUT. THIS INSTALLATION IS ALSO REQUIRED WHERE THE BUILDING IS LOCATED IN A FLOOD ZONE.

2. IF THE LID IS SUBJECT TO VEHICULAR TRAFFIC, USE A BOX AND LID DESIGNED FOR H-20 TRAFFIC LOADINGS.

3. BACKFLOW VALVE SHALL BE CONSTRUCTED OF CAST IRON OR APPROVED EQUAL. SEE APPROVED MATERIALS LIST.

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SEPTIC TANK EFFLUENT PUMP (STEP) SYSTEM, SEPTIC TANK
EFFLUENT GRAVY SYSTEM GUIDELINE, AND FORCE MAIN STANDARD

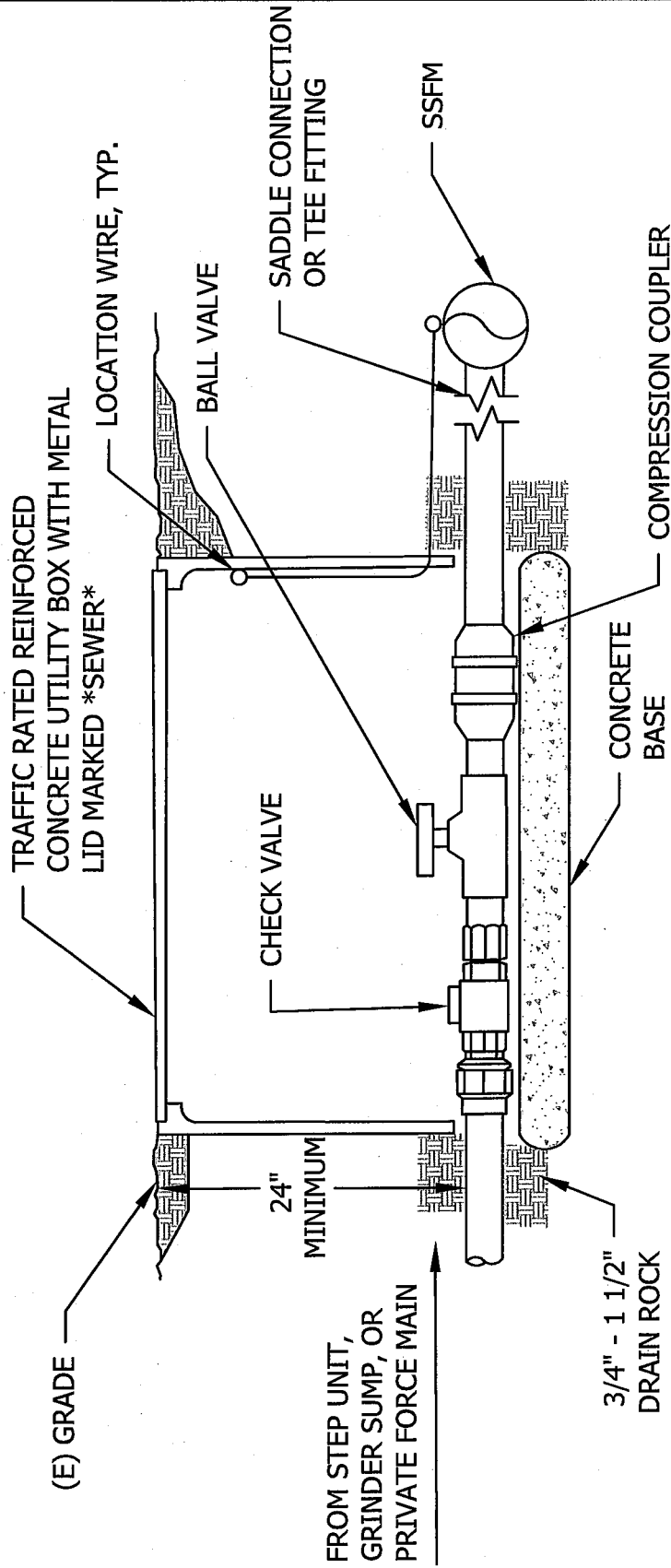


**BACKFLOW CHECK VALVE
INSTALLATION DETAIL**

ENGINEERING DESIGN MANAGER

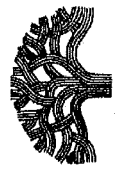
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S103



SIDE VIEW

SEPTIC TANK EFFLUENT PUMP (STEP) SYSTEM, SEPTIC TANK
EFFLUENT GRAVY SYSTEM GUIDELINE, AND FORCE MAIN STANDARD



**PRIVATE FORCE MAIN AND SERVICE
CONNECTION DETAIL**

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ENGINEERING DESIGN MANAGER

DATE: 11/28/18

S104